SUBMIT BID TO:

PROCUREMENT SERVICES UNIVERSITY OF FLORIDA 971 ELMORE DRIVE PO BOX 115250

GAINESVILLE, FL 32611

Phone: (352) 392-1331 - FAX: (352) 392-8837 Web Address: https://procurement.ufl.edu/



Construction Acknowledgment Form

Page 1 of 383 pages		BID WILL BE OPENED: March 24, 2022 at 3:00 PM local time and may not be withdrawn within 45 days after such date and time. Non-Mandatory Pre-bid: March 3, 2022 at 9:30 AM local time.		BID NO.: ITB22KO-129	
DATE: 2/17/2022		PROCUREMENT AGENT: KO	BID TITLE: Water Reclamation Facility Filtration System Replacement		
VENDOR NAM	E				
VENDOR MAILING ADDRESS			REASON FOR NOT SUBMITTING BID		
CITY - STATE - ZIP CODE			POSTING OF BID TA	BULATIONS	
AREA CODE TELEPHONE NO.			Bid tabulations with intended award(s) will be posted electronically for review by interested parties at https://procurement.ufl.edu/ and will remain		
	FAX NO.		 posted for a period of 72 hours excluding Saturdays, Sundays, or holidays. Failure to file a protest in accordance with Board of Gove (BOG) Regulation 18.002 or failure to post the bond or other secul required in the BOG regulations 18.002 and 18.003(3), shall constitution waiver of protest proceedings. 		
	WEB ADDRESS				
	EMAIL ADDRESS				
I certify that this connection with a materials, supplie or fraud. Lagree	s bid is made without any corporation, firm of so, or equipment and to a hide by all constants.	out prior understanding, agreement, or or person submitting a bid for the same s in all respects fair and without collusion ditions of this bid and certify that Lam			
I certify that this bid is made without prior understanding, agreement, or connection with any corporation, firm or person submitting a bid for the same materials, supplies, or equipment and is in all respects fair and without collusion or fraud. I agree to abide by all conditions of this bid and certify that I am authorized to sign this bid for the vendor and that the vendor is in compliance with all the requirements of the Invitation to Bid, including but not limited to, certification requirements. In submitting a bid on behalf of the Board of Trustees, hereinafter known as the University, the vendor offers and agrees that if the bid is accepted the vendor will convey, sell, assign, or transfer to the University all rights, title and interest in and to all causes of action it may now or hereafter acquire under the Anti-trust laws of the United States and the University for price fixing relating to the particular commodities or services purchased or acquired by the University. At the University's discretion, such assignment shall be made and become effective at the time the purchasing agency tenders final payment to the			AUTHORIZED SIGNA	TURE (MANUAL)	
			NAME AND TITL	E (TYPED)	

GENERAL CONDITIONS

SEALED BIDS: All bid sheets and this form must be executed and submitted in a sealed envelope. (DO NOT INCLUDE MORE THAN ONE BID PER ENVELOPE.) The face of the envelope shall contain, in addition to the above address, the date, and time of the bid opening and the bid number. Bids not submitted on the attached bid form shall be rejected. All bids are subject to the conditions specified herein. Those which do not comply with these conditions are subject to rejection.

- EXECUTION OF BID: Bid must contain an original manual signature of authorized representative in the space provided above. Bid must be typed or printed in ink. Use of erasable ink is not permitted. All corrections to prices made by vendor
- 2. **NO BID**: If not submitting a bid, respond by returning only this vendor acknowledgment form, marking it "NO BID", and explain the reason in the space provided above. Failure to respond to a procurement solicitation without giving justifiable reason for such failure, nonconformance to contract conditions, or other pertinent factors deemed reasonable and valid shall be cause for removal of the supplier's name from the bid mailing list. NOTE: To qualify as a respondent, vendor must submit a "NO BID", and it must be received no later than the stated bid opening
- BID OPENING: Shall be public, on the date, location and the time specified on the bid form. It is the vendor's responsibility to assure that the bid is delivered at the proper time and place of the bid opening. Bids which for any reason are not so delivered will not be considered. A bid may not be altered after opening of the bids. NOTE: Bid tabulations will be posted electronically at <a href="https://https:
- PRICES, TERMS AND PAYMENT: Firm prices shall be bid and will include all packing, handling, shipping charges, and delivery to the destination shown herein.
 (a) TAXES: The University does not pay Federal Excise and Sales taxes on direct
- purchases of tangible personal property or services. The Florida Tax Exempt Number is 11-06-024056-57C. This exemption does not apply to purchases of tangible personal property or services made by vendors who use the tangible personal property or services in the performance of contracts for the improvement of University-owned real property as defined in Chapter 192, F.S.

 (b) DISCOUNTS: Vendors are encouraged to reflect trade discounts in the unit property and the performance of the property and the performance of the pe
- prices quoted; however, vendors may offer a discount for prompt payment. Prompt payment discounts will not be considered in the bid award. However, every effort will be made to take the discount within the time offered.

- (c) MISTAKES: Vendors are expected to examine the specifications, delivery schedule, bid prices, extensions, and all instructions pertaining to supplies and services. Failure to do so will be at vendor's risk. In case of a mistake in extensions
- the unit price will govern.

 (d) INVOICING AND PAYMENT: Payment will be made by the University of Florida after the items awarded to a vendor have been received, inspected, and found to comply with award specifications, free of damage or defect and properly invoiced. All invoices shall bear the purchase order number. Payment for partial shipments shall invoices shall bear the purchase order number. Payment for partial shipments shall not be made unless specified. An original invoice shall be submitted. Failure to follow these instructions may result in delay in processing invoices for payment. Payment shall be made in accordance with Section 215.422 (1) (2) F.S. VENDOR OMBUDSMAN: The University's vendor ormbudsman, whose duties include acting as an advocate for vendors may be experiencing problems in obtaining payment from the University, may be contacted at 352-392-1241.

 (e) ANNUAL APPROPRIATIONS: The University's performance and obligation to pay under any contract awarded is contingent upon an annual appropriation by the Legislature.
- (f) CONDITION AND PACKAGING: It is understood and agreed that any item offered or shipped as a result of this bid shall be a new, current standard production model available at the time of this bid. All containers shall be suitable for storage or
- shipment, and all prices shall include standard commercial packaging.

 (g) SAFETY STANDARDS: Unless otherwise stipulated in the bid, all manufactured items and fabricated assemblies shall comply with applicable requirements of Occupational Safety and Health Act and any standards hereunder.
- CONFLICT OF INTEREST: The award hereunder is subject to the provisions of Chapter 112, F.S. All vendors must disclose with their bid the name of any officer, director, or agent who is also an employee of the University of Florida. Further, all vendors must disclose the name of any University employee who owns, directly or indirectly, an interest of five percent (5%) or more in the vendor's firm or any of its
- **6. AWARDS:** As the best interest of the University may require, the right is reserved to make award(s) by individual item, group of items, all or none or a combination thereof; to reject any and all bids or waive any minor irregularity or technicality in bids received. When it is determined there is no competition to the lowest responsible vendor, evaluation of other bids are not required. Vendors are cautioned to make no assumptions unless their bid has been evaluated as being responsive

- 7. INTERPRETATIONS/DISPUTES: Any questions concerning conditions or specifications shall be directed in writing to Procurement Services. Inquiries must reference the date of bid opening and bid number. No interpretations shall be considered binding unless provided in writing by the University in response to requests in full compliance with this provision.
- NOTICE OF BID PROTEST BONDING REQUIREMENT; Any person or entity who files an action protesting a decision or an intended decision pertaining to a competitive solicitation shall at the time of filing the formal protest, post with the University a bond payable to the University in an amount equal to: 10% of the estimated value of the protestor's bid or proposal; 10% of the estimated expenditure during the contract term; \$10,000.00; or whichever is less. The bond shall be conditioned upon the payment of all costs which may be adjudged against the person or entity filing the protest action. In lieu of a bond, the University may accept a cashier's check, bank official check or money order in the amount of the bond. FAILURE OF THE PROTESTING PERSON OR ENTITY TO FILE THE REQUIRED BOND, CASHIER'S CHECK, BANK OFFICIAL CHECK OR MONEY ORDER AT THE TIME OF THE FILING THE FORMAL PROTEST SHALL RESULT IN DENIAL OF THE PROTEST.
- 9. GOVERNMENTAL RESTRICTIONS: In the event any governmental restrictions may be imposed which would necessitate alteration of the material, quality, workmanship or performance of the items offered in this bid prior to their delivery, it shall be the responsibility of the successful vendor to notify the purchaser at once, indicating in writing the specific regulation which requires an alteration. The University reserves the right to accept any such alteration, including any price adjustments occasioned thereby, or to cancel the contract at no expense to the University.
- LEGAL REQUIREMENTS: Applicable provision of all Federal, State, county and local laws, and of all ordinances, rules and regulations shall govern development, submittal and evaluation of all bids received in response hereto and shall govern any submittal and evaluation of all bids received in response hereto and shall govern any and all claims and disputes which may arise between person(s) submitting a bid response hereto and the University, by and through its officers, employees and authorized representatives, or any other person, natural or otherwise: and lack of knowledge by any vendor shall not constitute a cognizable defense against the legal
- 11. LOBBYING: Vendor is prohibited from using funds provided under any contract or purchase order for the purpose of lobbying the Legislature or any official, officer, commission, board, authority, council, committee, or department of the executive branch or the judicial branch of state government.
- **12. ADVERTISING**: In submitting a bid, the vendor agrees not to use the results therefrom as a part of any commercial advertising. Vendor may not use the names, logos, or trademarks of the University, its employees, or affiliates without the prior written consent of the University.
- **13. ASSIGNMENT**: Any contract or purchase order issued pursuant to this Invitation to Bid and the monies which may become due hereunder are not assignable except with the prior written approval of the purchaser.
- 14. LIABILITY: The vendor agrees to indemnify and save the University of Florida, the State of Florida and the Florida Board of Governors, their officers, agents, and employees harmless from any and all judgments, orders, awards, costs and expenses, including attorney's fees, and also all claims on account of damages to property, including loss of use thereof, or bodily injury (including death) which may be hereafter sustained by the vendor, its employees, its subcontractors, or the University of Florida, the State of Florida and the Florida Board of Governors, their officers, agents, or employees, or third persons, arising out of or in connection with any contract awarded and which are the result of the vendor's breach of contract or of the negligent acts of the vendor, its officers, agents, and employees. This clause does not apply to contract to a contracts between government agencies. apply to contracts between government agencies.
- FACILITIES: The University reserves the right to inspect the vendor's facilities at any time with prior notice.
- **16. ADDITIONAL QUANTITIES**: For a period not exceeding ninety (90) days from the date of acceptance of any offer by the University of Florida, the right is reserved to acquire additional quantities up to but not exceeding those shown on bid or the bid level at the prices bid in this invitation. If additional quantities are not acceptable, the bid sheets must be noted "BID IS FOR SPECIFIED QUANTITY ONLY".
- SERVICE AND WARRANTY: Unless otherwise specified, the vendor shall define any warranty service and replacements that will be provided during and subsequent to this contract. Vendors must explain on an attached sheet to what extent warranty and service facilities are provided.
- 18. SAMPLES: Samples of items, when called for, must be furnished free of expense, on or before bid opening time and date, and if not destroyed, may upon request, be returned at the vendor's expense. Each individual sample must be labeled with vendor's name, manufacturer's brand name and number, bid number and item reference. Request for return of samples shall be accompanied by instructions which include chipping authorization and name of carrier and must be precised with the bid. include shipping authorization and name of carrier and must be received with the bid. If instructions are not received within this time, the commodities shall be disposed of by the University.
- 19. INSPECTION, ACCEPTANCE AND TITLE: Inspection and acceptance will be at destination unless otherwise provided. Title and risk of loss or damage of all items shall be the responsibility of the contract supplier until accepted by the University, unless loss or damage results from negligence by the University. The contract supplier shall be responsible for filing, processing and collecting all damage claims. However, to assist him in the expeditious handling of damage claims, the University will:
- Record any evidence of visible damage on all copies of the delivering carrier's Bill of Lading.

- Report damage (Visible or Concealed) to the carrier and contract supplier confirming such reports in writing within 15 days of delivery, requesting that the
- carrier inspect the damaged merchandise.

 Retain the item and its shipping container, including inner packing material until inspection is performed by the carrier, and disposition given by the contract
- Provide the contract supplier with a copy of the carrier's Bill of Lading and damage inspection report.
- 20. PATENTS, COPYRIGHTS, TRADEMARKS, ROYALTIES and other Intellectual Property: The vendor, without exception, shall indemnify and save harmless the University and its employees from liability of any nature or kind, including cost and expenses for or on account of any copyrighted, patented, or unpatented invention, process, or article manufactured or used in the performance of the contract, including its use by the University of Florida. If the vendor uses any design, device, or materials covered by letters, patent or copyright, it is mutually agreed and understood without expention that the high prices shall include all royalties or costs arising from the use of exception that the bid prices shall include all royalties or costs arising from the use of such design, device, or materials in any way involved in the work.
- 21. CONFLICT BETWEEN DOCUMENTS: If any terms and conditions contained within the documents that are a part of this ITB or resulting contract are in conflict with any other terms and conditions contained therein, then the various documents comprising this ITB or resulting contract, as applicable, shall govern in the following order of precedence: change order, purchase order, addenda, special conditions, general conditions, specifications, departmental description of work, and bid.
- MANUFACTURERS' NAMES AND APPROVED EQUIVALENTS: manufacturer's names, trade names, brand names, information and/or catalog numbers listed in a specification are for information and not intended to limit numbers listed in a specification are for information and not intended to influid competition. If bids are based on equivalent products, indicate on the bid form the manufacturer's name and number. Vendor shall submit with the bid, cuts, sketches, and descriptive literature, and/or complete specifications. Reference to literature submitted with a previous bid will not satisfy this provision. The vendor shall also explain in detail the reasons why the proposed equivalent will meet the specifications and not be considered an exception thereto. The University of Florida reserves the right to determine acceptance of item(s) as an approved equivalent. Bids which do not comply with these requirements are subject to rejection. Bids lacking any written indication of intent to quote an alternate brand will be received and considered in complete compliance with the specifications as listed on the bid form.
- 23. NONCONFORMANCE TO CONTRACT CONDITIONS: Items may be tested and/or inspected for compliance with specifications by any appropriate testing facilities. Should the items fail, the University may require the vendor to reimburse the University for costs incurred by the University in connection with the examination or testing. The data derived from any tests for compliance with specifications are public records and open to examination thereto in accordance with Chapter 119, F.S. tems delivered not conforming to specifications may be rejected and returned at vendor's expense. These items and items not delivered as per delivery data in bid and/or purchase order may result in vendor being found in default in which event any and all reprocurement costs may be charged against the defaulting vendor. Any violation of these conditions may also result in the vendor's name being removed from the University of Florida's vendor file.
- 24. PUBLIC RECORDS: Any material submitted in response to this Invitation to Bid will become a public document pursuant to Section 119.07 F.S. This includes material which the responding vendor might consider to be confidential or a trade secret. Any claim of confidentiality is waived upon submission, effective after opening pursuant to Section 119.07 F.S.
- 25. DELIVERY: Unless actual date of delivery is specified (or if specified delivery cannot be met), show number of days required to make delivery after receipt of purchase order in space provided. Delivery time may become a basis for making an award (see Special Conditions). Delivery shall be within the normal working hours of the University of Florida, Monday through Friday, unless otherwise specified.
- 26. PUBLIC PRINTING PREFERENCE GIVEN PRINTING WITHIN THE STATE: The University of Florida shall give preference to vendors located within the state when awarding contracts to have materials printed, whenever such printing can be done at no greater expense than, and at a level of quality comparable to, that obtainable from a vendor located outside of the state.
- (a) CONTRACTS NOT TO BE SUBLET: In accordance with Class B Printing Laws and Regulations "Printing shall be awarded only to printing firms. No contract shall be awarded to any broker, agent, or independent contractor offering printing manufactured by other firms or persons."

 (b) DISQUALIFICATION OF VENDOR: Reasonable grounds for believing that a vendor is involved in more than one bid for the same work will be cause for rejection
- of all bids in which such vendors are believed to be involved. Any or all bids will be rejected if there is reason to believe that collusion exists between vendors. Bids in
- which the prices obviously are unbalanced will be subject to rejection.

 (c) TRADE CUSTOMS: Current trade customs of the printing industry are recognized unless accepted by Special Conditions or Specifications herein.

 (d) COMMUNICATIONS: It is expected that all materials and proofs will be picked
- up and delivered by the printer or his representative, unless otherwise specified. Upon request, materials will be forwarded by registered mail.

 (e) RETURN OF MATERIAL: All copy, photos, artwork, and other materials supplied by the University of Florida must be handled carefully and returned in good condition upon completion of the job. Such return is a condition of the contract and payment will not be made until return is affected.
- 27. E-VERIFY COMPLIANCE. Agency is obligated to comply with the provisions of Section 448.095, Fla. Stat., "Employment Eligibility." Compliance with Section 448.095, Fla. Stat., includes, but is not limited to, utilization of the E-Verify System to verify the work authorization status of all newly hired employees. Vendor affirms and represents that it is registered with the E-Verify system and are using same, and will continue to use same as required by Section 448.095, Fla. Statute.

END OF SECTION

Bid Number: ITB22KO-129

Title: Water Reclamation Facility Filtration System Replacement

UF Project Number: UT00348



AUTHORIZED REPRESENTATIVE CONTACT INFO:

UF PROCUREMENT SERVICES

Karen Olitsky 971 Elmore Drive / PO Box 115250 Gainesville, FL 32611-5250 (352) 294-1163 kolitsk@ufl.edu

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https://facilities.ufl.edu/wp-content/uploads/forms/contracts/GTC.pdf

III. <u>Division 0 Non-Technical Specifications</u>

 $\underline{https://facilities.ufl.edu/wp\text{-}content/uploads/forms/contracts/Div0NonTechSpecs.pdf}$

IV. <u>Division 1 Non-Technical Specifications</u>

https://facilities.ufl.edu/wp-content/uploads/forms/contracts/Div1 NonTech Specs SEPT 2020.pdf

V. UF Design and Construction Standards

https://facilities.ufl.edu/projects/forms-standards/design-construction-standards/

VI. Standards, Policies, Regulations, Forms, Guides, Inspection & Closeout and References

https://facilities.ufl.edu/projects/forms-standards/

a. Other Forms

- Dig Permits: https://www.facilitiesservices.ufl.edu/departments/utilities/dig-permits/
- Building Codes Enforcement Inspections: https://www.ehs.ufl.edu/departments/facility-support-services/building-codes-enforcement/inspections/
- Fire Plan Review and Inspection: https://www.ehs.ufl.edu/departments/facility-support-services/fire-safety/

00020 - INVITATION TO BID

The Invitation to Bid shall be in accordance with the University of Florida, Procurement Services "Invitation to Bid Acknowledgement Form" with all relevant information provided therein.

END OF SECTION

00100 - INSTRUCTIONS TO BIDDERS

1.1 RELATED SECTIONS

A. Documents affecting the work of this Section include, but are not necessarily limited to, the General Terms & Conditions and other Sections in Divisions 0 and 1 of these Specifications.

1.2 THE WORK

PROJECT TITLE: Water Reclamation Facility Filtration System Replacement

1.3 SECURING DOCUMENTS

Copies of the proposed Contract Documents may be obtained from:

University of Florida Procurement Services website. https://procurement.ufl.edu/vendors/schedule-of-bids/

1.4 BID FORM

To be considered responsive and responsible, make bids in strict accordance with the following:

- A. Make bids upon the forms provided, properly signed and with all items completed. Do not change the wording of the bid form and do not otherwise alter or add words to the bid form. Unauthorized conditions, limitations, or provisions attached to the bid may be cause for rejection of the bid.
- B. Include with bid a completed and signed Invitation to Bid Construction AcknowledgmentForm.
- C. Include completed Section 00310 Bid Form.
- D. Include list of subcontractors as described in Section 00430 Subcontractor Listing.
- E. Bids must be submitted no later than March 24, 2022 at 3:00 PM, local time. No bids received after the time fixed for receiving them will be considered. Late bids will be returned to the bidder unopened.
- F. Address bids to Karen Olitsky, Procurement Agent III, and deliver to:

University of Florida Procurement Services 971 Elmore Drive / PO Box 115250 Gainesville, FL 32611-5250

Submit bid in a sealed envelope that includes the bid number, contractor name and date and time of the bid opening on the outside of the envelope. Submit one (1) original bid and one (1) electronic copy on flash drive or CD/DVD. It is the sole responsibility of the bidder to see that bids are received on time. Faxed and/or emailed bids will not be accepted.

1.5 PROOF OF COMPETENCY OF BIDDER

A bidder may be required to furnish evidence, satisfactory to the Owner, that the bidder and the

bidder's proposed subcontractors have sufficient means and experience in the types of work required to assure completion of the Contract in a satisfactory manner.

1.6 WITHDRAWAL OF BIDS

- A. A bidder may withdraw their bid, either personally or by written request, at any time prior to the scheduled time for opening bids.
- B. No bidder may withdraw their bid for a period of forty-five calendar days after the date set for opening thereof, and bids shall be subject to acceptance by the Owner during this period.

1.7 QUALIFICATION OF BIDDERS

- A. A contract will be awarded only to a responsible bidder, qualified by experience and in a financial position to perform the work specified.
- B. If the bidder has not been pre-qualified with UF Procurement Services within the fiscal year (July 1 through June 30), the bidder may be required to submit the following evidence of eligibility:
 - 1. Evidence that bidder is licensed by the appropriate government agency to perform the work specified.
 - 2. Experience record showing bidder's training and experience in similar work.
 - 3. A brief description of three to five projects of similar size and/or complexity satisfactorily completed over the last five years, including location, dates of contracts, names of contracts, and names and addresses of owners.

1.8 SUBCONTRACTS

If the Bidder intends to subcontract any of the Work:

- A. A list of all proposed subcontractors shall be provided with the bid for scopes/packages more than \$10,000. See Section 00430 Subcontractor Listing.
- B. Each subcontractor performing work more than \$10,000 must present evidence of being qualified in and licensed for the applicable trade. Such proof of subcontractor licensure shall be provided by the successful bidder after award, but prior to commencement of Work.

1.9 PERFORMANCE AND PAYMENT BONDS

See General Terms & Conditions, Article 20.

1.10 BID DEPOSIT

Not required.

1.11 AWARD OR REJECTION OF BIDS

The Contract, if awarded, will be awarded to the responsible and responsive bidder who has proposed the lowest Contract Sum, subject to the owner's right to reject any or all bids and to waive informality and irregularity in the bids and in the bidding. Acceptance or rejection of any bid will be at the owner's

sole discretion.

1.12 NON-MANDATORY PRE-BID CONFERENCE:

A Non-Mandatory Pre-bid Conference will be held prior to the scheduled bid opening for the purpose of considering questions posed by bidders. The conference is open to interested bidders, prospective subcontractors, and any other interested parties. This conference will be held <u>March 3, 2022 at 9:30</u> <u>AM</u>, local time at the Water Reclamaintion Facility, 1103 Gale Lemerand Drive, Gainesville, FL, 32611. The meeting will begin in the parking lot inside the fenced area.

1.13 EXECUTION OF AGREEMENT

- A. A Purchase Order (PO) will be issued for purposes of fiscal encumbrance and payment. The PO itself serves as the form of contract.
- B. Upon notice of Bid Award, the bidder to whom the Contract is awarded shall deliver to UF those Certificates of Insurance and Payment & Performance Bonds required by the Contract Documents.
- C. Bonds and Certificates of Insurance shall be approved by UF before the successful bidder may proceed with the Work.

1.14 INTERPRETATION OF CONTRACT DOCUMENTS PRIOR TO BIDDING

- A. If any person contemplating submitting a bid for construction of the Work is in doubt as to the true meaning of any part of the Contract Documents, or finds discrepancies in or omissions from any part of the Contract Documents, they may submit a written request for interpretation thereof no later than March 8, 2022 at 5:00 PM, local time, to Karen Olitsky, Procurement Agent III at kolitsk@ufl.edu. The person submitting the request shall be responsible for its prompt delivery.
- B. Interpretations or corrections of proposed Contract Documents will be made only by Addendum and will be available on the Procurement Services "Schedule of Bids" webpage https://procurement.ufl.edu/vendors/schedule-of-bids/. The Owner will not be responsible for any other explanations or interpretations of the proposed Contract Documents.

1.15 TIME OF COMPLETION:

A. Date of beginning, rate of progress and time for completion of Work for this Project are ESSENTIAL CONDITIONS of Contract. Successful Bidder hereby agrees that Work required by this Contract shall be commenced within ten (10) calendar days after issuance date of written Notice to Proceed; that all insurance and permits will be obtained; that all documents and notices will be filed; that all requirements as specified will be met; and that Work shall be prosecuted regularly, diligently and uninterruptedly at such rate of progress as will insure Substantial Completion of entire Project within nine (9) months after receipt of Notice to Proceed, and shall be finally completed within 30 days after the date of Substantial Completion.

END OF SECTION

00310 - BID FORMS

BID PROPOSAL

FROM:

	(Name of Bidder)		
ГО:	UNIVERSITY OF FLOR PROCUREMENT SERV 971 Elmore Drive P.O. Box 115250 Gainesville, Florida 3261	TICES	
Fl 1			and a Compath of Durings
entitled dand thore affecting equipment correct correc	TTB22KO-129, Water Reclar oughly inspected the site of the grand governing the construction and other items, facilities a impliance with the Contract Doment Services, and, if awarded	"Bidder", having reviewed the Contract Documentamation Facility Filtration System Replacement the proposed Project and familiarized himself/herself tion of said Project, hereby proposes to furnish a and services for the proper execution and completion occuments, Addenda, and all other Documents relating the Contract, to complete the said Work within the rein, for the sums as enumerated on this and the follows:	and having visited with all conditions all labor, materials, on of the Project, in the thereto on file in the time limits called
BASE I			Dollars
	\$		
ADDEN Receipt o		he Construction Documents is acknowledged:	
ADDEN	NDUM #	Dated	
ADDEN	NDUM #	Dated	
ADDEN	NDUM #	Dated	
COMPI	LETION DATE:		
	k covered by the Bidding Do occupancy as specified in the c	ocuments and the foregoing Base Bid shall be com- contract documents.	apleted and ready for
SIGNA	ΓURE:		
l hereby	certify that for all statements	and amounts herein made on behalf of	
Name of B	idder)		

have full authority to make the statements and commitment herein and submit this Bid Proposal in (its) (their) behalf, and all statements are true and correct.				
Signed and sealed this	day of		, 2022.	
(Signature of Bidder)				
(Print Name)		(Title)		
WITNESS:				
(Signature of Witness)				
(Print Name)				
Address:			_	
(City)	(State)	(Zip Code)	_	

a (Corporation) (Partnership) (Individual) organized and existing under the laws of the State of Florida, I have carefully prepared this Bid Proposal from Contract Documents described hereinbefore, I have examined Contract Documents and local conditions affecting execution of Work before submitting this Bid Proposal, I

END OF SECTION

00430 - SUBCONTRACTOR LISTING

1.1 RELATED SECTIONS

A. Documents affecting the work of this Section include, but are not necessarily limited to, the General Terms & Conditions and other Sections in Divisions 0 and 1 of these Specifications.

1.2 SUBCONTRACTOR LISTS

- A. Each bidder shall furnish with its bid a list of all subcontractors for subcontracted scopes/packages of work valued at more than \$10,000.
- B. This list shall identify for each subcontracted package in excess of \$10,000 the name and address of the proposed subcontractor and the approximate value of the subcontract.
- C. If the bidder does not intend to subcontract portions of the Work in amounts greater than \$10,000, then a statement to that affect shall be furnished with the bid.
- D. See Section 00100 Instruction to Bidders regarding subcontractor licensure requirements.

END OF SECTION

CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

for

UNIVERSITY OF FLORIDA WATER RECLAMATION FACILITY FILTRATION SYSTEM REPLACEMENT PROJECT (UT00348-1070)



UNIVERSITY OF FLORIDA

Utilities and Energy Services
Physical Plant Division
P.O. Box 117735
Gainesville, FL 32611-7735



ARDURRA GROUP, INC.

4921 Memorial Highway, Suite 300 Tampa, FL 33634

Bid Documents January 2022

UNIVERSITY OF FLORIDA WATER RECLAMATION FACITITY FILTRATION SYSTEM REPLACEMENT PROJECT

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01600	MATERIAL AND EQUIPMENT
01625	START-UP SYSTEMS TESTING

01640 **QUALITY CONTROL** 01670 SUBSTITUTIONS AND PRODUCT OPTIONS CONTRACT CLOSEOUT 01700 01710 PROJECT CLEANING 01720 PROJECT RECORD DOCUMENTS 01730 OPERATING AND MAINTENANCE DATA

WARRANTIES AND BONDS

DIVISION 02 SITE WORK

01740

02770

REMOVAL OF EXISTING EQUIPMENT 02062 02125 SILT BARRIERS 02140 TEMPORARY DEWATERING 02221 **EXCAVATION AND BACKFILL** 02276 TEMPORARY EROSION AND SEDIMENTATION CONTROL 02485 SURFACE RESTORATION GEOMEMBRANE LINER

DIVISION 03 CONCRETE

CONCRETE FORMWORK 03100 03200 CONCRETE REINFORCEMENT CAST-IN-PLACE CONCRETE 03300 03350 **CONCRETE FINISHES** 03600 **GROUT**

DIVISION 09 FINISHES

09900 PAINTING AND PROTECTIVE COATINGS

DIVISION 11 EQUIPMENT

11723 CLOTH MEDIA DISK FILTERS

11725 ALUMINUM FRAME SUPPORTED MEMBRANE FILTER COVER

DIVISION 13 SPECIAL CONSTRUCTION

13610 PLC AND SCADA EQUIPMENT

13620 PROCESS INSTRUMENTATION AND EQUIPMENT

13640 CONTROL STRATEGY

DIVISION 15 MECHANICAL

15010 BASIC MECHANICAL REQUIREMENTS

15062 DUCTILE IRON PIPE AND FITTINGS

15064 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

15094 PIPE HANGERS AND SUPPORTS

15100 VALVES AND APPURTENANCES

DIVISION 16 ELECTRICAL

16010 BASIC ELECTRICAL REQUIREMENTS

16110 RACEWAYS

16120 WIRES AND CABLES

16135 ELECTRICAL BOXES, CONTROL PANELS, AND FITTINGS

16142 ELECTRICAL CONNECTIONS FOR EQUIPMENT

16143 WIRING DEVICES

16190	SUPPORTING DEVICES
16195	ELECTRICAL IDENTIFICATIONS
16452	GROUNDING

SECTION 01005

GENERAL REQUIREMENTS

PART 1 - GENERAL

Α.

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SCOPE OF WORK 1.01

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The Work to be completed consists of the furnishing of all labor, materials and equipment, and the performance of all Work included in this Contract. The two Tertiary Cloth Media Filters will be purchased by the University under an Invitation to Negotiate (ITN) Procurement Services to accelerate production with installation included in this Contract.

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B. Work Included

Description

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The Contractor shall furnish all labor, superintendence, materials, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies and other means of construction necessary or proper for performing and completing the Work. The Contractor shall perform and complete the Work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the Engineer, and in strict accordance with the Contract Documents. The Contractor shall clean up the Work and maintain it during and after construction, until accepted, and shall do all Work and pay all costs incidental thereto. The Contractor shall repair or restore all structures and property that may be damaged or disturbed during performance of the Work.

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The cost of incidental Work described in these General Requirements, for which there are no specific Contract Items, shall be considered as part of the general cost of doing the Work and shall be included in the prices for the various Contract Items. No additional payment will be made.

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40 41 The Contractor shall provide and maintain such modern plant, tools, and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the Work required by this Contract. Only equipment of established reputation and proven efficiency shall be used. The Contractor shall be solely responsible for the adequacy of his workmanship, materials and equipment, prior approval of the Engineer notwithstanding.

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> 01005-1 GENERAL REQUIREMENTS

C. Existing Utility Installation and Structures

Existing utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes and all other appurtenances and facilities pertaining thereto whether owned or controlled by the University, other governmental bodies used to serve the University with transportation, traffic control, gas, electricity, telephone, sewerage, drainage, water or other public or private property which may be affected by the Work shall be deemed included hereunder.

The Contractor shall protect all existing utility installations and structures from damage during the Work. Access across any buried existing utility installation, or structure, shall be made only in such locations and by means approved by the Engineer. The Contractor shall so arrange his operations as to avoid any damage to these facilities. All required protective devices and construction shall be provided by the Contractor at his expense. All existing utilities damaged by the Contractor, shall be repaired by the Contractor, at his expense, as directed by the Engineer. No separate payment shall be made for such protection or repairs to existing utility installations or structures.

Existing utility installations or structures owned or controlled by the University or other governmental body, which are shown on the Plans to be removed, relocated, replaced or rebuilt by the Contractor, shall be considered as a part of the general cost of doing the Work and shall be included in the prices bid for the various contract items. No separate payment shall be made therefore.

1.02 DRAWINGS AND SPECIFICATIONS

A. Drawings

When obtaining data and information from the Construction Drawings, figures shall be used in preference to scaled dimensions, and large-scale drawings in preference to small scale drawings.

B. Copies Furnished to Contractor

After the Agreement has been executed, the Contractor will be furnished copies of Contract Documents in accordance with the General Conditions.

The Contractor shall furnish each of the subcontractors, manufacturers, and suppliers such copies of the Contract Documents as may be required for their Work. Additional copies of the Drawings and Specifications, when requested, may be furnished to the Contractor at cost of reproduction.

01005-2 GENERAL REQUIREMENTS

C. Supplementary Drawings

When, in the opinion of the Engineer, it becomes necessary to explain more fully the Work to be done or to illustrate the Work further or to show any changes which may be required, Drawings known as Supplementary Drawings, with Specifications pertaining thereto, will be prepared by the Engineer and up to five paper prints thereof will be given to the Contractor and two copies to the University.

D. Contractor to Check Drawings and Data

The Contractor shall verify all dimensions, quantities and details shown on the Shop Drawings, Construction Drawings, Supplementary Drawings, Schedules, Specifications or other data received from the Engineer and shall notify the Engineer of any errors, omissions, conflicts and discrepancies found therein. The Contractor shall submit to the Engineer a Request for Information (RFI), consecutively numbered, detailing all errors, omissions, conflicts and discrepancies. Engineer will promptly provide a response to all RFIs submitted by the Contractor. Contractor shall not take advantage of any errors or omissions, as full instructions will be furnished by the Engineer, should such errors or omissions be discovered.

E. Technical Specifications

The Technical Specifications consist of three parts: General, Products and Execution. The General Section contains General Requirements that govern the Work. Products and Execution modify and supplement these by detailed requirements for the Work and shall always govern whenever there appears to be an inconsistency.

F. Intent

All Work called for in the Specifications applicable to this Contract, but not shown on the Construction Drawings in their present form, or vice verse, shall be of like effect as if shown or mentioned in both. Work not specified in either the Construction Drawings or in the Specifications but involved in carrying out their intent or in the complete and proper execution of the Work, is required and shall be performed by the Contractor as though it were specifically delineated or described.

The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any Work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.

01005-3 GENERAL REQUIREMENTS

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The inclusion of the Related Requirements (or Work specified elsewhere) in the General part of the specifications is only for the convenience of the Contractor and shall not be interpreted as a complete list of related Specification Sections.

MATERIALS AND EQUIPMENT 1.03

Α. Manufacturer (Suppliers)

The names of proposed manufacturers, suppliers and dealers who are to furnish materials, fixtures, equipment, appliances or other fittings shall be submitted to the Engineer for approval. Such approval must be obtained before shop drawings will be checked. No manufacturer will be approved for any materials to be furnished under this Contract unless the Contractor shall be of good reputation and have a plant of ample capacity. The Contractor shall, upon the request of the Engineer, be required to submit evidence that The Contractor has manufactured a similar product to the one specified and that it has been previously used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request in writing to the Engineer, that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.

Any two or more pieces of material or equipment of the same kind, type or classification, and being used for identical types of service, shall be made by the same manufacturer.

B. Delivery

The Contractor shall coordinate delivery of materials in ample quantities to The Contractor shall insure the most speedy and prevent delays. uninterrupted progress of the Work so as to complete the Work within the allotted Contract Time. The Contractor shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the Work of any related Contractor.

C. Installation of Equipment

The Contractor shall have on hand sufficient proper equipment and 1. machinery of ample capacity to facilitate the Work and to handle all emergencies normally encountered in Work of this character.

> 01005-4 GENERAL REQUIREMENTS

- 2. Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Construction Drawings, unless directed otherwise by the Engineer during installation. All equipment shall be correctly aligned, leveled and adjusted for satisfactory operation and shall be installed so that proper and necessary connections can be made readily between the various units.
- 3. The Contractor shall furnish, install and protect all necessary anchor and attachment bolts and all other appurtenances needed for the installation of the devices included in the equipment specified. Anchor bolts shall be as approved by the Engineer and made of ample size and strength for the purpose intended. Substantial templates and working drawings for installation shall be furnished by the Contractor.
- 4. The Contractor shall, at his own expense, furnish all materials and labor for, and shall properly bed in non-shrink grout, each piece of equipment on its supporting base that rests on masonry foundations. Grout shall completely fill the space between the equipment base and the foundation. All metal surfaces coming in contact with concrete or grout shall receive a coat of coal tar epoxy equal to Kop-Coat 300M, or material/paint as directed by the Engineer.

E. Services of Manufacturer's Representative

- The prices for equipment shall include the cost of furnishing a competent and experienced, factory-trained engineer or superintendent who shall represent the manufacturer and shall assist the Contractor, when required, to install, adjust, test and place in operation the equipment in conformity with the Contract Documents. After the equipment is placed in permanent operation by the University, such engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that such equipment is proper and in satisfactory operating condition, and shall instruct such personnel as may be designated by the University in the proper operation and maintenance of such equipment.
- 2. In addition, the Contractor shall have the manufacturer's representative execute a written Certification of Proper Installation indicating that the Contractor has installed the equipment in accordance with the manufacturer's recommendations. No equipment will be accepted without this Certification of Proper Installation.

1.04 INSPECTION AND TESTING

A. General

For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Five copies of the reports shall be submitted, and certification thereof must be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment.

If, in the making of any test of any material or equipment, it is ascertained by the Engineer that the material or equipment does not comply with the Contract, the Contractor will be notified thereof and The Contractor will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the Work and replace it with acceptable material, without cost to the University.

Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.

The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage that may occur to equipment prior to the time when the University formally takes over the operation thereof.

B. Costs

All testing furnished under this Contract shall be performed by the Contractor or inspection bureaus without cost to the University, unless otherwise expressly specified.

The cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents shall be borne by the Contractor and such costs shall be deemed to be included in the Contract price.

Materials and equipment submitted by the Contractor as equivalent to those specified may be tested by the University for compliance with the specifications. The Contractor shall reimburse the University for the expenditures incurred in making such tests on materials and equipment that are rejected for non-compliance.

01005-6 GENERAL REQUIREMENTS

C. Inspection of Materials

The Contractor shall give notice in writing to the Engineer sufficiently in advance of his intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, the Engineer will arrange to have a representative present at such times during the manufacture as maybe necessary to inspect the materials or he will notify the Contractor that the inspection will be made at a point other than the point of manufacture, or he will notify the Contractor that inspection will be waived. The Contractor must comply with these provisions before shipping any material. Such inspection shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

D. Certificate of Manufacture

When inspection is waived or when the Engineer so requires, the Contractor shall furnish to him authoritative evidence in the form of Certificates of Manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

E. Shop Tests of Operating Equipment

Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function or special requirements are specified shall be tested in the shop of the maker in a manner that shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. No such equipment shall be shipped to the Work until the Engineer notifies the Contractor, in writing, that the results of such tests are acceptable.

Five copies of the manufacturers actual test data and interpreted results thereof, accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company, will be forwarded to the Engineer for approval.

The cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.

01005-7 GENERAL REQUIREMENTS

F. Preliminary Field Tests

As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make preliminary field tests of equipment. If the preliminary field tests indicate that any equipment furnished under this Contract does not comply with the requirements of the Contract Documents, the Contractor shall, prior to the acceptance tests, make all changes, adjustments and replacement required. The Contractor shall assist in the preliminary field tests as applicable.

G. Final Field Tests

Upon completion of the Work and prior to final payment, all equipment and piping installed under this Contract shall be subjected to acceptance tests as specified or required to prove compliance with the Contract Documents.

The Contractor shall furnish labor, fuel, energy, water and all other materials, equipment and instruments necessary for all acceptance tests, at no additional cost to the University. The Supplier shall assist in the final field tests as applicable.

H. Failure of Tests

Any defects in the materials and equipment or their failure to meet the tests, guarantee or requirements of the Contract Documents shall be promptly corrected by the Contractor, by replacement or otherwise as directed by the Engineer. The decision of the Engineer as to whether or not the Contractor has fulfilled his obligations under the Contract will be final and conclusive. If the Contractor fails to make these corrections, or if the improved materials and equipment, when tested, shall again fail to meet the guarantees or specified requirements, the University, notwithstanding its partial payment for Work, and materials and equipment, may reject the materials and equipment and may order the Contractor to remove them from the site at his own expense.

I. Final Inspection

During such final inspections, the Work shall be clean and free from water. In no case will the final estimate be prepared until the Contractor has complied with all requirements set forth and the Engineer has made his final inspection of the entire Work and is satisfied that the entire Work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents.

01005-8 GENERAL REQUIREMENTS

1.05 TEMPORARY STRUCTURES

A. Temporary Fences

If, during the course of the Work, it is necessary to remove or disturb any fence or part thereof, the Contractor shall, at his own expense, if so ordered by the Engineer, provide a suitable temporary fence, which shall be maintained until the permanent fence is replaced or the fence is not needed. The Engineer will be solely responsible for the determination of the necessity for providing a temporary fence and the type of temporary fence to be used.

B. Temporary Driveways

The Contractor shall furnish, install and maintain at its own expense all temporary driveways and access roads required to provide access to the Work and through the site of the Work, to maintain existing operations, and to allow construction of other projects in the area. The Contractor shall fully cooperate with the Engineer in providing this access.

1.06 TEMPORARY SERVICES

A. First Aid

The Contractor shall keep upon the site, at each location where Work is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times when people are employed on the Work.

1.07 LINES AND GRADE

A. Grade

All Work under this Contract shall be constructed in accordance with the lines and grades shown on the Construction Drawings, or as given by the Engineer. The full responsibility for keeping alignment and grade rests upon the Contractor.

The Contractor, prior to commencing construction, shall establish bench marks and base line controlling points. The Contractor shall so place excavation and other materials as to cause no inconvenience in the use of the reference marks provided. The Contractor shall remove any obstructions placed by him contrary to this provision.

01005-9 GENERAL REQUIREMENTS

B. Surveys

The Contractor shall furnish and maintain, at his own expense, stakes and other such materials to establish all working or construction lines and grades, as required, and shall be solely responsible for the accuracy thereof.

All surveying shall be performed in accordance with Specification 01050.

C. Safeguarding Marks

The Contractor shall safeguard all points, stakes, grade marks, monuments and bench marks made or established on the Work, bear the cost of reestablishing them if disturbed, and bear the entire expense of rectifying Work improperly installed due to not maintaining or protecting or to removing without authorization such established points, stakes and marks.

The Contractor shall safeguard all existing and known property corners, monuments and marks adjacent to but not related to the Work and, if required, shall bear the cost of re-establishing them if disturbed or destroyed.

1.08 ADJACENT STRUCTURES AND LANDSCAPING

A. The Contractor shall be entirely responsible and liable for all damage or injury as a result of his operations to all other adjacent public and private property, structures of any kind and appurtenances thereto met with during the progress of the Work. The cost of protection, replacement in their original locations and conditions or payment of damages for injuries to such adjacent public and private property and structures affected by the Work, whether or not shown on the Construction Drawings or specified shall be included in the various Contract Items and no separate payments will be made therefore. Where such public and private property structures of any kind and appurtenances thereto are not shown on the Construction Drawings and in the opinion of the Engineer are damaged and required to be removed in order to avoid interference with the Work, payment therefore will be made as provided for in the General Conditions.

Contractor is expressly advised that the protection of buildings, structures, tunnels, tanks, pipelines, etc., adjacent to and in the vicinity of his operations, wherever they may be, is solely his responsibility. Conditional inspection of buildings or structures in the immediate vicinity of the project, which may reasonably be expected to be affected by the Work, shall be performed by, and be the responsibility of, the Contractor.

Contractor shall, before starting operations, make an examination of the interior and exterior of the adjacent structures, buildings, pipelines, facilities, etc., and record by noting, measurements, photographs, etc., any conditions

01005-10 GENERAL REQUIREMENTS

that might be aggravated by open excavation and construction. Repairs or replacement of all conditions disturbed by the construction shall be made to the satisfaction of the University and to the satisfaction of the Engineer. This does not preclude conforming to the requirements of the insurance underwriters. Copies of surveys, photographs, reports, etc., shall be given to the Engineer.

B. Protection of Trees

- 1. Unless indicated to be removed, the Contractor shall adequately protect all trees and shrubs with boxes or otherwise in accordance with ordinances governing the protection of trees. No excavated materials shall be placed so as to injure such trees or shrubs. Trees or shrubs destroyed through negligence of the Contractor or his employees shall be replaced with new stock of similar size and age, in the proper season and at the sole expense of the Contractor.
- 2. Beneath trees or other surface structures, where possible, pipelines may be built in short tunnels, backfilled with excavated materials, except as otherwise specified, or the trees or structures carefully supported and protected from damage.
- The University may order the Contractor, for the convenience of the University, to remove trees along the line or trench excavation. If so ordered, the University will obtain any permits required for removal of trees.

C. Lawn Areas

Lawn areas shall be left in as good condition as before the starting of the Work. Where sod is to be removed, it shall be restored with new sod. The specific attention of the Contractor is directed to the requirements of those right-of-way use permits that require sod to be installed in lieu of grassing.

The cost of all labor, materials and equipment required for the replacement or repair of any lawn area shall be included in the appropriate bid items and no additional payment will be made therefore.

D. Restoration of Fences

Any fence, or part thereof, that is damaged or removed during the course of the Work shall be replaced or repaired by the Contractor and shall be left in as good a condition as before the starting of the Work. The manner in which the fence is repaired or replaced, and the materials used in such Work, shall be subject to the approval of the Engineer. The cost of all labor, materials and equipment required for the replacement or repair of any fence shall be

01005-11 GENERAL REQUIREMENTS

1 2 will be made therefore. 3 4 1.09 PROTECTION OF WORK AND PUBLIC 5 6 Α. Barriers and Lights 7 8 9 10 11 12 13 public. 14 15 B. Smoke Prevention 16 17 18 19 20 permitted. 21 22 C. Noise 23 24 25 26 27 28 29 30 31 32 33 34 35 of the Work. 36 Access to Public Services 37 D. 38 39 40 41 fire hydrants, valves or manholes. 42 Ε. 43 **Dust Prevention** 44 45 46

included in the appropriate Contract Item or items and no additional payment

During the prosecution of the Work, the Contractor shall put up and maintain at all times such barriers and lights as will effectively prevent accidents. The Contractor shall provide suitable barricades, red lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the Work causes obstructions to the normal traffic or constitutes in any way a hazard to the

The Contractor shall use hard coal, coke, oil or gas as fuel for equipment generating steam. A strict compliance with ordinances regulating the production of emission of smoke will be required. No open fires will be

The Contractor shall at all times minimize noise to the greatest extent practicable. Air compressing plants shall be equipped with silencers and the exhaust of all gasoline motors or other power equipment shall be provided with mufflers. In the vicinity of hospitals, special care shall be used to avoid noise or other nuisances. The Contractor shall strictly observe all local regulations and ordinances covering noise control.

Except in the event of an emergency, no Work shall be done between the hours of 7:00 P.M. and 7:00 A.M., holidays, or on Sundays. If the proper and efficient prosecution of the Work requires operations during the night, the written permission of the Engineer will be obtained before starting such items

Neither the materials excavated nor the materials or plant used in the construction of the Work shall be so placed as to prevent free access to all

The Contractor shall prevent dust nuisance from his operations or from traffic by keeping the roads and/or construction areas sprinkled with water at all

> 01005-12 GENERAL REQUIREMENTS

1 2 3			times. The Contractor shall be solely responsible for securing a source of reclaimed, potable or other source of water for dust prevention and control.			
4	1.10	CUTTING AND PATCHING				
5 6 7 8 9 10		A.	The Contractor shall do all cutting, fitting or patching of the Work that may be required to make the several parts thereof join and coordinate in a manner satisfactory to the Engineer and in accordance with the Construction Drawings and Specifications. The Work shall be performed by competent workmen skilled in the trade required by the restoration.			
12 13	1.11	CLEA	NING			
13 14 15 16 17 18		A.	At all times during the construction of the Work, the Contractor shall keep the site of the Work and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the Engineer, such material, debris, or rubbish constitutes a nuisance or is objectionable.			
20 21 22			The Contractor shall remove from the site all of his surplus materials and temporary structures when no further need therefore develops.			
23		B.	Final Clearing			
24 25 26 27 28			At the conclusion of the Work, all erection plant, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and the Contractor shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances.			
29 30 31 32			The Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver such materials and equipment undamaged in a bright, clean, polished and new operating condition.			
33 34	1.12	MISC	ELLANEOUS			
35 36 37		A.	Existing Facilities			
38 39 40 41			The Work shall be so conducted to maintain existing facilities in operation insofar as is possible. Requirements and schedules of operations for maintaining existing facilities in service during construction shall be as described in these Specifications.			
42 43		B.	Use of Chemicals			
14 15 16			All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of			
			01005-13 12/10/21 GENERAL REQUIREMENTS			

other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with manufacturers' instructions.

C. Related Permits

The Contractor recognizes that permit(s) will be required for the Work. Permits required for this project include, but may not be limited to:

- 1. The University of Florida Environmental Health and Safety

2. The University of Florida – Building Department Review

 It is the sole responsibility of the Contractor to submit, in a timely manner, any information, data, etc. which is required as a condition of a permit. Required information, data, etc. shall be submitted directly to the permitting agency by the Contractor with copies to the Permittee (or University) and the Engineer. The Contractor shall be responsible for any fine(s) or other action(s) resulting from his violation of permit conditions.

1.13 RESTORATION OF PROPERTY

 A. Responsibility. All damage resulting from construction on existing structures, roadway pavement, driveways, other paved areas, fences, utilities, traffic control devices and any other obstruction not specifically named herein, shall be repaired, restored or replaced by the Contractor unless otherwise specified.

 B. Temporary Repairs. At a minimum, all damage described in Paragraph A above shall be temporarily repaired, restored or replaced immediately following damage thereto. Temporary restoration shall mean putting the affected area back into a safe, usable condition. In no case shall trenches remain open over night within a street right-of-way unless the municipality's traffic control division grants specific approval.

C. Permanent Repairs. All damage shall be permanently repaired, restored, or replaced not later than the 30th calendar day following the completion of construction at that location unless otherwise stipulated. Permanent repairs shall be accomplished in a professional workmanship-like manner in accordance with Specifications contained herein, or contract documents, if addressed. The Contractor may be relieved of the 30-day time limit above only by specific written agreement with the Engineer.

D. University Retribution. In the event that the Contractor fails to make permanent repairs within the time specified, the University, at its option, will cause the repair, restoration, or replacement of the affected area to be

> 01005-14 GENERAL REQUIREMENTS

1 accomplished using its own resources or by contract with others. The costs 2 of such Work will be deducted from any other monies owed the Contractor. 3 4 1.14 HURRICANE PREPAREDNESS PLAN 5 6 Α. Within 30 days of the date of Notice to Proceed, the Contractor shall submit 7 to the Engineer and Owner a Hurricane Preparedness Plan. The Plan should 8 outline the necessary measures that the Contractor proposes to perform at 9 no additional cost to the Owner in case of a hurricane warning. 10 11 B. In the event of inclement weather, or whenever Engineer will direct; the 12 Contractor shall carefully protect the Work and materials against damage or 13 injury from the weather. If, in the opinion of Engineer, any portion of Work or 14 materials, work areas properties shall have been damaged or injured by reason of failure on the part of the Contractor or subcontractors to so protect 15 16 the Work, such Work and materials shall be removed and replaced at the 17 expense of the Contractor. 18 PART 2 - PRODUCTS 19 20 (Not Used) 21 22 PART 3 - EXECUTION 23 (Not Used) 24 **END OF SECTION** 25

1	SECTION 01014					
2 3	SUMMARY OF WORK					
4 5	PART	PART 1 – GENERAL				
6 7	1.01	LOCA	LOCATION OF WORK			
8 9 10		A.		Nork of this Contract is located at the University of Florida Water amation Facility in Gainesville, Florida.		
11 12	1.02	SCO	PE OF	WORK TO BE PERFORMED		
13 14 15 16 17 18 19		incide Draw requi	entals ings, i red as	actor shall furnish all labor, materials, equipment, tools, services and to complete all work required by these Specifications and as shown on the including repairs, testing, permits, clean up, replacements, and restoration a result of damages caused during this construction. The work of this enerally includes the following:		
20 21 22 23 24 25 26		Α.	Facilinstructor No No be in	Ill two cloth disc tertiary filter package units at the Water Reclamation ity (WRF) and furnish and install all associated piping, electrical, umentation, and appurtenances. The two tertiary filter package units will be hased by the University under a separate Procurement Services Invitation egotiate to allow production ahead of this Contract. Only one filter unit cannot be at least and place into operations at a time to maintain plant ations.		
27 28 29 30 31		B.	cons shov	ove existing six upflow sand filtration systems (3 with each plant truction phase at a time) including existing control panels and piping as on the drawings. Coordination of the work to avoid disruption of plant ations will be required.		
32 33	1.03	CON	STRU	CTION ACTIVITIES		
34 35		A.	Gen	eral		
36 37 38 39			1.	Upon successful construction completion of each new component, and pre-operational testing, Contractor shall conduct testing as required by the Contract Documents.		
40 41 42 43 44			2.	Contractor shall ensure that, prior to start-up of any component, all handrails, walkways, and lighting and associated safety-related facilities are in place.		
44 45 46 47 48			w b	contractor shall provide Engineer a minimum of 14-calendar days advance ritten notice of any requested change in operation to the existing facility, ypass requirements or connections to existing facilities, and shall obtain the ngineer's written review before scheduling this work.		

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4	B.	Rest	rictions
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6		1.	All operation of valves controlling flow to treatment processes shall be
7			performed by the University personnel. The Contractor shall not be
8			allowed to operate any valves except in emergencies. If there is an
9			emergency, the University shall be notified immediately.
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11			
12	PART 2 – F	PRODU	ICTS (NOT USED)
13			
14	PART 3 – E	EXECU	TION (NOT USED)
15			· ·
16			END OF SECTION
17			

SECTION 01015

CONTROL OF WORK

PART 1 – GENERAL

1.01 WORK PROGRESS

The Contractor shall provide equipment that is efficient, appropriate and large enough to secure a satisfactory quality of work at a rate of progress that insures the completion of the Work within the Contract Times established in the Contract. If, at any time, such facilities appear to the Engineer to be inefficient, inappropriate, or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, Engineer may order the Contractor to increase the facilities equipment, and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required. Such direction provided to the Contractor shall not be construed as accelerating the Work.

1.02 PRIVATE LAND

The Contractor shall not enter or occupy private land outside of designated project location/area, except by written permission of the land University.

1.03 WORK LOCATIONS

Work shall be located as indicated on the Drawings, but the Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required.

1.04 OPEN EXCAVATIONS

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and/or damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel for University's personnel, pedestrians and workmen. Bridges provided for access to private property during construction shall be provided, and then removed when no longer required. The length of open trench will be controlled by the particular surrounding conditions, but shall always be confined to limits that minimize interference with plant operating personnel and does not endanger existing facilities. If prosecution of the Work becomes hazardous, or if it excessively restricts traffic, construction procedures shall be implemented, such as limiting the length of open trench, prohibiting stacking

01015-1 CONTROL OF WORK

excavated material in the street, and/or requiring that the trench not remain open overnight.

- B. The contractor's methods of work will be consistent with the standard practices and requirements of all appropriate Safety Regulatory Agencies, particularly the Occupational Safety and Health Administration (OSHA) requirements for excavation. Unless otherwise specifically stated in these plans and specifications, the methods of safety control and compliance with regulatory agency safety requirements are the full and complete responsibility of the contractor.
- C. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, of other obstacles that could be dangerous to the public shall be well-lighted at night.
- D. No more than 1,000 lineal feet of trench shall be open at any one time and no open trenches overnight or during weekends, holidays, etc....

1.05 TEST PITS

A. The Contractor shall excavate test pits for the purpose of locating underground pipeline or structures in advance of construction. Such pits shall be excavated, protected and backfilled by the Contractor so as not to create a hazardous area. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineer.

1.06 CARE AND PROTECTION OF PROPERTY

- A. The Contractor shall be responsible for the preservation of all public and private property and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the Engineer.
- B. All sidewalks that are disturbed by the Contractor's operations shall be restored to their original condition with the use of similar or comparable materials. All curbing shall be restored in a condition equal to the original construction and in accordance with the best modern practice.
- C. Along the location of the work all fences, walks, bushes, trees, shrubbery, and other physical features shall be protected and restored in a thoroughly workmanlike manner. Fences and other features removed by the Contractor shall be replaced in the location indicated by the Engineer as soon as

01015-2 CONTROL OF WORK

conditions permit. All lawn areas beyond the limits of construction that have been damaged by the Contractor shall be restored to original conditions using sod.

D. Trees close to the work shall be boxed or otherwise protected against injury in accordance with local regulations. The Contractor shall trim all branches that are susceptible to damage due of his operations, but in no case shall any tree be cut or removed without prior notification of the appropriate authority and the Engineer. All injuries to bark, trunk, limbs, and roots of trees shall be repaired by dressing, cutting, and painting in accordance with approved methods, using only approved tools and materials.

E. The protection, removal, and replacement of existing facilities shall be considered part of the Work under the Contract and all costs in connection therewith shall be included in the unit and/or lump sum prices established.

1.07 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

A. The Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains, and electric and telephone cables, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operations shall be repaired by him at his expense.

B. The Contractor shall bear full responsibility for obtaining all locations of underground structures and utilities (including existing water services, drain lines, and sewers). Services shall be maintained and all costs or charges resulting from damage thereto shall be paid by the Contractor.

C. If, in the opinion of the Engineer, permanent relocation of a utility owned by the University is required, the Engineer may direct the Contractor in writing, to perform the work. Work so ordered will be paid for at the unit prices bid in the Proposal, if applicable, or as provided for in the General Conditions. If relocation of a privately owned utility is required, the University will notify the Utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate with the University and Utility and shall have no claim for delay due to such relocation.

1.08 DISTRIBUTION SYSTEMS AND SERVICES

A. The Contractor shall only interrupt water, telephone, Cable TV, sewer, gas, or other related utility services and disrupt the normal functioning of the system as little as possible and shall notify the Engineer and public 48 hours in advance of any requirement for dewatering, isolating, or relocating a

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46 47 section of a utility, so that necessary arrangements may be made with the appropriate agency.

B. If it appears that utility service will be interrupted for an extended period, the Engineer may order the Contractor to provide temporary service lines. Inconvenience of the users shall be the minimum, consistent with the existing conditions. The safety and integrity of the system is of prime importance in scheduling work.

1.09 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly constructed work shall be carefully protected from injury or damage in any way. No wheeling or walking or placing of heavy loads shall be allowed and any portion injured or damaged shall be reconstructed by the Contractor at his own expense.
- B. All structures shall be protected in a manner approved by the Engineer. Should any of the floors or other parts of the structures become heaved, cracked, or otherwise damaged, all such damaged portions of the work shall be completely repaired by the Contractor at his own expense and to the satisfaction of the Engineer. If, in the final inspection of the work, any defects, faults, or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for the guarantee period.
- C. The Contractor shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted by the University.

1.10 WATER FOR CONSTRUCTION PURPOSES

- A. The Contractor shall be responsible for providing all water required for construction purposes at the Contractor's own expense. The Contractor shall make all connections and other provisions necessary to complete all work included as a part of this Contract and shall make ready for use a fully functional system.
- B. The Contractor shall obtain from the University all water required for flushing, testing and cleaning purposes.
- C. Contractor shall coordinate with the University prior to making any connection to existing water mains. A University's representative must be present at the time of connection and the University will operate the valves.

01015-4 CONTROL OF WORK

1.11 MAINTENANCE OF FLOW

A. The Contractor shall, at his own cost, provide for the flow of sewers, drains, drainage facilities and water courses interrupted during the progress of the work, and shall immediately remove all offensive matter. The entire procedure for maintaining existing flows shall be approved by the Engineer in advance of the interruption of any flow.

1.12 COOPERATION WITHIN THIS CONTRACT

A. All firms or persons authorized to perform any work under this Contract shall cooperate with the General Contractor and his subcontractors or trades, and shall assist in incorporating the work of other trades where necessary or required.

B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the Engineer.

1.13 CLEAN-UP

A. During the course of the work, the Contractor shall keep the site of his operations in as clean and neat a condition as is possible. He shall dispose of all residues resulting from the construction work and, at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures, and any other refuse remaining from the construction operation, and shall leave the entire site of the work in a neat and orderly condition.

B. Contractor shall be responsible for the disposal of all materials removed from the site.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 Access to the site of the Work shall be via the various rights-or-way and easements owned or secured by the University. The University's fences that are temporarily removed for the performance of the Work shall be closed up nightly, on weekends, and holidays or any other time work is not in progress. No valves or equipment shall be operated by Contractor personnel without the prior approval of the University or without the University's personnel present during the equipment operation.

END OF SECTION

> 01015-5 CONTROL OF WORK

1 SECTION 01016 2 3 CONSTRUCTION PHASING PLAN 4 5 PART 1 - GENERAL 6 7 CONSTRUCTION PHASING PLAN 8 9 Α. The Contractor shall be responsible for keeping all existing upflow sand filters plant process units in-service during the course of construction based on a 10 11 phased replacement with the proposed new cloth media disc package filter 12 system. 13 14 В. No facility or structure shall be taken out of service until the new replacement 15 cloth media filter is fully constructed, tested and accepted by the University (only one cloth disc filter can be placed in service at a time, see Drawings 16 17 phasing plans). 18 C. 19 It is up to the Contractor to devise their own phasing plan, which will meet the 20 requirements as specified herein. The Contractor shall submit to the 21 Engineer a construction phasing plan for approval, prior to beginning any 22 construction onsite. 23 D. 24 Brief shutdown of equipment may be allowed during critical phases. The 25 Contractor shall notify the University and Engineer for approval, fourteen (14) 26 days prior to any temporary shutdowns. 27 28 Ε. The Contractor shall conduct his operations in such a manner that will 29 maintain access to property/driveways at all times and will result in minimum 30 inconvenience to the public accessing the neighborhood roads and/or 31 business establishments and shall provide temporary access during 32 construction. 33 34 F. Prior to taking out any structure or facilities, the Contractor shall make 35 temporary piping connections as required. All power, labor, equipment, and materials for any temporary piping and pumping shall be the responsibility of 36 37 the Contractor. 38 39 1.02 SUGGESTED PHASING PLAN 40 41 Α. 42 43

- The suggested phasing plan specified herein shall be representative only. It is up to the Contractor to develop their own phasing plan, which will meet the requirements as specified herein. The Contractor shall submit a phasing plan for approval, prior to beginning any construction onsite. The phasing plan shall be coordinated with the Contractors construction schedule.
- B. In general, the phasing plan shall be as follows:

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> 01016-1 CONSTRUCTION PHASING PLAN

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2	1. Nev	V Cloth Media Tertiary Filters
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4 5 6 7 8	a.	Coordinate with the University to isolate one secondary clarifier (east clarifier first) in order to install the piping as shown on the drawings. Only one clarifier may be taken offline at a time to allow the plant to maintain continuously in service throughout the duration of construction.
9	L	
10 11 12	b.	Demolish and relocate stormwater and waste sludge piping as indicated on the Drawings.
13 14 15 16	C.	Install the two (2) cloth media tertiary filter packages in concrete sump with backwash pumps and discharge piping up to the secondary clarifier effluent pipes, local control panel, electrical conduits, and appurtenances.
18 19	d.	Connect to the clarifier effluent pipe and tie-into the new filter piping as indicated in the Drawings.
20		piping do maiodica in the Draminger
21 22	e.	Install filter outlet piping to the existing filter structure flow control chambers requiring a wall core and gate removals.
23 24 25	f.	Modify the existing filter structure flow control chamber outlets (i.e., gate and weirs) as indicated in the Drawings.
26 27 28 29	g.	Perform startup, testing, and training of the University's plant operations staff for the east cloth media filter system and controls via the SCADA system.
30 31 32 33	h.	Demolish and remove the east train of the existing upflow sand filter internal and external components as shown on the drawings.
34 35 36	i.	Repeat (a) through (i) above for the west cloth media filter unit.
37 38 39	PART 2 – PRODUCTS (NOT USED)	
40 41	PART 3 – EXECUTION (NOT USED)	
42 43		END OF SECTION

1				SECTION 01040			
2		COORDINATION					
4 5	PART 1 – GENERAL						
6 7	1.01	PROJECT COORDINATION					
8 9 10 11		A.	effort	Contractor shall provide for the complete coordination of the cors. This shall include, but not necessarily be limited to, coord bllowing:			
12 13			1.	The work of subcontractors.			
14 15 16 17			2.	The flow of material and equipment from suppliers, especial offloading and installation of the two cloth media filter units have been purchased by the University.	•		
18 19 20 21			3.	The effort of equipment manufacturers during installation, t and checkout.	esting		
22			4.	The interrelated work with public and private utilities compa	inies.		
23 24 25			5.	The interrelated work with the University where tie-ins to facilities are required.	existing		
26 27			6.	The effort of independent testing agencies.			
28 29 30			7.	Use of University's valves and equipment, which shall operated by the University.	only be		
31 32 33 34	PART	2 – P (Not l	roduct Jsed)				
35 36 37	PART	3 – E (Not l	XECUT Used)	ΓΙΟΝ			
38 39 40 41 42 43				END OF SECTION			
45 46 47 48				01040-1	12/10/21		

COORDINATION

1			SECTION 01070					
2	ABBREVIATIONS AND SYMBOLS							
4 5	PART 1 – G	ENERAL						
6 7 8 9 10 11 12 13 14 15 16 17 18	A.	Referenced Standards: Any reference to published specifications or standards of any organization or association shall comply with the requirements of the specification or standard which is current on the date of Advertisement for Bids. In case of a conflict between the referenced specifications or standards, the one having the more stringent requirements shall govern. However, no provision of any referenced standard specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of the Owner, Contractor or Engineer, or any of their consultants, agents or employees from those set forth in the Contract Documents.						
19 20 21			between the referenced specifications or standards and ments, the Contract Documents shall govern.					
22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43	B.	Abbreviations: AA AASHTO AASHO ABPA ACI ACOE AGA AGMA AI AIEE AIMA AISC AISI ANSI API APWA AREA ASA ASCE	Aluminum Association American Association of State Highway & Transportation Officials American Association of State Highway Officials (now AASHTO) Acoustical and Board Products Association American Concrete Institute Army Corps of Engineers American Gas Association American Gear Manufacturers Association The Asphalt Institute American Institute of Electrical Engineers (now IEEE) Acoustical and Insulating Materials Association American Institute of Steel Construction American Iron and Steel Institute American National Standard Institute American Petroleum Institute American Public Works Association American Standards Association (now ANSI) American Society of Civil Engineers					
44 45 46		ASHRAE ASME	American Society of Heating, Refrigerating and Air Conditioning Engineers American Society of Mechanical Engineers					

01070-1 ABBREVIATIONS AND SYMBOLS

1	ASSCBC	American Standard Safety Code for Building
2		Construction
3	ASTM	American Society for Testing and Materials
4	AWPA	American Wood Preservers Association
5	AWPB	American Wood Preservers Bureau
6	AWS	American Welding Society
7	AWWA	American Water Works Association
8	CRSI	Concrete Reinforcing Steel Institute
9	CS	Commercial Standard
10	E/A	Engineer and/or Architect
11	EPA	Environmental Protection Agency
12	F'C	Concrete Compressive Strength
13	FDEP	Florida Department of Environmental Protection
14	FDER	(now FDEP - formerly Florida Department of
15		Environmental Regulation)
16	FDOT	Florida Department of Transportation
17	FDOT Specs	Spec Standard Specification for Road and Bridge
18	-	Construction, Florida Department of Transportation,
19		2011
20	FS	Federal Standard
21	GPM	Gallons Per Minute
22	HP	Horsepower
23	ID	Inside Diameter
24	IEEE	Institute of Electrical and Electronic Engineers
25	IPCEA	Insulated Power Cable Engineers Association
26	LBR	Limerock Bearing Ratio
27	NBFU	National Board of Fire Underwriters
28	NBS	National Bureau of Standards
29	NEC	National Electrical Code
30	NECA	National Electrical Code National Electrical Contractors' Association
31	NEMA	National Electrical Manufacturers Association
32	NFPA	National Fire Protection Association
33	NPDES	National Pollution Discharge Elimination System
34	NPT	National Pipe Threads
35	NSF	National Science Foundation
36	OD	Outside Diameter
37	OSHA	U.S. Department of Labor, Occupational Safety and
38		Health Association
39	PCA	Portland Cement Association
40	PCI	Prestressed Concrete Institute
41	PS	United States Products Standards
42	PSIG	Pounds Per Square Inch Gauge
43	RPM	Revolutions Per Minute
44	SAE	Society of Automotive Engineers
45	SDI	Steel Decks Institute
46	SJI	Steel Joists Institute
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SMACNA Sheet Metal and Air Conditioning Contractors' National Association Structural Steel Painting Council SSPC STA Station (100 feet) Southwest Florida Water Management District **SWFWMD** Total Dynamic Head TDH Underwriter's Laboratories, Inc. UL United States Army Corps of Engineers USACOE United States of America Standards Institute (Now USASI or USAS ANSI) USDA United State Department of Agriculture USEPA United States Environmental Protection Agency **END OF SECTION**

> 01070-3 ABBREVIATIONS AND SYMBOLS

1				SECTION 01090		
2				REFERENCE STANDARDS		
4 5 6 7 8 9 10 11 21 3 14 15 6 17 8 9 10 11 21 21 3 14 15 6 17 8 9 10 11 21 3 14 15 6 17 8 9 10 11 21 21 3 14 15 6 17 8 9 10 11 21 21 21 21 3 14 15 6 17 8 9 10 11 21 21 21 21 21 21 21 21 21 21 21 21	PAR1	PART 1 – GENERAL				
	1.01	REQUIREMENTS INCLUDED				
		A.		ns and acronyms are used in the Contract rence standards.	Documents to	
	1.02	QUALITY ASSURANCE				
		A.	requirement standard, e	When a standard is specified by reference ts and recommendations stated in latest verscept when requirements are modified by or applicable codes establish stricter standards.	ersion of that	
		B.		Date: The publication in effect on the date of iss except when a specific publication date is speci		
	1.03	ABBREVIATIONS, NAMES, AND ADDRESSES OF ORGANIZATIONS				
		Obtain copies of referenced standards direct from publication source, when needed for proper performance of Work, or when required for submittal by Contract Documents.				
		AA		Aluminum Association 1525 Wilson Blvd. Arlington, VA 22209		
		AASI	НТО	American Association of State Highway and Transportation Officials 444 North Capitol Street, NW Suite 249 Washington, DC 20001		
		ACI		American Concrete Institute 38800 Country Club Drive Farmington Hills, MI 48331		
		Al		Asphalt Institute 2696 Research Park Drive Lexington KY 40511		
		AISC		American Institute of Steel Construction One East Wacker Drive Suite 700 Chicago, IL 60601-2001		
				01090-1	12/10/21	

REFERENCE STANDARDS

4		
1 2 3 4 5	AISI	American Iron and Steel Institute 1140 Connecticut Avenue Suite 705 Washington DC 20036
6 7 8 9	ANSI	American National Standards Institute 1819 L Street, NW, 11 th Floor Washington, DC 20036
10 11 12 13 14	ASME	American Society of Mechanical Engineers Three Park Avenue New York, NY 10016-5990
15 16 17 18	ASTM	American Society for Testing and Materials 100 BarrHarbor Drive West Conshohocken, PA 19428
19 20 21 22	AWWA	American Water Works Association 6666 W. Quincy Avenue Denver, CO 80235
23 24 25 26	AWS	American Welding Society 550 N.W. LeJeune Road Miami, FL 33126
27 28 29 30	CRSI	Concrete Reinforcing Steel Institute 38800 Country Club Drive Farmington Hills, MI 48331
31 32 33 34 35 36	FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) 470 L'enfant Plaza – Suite 8100 Washington, DC 20407
37 38 39 40 41	NEMA	National Electrical Manufacturers' Association 1300 North 17 th Street Suite 1752 Rosslyn, VA 22209
42 43 44 45 46	PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077
46 47 48	PCI	Prestressed Concrete Institute 200 W. Adams Street, #2100

01090-2

REFERENCE STANDARDS

47 of 383

1		Chicago, IL 60606
2 3	SSPC	Society for Protective Coatings
4 5		40 24 th Street, 6 th floor Pittsburgh, PA 15222
6		3 /
7	UL	Underwriters' Laboratories, Inc.
8		
9		2600 NW Lake Road
10		Camas, WA 98607-8542
11 12	PART 2 - PRODUCTS	(NOT LISED)
13	PART 2 - PRODUCTS	(NOT USED)
14	PART 3 - EXECUTION	(NOT USED)
15	., 5 2,.2505	(1101 0012)
16		
17		END OF SECTION

1	SECTION 01152					
2				APPLICATIONS FOR PAYMENT		
4 5	PART 1 – GENERAL					
6 7	1.01	REQUIREMENTS INCLUDED				
8 9 10		A.		it Applications for Payment to the Engineer in accordanule as approved by the University.	ice with the	
11 12 13		B.		actor shall submit to the Engineer for review, the proposed syment form, prior to the first Payment Request.	Application	
14 15 16 17		C.	pay th	Contractor's attention is directed to the fact that the Universine Contractor for any stored materials. The Application for rejected if any stored materials are invoiced by the Cor	or Payment	
18 19	1.02	FORM	MAT AN	ND DATA REQUIRED		
20 21 22 23		A.	furnis	nit applications typed on forms either provided in these Sp hed by the University, as approved by the University, with it on 8-1/2 inch x 11 inch white paper continuation sheets.		
24 25		B.	Provid	de itemized data on continuation sheet:		
26 27 28			1.	Format, schedules, line items and values: those of the Values accepted by the Engineer.	Schedule of	
29 30	1.03	PREF	PARAT	ION OF APPLICATION FOR EACH PROGRESS PAYME	NT	
31 32		A.	Applic	cation Form:		
33 34 35			1.	Fill in required information, including that for Change Order prior to date of submittal of application.	ers executed	
36 37 38			2.	Fill in summary of dollar values to agree with respending to a continuation sheets.	ective totals	
39 40 41			3.	Execute certification with signature of a responsible of Contractor.	fficer of the	
42 43		B.	Conti	nuation Sheets:		
44 45 46 47			1.	Fill in total list of all scheduled component items of wor number and scheduled dollar value for each item.	k, with item	
.,				01152-1	12/10/21	

APPLICATIONS FOR PAYMENT

1 2				actor submits the required updated schedule. As-built Drawings shall accordance with Section 01720 Project Record Documents.		
3	1.05	PREP	PARAT	ON OF APPLICATION FOR FINAL PAYMENT		
5 6 7		A.	Fill in	application form as specified for progress payments.		
8 9		B.		continuation sheet for presenting the final statement of accounting as fied in the Specification.		
10 11		C.	All ap	propriate information must be entered on the application form.		
12 13 14 15 16			1.	The line title, "Application Period", must indicate the dates between which all work was completed during the pay period. The period is defined from the first day of the month to the last day of the month, i.e. January 1, 2018 to January 31, 2018.		
17 18 19 20 21 22			2.	All blank lines within the "Contract Data" and "Summary of Project Status" section of the application must be completed. Also, if any Change Orders have been approved, the "Change Orders" section must include that information.		
22 23 24			3.	All calculations and arithmetic must be precise to the penny.		
25 26			4.	The application must be signed and dated by an authorized representative of the Contractor and notarized.		
27 28 29	1.06	SUBN	ЛІТТАL	PROCEDURE		
30 31 32 33 34		A.	arranç install Repre	to submitting a completed Payment Request, the Contractor must ge a field meeting with the Project Inspector to review and verify all ed quantities and/or stored material. Only when the Resident Project esentative and Contractor agree on installed quantities and ntages, should the Payment Request be submitted.		
35 36 37		B.		it three (3) copies of Applications for Payment to the Engineer at the stipulated in the General Conditions.		
38 39 40		C.		the Engineer finds Application properly completed and correct, he will nit certificate for payment to University, with copy to Contractor.		
41 42 43	PART		RODU(USED			
44 45 46	PART		XECUT USED			
47 48 49		END OF SECTION				

01152-3 APPLICATIONS FOR PAYMENT

1 SECTION 01200 2 3 MEETINGS AND CONFERENCES 4 5 PART 1 - GENERAL 6 7 PRE-CONSTRUCTION CONFERENCE 1.01 8 9 Α. In accordance with the Contract Documents, prior to the commencement of 10 Work, a preconstruction conference shall be held at a mutually agreed time 11 at the University's designated location. 12 13 B. The purpose of the conference shall be to designate responsible personnel 14 and establish a working relationship. Matters requiring coordination shall be 15 discussed and procedures for handling such matters established. The agenda shall include as a minimum: 16 17 18 1. Contractor's Initial Construction Schedule 19 20 2. Procedures for Transmittal, Review and Distribution of Shop Drawings 21 22 3. Procedures for Submittal and Review of Monthly Pay Applications 23 4. 24 Maintaining Record Drawings 25 26 5. Critical Work Sequencing and Construction Restrictions 27 28 6. Field Decisions and Change Orders 29 Staging Areas and Security 30 7. 31 32 8. Equipment and Material Deliveries 33 34 9. Safety Meetings and Program 35 10. 36 Pre-construction Video 37 C. 38 The Engineer will preside at the conference and will arrange for keeping the 39 minutes and distributing them to all persons in attendance. 40 PROGRESS MEETINGS 41 1.02 42 43 Α. The Engineer will schedule and conduct regular project meetings at least 44 monthly and at other times as deemed necessary by the progress of the 45 Work. The Contractor and the Engineer will be represented at each meeting. The Contractor and/or Engineer may request attendance by representatives 46 of material Supplier(s) and Subcontractor(s). 47

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2	B.	The Engineer will preside at the conference and will arrange for keeping the
3		minutes and distributing them to all persons in attendance. The purpose o
4		the meetings will include but not be limited to reviewing the progress of the
5		Work, maintaining coordination of efforts, discussing changes in scheduling
6		and resolving problems which may develop; claims review; and future
7		scheduling.
8		
9	PART 2 – PF	RODUCT
10	(Not U	sed)
11		
12	PART 3 – EX	ECUTION
13	(Not U	sed)
14		
15		
16		END OF SECTION

		SECTION 01310	
		CONSTRUCTION SCHEDULES	
PAR1	Г1 – G	GENERAL	
1 01	O E NII	IERAL	
1.01	GEIN	NERAL	
	A.	Construction under this contract must be coordinated to construction is completed within the time allowed by the Contract The Contractor will also coordinate his activities with the other allow orderly and timely completion of all the work.	t Documents.
	B.	All construction schedules shall be of the critical path method prepared using Microsoft Project or equal.	and shall be
1.02	CON	ISTRUCTION SCHEDULING GENERAL PROVISIONS	
	A.	Within 15 calendar days after the issuance of the Notice of Contractor shall prepare and submit to the Engineer a preliminar progress schedule. The schedule shall contain a sufficient nu such that no single task has a value that exceeds 1.5% of the Amount. Partial payments will not be approved until an acceptable progress schedule has been approved by the Engineer.	y construction mber of tasks total Contract
	B.	The schedule shall be updated monthly reflecting the approschedule and the Contractor's progress on each activity. No progwill be approved until the updated schedule is submitted and ap Engineer.	gress payment
	C.	Night work may be established by the Contractor as regular proceed the prior written permission of the University. Such permission, be revoked at any time by the University if the Contractor fair adequate equipment and supervision for the proper execution and work at night.	however, may Is to maintain
	D.	The Contractor shall designate an authorized representative of shall be responsible for development and maintenance of the specified herein. This representative of the Contractor shall have control and complete authority to act on behalf of the Contractor commitments of the Contractor's schedule.	e schedule as e direct project
1.03	PRO	OGRESS OF THE WORK	
	A.	The work shall be executed with such progress as may be required any delay to the general completion of the work. The work shall be such times and in or on such parts of the project, and with	oe executed at
		01310-1	12/10/21

CONSTRUCTION SCHEDULES

materials and equipment to assure completion of the work in the time established by the Contract.

B. If the Contractor for his convenience and at his own expense, should desire to carry on his work at night or outside regular hours, he shall submit written notice to the Engineer and he shall allow ample time for satisfactory arrangements to be made for inspecting the work in progress. The Contractor shall reimburse the University for extra inspection required for work outside regular hours. The Contractor shall light the different parts of the project as required to comply with all applicable Federal and State regulations and with all applicable requirements of the University.

PART 2 - PROGRESS SCHEDULE SUBMITTALS

2.01 GENERAL REQUIREMENTS

- A. As required within the General Conditions, the Contractor shall submit a critical path progress schedule as described herein. The schedule shall take into considerations all work phasing and restrictions as specified elsewhere in the Contract Documents.
- B. The critical path progress schedule requirement will consist of a detailed schedule, a start-up schedule, and revisions to the schedules and analyses as described. The planning, scheduling, management and execution of the work are the sole responsibilities of the Contractor. The progress schedule shall allow Engineer to review Contractor's planning, scheduling, management and execution of the work; to assist Engineer in evaluating work progress and make progress payments; to allow other contractors to cooperate and coordinate their activities with those of the Contractor; and to provide University with information about "construction schedule" and "cumulative outlay schedule."
- C. Engineer's review of the schedule submittals shall not relieve Contractor from responsibility for any deviations from the Contract Documents unless Contractor has in writing called Engineer's attention to such deviations at the time of submission and Engineer has given written concurrence to the specific deviations, nor shall any concurrence by Engineer relieve Contractor from responsibility for errors and omissions in the submittals.
- D. Float or slack time is not for the exclusive benefit of the University, the Engineer or the Contractor. Extensions of time for performance, as specified in the General Conditions, will be granted only to the extent that equitable time adjustments for the network activity, or activities affected, exceed the total float or slack time along the affected network paths, as shown in the precedence diagram and computer printout report in effect at the instant of either (a) a notice to proceed with a change, or (b) a notice of suspension of work or possession, or (c) detection of a subsequently acknowledged differing site condition, or (d) occurrence of cause for an excusable delay. Further, use of

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float time in the schedule, or the allocation of float time to activities by means of special logic restraints or imposed dates, shall be shared to the benefit of University, Engineer, Contractor, and his subcontractors and suppliers in proportion of their scope of responsibilities. Excessive use of float time to the detriment of succeeding activities may be cause for denying an extension of time if it can be demonstrated that the float along the network paths affected at the instant of the delaying condition would have been larger than the delay had it not been for the excessive and unreasonable float usage in violation of the sharing concept required by this Specification.

E. Engineer's review of the schedule submittals shall be only for conformance with the information given in the Contract Documents and shall not extend to the means, methods, sequences and techniques or procedures of construction or to safety precautions or programs incident thereto. Engineer's review of the schedule submittals will be predicated on a Contractor's stamp of approval signed off by Contractor. Contractor's stamp of approval on any schedule submittals shall constitute a representation to University and Engineer that Contractor, has either determined or verified all data on the submittal, or assumes full responsibility for doing so, and that Contractor and his subcontractors and suppliers have reviewed and coordinated the sequences shown in the submittal with the requirements of the work under the Contract Documents.

2.02 SUPPLEMENTARY REQUIREMENTS

- A. Graphic network diagrams shall be on a time-scaled precedence network format. The graphic network diagram shall include the following format:
 - 1. Description of each activity, or restraint, shall be brief but convey the scope of work described.
 - 2. Activities shall identify all items of work that must be accomplished to achieve substantial completion, or any interim substantial completion, such as the major disciplines of work; items pertaining to the approval of regulatory agencies; contractor's time required for submittals, fabrication and deliveries; the time required by Engineer to review all submittals as set forth in the Contract Documents; items of work required of University to support pre-operational and start-up testing; time required for the relocation of utilities. Activities shall also identify interface milestones with the work of other contract work under separate contracts with University.
 - 3. Any activities not shown on the graphic network diagram shall be considered to have no effect on the Contractor's ability to achieve substantial completion, or interim substantial completion, within the Contract Time. Any delays to activities that do not appear in the concurred detailed schedule shall give rise only to non-prejudicial

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delays. Attempts to impose after-the-fact logic constraints where none existed previously to justify time extensions will not be permitted.

- 4. Activity durations shall be in whole working days.
- 5. Graphic diagrams shall be time-scaled and sequenced by work areas. The Diagram of Activities shall show numerical values for total float and be shown on their early schedules. The diagram shall be neat and legible and submitted on sheets no larger than 24 inches by 36 inches on a medium suitable for reproduction.
- B. Printout reports shall contain the following data for each activity or restraint:
 - 1. Activity identification, activity description, activity duration, activity man-days, computed or specified early start date, computed early finish date, computed late start date, computed or specified late finish date, and total float and free float.
 - 2. Five separate reports shall be provided, including all activities and restraints, and shall be submitted monthly as follows:
 - a. Activity, sort by early start dates in order of ascending numbers.
 - b. Activity, sort by department.
 - c. Float report, in order of ascending total float values.
 - d. Successor/predecessor report.

PART 3 - EXECUTION

3.01 DETAILED SCHEDULE SUBMITTAL

Α. Submittal shall include a time-scaled graphic diagram showing all Contract activities, computer printout reports, and a supporting narrative. The initial Detailed Schedule submittal shall be delivered within 10 calendar days after the Notice to Proceed, and shall use the Notice to Proceed as the "data date". Upon receipt of Engineer's comments, Contractor shall meet with Engineer and discuss an appraisal and evaluation of the proposed work plan. Necessary revisions resulting from this review shall be made by Contractor and the detailed schedule resubmitted within 15 calendar days after the meeting. The re-submittal, if agreed to by the University, and unless subsequently changed with the concurrence of or at the direction of University, shall be the work plan to be used by the Contractor for planning, scheduling, managing and executing the work. If Contractor fails to provide an acceptable Detailed Schedule submittal, he will be deemed not to have provided a basis upon which progress may be evaluated, which will further constitute reasons for refusing to recommend payment.

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- B. The graphic diagram shall be formatted in accordance with Article 2.02(A) above. The diagram shall include (1) all detailed activities grouped by major areas of work. The critical path activities shall be identified, including critical paths for interim dates, if applicable, by clearly highlighting the path on the graphics diagram.
- C. This submittal shall include five copies of the graphic diagram, the printout reports and the narrative, in accordance with Article 2.02 of these scheduling requirements.
- D. The narrative shall include sufficient data to explain the basis of Contractor's determination of durations, describe the contract conditions and restraints plugged into the schedule, and provide a "what-if" analysis pertaining to potential problems and practical steps to mitigate them. Should Engineer require additional data, this information shall be supplied by Contractor within ten calendar days.

3.02 REVISIONS

- A. All revised Detailed Schedule submittals shall be in the same form and detail as the initial submittal and shall be accompanied by an explanation of the reasons for such revisions, all of which shall be subject to review by Engineer. The revision shall incorporate all previously made changes to reflect current as-built conditions. Minor changes to the submittal may be reviewed at monthly meetings. Changes to activities having adequate float shall be considered a minor change.
- B. A revised detailed work plan submittal shall be submitted for review, when required by Engineer, for one of the following reasons:
 - 1. University or Engineer directs a change that affects the date(s) specified in the Agreement or alters the length of a critical path.
 - 2. Contractor elects to change any sequence of activities so as to affect a critical path of the currently accepted detailed schedule documents.
- C. If, prior to agreement on an equitable adjustment to the Contract Time, Engineer requires revisions to the Detailed Schedule in order to evaluate planned progress, Contractor shall provide an interim revised submittal for review with change effect(s) incorporated as directed.

3.03 START-UP SCHEDULE SUBMITTALS

A. At least 90 calendar days prior to the date of Substantial Completion, Contractor shall submit a time-scaled (days after notice to proceed) graphic diagram detailing the work to take place in the period between 60 days prior to Substantial Completion, together with a supporting narrative. Engineer shall

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have 10 calendar days after receipt of the submittal to respond. Upon receipt of Engineer's comments, Contractor shall make the necessary revisions and submit the revised schedule within ten calendar days. If Contractor fails to provide acceptable Start-up Schedule Submittals, he will be deemed not to have provided a basis upon which progress may be evaluated, which will be reason for refusing to recommend payment.

- B. The Start-up Schedule may not be combined with the Detailed Schedule. The Start-up Schedule is intended to show much greater detail than the Detailed Schedule for start-up activities. Typical information required includes, but is not limited to, the timing of vendor representatives, pre-op testing, individual equipment start-ups, University's training, and performance certification testing.
- C. The graphic diagram shall use the currently accepted Detailed Schedule for those activities completed ahead of the last 60 calendar days prior to Substantial Completion, and detailed activities for the remaining 60-day period within the time frames outlined in the currently accepted Detailed Schedule.
- D. In addition, Contractor will be required to submit a revised copy of the start-up graphic diagram on a monthly basis with a start-up narrative. This revised diagram shall highlight percentages of completion, actual start and finish dates, and remaining durations as applicable. Activities not previously included in the accepted detailed work plan shall be added in these submittals, except that contractual dates shall not be changed except by Change Order. Reviews of these submittals by Engineer will not be construed to constitute concurrence with the time frames, durations or sequence of work for each added activity.

3.04 CONSTRUCTION PERIOD

- A. Whenever it becomes apparent from the current monthly progress evaluation and updated schedule data that any milestone and/or Contract completion date will not be met, the Contractor shall take appropriate action to bring the work back on schedule. Actions could include:
 - 1. Increase construction manpower in such quantities and crafts as to substantially eliminate the backlog of work;
 - 2. Increase the number of working hours per shift, shifts per work day, work days per week, or the amount of construction equipment, or any combination of the foregoing sufficient to substantially eliminate the backlog of work; and,
 - 3. Reschedule work items to achieve concurrency of accomplishment.
- B. The addition of equipment or construction forces, increasing the working hours or any other method, manner, or procedure to return to the current Detailed

1	Schedule shall be at the Contractor's own cost and shall not be considered
2	justification for a Change Order or treated as an acceleration order.
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5	END OF SECTION
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1 SECTION 01340 2 3 SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES 4 5 PART 1 – GENERAL 6 7 REQUIREMENTS INCLUDED 1.01 8 9 Α. The Contractor shall submit to the Engineer for review such working 10 drawings, shop drawings, test reports and data on materials and equipment (hereinafter in this Section called data), and material samples (hereinafter in 11 12 this Section called samples) as are required for the proper control of work, 13 including but not limited to those working drawings, shop drawings, data and 14 samples for materials and equipment specified elsewhere in the 15 Specifications and in the Contract Drawings. 16 The Contractor shall note that there are specific submittal requirements in 17 B. 18 other sections of these Specifications. 19 20 1.02 SHOP DRAWINGS 21 22 A. When used in the Contract Documents, the term "shop drawings" shall be 23 considered to mean Contractor's Drawings for material and equipment which 24 become an integral part of the Project. These drawings shall be complete 25 and detailed. Shop drawings shall consist of fabrication, erection and setting 26 drawings and schedule drawings, manufacturer's scale drawings, bills of 27 material, wiring and control diagrams, and inspection and test reports 28 including performance curves and certifications as applicable to the Work. 29 30 B. All details on shop drawings submitted for review shall show clearly the 31 elevations of the various parts to the main members and lines of the structure 32 and/or equipment, and where correct fabrication of the work depends upon 33 field measurements, such measurements shall be made and noted on the 34 shop drawings before being submitted for review. 35 C. 36 See Shop Drawing Schedule requirements in Subparagraph 1.07 CONTRACTOR'S RESPONSIBILITY. 37 38 PRODUCT DATA 39 1.03 40 41 Product data as specified in individual sections, include, but are not Α. 42 necessarily limited to, standard prepared data for manufactured products 43 (sometimes referred to as catalog data), such as the manufacturers product

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specification and installation instructions, availability of colors and patterns,

manufacturer's printed statements of compliances and applicability, roughingin diagrams and templates, catalog cuts, product photographs, standard

certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing storage instructions, and printed product warranties, as applicable to the work.

1.04 WORKING DRAWINGS

 A. When used in the Contract Documents, the term "working drawings" shall be considered to mean the Contractor's Drawings for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities, ground water control systems, forming and falsework; for underpinning; and for such other work as may be required for construction but does not become an integral part of the Project.

wiring diagrams, printed performance curves and operational-range

diagrams, production or quality control inspection and test reports and

B. Working drawings shall be signed and sealed by a registered Professional Engineer, currently licensed to practice in the State and shall convey, or be accompanied by, calculations or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use. Prior to commencing such work, working drawings must have been reviewed without specific exceptions by the Engineer. Such review will be for general conformance and will not relieve the Contractor in any way from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error are assumed by the Contractor; the University and Engineer will have no responsibility therefore.

1.05 SAMPLES

 A. The Contractor shall furnish, for review of the Engineer, samples required by the Contract Documents or requested by the Engineer. Samples shall be delivered to the Engineer as specified or directed and in quantities and sizes as specified. A minimum of two samples of each item shall be submitted unless otherwise specified. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in work until reviewed by the Engineer.

 B. Samples specified in individual sections, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the Engineer or University for independent inspection and testing, as applicable to the Work.

C. The Contractor shall prepare a transmittal letter for each shipment of samples. He shall enclose a copy of this letter with the shipment and send a

01340-2 SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

copy of this letter to the Engineer. Review of a sample shall be only for the characteristics or use named in such review and shall not be construed to change or modify any Contract requirements.

1.06 SUBMITTAL REQUIREMENTS

- A. The Contractor shall submit a Schedule of Submittals at the preconstruction meeting listing his anticipated submittals and their proposed submittal date. The Engineer will review and approve the Schedule of Submittals for general completeness and with respect to the project schedule. In general, one submittal shall be provided for each specification section.
- B. The University and/or Engineer shall review and comment on each original submittal, plus one (1) re-submittal addressing comments and exceptions noted. The Contractor shall reimburse the Engineer at his Standard Hourly Rate for review of additional resubmittals and substitutions beyond this amount, at no additional cost to the University.
- C. Submittals to the Engineer shall be made electronically and via hardcopy and shall consist of:
 - Four (4) paper copies of all submittal materials, each accompanied by a stamped Contractor review cover in accordance with the specifications herein. All copies will be retained by the University and/or Engineer.
 - One (1) digital copy in Adobe PDF format, delivered by email or FTP as directed by the University or Engineer, including each a stamped Contractor review cover sheet in accordance with the specifications herein.
- D. The Contractor shall review, approve, and submit, with reasonable promptness and in such sequence, so as to cause no delay in the Contract Work or in the Work of the University or any separate contractor, all shop drawings, product data, working drawings and samples required by the Contract Documents.
- E. Shop drawings, product data, working drawings and samples shall be furnished with the following information:
 - 1. Number and title of the drawing.
 - 2. Date of drawing or revision.
 - 3. Name of project building, facility or system.
 - 4. Name of contractor, subcontractor, and manufacturer submitting drawing.

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- 5. Clear identification of contents, location of the work, and the sheet numbers where the product is found in the contract drawings.
- 6. Contractor Certification Statement.
- 7. Submittal Identification Number.
- 8. Contract Drawing Number Reference.
- F. All items specified are not necessarily intended to be a manufacturer's standard product. Variations from specified items will be considered on an "or equal" basis. If submittals show variations from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in his letter of transmittal and on the shop drawings along with notification of his intent to seek contract adjustment. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the Contractor fails to describe such variations he shall not be relieved of the responsibility for executing the work in accordance with the Contract, even though such drawings have been reviewed. Variations submitted but not described may be cause for rejection. Any variations initiated by the Contractor will not be considered as an addition to the scope of work unless specifically noted and then approved as such in writing by the Engineer.
- G. Data on materials and equipment shall include materials and equipment lists giving, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, material, size, finish and all other pertinent data.
- H. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name, and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained. In addition, a maintenance and lubrication schedule for each piece of equipment shall be submitted as specified in Section 01730.
- I. The Contractor shall use the color "green" to make his remarks on the Submittals. Only the Engineer will utilize the color "red" in marking submittals.

1.07 CONTRACTOR'S RESPONSIBILITY

A. It is the duty of the Contractor to check, and coordinate with the work of all trades, all drawings, data, schedules and samples prepared by or for him before submitting them to the Engineer for review. Each and every copy of any drawing or data sheet larger than 11"x17" shall bear Contractor's stamp showing that they have been so checked and approved. Drawings or data sheets 11"x17" and smaller shall be bound together in an orderly fashion and bear the Contractor's stamp on the cover sheet. The cover sheet shall fully describe the packaged data and include a list of all sheet numbers within the

01340-4 SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

package. Shop drawings submitted to the Engineer without the Contractor's stamp will be returned to the Contractor, without review at the Engineer's option, for conformance with this requirement.

- B. The Contractor shall review shop drawings, product data, and samples prior to submission to determine and verify the following:
 - 1. Field measurements.
 - 2. Field construction criteria.
 - 3. Manufacturer's catalog numbers and similar data.
 - 4. Conformance with Specifications.
- C. Shop drawings shall indicate any deviations in the submittal from the requirements of the Contract Documents.
- D. At a time decided upon at the preconstruction meeting the Contractor shall furnish the Engineer a Shop Drawing schedule fixing the respective dates for the initial submission of shop and working drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall be provided as a separate entity and indicate those submittals that are critical to the progress schedule. The Contractor shall prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work sections of the Specifications, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery, and similar sequenced activities. No extension of time will be authorized because of the Contractor's failure to transmit complete and acceptable submittals sufficiently in advance of the Work.
- E. The Contractor shall not begin any work affected by a submittal returned, "Rejected. Revise as indicated and resubmit". Before starting this work all revisions must be corrected by the Contractor. After resubmittal they will be reviewed and returned to him by the Engineer. If returned marked, "No exceptions noted" or "Exceptions as noted", then the Contractor may begin this work. Any corrections made to the shop drawings are to be followed without exception.
- F. The Contractor shall submit to the Engineer all shop drawings and data sufficiently in advance of construction requirements to provide no less than twenty-one (21) calendar days for review from the time the Engineer receives them.
- G. The Contractor shall be responsible for and bear all cost of damages which may result from the ordering of any material or from proceeding with any part of work prior to review by the Engineer of the necessary shop drawings.

01340-5 SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

- H. All shop drawings, product data, working drawings and samples submitted by subcontractors for review shall be sent directly to the Contractor for checking. The Contractor shall be responsible for their submission according to the approved shop drawing schedule so as to prevent delays in delivery of materials and project completion.
- I. The Contractor shall check all subcontractor's shop drawings, product data, working drawings and samples regarding measurements, size of members, materials, and details to satisfy himself that they are in conformance to the Contract Documents. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission to the Engineer.

1.08 ENGINEER'S REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

- A. The Engineer's review is for general conformance with the design concept and contract drawings. Markings or comments shall not be construed as relieving the Contractor from compliance with the Contract Drawings and Specifications or from departures therefrom. The Contractor remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.
- B. The review of shop drawings, data, and samples will be general. They shall not be construed:
 - 1. As permitting any departure from the Contract requirements;
 - 2. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;
 - 3. As approving departures from details furnished by the Engineer, except as otherwise provided herein.
- C. If the shop drawings, data or samples as submitted describe variations per subparagraph (1.07H), and show a departure from the Contract requirements which Engineer finds to be in the interest of the University and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting an exception.
- D. Submittals will be returned to the Contractor under one of the following:

"NO EXCEPTIONS NOTED" is assigned when there are no notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.

01340-6 SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

"EXCEPTIONS AS NOTED" is assigned when notations or comments have been made on the submittal pointing out minor discrepancies as compared with the Contract Documents. Resubmittal or confirmation is not necessary prior to release for manufacturing.

"EXCEPTIONS AS NOTED/CONFIRM." This combination of codes is assigned when a confirmation of the notations and comments is required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This confirmation is to address the omissions and/or nonconforming items that were noted. Only the items to be "confirmed" need to be resubmitted.

"EXCEPTIONS AS NOTED/RESUBMIT." This combination of codes is assigned when a resubmittal is required by the Contractor. The Contractor may release a portion of the equipment or material for manufacture; however, all notations and comments must be incorporated into the final submittal. This resubmittal is to address the omissions and/or nonconforming items that were noted.

"REJECTED. REVISE AS INDICATED AND RESUBMIT." This combination of codes is assigned when the submittal is in noncompliance with the Contract Documents and must be corrected and the entire package resubmitted. This code generally means that the equipment or material cannot be released for manufacture unless the Contractor takes full responsibility for providing the submitted items in accordance with Contract Documents.

"FOR YOUR INFORMATION" is assigned when the package provides information of a general nature that may or may not require a response.

- E. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing, on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the Engineer on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor. The Contractor shall make corrections to any work done because of this type revision that is not in accordance to the Contract Documents as may be required by the Engineer.
- F. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the Contractor shall give written notice thereof to the Engineer at least seven (7) working days prior to release for manufacture.

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1 2 3 4 5 6 7 8 9	G	The Contractor shall make all required corrections and shall resubmit the required number of corrected submittals. The Contractor shall direct specific attention in writing to revisions other than the corrections called for on previous submittals. Review and comment on up to ONE (1) resubmittal of any given item by the University and/or Engineer is included in the Contract; review of additional resubmittals of the same item to confirm compliance with these specifications will be at the additional expense to the Contractor, based on the hourly rates of the Engineer performing the review.
10	H	. When the shop drawings have been completed to the satisfaction of the
11		Engineer, the Contractor shall carry out the construction in accordance
12		therewith and shall make no further changes therein except upon written
13		instructions from the Engineer.
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15	l.	Partial submittals may not be reviewed. The Engineer will be the only judge
16		as to the completeness of a submittal. Submittals not complete will be
17 18		returned to the Contractor. The Engineer may at his option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.
19		mark the submittal directing the Contractor to the areas that are incomplete.
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21	PART 2	– PRODUCTS
22	(N	IOT USED)
23		
24		- EXECUTION
25	(N	IOT USED)
26		

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01340-8 SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

END OF SECTION

1			SECTION 01370
2			SCHEDULE OF VALUES
4 5	PART	1 – GI	ENERAL
6 7	1.01	DESC	CRIPTION
8		A.	Scope of Work:
10 1 2 3			1. The Contractor shall submit to the Engineer a proposed Schedule of Values allocated to the various lump sum price items of the Work, within ten (10) days after the issuance of the Notice to Proceed.
4 5 6 7			2. Upon request of the Engineer, the Contractor shall support the Schedule of Values with data that shall substantiate their correctness.
18 19 20			3. The Schedule of Values will be used by the University and Engineer for the purpose of reviewing lump sump price items and Payment Applications.
21 22	1.02	FORM	A AND CONTENT OF SCHEDULE OF VALUES
23 24 25 26 27		A.	The Schedule of Values shall be typed on 8-1/2 inch x 11-inch white paper; Contractor's standard forms and computer printout will be considered for approval by the Engineer upon Contractor's request. The schedule shall identify:
28 29 30 31 32 33			 Project name and location Project number Name and address of Contractor Engineer's name Date of submission
34 35 36 37		B.	The Schedule of Values shall list the installed value of the component part of the Work in sufficient detail to serve as a basis for computing values for partial payments during construction.
38 39 10		C.	Each line item shall be identified with the number and title of the respective major section of the Specifications.
11 12 13 14		D.	For each major line item, the Schedule of Values shall list sub-values of major products or operations under the item.
15 16 17	1.03	SUB-	SCHEDULE OF UNIT MATERIAL VALUES

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SCHEDULE OF VALUES

1 2 3 4		A.	The Contractor shall submit a Sub-Schedule of Unit Material Values, including costs and quantities, for products on which partial payments will be requested for stored products.
5 6 7		B.	The form of submittal shall parallel that of the Schedule of Values, with each item identified the same as the line item in the Schedule of Values.
8 9		C.	The unit quantity for bulk materials shall include an allowance for normal waste.
10 11 12		D.	The unit values for the materials shall be broken down into:
13 14			1. Cost of the material, delivered and unloaded at the site, with taxes paid.
15 16 17			 Copies of paid invoices for component material shall be included with the payment request in which the material first appears.
18 19		E.	The installed unit value multiplied by the quantity listed shall equal the cost of that item in the Schedule of Values.
20 21 22	1.04	REVI	EW AND RESUBMITTAL
23 24 25 26		A.	After review by Engineer and University, the Contractor shall revise and resubmit the Schedule of Values and Sub-Schedule of Unit Material Values as required.
27		B.	The Contractor shall resubmit revised schedules in the same manner.
28 29	PART	2 – PF	RODUCTS (NOT USED)
30 31 32	PART	3 – EX	KECUTION (NOT USED)
33 34			END OF SECTION

1			SECTION 01385	
2			COLOR AUDIO-VIDEO CONSTRUCTION RECORDS	
4 5	PART	PART 1 – GENERAL		
6 7	1.01 DES		CRIPTION	
8	1.01	520	DECORNI ITOTA	
9 10		A.	Scope	
11 12			The Contractor shall prepare color audio/video DVDs of all work areas within 21 days of the Notice to Proceed.	
13 14		B.	Requirements Included	
15 16 17 18 19 20 21 22 23 24			Prior to commencing work, the Contractor shall have a continuous color audio/video DVD recording taken along the entire length of the Project including all affected project areas. Streets, easements, rights-of way, lots or construction sites within the Project must be recorded to serve as a record of pre-construction conditions. One copy of DVD recordings and video log will be submitted to the University and one copy to the Engineer. The Engineer will designate those areas, if any, to be omitted from or added to the audio-visual coverage. All DVDs and written records will become property of the University.	
25 26 27		C.	Scheduling	
28 29 30 31 32 33 34 35			No construction shall begin prior to review and approval of the DVDs covering the Project construction area(s) by the Engineer. The Engineer and University will have the authority to reject all or any portion of video DVD not conforming to specifications and order that it be redone at no additional charge. The Contractor shall reschedule unacceptable coverage within seven days after being notified. DVD recordings shall not be made more than 21 days after Notice to Proceed.	
36 37		D.	Videographer Qualifications	
38 39 40 41 42 43			The Contractor shall engage the services of a professional videographer known to be skilled and regularly engaged in the business of preconstruction color audio-video DVD documentation. The videographer, through the Contractor, shall furnish to the Engineer a list of all equipment to be used for the audio-video recording, i.e., manufacturer's name, model number, specifications and other pertinent information.	
44 45 46			Additional information to be furnished by the videographer is the names and addresses of two references that the videographer has performed color	

COLOR AUDIO-VIDEO CONSTRUCTION RECORDS

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audio-video recording on projects of a similar nature within the last 12 months. Engineer's approval of the selected videographer is required prior to taking first audio-video DVD.

E. Equipment

The Contractor shall furnish all equipment, accessories, materials and labor to perform this service. The total audio-video system shall reproduce bright, sharp, clear pictures with accurate colors and shall be free from distortion, tearing, rolls or any other form of imperfection. The audio portion of the recording shall reproduce the commentary of the camera operator with proper volume, clarity and be free from distortion and interruptions. In some instances, audio-video coverage may be required in areas not accessible by conventional wheeled vehicles. Such coverage shall be obtained by walking. The color video camera used in the recording shall be of Industrial Grade and shall have EIA Standard NTSC type color - 1.0V 75 OHMS. Video output from camera shall be capable of horizontal resolution of 350 lines at center and utilize a minimum of 8:1 zoom with a 2/3 Newvicon tube or CCD pick-up element for optimum color imagery plus minimum lag through of one foot candle. The recording shall be made with Industrial Grade recorder. The recordings shall be high resolution, extended still frame capable, in color. The recorded video DVDs shall be compatible for playback with any American TV Standard DVD player.

F. Recorded Information, Audio

Each DVD shall begin with the current date, project name and be followed by the general location, i.e., viewing side and direction of progress. Accompanying the video recording of each video DVD shall be a corresponding and simultaneously recorded audio recording. This audio recording, exclusively containing the commentary of the camera operator or aide, shall assist in viewer orientation and in any needed identification, differentiation, clarification, or objective description of the features being shown in the video portion of the recording. The audio recording shall also be free from any conversations.

G. Recorded Information, Video

All video recordings must continuously display transparent digital information to include the date and time of recording. The date information shall contain the month, day and year. The time information shall contain the hour, minutes and seconds. Additional information shall be displayed periodically. Such information shall include, but not be limited to, project name, contract number, direction of travel and the viewing side. This transparent information shall appear on the extreme upper left hand third of the screen. Camera pan, tilt, zoom-in and zoom-out rates shall be sufficiently controlled such that

01385-2 COLOR AUDIO-VIDEO CONSTRUCTION RECORDS

 recorded objects will be clearly viewed during video DVD playback. In addition, all other camera and recording system controls, such as lens focus and aperture, video level, pedestal, chrome, white balance, and electrical focus shall be properly controlled or adjusted to maximize picture quality. The construction documentation shall be recorded in SP mode.

H. Viewer Orientation

The audio and video portions of the recording shall maintain viewer orientation. To this end, overall establishing views of all visible house and business addresses shall be utilized. In areas where the proposed construction location will not be readily apparent to the video DVD viewer, highly visible yellow flags shall be placed, by the Contractor, in such a fashion as to clearly indicate the proposed centerline of construction. When conventional wheeled vehicles are used as conveyances for the recording system, the vertical distance between the camera lens and the ground shall not exceed 10 feet. The camera shall be firmly mounted such that transport of the camera during the recording process will not cause an unsteady picture.

I. Lighting

All recording shall be done during time of good visibility. No recording shall be done during precipitation, mist or fog. The recording shall only be done when sufficient sunlight is present to properly illuminate the subjects of recording and to produce bright, sharp video recordings of those subjects.

J. Speed of Travel

The average rate of travel during a particular segment of coverage shall be directly proportional to the number, size and value of the surface features within that construction areas zone of influence. The rate of speed in the general direction of travel of the vehicle used during recording shall not exceed 44 feet per minute.

K. Video Log/Index

All video DVDs shall be permanently labeled and shall be properly identified by video DVD number and project title. Each video DVD shall have a log of that video DVD's contents. The log shall describe the various segments of coverage contained on the video DVD in terms of the names of the streets or location of easements, coverage beginning and end, directions of coverage, video unit counter numbers, engineering survey or coordinate values (if reasonably available) and the date.

L. Area of Coverage

01385-3 COLOR AUDIO-VIDEO CONSTRUCTION RECORDS

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23 24 M. Costs of Video Services

The cost to complete the requirements under this section shall be included in the contract items provided in the Bid Form. There is no separate pay item for this work.

DVD coverage shall include all surface features located within the zone of

influence of construction supported by appropriate audio coverage. Such

coverage shall include, but not be limited to, existing driveways, sidewalks,

curbs, pavements, drainage system features, mailboxes, landscaping,

culverts, fences, signs, Contractor staging areas, adjacent structures, etc.,

within the area covered by the project. Of particular concern shall be the

existence of any faults, fractures, or defects. DVD coverage shall be limited

to one side of the site, street, easement or right-of-way at any one time.

(NOT USED)
PART 3 – EXECUTION

(NOT USED)

PART 2 - PRODUCTS

END OF SECTION

01385-4 COLOR AUDIO-VIDEO CONSTRUCTION RECORDS

TEMPORARY FACILITIES

SECTION 01500

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PART 1 – GENERAL

1.01 SANITARY FACILITIES

 A. Contractor shall furnish temporary separate male and female sanitary facilities at the site, as provided herein, for the needs of all construction workers and others performing work or furnishing services on the Project.

B. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 persons. Contractor shall enforce the use of such sanitary facilities by all personnel at the site.

1.02 MAINTENANCE OF TRAFFIC

A. Contractor shall conduct his work to interfere as little as possible with public travel, whether vehicular or pedestrian. Whenever it is necessary to cross, obstruct, or close roads, driveways and walks, whether public or private, Contractor shall provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel, and shall give reasonable notice to University's of private drives before interfering with them. Driveway access to commercial properties shall be maintained at all times. Such maintenance of traffic shall not be required when Contractor has obtained permission from the University and tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point. At all times, the Contractor shall perform the Work in accordance with the permits and easement agreements.

B. Traffic control shall be in accordance with the latest FDOT Standards and as shown on the Drawings. The Contractor shall follow all traffic rules regulated by the local governments.

C. In making open-cut street crossings, the Contractor shall not block more than one-half of the street at a time. Whenever possible, Contractor shall widen the shoulder on the opposite side to facilitate traffic flow. Temporary surfacing shall be provided as necessary on shoulders.

1.03 BARRICADES AND LIGHTS

A. All streets, roads, highways, and other public thoroughfares which are closed to traffic shall be protected by effective barricades on which shall be placed

01500-1 TEMPORARY FACILITIES

acceptable warning signs. Barricades shall be located at the nearest intersecting public highway or street on each side of the blocked section.

- B. All open trenches and other excavations shall have suitable barricades, signs, and lights to provide adequate protection to the public. Obstructions such as material piles and equipment shall be provided with similar warning signs and lights. Contractor shall be responsible for public safety within the construction area.
- C. All barricades and obstructions shall be illuminated with warning lights from sunset to sunrise. Material storage and conduct of the Work on or alongside public streets and highways shall cause the minimum obstruction and inconvenience to the traveling public. All barricades, signs, lights and other protective devices shall be installed and maintained in conformity with applicable statutory requirements and, where within railroad and highway rights-of-way, as required by the authority having jurisdiction thereof.
- D. Open trenches and other excavations shall not be left open overnight, over weekends and holidays, or greater than one calendar day, except during adverse weather conditions.

1.04 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

A. Contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by his construction operations. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards and parking areas, shall be restored to their original condition, whether within or outside the easement. All replacements shall be made with new materials.

1.05 PARKING

A. Contractor shall provide and maintain suitable parking areas for the use of all construction workers and others performing work or furnishing services in connection with the Project, as required to avoid any need for parking personal vehicles where they may interfere with public traffic, University's operations, or construction activities.

1.06 DUST CONTROL

A. Contractor shall take reasonable measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by application of an approved chemical dust suppressant. Dusty materials in piles or in transit shall be covered when practicable to prevent blowing.

01500-2 TEMPORARY FACILITIES

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B. Buildings or operating facilities that may be adversely affected by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels or similar equipment, shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

1.07 SWEEPING

A. The Contractor shall sweep loose material from all pavements at the end of each workday.

1.08 POLLUTION CONTROL

A. Contractor shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris and other substances resulting from construction activities. No sanitary wastes will be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris or other substance will be permitted to enter sanitary sewers and reasonable measures will be taken to prevent such materials form entering any drain or watercourse.

1.09 STORMWATER CONTROL

A. The Contractor shall be responsible for maintaining stormwater flow and drainage of the construction area. In cases where existing stormwater structures and culverts are to be removed as part of construction, temporary flow paths or bypass pumping shall be provided.

1.10 COMBUSTIBLES STORAGE

- A. The Contractor shall protect all combustible products and materials placed on site from vehicular damage and vandalism.
- B. Contractor shall submit a plan for all locations of fuel and vehicle storage through the duration of the project, updated as necessary to address specific phases or locations of the work.
- C. There shall be no fuel storage in wetland areas.
- D. Fuel storage containers shall be limited to 549 gallons or less. The Contractor is solely responsible for maintaining fuel containers and ensuring that all measures for protection and containment are provided as required by law.

1 PART 2 – PRODUCT
2 (Not Used)
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4 PART 3 – EXECUTION
5 (Not Used)
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END OF SECTION

1 SECTION 01505 2 3 **MOBILIZATION** 4 5 PART 1 - GENERAL 6 7 **DEFINITION AND SCOPE** 1.01 8 9 Α. Mobilization shall include the obtaining of all permits, insurance, and bonds; 10 moving onto the site with construction equipment; furnishing and erecting temporary facilities, and other construction facilities; all as required for the 11 proper performance and completion of the Work. Mobilization shall include, 12 but not be limited to, the following principal items: 13 14 Move onto the site all equipment required for first month's operations. 15 1. 16 17 2. Install temporary construction power, wiring, and lighting facilities. 18 3. 19 Establish fire protection plan and safety program and Hurricane Preparedness Plan. 20 21 22 4. Secure construction water supply. 23 5. 24 Provide on-site sanitary facilities and potable water facilities. 25 26 6. Arrange for and erect Contractor's work and storage yard and 27 employees' parking facilities. 28 29 7. Submit all required insurance certificates and bonds. 30 31 8. Obtain all required permits. 32 33 9. Post all OSHA, Environmental Protection Agency, Department of 34 Labor, and all other required notices. 35 10. 36 Have superintendent at the job site full time. 37 38 11. Submit a detailed construction schedule acceptable to the Engineer. 39 40 12. Submit a finalized schedule of values of the Work acceptable to the 41 Owner. 42 Submit a finalized schedule of submittals. 43 13. 44 45 46 47 48 01505-1 12/10/21

14.	Construct, maintain, and restore temporary access and haul roads.
15.	Provide a continuous color audio-videotape recording of existing
	conditions.
PART 2 – PRODUC	CT
(Not Used)	
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PART 3 - EXECUT	TION
(Not Used)	
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	END OF SECTION
	15. PART 2 – PRODUC (Not Used) PART 3 – EXECUT

1			SECTION 01510					
2		TEMPORARY UTILITIES						
4 5	PART I - GENERAL							
6 7	1.01	REQ	UIREMENTS INCLUDED					
8 9 0		A.	Furnish, install and maintain temporary utilities required for construction, remove on completion of Work.					
1 2	1.02	REQ	UIREMENTS OF REGULATORY AGENCIES					
3 4		A.	Comply with National Electric Code.					
5 6 7		B.	Comply with Federal, State and local codes and regulations and with utility company requirements.					
8		C.	Comply with regulations of Health Department of the municipalities.					
20 21	PAR1	ΓII - PI	RODUCTS					
22 23 24	2.01	MAT	MATERIALS, GENERAL					
25 26 27		A.	Materials may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.					
28 29	2.02	TEM	PORARY POWER AND LIGHTING					
30 31 32 33 34 35		A.	The Contractor shall be responsible for furnishing temporary power and lighting as required for the construction, testing and startup of the equipment prior to final acceptance of the work by the University as stipulated by the Engineer. All cost associated with obtaining temporary and permanent power will be at Contractor expense.					
36 37 38		B.	Provide adequate artificial lighting for all areas of work when natural light is not adequate for work.					
19 10	2.04	TEM	PORARY WATER					
1 2 3		A.	If applicable, install at each and every connection to the University's potable water supply a backflow preventer and meter meeting local requirements.					
4 5 6		B.	The Contractor shall make all arrangements for connections to the potable water at the Water Reclamation Facility. The Contractor shall obtain a					
			01510-1 12/10/21 TEMPORARY UTILITIES					

1			potable water flowmeter from the University's Physical Plants Division.
2 3 4		C.	The Contractor shall be responsible for all charges associated with the potable water connection.
5 6 7	2.05	TEMF	PORARY SANITARY FACILITIES
8 9		A.	The Contractor shall provide temporary sanitary facilities for his/her employees in compliance with laws and regulations.
0 1 2		B.	Service, clean and maintain facilities and enclosures.
3	PART	III - E	XECUTION
5 6	3.01	GENE	ERAL
7 8		A.	Maintain and operate systems to assure continuous service.
19 20		B.	Modify and extend systems as work progress requires.
21 22	3.02	REM	OVAL
23 24 25		A.	Completely remove temporary materials and equipment when their use is no longer required as determined by the Engineer, but not before achieving Substantial Completion.
26 27 28 29		B.	Clean and repair damage caused by temporary installations or use of temporary facilities.
30 31			END OF SECTION

1			SECTION 01540				
2			SECURITY				
4 5 6 7 8 9 10 11 21 3 3 4 14 15 16 17 18 19 19 19 19 19 19 19 19 19 19 19 19 19	PART 1 – GENERAL						
	1.01	DESC	CRIPTION				
		A.	The Contractor shall insure that each employee, representative, subcontractor, supplier, and others working for the Contractor use designated access roads and parking areas.				
		В.	The Contractor shall employ watchmen on the Work when necessary and shall erect and maintain such strong and suitable barriers and such lights as shall effectually prevent the happening of any accident to health or to property or to any partially completed Work or to any materials stored on or adjacent to the site of the Work.				
		C.	The Contractor shall employ temporary fencing and gates to adequately protect the Work, and shall provide all access required by the Engineer, the University, and others requiring access to the Work.				
		D.	Stored materials shall be kept in a neat and orderly manner. Materials that are subject to deterioration by exposure to the sun, rain or other elements shall be kept adequately covered and protected.				
26 27 28 29		E.	The Contractor shall be responsible for protecting all stored materials and the Project site safe from theft and vandalism. All security measures shall be provided at no additional cost to the University.				
30 31	PAR1	Γ2 – M	ATERIALS (NOT USED)				
32 33 34	PART	Г3 – Е	XECUTION (NOT USED)				
35 36 37 38 39 40 41 42 43			END OF SECTION				
15 16							

1				SECTION 01600		
2				MATERIAL AND EQUIPMENT		
4 5	PART	PART 1 – GENERAL				
6 7	1.01	REQUIREMENTS INCLUDED				
8	1.01	NE CONTENTO INCLUDED				
9 10		Mater	rial and	equipment incorporated into the Work:		
11 12		A.	Confo	orm to applicable specifications and standards.		
13 14 15		B.		oly with size, make, type and quality specified, or as specifically wed in writing by the Engineer.		
16		C.	Manu	factured and fabricated products:		
17 18 19			1.	Design, fabricate and assemble in accord with the best engineering and shop practices.		
20 21 22 23 24			2.	Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.		
25			3.	Two or more items of the same kind shall be identical, by the same manufacturer.		
26 27			4.	Products shall be suitable for service conditions.		
28 29 30			5.	Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.		
31 32 33		D.		ot use material or equipment for any purpose other than that for which it signed or is specified.		
34 35	1.02	APPR	ROVAL	OF MATERIALS		
36 37 38 39 40		A.	the in	aterials and equipment furnished by the Contractor shall be subject to spection and approval of the Engineer. No material shall be delivered work without prior review of the Engineer.		
41 42 43 44 45		B.	shall begin samp strate	ties and labor for handling and inspection of all materials and equipment be furnished by the Contractor. If the Engineer requires, either prior to ning or during the progress of the work, the Contractor shall submit les of materials for such special tests as may be necessary to demon- that they conform to the specifications. Such samples shall be hed, stored, packed, and shipped as directed at the Contractor's		

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expense. Except as otherwise noted, the Engineer will make arrangements and the University will pay for the tests.

- C. The Contractor shall submit data and samples sufficiently early to permit consideration and review before materials are necessary for incorporation in the work. Any delay resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of claims against the University or the Engineer.
- D. The materials and equipment used on the work shall correspond to the approved samples or other data previously submitted to the Engineer for review.

1.03 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

- A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including four (4) copies to the Engineer.
 - 1. Maintain one set of complete instructions at the job site during installation and until completion.
- B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.
 - 1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further instructions.
 - 2. Do not proceed with work without clear instructions.
- C. Perform work in accord with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.
- D. Upon completion of installation, the Contractor shall obtain from the manufacturer a signed certification that the equipment has been properly installed in accordance with the manufacturer's recommendations.

1.04 TRANSPORTATION AND HANDLING

- A. Arrange deliveries of products in accord with construction schedules, coordinate to avoid conflict with work and conditions at the site.
 - 1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

- 2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that products are properly protected and undamaged.
- B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.05 STORAGE AND PROTECTION

- A. The Contractor shall furnish a covered, weather-protected storage structure providing a clean, dry, noncorrosive environment for all mechanical equipment, valves, architectural items, electrical and instrumentation equipment, and special equipment to be incorporated into this project. Storage of equipment shall be in strict accordance with the "instructions for storage" of each equipment supplier and manufacturer including connection of heaters, placing of storage lubricants in equipment or climate-controlled facilities, etc. The Contractor shall furnish a copy of the manufacturer's instructions for storage to the Engineer prior to storage of all equipment and materials. Corroded, damaged or deteriorated equipment and parts shall be replaced before acceptance of the project. Equipment and materials not properly stored will not be included in a payment estimate.
- B. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.
 - 1. Store products subject to damage by the elements in weather tight enclosures.
 - 2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.
 - Store fabricated products above the ground on blocking or skids to prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.
 - 4. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
- C. All materials and equipment to be incorporated in the work shall be handled and stored by the Contractor before, during, and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage of any kind whatsoever to the material or equipment.
- D. Cement, sand and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All miscellaneous steel and

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reinforcing steel shall be stored off the ground and covered or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Precast concrete sections shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking. Brick, block and similar masonry products shall be handled and stored in a manner to reduce breakage, chipping, cracking, and spilling to a minimum.

- E. All materials that, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified shall be promptly removed from the site of the work, and the Contractor shall receive no compensation for the damaged material or its removal.
- F. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.
- G. Protection after Installation:
 - 1. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove covering when no longer needed.
- Н. The Contractor shall be responsible for all material, equipment, and supplies sold and delivered to the University under this Contract until final inspection of the work and acceptance thereof by the University. In the event any such material, equipment, and supplies are lost, stolen, damaged, or destroyed prior to final inspection and acceptance, the Contractor shall replace same without additional cost to the University.
- I. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within seven days after written notice to do so, the University retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the Contract Price. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, and engineering and any other costs associated with making the necessary corrections.

SUBSTITUTIONS AND PRODUCT OPTIONS

Α. Contractor's Options:

1. For products specified only by reference standard, select any product meeting that standard.

> 01600-4 MATERIAL AND EQUIPMENT

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- 2. For products specified by naming several products or manufacturers, submit the products or manufacturers named in the Proposal, which complies with the specifications.
- For products specified by naming one or more products or more products or manufacturers and "or equal", Contractor shall submit a request as for substitutions for any product or manufacturer not specifically named.

B. Substitutions:

- 1. After the Effective Date of the Agreement, the Engineer will consider written requests from Contractor for substitution of products.
- 2. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including:
 - a. Comparison of the qualities of the proposed substitution with that specified.
 - b. Changes required in other elements of the work because of the substitution.
 - c. Effect on the construction schedule.
 - d. Cost data comparing the proposed substitution with the product specified.
 - e. Any required license fees or royalties.
 - f. Availability of maintenance service, and source of replacement materials.
- 3. The Engineer will solely determine the acceptability of the proposed substitution.

C. Contractor's Representation:

- 1. A request for a substitution constitutes a representation that Contractor:
 - a. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
 - b. Will provide the same warranties or bonds for the substitution as for the product specified.

1			C.	Will coordinate the installation of an accepted substitution into
2 3 4			C.	the Work, and make such other changes as may be required to make the Work complete in all respects.
5 6			d.	Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
7 8	1.07	SPEC	CIAL TOOLS	
9 0 1 2 3 4		A.	(including gr adjustment, ouse. The Co	rs of equipment and machinery shall furnish any special tools rease guns or other lubricating devices) required for normal operations and maintenance, together with instructions for their intractor shall preserve and deliver to the University these tools ons in good order no later than upon completion of the Contract.
6	1.08	WARI	RANTY	
17 18 19 20 21 22 23		A.	manufacture manufacture one (1) yea	r pieces of equipment, submit a warranty from the equipment r as specified in Section 01740. At a minimum, the r's warranty period shall be concurrent with the Contractor's for r after the time of Substantial Completion. Exceptions for arranties shall be noted within each piece of equipment's ecification.
25	1.09	SPAR	RE PARTS	
26 27 28 29 30 31 32 33 34		A.	sections of t spare parts a addition, the spare parts, of the supplie	for certain equipment have been specified in the pertinent the Specifications. The Contractor shall collect and store all so required in an area to be designated by the Engineer. In Contractor shall furnish to the Engineer an inventory listing all the equipment they are associated with, the name and address er, and the delivered cost of each item. Copies of actual invoices m shall be furnished with the inventory to substantiate the st.
36 37 38		B.	furnished, the	nufacturer's Recommended" spare parts are specified to be e Contractor shall furnish those spares that are recommended facturer as noted in their standard product literature.
39 10 11	PART	2 – PF (Not U	RODUCTS Jsed)	
12 13 14 15	PART	3 – E) (Not U	XECUTION Jsed)	

01600-6 MATERIAL AND EQUIPMENT

END OF SECTION

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C.

PART 1 - GENERAL

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REQUIREMENTS INCLUDED 1.01

9 10 Α. Prior to requesting issuance of the Certificate of Substantial Completion, the Contractor shall perform start-up testing services as specified herein.

SECTION 01625

START-UP SYSTEMS TESTING

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В. Start-up of the facilities and appurtenances will require completion of all structures, installation of all equipment, and all connections to existing systems. All components of the Work shall be installed as if each were ready for use by the Owner for their intended purposes.

All equipment shall be tested, approved, and accepted by the Engineer prior

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D. All lubricants, water, air, fuel and power necessary for initial operation and tests as specified herein shall be furnished by the Contractor at no additional cost to the Owner.

to placement of the new facilities into operation.

E. In addition to furnishing, delivering, installing, and testing each piece of equipment, the Contractor shall provide the services of competent factory certified representatives for the periods indicated in other sections of these Specifications. Such representatives shall assist the Engineer by instructing

the operating personnel of the Owner in the maintenance and operation of the equipment, conducting tests, and making recommendations for producing the most efficient results. These services shall be made during the initial operation of the completed facilities and shall be in addition to services necessary during erection or to correct defective materials or workmanship during the guarantee period. These representatives shall be specially trained and qualified for installation, adjustment, start-up, and testing work and shall not be sales representatives only. The cost of such representation, including subsistence and travel, shall be provided by the Contractor at no additional

F. The Contractor shall furnish a signed and dated certificate from each manufacturer or supplier of equipment furnished stating that the equipment has been installed in strict accordance with the manufacturer's

recommendations and that it is ready to be placed in service.

PART 2 - PRODUCTS (NOT USED)

cost to the Owner.

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01625-1 START-UP SYSTEMS TESTING

PART 3 - EXECUTION

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PRELIMINARY MATTERS 3.01

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Α. General Requirements:

- 1. Successfully execute the start-up of the system(s) and demonstrate satisfactory performance of the intended use thereof. The start-up and performance demonstration shall be successfully executed prior to the Engineer's issuance of Substantial Completion.
- 2. Field acceptance tests will be witnessed by the Engineer. At least thirty (30) calendar days prior to scheduled testing, Contractor shall submit details of all test procedures to the Engineer for review, comment, and approval. Test procedures shall be submitted to the Engineer in accordance with Specification Section 01340.
- 3. All performance tests and inspections shall be scheduled at least ten (10) working days in advance with the Engineer. All performance tests and inspections shall be conducted during the normal work week of Monday through Friday, unless otherwise authorized, in writing, by the Engineer.
- 4. The Contractor shall be fully responsible for the proper operation of equipment during start-up systems testing and shall neither have nor make any claim for damage that may occur to equipment prior to the time when the Owner takes over the operation thereof.

B. Preparation for Systems Start-Up:

- 1. Upon completion of the Work and all related systems, all pipes shall be filled and flushed clean with water. All process systems and pipelines shall be filled and flushed with water, or other applicable fluid, and hydraulically checked for leaks, cracks, and defects.
- 2. All mechanical and electrical equipment shall be checked to ensure that each component is in good working order and properly installed and connected. All systems shall be purged as required. All pipelines that are hydraulically checked shall be drained and returned to their original condition once the water testing is complete. All pipelines that have been filled and flushed shall be drained clean.
- 3. All instruments and controls shall be calibrated through their full operational distribution range. Any other adjustments required for proper operation of all instrumentation and control equipment shall be made and confirmed by the specific factory authorized service representative.

01625-2 START-UP SYSTEMS TESTING

- 4. The Contractor shall work with each factory certified technician to complete any remaining tasks, connections, adjustments, and preparations needed to ensure proper equipment and/or system operation.
- 5. No testing or equipment operation shall occur until the Engineer has confirmed that all specified safety equipment has been installed and is in good working order.
- 6. No testing or equipment operation shall occur until the Engineer has verified that all calibrations, Manufacturer's Certification of Proper Installation, spare parts, Owner training, maintenance equipment, and approved equipment Operation and Maintenance manuals have been furnished as specified.
- 7. No testing or equipment operation shall occur until the factory certified technician for that particular component has confirmed that all lubricants, electrical connections, drains, fuel and exhaust systems have been provided and installed in accordance with the manufacturer's recommendations.

3.02 PRESSURE TESTING

- A. Field tests shall be made to confirm compliance with the contract and to establish compliance with the technical provision. The test shall be performed by the Contractor as herein specified. All piping, and equipment shall be tested in the field in the presence of the Engineer or his authorized assistant, in the manner prescribed in the Sections of these Specifications pertaining to such installation.
- B. Prior to pressure testing, all mains shall be flushed and pigged to remove all sand and other foreign matter. The velocity of the flushing water shall not be less than 2 feet per second. Flushing shall be terminated at the direction of the Engineer. The Contractor shall dispose of the flushing water without causing a nuisance or property damage.
- C. Pressure and Leakage Test of Underground Piping
 - Hydrostatic pressure and leakage tests shall conform with Section 4 of AWWA C600 Specification with the exception that the Contractor shall furnish all gauges, meters, pressure pumps and other equipment needed to test the line.
 - 2. The pressure required for the field hydrostatic pressure and leakage test shall be 150 psi. The Contractor shall provide temporary plugs and blocking necessary to maintain the required test pressure.

01625-3 START-UP SYSTEMS TESTING

Corporation cocks at least 2 inches in diameter, pipe riser and angle globe valves shall be provided at each pipe dead-end in order to bleed air from the line. The cost of these items shall be included as part of testing.

- 3. All leaks evident at the surface shall be repaired and leakage eliminated regardless of total leakage as shown by test. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves, and accessories shall be removed and replaced. The pipe lines shall be tested in such sections as may be directed by the Engineer by shutting valves or installing temporary plugs as required. The line shall be filled with water and all air removed and the test pressure shall be maintained in the pipe for the entire test period by means of a force pump to be furnished by the Contractor. Accurate means shall be provided for measuring the water required to maintain this pressure. The amount of water required is a measure of the leakage.
- 4. During the duration of the test, the line pressure shall not be permitted to drop more than 5 psi below the test pressure. Once the pressure drops 5 psi below the test pressure, the line shall be refilled until the test pressure is restored.
- 5. The amount of leakage which will be permitted shall be in accordance with AWWA, C600 Standards for all pressure. No pipe installation shall be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{148,000}$$

In which L is the allowable leakage in gallons per hour; S is the length of pipe tested, in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge. The duration of the leakage test shall be two (2) hours for pressurized pipes. The equation is based on 20' pipe lengths and shall be adjusted accordingly for other lengths.

6. The Contractor must submit his plan for testing to the Engineer for review at least ten (10) days before starting the test. The Contractor shall remove and adequately dispose of all blocking material and equipment after completion and acceptance of the field hydrostatic test, unless otherwise directed by the Engineer. Any damage to the pipe coating shall be repaired by the Contractor. Lines shall be totally free and clean prior to final acceptance.

1 2 3	7.	No leakage will be allowed for solvent weld PVC pipe or pipe sections less than 500 feet in length.
4 5		END OF SECTION

1			SECTION 01640			
2			QUALITY CONTROL			
4 5	PART 1 – GENERAL					
6 7	1.01	SECT	TION INCLUDES			
8 9		A.	Quality assurance and control of installation.			
10 11		B.	References.			
12 13		C.	Field samples.			
14 15		D.	Manufacturers' field services and reports.			
16 17	1.02	REL/	ATED SECTIONS			
18 19	-	A.	Section 01090 - Reference Standards.			
20 21		B.	Section 01340 - Shop Drawings, Product Data, Working Drawings and			
22		ъ.	Samples			
23 24	1.03	QUALITY ASSURANCE/CONTROL OF INSTALLATION				
25 26 27		A.	Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.			
28 29 30		B.	Comply fully with manufacturers' instructions, including each step in sequence.			
31 32 33		C.	Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.			
34 35 36 37		D.	Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.			
38 39 40		E.	Perform work by persons qualified to produce workmanship of specified quality.			
41 42 43		F.	Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.			
14 15	1.04	REFE	ERENCES			
46 47		A.	Conform to reference standard by date of issue current on date of University 01640-1 12/10/21			

QUALITY CONTROL

1			Bids.			
2 3 4		B.	Should specified reference standards conflict with Contract Documents, request clarification for Engineer before proceeding.			
5 6 7 8		C.	The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.			
9 0 1	1.05	FIELD	SAMPLES			
2 3 4		A.	Install field samples at the site as required by individual specifications Sections for review.			
5 6		B.	Acceptable samples represent a quality level for the Work.			
7 8		C.	Where field sample is specified in individual Sections to be removed, clear area after field sample has been accepted by Engineer.			
19 20	1.06	MANU	JFACTURERS' FIELD SERVICES AND REPORTS			
21 22 23 24 25 26		Α.	When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable, and to initiate instructions when necessary.			
27 28 29 30 31		B.	Submit qualifications of observer to Engineer 30 days in advance of required observations. Observer shall be subject to approval of Engineer and University.			
32 33 34 35		C.	Individuals shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.			
36 37		D.	Submit report in duplicate within 30 days of observation to Engineer for review.			
38 39 40	PART	Γ 2 – PRODUCTS (Not Used)				
11 12 13 14	PART	3 – E> (Not L	(ECUTION Jsed)			
15 16 17			END OF SECTION			

01640-2

QUALITY CONTROL

1				SECTION 01670								
2		SUBSTITUTIONS AND PRODUCT OPTIONS										
4 5 6 7	PART I – GENERAL											
	1.01	DESC	CRIPTION									
8 9		A.	Gene	ral:								
10 11 12 13 14 15 16			1.	This section covers the furnishing of all labor, materials, tools, equipment, and performance of all work and services for furnishing, submitting, processing and handling of requests for substitution and product options. See items as indicated on Drawings and as specified. Any substitution or option shall be in accord with the provisions of Contract Documents, and completely coordinated with work of other trades.								
18 19 20 21 22			2.	Although such work is not specifically indicated, furnish all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.								
23 24 25			3.	See appropriate sections for specific items specified. See General Conditions for additional information.								
26 27		B.	Proce	edure:								
28 29 30			1.	For equipment and materials that are listed in the Bid Form, observe procedures outlined in Instructions to Bidders.								
31 32 33 34			2.	For products, equipment, and materials that are named in Drawings or Specifications for which a request for substitution is made, observe procedures outlined in these specifications.								
35 36 37 38 39		C.	samp	c: Cost incurred by requestor in providing information, catalogs, and les - including but not limited to labor, materials, freight postage, and cortation - are sole cost of "Requestor" with no cost assessed Owner or eer.								
40 41	1.02	REQI	JESTS	FOR SUBSTITUTION - GENERAL:								
42 43		A.	Base	all bids on materials, equipment and procedures specified.								
14 15 16		B.		in types of equipment and kinds of material are described in fications by means of trade names and catalog numbers and/or								

1 2 3 4 5			from o other of ac	conside trade n complis	er's names. Where this occurs, it was not intended to exclude eration such types of equipment and kinds of material bearing names, catalog numbers and/or manufacturer's names, capable shing purpose of types of equipment or kinds of material andicated.
6 7 8		C.		types o	of equipment and kinds of material may be acceptable to Owner er.
9 0 1 2		D.	specif	•	uipment, kinds of material and methods of construction, if not ndicated must be approved in writing by Engineer and be agreed ner.
3 4	1.03	SUBM	IISSIO	N OF F	REQUESTS FOR SUBSTITUTION:
5 6 7 8 9 20		A.	consideration items.	der requ	ore than 30 days after award of the Contract, the Engineer will uests for substitutions of products, materials, systems or other ests must be received by Engineer within 30 calendar days after p Proceed. All requests for substitution shall be completed as low.
22 23 24		B.			ems must comply with color and pattern of base specified items fically approved otherwise.
25		C.	Subm	it two ((2) copies of request for substitution. Include in request:
26 27 28 29			1.	follow	e of product located by Drawing No. or Specification No., red by a detail or line number the particular item(s) for which est for substitution is initiated.
30 31 32			2.		blete data substantiating compliance of proposed substitution Contract Documents.
33 34			3.	For pr	roducts, include:
35 36 37				a.	Product identification by schedule or tag no., including manufacturer's name.
38 39 40 41				b.	Manufacturer's literature, marked to indicate specific model, type, size, and options to be considered:
11 12 13 14 15 16					 Product Description Performance and test data Reference standards Difference in power demand Dimensional differences for specified unit

- c. Submit samples, full size if so required. The Engineer reserves the right to impound samples until physical units are installed on project for comparison purposes. All costs of furnishing and return of samples shall be paid by requester. Engineer is not responsible for loss of or damage to samples.
- d. Name and address of similar projects where product was used, date of installation, and field performance data on installation.
- 4. For construction methods, include:
 - a. Detailed description of proposed method.
 - b. Drawings illustrating methods.
- 5. Itemized comparison of proposed substitution with product or method specified.
- 6. Data relating to changes in construction schedule.
- 7. Accurate cost data on proposed substitution in comparison with product or method specified.
- 8. Include with any request a specific statement defining changes in contract time or amount.
- D. In making request for substitution, or in using an approved substitute item, Supplier/Manufacturer represents:
 - He has personally investigated proposed product or method, and has determined that it is equal or superior in all respects to that specified, and that it will perform function for which it is intended.
 - 2. Will provide same or better warranty for substitute item as for product or method specified.
 - 3. Will coordinate installation of accepted substitution into work, to include but not be limited to the following:
 - a. Building and structure modifications as necessary;
 - b. Additional ancillary equipment to accommodate change;
 - c. Piping, valving, mechanical, electrical, or instrumentation changes, and,

1 2 3 4				d.	All other changes required for work to be complete in all respects to permit incorporation of substitution into project.
5 6 7			4.		es all claims for additional costs related to substitution which equently become apparent.
8 9		E.			eptance or rejection of items presented for substitution will be two weeks of receipt of request.
10 11 12 13 14		F.	Price will be alternated	or Time e issue	the acceptance of a substitute results in a change in Contract e, or is a deviation from the Contract Documents, a change order ed to reflect such change. In the event the acceptance of an es not result in a change in Contract Price or Time, a field order ed.
16 17		G.	Subst	itutes r	may be rejected for the following reasons:
18 19 20			1.		ptance will require substantial revision of Contract Documents or ng spaces.
21 22 23			2.		y are in Engineer's opinion, not equal to base product specified, I not adequately perform function for which intended.
24 25 26			3.	•	uest is not initiated by the Contractor in accordance with this fication section.
27 28	1.04	SUBS	TITUT	ION DI	UE TO UNAVAILABILITY
29 30 31 32		A.	discor	ntinuan	by of specified item due to strikes, lockouts, bankruptcy, ince of production, proven shortage, or similar occurrences are substitution after Contract award.
33 34 35 36		B.	appar	ent; in	neer in writing, as soon as condition of unavailability becomes include substantiating data. Submit request for substitution in advance to avoid delays.
37 38		C.	Subm	it data	as required in paragraph 1.03 above.
39 40 41 42	PART		ODUC USED		
42 43 44 45	PART		KECUT USED		
46 46					END OF SECTION

01670-4 SUBSTITUTIONS AND PRODUCT OPTIONS

1			SECTION 01700						
2 3 4			CONTRACT CLOSEOUT						
5 PART 1 – GENERAL 6									
7	1.01	REQU	IREMENTS INCLUDED						
8 9 10 11			y with requirements stated in General Conditions and in Specifications for strative procedures in closing out the Work.						
12 13	1.02	SUBS	FANTIAL COMPLETION						
14 15		A.	When Contractor considers the Work is substantially complete, he shall submit to the Engineer:						
16 17 18			 A written notice that the Work, or designated portion thereof, is substantially complete. 						
19 20			2. A list of items to be completed or corrected.						
21 22			3. A copy of all applicable, executed:						
23 24 25			 Manufacturer Certifications of Proper testing, Ready for Operation and Completion 						
26 27			 Calibration and Testing Certificates Transmittals of Operations and Maintenance Manuals 						
28 29 30			 Transmittals of Spare Parts University's Equipment Training Attendance Sign-in sheets Warranties and guarantees of the manufacturer(s). 						
31 32 33		В.	Within a reasonable time after receipt of such notice, the Engineer will make an inspection to determine the status of completion.						
34 35 36		C.	Should the Engineer determine that the Work is not Substantially Complete:						
37 38			 The Engineer will promptly notify the Contractor, in writing, giving the reasons therefore. 						
39 40 41			 Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Engineer. 						
42 43			3. The Engineer will re-inspect the Work.						
44 45 46 47		D.	When the Engineer finds that the Work is Substantially Complete, he will:						

1 2 3			1.	Prepare and deliver to University a tentative Certificate of Sc Completion with a tentative list of items to be completed or before final completion.	
4 5 6 7 8 9			2.	After consideration of any objections made by the Universided in Conditions of the Contract, and when the considers the Work Substantially Complete, he will exedeliver to the University and the Contractor a definite Cer Substantial Completion with a revised tentative list of ite completed or corrected.	Engineer cute and tificate of
11 12	1.03	FINAI	L INSP	ECTION	
13 14 15		A.		n Contractor considers the Work to be complete, he shall subr cation that:	nit written
16 17			1.	Contract Documents have been reviewed.	
18 19			2.	Work has been inspected for compliance with Contract Do	cuments.
20 21			3.	Work has been completed in accordance with Contract Do	cuments.
22 23 24			4.	Equipment and systems have been tested in the presen University's representative and are operational.	ce of the
25 26			5.	Work is completed and ready for final inspection.	
27 28 29		B.		Engineer will make an inspection to verify the status of complenable promptness after receipt of such certification.	etion with
30 31		C.	Shou	ld the Engineer consider that the Work is incomplete or defe	ctive:
32 33 34			1.	The Engineer will promptly notify the Contractor in writing, incomplete or defective work.	listing the
35 36 37 38			2.	Contractor shall take immediate steps to remedy the deficiencies, and send a second written certification to the that the Work is complete.	
39 40			3.	The Engineer will re-inspect the Work.	
41 42		D.		n the Engineer finds that the Work is acceptable under the ments, he shall request the Contractor to make closeout sub	
43 44	1.04	REIN	SPECT	TION FEES	
45 46 47		A.		ld the Engineer perform re-inspections, due to failure of the	
				01700-2	12/10/21

CONTRACT CLOSEOUT

1						
1 2 3			1.	Unive	rsity will compensate the Engineer for such additiona	ıl services.
4 5			2.		rsity will deduct the amount of such compensation froent to the Contractor.	m the final
6 7	1.05	CON	TRACT	OR'S	CLOSEOUT SUBMITTALS TO ENGINEER	
8 9		A.	Evide	ence of	compliance with requirements of governing authoriti	es.
10 11		B.	Proje	ct Reco	ord Documents and As-built Drawings.	
12 13		C.	Opera	ating ar	nd Maintenance Data, Instructions to University's Pe	rsonnel.
14 15		D.	Warra	anties a	and Bonds, w/ a log of start dates and expiration date	∋S.
16 17		E.	Keys	and Ke	eying Schedule.	
18 19		F.	Spare	e Parts,	Maintenance Materials and Specific Tools.	
20 21 22		G.	Evide	ence of	Payment and Release of Liens.	
23		H.	Certif	icate o	Insurance for Products and Completed Operations.	
24 25		l.	Contr	actor's	Final Affidavit.	
26 27		J.	Lien \	Waivers	s from Subcontractors and Suppliers.	
28 29		K.	Cons	ent of S	Surety from the bonding company.	
30 31		L.	Contr	actor's	Guarantee.	
32 33	1.06	FINA	L ADJU	JSTME	NT OF ACCOUNTS	
34 35		A.	Subm	nit a fina	al statement of accounting to the Engineer.	
36 37		B.	State	ment s	nall reflect all adjustments to the Contract Sum:	
38 39			1.	The o	riginal Contract Sum.	
40 41			2.	Additi	ons and deductions resulting from:	
12 13				a.	Previous Change Orders.	
14 15				b.	Unit Prices.	
46 47				C.	Deductions for uncorrected Work.	
				J.	01700-3	12/10/21

CONTRACT CLOSEOUT

1					
2				d.	Penalties and Bonuses.
3 4				e.	Deductions for liquidated damages.
5 6				f.	Deductions for re-inspection payments.
7 8				α.	Other adjustments
9				g.	Other adjustments.
10			3.	Total	Contract Sum, as adjusted.
11 12			4.	Previo	ous payments.
13			_	•	
14 15			5.	Sum r	emaining due.
16 17		C.			prepare a final Change Order, reflecting approved adjustments act Price, which were not previously made by Change Orders.
18			10 1110	Contro	ot i noc, which were not previously made by change cracis.
19 20	1.07	FINAL	. APPL	ICATIO	ON FOR PAYMENT
21 22		A.			nall submit the final Application for Payment in accordance with and requirements stated in the General Conditions.
23			proces	aa100 c	and requirements stated in the Constal Conditions.
24	PART	2 – PF	RODUC	CTS	
25		(Not L	Jsed)		
26			-		
27	PART		KECUT	ION	
28		(Not L	Jsed)		
29					
30 31					END OF SECTION
J I					LIND OF SECTION

1			SECTION 01710					
2			PROJECT CLEANING					
4 5	PART	1 – G	ENERAL					
6 7	1.01	SCOF	PE OF WORK					
8	1.01	0001						
9 0 1		Α.	The Contractor shall execute cleaning during progress of Work and at completion of the Work as required by the General Conditions.					
2	1.02	DISP	OSAL REQUIREMENTS					
3 4 5		A.	The Contractor shall conduct cleaning and disposal operations to comply with all applicable Laws and Regulations.					
6 7	PART	2 – M	ATERIALS					
8	2.01	MATE	ERIALS					
20 21 22		A.	The Contractor shall use only those cleaning materials which do not create hazards to health or property and which do not damage surfaces.					
23 24 25		B.	The Contractor shall use only those cleaning materials and methods recommended by the Manufacturer of the surface material to be cleaned.					
26 27 28		C.	The Contractor shall use cleaning materials only on surfaces so recommended by cleaning material Manufacturer.					
<u>29</u> 30	PART	3 – E	3 – EXECUTION					
31 32	3.01	CLEA	NING DURING CONSTRUCTION					
33 34 35 36 37		A.	The Contractor shall execute daily cleaning to keep the Work, the site and adjacent properties free from accumulations of waste materials, water, eroded material, rubbish and windblown debris resulting from construction operations.					
38 39 40 41		B.	The Contractor shall provide suitable on-site containers for the daily collection of all waste materials, debris and rubbish.					
		C.	The Contractor shall remove waste materials, debris and rubbish from site containers periodically and dispose of at properly licensed and permitted disposal areas away from the site.					
16 17		D.	The Contractor shall remove from the site all surplus materials and temporary structures when no further need therefore develops and as approved					
			01710-1 12/10/21					

PROJECT CLEANING

1	by the Engineer. The Contractor shall be responsible and liable for al
<u>2</u>	spillage and shall incur all associated costs including, but not limited to, costs
3	related to repair and maintenance resulting from any such damage.
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5	
3	END OF SECTION

1		SECTION 01720									
2				PROJECT RECORD DOCUMENTS							
4 5	PART	1 – GI	I – GENERAL								
6 7	1.01	REQU	JIREM	ENTS INCLUDED							
8 9		A.	Maint	ain at the site for the University one record copy of:							
10 11			1.	Drawings							
12 13			2.	Specifications							
14 15			3.	Addenda							
16 17			4.	Requests for Information							
18 19			5.	Work Change Directives, Requests for Cost Proposals							
20			6.	Change Orders and other Modifications to the Contract							
21 22 23 24			7.	Engineer's Field Orders or written instructions							
24 25			8.	Approved Shop Drawings, Working Drawings and Samples							
26			9.	Field Test Records							
27 28											
29 30			10.	Construction Photographs							
31 32			11.	Detailed Progress Schedule, Monthly Updates							
33 34	1.02	MAIN	TENAN	NCE OF DOCUMENTS AND SAMPLES							
35 36		A.		documents and samples in Contractor's field office apart from nents used for construction.							
37 38			1.	Provide files and racks for storage of documents.							
39 40 41			2.	Provide locked cabinet of secure storage space for storage of samples.							
42 43		B.	File d	ocuments and samples in accordance with CSI format.							
14 15 16 17		C.		ain documents in a clean, dry, legible condition and in good order. Do se record documents for construction purposes.							

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PROJECT RECORD DOCUMENTS

1 2		D.	Make documents and samples available at all times for inspection by the Engineer.
3 4 5 6		E.	As a pre-requisite for monthly progress payments, the Contractor is to exhibit the currently updated "record documents" for review by the Engineer and University.
7 8 9	1.03	MAR	NG DEVICES
10 11 12		A.	Provide felt tip marking pens for recording information in the color code designated by the Engineer.
13 14	1.04	RECO	RDING
15 16		A.	Label each document "PROJECT RECORD" in neat large printed letters.
17		B.	Record information concurrently with construction progress.
18 19			Do not conceal any work until required information is recorded.
20 21		C.	Drawings: Legibly mark to record actual construction:
22 23 24			 Depths of various elements of foundation in relation to finish first floor datum
25 26 27 28 29 30			2. Denote all underground piping elevations and dimensions; all changes to piping location; horizontal and vertical locations of underground utilities and appurtenances, all referenced to permanent surface improvements or by state Plane coordinates. Actual installed pipe material, class, etc.
31 32 33 34 35			3. Locations of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
36 37			4. Field changes of dimension and detail.
38 39			5. Changes made by Field Order, Work Change Directives, Request for Information or by Change Order.
40 41			6. Details not on original Contract Documents.
42 43			7. Equipment and piping relocations.
44 45		D.	Specifications and Addenda; legibly mark each Section to record:

1 2 3			 Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
4 5			2. Changes made by Field Order or by Change Order.
6 7		E.	Shop Drawings (after final review and approval)
8 9	1.05	AS-BI	JILT DRAWINGS
10 11 12		A.	As-built drawings shall be maintained by the Contractor in strict Accordance with the GENERAL CONDITIONS.
13 14 15 16		B.	Payment Applications will not be approved if the As-built drawings are not kept current and will not be approved until the As-built drawings show completely all information required and are current.
17 18 19 20 21 22		C.	The final Payment Application shall not be accepted by the University until the As-built drawings are approved for conformance to the minimum requirements. The University's acceptance of the Contractor's As-built drawings does not relieve the Contractor of the sole responsibility for the accuracy or completeness of the As-built drawings.
23 24 25 26		D.	The Contractor shall submit all As-built drawings after review and approval by the University and Engineer in digital electronic format (Auto CADD and pdf) along with one set of marked up drawings.
27 28		E.	Submit three (3) full sized 24"x36" of as-built survey, signed and sealed by the Registered Land Surveyor.
29 30 31		F.	Submit two (2) CD-ROMS of the as-built survey in AUTOCAD 2007 or later format.
32 33	1.06	SUBM	IITTAL
34 35 36 37		A.	At contract close-out, deliver Record Documents to the Engineer for the University.
38 39		B.	Accompany submittal with transmittal letter in duplicate, containing:
40 41			1. Date
42 43			2. Project title and number
43 44 45			3. Contractor's name and address
45 46 47			4. Title and number of each Record Document

1 2			5. Signature of Contractor or his authorized representative				
3 4	1.07	MAJOR EQUIPMENT SHOP DRAWINGS, PIPE LAYING SCHEDULE, AND SURVEYING MANUAL					
5 6 7 8 9 10 11 12		A.	This manual shall contain a copy of the final approved shop drawings for the major materials and equipment associated with the project. The manual shall be divided into sections with each section dedicated to a particular specification section. The manual shall contain pipe laying schedules and reference survey information appropriate for the project.				
		B.	Five hard copy sets of this manual and one electronic file copy in ".pdf" format are to be delivered to the University. The requirements for hard copies and for electronic files are provided below in this section.				
5 6 7	1.08	WARI	WARRANTIES, GUARANTEES, BONDS, AND CERTIFICATES MANUAL				
18 19 20 21 22		A.	This manual shall contain all warranties, guarantees, bonds, certificates, and similar documents, including those customarily provided by manufacturers and suppliers, which shall cover a period of one (1) year after system acceptance by the University. Show University as beneficiary on these documents.				
24 25 26 27		B.	Two hard copy sets of this manual and one electronic file copy in PDF format are to be delivered to the University. The requirements for hard copies and for electronic files are provided below in this section.				
28 29 30	PART	2 – PI (Not l	RODUCTS Jsed)				
31 32 33	PART	3 – E) (Not U	XECUTION Jsed)				
34 35			END OF SECTION				

1		SECTION 01730				
2			OPERATING AND MAINTENANCE DATA			
4 5	PART	Γ1 – GENERAL				
6 7	1.01	REQI	JIREMENTS INCLUDED			
8 9 10 11		A.	The Contractor shall compile product data and related information appropriate for University's maintenance and operation of the actual products furnished by the Contractor.			
12 13 14 15			 Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications. 			
16 17 18		B.	The Contractor shall instruct University's personnel in maintenance of products and in operation of equipment and systems.			
19 20 21 22 23		C.	The Contractor shall furnish the University three (3) approved complete hardcopy sets of Operation and Maintenance Data and one (1) approved complete set of Operation and Maintenance Data in electronic ".pdf" format as specified herein for the project.			
24 25 26 27		D.	The Contractor shall organize all electronic Operation and Maintenance Data by specification division and section number, and shall submit on compact disc (CD) media.			
28	1.02	QUAL	LITY ASSURANCE			
29 30		A.	Preparation of data shall be done by personnel:			
31 32 33 34			 Trained and experienced in maintenance and operation of described products. 			
35			2. Familiar with requirements of this Section.			
36 37 38 39			3. Skilled and technical writer to the extent required to communicate essential data.			
40 41			4. Skilled as draftsman competent to prepare required Drawings.			
42 43	1.03	FORM	M OF SUBMITTALS			
44 45 46 47		A.	Prepare data in form of an instructional manual for use by University's personnel.			

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OPERATING AND MAINTENANCE DATA

1		B.	Form	nat:	
2 3			1.	Size: 8-1/2 inches x 11-inches.	
4 5			2.	Paper: 20 pound minimum white, for typed pages.	
6 7			3.	Text: Manufacturer's printed data, or neatly typewritten.	
8 9 10 11			4.	Drawings: a. Provide reinforced punched binder tabs, bind in with text. b. All drawings shall be on 11 x 17 paper and folded to 8-1/2 x 11	
13 14 15 16 17			5.	Provide fly-leaf for each separate product, or each piece of operating equipment. a. Provide typed description of product, and major component parts of equipment. b. Provide indexed tabs.	
18 19 20 21 22 23			6.	Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS." List: a. Title of Project b. Identity of separate structure, as applicable. c. Identity of general subject matter covered in the manual.	
24 25		C.	Binde	ers:	
26 27 28			1.	Commercial quality three-post binders with durable and cleanable plastic covers.	
29 30			2.	Maximum post width: 2-inches.	
31 32 33			3.	When multiple binders are used, correlate the data into related consistent groupings.	
34 35	1.04	CONT	ΓENT (OF MANUAL	
36 37 38		A.	Neatly order	y typewritten table of contents for each volume, arranged in systematic	
39 40 41			1.	Supplier name and contact information for parts and technical assistance.	
42 43 44			2.	Contractor, name of responsible principal, address and telephone number.	
45 46 47			3.	A list of each product required to be included, indexed to content of the volume.	
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OPERATING AND MAINTENANCE DATA

1 2 3 4 5 6 7		4.	List, with each product, name, address and telephone number of: a. Subcontractor or installer. b. Maintenance contractor, as appropriate. c. Identify area of responsibility of each. d. Local source of supply for parts and replacement.
8 9		5.	Identify each product by product name and other identifying symbols as set forth in Contract Documents.
10 11		6.	Exploded views with part numbers identified for all components.
12 13 14		7.	Provide only information specific to the equipment provided or designate the specific pertinent information.
15 16		8.	Final version of the approved shop drawings.
17 18		9.	All applicable testing results.
19 20		10.	Startup Report
21 22	B.	Produ	uct Data:
23 24		1.	Include only those sheets that are pertinent to the specific product.
25 26 27 28 29		2.	Annotate each sheet to: a. Clearly identify specific product or part installed. b. Clearly identify data applicable to installation. c. Delete references to inapplicable information.
30 31	C.	Draw	ings:
32 33 34 35 36		1.	Supplement product data with drawings as necessary to clearly illustrate, where applicable to the individual subsystem: a. Relationship of component parts of equipment and systems. b. Control and flow diagrams.
37 38 39 40 41	D.		en text, as required to supplement product data for the particular lation: Organize in consistent format under separate headings for different procedures.
42 43		2.	Provide logical sequence of instructions of each procedure.
44 45	E.	Сору	of each warranty, bond and service contract issued.
46 47		1.	Provide information sheet for University's personnel, give:
			01730-3 12/10/21

OPERATING AND MAINTENANCE DATA

1 2			a. b.	Proper procedures in event of failure. Instances which might affect validity of warranties or bonds.
3 4	1.05	INST	RUCTION O	F UNIVERSITY'S PERSONNEL
5 6 7 8 9		A.	operating a	I inspection or acceptance, fully instruct University's designated and maintenance personnel in operation, adjustment and se of products, equipment and systems.
10		B.	Operating a	and maintenance manual shall constitute the basis of instruction.
11 12 13 14				ew contents of manual with personnel in full detail to explain all ects of operation and maintenance.
15 16 17 18		C.	shall be sul	prior to the schedule vendor's training, a detailed lesson plan bmitted to the Engineer for review that is representative of the be covered during the training period.
19 20 21 22		D.	successful Report. Th	ance of the manufacturer's training will be in accordance with the completion of the attached Manufacturer's Training Summary is checklist will be completed by the University and Engineer at tion of each vendor training session.
23 24	PART		RODUCTS	
25 26		(Not U	Jsea)	
27 28 29	PART	3 – E) (Not l	XECUTION Jsed)	
30 31				END OF SECTION

1	SECTION 01740					
2				WARRANTIES AND BONDS		
4 5	PART	1 – GI	ENERA	AL		
6 7	1.01	REQU	JIREMI	ENTS INCLUDED		
8 9 10		A.	Comp Condi	oile warranties and bonds, as specified in Articles 5 and 6 of the General tions.		
1 2		B.	Co-ex	ecute submittals when so specified.		
3 4		C.	Revie	w submittals to verify compliance with Contract Documents.		
5 6		D.	Subm	it to the Engineer for review and transmittal to University.		
7 8	1.02	SUBM	IITTAL	REQUIREMENTS		
19 20 21 22 23 24		A.	execu	mble warranties, bonds and service and maintenance contracts, ated by each of the respective manufacturers, suppliers and contractors.		
23 24		B.	Numb	per of signed originals required: two (2) each.		
25 26 27		C.		able of Contents shall be neatly typed in orderly sequence. Provide lete information for each item.		
28 29			1.	Product or work item.		
30 31			2.	Firm, with name of principal, address and telephone number.		
32 33			3.	Scope.		
34 35 36			4.	Date of beginning warranty, bond or service and maintenance contract.		
37 38			5.	Duration of warranty, bond or service maintenance contract.		
39 10			6.	Provide information for University's personnel:		
↓1 ↓2				a. Proper procedure in case of failure.		
13 14				b. Instances which might affect the validity of warranty or bond.		
15 16 17			7.	Contractor, name of responsible principal, address and telephone number.		

01740-1 WARRANTIES AND BONDS

1	1.03	WAR	WARRANTY SUBMITTAL REQUIREMENTS				
2 3 4 5 6 7		A.	For all major pieces of equipment, submit a warranty from the equipment manufacturer. The manufacturer's warranty period shall be concurrent with the Contractor's warranty and be for 1 year, unless otherwise specified, commencing at the time of Substantial Completion.				
8	PART	2 – PRODUCTS (Not Used)					
10		(1101)	JS64)				
1	PART	3 – E	KECUTION				
2		(Not l	Jsed)				
13		`	·				
4							
15			END OF SECTION				

		SECTION 02062			
		REMOVAL OF EXISTING EQUIPMENT			
PART	1 – G	ENERAL			
1.01	SCOF	PE OF WORK			
	A.	Furnish all labor, tools, equipment, materials, and incidentals required to remove all existing structures, equipment, pipe, fittings, valves, electrical, instrumentation and controls, and all appurtenances as noted on the Contract Drawings, as reasonably inferred and as required in order to perform the work as described in the Contract Documents.			
	B.	Where equipment or equipment control panels are removed, the Contractor shall be required to remove all conduit and wire back to the MCC and/or PLC panel to which the equipment was connected. This requirement applies to all demolition work shown on the Drawings.			
PART	2 – P	RODUCTS (NOT USED)			
PART	3 – E	XECUTION			
3.01	GEN	NERAL			
	A.	The Contractor shall not proceed with the removal of any removal without specific approval of the Engineer. Any facilities removed without proper authorization shall be replaced to the satisfaction of the Engineer at the Contractor's expense.			
	B.	All existing equipment, valves, hardware, tubing, insulation, hangers, and supports not required to be reused and not designated as being turned over to the Owner, shall become the property of the Contractor immediately upon removal from their present locations. The Contractor shall remove such material from the plant site at his own expense and it shall not be reused.			
	C.	All existing equipment, valves, hardware, tubing, insulation, hangers, and supports designated as being turned over to the Owner, shall be identified, cleaned, protected, crated or boxed and stored at the plant site.			
	D.	Pieces of equipment weighing 150 lbs or more shall be provided with suitable skids before storing.			
	E.	Wherever piping is removed for disposition, adjacent pipe, and headers that are to remain in service shall be blanked off or plugged and then supported or anchored in an approved manner.			

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REMOVAL OF EXISTING EQUIPMENT

3.02 EQUIPMENT TO BE RETAINED

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- A. Any existing mechanical or electrical equipment or materials which are removed or replaced as a result of construction under this project may be designated by the University to be salvaged. Any existing equipment or material to be salvaged shall remain onsite and the Contractor shall be responsible for delivering the salvage equipment/materials to the exact location onsite as directed by the Engineer.
- В. If the University elects not to retain ownership of a certain item, the item shall become the property of the Contractor and shall be removed from the plant site at the Contractor's expense

END OF SECTION

1		SECTION 02125							
2 3 4		SILT BARRIERS							
5	PAR1	PART 1 – GENERAL							
6 7	1.01	sco	SCOPE OF WORK						
8 9 10 11 12 13		A.	The work included under thi labor, equipment, tools and connection with the installatio or a floating silt barrier for the areas intended to remain under the contract of the	materials, and in performaterials, and in performater, of a staked silt barrier, or open wat	rming all operations in of cloth or straw bales, er, wetland systems or				
14 15 16 17 18 19		B.	This work shall be performed applicable sections of these grades, notes and typical sec the Engineer or as directed having permitting jurisdiction	e specifications and in tions as shown on the di by representatives of g	conformity with lines, rawings, as directed by overnmental agencies				
20 21 22 23 24 25 26	PART 2 – PRODUCTS								
	2.01	STAI	STAKED FABRIC SILT BARRIER						
		A.	The sediment control fabric following standards:	is to be woven polyp	propylene meeting the				
27 28 29 30 31			Mullen Burst Test Grab Elongation Slurry Flow Rate Retention Efficiency	(ASTM D-3786) (ASTM D-1682) (VTM-51) (VTM-51)	200 psi (min.) 30% (max.) 0.3 gpm/sf (min.) 75% (min.)				
32 33 34 35		B.	The fabric shall be provided minimum of 24 inches in heig for restraint.	•	•				
36 37	PAR1	PART 3 – EXECUTION							
38 39 40	3.01	STA	STAKED CLOTH SILT BARRIER						
40 41 42 43 44 45 46		A.	The sediment control fabric recommendations to the uphi stakes shall be spaced at 6 to along the fence line and back in place.	Il or sediment producing 10 foot intervals. A 4" to	side of the stakes. The 6" trench shall be dug				

1 2 3 4 5		B.	The ends of each unit of fence shall be connected to adjoining fence sections with a connector provided by the manufacturer or by intertwining the two end posts to overlap the fabric sufficiently to prevent sediment from escaping, as shown in the Drawings.
6 7	3.02	STAK	KED STRAW/SYNTHETIC BALES
8 9 10 11 12 13		A.	Securely bound straw/synthetic bales may be used as a sediment barrier. The bales shall be securely bound with two strands of rope or wire. The bales shall be positioned in a 4 inch trench along the plan alignment and each bale is to be secured by driving two 2"x 2" stakes or #5 rebar through the bale and 18" to 24" into the ground. The tops of the stakes shall then be secured by a continuous wire tie.
15 16		B.	Deteriorated bales shall be replaced as directed by the Engineer.
17 18	3.03	REM	OVAL
19 20 21 22 23 24		A.	Upon obtaining Substantial Completion, the Contractor shall be responsible for the complete removal of all silt barriers unless so directed by the Engineer. Following removal, all materials shall become the property of the Contractor.
2 4 25			END OF SECTION

1			SECTION 02140
2			TEMPORARY DEWATERING
4 5	PART	1 – G	ENERAL
6 7	1.01		DESCRIPTION
8 9 10 11 12		A.	The Work to be performed includes the furnishing of all equipment, materials and labor necessary to remove surface or subsurface waters from excavation areas in accordance with the requirements set forth and as shown on the Drawings or as specified.
3 4 5		B.	Unless specifically authorized by the Engineer, all pipe and structures shall be laid "in the dry".
6 7	1.02	QUAL	LITY ASSURANCE
18 19 20 21 22 23		A.	The dewatering of any excavation areas and the disposal of the water produced shall be in strict accordance with the latest revision of all Laws and Regulations; with the local, State and Federal permits for the project; and, with the Contractor's approved Storm Water Pollution Prevention Plan (SWPPP).
24 25	PART	2 – PF	RODUCTS (Not Applicable)
26 27	PART	3 – E	KECUTION
28 29	3.01	TEMF	PORARY DEWATERING
30 31 32 33 34		A.	Prior to commencing work, the Contractor shall submit to the Engineer for approval the Contractor's plans for dewatering. The dewatering system shall be in conformity with the overall construction plan.
35 36 37 38		B.	The Contractor is responsible for obtaining all permits required for dewatering discharges, including a Florida Department of Environmental Protection Generic Permit for Produced Groundwater per F.A.C 62-621.300.
39 10 11 12 13 14 15 16		C.	The Contractor shall provide adequate equipment for the removal of surface or subsurface waters that may accumulate in the excavation. Flotation and migration of fines shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages that may result from the operation and/or failure of this system.

- D. If subsurface water is encountered, the Contractor shall utilize suitable equipment to adequately dewater the excavation so that it will be dry to a depth of 12-inches below the pipeline subgrade compaction level or over-excavation level, whichever is lower, but not more than 5-feet, to facilitate effective subgrade compaction and to provide for a stable trench bottom. For concrete structures, the dewatering system shall maintain the water at such a level at least 2 feet below the subgrade of the structure. A wellpoint system, trench drain, sump pump operation, or other dewatering method shall be utilized to maintain the excavation in a dry condition for preparation of the trench bottom and until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. No water shall be allowed to contact masonry or concrete within 24 hours after being placed.
- E. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation and to preserve the integrity of adjacent structures and utilities. Well or sump installations shall be constructed and operated continuously with proper sand filters to prevent drawing of finer grained soil from the surrounding ground. Dewatering by trench pumping shall not be permitted if migration of fine grained natural material from bottom, side walls, or bedding material may occur.
- F. In the event that satisfactory dewatering cannot be accomplished due to subsurface conditions, or where dewatering could damage existing structures, the Contractor shall obtain the Engineer's approval of wet trench construction or procedure before commencing construction.
- G. Engine-driven dewatering pumps shall be equipped with residential type mufflers. Where practical and feasible, electrical "power drops" and electric motor-driven equipment shall be used in lieu of portable generators.
- H. The Contractor shall take all additional precautions to prevent uplift of any structure during construction.
- I. The Contractor shall take all precautions to preclude the accidental discharge of fuel, oil, etc. to prevent adverse effects on groundwater quality. All costs associated with any such adverse effects shall be borne by the Contractor.
- J. The Contractor shall, at no expense to the Owner, be required to excavate below grade and refill with approved fill material if the Engineer determines that adequate drainage has not been provided.

3.02 DISPOSAL

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 - 3.03 EQUIPMENT REMOVAL

- Α. All product water from dewatering shall be pumped from the trench or other excavation and shall be disposed of in strict accordance with the Permits. The Contractor will be allowed to discharge product water from dewatering offsite into storm sewers, or ditches having adequate capacity, canals or suitable disposal pits, or other surface waters in accordance with the Dewatering Plan, provided that the water has been sampled and tested by the Contractor, is in compliance with the concentration limits specified in 62-621.300(2) FAC, and the Contractor has obtained a Generic Permit for the Production of Groundwater. The frequency of water sampling and testing shall be determined by the Engineer based on existing conditions and field observations.
- B. Prior to discharging produced groundwater from any construction site, the contractor must collect samples and analyze the groundwater, which must meet acceptable discharge limits per 62-621.300(2) FAC.
- C. Permission to use any storm sewers, or drains, for water disposal purposes shall be obtained from the authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the However, the Contractor shall not cause flooding by Contractor. overloading or blocking up the flow in the drainage facilities, and shall leave the facilities unrestricted and as clean as originally found. Any damage to existing facilities shall be repaired or restored as directed by the Engineer or the authority having jurisdiction, at no cost to the Owner.
- D. Contractor shall be responsible for acquiring and complying with all permits required to discharge the product water from dewatering and shall protect waterways from turbidity during the operation.
- E. In areas where adequate disposal sites are not available, partially backfilled trenches may be used for water disposal only when the Contractor's plan for trench disposal is approved in writing by the The Contractor's plan shall include temporary culverts, barricades and other protective measures to prevent damage to property or injury to any person or persons.
- F. Contractor shall not dam, divert, or cause water to flow in excess in existing gutters, pavements or other structures; and to do this he may be required to conduct the water to a suitable place of discharge determined by the Engineer.
- G. No flooding of streets, roadways, driveways or private property shall be permitted.
 - 02140-3 TEMPORARY DEWATERING

A. Removal of dewatering equipment shall be accomplished after the system is no longer required. All materials and equipment constituting the system shall be removed by the Contractor.

END OF SECTION

1			SECTION 02221						
2			EXCAVATION AND BACKFILL						
4 5	PART 1 – GENERAL								
6 7	1.01	SCOF	SCOPE OF WORK						
8 9 10 11 12		A.	This work covers clearing and grubbing, site work, excavation, and backfill for piping and their appurtenances.						
	1.02	BURN	NING						
13 14		A.	A. Burning of debris shall not be permitted.						
15 16	1.03	CLEA	N-UP						
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37		Α.	Clean-up is an essential part of the work. As the work progresses and is completed, the Contractor shall clean the various sites of all operations and completely restore all work areas to the satisfaction of the Engineer and the Owner. This clean-up shall be done as promptly as practical and shall not be left until the end of the construction period. No part of the work shall be considered complete, and no payment will be made, until clean-up is completed.						
		В.	It is the Contractor's responsibility to assure that all construction sites and all other affected properties are restored to a condition equal to, or better than, the existing conditions prior to construction. All restoration is subject to the approval of the Engineer and/or Property Owners.						
	1.04	DRAINAGE							
		A.	It is the responsibility of the Contractor to maintain the existing drainage systems during construction. Any damage done to an existing drainage structure or system is to be immediately repaired at no additional cost to the Owner to a condition equal to or better than its original condition to the satisfaction of the Engineer.						
38 39	1.05	DUST	CONTROL						
40 41 42 43 44 45 46		A.	It is the responsibility of the Contractor to control all dust problems that may occur during the construction with required watering. Dust control will be required seven days a week.						

1.06 SPRINKLERS

A. The Contractor shall be responsible for sprinklers encountered within the area of excavation and shall make sure that, if disturbed or damaged, they shall be rebuilt to the satisfaction of the Engineer or property Owner and with no additional cost to the Owner.

1.07 EROSION CONTROL

A. It is the Contractor's responsibility to erect suitable silt fences, hay bales or other erosion runoff control devices prior to commencement of earth moving or excavation activities. The Contractor shall be responsible for maintaining the silt fences, hay bales or other erosion runoff control devices in an effective manner, repairing or replacing damaged or ineffective section during the course of the work until a ground cover of grass is established and final environmental approval has been obtained.

1.08 PERMITS FOR DEWATERING OPERATIONS

A. The Contractor is responsible for obtaining all permits required for dewatering discharges, including a Florida Department of Environmental Protection Generic Permit for Produced Groundwater per F.A.C 62-621.300 and as specified in Section 02140.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

 1. Materials for use as fill are described below. For each material, the Contractor shall notify the testing lab of the source of the material at least ten (10) calendar days prior to the date of anticipated use of such material.

2. Materials shall be furnished as required from off site sources and hauled to the site.

3. Disposal of unsuitable material is specified in this Section.

B. Common Fill

 Common fill shall consist of mineral soil, free of organic material, loam, wood, trash and other objectionable materials, which may be compressible or which cannot be compacted properly. Common fill shall not contain stones larger than four inches in any dimension,

> 02221-2 EXCAVATION AND BACKFILL

1 2 3 4				broken concrete, masonry, rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling.					
5 6 7 8 9			2.	Material falling within the above Specification, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material, which in the opinion of the Engineer, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials.					
11		C.	Selec	t Fill					
12 13 14 15 16 17 18			1.	Select fill shall be noncohesive, non-plastic material free of all debris, lumps or clods. Fill material shall be clean earth fill composed of sand or an approved mixture of clay and sand. Backfill material placed within one foot of piping and appurtenances shall not contain any stones or rocks larger than two inches in diameter, or three-quarter inch in diameter for PVC pipe.					
20	PART	RT 3 – EXECUTION							
21 22	3.01	SAFETY PRECAUTIONS AND TEMPORARY WORKS							
23 24 25 26 27 28		A.	signs,	contractor shall provide and maintain adequate barricades, construction torches, flashers and guards as required in pedestrian and vehicular areas. All safety rules and regulations of local authorities shall be ved.					
29 30 31 32		B.	protec encou	Contractor shall furnish temporary or permanent support, adequate ction and maintenance of all underground facilities and utilities intered. Support, protection, maintenance and restoration are the actor's responsibility at no additional cost to the Owner.					
33 34	3.02	CLEA	RING	AND GRUBBING					
35 36 37 38		A.	grass	Contractor shall remove only vegetation such as trees, shrubs, and , which interfere with the construction, as may be determined by the eer, and he shall preserve and protect all other existing vegetation.					
39 40	3.03	EXCA	VATIC	DN .					
41 42		A.	Gene	ral					
43 44 45 46 47			1.	The Contractor shall perform all excavation of every description, and of whatever substances encountered, to the depth indicated on the Drawings, or as otherwise specified.					

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- 2. Trench excavation shall be such that the pipe can be laid to the alignment and grade required. Trenches shall be shored and drained in such a manner that work may proceed safely and efficiently.
- 3. Trench dewatering pumps shall discharge to natural drainage channels, drains or sewers and shall be adequate to remove accumulated storm and/or subsurface water. The Contractor shall take necessary action to prevent surface water from flowing into the trenches. It is the responsibility of the Contractor to assure that all trench walls and trench bottoms are dry and remain dry during pipeline construction.
- 4. The Contractor shall separate, remove and dispose of excavated material not suitable for backfill, as directed by the Engineer.
- 5. All excavated material retained for backfill shall be piled in such a manner as not to endanger the work or obstruct the sidewalks, driveways or drainage. Fire hydrants, valve pit covers and hoses, curb stop boxes, fire and police call boxes and other utility controls shall be unobstructed and accessible at all times during construction.

B. Unclassified Excavation

1. Unclassified excavation shall include soil, clay, silt, sand, muck, gravel, hardpan, loose shale, loose stones in masses and boulders measuring less than one-half cubic yard in volume.

C. Classified Excavation

- 1. Classified excavation shall be rock further defined as follows: boulders, measuring one-half cubic yard or more in volume, rock material in ledges, bedded deposits and unstratified masses, conglomerate deposits firmly cemented and concrete or masonry structures, except sidewalks and paving, that in the opinion of the Engineer, requires removal by drilling and blasting, wedging, sledging, barring or breaking up with a power operated hand tool.
- 2. No soft or disintegrated rock that can be removed with a hand pick or power operated excavator or shovel, no loose, shaken, or previously blasted rock or broken stone in rock fillings or elsewhere, and no rock exterior to the minimum limits of measurement all owed, which may fall into the excavation, shall be considered as rock.

3.04 TRENCH PREPARATION

A. Unsupported trench width shall be limited to the minimum practicable width allowing working space to place and compact the haunching material.

- B. Dewatering of the trench bottom shall be accomplished using adequate means to allow preparation of bedding, placement of haunching and pipe in a trench environment without standing water. Dewatering shall continue until sufficient backfill is placed above the pipe to prevent flotation.
- C. The trench shall be dug so that the pipe can be laid to the alignment and depth required, and it shall be excavated only so far in advance of the pipe laying as allowed by the Engineer. The trench shall be so braced and drained that the workmen may work in it safely and efficiently. All trench preparation shall comply with all the latest applicable Local, State (Florida Trench Safety Act) and Federal Regulations (OSHA: Safe Trench Act). It is essential that the discharge of the trench dewatering pumps be conducted to natural drainage channels, drains or storm sewers.

E. Trench Bottom

- 1. Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, refuse, vegetable or other organic matter, or large pieces or fragments of inorganic material that, in the judgment of the Engineer, should be removed, the Contractor shall excavate and remove such unsuitable material to the width and depth as directed by the Engineer. Before the pipe is laid, the subgrade shall be made by backfilling with an approved material in three inch uncompacted layers. The layers shall be thoroughly tamped as specified by the Engineer to provide the uniform and continuous bearing support as heretofore described.
- 2. The trench shall be dry when the bottom is prepared. The trench bottom shall be excavated, or filled and compacted, as required to bring it to grade and shaped to receive and support the pipe barrel. In addition, bell holes shall be excavated so that after placement only the barrel of the pipe receives bearing pressure from and is uniformly supported by, the bottom of the trench. Preparation of the trench bottom and placement of the pipe shall be such that the final position of the pipe is true to line and grade, and uniformly supported throughout the barrel of each length. When pipe is placed in refill material, additional refill of the same material shall be tamped on each side of the barrel to the springline, thus forming a trough of firm bedding.
- F. All materials that, in the opinion of the Engineer, are suitable for reuse in restoring the disturbed surface shall be kept separated from the general excavation material and can only be used as directed by the Engineer.
- G. All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Hydrants, valve

pit covers, valve boxes, curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters, drainage inlets, natural water courses and miscellaneous drainage structures shall be kept clear or other satisfactory provisions made for their proper operation.

H. Hand methods for excavation shall be employed when damage to existing facilities is likely if heavy equipment is utilized or as directed by the Engineer.

3.05 DEPTH

- A. Trench shall be excavated to the depth required so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at every point between bell holes, except as necessary for removal of pipe slings or other lifting tackle. Any part of the bottom of the trench excavated to a point below the specified grade shall be corrected with approved material at the Contractor's expense and thoroughly tamped as directed by the Engineer.
- B. Wherever unstable soil or muck that is determined by the Engineer to be incapable of properly supporting the pipe is encountered in the bottom of the trench, such material shall be removed to the required depth and the trench refilled as specified to proper grade. If, in the opinion of the Engineer, removal of the unstable material by this method is impractical, then the Contractor shall support the pipe as detailed on the plans, or as directed by the Engineer.

3.06 BACKFILL

A. General

- 1. The Contractor shall not perform any of the backfilling operations until after he has inspected the lines and found them to be acceptable to the Owner.
- 2. Backfill material shall consist of earth, loam, sandy clay, sand, gravel, soft shale or other materials, free from organic materials, large clods of earth, or stones. Where excavated material is not suitable for backfill, it shall be replaced by excess excavated material from other areas.
- In all areas, backfill material shall be deposited in six -inch layers and carefully tamped until the compacted backfill depth reaches one foot above the top of pipe.
- 4. No mechanical equipment, or machinery other than a hand operated mechanical vibrator, shall be allowed within the trench area until the

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EXCAVATION AND BACKFILL

backfill has been properly tamped to one foot above the top of pipe. The remainder of the backfill shall be deposited in one foot layers and thoroughly tamped. Settling the backfill with water shall not be permitted.

5. Where trenches are improperly backfilled, or where settlement occurs, the trenches shall be reopened to the depth required for proper compaction, refilled and compacted, and the surface restored to the required grade and compaction, mounded over and smoothed off.

B. Compaction Requirements

- Trenches located under pavement or inside the two feet horizontal to one foot vertical slope, downward from roadway shoulder or the back of curb and from spring line to bottom of sub-grade or the finished surface of the embankment, as appropriate, shall be compacted to a density of ninety-eight (98) percent as determined by AASHTO T-180, Modified Density Test.
- 2. Trenches located outside of the two feet horizontal to one foot vertical slope downward from roadway shoulder or the back of curb and where no vehicular traffic will pass over the trenches, backfill shall be compacted as follows:
 - 1. For trenches less than 4-feet wide, backfill shall be compacted to a density approximately equal to that of soil adjacent to the trench.
 - For trenches greater than 4-feet wide and 25-feet long, backfill shall be compacted to a density approximately equal to that of soil adjacent to the trench but not less than ninety-five (95) percent of the maximum density as determined by AASHTO T-180, Modified Density Test.

C. Testing of Backfill

- Trenching within, or across roadways, or other areas to be paved, or stabilized shall be backfilled and compacted to their full depth.
- 2. Density tests for backfilled trenches within, or across roadways, shall be performed as specified or as directed by the Engineer, with at least one test taken at different locations for each vertical foot beginning from two feet over pipe to ground level.
- 3. Where unsatisfactory compaction is revealed by the test, the Contractor shall re-excavate, backfill, re-compact and/or rework the

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backfill as required, to obtain the required degree of compaction over the entire depth of the trench.

4. Satisfactory backfill compaction is an integral part of pipe laying, paving, and stabilizing. Satisfactory density reports shall be on file before each Contractor's statement is submitted for payment.

3.07 DISPOSAL OF SURPLUS MATERIAL

- A. All excavated material not required or not suitable for fill, or backfill, shall be disposed of by the Contractor, as directed by the Engineer.
- B. Material suitable for backfill shall be stockpiled on, or near site, until released by the Engineer for disposal.
- C. The Contractor shall bear all costs for disposal of all surplus or unsuitable materials.

3.08 SHEETING AND BRACING

- A. The Contractor shall do all shoring and sheeting required to perform and protect the excavation and, as required, for the safety of the employees.
- B. All trenches shall be sheeted and braced as required by the Engineer and all applicable Federal, State, County and Municipal regulations. Sheeting and bracing shall be used to prevent shifting of adjacent soil and to prevent damage to structures or the work. The sole responsibility for the design, methods of installation, and adequacy of the sheeting and bracing, shall be and shall remain that of the Contractor.

3.09 DEWATERING BY WELLPOINT

- A. Well points shall be spaced and at sufficient depths as required to eliminate water during the excavation period until the work is completed. Ample means and equipment shall be provided with which to remove promptly, and dispose properly all water entering any excavation. This includes the use of sand or gravel as required to maintain adequate flow during the pipe laying or installation of other items of work within the excavation.
- B. Water pumped or drained shall be disposed of in a suitable manner without damage to adjacent property to other work under construction or to street pavements or public parks. Water shall not be discharged onto streets without adequate protection of the surface at the point of discharge. All gutter, drains, culverts, sewers and inlets shall be kept clean and open for surface drainage. Water shall not be directed across or over pavements except through approved pipes or properly constructed troughs. Contractor shall obtain permission from the owner of any property involved before

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digging ditches or constructing water courses for removal of water, and provide for disposal of the water without ponding or creating a public nuisance. Water may be discharged into storm sewers provided that such water has been pre-treated to meet the Contractor's Storm Water Pollution Prevention Plan (SWPPP). Payment for dewatering shall not be paid for under a separate item, but shall be included in the payment for other items of work, unless it is specifically included as a Pay Item in the Contract.

END OF SECTION

1 2	SECTION 02276								
3			TEMPORARY EROSION AND SEDIMENTATION CONTROL						
4 5	PART 1 – GENERAL								
6 7	1.01	SCOPE OF WORK							
8 9 10 11		A.	The work specified in this Section consists of designing, providing, maintaining and removing temporary erosion and sedimentation controls as necessary.						
12 13 14 15 16 17 18 19		В.	Temporary erosion controls include, but are not limited to, straw, hay, filter fabric, permanent vegetation, grassing, mulching, netting, watering and reseeding on-site surfaces, spoil and borrow areas and providing interceptor ditches at those locations that will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the Engineer, Owner and the permitting agencies.						
20 21 22 23 24		C.	Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers and appurtenances, which ensure that sedimentation will be either eliminated or maintained within acceptable limits as established by the Owner and the permitting agencies.						
25 26 27		D.	The Contractor shall provide routine re-establishment, daily maintenance of permanent and temporary erosion and sediment control measures features until the project is complete and all soil stabilized.						
28 29 30 31		E.	Contractor shall be required to comply with all permit conditions included as attachments to these Contract Documents and as required by these Specifications.						
32 33 34 35		F.	The Contractor shall use all methods and products that meet or exceed those set forth in the FDOT Standard Specifications.						
36 37	1.02	REFE	ERENCE SPECIFICATIONS, CODES AND STANDARDS						
38 39 40		A.	Standard Building Code.						
41 42	PART	2 – PR	RODUCTS						
42 43 44	2.01	EROS	SION CONTROL						
45 46		A.	Loaming, seeding, sodding, and mulching is specified in Section 02485.						

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TEMPORARY EROSION AND SEDIMENTATION CONTROL

1		B.	Netting - fabricated of material acceptable to the Engineer.							
2 3	2.02	SEDI	MENTATION CONTROL							
4 5		A.	Bales – synthetic or clean, seed-free cereal hay type.							
6 7		B.	Netting - fabricated of material acceptable to the Engineer.							
8 9 10		C.	Filter stone - crushed stone conforming to Florida Department of Transportation specifications.							
11 12		D.	Concrete block - hollow, non-load-bearing type.							
13 14		E.								
15 16 17		F.	Drain pipe with sock (sedimentation control) shall be used to prevent and control soil erosion runoff and intrusion into stormwater drainage systems.							
18 19			Drain sock products such as "ADSSock" or approved equal.							
20 21 22 23 24 25			2. Sock material shall be on ultra-porous filter (synthetic wrap material) fitted snuggly over pipe. Material shall be 100 percent knitted polyester (or approved equal), equivalent opening size of 30 to 40, burst strength of 100-135 (ASTM D 3786), fiber size of 100-40 200 denier filament, 2.5 to 3.5 ounces per square yard (ASTM D 3776).							
26 27			3. Approval of material is required by Owner prior to use.							
28 29			4. Drain pipe with sock shall span the entire opening of the inlet.							
30	PART	3 – E	ECUTION							
32 33	3.01	EROSION CONTROL								
34 35 36		A.	Type of erosion control barriers used shall be governed by the nature of the construction operation, Contract Documents and all applicable permits.							
37 38 39 40 41		B.	Diversion ditches or swales may be required to prevent turbid storm water runoff from being discharged to wetlands or other water bodies. It may be necessary to employ a combination of barriers, ditches and other erosion/turbidity control measures as conditions warrant.							
42 43 44 45		C.	Fill material stockpiles shall be protected at all times by on-site drainage controls which prevent erosion of the stockpiled material. Control of dust from such stockpiles may be required, depending upon their location and the							
			02276-2 12/10/21							

TEMPORARY EROSION AND SEDIMENTATION CONTROL

1 2 3				cted length of time the stockpiles will be pre bilized stockpile remain after thirty (30) cale	
4 5 6 7 8 9		D.	unles days portic stabil	sturbed area may be denuded for more than so therwise authorized by the University. Wafter final grade is established on any portion of the site shall be provided with established measures per the original site plantee or landscaping.	/ithin sixty (60) calendar on of a project site, that ablished permanent soil
10 11 12		E.	Minin	num procedures for grassing are:	
13 14 15			1.	Scarify slopes to a depth of not less than 6 clods, rock, stumps and roots all larger than debris.	
16 17 18 19			2.	Sow seed within twenty-four (24) hours after with either mechanical seed drills or rotary	<u> </u>
20 21			3.	Apply mulch loosely and to a thickness bet inches.	ween 3/4-inch and 1-1/2
22 23 24			4.	Apply netting over mulched areas on all slo	ped surfaces.
25 26 27			5.	Roll and water seeded areas in a manne sprouting of seeds and growing of grass. Funsatisfactory growth. Backfill and seed en	Reseed areas that exhibit
28 29 30	3.02	SEDI	MENTA	ATION CONTROL	
31 32 33 34		A.	on th	I and maintain silt dams, traps, barriers and a e Drawings and as described herein. Hay b stone that is dislodged shall be replaced.	• •
35 36 37 38		B.	sedin comp	ng storm water systems shall be protected nentation of the storm water system. Sedim ly with or exceed "Best Management Practice nwest Florida Water Management District.	entation prevention shall
39 40 41 42 43		C.	depth	on accumulations greater than the lesser of of the siltation control barrier shall be imd in upland areas.	
14 15 16		D.	area,	e pumps are to be used to remove turbid wat the water shall be treated to reduce turbid lards prior to discharge to the wetlands. Tre	ity to state water quality
				02276-3 TEMPORARY EROSION AND	12/10/21

SEDIMENTATION CONTROL

for example, turbid water being pumped into grassed swales or appropriate vegetated areas (other than upland preservation areas and wetland buffers), sediment basins, or confined by an appropriate enclosure such as turbidity barriers and kept confined until its turbidity level meets state water quality standards.

- E. Sediment basins and traps, perimeter berms, filter fences, berms, sediment barriers, vegetative buffers and other measures intended to trap sediment and/or prevent the transport of sediment onto adjacent properties, or into existing water bodies; must be installed, constructed, or, in the case of vegetative buffers, protected from disturbance, as a first step in the land alteration process. Such systems shall be fully operative and inspected by the University before any other disturbance of the site begins. Earthen structures including but not limited to berms, earth filters, dams or dikes shall be stabilized and protected from drainage damage or erosion within one week of installation.
- F. Areas of 3 acres or more shall be required to have temporary sedimentation basins as a positive remedy against downstream siltation and will be shown and detailed on construction plans. During development, permanent detention areas may be used in place of silt basins provided they are maintained to the satisfaction of the University.
- G. The Contractor shall be prohibited from discharging silt through any stormwater outfall structure during construction. When temporary sedimentation basins are used, they shall be capable at all times of containing at least one (1) cubic foot of sediment for each one hundred (100) square feet of area tributary to the basin. Such capacity shall be maintained throughout the project by regular removal of sediment from the basin.
- H. Land alteration and construction shall be minimized in both permanent and intermittent waterways and the immediately adjacent buffer of 25 feet from top of bank of the waterways and the buffer area whenever possible, and barriers shall be used to prevent access. Where in channel work cannot be avoided, precautions must be taken to stabilize the work area during land alteration, development and/or construction to minimize erosion. If the channel and buffer area are disturbed during land alteration, they must be stabilized within three (3) calendar days after the in channel work is completed.
- I. Silt curtains or other filter/siltation reduction devices must be installed on the downstream side of the in channel alteration activity to eliminate impacts due to increased turbidity. Wherever stream crossings are required, properly sized temporary culverts shall be provided by the contractor and removed when construction is completed. The area of the crossing shall be restored

02276-4 TEMPORARY EROSION AND SEDIMENTATION CONTROL

1 2			to a condition as nearly as possible equal to that which existed prior to any construction activity.
3 4	3.03	PFRF	ORMANCE
5	0.00		
6		A.	Should any temporary erosion and sediment control measures employed by
7			the Contractor fail to produce results, which comply with the requirements of
8			the State of Florida, the Contractor shall immediately take the necessary
9			steps to correct the deficiency at his or her own expense.
10			
11	3.04	MAIN	TENANCE
12			
13			All erosion and siltation control devices shall be checked regularly, especially
14			after each rainfall and will be cleaned out and/or repaired as required.
15	2.05	CON45	
16	3.05	COM	PLIANCE
17 18		A.	Failure to comply with the aforementioned requirements may result in a fine
19		Α.	and/or more stringent enforcement procedures such as (but not limited to)
20			issuance of a "Stop Work Order".
21			issuance of a Glop Work Graci .
22			
23			END OF SECTION
24			25 3. 323311

1	SECTION 02485								
2	SURFACE RESTORATION								
4 5	PART	PART 1 – GENERAL							
6 7	1.01	SCOF	SCOPE OF WORK						
8 9 10		A.	Furnish all labor, materials, and equipment necessary to satisfactorily return all construction areas to their original conditions or better.						
1 2 3 4		B.	Work includes furnishing and placing sidewalks, sod, fertilizer, gravel, concrete, asphalt, planting, watering and maintenance until acceptance by the Owner.						
5 6 7		C.	All grassed areas disturbed by the work of this contract shall be sodded. Seeding/Hydroseeding shall not be acceptable, unless shown on the plans.						
18 19	1.02	QUALITY ASSURANCE							
20 21 22 23 24 25		A.	Requirements: It is the intent of this Specification that the Contractor is obliged to deliver a satisfactory stand of grass as specified. If necessary, the Contractor shall repeat any or all of the work, including grading, fertilizing, watering, and sodding at no additional cost to the Owner until a satisfactory stand is obtained.						
26 27 28 29 30		B.	Satisfactory Stand: For purposes of grassing, a satisfactory stand of grass is herein defined as a full lawn cover over areas to be sodded, with grass free of weeds, alive and growing, leaving no bare spots larger than 3/4 sq. yd. within a radius of 10 ft.						
31 32	1.03	SUBM	MITTALS						
33 34 35		A.	Provide technical data as required for shop drawings on all materials or installation procedures required under this Section.						
36 37	PART	2 – PF	RODUCTS						
38 39	2.01	MATE	ERIALS						
10 11		A.	Fertilizer						
12 13 14 15 16			1. Fertilizer shall be a complete fertilizer, the elements of which are derived from organic sources. Fertilizer shall be a standard product complying with State and Federal fertilizer laws.						

- 2. Percentages of nitrogen, phosphorus and potash shall by based on laboratory tests on soils outlined in Paragraph 1.03B and approved by the Engineer. For purpose of bidding, assume 6% nitrogen, 6% phosphorus and 6% potash by weight. At least 50% of the total nitrogen shall contain no less than 3% water-insoluble nitrogen.
- 3. Fertilizer shall be delivered to the site, mixed as specified, in the original unopened standard size bags showing weight, analysis and name of manufacturer. Containers shall bear the manufacturer's guaranteed statement of analysis, or a manufacturer's certificate of compliance covering analysis shall be furnished to the Engineer. Store fertilizer in a weatherproof place and in such a manner that it will be kept dry and its effectiveness will not be impaired.
- 4. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes containing not less than 20% available phosphoric acid.

B. Sodding

- 1. Sod shall be Argentine Bahia or to match existing sod of firm texture having a compacted growth and good root development as approved.
- 2. Sod shall be certified to meet Florida State Plant Board Specifications, absolutely true to varietal type, and free from weeds or other objectionable vegetation, fungus, insects and disease of any kind.
- 3. Before being cut and lifted the sod shall have been mowed 3 times with the final mowing not more than a week before cutting into uniform dimensions.

C. Water

It is the Contractor's responsibility to water the site, as required during sodding operations and through the maintenance period and until the work is accepted. The Contractor shall make whatever arrangements may be necessary to ensure an adequate supply of water to meet the needs for his work. The Contractor shall also furnish all necessary hose, equipment, attachments and accessories for the adequate irrigation of lawns and planted areas as may be required.

D. Concrete Driveways

1. Concrete driveways that are crossed or traversed by the trenches shall be restored to the conditions existing prior to the excavation.

- 2. Removal shall be held to a minimum, but when necessary removal shall be made in neat sawcut lines or to the nearest joint if approved by the Engineer.
- 3. Concrete driveways shall be 3000 psi/28day with 6 x 6 wire mesh reinforcing.
- 4. Expansion joints shall be installed between concrete driveways and sidewalks, where new concrete abuts old concrete.

E. Concrete Sidewalks

- Sidewalk removal, where required in the construction of this work, shall be held to a minimum. Sidewalk material removed shall be carefully separated from the trench excavation material and shall be disposed of as directed. Sidewalk shall be cut at the nearest regular joint on each side of the trench.
- 2. The Contractor shall replace all sidewalks which are removed. Sidewalks shall be replaced as soon as practicable after the backfill is placed and compacted and shall duplicate, in all respects, the original sidewalk.
- 3. The Contractor shall replace all sidewalks which are damaged by the construction operation or by the heavy equipment traveling over them and shall replace them at their own expense.
- 4. Sidewalk shall be 3000 psi/28 day, four inches thick, except at driveways. Driveway sidewalks shall be six inches thick with 6 x 6 #10 wire mesh reinforcing.
- 5. The top surface of all sidewalks shall be given a light broom finish.

F. Asphalt Restoration

1. Base

a. Limerock for use as base material shall meet the requirements of Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Section 911. The limerock producer shall address each truck receipt to the Contractor and the job site. Each receipt shall show the source of the material by D.O.T. pit number. One copy of each receipt will be submitted daily to the Owner for his records.

1			2.	Aspha	alt	
2 3 4 5 6 7 8 9				a.	All asphalt pavement removed shall be replaced with bas surface materials which are of a quality and thickness eq or more than the materials removed. The edges of the p shall be cut to neat lines beyond any settled or broken a Pavement shall be replaced as soon as practicable compaction of backfill.	qual to paving areas.
10 11				b.	The bituminous wearing surface applied shall be type SI minimum 1-1/2" thick.	P - 9.5,
12 13	PART	3 – E	XECUT	ION		
14 15	3.01	INSTA	ALLATI	ON		
16 17 18 19 20		A.	lawns	and gr	e subgrade preparation, the Contractor shall commence we rassed areas. Areas to be sodded shall be free from soft grades. Apply 20 lbs. of 12-3-6 fertilizer per 1,000 sq. ft.	spots
21 22		B.	Prote	ction		
23 24 25 26			warnii prior t	ng sign o actua	as shall be protected against the traffic or other use by plowns or erecting barricades as necessary. Any areas dame all acceptance by the Owner shall be repaired by the Control the Engineer.	naged
27 28	3.02	LAWN	N BED	PREP/	ARATION	
29 30 31		A.			sodded shall be cleared of all rough grass, weeds, and dund brought to an even grade as approved.	lebris,
32 33		B.	The s	oil shal	Il then be thoroughly tilled to a minimum 8-inch depth.	
34 35 36 37 38 39		C.	foot a 1000	nd com square	hate at a rate for bidding purposes of 5 pounds per 1,000 s inplete fertilizer at a rate for bidding purposes of 16 pound e foot shall be evenly distributed over entire area and of a depth of 4-6 inches.	ds per
40 41 42 43 44		D.	other confo	foreign rm to fi	hall then be brought to proper grade, free of sticks, stone matter over 1-inch in diameter of dimension. The surface finish grade, less the thickness of sod, free of water-retar, the soil friable and of uniformly fill texture.	e shall
45	3.03	SOD	HANDL	ING A	AND INSTALLATION	
46 47 48		A.		-	ery, prior to planting, and during the planting of the lawn a	
					02485-4 12/ SURFACE RESTORATION	/10/21

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unnecessary exposure of the roots to the sun. All sod shall be stacked during construction and planting so as not to be damaged by sweating or excessive heat and moisture.

- B. After completion of soil conditioning as specified above, sod panels shall be laid tightly together so as to make a solid sodded lawn area. On mounds and other slopes, the long dimension of the sod shall be laid perpendicular to the slope. Immediately following sod laying the lawn areas shall be rolled with a lawn roller customarily used for such purposes, and then thoroughly watered.
- C. Bring the sod edge in a neat, clean manner to the edge of all paving and shrub areas. Top dressing with approved, clean, weed free, sand may be required at no additional cost to the Owner if deemed necessary by the Engineer.

3.04 CLEANUP

A. Soil, mulch, or similar materials spilled onto paved areas shall be removed promptly, keeping those areas as clean as possible at all times. Upon completion of sodding operations, all excess soil, stones, and debris remaining shall be removed from the construction areas.

3.05 MAINTENANCE

- A. Any existing landscape items damaged or altered during construction by the Contractor shall be restored or replaced as directed by the Engineer.
- B. Maintain landscape work until Owner accepts project. Watering, weeding, cultivating, restoration of grade, mowing and trimming grass, protection from insects and diseases, fertilizing and similar operations as needed to ensure normal growth and good health for live plant material shall be the responsibility of the Contractor and at no additional cost to the Owner. Sodded areas shall receive no less than 1.5 inches of water per week.

3.06 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATIONS

A. Lawn areas planted under this Contract and all lawn areas damaged by the Contractor's operation shall be repaired by proper soil preparation, fertilizing, and resodding, in accordance with these Specifications.

END OF SECTION

1		SECTION 02770									
2	GEOMEMBRANE LINER										
4 5	PART	PART 1 - GENERAL									
6 7	1.01	DESC	DESCRIPTION								
8 9 10 11 12		Instal filters the re	This section covers the technical requirements for the Manufacturing and Installation of the geomembrane used to cover over the grating of the six upflow filters and flow channels to prevent rain water access. All materials meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications								
14 15	1.02	SUBI	MITTAL	_S							
16 17 18		A.			ER shall fu prior to inst		following i	information	to the EN	GINEER	
19 20 21 22 23			1.	i. N d	etails	proposed		out includin	J		
24 25 26			2.				e for coned by site of	cept only conditions.	and actua	al panel	
27 28	1.03	QUAI	LIFICA	TIONS							
29 30		A.	MAN	UFACTU	RER						
31 32 33			1.		mbrane sh oved equal		nufactured	by BTL Line	ers, Seam	an Corp.	
34 35		B.	INST	ALLER							
36 37			1.	Installat	ion shall be	e perform	ed by CON	ITRACTOR	or approv	ed equal	
38 39	1.04	DELI	IVERY, STORAGE AND HANDLING								
40 41 42		A.		•	h roll of ge ACTUREF		ane deliver	ed to the si	ite shall be	labeled	
43 44 45 46 47 48			i ii	i. n ii. p ii. th	el will iden nanufactur roduct ide nickness ength	er's name				12/10/21	

GEOMEMBRANE LINER

1 2			v. vi.	width roll number					
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17		B.			prepared to ship by appropriate and to facilitate off-loading.	means to			
		C.	by the CON		cation for geomembrane materia otect the geomembrane from and moisture				
			1. Shoul i. ii. iii. iv. v.	d have the following level (no wooden smooth dry protected from the adjacent to the are	pallets) eft and vandalism				
18 19		D.	Handling- Ma	aterials are to be ha	andled so as to prevent damage.				
20 21	1.05	WA	VARRANTY						
22 23 24		A. Material shall be warranted, on a pro-rata basis against Manufactu defects for a period of 5 years from the date of geomembrane installation							
25 26 27		B.			against defects in workmanship for embrane completion.	or a period			
28 29	PART	PART 2 – PRODUCTS							
30 31	1.01	GEI	NERAL						
32 33 34 35 36 37 38 39 40 41		A.	material prov unsatisfactor	vided. Should any or ry results, the CON with satisfactory m	solely responsible for the qua of the tests performed on the ma TRACTOR will be responsible fo aterials without delay to the proj	terial yield r replacing			
	1.02	GEO A.	OMEMBRANE BTL Liners -	Armor Cover – 16r	mil (Black LDPE/HDPE/White LD	PE)			
			Fabrication & Weight	Warehouse	PRINEVILLE, OREGON 7.5 OZ./SQ.YD. (+/-5%)				
			Thickness		16 MIL (+/-10%)				

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Coating Thickness	2 MIL EACH (+/-5%)
Tensile Strength (Grab Method)	Warp 210 LBS. Weft 190 LBS.
Tear Strength (Tongue Method)	Warp 60 LBS. Weft 60 LBS.
Bursting Strength (Mullen)	375 PSI
Hydrostatic Resistance	97 PSI
Puncture Resistance	113 LBS.
Low Temperature Cold Crack	-22 ° F
UV Resistance	>90% Strength Retained After 2000 HRS.

B. Seaman Corporation – 8228 XR-3

Base Fabric Type	Polyester
Base Fabric Weight (nominal)	3.0 OZ./SQ.YD.
Finished Coated Weight ASTM D751	28.0 (+/- 2) OZ./SQ.YD.
Thickness ASTM D751	30 MIL (nominal)
Trapezoid Tear ASTM D4533	30/30 LBF. (nominal)
Grab Tensile ASTM D751 Grab Method	250/200 LBF. (min)
Hydrostatic Resistance ASTM D751, Procedure A	300 PSI (min)
Adhesion ASTM D751 Dielectric Seam	10 LBF./in (min)

Cold Crack ASTM D2136 1/8" mandrel, 4 HRS.	Pass @ -25° F
Puncture Resistance ASTM D4833	50 LBF. (typical)
Dead Load ASTM D751	2in Seam, 4 HRS., 1in Strip 100 LBF. @ 70° F 50 LBF. @ 160° F

1 2 3

 1.03 DELIVERY STORAGE AND PROTECTION

A. Shipping

- 1. Completed panels will be placed on clean, serviceable pallets, free from exposed nails or other obstructions.
- 2. A layer of geomembrane, geotextile, or wood will be placed on all pallets to protect the panel from damage.
- 3. Secure panels to the pallet using metal or plastic bands. Use a layer of geomembrane between the packaged liner and the band to prevent damage to the liner as the band is tightened.
- 4. The packaged liner must not extend beyond the outer edges of the pallet. Use larger pallets or a layer of plywood to extend the pallet edges to match the liner.
- 5. Carefully handle and place on the truck to avoid damage to the liner.

B. Delivery

- 1. All panels will be inspected for damage on delivery.
- 2. Use suitable unloading equipment to handle panels. Do not drag, slide, or drop panels during unloading.
- 3. Place panels in a prepared area away from soft ground, standing water, or other deleterious surfaces.
- 4. Replace any pallets that may become damaged during shipping or handling.
- 5. Store liner panels in a secure area protected from extremes of heat or cold.
- 6. Protect panels from damage prior to use 02770-4
 GEOMEMBRANE LINER

PART 3 – EXECUTION

1.01 SITE PREPARATION

- A. Ensure surfaces to be lined are smooth, free of foreign and organic material, sharp objects, or debris of any kind.
- B. Prepare mechanical attachments according to drawing details.
- C. All concrete surfaces to which the liner will attach shall have "smooth trowel" finish.

1.02 INSTALLATION

- A. Installation of the geomembrane shall be performed in a logical sequence.
- B. Place panels according to the drawings, the panel layout, and the label on each panel.
- C. Sufficient thermal slack shall be incorporated during placement to ensure that harmful stresses do not occur in service.
- D. Weather Conditions at Time of Installation:
 - 1. Installation of membrane in winds above <20 km/h> <<12 mph>> can proceed only if the installer can demonstrate that the liner will not be at risk of damage.
 - 2. Do not install membrane during precipitation or in the presence of excessive moisture.
 - 3. Do not install in weather conditions that may be detrimental to the function of the membrane.
- E. Ensure personnel working on geomembrane do not use damaging footwear.
- F. Protect completed panels from damage; handle carefully to avoid damaging the liner.
- G. Equipment and methods used to unroll liner panels should not damage the prepared subgrade.
- H. Ballast used to prevent uplift by wind must not damage the geomembrane.
 A continuous load is recommended along the edges of panels to eliminate the risk of wind uplift.

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1			
2		l.	Field Seams
4 5 6 7 8			See MANUFACTURER for details per material chosen.
	1.03	REPA	IRS
		A.	Inspect seams and non-seam areas for holes, tears, or other defects.
9		B.	Repair all through-thickness defects.
12		C.	Small Holes: Repair by patching with a patch
3 4		D.	Tears: Cap area with a patch secured designated Tape
5 6 7		E.	Patches: Round or oval, of same geomembrane. Extend minimum <75 mm> <<3 inches>> beyond the edge of the defect.
8 9		F.	Verification of Repairs: All repairs to be visually inspected.
20 21		G.	Keep records of all repairs and the results of repair inspection.
22 23	1.04	FIELD	QUALITY ASSURANCE
24 25 26 27 28		A.	The ENGINEER and CONTRACTOR shall visually inspect all material to be included in the work and compare panel identification numbers with those on the certifications provided by the manufacturer to assure delivery of the appropriate material.
29 30 31 32 33		B.	Damage to geomembrane during installation shall be repaired according to MANUFACTURER recommendations. If the ENGINEER determines that any damage cannot adequately be repaired, the damaged material will be replaced.
34 35 36 37 38		C.	The ENGINEER and CONTRACTOR shall visually inspect all geomembrane seams.
39 10			END OF SECTION

1		SECTION 03100						
2			CONCRETE FORMWORK					
4 5	PART	PART 1 – GENERAL						
6 7	1.01	SCO	PE OF WORK					
8 9 10 11		A.	Furnish all labor and materials required to install, prepare, and remove concrete formwork as shown on the Contract Drawings and specified herein.					
12 13	1.02	RELA	ATED WORK					
14 15		A.	Concrete Reinforcement is included in Section 03200.					
16 17		B.	Cast-in-Place Concrete is included in Section 03300.					
18 19		C.	Concrete Finishes is included in Section 03350.					
20 21	1.03	SUBN	MITTALS					
22 23 24		A.	Submit to the Engineer shop drawings and product data including the following:					
25 26 27 28 29			 Form material Layout of panel joints and tie-hole pattern Proposed method of sealing tie-holes Manufacturer's data for form release agent 					
30 31	1.04	REFE	ERENCE STANDARDS					
32 33		A.	American Concrete Institute (ACI)					
34 35 36			ACI 117: Standard Specifications for Tolerances for Concrete Construction and Materials					
37 38			2. ACI 347: Formwork for Concrete					
39 40	1.05	DESI	GN REQUIREMENTS					
41 42 43 44		A.	All formwork shall be designed in accordance with ACI 347 to provide concrete finishes specified in Section 03350.					

1 2 3		B.	When high water reducer (superplasticizer) is used in the proposed concrete design mix, forms shall be designed for full hydrostatic pressure per ACI 347.
4 5 6		C.	All joints in forms shall be made watertight.
7	1.06	QUAL	TY ASSURANCE
8 9 10 11		A.	All formwork shall be completed by individuals having applicable experience in successfully performing similar work.
12 13 14 15		B.	Forms shall not be stored in direct or indirect sunlight. When not in use or being cleaned, forms shall be stored either indoors or under black polyethylene. Forms shall not be used in temperatures in excess of 100 degrees F.
17	PART	2 – PI	ODUCTS
18 19	2.01	FORM	MATERIALS
20			
21 22		A.	Precast and Cast-in-Place Concrete
23 24 25 26			 Acceptable form materials for precast and cast-in-place concrete include plywood, hard plastic finished plywood, overlaid waterproof particle board, or steel in new or undamaged condition, of sufficient strength and surface smoothness to produced specified finishes.
27 28		B.	Form Release Agents
29 30 31 32			 Release agents shall not bond with, stain, or adversely affect concrete surfaces, and shall not impair subsequent treatments of concrete surfaces when applied to forms.
33 34 35 36			 Release agents shall be environmentally safe, meeting local, state, and federal regulations.
37		C.	Form Ties
38 39 40 41			 Form ties shall be steel and conical or spherical in shape and shall be designed to maintain positive contact with forming material. Wire ties shall not be permitted.
42 43	PART	3 – E	ECUTION
14 15	3.01	FORM	SURFACE PREPARATION
46			

1 2 3		A.	Form surfaces that will be in contact with concrete or that have been in contact previously with cast concrete, dirt, and other surface contaminants shall be thoroughly cleaned.
4 5 6 7		B.	For steel forms, the form release agent shall be applied immediately after cleaning so as to prevent discoloration of the concrete from rust.
8 9 10		C.	For exposed wood forms in contact with concrete, the form release agent shall be applied as recommended by the manufacturer.
11 12	3.02	EREC	CTION
13 14 15		A.	Unless specified otherwise by the Engineer, all forms are to be erected following applicable recommendations of ACI 347.
16 17 18 19		B.	Provide standard steel or wood forms as specified herein for cast-in-place sidewalks. Forms shall be set to true lines and grades, and securely staked in position.
20 21	3.03	FORM	// REMOVAL
22 23 24 25 26 27		A.	Concrete forms may be removed once concrete is sufficiently hard so as not to sustain damage by form removal operations. The Contractor shall be responsible for all damage resulting from removal of forms. Form removal shall conform to the requirements specified in Section 03 30 00 and a curing compound applied.
28 29		B.	Form removal shall not disrupt concrete curing and protection operations.
30 32			END OF SECTION

1				Section 03200		
2						
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23		CONCRETE REINFORCEMENT				
	PART	T 1 – GENERAL				
	1.01	SCOF	PE OF	WORK		
		A.	all co	sh all labor, materials, equipment and incidentals required and install ncrete reinforcement complete as shown on the Drawings and as fied herein.		
		B.		sh only all deformed steel reinforcement required to be entirely built oncrete masonry unit construction.		
	1.02	RELA	RELATED WORK			
		A.	Cast-i	n-place Concrete is included in Section 03300.		
	1.03	SUBN	/IITTAL	S		
		A.		it to the ENGINEER, shop drawings and product data showing ials of construction and details of installation for:		
24 25 26 27 28 29 30 31			1.	Reinforcing steel. Placement drawings shall conform to the recommendations of ACI 315. All reinforcement in a concrete placement shall be included on a single placement drawing or cross referenced to the pertinent main placement drawing. The main drawing shall include the additional reinforcement (around openings, at corners, etc) shown on the standard detail sheets. Bars to have special coatings and/or to be of special steel or special yield strength are to be clearly identified.		
33 34 35 36 37 38 39 40			2.	Bar bending details. The bars shall be referenced to the same identification marks shown on the placement drawings.		
			3.	Schedule of all placements to contain synthetic reinforcing fibers. The amount of fibers per cubic yard to be used for each of the placements shall be noted on the schedule. The name of the manufacturer of the fibers and the product data shall be included with the submittal.		
42 43		B.	Subm	it Test Reports of each of the following items.		
14 15 16			1.	Certified copy of mill test on each steel proposed for use showing the physical properties of the steel and the chemical analysis.		

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CONCRETE REINFORCEMENT

1 2 3 4			 Welder's certification. The certification shall be in accordance with AWS D1.4 when welding of reinforcement required.
5 6	1.04	REFE	RENCE STANDARDS
7 8		A.	American Society for Testing and Materials (ASTM)
9 10			1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
11 12			 ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
13			3. ASTM A185 - Standard Specification for Steel Welded Wire Fabric,
14 15			Plain, for Concrete Reinforcement 4. ASTM A496 - Standard Specification for Steel Wire, Deformed, for
16 17			Concrete Reinforcement 5. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed for Congrete Reinforcement
18 19			Deformed, for Concrete Reinforcement 6. ASTM A615 - Standard Specification for Deformed and Plain
20 21			Billet-Steel Bars for Concrete Reinforcement 7. ASTM A616 - Standard Specification for Rail-Steel Deformed and
22 23			Plain Bars for Concrete Reinforcement 8. ASTM A617 - Standard Specification for Axle-Steel Deformed and
24 25			Plain Bars for Concrete Reinforcement 9. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed
26 27			 and Plain Bars for Concrete Reinforcement. 10. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized)
28 29			Steel Bars for Concrete Reinforcement 11. ASTM A775 - Standard Specification for Epoxy-Coated Reinforcing
30 31			Steel Bars. 12. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire
32 33 34			 and Welded Wire Fabric for Reinforcement. 13. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
35 36 37		В.	American Concrete Institute (ACI)
38 39 40 41			 ACI 301 - Standard Specification for Structural Concrete ACI 315 - Details and Detailing of Concrete Reinforcement. ACI 318 - Building Code Requirements for Structural Concrete ACI SP-66 - ACI Detailing Manual
42 43		C.	Concrete Reinforcing Steel Institute (CRSI)
44 45			Manual of Standard Practice
46 47		D.	American Welding Society (AWS)

		AWS D1.4 - Structural Welding Code Reinforcing Steel			
	E.	Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.			
1.05	QUA	TY ASSURANCE			
	A.	Provide services of a manufacturer's representative, with applicable experience in the use of the reinforcing fibers for a preconstruction meeting and assistance during the first placement of the material.			
1.06	DELI	VERY, HANDLING AND STORAGE			
	A.	Reinforcing steel shall be substantially free from mill scale, rust, dirt, grease, or other foreign matter.			
	B.	Reinforcing steel shall be shipped and stored with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same "mark" designations as those shown on the submitted Placing Drawings.			
	C.	Reinforcing steel shall be stored off the ground and kept free from dirt, oil, or other injurious contaminants.			
PART	2 – P	RODUCTS			
2.01	MAT	ERIALS			
	A.	Materials shall be new, of domestic manufacture and shall comply with the following material specifications.			
	B.	Deformed Concrete Reinforcing Bars: ASTM A615, Grade 60 deformed bars.			
	C.	Concrete Reinforcing Bars required on the Drawings to be welded: ASTM A706.			
	D.	Welded Steel Wire Fabric: ASTM A185. Provide in flat sheets.			
	E.	Welded Deformed Steel Wire Fabric: ASTM A497.			
	F.	Welded Plain Bar Mats: ASTM A704 and ASTM A615 Grade 60 plain bars.			
	G.	Fabricated Deformed Steel Bar Mats: ASTM A184 and ASTM A615 Grade 60 deformed bars.			
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- H. The following alternate materials are allowed:
 - 1. ASTM A615 Grade 60 may be used for ASTM A706 provided the following requirements are satisfied:
 - a. The actual yield strength of the reinforcing steel based on mill tests shall not exceed the specified yield strength by more than 18,000 psi. Retests shall not exceed this value by more than an additional 3000 psi.
 - b. The ratio of the actual ultimate tensile strength to the actual tensile yield strength of the reinforcement shall not be less than 1.25.
 - c. The carbon equivalency (CE) of bars shall be 0.55 or less.
- I. Reinforcing Steel Accessories
 - Plastic Protected Bar Supports: CRSI Bar Support Specifications, Class 1 - Maximum Protection.
 - 2. Stainless Steel Protected Bar Supports: CRSI Bar Support Specifications, Class 2 Moderate Protection.
 - Precast Concrete Block Bar Supports: CRSI Bar Support Specifications, Precast Blocks. Blocks shall have equal or greater strength than the surrounding concrete.
 - 4. Steel Protected Bar Supports: #4 Steel Chairs with plastic or rubber tips.
- J. Tie Wire
 - 1. Tie Wires for Reinforcement shall be 16-gauge or heavier, black annealed wire or stranded wire.
- K. Mechanical reinforcing steel butt splices shall be positive connecting taper threaded type employing a hexagonal coupler such as Lenton rebar splices as manufactured by Erico Products Inc., Solon, OH or equal. They shall meet all ACI 318 Building Code requirements. Bar ends must be taper threaded with coupler manufacturer's bar threader to ensure proper taper and thread engagement. Bar couplers shall be torqued to manufacturer's recommended value.
 - 1. Unless otherwise noted on the Drawings, mechanical tension splices shall be designed to produce a splice strength in tension or

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1 2 3				compression of not less than 125 percent of the ASTM minimum yield strength of the rebar.	/I specified
5 5 6 7			2.	Compression type mechanical splices shall provide bearing from one bar to the other bar and shall be developing the ultimate strength of the rebar in compress	capable of
8 9		L.	Fiber	Reinforcement	
10 11 12 13 14			1.	Synthetic reinforcing fiber for concrete shall be 10 polypropylene collated, fibrillated fibers as manufactured Concrete Systems Chattanooga, TN - Propex or equiength and quantity for the concrete mix shall be compliance with the manufacturer's recommendations as by the ENGINEER.	by Propex ual. Fiber e in strict
16 17	2.02	FABR	RICATION	ON	
18 19 20 21		A.		cation of reinforcement shall be in compliance with the CF andard Practice.	RSI Manual
22		B.	Bars	shall be cold bent. Bars shall not be straightened or re-ber	nt.
23 24 25		C.		shall be bent around a revolving collar having a diameter that recommended by the ACI 318.	of not less
26 27 28 29		D.	in me ends	ends that are to be butt spliced, placed through limited diancetal, or threaded, shall have the applicable end(s) saw-shall terminate in flat surfaces within 1-1/2 degrees of a rigories of the bar.	cut. Such
31 32 33	PART	3 – E	XECUT	TION	
34 35	3.01	INST	ALLAT	ION	
36 37 38 39 40		A.	reinfo	ce condition, bending, spacing and tolerances of pla orcement shall comply with the CRSI Manual of Standar CONTRACTOR shall be solely responsible for providing ar oer of bars and maintaining the spacing and clearances sho	d Practice. n adequate
41 42 43		B.		pt as otherwise indicated on the Drawings, the minimur of reinforcement shall be as follows:	n concrete
14 15 16			1.	Concrete cast against and permanently exposed to earth	: 3-in
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- 2. Concrete exposed to soil, water, sewage, sludge and/or weather: 2-in (Including bottom cover of slabs over water or sewage)
- C. Reinforcement which will be exposed for a considerable length of time after being placed shall be coated with a heavy coat of neat cement slurry.
- D. No reinforcing steel bars shall be welded either during fabrication or erection unless specifically shown on the Drawings or specified herein, or unless prior written approval has been obtained from the ENGINEER. All bars that have been welded, including tack welds, without such approval shall be immediately removed from the work. When welding of reinforcement is approved or called for, it shall comply with AWS D1.4.
- E. Reinforcing steel interfering with the location of other reinforcing steel, conduits or embedded items may be moved within the specified tolerances or one bar diameter, whichever is greater. Greater displacement of bars to avoid interference shall only be made with the approval of the ENGINEER. Do not cut reinforcement to install inserts, conduits, mechanical openings or other items without the prior approval of the ENGINEER.
- F. Securely support and tie reinforcing steel to prevent movement during concrete placement. Secure dowels in place before placing concrete.
- G. Reinforcing steel bars shall not be field bent except where shown on the Drawings or specifically authorized in writing by the ENGINEER. If authorized, bars shall be cold-bent around the standard diameter spool specified in the CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. If the reinforcing steel is damaged, replace, Cadweld or otherwise repair as directed by the ENGINEER. Do not bend reinforcement after it is embedded in concrete unless specifically shown otherwise on the Drawings.

3.02 REINFORCEMENT AROUND OPENINGS

A. Unless specific additional reinforcement around openings is shown on the Drawings, provide additional reinforcing steel on each side of the opening equivalent to one half of the cross-sectional area of the reinforcing steel interrupted by an opening. The bars shall have sufficient length to develop bond at each end beyond the opening or penetration.

3.03 SPLICING OF REINFORCEMENT

A. All splices shall be Class "B" tension lap splices in compliance with ACI 318, unless noted otherwise. In addition, minimum lap splice length shall be 57 bar diameters but not less than 24 inches.

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- 40 41 42 43

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- B. Install wire fabric in as long lengths as practicable. Wire fabric from rolls shall be rolled flat and firmly held in place. Splices in welded wire fabric shall be lapped in accordance with the requirements of ACI-318 but not less than 12-in. The spliced fabrics shall be tied together with wire ties spaced not more than 24-in on center and laced with wire of the same diameter as the welded wire fabric. Do not position laps midway between supporting beams, or directly over beams of continuous structures. Offset splices in adjacent widths to prevent continuous splices.
- C. Mechanical reinforcing steel splicers shall be used only where shown on the Drawings. Splices in adjacent bars shall be offset by at least 30 bar diameters. Mechanical reinforcing splices are only to be used for special splice and dowel conditions approved by the ENGINEER.

3.04 **ACCESSORIES**

- Α. Determine, provide and install accessories such as chairs, chair bars and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the reinforcement and the placement of concrete.
- B. Use precast concrete blocks where the reinforcing steel is to be supported over soil.
- C. Stainless steel bar supports or steel chairs with stainless steel tips shall be used where the chairs are set on forms for a concrete surface that will be exposed to weather, high humidity, or liquid (including bottom of slabs over liquid containing areas). Use of galvanized or plastic tipped metal chairs is permissible in all other locations unless otherwise noted on the Drawings or specified herein.
- D. Alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcing steel fastened to the bottom and top mats, may be used if approved by the ENGINEER.

INSPECTION 3.05

Α. In no case shall any reinforcing steel be covered with concrete until the installation of the reinforcement, including the size, spacing and position of the reinforcement has been observed by the ENGINEER and the ENGINEER's release to proceed with the concreting has been obtained. The ENGINEER shall be given ample prior notice of the readiness of placed reinforcement for observation. The forms shall be kept open until the ENGINEER has finished his/her observations of the reinforcing steel.

> 03200-7 CONCRETE REINFORCEMENT

1			SECTION 03300						
2		CAST-IN-PLACE CONCRETE							
4 5 6 7 8 9 10 11 12 13	PART	PART 1 – GENERAL							
	1.01	SCOI	SCOPE OF WORK						
		A.	Furnish all labor and materials required and install cast-in-place concrete complete as shown on the Drawings and as specified herein.						
	1.02	RELA	RELATED WORK						
		A.	Concrete Formwork is included in Section 03100.						
15 16		B.	Concrete Reinforcement is included in Section 03200.						
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40		C.	Concrete Joints and Joint Accessories are included in Section 03250.						
		D.	Concrete Finishes are included in Section 03350.						
		E.	Grout is included in Section 03600.						
	1.03	SUBMITTALS							
		A.	Submit to the Engineer, in accordance with Sections 01300 and 01340, shop drawings and product data including the following:						
			Sources of cement, pozzolan and aggregates.						
			2. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.						
			3. Air-entraining admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.						
			4. Water-reducing admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.						
41 42 43 44 45 46			5. High-range water-reducing admixture (plasticizer). Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, retarding effect, slump range and conformity to ASTM standards. Identify proposed locations of use.						

- 6. Concrete mix for each formulation of concrete proposed for use including constituent quantities per cubic yard, water-cementitious materials ratio, concrete slump, type and manufacturer of cement. Provide either a. or b. below for each mix proposed.
 - a. Standard deviation data for each proposed concrete mix based on statistical records.
 - b. The curve of water-cementitious materials ratio versus concrete cylinder strength for each formulation of concrete proposed based on laboratory tests. The cylinder strength shall be the average of the 28 day cylinder strength test results for each mix. Provide results of 7 and 14 day tests if available.
- 7. Sheet curing material. Product data including catalogue cut, technical data and conformity to ASTM standard.
- 8. Liquid curing compound. Product data including catalogue cut, technical data, storage requirements, product life, application rate and conformity to ASTM standards. Identify proposed locations of use.

B. Samples

1. Fine and coarse aggregates if requested by the Engineer.

C. Test Reports

- 1. Fine aggregates sieve analysis, physical properties, and deleterious substance.
- 2. Coarse aggregates sieve analysis, physical properties, and deleterious substances.
- 3. Cements chemical analysis and physical properties for each type.
- 4. Pozzolans chemical analysis and physical properties.
- 5. Proposed concrete mixes compressive strength, slump and air content.

D. Certifications

- 1. Certify admixtures used in the same concrete mix are compatible with each other and the aggregates.
- 2. Certify admixtures are suitable for use in contact with potable water after 30 days of concrete curing.

1 2			3.	Certify curing compound is suitable for use in contact with potable water after 30 days (non-toxic and free of taste or odor).					
3	1.04	REFE	ERENCE STANDARDS						
5 6		A.	Amer	ican Society for Testing and Materials (ASTM)					
7 8 9			1.	ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.					
10 11			2.	ASTM C33 - Standard Specification for Concrete Aggregates.					
2 3 4			3.	ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.					
5 6 7			4.	ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.					
8 9			5.	ASTM C94 - Standard Specification for Ready-Mixed Concrete.					
20 21 22 23 24 25			6.	ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete					
23 24			7.	ASTM C150 - Standard Specification for Portland Cement					
26 27			8.	ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete					
28 29 30			9.	ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.					
31 32 33			10.	ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.					
34 35 36			11.	ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.					
37 38 39			12.	ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.					
10 11 12			13.	ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.					
13 14 15 16			14.	ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.					

1 2 3			15.	ASTM C1017 - Standard Specification for Chemical Admixtures for use in Producing Flowing Concrete.
4		B.	Ameri	ican Concrete Institute (ACI).
5 6			1.	ACI 301- Standard Specification for Structural Concrete
7 8			2.	ACI 305.1 – Standard Specification for Hot Weather Concreting.
9			3.	ACI 306.1 - Standard Specification for Cold Weather Concreting.
11 12 13			4.	Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.
14 15	1.05	QUAL	ITY AS	SSURANCE
16 17 18 19		A.	above	orced concrete shall comply with specifications and standards noted e. The most stringent requirement of the codes, standards and this Section apply when conflicts exist.
20 21 22		B.		one source of cement and aggregates shall be used on any one structure. rete shall be uniform in color and appearance.
23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39		C.	individed method concrete high-relationship the	n advance of placing concrete, discuss with the Engineer the sources of dual materials and batched concrete proposed for use. Discuss placement ods, waterstops and curing. Propose methods of hot and cold weather eting as required. Prior to the placement of any concrete containing a range water-reducing admixture (plasticizer), the Contractor, accompanied a plasticizer manufacturer, shall discuss the properties and techniques of ing and placing plasticized concrete.
		D.	requir Engin be ne	ring the progress of the work, it is impossible to secure concrete of the red workability and strength with the materials being furnished, the eer may order such changes in proportions or materials, or both, as may cessary to secure the desired properties. All changes so ordered shall be at the Contractor's expense.
		E.	accep	ring the progress of the work, the materials from the sources originally sted change in characteristics, the Contractor shall, at his/her expense, new acceptance tests of aggregates and establish new design mixes.
41 42 43 44		F.		ng of the following materials shall be furnished by Contractor to verify rmity with this Specification Section and the stated ASTM Standards.
45 46 47			1.	Fine aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.

1 2			2.	Coarse aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.
3 4 5			3.	Cements for conformity with ASTM C150 - chemical analysis and physical properties.
6 7 8			4.	Pozzolans for conformity with ASTM C618 - chemical analysis and physical properties.
9 10 11			5.	Proposed concrete mix designs - compressive strength, slump and air content.
12 13 14			6.	Concrete placements - compressive strength (cylinders), compressive strength (cores), slump, and air content.
15 16 17 18		G.	of suc	testing and inspection services will be provided by the Owner. The cost ch work, except as specifically stated otherwise, shall be paid by the r. Testing of the following items shall be by the Owner to verify conformity his Specification Section.
20 21			1.	Other materials or products that may come under question.
22 23		H.	All ma	aterials incorporated in the work shall conform to accepted samples.
24 25	1.06	DELI	/ERY,	STORAGE AND HANDLING
26 27 28		A.		ent: Store in weather-tight buildings, bins or silos to provide protection from ness and contamination and to minimize warehouse set.
29 30 31 32 33 34		B.	conta stock Comp	egate: Arrange and use stockpiles to avoid excessive segregation or mination with other materials or with other sizes of like aggregates. Build piles in successive horizontal layers not exceeding 3-ft in thickness. Plete each layer before the next is started. Do not use frozen or partially aggregate.
35 36 37 38		C.	to uni	Arrange and use stockpiles to avoid contamination. Allow sand to drain form moisture content before using. Do not use frozen or partially frozen gates.
39 40 41 42 43		D.	dama ingred admix	ctures: Store in closed containers to avoid contamination, evaporation or ge. Provide suitable agitating equipment to assure uniform dispersion of dients in admixture solutions which tend to separate. Protect liquid stures from freezing and other temperature changes which could adversely their characteristics.
45 46 47		E.		blan: Store in weather-tight buildings, bins or silos to provide protection dampness and contamination.
				CAST-IN-PLACE CONCRETE

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- F. Sheet Curing Materials: Store in weather-tight buildings or off the ground and under cover.
- G. Liquid Curing Compounds: Store in closed containers.

PART 2 - PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

2.02 MATERIALS

- A. Materials shall comply with this Section and any applicable State or local requirements.
- B. Cement: Domestic portland cement complying with ASTM C150. Air entraining cements shall not be used. Cement brand shall be subject to approval by the Engineer and one brand shall be used throughout the Work. The following cement type(s) shall be used:
 - 1. All Classes Type I/II or Type II.
- C. Fine Aggregate: Washed inert natural sand conforming to the requirements of ASTM C33.
- D. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33. Grading requirements shall be as listed in ASTM C33 Table 2 for the specified coarse aggregate size number. Limits of Deleterious Substances and Physical Property Requirements shall be as listed in ASTM C33 Table 3 for severe weathering regions. Size numbers for the concrete mixes shall be as shown in Table 1 herein.
- E. Water: Potable water free from injurious amounts of oils, acids, alkalis, salts, organic matter, or other deleterious substances.
- F. Admixtures: Admixtures shall be free of chlorides and alkalis (except for those attributable to water). When it is required to use more than one admixture in a concrete mix, the admixtures shall be from the same manufacturer. Admixtures shall be compatible with the concrete mix including other admixtures and shall be suitable for use in contact with potable water after 30 days of concrete curing.
 - 1. Air-Entraining Admixture: The admixture shall comply with ASTM C260. Proportioning and mixing shall be in accordance with manufacturer's recommendations.

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- 2. Water-Reducing Agent: The admixture shall comply with ASTM C494, Type A. Proportioning and mixing shall be in accordance with manufacturer's recommendations.
- 3. High-Range Water-Reducer (Plasticizer): The admixture shall comply with ASTM C494, Type F and shall result in non-segregating plasticized concrete with little bleeding and with the physical properties of low water/cement ratio concrete. The treated concrete shall be capable of maintaining its plastic state in excess of 2 hours. Proportioning and mixing shall be in accordance with manufacturer's recommendations. Where walls are 14" thick or less and the wall height exceeds 12 ft a mix including a plasticizer must be used.
- 4. Admixtures causing retarded or accelerated setting of concrete shall not be used without written approval from the Engineer. When allowed, the admixtures shall be retarding or accelerating water reducing or high range water reducing admixtures.
- G. Pozzolan (Fly Ash): Pozzolan shall be Class C or Class F fly ash complying with ASTM C618 except the Loss on Ignition (LOI) shall be limited to 3 percent maximum.
- H. Ground-granulated Blast Furnace Slaq. Ground-granulated blast furnace slaq shall conform to the following:
 - 1. ASTM C989
 - 2. Slag activity classification: Grade 100 or 120.
- I. Sheet Curing Materials. Waterproof paper, polyethylene film or white burlap-polyethylene sheeting all complying with ASTM C171.
- J. Liquid Curing Compound. Liquid membrane-forming curing compound shall comply with the requirements of ASTM C309, Type 1-D (clear or translucent with fugitive dye) and shall contain no wax, paraffin, or oil. Curing compound shall be approved for use in contact with potable water after 30 days (non-toxic and free of taste or odor). Curing compound shall comply with Federal, State and local VOC limits.

2.03 MIXES

- A. Development of mix designs and testing shall be by an independent testing laboratory acceptable to the Engineer engaged by and at the expense of the Contractor.
- B. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce concrete having proper placability,

durability, strength, appearance and other required properties. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing excessive free water to collect on the surface.

- C. The design mix shall be based on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if such data is not available, be developed by a testing laboratory, acceptable to the Engineer, engaged by and at the expense of the Contractor. Acceptance of mixes based on standard deviation shall be based on the modification factors for standard deviation tests contained in ACI 318. The water content of the concrete mix. determined by laboratory testing, shall be based on a curve showing the relation between water cementitious ratio and 7 and 28 day compressive strengths of concrete made using the proposed materials. The curves shall be determined by four or more points, each representing an average value of at least three test specimens at each age. The curves shall have a range of values sufficient to yield the desired data, including the specified design strengths as modified below, without extrapolation. The water content of the concrete mixes to be used, as determined from the curve, shall correspond to strengths 16 percent greater than the specified design strengths. The resulting mix shall not conflict with the limiting values for maximum water cementitious ratio and net minimum cementitious content as specified in Table 1.
- D. Compression Tests: Provide testing of the proposed concrete mix or mixes to demonstrate compliance with the specified design strength requirements in conformity with the above paragraph.
- E. Entrained air, as measured by ASTM C231, shall be as shown in Table 1.
 - 1. If the air-entraining agent proposed for use in the mix requires testing methods other than ASTM C231 to accurately determine air content, make special note of this requirement in the admixture submittal.
- F. Slump of the concrete as measured by ASTM C143, shall be as shown in Table 1. If a high-range water-reducer (plasticizer) is used, the slump indicated shall be that measured before plasticizer is added. Plasticized concrete shall have a slump ranging from 5 to 8-in.
- G. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.

1 2	TABLE 1 CONCRETE MIX REQUIREMENTS						
3 4 5 6 7 _	Class	Design Strength (1)	Fine Cement (2)	Coarse Aggregate (2)		Cementitious Aggregate (3)	Content (4)
8 9 10 11 12 13	A B C D	2500 3000 4000 5000	C150 Type II C150 Type II C150 Type II C150 Type II	C33 C33 C33 C33		57 57 57 57	440 min. 480 min. 560 min. 600 min.
14 15 16 17 _	Class	W/Cm Ratio (5)	Fly Ash	AE Range (6)	WR (7)	HRWR (8)	Slump Range Inches
18 19 20 21 22 23	A B C D	0.62 max. 0.54 max. 0.44 max. 0.40 max.	 25% max 	3.5 to 5 3.5 to 5 3.5 to 5 3.5 to 5	Yes Yes Yes Yes	*	1-4 1-3 3-5 3-5
24 25 26 27 28 29 30 31 32 33 34 35	NOTES: (1) Minimum compressive strength in psi at 28 days (2) ASTM designation (3) Size Number in ASTM C33 (4) Cementitious content in lbs/cu yd (5) W/Cm is Water-Cementitious ratio by weight (6) AE is percent air-entrainment (7) WR is water-reducer admixture (8) HRWR is high-range water-reducer admixture * HRWR used at contractor's option except where walls are 14" thick or less and the wall heige exceeds 12 ft a mix including a plasticizer must be used.						

PART 3 - EXECUTION

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MEASURING MATERIALS 3.01

- Α. Concrete shall be composed of portland cement, fine aggregate, coarse aggregate, water and admixtures as specified and shall be produced by a plant acceptable to the Engineer. All constituents, including admixtures, shall be batched at the plant except a high-range water-reducer may also be added in the field.
- B. Measure materials for batching concrete by weighing in conformity with and within the tolerances given in ASTM C94 except as otherwise specified. Scales shall have been certified by the local Sealer of Weights and Measures within 1 year of use.
- C. Measure the amount of free water in fine aggregates within 0.3 percent with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as-batched on printed batching tickets.
- D. Admixtures shall be dispensed either manually using calibrated containers or measuring tanks, or by means of an automatic dispenser approved by the manufacturer of the specific admixture.
 - 1. Charge air-entraining and chemical admixtures into the mixer as a solution using an automatic dispenser or similar metering device.
 - 2. Inject multiple admixtures separately during the batching sequence.

MIXING AND TRANSPORTING

- Α. Batch plants shall have a current NRMCA Certification or equal.
- B. Concrete shall be ready-mixed concrete produced by equipment acceptable to the Engineer. No hand-mixing will be permitted. Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant. Equip each transit-mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions at mixing speeds.
- C. Ready-mix concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.
- D. Keep the water tank valve on each transit truck locked at all times. Any addition of water above the appropriate W/Cm ratio must be directed by the Engineer. Added water shall be incorporated by additional mixing of at least 35 revolutions. All added water shall be metered and the amount of water added shall be shown on each delivery ticket.

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- E. All central plant and rolling stock equipment and methods shall comply with ACI 318 and ASTM C94.
- F. Select equipment of size and design to ensure continuous flow of concrete at the delivery end. Metal or metal-lined non-aluminum discharge chutes shall be used and shall have slopes not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20-ft long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.
- G. Retempering (mixing with or without additional cement, aggregate, or water) of concrete or mortar which has reached initial set will not be permitted.
- H. Handle concrete from mixer to placement as quickly as practicable while providing concrete of required quality in the placement area. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.
- I. Furnish a delivery ticket for ready mixed concrete to the Engineer as each truck arrives. Each ticket shall provide a printed record of the weight of cement and each aggregate as batched individually. Use the type of indicator that returns for zero punch or returns to zero after a batch is discharged. Clearly indicate the weight of fine and coarse aggregate, cement and water in each batch, the quantity delivered, the time any water is added, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of the truck mixer.
- J. Temperature and Mixing Time Control
 - 1. In cold weather, do not allow the as-mixed temperature of the concrete and concrete temperatures at the time of placement in the forms to drop below 40 degrees F.
 - 2. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90 degrees F.
 - In hot weather, cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90 degrees F. If necessary, substitute well-crushed ice for all or part of the mixing water.
 - 4. The maximum time interval between the addition of mixing water and/or cement to the batch and the placing of concrete in the forms shall not exceed the values shown in Table 2.

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1				TABLE 2	
2			ī	MAXIMUM TIME TO DISCHARGE OF CONCRE	:TE
4 5			Air or (Concrete Temperature (whichever is higher)	Maximum Time
6 7			80 to 9	0 Degree F (27 to 32 Degree C)	45 minutes
8			70 to 7	9 Degree F (21 to 26 Degree C)	60 minutes
0 1 2			40 to 6	9 Degree F (5 to 20 Degree C)	90 minutes
3 4 5				roved high-range water-reducer (plasticizer) is use, the maximum time interval shall not exceed 90	•
6 7	3.03	CON	CRETE	E APPEARANCE	
18 19 20 21 22 23		A.	aggre the c	crete mix showing either poor cohesion or poor gate with paste shall be remixed. If this does concrete shall be rejected. If the slump is withing serve bleeding, poor workability, or poor finishabile concrete mix shall be obtained only by adjusting:	not correct the condition, in the allowable limit, but ity are observed, changes
24 25			1.	The gradation of aggregate.	
26 27			2.	The proportion of fine and coarse aggregate.	
28 29			3.	The percentage of entrained air, within the allo	wable limits.
30 31 32 33 34 35		В.	harde and requi viewe	crete for the work shall provide a homogeneous ened, will have the required strength, durability a workmanship shall be such that concrete surfa- re no finishing. When concrete surfaces are stri- ed in good lighting from 10-ft away, shall be plea- ft shall show no visible defects.	nd appearance. Mixtures aces, when exposed, will pped, the concrete, when
37 38 39	3.04	PLAC	CING A	ND COMPACTING	
10		A.	Placi	ng	
11 12 13 14 15 16			1.	Verify that all formwork completely encloses of is securely braced prior to concrete placeme water, dirt and other foreign materials from reinforcement and other embedded items are sompetent workman at the location of the place	ent. Remove ice, excess m forms. Confirm that securely in place. Have a

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reinforcing steel and embedded items remain in designated locations while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of water from the mix. Seal extremely porous subgrades in an approved manner.

- 2. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing. Place concrete continuously at a rate which ensures the concrete is being integrated with fresh plastic concrete. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials or on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.
- 3. Pumping of concrete will be permitted. Use a mix design and aggregate sizes suitable for pumping and submit for approval.
- 4. Remove temporary spreaders from forms when the spreader is no longer useful. Temporary spreaders may remain embedded in concrete only when made of galvanized metal or concrete and if prior approval has been obtained.
- 5. Do not place concrete for supported elements until concrete previously placed in the supporting element (columns, slabs and/or walls) has reached adequate strength.
- 6. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms with a suitable tool to bring the full surface of the mortar against the form. Prevent the formation of excessive surface voids.

7. Slabs

- a. After suitable bulkheads, screeds and jointing materials have been positioned, the concrete shall be placed continuously between construction joints beginning at a bulkhead, edge form, or corner. Each batch shall be placed into the edge of the previously placed concrete to avoid stone pockets and segregation.
- b. Avoid delays in casting. If there is a delay in casting, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints. Concrete shall then be brought to correct level and struck off with a straightedge. Bullfloats or darbies shall be used to smooth the surface, leaving it free of humps or hollows.

c. Where slabs are to be placed integrally with the walls below them, place the walls and compact as specified. Allow 1 hour to pass between placement of the wall and the overlying slab to permit consolidation of the wall concrete. Keep the top surface of the wall moist so as to prevent cold joints.

8. Formed Concrete

- a. Place concrete in forms using tremie tubes and taking care to prevent segregation. Bottom of tremie tubes shall preferably be in contact with the concrete already placed. Do not permit concrete to drop freely more than 4-ft. Place concrete for walls in 12 to 24-in lifts, keeping the surface horizontal. If plasticized concrete is used, the maximum lift thickness may be increased to 7-ft and the maximum free fall of concrete shall not exceed 15-ft.
- 9. Underwater concreting shall be performed in conformity with the recommendations of ACI 304R. The tremie system shall be used to place underwater concrete. Tremie pipes shall be in the range of 8 to 12-in in diameter and be spaced at not more than 16-ft on centers nor more than 8-ft from an end form. Where concrete is being placed around a pipe, there shall be at least one tremie pipe on each side of each pipe. Where the tremie system is not practical, direct pumped concrete for underwater placement may be used subject to approval of the system including details by the Engineer.

B. Compacting

- Consolidate concrete by vibration, puddling, spading, rodding or forking so that concrete is thoroughly worked around reinforcement, embedded items and openings and into corners of forms. Puddling, spading, etc., shall be continuously performed along with vibration of the placement to eliminate air or stone pockets which may cause honeycombing, pitting or planes of weakness.
- 2. All concrete shall be placed and compacted with mechanical vibrators. The number, type and size of the units shall be approved by the Engineer in advance of placing operations. No concrete shall be ordered until sufficient approved vibrators (including standby units in working order) are on the job.
- 3. A minimum frequency of 7000 rpm is required for mechanical vibrators. Insert vibrators and withdraw at points from 18 to 30-in apart. At each insertion, vibrate sufficiently to consolidate concrete, generally from 5 to 15 seconds. Do not over vibrate so as to segregate. Keep a spare vibrator on the site during concrete placing operations.

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- 4. Concrete Slabs: Concrete for slabs less than 8-in thick shall be consolidated with vibrating screeds; slabs 8 to 12-in thick shall be compacted with internal vibrators and (optionally) with vibrating screeds. Vibrators shall always be placed into concrete vertically and shall not be laid horizontally or laid over.
- 5. Walls and Columns: Internal vibrators (rather than form vibrators) shall be used unless otherwise approved by the Engineer. In general, for each vibrator needed to melt down the batch at the point of discharge, one or more additional vibrators must be used to densify, homogenize and perfect the surface. The vibrators shall be inserted vertically at regular intervals, through the fresh concrete and slightly into the previous lift, if any.
- 6. Amount of Vibration: Vibrators are to be used to consolidate properly placed concrete but shall not be used to move or transport concrete in the forms. Vibration shall continue until:
 - a. Frequency returns to normal.
 - b. Surface appears liquefied, flattened and glistening.
 - c. Trapped air ceases to rise.
 - d. Coarse aggregate has blended into surface, but has not disappeared.

3.05 CURING AND PROTECTION

A. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.

B. Curing Methods

- Curing Methods for Concrete Surfaces: Cure concrete to retain moisture and maintain specified temperature at the surface for a minimum of 7 days after placement. Curing methods to be used are as follows:
 - a. Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling or covered with saturated burlap. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.
 - b. Sheet Material Curing: Cover entire surface with sheet material. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.

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- c. Liquid Membrane Curing: Apply over the entire concrete surface except for surfaces to receive additional concrete. Curing compound shall NOT be placed on any concrete surface where additional concrete is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Curing compound shall be applied as soon as the free water on the surface has disappeared and no water sheen is visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Application shall be in compliance with the manufacturer's recommendations.
- 2. Specified applications of curing methods.
 - a. Slabs for Water Containment Structures: Water curing only.
 - b. Slabs on Grade and Footings (not used to contain water): Water curing, sheet material curing or liquid membrane curing.
 - c. Structural Slabs (other than water containment): Water curing or liquid membrane curing.
 - d. Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout or Other Material that Requires Bond to the substrate: Water curing.
 - e. Formed Surfaces: None if nonabsorbent forms are left in place 7 days. Water cure if absorbent forms are used. Water cure if forms are removed prior to 7 days. Exposed horizontal surfaces of formed walls or columns shall be water cured for 7 days or until next placement of concrete is made.
 - f. Surfaces of Concrete Joints: Water cured or sheet material cured.
 - g. Finished surfaces and slabs shall be protected from the direct rays of the sun to prevent checking and crazing.
 - h. Cold Weather Concreting:
- C. Finished surfaces and slabs shall be protected from the direct rays of the sun to prevent checking and crazing.
- D. Cold Weather Concreting:
 - 1. "Cold weather" is defined as a period when for more than 3 successive days, the average daily outdoor temperature drops below 40 degrees F.

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The average daily temperature shall be calculated as the average of the highest and the lowest temperature during the period from midnight to midnight.

- 2. Cold weather concreting shall conform to ACI 306.1 and the additional requirements specified herein. Temperatures at the concrete placement shall be recorded at 12 hour intervals (minimum).
- 3. Discuss a cold weather work plan with the Engineer. The discussion shall encompass the methods and procedures proposed for use during cold weather including the production, transportation, placement, protection, curing and temperature monitoring of the concrete. The procedures to be implemented upon abrupt changes in weather conditions or equipment failures shall also be discussed. Cold weather concreting shall not begin until the work plan is acceptable to the Engineer.
- 4. During periods of cold weather, concrete shall be protected to provide continuous warm, moist curing (with supplementary heat when required) for a total of at least 350 degree-days of curing.
 - Degree-days are defined as the total number of 24 hour periods multiplied by the weighted average daily air temperature at the surface of the concrete (eg: 5 days at an average 70 degrees F = 350 degree-days).
 - b. To calculate the weighted average daily air temperature, sum hourly measurements of the air temperature in the shade at the surface of the concrete taking any measurement less than 50 degrees F as 0 degrees F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.
- 5. Salt, manure or other chemicals shall not be used for protection.
- 6. The protection period for concrete being water cured shall not be terminated during cold weather until at least 24 hours after water curing has been terminated.

E. Hot Weather Concreting

1. "Hot weather" is defined as any combination of high air temperatures, low relative humidity and wind velocity which produces a rate of evaporation estimated in accordance with ACI 305R, approaching or exceeding 0.2 lbs/sqft/hr).

1 2 3 4 5 6 7 8			2.	Concrete placed during hot weather, shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 305R and the additional requirements specified herein.				
				a.	Temperature of concrete being degrees F and every effort shall concrete mix temperature below the concrete shall be such that it of slump, flash set or cold joints.	be made to maintain a uniform this level. The temperature of		
10 11 12 13 14				b.	All necessary precautions shall promptly place the concrete up provide vibration immediately after	on its arrival at the job and to		
15 16				C.	The Engineer may direct the C plastic concrete with sheet mater			
17 18 19 20 21	3.06		3.	proce hot w	ss with the Engineer a work pladures proposed to use for concre eather periods. Hot weather conclant is acceptable to the Engineer	ete placement and curing during acreting shall not begin until the		
22 23		REMO	OVAL C	F FOF	RMS			
24 25 26 27 28		A.	remov specif	ed bef	herwise specifically authorized by ore the concrete has attained a stresign strength, nor before reactoff of curing (whichever is the longer	ength of at least 30 percent of its hing the following number of		
29 30					TABLE 3			
31 32				M	IINIMUM TIME TO FORM REMOV	/AL		
33 34				<u>Forms</u>	s for	Degree Days		
35 36 37 38					s and slabs and vertical surfaces	500 100		
39 40 41 42 43				(See	definition of degree-days in Paragi	raph 3.05D above).		
		B.	of its	specifie	not be removed until the concrete ed design strength and also suffici and construction live loads.	•		

3.07 INSPECTION AND FIELD TESTING

- A. The batching, mixing, transporting, placing and curing of concrete shall be subject to the inspection of the Engineer at all times. The Contractor shall advise the Engineer of his/her readiness to proceed at least 24 hours prior to each concrete placement. The Engineer will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing steel and the alignment, cleanliness and tightness of formwork. No placement shall be made without the inspection and acceptance of the Engineer.
- B. Sets of field control cylinder specimens will be collected and tested by an independent testing company hired by the Contractor and subject to approval by the Engineer. The cylinder specimens shall be collected and tested during the progress of the work, in compliance with ASTM C31. The number of sets of concrete test cylinders taken of each class of concrete placed each day shall not be less than one set per day, nor less than one set for each 150 cu yds of concrete nor less than one set for each 5,000 sq ft of surface area for slabs or walls.
 - 1. A "set" of test cylinders consists of five cylinders: one to be tested at 7 days and two to be tested and their strengths averaged at 28 days. The fourth may be used for a special test at 3 days or to verify strength after 28 days if 28 day test results are low. The fifth is to be used at 28 days or 56 days where test results are low.
 - When the average 28 day compressive strength of the cylinders in any set falls below the specified design strength or below proportional minimum 7 day strengths (where proper relation between seven and 28 day strengths have been established by tests), proportions, water content, or temperature conditions shall be changed to achieve the required strengths.
- C. Cooperate in the making of tests by allowing free access to the work for the selection of samples, providing an insulated closed curing box for specimens, affording protection to the specimens against injury or loss through the operations and furnish material and labor required for the purpose of taking concrete cylinder samples. All shipping of specimens will be paid for by the Owner. Curing boxes shall be acceptable to the Engineer.
- D. Slump tests will be made in the field immediately prior to placing the concrete. Such tests shall be made in accordance with ASTM C143. If the slump is greater the specified range, the concrete shall be rejected.
- E. Air Content: Test for air content shall be made on fresh concrete samples. Air content for concrete made of ordinary aggregates having low absorption shall

 be made in compliance with either the pressure method complying with ASTM C231 or by the volumetric method complying with ASTM C173.

- F. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determination of concrete quality. The results of tests on such cores shall be the basis for acceptance, rejection or determining the continuation of concrete work.
- G. Cooperate in obtaining cores by allowing free access to the work and permitting the use of ladders, scaffolding and such incidental equipment as may be required. Repair all core holes. The work of cutting and testing the cores will be at the expense of the Owner.

3.08 FAILURE TO MEET REQUIREMENTS

- Α. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in Table 1, the Engineer shall have the right to require changes in proportions outlined to apply to the remainder of the work. Furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the test specimens which failed. The cost of such additional curing shall be at the Contractor's expense. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at the expense of the Contractor. In such cases of failure to meet strength requirements the Contractor and Engineer shall confer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94. The "purchaser" referred to in ASTM C94 is the Contractor in this Section.
- B. When the tests on control specimens of concrete fall below the specified strength, the Engineer will permit check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C42 and C39. In the case of cores not indicating adequate strength, the Engineer, in addition to other recourses, may require, at the Contractor's expense, load tests on any one of the slabs, beams, piles, caps, and columns in which such concrete was used. Tests need not be made until concrete has aged 60 days.
- C. Should the strength of test cylinders fall below 60 percent of the required minimum 28 day strength, the concrete shall be rejected and shall be removed and replaced.

3.09 PATCHING AND REPAIRS A. It is the intent of this S

- A. It is the intent of this Section to require quality work including adequate forming, proper mixture and placement of concrete and curing so completed concrete surfaces will require no patching.
- B. Defective concrete and honeycombed areas as determined by the Engineer shall be repaired as specified by the Engineer.
- C. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed; recesses left by the removal of form ties shall be filled; and surface defects which do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to approval of the Engineer.
- D. Immediately after removal of forms remove plugs and break off metal ties as required by Section 03100. Promptly fill holes upon stripping as follows: Moisten the hole with water, followed by a 1/16-in brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the touch (just short of "balling"). Hammer the grout into the hole until dense, and an excess of paste appears on the surface in the form of a spiderweb. Trowel smooth with heavy pressure. Avoid burnishing.
- E. When patching exposed surfaces the same source of cement and sand as used in the parent concrete shall be employed. Adjust color if necessary by addition of proper amounts of white cement. Rub lightly with a fine Carborundum stone at an age of 1 to 5 days if necessary to bring the surface down with the parent concrete. Exercise care to avoid damaging or staining the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.

3.10 SCHEDULE

A. The following (Table 4) are the general applications for the various concrete classes and design strengths:

TABLE 4

CONCRETE SCHEDULE

Design

CAST-IN-PLACE CONCRETE 03300-21

1 2	<u>Class</u>	Strength (psi)	<u>Description</u>
3			
4	Α	2,500	Concrete fill and duct encasement
5			
6	В	3,000	Concrete overlay slabs and pavements
7			
8	С	4,000	Walls, slabs on grade, suspended slab and
9			beam systems, columns, grade beams and all
10			other structural concrete
11			
12	D	5,000	Prestressed concrete
13			
14			
15			
16		END OF	SECTION
17			

1			SECTION 03350					
2		CONCRETE FINISHES						
4 5	PART	1 - G	ENERAL					
6 7	1.01	SCOF	PE OF WORK					
8 9 10 11		A.	Furnish all labor, materials, equipment and incidentals required and finish cast-in-place concrete surfaces as shown on the Drawings and as specified herein.					
2 3	1.02	RELA	TED WORK					
4 5		A.	Concrete Formwork is included in Section 03100.					
6 7 8		B.	Cast-In-Place Concrete is included in Section 03300.					
19 20	1.03	SUBN	MITTALS					
21 22 23 24 25		A.	Submit to the Engineer shop drawings and product data showing materials of construction and details of installation for:					
26			 Concrete sealer. Confirmation that the sealer is compatible with additionally applied coatings shall also be submitted. 					
27 28	1.04	REFE	RENCE STANDARDS					
29 30		A.	American Society for Testing and Materials (ASTM)					
31 32			ASTM C33 - Standard Specification for Concrete Aggregates.					
33 34 35		B.	Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.					
36 37	1.05	QUAL	LITY ASSURANCE					
38 39 40 41 42 43		A.	Finishes 1. For concrete which will receive additional applied finishes or materials, the surface finish specified is required for the proper application of the specified manufacturer's products. Where alternate products are approved for use, determine if changes in					
			03350-1					

CONCRETE FINISHES

1					are requir	ed and p	rovide	the p	roper	finishes	s to	receive	,
2			2.		in finishes								
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22		B.		ete seale						•			
23 24				ons – BAS I/TAMMS (MP-20 b	y W.R.	Mead	dows,	Aqua-C	ure \	OX by	/
2 5			Luciiu		or equal.								
26													
27 28	PART	ГЗ - Е.	XECUT	ION									
29	3.01	FORM	MED SU	JRFACES									
30		_	_					_					
31 32		A.		s shall not been satis		ved befor	e the i	require	ements	s of Sec	ction	03300	,
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38		C.		all expo		rete surf	aces a	and ad	djoinin	g work	stair	ned by	,
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40 41		D.	Roual	h-Form Fir	nish								
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						03350-2							
					CON	CRETE F	INISHE	ES			12/1	0/21	

2. Promptly fill holes left by tie cones and defects as specified in Section 03 30 00.

E. Rubbed Finish

- Immediately upon stripping forms and before concrete has changed color, carefully remove all fins. While the wall is still damp apply a thin coat of medium consistency neat cement slurry by means of bristle brushes to provide a bonding coat within all pits, air holes or blemishes in the parent concrete. Avoid coating large areas with the slurry at one time.
- 2. Before the slurry has dried or changed color, apply a dry (almost crumbly) grout proportioned by volume and consisting of 1 part cement to 1-1/2 parts of clean masonry sand having a fineness modulus of approximately 2.3 and complying with the gradation requirements of ASTM C33 for such a material. Grout shall be uniformly applied by means of damp pads of coarse burlap approximately 6-in square used as a float. Scrub grout into the pits and air holes to provide a dense mortar in all imperfections.
- 3. Allow the mortar to partially harden for 1 or 2 hours depending upon the weather. If the air is hot and dry, keep the wall damp during this period using a fine, fog spray. When the grout has hardened sufficiently so it can be scraped from the surface with the edge of a steel trowel without damaging the grout in the small pits or holes, cut off all that can be removed with a trowel. (Note: Grout allowed to remain on the wall too long will harden and will be difficult to remove.)
- 4. Allow the surface to dry thoroughly and rub it vigorously with clean dry burlap to completely remove any dried grout. No visible film of grout shall remain after this rubbing. The entire cleaning operation for any area must be completed the day it is started. Do not leave grout on surfaces overnight. Allow sufficient time for grout to dry after it has been cutoff with the trowel so it can be wiped off clean with the burlap.
- On the day following the repair of pits, air holes and blemishes, the walls shall again be wiped off clean with dry, used pieces of burlap containing old hardened mortar which will act as a mild abrasive. After this treatment, there shall be no built-up film remaining on the parent surface. If, however, such a film is present, a fine abrasive stone shall be used to remove all such material without breaking through the surface film of the original concrete. Such scrubbing shall be light and sufficient only to remove excess material without changing the texture of the concrete.

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6. A thorough wash-down with stiff bristle brushes shall follow the final bagging or stoning operation. No extraneous materials shall remain on the surface of the wall. The wall shall be sprayed with a fine fog spray periodically to maintain a continually damp condition for at least 3 days after the application of the repair grout.

F. Abrasive Blast Finish

- Coordinate with Rubbed Finish application. Do not begin until Rubbed Finish operation is complete or before concrete has reached minimum 7-day strength. The Rubbed Finish application may be deleted by the Engineer if the unfinished concrete surface is of superior quality. Apply the abrasive blast finish only where indicated on Drawings.
- 2. Prepare a sample area of minimum 4-ft high by 16-ft wide Blast Finish as directed by Engineer on a portion of new wall construction which will not be exposed in the final work. Sample area shall contain a variety of finishes obtained with different nozzles, nozzle pressures, grit materials and blasting techniques for selection by Engineer. Final accepted sample shall remain exposed until completion of all Blast Finish operations.
- Blast finish operation shall meet all regulatory agency requirements. Blast Finish contractor shall be responsible for obtaining all required permits and/or licenses.
- 4. Perform abrasive blast finishing in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish on each surface or area of work. Maintain patterns or variances in depths of blast as present on the accepted sample.
- 5. Use an abrasive grit of proper type and gradation as well as equipment and technique to expose aggregate and surrounding matrix surfaces as follows:
- 6. Medium: Generally expose coarse aggregate 1/4-in to 3/8-in reveal.
- 7. Abrasive blast corners and edge of patterns carefully, using back-up boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure and blasting techniques required to match Architect's samples.
- 8. Upon completion of the Blast Finish operation, thoroughly flush finished surfaces with clean clear water to remove residual dust and grit. Allow to air dry until curing of concrete is complete.
- 9. After the concrete has cured for a minimum of 28 days, apply a clear acrylic sealer as directed by manufacturer.

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3.02 FLOORS AND SLABS

Α. Floated Finish

1. Machine Floating

- a. Screed floors and slabs with straightedges to the established grades shown on the Drawings. Immediately after final screeding, a dry cement/sand shake in the proportion of two sacks of portland cement to 350 lbs of coarse natural concrete sand shall be sprinkled evenly over the surface at the rate of approximately 500 lbs /1,000 sq ft of floor. Do not sprinkle neat, dry cement on the surface.
- b. The application of the cement/sand shake may be eliminated at the discretion of the Engineer if the base slab concrete exhibits adequate fattiness and homogeneity and the need is not When the concrete has hardened sufficiently to support the weight of a power float without its digging into or disrupting the level surface, thoroughly float the shake into the surface with a heavy revolving disc type power compacting machine capable of providing a 200 lb compaction force distributed over a 24-in diameter disc.
- c. Start floating along walls and around columns and then move systematically across the surface leaving a matte finish.
- d. The compacting machine shall be the "Kelly Power Float with Compaction Control" as manufactured by Kelley Industries of SSP Construction Equipment Inc., Pomona, CA or equal. Troweling machines equipped with float (shoe) blades that are slipped over the trowel blades may be used for floating. Floating with a troweling machine equipped with normal trowel blades will not be permitted. The use of any floating or troweling machine which has a water attachment for wetting the concrete surface during finishing will not be permitted.

2. Hand Floating

a. In lieu of power floating, small areas may be compacted by hand floating. The dry cement/sand shake previously specified shall be used unless specifically eliminated by the Engineer. Screed the floors and slabs with straightedges to the established grades shown on the Drawings. While the concrete is still green, but sufficiently hardened to support a finisher and

> 03350-5 CONCRETE FINISHES

kneeboards with no more than 1/4-in indentation, wood float to a true, even plane with no coarse aggregate visible. Use sufficient pressure on the wood floats to bring moisture to the surface.

3. Finishing Tolerances

a. Level floors and slabs to a tolerance of plus or minus 1/8-in when checked with a 10-ft straightedge placed anywhere on the slab in any direction. Where drains occur, pitch floors to drains such that there are no low spots left undrained. Failure to meet either of the above requirements shall be cause for removal, grinding, or other correction as directed by the Engineer.

B. Broom Finish

 Screed slabs with straightedges to the established grades indicated on the Drawings. When the concrete has stiffened sufficiently to maintain small surface indentations, draw a stiff bristle broom lightly across the surface in the direction of drainage, or, in the case of walks and stairs, perpendicular to the direction of traffic to provide a non-slip surface.

C. Steel Trowel Finish

1. Finish concrete as specified in Paragraph 3.04 and 3.05. Then, hand steel trowel to a perfectly smooth hard even finish free from high or low spots or other defects.

D. Concrete Sealer

- 1. Prepare and seal surfaces indicated on the room finish schedule to receive a sealer as follows:
 - a. Finish concrete as specified in the preceding paragraphs and in accordance with the Schedule in Paragraph 3.05 below.
 - b. Newly Placed Concrete: Surface must be sound and properly finished. Surface is application-ready when it is damp but not wet and can no longer be marred by walking workmen.
 - c. Newly-Cured Bare Concrete: Level any spots gouged out by trades. Remove all dirt, dust, droppage, oil, grease, asphalt and foreign matter. Cleanse with caustics and detergents as

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1 2 3 4 5 6 7 8 9 10 1 12 3 4 4 5 6 7 8 9 20 1 22 3			required. Rinse thoroughly and allow to dry so that surface is no more than damp, and not wet. d. Aged Concrete: Restore surface soundness by patching grouting, filling cracks and holes, etc. Surface must also be free of any dust, dirt and other foreign matter. Use power tool and/or strippers to remove any incompatible sealers or coatings Cleanse as required, following the procedure indicated under cured concrete. e. Methods: Apply sealer so as to form a continuous, uniform film by spray, soft-bristle pushbroom, long-nap roller or lambswood applicator. Ordinary garden-type sprayers, using neoprending hose, are recommended for best results. f. Applications: For curing only, apply first coat evenly and uniformly as soon as possible after final finishing at the rate of 200 to 400 sq ft per gallon. Apply second coat when all trade are completed and structure is ready for occupancy at the rate of 400 to 600 sq ft per gallon. g. To meet guarantee and to seal and dustproof, two coats are required. For sealing new concrete, both coats shall be applied full-strength. On aged concrete, when renovating, dustproofing and sealing, the first coat should be thinned 10 to 15 percentitions.
23 24	3.03	CON	RETE RECEIVING CHEMICAL HARDENER
25 26 27 28 29		A.	After 28 days, minimum, concrete cure, apply chemical hardener in three applications to a minimum total coverage of the undiluted chemical of 10 sq ft per gallon and in accordance with manufacturer's recommendation as reviewed.
30 31 32	3.04	APPR	OVAL OF FINISHES
33 34		A.	All concrete surfaces, when finished, will be inspected by the Engineer.
35 36 37		B.	Surfaces which, in the opinion of the Engineer, are unsatisfactory shall be refinished or reworked.
38 39 40		C.	After finishing horizontal surfaces, regardless of the finishing procedure specified, the concrete shall be cured in compliance with Section 0330 unless otherwise directed by the Engineer.
11 12 13	3.05	SCHE	DULE OF FINISHES

03350-7 CONCRETE FINISHES

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- A. Concrete shall be finished as specified either to remain as natural concrete to receive an additional applied finish or material under another section.
- B. Concrete for the following conditions shall be finished as noted on the Drawings and as further specified herein:
 - 1. Concrete Not Exposed to View and Not Scheduled to Receive an Additional Applied Finish or Material: Rough-form finish. See Paragraph 3.01D above.
 - 2. Exterior Vertical Concrete Above Grade Exposed to View: Rubbed finish. See Paragraph 3.01E above.
 - 3. Interior Vertical Concrete Exposed to View Except in Water Containment Areas: Rubbed finish. See Paragraph 3.01E above.
 - 4. Interior and Exterior Underside of Concrete Exposed to View: Rubbed finish. See Paragraph 3.01E above.
 - 5. Exterior surfaces exposed to view and indicated to have an abrasive blast finish. See Paragraph 3.01F above.
 - 6. Interior or Exterior Horizontal Concrete not Requiring Floor Hardener or Sealer: Floated finish. See Paragraph 3.02A above.
 - 7. Concrete for Exterior Walks and Slabs: Broomed finish perpendicular to direction of traffic. See Paragraph 3.02B above.
 - 8. Concrete to Receive Hardener: See Paragraph 3.03 above.
 - 9. Concrete to Receive Floor Sealer: See Paragraph 3.02D above.

END OF SECTION

03350-8 CONCRETE FINISHES

			SECTION 03600	
			GROUT	
PAR	Γ I – G	ENERA	L	
1.01	SCO	PE OF V	WORK	
	A.		sh all labor, materials, equipment and incidentals required and install groblete as shown on the Drawings and as specified herein.	ut
1.02	SUB	MITTA	LS	
	A.		nit to the Engineer, in accordance with Section 01300, shop drawings are act data showing materials of construction and details of installation for:	ıd
		1.	Commercially manufactured nonshrink cementitous grout. The submitt shall include catalog cuts, technical data, storage requirements, produlife, working time after mixing, temperature considerations, conformity required ASTM standards and Material Safety Data Sheet.	ct
		2.	Commercially manufactured nonshrink epoxy grout. The submittal share include catalog cuts, technical data, storage requirements, product lift working time after mixing, temperature considerations, conformity required ASTM standards and Material Safety Data Sheet.	e,
		3.	Cement grout. The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any propose admixtures and the proposed mix of the grout.	
		4.	Concrete grout. The submittal shall include data as required for concre as delineated in Section 03300 and for fiber reinforcement as delineated Section 03200. This includes the mix design, constituent quantities p cubic yard and the water/cement ratio.	in
	B.	Labor	ratory Test Reports	
		1.	Submit laboratory test data as required under Section 03300 for concreto be used as concrete grout.	te
	C.	Certif	fications	
		1.	Certify that commercially manufactured grout products and concrete gro admixtures are suitable for use in contact with potable water after 30 day curing.	
	D.	Quali	ifications	
			03600-1 12/10/2 CONCRETE REINFORCEMENT	:1

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2 3			1. Grout manufacturers shall submit documentation that they have at least 10 years experience in the production and use of the proposed grouts which
4			they will supply.
5 6	1.03	REFE	RENCE STANDARDS
7 8		A.	American Society for Testing and Materials (ASTM)
9 10 11 12 13			 ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts and Monolithic Surfacings and Polymer Concretes
13 14 15 16			2. ASTM C579 - Standard Test Method for Compressive Strength of Chemical Resistant Mortars, Grouts and Monolithic Surfacings and Polymer Concretes
8			3. ASTM C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
20 21 22 23 24 25 26			4. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
24 24		B.	U.S. Army Corps of Engineers Standard (CRD)
25 26 27			1. CRD C-621 - Corps of Engineers Specification for Nonshrink Grout
28 29		C.	Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.
30 31	1.04	QUAL	ITY ASSURANCE
32 33		A.	Qualifications
34 35 36 37			1. Grout manufacturer shall have a minimum of 10 years experience in the production and use of the type of grout proposed for the work.
38 39 40 41 42 43 44		B.	Pre-installation Conference 1. Well in advance of grouting, hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing and curing procedures for each product proposed for use. Parties concerned with grouting shall be notified of the meeting at least 10 days prior to its scheduled date.
15 16		C.	Services of Manufacturer's Representative

1 2 3 4 5			1. A qualified field technician of the nonshrink grout manufacturer, specifically trained in the installation of the products, shall attend the pre-installation conference and shall be present for the initial installation of each type of nonshrink grout. Additional services shall also be provided, as required, to correct installation problems.
6 7		D.	Field Testing
8 9 10 11 12			1. All field testing and inspection services required shall be provided by the Owner. The Contractor shall assist in the sampling of materials and shall provide any ladders, platforms, etc, for access to the work. The methods of testing shall comply in detail with the applicable ASTM Standards.
12 13 14 15			2. The field testing of Concrete Grout shall be as specified for concrete in Section 03300.
16 17 18	1.05	DELI	VERY, STORAGE AND HANDLING
19 20		A.	Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers and printed instructions.
21 22 23 24 25 26		В.	Store materials in full compliance with the manufacturer's recommendations. Total storage time from date of manufacture to date of installation shall be limited to 6 months or the manufacturer's recommended storage time, whichever is less.
27 28 29		C.	Material which becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional expense to the Owner.
30 31 32 33		D.	Nonshrink cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.
34 35 36		E.	Nonshrink epoxy grouts shall be delivered as premeasured, prepackaged, three component systems requiring only blending as directed by the manufacturer.
37 38	1.06	DEFI	NITIONS
39 40 41 42		A.	Nonshrink Grout: A commercially manufactured product that does not shrink in either the plastic or hardened state, is dimensionally stable in the hardened state and bonds to a clean base plate.
+2 43 44	PART	TII – PR	RODUCTS
14 15	2.01	GENE	GRAL.

1 2 3		A.	The use of a manufacturer's name and product or catalog number is for the purpose of establishing the standard of quality desired.
4 5		B.	Like materials shall be the products of one manufacturer or supplier in order to provide standardization of appearance.
6 7	2.02	MATI	ERIALS
8 9		A.	Nonshrink Cementitious Grout
10 11 12 13 14 15 16 17 18 19 20 21 22 23			 Nonshrink cementitious grouts shall meet or exceed the requirements of ASTM C1107, Grades B or C and CRD C-621. Grouts shall be portland cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents and shall require only the addition of water. Nonshrink cementitious grouts shall not contain expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827. a. General purpose nonshrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Set Grout by Master Builders, Inc.; Gilco Construction Grout by Gifford Hill & Co.; Euco NS by The Euclid Chemical Co.; NBEC Grout by U. S. Grout Corp. or equal.
21 22 23 24 25 26 27 28 29			b. Flowable (Precision) nonshrink cementitious grout shall conform to the standards stated above and shall be Masterflow 928 by Master Builders, Inc.; Hi-Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Supreme Grout by Gifford Hill & Co.; Five Star Grout by U. S. Grout Corp. or equal.
31 32		B.	Nonshrink Epoxy Grout
33 34 35 36 37 38 39 40			1. Nonshrink epoxy-based grout shall be a pre-proportioned, three component, 100 percent solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in 7 days when tested in conformity with ASTM D695 and have a maximum thermal expansion of 30 x 10-6 when tested in conformity with ASTM C531. The grout shall be Ceilcote 648 CP by Master Builders Inc.; Five Star Epoxy Grout by U.S. Grout Corp.; Sikadur 42 Grout-Pak by Sika Corp.; High Strength Epoxy Grout by the Euclid Chemical Co. or equal.
12 13		C.	Cement Grout
14 15 16 17			1. Cement grouts shall be a mixture of one part portland cement conforming to ASTM C150, Types I, II, or III and 1 to 2 parts sand conforming to ASTM C33 with sufficient water to place the grout. The water content

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1 2				shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.
3 4		D.	Concre	ete Grout
5				
6			1.	Concrete grout shall conform to the requirements of Section 03300 except
7				as specified herein. It shall be proportioned with cement, coarse and fine
8				aggregates, water, water reducer and air entraining agent to produce a mix
9				having an average strength of 2900 psi at 28 days, or 2500 psi nominal
10				strength. Coarse aggregate size shall be 1/2-in maximum. Slump should
11				not exceed 5-in and should be as low as practical yet still retain sufficient
12				workability.
13			2	
14			2.	Synthetic reinforcing fibers as specified in Section 03200 shall be added to
15 16				the concrete grout mix at the rate of 1.5 lbs of fibers per cubic yard of
16 17				grout. Fibers shall be added from the manufacturer's premeasured bags and according to the manufacturer's recommendations in a manner which
18				will ensure complete dispersion of the fiber bundles as single
19				monofilaments within the concrete grout.
20				21010101141110110 W1111111 0110 CONOTON BLOOM
21		E.	Water	
22				
23			1.	Potable water, free from injurious amounts of oil, acid, alkali, organic
23 24 25				matter, or other deleterious substances.
25				
26	PART	III – E	XECUT	TION
27	2.01	DDED	AD ATI	ON
28 29	3.01	PKEP	ARATI	ON
29 30		A.	Grout	shall be placed over cured concrete which has attained its full design
31		71.		th unless otherwise approved by the Engineer.
32			sucing	an amoss otherwise approved by the Engineer.
33		B.	Concre	ete surfaces to receive grout shall be clean and sound; free of ice, frost, dirt,
34			grease	e, oil, curing compounds, laitance and paints and free of all loose material or
35			foreign	n matter which may effect the bond or performance of the grout.
36				
37		C.	_	nen concrete surfaces by chipping, sandblasting, or other mechanical means
38				ninimum of ¼" amplitude or provide a raked finish in order to ensure bond
39				grout to the concrete. Remove loose or broken concrete. Irregular voids or
40 41				ting coarse aggregate need not be removed if they are sound, free of
41 42			rantanc	ce and firmly embedded into the parent concrete.
1 2			1.	Air compressors used to clean surfaces in contact with grout shall be the
44			1.	oilless type or equipped with an oil trap in the air line to prevent oil from
45				being blown onto the surface.
46		D.	Remo	ve all loose rust, oil or other deleterious substances from metal embedments
47			or bott	tom of baseplates prior to the installation of the grout.

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E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours prior to the placement of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24 hour period, visible water shall be removed from the surface prior to grouting. The use of an adhesive bonding agent in lieu of surface saturation shall only be used when approved by the Engineer for each specific location of grout installation.

F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.

G. Construct grout forms or other leakproof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer. Forms shall be of adequate strength, securely anchored in place and shored to resist the forces imposed by the grout and its placement.

H. Forms for epoxy grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.

I. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.

J. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks or other approved means. The shims, wedges and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the Engineer.

3.02 INSTALLATION – GENERAL

A. Mix, apply and cure products in strict compliance with the manufacturer's recommendations and this Section.

B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.

C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 and 90 degrees F during grouting and for at least 24 hours thereafter or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.

D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the

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1 2 2			temperature of the materials in contact with the grout are outside of the 60 and 90 degrees F range.
3 4 5 6		E.	Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or control joint.
7 8 9		F.	Reflect all existing underlying expansion, control and construction joints through the grout.
10 11 12 13	3.03		ALLATION - CEMENT GROUTS AND NONSHRINK ENTITIOUS GROUTS
14 15 16		A.	Mix in accordance with manufacturer's recommendations. Do not add cement, sand, pea gravel or admixtures without prior approval by the Engineer.
17 18 19 20 21 22		В.	Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is recommended. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.
23 24 25 26 27		C.	Placements greater than 3-in in depth shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.
28 29 30 31 32 33		D.	Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.
34 35 36 37		E.	Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.
38 39 40 41		F.	Just before the grout reaches its final set, cut back the grout to the substrate at a 45 degree angle from the lower edge of bearing plate unless otherwise approved by the Engineer. Finish this surface with a wood float (brush) finish.
42 43 44 45 46 47		G.	Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a

1 given curing method to keep grout moist, erect wind breaks until wind is no 2 longer a problem or curing is finished. 3 4 3.04 INSTALLATION - NONSHRINK EPOXY GROUTS 5 6 A. Mix in accordance with the procedures recommended by the manufacturer. Do 7 not vary the ratio of components or add solvent to change the consistency of the 8 grout mix. Do not overmix. Mix full batches only to maintain proper proportions 9 of resin, hardener and aggregate. 10 11 B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 or above 90 12 13 degrees F. 14 15 C. Place grout into the designated areas in a manner which will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact 16 17 between the grout and adjoining surfaces. Provide grout holes as necessary. 18 19 D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). 20 In no case shall the shoulder length of the grout be greater than the grout 21 thickness. 22 23 E. Finish grout by puddling to cover all aggregate and provide a smooth finish. 24 Break bubbles and smooth the top surface of the grout in conformity with the 25 manufacturer's recommendations. 26 27 F. Epoxy grouts are self curing and do not require the application of water. Maintain 28 the formed grout within its recommended placement temperature range for at least 29 24 hours after placing, or longer if recommended by the manufacturer. 30 31 3.05 **INSTALLATION - CONCRETE GROUT** 32 33 A. Screed underlying concrete to the grade shown on the Drawings. Prepare the 34 surface according to 3.01B. Protect and keep the surface clean until placement of 35 concrete grout. 36 37 Remove the debris and clean the surface by sweeping and vacuuming of all dirt В. 38 and other foreign materials. Wash the tank slab using a strong jet of water. 39 Flushing of debris into tank drain lines will not be permitted. 40 Saturate the concrete surface for at least 24 hours prior to placement of the 41 C. 42 concrete grout. Saturation may be maintained by ponding, by the use or soaker 43 hoses, or by other methods acceptable to the Engineer. Remove excess water just prior to placement of the concrete grout. Place a cement slurry immediately 44 ahead of the concrete grout so that the slurry is moist when the grout is placed. 45 Work the slurry over the surface with a broom until it is coated with 46 approximately 1/16 to 1/8-in thick cement paste. (A bonding grout composed of 1 47 12/10/21

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1 2 3			part portland cement, 1.5 parts fine sand, an approved bonding admixture and water, mixed to achieve the consistency of thick paint, may be substituted for the cement slurry.)		
4 5 6 7 8 9		D.	Place concrete grout to final grade using the scraper mechanism as a guide for surface elevation and to ensure high and low spots are eliminated. Unless specifically approved by the equipment manufacturer, mechanical scraper mechanisms shall not be used as a finishing machine or screed.		
10 11		E.	Provide grout control joints as indicated on the Drawings.		
12 13		F.	Finish and cure the concrete grout as specified for cast-in-place concrete.		
14 15	3.06	SCHEDULE			
16 17		A.	The following list indicates where the particular types of grout are to be used:		
18 19 20 21 22		В.	General purpose nonshrink cementitious grout: Use at all locations where non shrink grout is called for on the plans except for base plates greater in area than 3-ft wide by 3-ft long and except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.		
23 24 25 26 27 28		C.	Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3-ft by 3-ft. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable nonshrink grout for general purpose nonshrink cementitious grout.		
29 30 31 32		D.	Nonshrink epoxy grout: Use for the setting of anchor rods, anchor bolts and reinforcing steel in concrete and for all locations specifically indicated to receive epoxy grout.		
33 34 35 36 37		E.	Cement grout: Cement grout may be used for grouting of incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, etc. It shall not be used when nonshrink grout is specifically called for on the Drawings or for grouting of primary structural steel members such as columns and girders.		
38 39 40 41		F.	Concrete grout: Use for overlaying the base concrete under scraper mechanisms of clarifiers to allow more control in placing the surface grade.		
42 43 44			+ + END OF SECTION + +		

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1 SECTION 09900 2 3 PAINTING AND PROTECTIVE COATINGS 4 5 PART 1 – GENERAL 6 7 1.01 SCOPE OF WORK 8 9 Α. Provide all labor, materials, apparatus, scaffolding, and all appurtenant 10 work in connection with painting and protective coatings, complete as indicated, specified and required. 11 12 All above grade PVC and ductile iron pipe, fittings, valves, pumps, and 13 B. 14 appurtenances shall be coated using the high-performance coating as 15 specified herein. 16 17 C. The new tertiary filter containment concrete slab and interior and top of 18 wall shall be coated as specified herein. 19 20 D. All piping that has been coated shall be labeled and have directional 21 arrows showing direction of flow. Adhesive lettering is not permitting. 22 Lettering shall be painted onto pipe using spray-on epoxy paint (color as 23 selected by the University) and pre-cut standard stencils. Lettering size 24 shall be as specified herein. Label abbreviations shall be as selected by 25 the University. 26 27 F. All colors shall be selected by the University. 28 29 **SUBMITTALS** 1.02 30 31 Α. Samples 32 33 1. Prepare and submit for Engineer's approval one (1) hardcopy set of 34 color samples on 8-1/2" x 11" size cards and one (1) set of color 35 samples in a PDF file for each paint and protective coating system. Each sample card shall clearly show each coat of the finish system, 36 37 and shall be clearly marked with the manufacturer's name and 38 product identification, and shall be submitted in sufficient time to 39 allow for approval and, if necessary, disapproval and resubmittal 40 without causing any delay of the project. 41 42 B. **Coating Materials List** 43 44 1. The Contractor shall provide one (1) file in PDF format of a paint 45 and coating materials list which indicates the manufacturer and 46 paint number, keyed to the coating schedule herein, for approval by

the Engineer prior to or at the time of submittal of samples required herein.

- 2. The Contractor shall include with his submittal, his protective coating schedule for shop and field coatings of items to receive protection. The schedule shall conform to the specified requirements for surface preparation, priming, and coating for items covered, and shall follow the same requirements for similar work where such work has not been specifically called-out. No bare ferrous nonworking surfaces shall be omitted from the schedule. Particular care shall be taken to cover in sufficient detail the coating of mechanical joints and other mechanical devices which shall conform to the recommended practice of the manufacturer of the joint or other mechanical devices.
- 3. Submittals shall be in accordance with Section 01340 to permit for the Engineer's review and then Contractor's coordination with affected material and equipment suppliers to assure their use of approved shop coats of same manufacture as field coats and compatibility with field applied coats for respective coating systems.
- 4. Coatings to be used on plastic and fiberglass materials shall be certified as acceptable by all plastic and fiberglass manufacturers whose products are to be coated. Certification copies shall be submitted to the Engineer. The Contractor shall be certified in writing by the painting and coating material manufacturers as qualified applicators of their products with copies of the certification submitted to the Engineer.
- C. Product Data Sheets. Contractor shall submit paint and coatings material manufacturers' printed technical data sheets for products intended for use in each paint and coating system. Data sheets shall fully describe material as to its intended use, makeup, recommended surface preparation and application conditions, primers, material mixing and application (including recommended dry mil thickness recoat time), precautions, safety and maintenance cleaning directions.
- D. Material Safety Data Sheets. Material Safety Data Sheets (MSDS) shall accompany all paint submittals and shall be prominently displayed at the job site during all painting activities.
- E. Process Piping Labeling and Color Coding Schedule. Contractor shall submit piping labeling schedule indicating abbreviation for the content of the pipe to the Engineer at the time of submittal of paint data specified herein. Piping color coding schedule for each type of process material shall be submitted to Engineer prior to painting.

F. Warranties shall be submitted in accordance with Section 01740.

1.03 QUALITY ASSURANCE

- A. The Contractor shall be responsible for any and all damage to his work or the work of others during the time his work is in progress.
- B. The Engineer shall have the right to reject all material or work that is unsatisfactory, and require the replacement of either or both at the expense of the Contractor.
- C. To the maximum extent possible, all products shall be the product of one manufacturer unless a specific specialty coating system is specified. Without exception, all coatings for any service condition specified herein shall be by one manufacturer. Once a paint manufacturer has been selected by the Contractor and approved by the Engineer, the Contractor shall ensure that all equipment manufacturers prime their equipment with the same or a compatible primer. If this cannot be or is not done for any reason, the Contractor shall apply a "universal primer" and recoat with the approved manufacturer's product in the field.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Surfaces to receive paint and protective coating materials as herein specified in this Section shall be prepared in conformance with the applicable coating systems specified herein. All materials specified by name and/or manufacturer or approved for use under these Specifications, shall be delivered unopened at the job site in their original containers and shall not be opened until inspected by the Engineer.
- B. All paint and coatings shall be produced and applied as herein called for or, if not specifically called for, it shall be applied in accordance with the manufacturer's printed recommendations as approved by Engineer. So far as possible, all paint and coating materials shall be provided by a single source supplier. Coating materials shall meet Volatile Organic Compounds (VOC) requirements of not more than 3.5 lb./gal. as applied after thinning.

C. General

1. Paint and protective coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use. Pigmented paints shall be furnished in containers not larger than five (5) gallons. Materials shall conform

to the specifications shown herein and to the requirements hereinafter specified.

- Products shall be standard of recognized manufacturer engaged in production of such materials for essentially identical or similar applications in the water and wastewater treatment industry.
- D. Only compatible materials shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, subject to approval of the Engineer, a compatible barrier coat shall be applied between all existing prime coat and subsequent field coats to ensure compatibility. Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with finish paints to be used.
- E. All colors and shades of colors of all coats of paints and protective coating material shall be as identified in the architectural sketches or schedules or as modified/selected by the University. Each coat shall be of a slightly different shade, as directed by the Engineer to facilitate inspection of surface coverage of each coat.
- F. Total Dry Film Thickness specified herein shall not include spot prime coat or pre-existing coatings.

2.02 COATING SCHEDULE

- A. Exterior Exposed Ductile Iron Piping, Valves, Pumps, and Equipment
 - 1. Minimum Performance Requirements:
 - Adhesion: ASTM D7234 Exceeds the cohesive strength of concrete substrate (400 psi), average of three tests.
 - Tensile Strength, Elongation, Modulus of Elasticity: ASTM D2370 - Elongation no less than 200 percent, average of five tests. Tensile strength no less than 250 psi (1.7 MPa), average of three tests.
 - Fungal/Mold/Mildew Resistance: ASTM D3273 No More than slight mold growth after five weeks exposure.
 - Wind Driven Rain Resistance: FED TT-C-555B, Section 4.4.7.3 - No damage to coating or substrate. No visible moisture on the back of lightweight block after 48 hours exposure.
 - QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) No blistering, cracking, chalking or delamination of the film. No less than 69% gloss retention, no more than 1.1 units gloss loss, and no more than 3.59 DE (FMC-2) color change (white) after 5,000 hours QUV exposure.

2. Surface Preparation:

- Remove all chalk, dirt, dust, loose old coatings, mold, mildew, and other soluble contaminants by high pressure water cleaning (minimum 3500 p.s.i.). A cleaning detergent such as Trisodium Phosphate or equal must be utilized to facilitate cleaning. Ensure all residue is removed before proceeding.
- Remove any remaining loose old coatings by scraping or grinding and feather the edges of the remaining tightly adhered existing coatings.
- All surfaces must be clean and dry prior to the application of any coatings.
- 3. Coating System: (TNEMEC, no exceptions)
 - Primer Coat: Series N69 Hi-Build Epoxoline II.....3.0-5.0 mils
 - 1st Coat: Series N69 Hi-Build Epoxoline II.......3.0-5.0 mils
 - 2nd Coat: Series 750 UVX2.5-4.0 mils
 - Total Dry Film Thickness: 8.5 14.0 mils

B. Exterior Exposed PVC Piping

- 1. Minimum Performance Requirements:
 - Adhesion: ASTM D7234 Exceeds the cohesive strength of concrete substrate (400 psi), average of three tests.
 - Tensile Strength, Elongation, Modulus of Elasticity: ASTM D2370 - Elongation no less than 200 percent, average of five tests. Tensile strength no less than 250 psi (1.7 MPa), average of three tests.
 - Fungal/Mold/Mildew Resistance: ASTM D3273 No More than slight mold growth after five weeks exposure.
 - Wind Driven Rain Resistance: FED TT-C-555B, Section 4.4.7.3 - No damage to coating or substrate. No visible moisture on the back of lightweight block after 48 hours exposure.
 - QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) - No blistering, cracking, chalking or delamination of the film. No less than 69% gloss retention, no more than 1.1 units gloss loss, and no more than 3.59 DE (FMC-2) color change (white) after 5,000 hours QUV exposure.

2. Surface Preparation:

 Remove all solvents following SSPC-SP1 standard procedures. This shall be followed by hand or power sanding to thoroughly and uniformly scarify and de-gloss the surface.

1 2			 Remove any remaining loose old coatings by scraping or grinding and feather the edges of the remaining tightly
3 4 5			 adhered existing coatings. All surfaces must be clean and dry prior to the application of any coatings.
6 7			3. Coating System: (TNEMEC, no exceptions)
8 9 10 11 12 13			 Primer Coat: Series N69 Hi-Build Epoxoline II3.0-5.0 mils 1st Coat: Series N69 Hi-Build Epoxoline II3.0-5.0 mils 2nd Coat: Series 750 UVX2.5-4.0 mils Total Dry Film Thickness: 8.5 – 14.0 mils
14 15		C.	Concrete Surfaces of Filtration System Structure including Top and Face of Wall
16 17 18			Minimum Performance Requirements for Epoxy Lining:
19 20 21 22 23 24 25			 Type: FRP-type, hybrid polymer (epoxy/expoxide). Adhesion strength (concrete, dry): substrate failure (Reference CIGMAT CT-2/3). Water Absorption: < 0.1 g/sq. m (Reference ASTM D1653) Solids by Volume: 100% (Reference ASTM D2697) Complete Cure: 18 hours (@ 77° F).
26 27			2. Surface Preparation:
28 29 30 31 32 33 34 35			 Abrasive blast in accordance with SSPC-SP13/NACE No. 6 to remove all existing coatings and provide a minimum ICRI-CSP 3 profile or higher. Following surface preparation, verify dryness by testing for moisture with a "plastic film tape-down test". (Reference ASTM 04263). All surfaces must be clean, dry, and abraded prior to the application of any coatings.
36 37			3. Coating System: (Epoxytec, no exceptions)
38 39 40 41 42			Epoxy Lining: Epoxytec CPP #RC3 (and/or CPP Sprayable #C311S
42 43 44	2.03	WAR	RANTY
45 46 47 48 49		A.	A twelve (12) month warranty which commences on the date of final completion against failure of all coatings shall be provided, unless more stringent requirements are specified hereinafter. Failure of any coating during the warranty period shall be repaired by the Contractor who shall absorb all costs related to the repair of the coating. Failure shall be

defined as peeling, blistering, delamination or loss of adhesion of any of the coatings.

2.04 EXTRA STOCK

A. One (1) gallon of each type and color of finish paint coating or one (1) small kit of each type and color of finish paint and coating kit used on the project shall be provided as extra stock to the University. Extra stock paint shall be supplied in appropriate sealed containers and be clearly labeled as to paint type, formula, and color.

PART 3 - EXECUTION

3.01 MANUFACTURER'S RECOMMENDATIONS

A. Unless otherwise specified herein, the paint and coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protection of his coating materials; for preparation of surfaces for coating; and for all other procedures relative to coating shall be strictly observed. No substitutions or other deviations will be permitted without written permission of the Engineer.

3.02 DELIVERY AND STORAGE

 A. Materials shall be delivered in manufacturer's original, sealed containers, with labels and tags intact. Coating materials and equipment shall be stored in designated areas. Coating containers shall be opened only when required for use. Coatings shall be mixed only in designated areas and in the presence of the Engineer, unless otherwise directed. Coatings shall be thoroughly stirred or agitated to uniformly smooth consistency and prepared and handled in a manner to prevent deterioration and inclusion of foreign matter. Unless otherwise specified or approved, no materials shall be reduced, changed, or used except in accordance with the manufacturer's label or tag on container.

3.03 SAFETY REQUIREMENTS

 A. In accordance with the requirements of applicable OSHA Regulations for Construction, the Contractor shall provide and require the use of personal protective equipment for all persons working in or about the project site.

B. Respirators shall be worn by all persons engaged in, and assisting in, spray painting. In addition, workers engaged in or near the work during sandblasting shall wear eye and face protection devices meeting the requirements of ANSI Z87.1 latest revisions, and approved OSHA Regulations for sand blasting operations and equipment including

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half-mask or mouthpiece respirator approved air-purifying, with appropriate filter.

- C. Where ventilation is used to control potential exposure to workers as set forth in Section 1910.94 of the OSHA Regulations for Construction, ventilation shall be adequate to reduce the concentration of the air contaminant to the degree that a hazard to the worker does not exist. Methods of ventilation shall meet the requirements set forth in ASNI-Z9.2, latest revision.
- D. In accordance with Sections 1926.52 and 1926.101 of OSHA Regulations for Construction, whenever the occupational noise exposure exceeds maximum sound levels as set forth in Table D-2 ear protective devices shall be fitted and used, and a continuing, effective hearing conservation program shall be administered.
- E. The Contractor shall exercise every precaution in the storing of paints, solvents, cleaning fluids, rags, and similar materials as to eliminate the risk of spontaneous combustion or other hazardous conditions. Portable fire extinguishing equipment shall be provided in a convenient location for emergency access. All painting materials stored on the job site shall be stored in a location outside of the work area. The Contractor shall take all safety precautions in accordance with Section 7 of AWWA D-102, NFPA Bulletin No. 101 and all federal, state and local regulations. Cloths and cotton waste that might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each work day.

3.04 STORAGE, MIXING AND THINNING

Α. Paint and coating materials shall be protected from exposure to cold weather, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Materials of different manufacturers shall not be mixed together. Packaged materials shall be thinned immediately prior to application in accordance with the manufacturer's directions.

3.05 WORKMANSHIP

- Α. Skilled craftsmen and experienced supervision shall be used on all work.
- B. All paint and coatings shall be applied in a workmanlike manner so as to produce an even film of specified uniform thickness. Edges, corners, crevices, and joints shall receive special attention to ensure that they have been thoroughly cleaned and that they receive an adequate thickness of paint. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat of paint would not increase the hiding. All coats shall be applied so as to produce a film of

uniform thickness. Special attention shall be given to ensure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other approved precautionary measures.

3.06 PREPARATION FOR PAINTING AND PROTECTIVE COATING

A. All surfaces to receive paint and protective coatings shall be dry and cleaned as specified herein prior to application of coating materials. The Contractor shall examine all surfaces to be coated, and shall correct all surface defects before application of any coating material. Beginning the work of this Section without reporting unsuitable conditions to the Engineer constitutes acceptance of conditions by the Contractor. Any required removal, repair, or replacement of this work caused by unsuitable conditions shall be done at no additional cost to the University. All marred or abraded spots on shop-primed and factory-finished surfaces shall receive touch-up restoration prior to any other coating application. Report all unsatisfactory surfaces to the Engineer.

B. Mildew shall be removed and neutralized by scrubbing affected areas thoroughly with a solution made by adding two (2) ounces of tri-sodium phosphate and eight (8) ounces of sodium hypochloride to one (1) gallon warm water. Use a scouring powder, if necessary, to remove mildew spores. Rinse with clean water and allow to dry thoroughly before painting.

 C. All metal welds, blisters, etc., shall be ground and sanded smooth in accordance with SSPC-SP-3 or in difficult and otherwise inaccessible areas by hand cleaning in accordance with SSPC-SP-2. All pits and dents shall be filled and all imperfections shall be corrected so as to provide a smooth surface for painting. All rust, loose scale, oil, grease and dirt shall be removed by use of approved solvents, wire brushing or sanding.

D. Special care shall be given to thoroughly clean concrete surfaces of all marks before application of finish. Concrete surfaces shall have been finished, as specified in Division 3. Concrete shall be free of dust, oil, curing compounds, and other foreign matter.

E. All plastic pipe surfaces shall be lightly sanded before painting.

3.07 ITEMS NOT TO BE COATED

A. Hardware, aluminum hatches and covers, stainless steel, hardware accessories, name plate data tags, machined surfaces, and ladders, sump pumps, concrete pads, concrete sidewalks, concrete pipe, motor actuators, instrumentation, and similar items shall be removed or masked prior to surface preparation and painting operations. Following completion

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involved.

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Shop Coating. Fabricated metalwork and equipment which requires Α. coating shall be shop primed with specified primer. Any such work delivered to the job site with any other shop coat shall either have this

3.08 FABRICATED EQUIPMENT

Α. Unless otherwise indicated, all fabricated equipment shall be shop primed and shop or field finished.

of coating of each piece, removed items shall be reinstalled. Such

removal and installation shall be done by workmen skilled in the trades

- B. All items to be shop primed shall be thoroughly cleaned of all loose material per SSPC SP-1 Solvent Cleaning prior to priming. If, in the opinion of the Engineer, any prime coating shall have been improperly applied or if material contrary to these Specifications shall have been used, that coating shall be removed by sandblasting to white metal (SSPC SP-5 White Metal Blast Cleaning) and reprimed in accordance with these Specifications.
- C. All shop prime coats shall be of the correct materials and applied in accordance with these Specifications. Remove any prime coats not in accordance with these Specifications by sandblasting and apply the specified prime coat at no additional cost to the University.
- D. Shop primed surfaces shall be cleaned thoroughly, and damaged or bare spots retouched with the specified primer before the application of successive paint coats in the field.
- E. Contractor shall be responsible for and take whatever steps are necessary to properly protect the shop prime and finish coats against damage from weather or any other cause.
- F. A shop finish coat shall be equal in appearance and protection quality to a field applied finish coat. If, in the opinion of the Engineer, a shop finish coat does not give the appearance and protection quality of other work of similar nature, prepare the surfaces and apply the coat or coats of paint, as directed by the Engineer, to accomplish the desired appearance and protection quality. Submit to the Engineer substantial evidence that the standard finish is compatible with the specified finish coat.
- G. Wherever fabricated equipment is required to be sandblasted, protect all motors, drives, bearings, gears, etc., from the entry of grit. Any equipment found to contain grit shall be promptly and thoroughly cleaned.

APPLICATION OF PROTECTIVE COATINGS

coating removed or shall be recoated with "universal-primer", and the specified coating applied in the field. Manufactured equipment with approved corrosion resistant factory finishes and galvanized finishes shall be exempt from this requirement.

B. Application of Field Coatings.

- 1. Except where in conflict with the manufacturer's printed instructions, or where otherwise specified herein, the Contractor may use brush, roller, air spray, or so-called airless spray application; however, any spray painting must first have the approval of the Engineer. Rollers for applying enamel shall have a short nap. Areas inaccessible to spray coating or rolling shall be coated by brushing or other suitable means.
- 2. The Contractor shall give special attention to the work to ensure that edges, corners, crevices, welds, bolts, and other areas, as determined by the Engineer, receive a film thickness at least equivalent to that of adjacent coated surfaces.
- 3. All protective coating materials shall be applied in strict accordance with the manufacturer's printed instructions.
- 4. Prime coat shall be applied to all clean surfaces within a four hour period of the cleaning, and prior to deterioration or oxidation of the surface, and in accordance with the manufacturer's recommendations. Drift from sand-blasting procedures shall not be allowed to settle on freshly painted surfaces.
- 5. All coatings shall be applied in dry and dust-free environment. No coating or paint shall be applied when the surrounding air temperature, measured in the shade, is below 40 degrees F. No coating or paint shall be applied to wet or damp surfaces and shall not be applied in rain, fog or mist, or when the relative humidity exceeds 90 percent. No coating or paint shall be applied when it is expected that the relative humidity will exceed 90 percent or that the air temperature will drop below 40 degrees F within 8 hours after the application of the coating or paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, coating or painting shall be delayed until mid-morning to be certain that the surfaces are dry. The day's coating or painting shall be completed well in advance of the probable time of day when condensation will occur, in order to permit the film sufficient drying time prior to the formation of moisture.
- 6. Each coat shall be applied evenly, at the proper consistency, and free of brush marks, sags, runs, and other evidence of poor

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workmanship. Care shall be exercised to avoid lapping paint on glass or hardware. Coatings shall be sharply cut to lines. Finished coated surfaces shall be free from defects or blemishes. Protective coverings shall be used to protect floors, fixtures, and equipment. Care shall be exercised to prevent paint from being spattered onto surfaces from which such paint cannot be removed satisfactorily. Surfaces from which paint cannot be removed satisfactorily shall be painted or repainted as required to produce a finish satisfactory to the Engineer. Whenever two (2) coats of a dark colored paint are specified, the first cost shall contain sufficient powdered aluminum to act as an indicator of proper coverage, or the two (2) coatings shall be of a contrasting color.

- 7. Touch-up of all surfaces shall be performed after installation.
- 8. All surfaces to be coated shall be clean and dry at the time of application.

C. Time of Coating

- 1. Sufficient time shall be allowed to elapse between successive coats to permit satisfactory recoating, but, once commenced; the entire coating operation shall be completed without delay. No additional coating of any structure, equipment, or other items designated to be painted shall be undertaken without specified permission of the Engineer until the previous coating has been completed for the entire structure, piece of equipment, or other items.
- 2. Piping shall not be finish coated until it has been pressure tested and approved.
- D. The dry film mil-thickness specified shall be achieved and verified for each coat.
- E. Existing surfaces to remain which have been previously safety-color coated to identify a potential tripping or low head-room area shall be prepared and recoated with a similar safety color scheme unless directed otherwise by the Engineer.
- F. Any newly constructed areas which will present a potential tripping or low head-room area shall be coated safety yellow in accordance with the appropriate coating system as directed by the Engineer.

All above-ground piping shall be labeled with black painted, stenciled Α.

half the pipe diameter for pipes less than 8 inches. The labeling shall be the approved abbreviation for the contents of the pipe, with flow arrows indicating direction of flow. Adhesive stencil lettering is not considered acceptable.

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3.11 TESTING AND INSPECTION

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14 15 A. The Contractor shall furnish, until final acceptance of coating and painting, inspection devices in good working condition for detection of holidays, humidity and measurement of dry-film and wet-film thickness of coatings and paints. The Contractor shall also furnish U.S. department of Commerce, National Bureau of Standards certified thickness calibration plates to test accuracy of dry-film thickness gauge and certified instrumentation to test accuracy. Dry-film thickness gauges shall be made available for the Engineer's use at all times until final acceptance of application.

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B. The Contractor shall conduct film thickness measurements and electrical inspection of the coated surfaces with equipment furnished by him and shall recoat and repair as necessary for compliance with the Specifications.

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C. After repaired and recoated ferrous metals areas have cured, final inspection tests will be conducted by the Engineer with equipment provide by the Contractor. Coating thickness specified in mils on ferrous substrates will be measured with a nondestructive magnetic type dry-film thickness gage such as the Elcometer, manufactured by Gardner Laboratories, Inc. Discontinuities, voids, and pinholes in the coatings will be determined with a nondestructive type electrical holiday detector. Epoxy coatings and other thin film coatings will be checked for discontinuities and voids with a low voltage detector of the wet-sponge type, such as Model M1 as manufactured by Tinker and Rasor. Use a non-sudsing type wetting agent, such as Kodak Photo-Flo, which shall be added to the water prior to wetting the sponge. A high voltage, low current, spark type detector such as Model EP, manufactured by Tinker and Rasor, will be used for electrical inspection of only coal tar enamel. Tape type coatings will be inspected for holidays using a device designed for use in detecting such flaws. All pinholes shall be marked, repaired in accordance with the manufacture's printed recommendations and No pinholes or other irregularities will be permitted. thickness discrepancies shall be measured and verified with a micrometer or other approved measuring instrument with 5 readings taken every 100 ft2 of painted surface. Coatings not in compliance with the Specifications will not be acceptable and shall be replaced and reinspected at Contractor's expense until the Specifications are met.

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D. On non-ferrous surfaces, dry film thickness readings shall be taken at random locations with a Tooke Gauge at the rate of approximately five readings per 100 square feet of surface. Grooves cut into coatings shall be repaired by application of all coats of paint or coating film being tested. The average of all readings for a given area or surface shall be within required dry film thickness range and no individual reading shall be more than 20 percent below the recommended dry film thickness. Any areas that are found to be below standard shall be marked and recoated to obtain proper film thickness.

3.12 CLEAN-UP

A. The premises shall at all times be kept free from accumulation of waste material and rubbish caused by employees or work. Upon completion of the work, staging, scaffolding, and containers shall be removed from the site or destroyed in an approved manner.

B. Upon completion, remove all paint where it has been spilled, splashed or splattered on all surfaces, including floors, fixtures, equipment, furniture, etc., leaving the work ready for inspection. Upon completion of the work, the entire job left clean and acceptable to the Engineer.

END OF SECTION

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SECTION 11723

CLOTH MEDIA DISK FILTERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The University has pre-purchased two (2) standalone cloth media disk filter units for the University's Water Reclamation Facility (WRF). The Contractor shall be responsible for the installation of two (2) fully automatic standalone cloth media disk filter units with all controls, control panels, backwash pumps and appurtenances necessary to provide a complete and operational system as shown on the drawings and specified herein.

B. The Contractor's attention is directed to the fact that the University has issued a Purchase Order (PO) for procurement of the disk filters, which includes in general the disk filter units and the local control panels (LCP). However, it shall be the Contractor's responsibility to coordinate the delivery of the equipment, provide labor, power, and equipment for offloading the disk filter units when they arrive onsite at the University's WRF, install the equipment, coordinate and perform testing/startup of the equipment, and coordinate Owner training. The Contractor shall obtain a Bill of Materials from the equipment manufacturer so that any materials such as mounting hardware, nuts, bolts, washers, anchors, valves, piping, and ancillary appurtenances that are shown on the Drawings or required for the proper installation and operation of the cloth media disk filters and local control panels that are not being provided by the equipment manufacturer shall be furnished and installed by the Contractor.

C. These Specifications are intended to give a general description of the system required, but do not cover all details; which will vary in accordance with the requirements of the equipment as offered. They are, however, intended to cover the installation and field testing of all materials, equipment and appurtenances for the complete unit as herein specified, whether specifically mentioned in these Specifications or not. The scope of work includes coordinating with the manufacturer's authorized representative to perform startup of the equipment, and to instruct the Owner's personnel in the care, operation and maintenance of all equipment provided under this section.

1.02 SUBMITTALS

A. The Contractor shall be responsible to submit the following:

1. Shop drawings with additional information as described below:

11723-1 CLOTH MEDIA DISK FILTERS

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11723-2 CLOTH MEDIA DISK FILTERS

hardware, nuts, bolts, washers, anchors, valves, piping, and ancillary

appurtenances that are shown on the Drawings or required for the proper

installation and operation of the washer and compactor that is not being

1 2			provided by the equipment manufacturer shall be furnished and installed by the Contractor.		
3 4 5 6		B.	All installation/mounting hardware, such as nuts, bolts, washers, screws, brackets, anchors, and etc. shall be constructed of 316 S.S., no exceptions.		
7 8	PART	3 – E	XECUTION		
9 10	3.01	GENE	=RAL		
11 12 13		A.	Install the disk filters, instrumentation, and appurtenant equipment in accordance with the manufacturer's installation instructions.		
14 15	3.02	INSTRUMENTATION AND CONTROLS			
16 17 18 19		A.	The Contractor shall be responsible for coordinating between the Systems Integrator and the equipment manufacturer to provide the monitoring and controls at the University's SCADA System as specified in Section 13640.		
20 21	3.03	MAN	UFACTURER'S SERVICE		
22 23 24 25 26 27 28 29 30 31 32		Α.	The Contractor shall coordinate with the manufacturer to ensure a certification of proper installation (CPI) is provided by the manufacturer and submitted to the Engineer prior to starting the equipment. The CPI shall cover inspections performed, outline in detail any deficiencies observed and outline in detail corrective measures taken and provide actual amp readings under the heaviest loaded conditions. The technician shall remain on the job site until all deficiencies are corrected or shall make as many additional trips as required to determine the installation is proper. Any extra time or trips shall be provided at no additional cost to the Owner.		
33 34 35 36 37 38 39 40 41 42 43 44 45 46		B.	The Contractor shall be responsible for coordinating and scheduling with the University staff for O&M training of the equipment. The Contractor shall notify the University a minimum of fourteen (14) days of when the training will be conducted. Hard copies of the O&M Manual shall be provided at least seven (7) days prior to conducting the training. END OF SECTION		
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1		SECTION 11725							
2 3		ALUMINUM FRAME SUPPORTED MEMBRANE FILTER COVER							
4 5	PART	PART 1 – GENERAL							
6 7 8	1.01	SUMN	SUMMARY						
9 10 11 12 13 14		A.	Scope 1.	Work under this section includes the design, supply and installation of the clear span structurally supported membrane covers for the two cloth disc filters. Work includes all related accessories and incidentals so as to make a complete and functional cover system.					
16 17 18 19			2.	Associated work includes supply and installation of the cover anchor system, specified accessories, and the erection and removal of any temporary works necessary for installation of the Work.					
20 21 22	1.2	SUBN	MITTALS						
22 23 24 25 26		A.	include	ttal drawings shall be supplied by the cover manufacturer and shall applicable drawings, material specifications and data required se specifications.					
27 28 29 30		B.	with t	urchaser's representative shall review the submittals for compliance hese specifications and shall return a set marked approved, red as noted or rejected for appropriate action by the manufacturer.					
31 32		C.		ontractor shall field verify all dimensions prior to releasing the cover rication.					
33 34 35	1.3	DELI\	VERY, S	TORAGE AND HANDLING					
33 36 37 38 39		A.	shippe	num Frame Supported Membrane Cover System modules shall be ed in a pre-assembled state. Care shall be taken by the acturer to prevent damage during shipping.					
40 41 42		B.		Manufacturer shall coordinate shipment with the Contractor to ate or reduce exposed outdoor storage prior to installation.					
43 44	PART	2 – PR	RODUCT	-S					
45 46	2.1	MATE	RIALS/	EQUIPMENT					
46 47 48		A.	Gener	al:					

1 2 3		1.	The Aluminum Frame Supported Membrane Cover System shall be a low-profile construction that does not interfere with internal tank access of processes.
4 5 6 7 8 9		2.	The Aluminum Frame Supported Membrane Cover System shall be constructed from factory fabricated clear span aluminum truss modules with the cover membrane permanently attached to the aluminum truss structure in a factory-controlled environment.
10 11 12 13		3.	The Aluminum Frame Supported Membrane Cover System shall be delivered to the site in a state of completion such that module connections and anchors are the only field operations required. Field fabrication of membrane material shall not be acceptable.
14 15 16	B.	Suppli 1.	er: Environetics, Inc., Lockport, IL,.
17 18	C.	Design	n Criteria:
19 20 21 22 23 24 25 26		1.	Service Conditions. a. The Aluminum Frame Supported Membrane Cover System shall be designed to meet local ASCE 7 Minimum Design Loads for Buildings and Other Structures. b. The Aluminum Frame Supported Membrane Cover System shall shed precipitation to the tank exterior. Cover Systems with interior drains shall not be acceptable.
27 28 29 30 31 32 33 34 35 36 37 38 39 40		2.	Structural Supports: a. Structural supports shall be fabricated in modular assemblies from aluminum alloy extrusions with provisions for permanent mechanical attachment of the membrane cover material to the aluminum alloy extrusions. b. Connection of structural support modular assemblies to each other shall be made with 3/8-in diameter Series 300 stainless steel bolts, nuts, washers and lock washers. c. All structural connections to existing concrete structures shall be made with minimum 3/8-in diameter by 3-3/4-in Series 300 stainless steel expansion anchor bolts. d. All structural connections to existing steel structures shall be made with minimum 3/8-in diameter Series 300 stainless steel bolts, nuts, washers and lock washers.
42 43 44 45 46 47		3.	Membrane Cover Material: a. The membrane cover material shall be continuously mechanically attached to the aluminum alloy structural supports in a factory-controlled environment. Cover systems that utilize field installed membrane cover material shall not be acceptable.

1				b.	The membrane cover material used in the cover fabrication
2 3					shall be fastened to lay tight and smooth over the aluminum alloy structural supports.
4					aluminum alloy structural supports.
5			4.	Cover	Access:
6			4.	a.	Cover access shall be operable by a single individual.
7				b.	Access hatches shall be provided at all locations specified
8				υ.	on the project drawings.
9				0	
9 10				C.	Inspection and equipment access hatches shall be manufactured from materials identical to the structural
11				_1	supports and the membrane cover material listed above.
12				d.	Manway access hatches shall meet or exceed current
13					OSHA Occupational Safety and Health Standards.
14					1. Cover Leaf (s): 1/4" aluminum diamond plate.
15					2. Angle Frame: 1/4" with continuous anchor flange.
16					3. Load Rating: 250 lbs. psf uniform live load with a
17					maximum allowable deflection of the 1/150 of span.
18					4. Locking System: non-corrosive locking bar used in
19					conjunction with an owner supplied padlock.
20					5. Cover equipped with the following: Type 316 stainless
21					steel features: heavy duty hinges, tamper-proof
22					attaching hardware, automatic hold open arm with
23					aluminum latch.
24				e.	Inspection ports shall be manufactured from non-corrosive
25					materials.
26					
27		D.	Materia	als:	
28				1.	Membrane Cover Material: The cover shall be constructed
29					of ENV-3004-12 (30 mil polyester reinforced Ethylene
30					Interpolymer Alloy).
31				2.	Structural Supports: All structural supports shall be type
32					extruded 6053-T52 aluminum alloy with a minimum wall
33					thickness of 0.125 inches.
34				3.	Associated Parts: All associated parts shall be compatible
35					for service in the application environment.
36					
37	PART	3 – EXE	ECUTIO	N	
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39	3.1	QUALI	TY ASS	SURAN	CE
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41		A.	Manufa	acturer'	s Qualifications:
42			1. The	e cover	(s) shall be equivalent in all respects to the DEFENDER ™
43					uminum Frame Supported Membrane Cover System
44					ired by Environetics, Inc., Lockport, IL, Phone: 815-838-
45			833		
46					manufacturers must have at least twenty years of
47					e in the fabrication of geomembrane products and must
48					cessfully completed at least ten membrane cover systems
49					last ten years. Each bidder shall provide a list of at least
- /			••••		The state of the state of the provided a flot of the loads

1			ten such projects stating location, completion date, contact names
2 3			and telephone numbers.The membrane fabricator must be recognized as an approved
4			fabricator/installer by the membrane material manufacturer.
5			4. Alternate manufacturers wishing to pre-qualify shall submit the
6			following to Procurement, kolitsk@ufl.edu, no later than 3/8/22 at 5PM:
7			5. A list of at least ten membrane cover system projects stating location,
8			completion date, contact names and telephone numbers.
9			6. Detail drawings meeting the requirements of this specification.
10			7. A certificate from the membrane material manufacturer stating that the
11			cover manufacturer is an approved fabricator/installer.
12 13	3.2	INISPE	ECTION
14	5.2	IINOI L	LOTION
15		A.	Installation contractor shall examine conditions under which the
16			Aluminum Frame Supported Membrane Cover System is to be installed,
17			and notify the Contracting Officer in writing of any unsatisfactory
18			conditions existing. Work shall not proceed until unsatisfactory conditions
19			or deficiencies have been corrected in a manner acceptable to OWNER.
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21	3.3	WAR	RANTY
22 23 24 25		A.	The Manufacturer shall warrant the Aluminum Frame Supported
23 24		A.	Membrane Cover System to be free from defects for a period of 2 years
25			from the date of Substantial Completion.
26		B.	The Membrane Material Manufacturer shall warrant the Membrane Cover
27			Material to be free from defects for a period of 10 years from the date of
28			Substantial Completion.
29			
30	3.4	INSTA	ALLATION
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32		A.	Cover modules, cover connections and anchor hardware, and all
33 34			accessories shall be assembled and installed to form a complete functional Aluminum Frame Supported Membrane Cover System.
35		B.	Aluminum Frame Supported Membrane Cover System and all
36		٥.	components shall be installed in accordance with the approved Submittal
37			Drawings.
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39			END OF SECTION
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1			SECTION 13610							
2 3 4		PLC AND SCADA EQUIPMENT								
5 6	PART	PART 1 - GENERAL REQUIREMENTS								
7 8	1.01	DEFIN	NITIONS							
9 10 11		A.	University SCADA System - Supervisory Control and Data Acquisition System owned by the University of Florida.							
12 13		B.	LCP – Local Control Panel							
14 15		C.	PLC – Programmable Logic Controller							
16 17		D.	OIT – Operator Interface Terminal							
18 19		E.	RIO – Remote I/O							
20 21	1.02	REFE	REFERENCES							
22 23		A. Institute of Electrical and Electronics Engineers (IEEE).								
24 25		B.	Instrument Society of America (ISA).							
26 27	1.03	SCOF	PE OF WORK							
28 29 30 31		A.	Furnish all labor, materials, equipment and incidentals required to install, complete and ready for operation, the PLC and SCADA systems depicted on the Drawings and/or specified in the Contract Documents.							
32 33 34 35 36		B.	The following is a list of the new local control panels that shall be installed and integrated into the existing SCADA System. The two tertiary filter units with LCP/PLC panels will be purchased by the University under a separate package for integration under this Contract:							
37 38			West Tertiary Cloth Disk Filter LCP with PLC-410 and OIT							
39 40			2. East Tertiary Cloth Disk Filter LCP with PLC-420 and OIT							
41 42 43 44 45 46 47		C.	Where shown on the drawings, new process instrumentation shall be wired and configured into the existing PLC-400 located in the electrical room. The existing PLC-400 is equipped with an Allen-Bradley CompactLogix L33ER PLC. The Systems Integrator shall be responsible to field verify if additional I/O modules, terminal blocks, contact relays/outputs, and miscellaneous control components are required to be installed into the existing PLC-400 in							

4 D.

order to connect and configure the I/O as shown in the drawings and specified in Section 13640.

- D. To ensure unity of responsibility, the Contractor shall furnish the services of an approved System Integrator for modifying the University SCADA System as specified herein. The Contractor shall be responsible for coordinating with the Systems Integrator and all other equipment manufacturers so as to provide the controls specified in Section 13640. The Contractor, via the Systems Integrator, shall assume full responsibility for the satisfactory installation and operation of the SCADA system.
- E. The Systems Integrator shall furnish and install a fully functional SCADA system including all required programmable logic controllers (PLC), network hardware, software, PLC ladder logic programming, HMI graphic screen development and configuration, installation, and testing. VT SCADA program shall be on all HMIs with complete system control.
- F. The Systems Integrator shall be responsible to provide the required connections, software, and cabling to network the new PLC's and the existing SCADA network at the site.
- G. The Systems Integrator shall provide the networking cable required including Cat-5e, or Cat-6e cable, and the fiber optic cable, and shall be responsible for termination of all cables.
- H. These specifications are intended to give a general description of what is required, but do not cover all details, which will vary in accordance with the requirements of the equipment furnished. They are, however, intended to cover the furnishing, the shop testing, the delivery and complete installation and field testing of all materials equipment and appurtenances for the complete system specified herein, whether specifically mentioned in the Specifications or not.
- I. There shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in these Specifications or not. This shall include field testing of the entire installation and instruction of the regular operating personnel in the care, operation and maintenance of all equipment.

1.04 QUALIFICATIONS

A. All equipment furnished under these Specifications shall be new and unused and shall be the standard cataloged product of a manufacturer having a successful record of manufacturing and servicing the equipment and systems specified herein.

1.05 SUBMITTALS

A. Copies of all materials required to establish compliance with the Specifications shall be submitted in accordance with the Sections and 01340.

B. Before proceeding with any manufacturing, submit the following for approval in complete bound sets indexed by specification number. Describe and verify all component part numbers for the items being submitted. Show dimensions, physical configurations, methods of connecting instruments together, mounting details, and wiring schematics. Schematics shall be complete with all components identified by a unique tag reference in accordance with ISA-5.1 Instrumentation Symbols and Identification. Terminal number identification associated with relays, lights, electrical devices, etc., shall be clearly identified on all drawings. Submit fabrication drawings, nameplate legends, and control panel internal wiring and piping schematic drawings clearly showing all equipment and tag numbers for all components. Submit panel graphic drawings when applicable. Include material specifications listed where applicable.

C. Include a draft of the theory of operation for all relay circuits including software logic implemented via programmable controllers that will eventually be included in the operation and maintenance instruction manuals required below.

D. Include a network riser diagram detailing all network components, interconnects, physical locations, and IP addressing. This diagram shall be designed such that it shows the "schematic" layout of the network and how it functions and shall encompass the entire project on one sheet.

E. Computer generated document detailing the license agreements for each installation of software in the SCADA system including license numbers, license details (product, number of tags, etc.), registered contact, key type (hard or soft), expiration dates of support agreements and any other data that may be helpful to personnel supporting the system in the future.

F. Each submittal shall be bound in a white, standard three ring, clear view type, hard cover binder which indicates the system name, submittal content, project reference, revision date and purpose of the submittal on the spine as well as the cover which shall also include the Engineers name, location, and supplier's name. Binders shall not exceed three inches in thickness.

G. For PLC-400, the Owner will provide the Systems Integrator with the original PLC-400 panel drawings. The System Integrator shall use the original panel drawings to show all proposed changes to the existing PLC-400. The System provide an electronic PDF shop drawing of the PLC panel showing

all proposed modifications, new I/O modules, terminal blocks, relay contacts/outputs, and any new components that are to be added to the existing PLC panel. Provide the following submittals to the Engineer meeting the requirements of Section 01340 for review and approval:

Hardware Submittal

- a. Provide a detailed index identifying each tabbed section and its content.
- b. If there are any deviations or clarifications to the specifications, they shall be documented in writing in this section. If there are no comments or concerns identified in the submittal, it will be presumed that there are no deviations from the Contract Documents for the system being furnished.
- c. Component Data Sheets shall be specifically prepared for all components being furnished under these Specifications. The purpose of this material is to supplement the generalized catalog information by providing the specifics of each component (e.g., individual component tag ID reference, service, quantity supplied, part number, breakdown and descriptions for all options, scales, ranges, materials of construction, component location reference, and reference to associated drawings).
- d. Include such other necessary data as would provide a complete and adequate specification for re-ordering an exact duplicate of the original item from the manufacturer at some future date. More than one tag numbered item with the same part number may be included on a sheet.
- e. Manufacturer's standard specification or data sheets shall be clearly marked to delineate the options or styles to be furnished. Standard manufacturer catalog information, descriptive literature, wiring diagrams, and shop drawings shall be provided for all devices, whether electrical or mechanical, furnished under these Specifications. This includes, but is not limited to, pressure switches, gauges, solenoid valves, controllers, indicators, power supplies, switches, lights, relays, timers, circuit breakers, fuses, etc.
- f. Complete certified sizing calculations shall be provided for all control valves and flow elements. The calculations shall include the process data used, minimum and maximum values, permanent head loss and all assumptions made.

Equations shall be submitted for all computing modules and function generating modules and shall include the actual scaling factors and units used.

- g. System Hardware Submittal Format
 - i. Tab 1. Component Index and Comments
 - ii. Tab "N" through "NN" (as required)
 - iii. Component "X" Data Sheet(s) one tab shall be provided per each component type and shall include the standard manufacturer catalog information and sizing calculations (when required).
- 2. System Control Panel(s) Drawing Submittal
 - a. Provide a detailed index identifying each tabbed section and its content.
 - b. All drawings shall be provided on 11"x17" size paper and shall be laser generated with a 300 DPI resolution, tabbed, and bound as directed above. Drawing submittal may be combined with the Hardware submittal providing the binder capacity is not exceeded.
 - c. If there are any deviations or clarifications to the specifications, they shall be documented in writing in this section. If there are no comments or concerns identified in the submittal, it will be presumed that there are no deviations from the contract documents for the system being furnished.
 - d. Provide detailed shop drawings for all panels and enclosures. Drawings shall show the location of all exterior and internal panel mounted devices to scale and shall include a panel legend and bill of materials. Layout drawings shall show all major dimensions, front, back, side, and mounting details, as well as all elevations, in inches from the base up, of all rows of components.
 - e. The panel legend shall list and identify all front of panel devices by the components unique tag identifier, all nameplate inscriptions, service legends, and annunciator inscriptions when applicable. Service legends, and nameplate inscriptions shall show size, engraving per line, character height and color. Information may be included on the layout drawing if spacing permits.

- f. The bill of materials shall include all components mounted within or on the panel that are not listed in the panel legend, and shall include the component identification tag, description, manufacturer, and complete part number for reordering. Information may be included on the layout drawing if spacing permits.
- g. Fabrication drawings shall be submitted for review and shall show all cut-out dimensions, support details, brackets, materials of construction, finish, etc. to be used for fabrication of each panel. Fabrication drawings may be submitted separately after the layout drawings have been approved. Construction of panels shall not be started until the approval of the fabrication drawings is received.
- h. Wiring diagrams shall be provided in the form of ladder type schematics with line numbers for all devices. All components shall be identified by a unique identification tag, terminal block numbers, wire sizes and color codes clearly identified, and external interconnections noted. Drawings shall be drawn in "landscape" mode.
- i. Provide complete terminal identification of all internal and external elements, panels, and junction boxes.
- j. Polarity of all analog signals shall be shown at each terminal as well as all shielded cable connections and grounding requirements.
- k. All external panel wiring that must be provided and installed shall be clearly identified as a dashed line. Use unique terminal symbols to denote MCC locations.
- I. All special cables that are provided with purchased equipment external to panels shall be identified as being supplied by the System Integrator.
- m. Wiring diagrams shall show all circuits individually; no common diagrams will be allowed.
- n. Provide panel power wiring diagrams for all panels. The diagrams shall include all grounding requirements.
- o. Control Panel Submittal Format
 - Tab 1. Index and Comments

1			ii. Tab "N" through "NN" as required.
2			iii. Heat Dissipation and Power Calculations Summary.
3			iv. Panel "A" Layout Drawing (one tab per panel).
4			v. Panel "A" with Fabrication Drawing (Legend,
5			Engravings, Bill of Materials)
6			vi. Panel "A" Power Wiring.
7			vii. Panel "A" Wiring Diagrams.
8			viii. Tab "X" Loop Drawings (When Applicable)
9			, • · · · · ,
			ix. Tab "Y" Installation Details (When Applicable)
0	0	D:	ste and Analan Laan Dressing Culturalital
11	3.	Discre	ete and Analog Loop Drawing Submittal
12			
13		a.	Provide an individual loop wiring diagram for each discrete
14			and analog loop showing all terminal numbers, the location of
15			the DC power source, the location of any dropping resistors,
16			polarity, etc. The loop diagrams shall meet the minimum
17			requirements of ISA - S5.4 (latest edition), in addition to the
18			following requirements.
19			
20		b.	Loop diagrams shall be on 11-inch by 17-inch paper. Only one
21			loop shall be shown on each drawing.
22			resp shall be shell shall araning.
23		C.	Reference to supplementary records and drawings, such as
24		0.	installation details, P&IDs, location drawings, wiring diagrams
- - 25			or drawings, and instrument specifications shall be included.
20			•
26			Drawings may be included in the Control Panel Drawing
27			Submittal when only a few drawings are required.
28	4	1	and the fall of the Date No. O. L. and Gall
29	4.	instrui	ment Installation Details Submittal
30			
31		a.	The System Integrator shall develop and submit for review,
32			complete installation details for each field mounted device and
33			panel furnished prior to shipment and installation. Common
34			details may be referenced by an index showing the complete
35			instrument tag number, service, location, and device
36			description. Installation details shall be provided as required
37			to adequately define the installation of the components.
38			Drawings may be included in the Control Panel Submittal
39			when only a few are required.
10			A
11	5.	Power	r Requirement and Heat Dissipation Summary
12	0.	1 0000	Trogonomon and Float Bioopation Gainmary
13		a.	Provide a summary of the power requirements and heat
14		a.	dissipation for all control panels furnished. Power
1 4 15			requirements shall state required voltages, currents, and
16			· · · · · · · · · · · · · · · · · · ·
I U			phase(s). Heat dissipations shall be maximums and shall be

given in BTU/Hr. Summary shall be supplemented with calculations and show expected temperatures to be maintained for proper control equipment operation.

6. PLC Subsystem Submittal

- a. In addition to the detailed hardware submittal requirements noted herein, the following shall also be provided:
 - i. Theory of Operation and Logic Descriptions.
 - ii. System block diagram and cabling requirements.
 - iii. Annotated software program listing and I/O address mapping.
 - iv. I/O arrangement and wiring drawings.

7. Operation and Maintenance Manuals Submittal

- a. Submit Operation and Maintenance Instruction Manuals and Parts Lists to the Engineer for all equipment provided in accordance with Section 01730. Manuals shall be submitted no later than the equipment shipment date. After installation is complete, update the manuals to reflect any changes that occurred during installation and deliver the balance of the manuals to the Engineer.
- b. All manuals shall be original manufacturers literature provided as noted herein above.
- c. Include in the manuals not less than the following applicable information for each instrument, component, subsystem and/or control loop.
- d. Provide a detailed index identifying each tabbed section and its content.
- e. If there are any deviations or clarifications to the specifications, they shall be documented in writing in this section. If there are not comments or concerns identified in the submittal, it will be presumed that there are no deviations from the contract documents for the system being furnished.
- f. A listing of all the panels, racks, instruments, components, and devices furnished. All components shall be grouped by component type, i.e., pressure switches, pressure gauges, indicators, etc. The list shall contain, as a minimum:

1 2 3 4 5 6 7 8			 i. Instrument, panel, rack or device tag number ii. Description iii. Quantity supplied iv. Reference to component data sheet and/or catalog cut v. Component type vi. Component Data Sheets vii. Catalog Cuts
9 10 11		g.	Operation and Maintenance instructions containing the following information:
12			i. Operation procedures
13			
13 14			·
15			· ·
			iv. Troubleshooting procedures
16			v. Calibration procedures
17			vi. Internal device schematics and wiring diagrams
18			vii. Shut-down procedures
19			viii. Component parts list
20			ix. Detailed circuit operational description including
21			programmable controller ladder diagrams
22			x. Listing of Manufacturers with local telephone numbers
23 24			and contacts for all instrumentation hardware
24			furnished.
25			
26		h.	A spare parts and expendables list shall be submitted to
27			include not only those items being supplied, but also any
28			additional items recommended for successful long term
29			operation.
30			
31 32	8.	Syste	m Calibration and Test Documentation Submittal
33		a.	The Systems Integrator shall submit an example of each type
34			of Instrument Calibration Report and Loop Functional Test
35			Report that will be used to verify that all preliminary calibration
36			and testing has been performed and the system is
37			considered, by the supplier, to be ready for the Engineer's
38			acceptance testing.
39			
40		b.	After approval of the examples, the System Integrator shall
41			prepare Loop Functional Test Report(s) for each loop and an
12			Instrument Calibration Sheet for each active element (except
43			simple hand switches, lights, etc.). These sheets shall be
14			completed and submitted to the Engineer after completion of
45			the operational availability field tests.
46			and approximation around any many many
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- c. An Instrument Calibration report shall be used to certify that each instrument requiring calibration has been calibrated to its published specified accuracy shall be submitted to the Engineer. This report shall include all applicable data as listed below plus an area to identify any defects noted, corrective action required, and corrections made. Instrument calibration reports shall include:
 - i. Facility identification (Name, location, etc.)
 - ii. Loop Identification (Name or function)
 - iii. Equipment tag and serial numbers
 - iv. Scale ranges or units
 - v. Test mode or type of test
 - vi. Input values or settings
 - vii. Expected outputs and tolerances
 - viii. Actual readings at 0, 10, 25, 50, 75, 90 and 100 percent of span
 - ix. Percent of error for each reading
 - x. Explanations or special notes as applicable
 - xi. Date, time and weather conditions
 - xii. Tester's certification with name and signature
- d. Loop and functional test reports shall be provided for each function that can be demonstrated on a loop-by-loop basis. Each form shall include:
 - i. Project name
 - ii. Loop number
 - iii. Loop description
 - iv. Test procedure description, with a space after each specific test to facilitate sign off on completion of each test.
 - v. For each component: tag number, description, manufacturer, and data sheet number.
 - vi. Space for sign off and date by the System Integrator
- e. Functional Acceptance Test Report For those functions that cannot be demonstrated on a loop-by-loop basis. Each form shall include a listing of the specific tests to be conducted. With each test description the following information shall be included:
 - Specification page and paragraph of function to be demonstrated
 - ii. Description of function
 - iii. Test procedure description

1 2			iv. Space after each specific test to facilitate sign off on completion of each test
3 4 5 6 7 8 9		f.	System Integrator's Installation Certification Reports. Upon completion of all preliminary calibration and functional testing, the System Integrator, shall submit a certified report for each control panel and its associated field instruments certifying that the equipment:
10			i. Had been properly installed under his or her
11			supervision;
12			ii. Is in accurate calibration;
13 14			iii. Was placed into operationiv. Has been checked, inspected, calibrated, and adjusted
15			iv. Has been checked, inspected, calibrated, and adjusted as necessary;
16			v. Has been operated under maximum power variation
17			conditions and operated satisfactorily is fully covered
18			under the terms of the guarantee.
19			
20		9. Func	tional Acceptance Test Procedures Submittal
21		_	Outroit for annual not leter then 00 days mice to the
22 23		a.	Submit for approval not later than 30 days prior to the functional acceptance test demonstration, a written plan for
24			demonstrating that each device and function of the equipment
25			provided under these specifications meets the specified
26			operational requirements.
27			
28		b.	The plan shall detail procedures to be used in the functional
29			acceptance testing of all systems. The plan shall include a
30			description of test methods and materials that will be utilized
31 32			for testing each system.
33 34		C.	Immediately correct defects and malfunctions with approved methods and materials in each case and repeat the testing.
35	4.00		TRUCTIONS
36	1.06	OPERATING INST	RUCTIONS
37 38		A. Operating a	nd maintenance manuals shall be furnished in accordance with
39		Section 017	
40			and shall include all required cuts, drawings, equipment lists,
41			, equipment configuration details, etc., that are required to
42		instruct ope	erating and maintenance personnel unfamiliar with such
43		equipment t	he number and special requirements shall be as specified.
44			
45	1.07	SPARE PARTS	
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A. Spare parts shall be properly marked and protected for long periods of storage and packed in a suitable container that is clearly identified with indelible markings as to the contents.

1.08 WARRANTY

A. Each component manufacturer shall provide a warranty in accordance with Specification 01740. The manufacturer shall guarantee that the equipment, hardware and software furnished is suitable for the purpose intended and free from defects of design, material and workmanship for a period of one (1) year from the date of system acceptance by the Owner. In the event the equipment fails to perform as specified any time during installation or during the warranty period, the equipment manufacturer shall promptly repair or replace the defective equipment without any cost to the Owner (including handling, shipment and labor costs).

PART 2 - PRODUCTS

2.01 PROGRAMMABLE LOGIC CONTROLLER I/O MODULES

A. The existing PLC-400 is equipped with an Allen-Bradley CompactLogix L33ER PLC. The Systems Integrator shall be responsible to field verify if additional I/O modules, terminal blocks, contact relays/outputs, and miscellaneous control components are required to be installed into the existing PLC-400 in order to connect and configure the I/O as shown in the drawings and specified in Section 13640. If additional I/O modules are required, all I/O modules shall be compatible with the Allen-Bradly Compact Logix PLC and shall be Allen-Bradly 1769 series I/O modules.

2.02 PLC Programming Software

 A. The Systems Integrator shall be responsible to have his/her own Rockwell Automation PLC programming software to modify and program the existing PLC-400. The Owner or Engineer shall not be required to expend any programming effort in order to achieve a fully operational system.

2.03 ETHERNET CABLING

A. The network equipment shall be connected using pre-molded Cat-5e or Cat-6 patch cords with RJ-45 connectors. Lengths shall be as required.

 B. If it is not possible to use pre-molded cables due to installation requirements, plenum rated Cat-5e or Cat-6 cable must be used. In addition, a qualified installer must be employed to make the RJ-45 connections at each end of the Ethernet run as well as to test the cable. Testing must include a computer generated print-out of the test results

including pin connections and dB loss in the cable. Furnish test results to the Engineer.

2.02 IP ADDRESSING

- A. The existing plant network has IP addresses defined for existing equipment. All new equipment requiring IP addresses shall be assigned with and IP address matching the existing plant network IP address scheme to allow complete and operational controls of all equipment as specified in Section 13640.
- B. The Contractor shall submit a list of proposed IP addresses for all new equipment requiring IP addresses to be approved by the Owner.

2.03 HMI GRAPHIC SCREEN DEVELOPMENT AND MODIFICATION

- A. Integrator shall be responsible for developing HMI graphic screens on the the Owner's existing HMI SCADA system is a VTScada System located at the WRF control room. The Contractor shall modify the existing VTScada software to include additional HMI graphics for all modifications performed as part of this project. Each of the LCP's provided by the filter equipment manufacturer (LCP-410 and LCP-420) will be equipped with a Panel View Plus 7" OIT. The OIT graphic screens will be developed by the equipment manufacturer. The System will be responsible for developing HMI graphic screens on the VTSCADA System for each filter system (east/west) in order to provide the monitoring and controls as described in Section 13640 and as shown on the P&ID drawings.
- B. The Contractor shall submit to the Engineer for approval all HMI graphic screens in color print on 8.5" x 11" sized paper. The Contractor shall provide the following as a minimum for all HMI graphic screens:
 - 1. One filter overview graphic screen for each filter system (east and west) complete with all associated I/O for control and monitoring.
 - 2. Historical trending screens for all 4-20mA I/O added as part of this project.
 - All rotating equipment such as pumps shall be programmed with elapsed run time meters to be logged and display on the HMI. A separate screen shall be furnished to display elapsed run time for all equipment.
 - 4. Any additional HMI graphic screens required in order to provide controls and monitoring as specified in Section 13640 shall be furnished by the Contractor at no additional cost to the Owner.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The work included in this section consists of furnishing, installing and placing in operation, the equipment and appurtenances, including all conduit, wiring and circuitry necessary to provide the Owner with a fully operable system properly configured and installed.

B. Install and mount equipment in accordance with the Contract Documents, manufacturer's instructions and installation detailed shop drawings. Mount equipment so that they are rigidly supported, level and plumb, and in such a manner as to provide accessibility; protection from damage; isolation from heat, shock and vibration; and freedom from interference with other equipment, piping and electrical.

C. Include the services of a factory trained, qualified network engineer to inspect the complete equipment installation to assure that it is installed in accordance with the manufacturer's recommendations, make all adjustments necessary to place the system in trouble-free operation and instruct the operating personnel in the proper care and operation of the equipment furnished.

D. All workmanship utilized in the manufacture and installation of this system shall be of the highest quality and performed in a manner which is consistent with all accepted practices for industrial and office data networks.

E. All work shall be coordinated and arranged in advance with the on site personnel at each site, and shall minimize disruption to the normal operations at each site.

F. Equipment racks shall be placed in the Contactor submitted and Ownerapproved locations, and shall be semi-permanently secured to prevent damage to equipment or personnel injury.

G. All equipment in the System Integrator provided panels shall be completely connected internally including power and Ethernet patch cords as required.

3.02 FIELD TESTS AND ACCEPTANCE

A. General

1. Field tests shall consist of installation check-out, Field Acceptance Test, and final inspection in sequence. Each stage of testing shall

not be commenced until the preceding stage is substantially complete as determined by the Engineer.

B. Installation Check-out

- Installation check-out shall be performed by the Owner and Engineer. The Owner and Engineer will check the installation to ensure compliance with component locations and to ensure that any electrical installation has been completed in accordance with this specification.
- 2. A thorough inspection of all equipment including UPS equipment, PLCs, software installation, programming and configuration and appurtenances shall be made to determine performance and compliance with design requirements and specifications.
- The Systems Integrator shall make any and all necessary repairs, adjustments, and replacements until performance has been demonstrated to the satisfaction of the Owner and Engineer. The Systems Integrator shall bear the cost of any repair, adjustment and replacement.
- 4. The site must be approved by the Systems Integrator, the Engineer and the Owner after successful completion of this inspection.

C. Field Testing

- 1. Field tests shall be performed at the site to test all required configurations for this network including but not necessarily limited to:
 - a. Proper monitoring and control of all equipment through the SCADA HMI graphic screens in the control room to meet the requirements of Section 13640 and other applicable control specifications of the Contract Documents.
 - b. All other tests as shall be deemed necessary to test the complete functionality of the system.
- 2. All tests shall be made by the System Integrator in the presence of the Engineer and the Owner. The System Integrator shall request the Owner's and Engineer's presence a minimum of 72 hours prior to testing.
- 3. The System Integrator shall make any and all necessary repairs, adjustments, and replacements until performance has been

demonstrated to the satisfaction of the Engineer. The System Integrator shall bear the cost of any repair, adjustment and replacement.

3.03 TRAINING

A. The Contractor shall provide operator training for each PLC panel installed. Therefore, the Contractor shall provide one (1) separate 8-hour training session to train operators not familiar the SCADA system HMI graphic screens. Training shall highlight procedures on navigating through screens, trending, adjusting setpoints, turning on/off equipment through the VTScada system and OIT. Training shall also include the operation and maintenance of all networking equipment.

3.04 AS-BUILT DRAWINGS

 A. The Contractor, through the Systems Integrator, shall provide to the Owner and Engineer complete as-built drawing(s) showing the actual control components and devices (show existing and new devices) that are mounted in the existing PLC-400 after modification. Drawings shall also include identification of each wire in the existing panel, to which terminal strip it is connected, circuit breaker identification, I/O modules, corresponding I/O, etc. Two additional copies of the panel as-built drawings shall be placed in the pocket holder in the door of the existing panel.

END OF SECTION

2 3

PROCESS INSTRUMENTATION AND EQUIPMENT

SECTION 13620

4 5

PART 1 - GENERAL

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1.01 SCOPE OF WORK

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Α. The Contractor shall install all instrumentation and controls hereinafter specified to perform the intended function and achieve a fully integrated and operational system. The equipment and services defined herein shall be furnished by a single instrumentation system integrator who shall coordinate the instrument and control system for proper operation with related equipment and materials provided by other suppliers on this project.

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B. Work shall include all labor, materials, equipment, performance of all work necessary to provide programming, calibration, installation supervision, training system start-up, services and incidentals required to install instrumentation and control systems, including all work necessary during the Warranty Period, as specified herein, in other specification sections as listed below under related work, and as shown on the Contract Drawings.

21 22

> C. Auxiliary and accessory devises necessary for system operation or performance, such as transducers or relays to interface with existing equipment or equipment shall be furnished, installed, coordinated and interfaced by the instrumentation system integrator whether or not they are shown on the drawings or specified herein.

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D. Equipment shall be fabricated, assembled, installed, and placed in proper operating condition in full conformity with detail Drawings and Specifications, engineering data, instructions and recommendations of the equipment manufacturer as approved by the Engineer.

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E. The Contractor shall be responsible for the coordinating between the equipment supplier, equipment manufacturer, and the Systems Integrator such that all parties are completely aware of the controls that are required for various specified systems within the project.

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PART 2 - PRODUCTS

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ULTRASONIC LEVEL TRANSMITTER

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Α. Ultrasonic level transmitter system shall be furnished for level measurement at the existing filter splitter box as shown on the Drawings to replace two existing units. Two (2) level transducers and two (2) level transmitter shall be provided, as shown on the drawings. Each level transmitter shall be

> 13620-1 PROCESS INSTRUMENTATION AND EQUIPMENT

1 2			ed in a d white	Nema 4X stainless steel panel box, panel shall be powered.
3 4 5	B.			ansmitter shall be connected to the existing PLC-400 via 4-20 s shown on the drawings.
6 7 8	C.	Trans	ducer s	shall be a non-contact, ultrasonic level transducer.
9 10 11	D.		ducer ications	shall be furnished with the following performance/function s:
12 13			a.	Measuring Range: Transducer range shall have a minimum detection range of 0-33 ft.
14 15			b.	Accuracy: The level transducer shall have accuracy of 0.25% of the measuring range.
16 17			c. d.	Temperature Range: –40 to 95 degrees C. Relative Humidity: Zero to 100 percent.
18 19		2.	Physic	cal:
20 21 22			a.	Transducers shall be housed in a non-contact, type 304 stainless-steel encapsulated sensor.
23 24			b.	Transducers shall be capable of being completely submerged without damage.
25 26 27			C.	Transducers shall be suitable for surface, pipe, or flange mounting as indicated on the Drawings. Appropriate mounting hardwired shall be provided.
28 29 30		3.	Acces	sories/Documentation Required:
31 32 33 34			a.	Signal cable as recommended by the manufacturer, for installation between the transducer(s) and the transmitter. Length, up to 1000 feet (300 m), shall be as required by installation indicated on the Drawings.
35 36 37	E.	Trans	mitter/C	Converter:
38 39		4.	Type:	
40 41			a.	Microprocessor based compatible with the transducer(s) provided.
42 43 44		5.	Functi	onal/Performance:
45 46			a.	Resolution (including transducer): Plus or minus 0.1 percent of range or 0.08 inches (2 mm), whichever is greater

1 2				b.	Accuracy (including transducer): Plus or minus 0.25 percent of range or 0.24 inches (6 mm).
3				C.	Range: As required by the installation indicated on the
4					Drawings.
5				d.	Temperature Range: -20 to 50 degrees C.
6				e.	Power Requirement: 120 VAC 50/60 Hz
7				f.	Output: Minimum two isolated 4-20 mA outputs. Output
8					contacts shall be rated 5 A at 230 VAC.
9				g.	Temperature Compensation: Compensation over the
10				h	temperature range of the sensor.
11 12				h.	Display: Digital indicator displaying level/differential level or volume in engineering units or percent as indicated on the
13					Drawings or in the Instrument Device Schedule.
14				i.	Diagnostics: On-screen instructions and display of self-
15				••	diagnostics.
16				j.	Loss of Signal: Transmitter shall ignore momentary loss-of-
17				,.	echo signals and shall indicate loss of echo on the
18					transmitter unit.
19				k.	Configuration Protection: Programmable parameters shall be
20					protected using E2PROM. Battery backup protection is not
21					acceptable.
22					
23			6.	Physi	cal:
24					
25				a.	Transmitter shall be suitable for surface or pipe stand
26					mounting.
27				b.	Enclosure shall be NEMA 4X (IP65).
28				C.	A/C power will be as specified in Section 13300.
29				d.	All mounting hardware shall be 316-stainless steel.
30				e.	Transmitter shall be mounted in a NEMA 4X 316 S.S.
31					enclosure.
32 33		F.	Manu	footuro	ro
34		г.	Mariu	facture	15.
35			1.	Sieme	ens HydroRanger 200 HMI, Echomax XPS-10 Transducer
36			١.	Series	•
37				Ochica	J.
38					
39	2.02	TURE	BIDITY	ANALY	/ZER (TURBIDIMETER)
40					(,
41		A.	Type:		
42			71		
43			1.	The p	roposed turbidity analyzer (turbidimeter) shall be installed in a
44					A 4X 316 stainless steel enclosure to provide continuous, online
45					oring of low range turbidity in the filter effluent water. The
46					or shall be a low range, online laser-based turbidimeter with
47				predic	ctive diagnostics designed to continuously monitor turbidity in a

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PROCESS INSTRUMENTATION AND EQUIPMENT

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sample stream with automatic cleaning capabilities. The sensor shall be provided with the compatible SC-200 transmitter to communicate back to the associated programable logic controller (PLC).

B. Function/Performance:

- 1. Accuracy: < 1% of the measured value.
- 2. Measuring Range: 0 NTU 1000 NTU.
- 3. Repeatability: ±1% of reading
- 4. Accuracy: ±2% of reading from 0 to 40 NTU ±10% of reading from 40 to 1000 NTU
- 5. Resolution: 0.0001 NTU
- 6. Response Time: <45 seconds at 100mL/min
- 7. Sample Flow: 100 to 1000 mL/min; optimal flow rate is 200 to 500 mL/min
- 8. Sample Temperature: 2 to 60°C (36 to 140°F)

C. Accessories Required:

- 1. One Hach SC-200 controller for communication back to the SCADA network (refer to Part 2.04, this section).
- 2. The turbidimeter shall be installed with an automatic cleaning module to match the existing turbidimeter on site.
- 3. Sufficient cable for installation between the sensor and analyzer/controller as indicated on the Drawings.
- 4. The proposed turbidimeter shall be installed inside a 36" x 30" x 12" NEMA 4X enclosure coated in a white polyester powder finish, as indicated on the drawings. Refer to Specification Section 16135 Part 2.01.F for enclosure requirements.
- A second identical NEMA 4X enclosure shall be provided to house the existing Hach TU5300sc Low Range Laser Turbidimeter that is to be relocated, as indicated on the drawings.

1		D.	Manufacturer:				
2 3 4 5			 Hach TU5300sc Low Range Laser Turbidimeter, no exceptions. Manufacturer's start-up and training services shall also be included. 				
6 7	2.03	HACH	SC-200 CONTROLLER				
8 9 10 11		A.	The Hach SC-200 controller shall serve as the transmitter for the turbidity sensor mentioned above. The SC-200 controller shall be a microprocessor-based sensor controller.				
12 13		B.	Hach SC-200 controller shall be furnished with the following performance/function specifications:				
14 15 16			1. Power Requirements: 120 VAC, 24 V DC				
17 18			2. Operating Temperature: -20° to 60° C (-4° to 140° F)				
19 20			3. Fuse Ratings: 250 V				
21 22			4. Enclosure: Metal housing with corrosion-resistant surface finish. IP65 rating				
23 24 25			5. Warranty: 2 year				
26 27		C.	The Hach SC-200 Controller shall be furnished and installed with the Hach TU5300sc Low Range Laser Turbidimeter, no exceptions.				
28 29 30	2.04	TRAN	ISIENT PROTECTION/SURGE SUPPRESSION DEVICES				
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46		Α.	Surge and transient protection devices shall be two-stage units incorporating gas tube and electronic clamping. Either polarity in surges shall be equally protected. The protection devices shall provide long life, reliability and easy mounting. Surge protection devices for 4-20 mA loops shall add no more than 5 ohms to the circuit. Surge protection shall be used on all 4-20 mA transmitters (e.g. LIT, FIT). Surge protection devices for instrument loops of 4-20 mA shall be Phoenix Contact, Inc. Surgetrab Series or approved equal.				
		В.	All instrument and control equipment mounted outside of protective structures (field mounted equipment) shall be equipped with suitable surge-arresting devices to protect the equipment from damage due to electrical transients induced in the interconnecting lines from lightning discharges or nearby electrical devices. Both power and signal circuits shall be protected with surge and transient protectors installed at the source and destination ends of the circuits. Protective devices used on 120V ac inputs to field				

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1 2 3			mounted equipment shall be secondary valve surge protectors conforming to the requirements of IEEE Standard 28-1972 (ANSI C62.1-1971).			
5 5 6 7 8 9		C.	Surge and transient protectors shall be normally connected to the electrical system ground. When an electrical system ground is not available near the device, the protectors shall be connected to a ground rod 10 ft. in length by 3/4 inch in diameter and located within 10 feet of the device. The ground that surge protectors are connected to shall be a maximum of 5 Ohms.			
10 11 12 13		D.	Protectors for 4-20mA signal circuits at the field transmitter shall be Phoenix Contact, Inc. Surgetrab series and Phoenix Contact, Inc. PT series in panels. Protectors for 120-volt power circuits shall be UL listed Phoenix Contact, Inc. Mains PT series."			
15 16	PART	KECUTION				
17 18	3.01	INSTALLATION				
19 20 21 22 23 24 25		Α.	Field mounted elements shall be installed, calibrated, and started-up in strict compliance with the manufacturer's requirements and recommendations. Conflicts between the manufacturer's requirements and recommendations and these Specifications or the Drawings shall be presented to the Engineer for resolution before any affected work is started. Installed equipment shall be certified as appropriate for the application and process by the Contractor.			
26 27 28 29		B.	All field-mounted instruments shall be protected and isolated from vibration, temperature extremes, radiant heat, rain, sleet or falling water, and similar adverse conditions.			
30 31 32 33 34 35 36		C.	Field mounted elements shall be marked with data required for calibration such as location of adjustments, span, offset, zero suppression, and test voltages. If such data are not provided in permanent markings or on the manufacturer's nameplate, a durable tag or label shall be affixed in a protected location that will become readily visible in the normal course of servicing the instrument.			
37 38	3.02	EQUIPMENT TESTING AND CALIBRATION				
39 40 41 42 43 44 45		Α.	Field Tests and Calibration. Field mounted elements which were not calibrated to final working values of range, span, and zero suppression at the factory shall be so calibrated prior to or at the time of installation. This calibration shall meet the same requirements for accuracy and be traceable, as required for factory testing above. The Engineer shall be given 48 hours notice and the opportunity to witness this calibration.			
46			END OF SECTION			

1 2		SECTION 13640					
3		CONTROL STRATEGY					
5	PART	T 1 - GENERAL					
6 7	1.01	DESCRIPTION					
8 9 10 11		Requirements specified in the conditions of the Contract and Division 1 form a part of this section.					
12 13 14 15		A.	monito	section specifically describes the instrumentation, controring system for the tertiary filter replacement project. The two disc filters have been direct purchased by the University for inse Contractor.	tertiary		
17 18 19 20 21		B.	the w specif instrui	Contractor shall furnish the services of a Systems Integrator to york of this section and all related instrumentation and fications to install, program, start-up, and test a complete and comentation, control and monitoring SCADA system as indicated and specified herein.	controls perable		
22 23 24 25 26 27 28 29		C.	It is the intent of this specification to briefly describe each main system so that both the Contractor and the Systems Integrator are aware of the magnitude of the total instrumentation system and to ensure compatibility with systems already existing. Certain systems described are to be furnished under other Divisions. Interfacing and coordination with these systems is the responsibility of the Systems Integrator and is part of the Work of this Division.				
30 31	1.02	GENERAL					
32 33		A.	Defini	tions			
34 35 36			1.	University SCADA System – Supervisory Control an Acquisition System owned by the University of Florida.	d Data		
37 38 39 40			2.	HMI – Human Machine Interface, the existing VTScada s configured to run on a computer located in the Control Room University WRF.			
41 42			3.	LCP – Local Control Panel.			
43 44			4.	OIT - Operator Interface Terminal			
45 46 47		B.		entrols including delay timers, PLC ladder logic programminics, ancillary programming and configuration as generally de	•		
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CONTROL STRATEGY

herein shall be provided by the Contractor at no additional cost to the University.

- C. The system(s) listed below shall be able to be controlled locally at the LCP equipped with lights, buttons, and switches, or via the OIT or from any HMI located at the University WRF Control Room. Any control commands made by the operator at the OIT shall be equivalent to making control commands at the HMI. Any control commands made by the operator using the buttons/switches on the LCP shall override any control commands from the HMI/OIT. The precedence for control shall be:
 - 1. Any local manual controls from the LCP using the physical buttons/switches.
 - 2. Any manual controls from the HMI or /OIT.
 - 3. Any automatic controls from the HMI or /OIT.
- D. All equipment with LOCAL-OFF-REMOTE shall operate as follows:
 - 1. In LOCAL, the equipment shall run;
 - 2. In OFF, the equipment shall turn off;
 - 3. In REMOTE, the equipment shall be controlled remotely by the OIT or HMI.
- E. Where I/O is available, all equipment run status shall be displayed on the HMI/OIT whether specified herein or not.
- F. All alarm conditions shall be indicated on an ALARM screen of the HMI/OIT. All new control panels shall be equipped with an audible alarm and light that activates under alarm conditions. The audible alarm and light shall continue to be active until cleared by the operator at the respective local control panel OIT ALARM screen.
- G. A MAINTENANCE screen shall be added to the HMI/OIT. The MAINTENANCE screen shall contain a list of all equipment (pumps, mixers, aerators, valves, etc.) on the SCADA network, and allow the operator to select individual pieces of equipment as "Out of Service". When "Out of Service" is selected, all alarms, and any equipment alternating sequences for the piece of equipment shall be disabled. Every rotating equipment (blowers, pumps, mixers, aerators, compressors, etc.) whether specified herein or not shall have an elapsed runtime meter displayed MAINTENANCE screen on the HMI/OIT. A reset button shall be provided for each equipment to reset the runtime.
- H. Any additional controls, including delay timers and ancillary programming needed for the proper operation of the various systems, as directed by the Engineer or required, shall be provided by the Contractor at no additional cost to the University or Engineer.

- I. Historical trend screens shall be developed for all 4-20 mA I/O (i.e. Flow, Level, Pressure, Temperature, Analyzers, Pump Speed, Power, and etc.) whether specifically described in the individual control strategies herein or not and shall be stored in the SCADA System. All existing historical trends shall remain on the HMI/OIT and updated with the new tag name.
- J. Units for all I/O displayed on the University SCADA System are as follows:

Flowrate: GPM and/or MGD
 Totalized Flow: GAL and/or MG

3. Level: FT, FT-INCH, and/or INCHES

4. Pressure: PSI

5. Time: MIN and/or HRS-MIN

6. Pump Speed: HERTZ7. Voltage: VOLTS8. Amperage: AMPS9. Wattage: kW

- K. All existing and new HMI/OIT graphic screens shall be modified such that each equipment or instrument shall be provided with the tag name placed adjacent, above, or below the equipment or instrument. Hovering over the equipment to see the tag name is not an acceptable alternative.
- L. The Systems Integrator shall write his/her own PLC program to meet the requirements of the Control Strategy as defined herein and use the existing PLC program/ladder logic in the existing PLC as a "go-by". All existing controls, functions, status setpoints, interlocks, alarms, etc. shall be made functional in the new PLC and HMI/OIT. Any additional monitoring and control functions for the existing process shall be programmed into the new PLC and HMI/OIT as specified herein.
- M. For any instrument that is not specifically mentioned in the Control Strategy herein, but is required for proper operation of the facility, the Systems Integrator shall obtain the functionality of the instrument within the existing PLC and migrate it to the corresponding PLC as shown the Drawings.
- N. An I/O point test shall be conducted to confirm every I/O point on the existing PLC is shown or is shown correctly on the HMI/OIT. At the completion of the I/O point test, the HMI/OIT graphic screens shall be modified such that each equipment or instrument shall be provided with the tag name placed adjacent, above, or below the equipment or instrument for proper identification on the HMI/OIT graphic screen
- O. One copy of the PLC program shall be provided, after debugging, recorded on CD-ROM for each PLC.

1.03 CONTROL STRATEGY

A. Turbidity Analyzers (AIT-501 and AIT 502)

 The West Filter Effluent Turbidity Analyzer (AIT-501) and East Filter Effluent Turbidity Analyzer (AIT-502) shall display instantaneous readings, daily minimums, daily maximums on the HMI.

2. Each turbidity analyzer shall be provided with an operator adjustable high level alarm setpoint on the HMI. An alarm shall be displayed on the HMI when the measured turbidity value is above the high level alarm setpoint.

 3. Each turbidity analyzer shall be provided with an operator adjustable high-high level alarm setpoint on the HMI. An alarm shall be displayed on the HMI when the measured turbidity value is above the high-high level alarm setpoint. This high-high turbidity setpoint shall be used to control the motor operated valves (MOV) as specified herein.

4. A turbidity analyzer general fault alarm shall be displayed at the HMI/OIT.

5. Historical trends shall be provided for each turbidity analyzers' measured values.

B. West Tertiary Cloth Disk Filter (LCP-410) and East Tertiary Cloth Disk Filter (LCP-420)

 Each filter unit is provided with a manufacturer supplied local control panel, LCP-410 and LCP-420 that provides all local control of the filter units. The following remote controls shall be provided by the Contractor/Systems Integrator.

2. The filter run status and general fault alarm for each filter unit shall be indicated at the HMI.

3. The backwash run status and general fault alarm for each filter unit shall be indicated at the HMI.

4. The backwash pump(s) run status and general fault alarm for each filter unit shall be indicated at the HMI.

5. The elapsed backwash run time for each filter unit shall be calculated and displayed at the HMI. Elapsed time since last backwash shall be displayed at the HMI.

> 13640-4 CONTROL STRATEGY

- 6. An elapsed backwash runtime RESET software pushbutton shall be provided at the HMI.
- 7. The backwash valve(s) open/close status and general fault alarm for each filter unit shall be indicated at the HMI.
- 8. The instantaneous filter level (LIT-410 and LIT-420) shall be displayed on the HMI. Historical trends shall be provided for each filters' level. Each filter level shall be provided with an operator adjustable high level alarm setpoint on the HMI. An alarm shall be displayed on the HMI when the measured level value is above the high level alarm setpoint. This high level setpoint shall be used to control the motor operated valves (MOV) as specified herein.
- 9. A High-high Level alarm (LSHH-410 and LSHH-420) shall be displayed on the HMI.
- C. Filter Flow Meters (FIT-520 and FIT-521)
 - 1. The filter effluent splitter box is equipped with ultrasonic level transmitter that is used to measure the flow over the weir. The level transmitters shall measure, record, and indicate the water level in the filter splitter box at the HMI.
 - 2. Each filter splitter box level shall have an operator adjustable high level alarm that shall be indicated and alarmed at the HMI.
 - 3. The filter flow from each splitter box shall be calculated based on the level as measured by the level transmitter.
 - 4. The instantaneous filter flow, daily maximum flow, daily minimum flow and a daily totalized flow shall be displayed at the HMI for FIT-520 and FIT-521.
- D. PLC-500 Hypochlorite Feed System Modifications
 - 1. The existing PLC-500 for the Hypochlorite Feed System is equipped with an Allen-Bradley Compact Logix PLC that uses the existing FIT-520 and FIT-521 for flow pacing. Since the existing FIT's are being replaced with new FIT-520 and FIT-521 under this project, the Systems Integrator shall be responsible for miscellaneous programming/updating of the existing PLC-500 program to utilize the new FIT's (FIT-520 and FIT-521) as part of the flow pacing controls of the hypochlorite feed system.
- E. Motor Operated Valves (MOV-410, MOV-411, and MOV-412)

13640-5 CONTROL STRATEGY

- The motor operated valves are plug valves equipped with a motor actuator. The motor actuator is equipped with a LOCAL-REMOTE switch. In LOCAL, the valve shall be opened/closed using the OPEN/CLOSE switch/button on the motor actuator.
- 2. Open/closed status, local-remote status, and general fault alarm from the motor actuator shall be displayed on the HMI.
- 3. In REMOTE, the operation of each MOV shall be via the HMI. Each MOV shall be furnished with an HAND-OFF-AUTO software switch at the HMI for selection of the operating mode. In HAND, the MOV shall be remotely opened or closed using OPEN/CLOSE software pushbuttons on the HMI.
- 4. In AUTO, the MOV shall be automatically controlled to open/close based on either the filter level (LIT-410/LIT-420) or the turbidity analyzer (AIT-501/AIT-502) as follows:
 - a. In AUTO, MOV-410 shall be normally closed, MOV-411 and MOV-412 shall be normally opened.
 - b. If the filter level as measured by LIT-410 or the turbidity as measured by AIT-501 is above the high-high level setpoint, MOV-410 shall automatically open. Once MOV-410 is in the open position, MOV-411 shall close. MOV-412 shall remain open during this sequence. This shall direct all flow through MOV-412 to the East Filter.
 - c. If the filter level as measured by LIT-420 or the turbidity as measured by AIT-502 is above the high-high level setpoint, MOV-410 shall automatically open. Once MOV-410 is in the open position, MOV-412 shall close. MOV-411 shall remain open during this sequence. This shall direct all flow through MOV-411 to the West Filter.
 - d. In AUTO, an interlock shall be programmed to prevent MOV-411 and MOV-412 to both be in the closed position.
 - e. In AUTO, an interlock shall be programmed such that if either MOV-411 or MOV-412 is in the closed position, MOV-410 shall be in the open position
 - f. The two above interlocks are to prevent an overflow condition from occurring at the Clarifiers.
 - g. In AUTO mode, should there be a loss of power, upon restoration of power, the MOV shall operate as follows:

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1 2 3 4 5 6			i.	If the MOV is stationary and there is a loss of power, when power resumes, the MOV will remain at their last known state, regardless if communications to the HMI is restored or not.
7 8 9 10			ii.	If the MOV is in motion and there is a loss of power, when power resumes, the MOV will continue to travel to the last command (i.e. open/close), regardless if communications to the HMI is restored or not.
12 13 14 15 16			iii.	The above controls shall not require any operator intervention. (i.e. the loss of power, which may cause a loss of communications with the HMI shall not trip an alarm that requires an operator to acknowledge before controls are restored.)
17 18	1.04	PLC	AND HMI GRAPHI	CS PROGRAMMING
19 20 21 22 23		A.	modifying the exi	shall be responsible for programming, configuring, and sting HMI/OIT SCADA System graphic screens for all I/O wing and specified herein.
24 25 26 27 28 29 30		B.	controls and mon the Contractor a furnish up to an a PLC ladder logic	HMI/OIT graphic screens required in order to provide litoring as specified in Section 13640 shall be furnished by t no additional cost to the University. Contractor shall additional 10% quantity of HMI/OIT graphics screens and programming to provide controls and monitoring of any no additional cost to the University.
31	PAR1	Г 2 — F	PRODUCTS (NOT U	JSED)
32 33 34	PAR1	Г3 – Е	EXECUTION (NOT	USED)
35				END OF SECTION

1			SECTION 15010				
2		BASIC MECHANICAL REQUIREMENTS					
4 5	PART	PART 1 – GENERAL					
6		I AKT I - OLIVLIKAL					
7 8	1.01	SUMN	SUMMARY				
9 0 1 2		A.	This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of these specifications.				
3	1.02	RELA	RELATED DOCUMENTS				
4 5 6 7		A.	Drawings and general provisions of the Contract, including all specification sections apply to the work.				
8 9	1.03	ACCE	ACCESSIBILITY				
9 20 21 22 23 24		A.	Equipment and materials shall be installed allowing for adequate access for service. Coordinate the final location of concealed equipment with the final location of access panels and doors. Allow ample space to remove all parts that may be replaced or require service.				
25	1.04	MECH	HANICAL INSTALLATIONS				
26 27 28 29 30		A.	Coordinate mechanical equipment and materials installation with other building components. Verify all dimensions by field measurements. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.				
32 34 35 36 37		B.	Coordinate the installation of supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning.				
10 11 12 13		C.	Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible. Coordinate the installation of mechanical materials and equipment above ceilings with suspension system, light fixtures, and other installations.				
4 5 6 7		D.	Coordinate connection of mechanical 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.				

1.05 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.06 THIRD PARTY CERTIFICATION

A. All packaged equipment shall be Independently Third Party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulation 29CFR1910.399 and NFPA 70, "National Electrical Code" (NEC), Article 90-7.

PART 2 - PRODUCTS-NOT USED

PART 3 – EXECUTION- NOT USED

END OF SECTION

		SECTION 15062	
		DUCTILE IRON PIPE AND FITTINGS	
PAR	Γ1 – G	ENERAL	
1.01 SCOPE OF WORK			
	A.	The Contractor shall furnish all the materials, tools, labor, supervision and appliances for and properly install, connect, adjust, test and place in continuous satisfactory service all ductile iron pipe and fittings at the locations and to the elevations indicated, specified or required for the proper completion of all work.	
	B.	Wherever Construction activities disturb existing conditions or work already completed, Contractor shall restore the same to its original condition in every detail. All such replacement and repair shall meet with the approval of the Engineer and the Owner.	
	C.	Ductile iron pipe and fittings are not necessarily completely indicated or detailed on the Construction Drawings. The Drawings are schematic only, and indicate pipe and fittings in a general way. It is the Contractor's responsibility to furnish all materials, pipe and fittings required.	
	D.	It is the intent of these Contract Documents to require an installation, complete in every detail, whether or not indicated on the Construction Drawings, or specified herein. Consequently, the Contractor shall be responsible for all details, devices, accessories, and special construction necessary to properly furnish, install, adjust, test, place into continuous satisfactory service, and complete the Work in an acceptable manner.	
	E.	Full responsibility for designing, fabricating, and installing the ductile iron pipe and fittings, for selecting materials of construction, and for demonstrating compliance with specified performance requirements shall rest with the Contractor, and through the Contractor, the Manufacturer and the Material Supplier. The Engineer's approval of 1) the manufacture and installation of the ductile iron pipe and fittings 2) the use of materials included in this Specification, and 3) alternative materials offered by the Contractor, shall not relieve the Contractor and Supplier of full responsibility for meeting all performance requirements and guarantees.	
.02	DESC	CRIPTION OF SYSTEM	
	A.	Piping shall be installed in the locations as shown on the Drawings and as specified herein.	

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B.

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All pipe, fittings, specials and appurtenances used for potable water piping shall

1			be NS	SF-61 certified for continuous contact with potable water.			
3	1.03	REFE	RENCE SPECIFICATIONS, CODES AND STANDARDS				
4 5 6 7 8		A.	All Work specified herein shall be in accordance with the standards of the belo listed organizations, except as otherwise shown or specified. Where referen is made to a standard of one of these, or other organizations the version of t standard in effect at the time of bid opening shall apply.				
9		B.	Ameri	can National Standards Institute (ANSI)			
12			1.	Bl.1 - Standard Specification for Unified Inch Screw Threads.			
3 4 5			2.	B16.5 - Standard Specification for Pipe Flanges and Flanged Fittings and other special Alloys.			
16		C.	Ameri	can Society for Testing Materials (ASTM)			
18 19 20			1.	A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.			
21			2.	C33 - Standard Specification for Concrete Aggregates.			
21 22 23 24 25 26			3.	C128 - Standard Specification for Specific Gravity and Absorption of Fine Aggregate.			
27			4.	C144 - Standard Specification for Masonry Mortar.			
28			5.	C150 - Portland Cement.			
30			6.	D75- Standard Practice for Sampling Aggregates.			
32			7.	E8 - Methods of Tension Testing of Metallic Materials.			
34 35			8.	E23 - Methods for Notched Bar Impact Testing of Metallic Materials.			
36 37			9.	G95 - Cathodic Disbondment Test.			
38 39		D.	Ameri	can Water Works Association (AWWA)			
10 11 12			1.	C104 - Standard for Cement - Mortar Lining for Ductile Iron Pipe and Fittings for Water.			
13 14 15			2.	C105 - Standard for Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.			
16 17 18			3.	C111 - Standard for Rubber - Gasket Joints for Ductile Iron Pressure Pipe and Fittings.			
				DUCTUE IRON PIPE AND FITTINGS			

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1 2 3			4.	C115 - American National Standard for Flanged Ductile-Iron Pipe with Threaded Flanges.
4 5			5.	C150 - Standard for the Thickness Design of Ductile Iron Pipe.
6 7 8 9 10 11			6.	C151 - Standard for Ductile - Iron Pipe. Centrifugally Cast for Water or Other Liquids.
			7.	C153 - Standard for Ductile Iron Compact Fittings. 3-inch through 16-inch for Water and Other Liquids.
12 13 14			8.	C600 - Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.
15 16			9.	C651 - Standard for Disinfecting Water Mains.
17 18		E.	NSF I	International, The Public Health and Safety Company
19 20			1.	No. 60 - Drinking Water Treatment Chemicals - Health Effects.
21			2.	No. 61 - Drinking Water System Components - Health Effects.
23 24	1.04	SUBN	/IITTAL	S
25 26 27 28 29		A.	all ap 01300	Contractor shall submit Shop Drawings to the Engineer of pipe, fittings and purtenances in accordance with these Contract Documents and Sections 2 and 01340. The requirements of AWWA C110, C150, C151 and the ring supplemental requirements are applicable:
30			1.	Certified dimensional drawings of all pipe, specials and fittings.
32 33 34 35 36			2.	Joint and pipe/fitting wall construction details, which indicate the type and thickness of the wall; manufacturing tolerances; performance history; and all other pertinent information required for the manufacture of the product.
37 38 39 40 41 42 43 44 45 46			3.	Details of fittings and specials such as elbows, wyes, tees, outlets, connections, test bulkheads, bosses and nozzles or other specials where shown on the Construction Drawings, which indicate amount and position of reinforcement. All fittings and specials shall be properly reinforced to withstand the internal pressure both circumferential and longitudinal, and the external loading conditions as indicated in the Contract Documents. Shop Drawings shall clearly detail special castings indicating all pertinent dimensions.
47 48		B.	The C	Contractor shall furnish a certified affidavit of compliance for all pipe and DUCTILE IRON PIPE AND FITTINGS

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1 other products or materials furnished under this Section of the Specifications, 2 as specified in ANSI/AWWA C105, C110, C150, and C151; respectively, and 3 certified copies of the following supplemental data for all pipe, fittings, and 4 specials: 5 6 1. The Supplier shall provide, through the Contractor, a sworn statement 7 that the inspection and all specified tests have been made and all results 8 thereof comply with the requirements of these Specifications. 9 10 C. All expenses incurred in making samples for certification of tests and in the preparation of any design reports shall be borne by the Contractor. 11 12 13 D. Approval of the Shop Drawings shall not relieve the Contractor of the 14 responsibility to ensure that the pipe is designed and installed in strict 15 accordance with the Contract Documents. 16 17 1.05 QUALITY ASSURANCE 18 19 Α. The Contractor shall furnish materials under this Section that are new, unused 20 and as specified, or if not particularized herein, which are the best of their respective kind, free of defects and imperfections, and suitable for the service 21 22 intended, subject to the approval of the Engineer. 23 В. 24 The Contractor shall provide workmanship that is first class in every respect, 25 and have the installation performed by workmen thoroughly experienced in such 26 work. A neat and workmanlike appearance in the finished Work shall be 27 required. 28 29 C. The Contractor shall perform Work in accordance with all applicable laws and regulations and in accordance with all applicable permits and easements. 30 31 32 D. The ductile iron pipe furnished under this Specification shall comply with AWWA 33 C151 except as it may be modified herein. 34 35 E. Welders and welding methods shall be certified to a nationally recognized welding specification for the type of ductile iron used to manufacture the pipe 36 and fittings. 37 38 F. 39 All test equipment used in activities affecting quality control shall be calibrated and certified at not longer than annual intervals, unless otherwise specified or 40 41 required. 42 43 G. All pipe shall be clean, sound, and without defects. No manner of repair will be

> DUCTILE IRON PIPE AND FITTINGS 15062-4

accepted, unless otherwise specified or approved by the Engineer.

The Contractor, at no additional cost to the Owner, shall perform all the testing and recording that is required in these Specifications unless otherwise specified.

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Н.

I. The Engineer shall have the right to determine the amount of pipe to be rejected as defined in AWWA C151 Section 5.7.1 "Determining Rejection."

1.06 SUPPLIER'S QUALIFICATIONS

A. All pipe shall be manufactured, fabricated, coated, cement mortar-lined or epoxy-lined by a single qualified Manufacturer. Fittings may be fabricated and the lining for force main pipe and fittings may be applied at a site other than where the pipe is manufactured. The Manufacturer shall have at least 5 years experience in work similar in specification to that which is to be furnished on this project. The Manufacturer shall be required to show experience in supplying pipe in environments similar to those expected to exist on this project and that the pipe supplied in those environments has functioned satisfactorily.

16 1.07 SHOP TESTS

A. All pipes shall be tested by the Manufacturer in accordance with AWWA C104, C110, C150, and C151, the Manufacturer's standard procedures, and this Specification. Shop Tests shall be subject to witness by the Engineer and/or Owner, and/or the Owner's Representative and certified test reports shall be submitted to the Engineer by the Contractor for approval. No lot of pipe shall be shipped to the site of the Work until acceptable shop tests are completed and approved.

26 1.08 INSPECTION

A. All Work under this Specification, including but not limited to proof of design testing, shop testing and the production of the pipe, fittings and specials, shall be subject to inspection by the Owner's representatives and/or the Engineer in the Supplier's plant. All travel, lodging and meal costs associated with this plant inspection shall be incurred by the Owner and/or the Engineer.

B. The Engineer shall have the right to order any pipe that, in the Engineer's opinion, does not meet the Specifications to be rejected and not shipped to the Project site.

PART 2 - PRODUCTS

2.01 GENERAL

 A. All ductile iron pipes, including flanged, mechanical joint, push-on joint, restrained joint, and plain end pipe, shall be manufactured in accordance with ANSI/AWWA Specification C 151/A 21.51.

B. Where ductile iron pipe is supplied for the Project or shown on the Drawings, above ground pipe shall be flanged and buried (underground) pipe shall be

1		mechanical joint, restrained joint or push-on joint, as required.
2 3 4 5 6 7	C.	All ductile iron fittings shall be marked in accordance with ANSI/AWWA C 110/A 21.10 Section 10-9, "Markings on Fittings." All ductile iron pipe shall be marked in accordance with Section 51-10, "Marking Pipe" of ANSI/AWWA Specification C 151/A 21.51.
8 9 10	D.	Maximum pipe laying lengths shall be 20 feet with shorter lengths provided as required by the Construction Drawings or to complete the Work and as allowed by AWWA C151.
11 12 13 14	E.	Shop cement-mortar lined pipe shall have smooth dense interior surfaces and shall be free from fracture, excessive interior surface crazing and roughness.
15 16 17 18	F.	Pipe joints shall not be bonded for electrical conductivity in accordance with these Specifications and the details as shown on the Construction Drawings and the following schedule:
19 20 21		 All blow-offs, air valve assemblies, and lateral connections to or from the pipe shall not be fitted with dielectric gaskets and/or couplings.
22 23 24 25	G.	All materials that may be in contact with the water being conveyed (linings, gaskets, lubricants, grout, disinfecting agents, etc.) shall be in accordance with and approved by the appropriate NSF Standard 60 or 61.
26 2.02	2 DESI	GN CRITERIA
27 28 29 30 31 32 33	A.	The pipe furnished under this section shall be ductile iron pipe, cement mortar or epoxy lined and asphalt coated, with EPDM gasket joints. The pipe shall consist of a cast ductile iron wall, shop lined with Portland cement mortar (potable water and reclaimed water) or epoxy (sanitary force main) and an exterior coating of asphalt.
34 35 36	В.	The pipe shall be designed, manufactured, tested, inspected, and marked according to applicable requirements stated herein and except as modified, shall conform to ANSI/AWWA C104, C150, C151.
37 38 39 40 41	C.	Pipe supplied for this project shall be suitable for use with neutral pH (approximately 7.0) meeting FDEP Part IV water quality standards (reclaimed water), domestic raw sewage (force mains) or chloraminated drinking water (potable water).
42 43 2.03	3 PIPE	DESIGN
44 45 46 47	Α.	All ductile iron pipe shall have a minimum wall thickness corresponding to Class 150, as calculated according to AWWA C150.

1 2 3 4 5	B.	Where threaded flanges are used on ductile iron pipe, the minimum thickness of the pipe wall at the last critical thread after threading shall not be less than the minimum calculated thickness of the pipe including net thickness, casting tolerance and service allowance.
6 7 8 9	C.	The Contractor shall provide design data on the pipe including calculations showing the separate and combined stresses in the wall of the pipe due to the design loads.
10 2.04 11	MAT	ERIALS
12 13 14 15 16	A.	All ductile-iron pipes shall meet the requirements of ANSI/AWWA C 151/A21.51. The interior of the pipe shall be finished so that the Hazen-Williams friction factor will not be less than 130. Each length of pipe shall be hydrostatically tested to at least 500 psi by the manufacturer in accordance with ANSI/AWWA C 151/A21.51. Additionally, 30-inch and larger pipe shall be hydrostatically tested

 pipe.

B. Castings and connecting pieces, such as bell and bell, bell and spigot, bell and flange, flange and flange, flange and spigot, and flange and flare, shall meet the requirements of ANSI/AWWA C110/A21.10. Connecting pieces may be fabricated.

to 75% of the yield strength of the metal, based on the nominal thickness of the

C. The exterior of exposed ductile iron pipe, fittings, glands and bolts shall be field coated in strict conformance with the coating manufacturer's recommendations and Section 09900.

D. Pipe that is to be buried shall have the standard asphaltic outside coating specified in ANSI/AWWA C151/A21.51.

E. The weight and class designation shall be painted conspicuously in a contrasting color on the outside of each pipe, fitting, and special casting after the shop coat has cured.

F. Epoxy lining for force mains shall be an amine cured epoxy containing at least 20% ceramic quartz pigment by volume. The standard of quality is Proteco 401 Ceramic Epoxy or approved equal.

40 2.05 JOINTS

A. Flanges and flanged joints for ductile iron piping shall conform to the dimensions and requirements of ANSI Specification B 16.1. Where threaded flanges are used, they shall be ductile iron and conform to the requirements of ANSI/AWWA Specification C 115/A 21.15. All flanged ductile iron pipe and fittings shall be rated for 250 pound working pressure and shall be faced and drilled to match ANSI B16.1 Class 125 flanges unless special drilling is called for or required.

- Where tap or stud bolts are required, flanges shall be drilled and tapped accordingly.
- B. All pipe flanges shall be coated with a rust preventive coating, as specified in ANSI/AWWA Specification C 115/A 21.15, immediately after they have been faced and drilled.
- C. Flanged bolt holes on each end of flanged pipe and fittings shall accurately straddle the same horizontal and vertical centerlines unless special drilling is called for, or required.
- D. The Contractor shall be responsible for assuring that the flanges of the pipe are compatible with the flanges of the various components and/or appurtenances.
- E. Flanged pipe, approximately twelve (12) inches or less in length, shall have flanges cast solidly to pipe barrel. Flanges on pipe longer than twelve (12) inches in length may be of the threaded type. Pipe threads shall be of such length that, with flanges screwed home, the end of the pipe shall project beyond the face line of the flange. Flange and pipe shall then be faced to give a flush finish to the flange and the flange surface shall be normal to the axis of the pipe. Flanges shall be of such design that the flanged neck completely covers the threaded portion of the pipe to protect it against damage and corrosion.
- F. Push-on joints for ductile iron piping shall conform to the dimensions and requirements of ANSI/AWWA Specification C111/A 21.11 as they apply to push-on joints.
- G. Mechanical joints for ductile iron piping shall conform to the dimensions and requirements of ANSI/AWWA Specification C 111/A 21.11. Where stud bolts are required, bells shall be drilled and tapped accordingly. The Contractor shall tighten joint bolts by the use of approved wrenches, to a tension recommended by the pipe Supplier.
- H. Where joints are in contact with liquids, or buried underground, the Contractor shall paint all bolts and nuts with two (2) heavy coats of coal tar pitch and where joints are buried, the joints, including glands and bolts, shall be wrapped with two laps of 8 mil polyethylene film and sealed to the pipe with polyethylene adhesive tape.
- I. Restrained Joints:
 - All buried pipe shall be restrained as shown on the Drawings and as specified herein. Pipes subject to pressure or being fed by a pumping system shall be restrained based on the pressures shown on the drawings or specified elsewhere herein. Pipes subject to gravity flow shall be restrained based on 30 psi of working pressure. Restrained joint length indicated in the Tables included on the Drawings represents the

1 length on all sides of fittings and valves within which all joints must be 2 restrained. As a minimum, the joints at all fittings and valves shall be 3 restrained. 4 5 2. Restrained joints shall be capable of holding against withdrawal for line 6 pressures 50 percent above the normal working pressure, but not less 7 than 200 psi. The pipe and fittings shall be restrained push-on joints or 8 restrained mechanical joints. 9 10 3. The pipe Supplier's standard restrained joints shall be of the type utilizing cast lugs, shop welded retainer lugs or retainer rings bearing against pipe 11 shoulders. Field installed joint restraint systems, such as Megalugs, as 12 manufactured by EBAA Iron, or approved equal, are required for 13 14 restraining mechanical joint fittings. Field welding or grooving of the restrained joint or components shall not be acceptable. Restrained joints 15 shall be capable of withstanding full bulkhead thrust that can be 16 developed within the pipeline due to the sum of the working and surge 17 18 pressures. 19 20 4. Thrust blocks shall not be permitted unless specifically identified on the 21 Drawings. 22 23 Joints in tunnels and casings shall be restrained joints as defined 5. 24 previously. 25 26 2.06 **FITTINGS** 27 28 All restrained joint, flanged, mechanical joint, and push-on joint shall be ductile Α. iron and shall be manufactured in accordance with, and shall meet the 29 requirements of ANSI/AWWA Specification C 110/A 21.10 or C153. 30 31 32 B. Dimensions of flanged fittings not included under ANSI/AWWA Specification 33 C110/A 21.10 shall conform to the requirements of ANSI Specification B 16.1. 34 Class 125. Fittings shall be short radius (compact) type were possible. 35 C. All fittings shall meet the requirements, as to dimensions and weights, as shown 36 37 in the current Edition of the "Handbook of Ductile Iron Pipe" of the Ductile Iron 38 Pipe Research Association. 39 40 D. All fittings furnished under ANSI/AWWA Specification C110/A 21.10 or C153 shall be ductile iron and shall have the same minimum pressure rating as the 41 42 pipe to which it is connected. 43 E. 44 Special fittings, where required, shall be of an approved design and have the 45 same diameters and thickness as standard fittings, unless otherwise required, 46 but their laying lengths and other functional dimensions shall be determined by 47 their positions in the pipelines and by the particular piping materials to which they connect. 48

> DUCTILE IRON PIPE AND FITTINGS 15062-9

2.07 INTERIOR LINING

A. Potable Water and Reclaimed Water Piping:

- 1. All ductile iron pipe and fittings shall be lined with standard single thickness cement mortar lining and bituminous seal coated inside, at the point of manufacture, in accordance with ANSI/AWWA Specification C 104/A 21.4. Portland cement for cement mortar lining shall be in accordance with the requirements of ASTM C150, Type II cement. Shop cement-mortar lined pipe shall have smooth dense interior surfaces and shall be free from fractures, excessive interior surface crazing, disbondment, and roughness.
- 2. The Contractor shall take precautions to prevent damage to the interior lining and shall repair all damaged linings to the satisfaction of the Engineer.
- 3. Test records shall be submitted to the Engineer for his review and approval.
- 4. The use and type of any admixtures must be approved by the Engineer prior to their use. All material batching shall be by weight.
- 5. The method of placing and curing of the mortar lining shall be one with which the manufacturer has experience and can demonstrate a successful history. The lining shall be cured in a manner acceptable to the Engineer so that it will provide a hard and durable lining with a minimum of cracks, surface crazing and disbonded areas.

B. Epoxy Lining for Wastewater Service

- 1. Prior to abrasive blasting, the entire area to receive the protective compound shall be inspected for oil, grease, etc. Any areas with oil, grease, or any substance that can be removed by solvent, shall be solvent cleaned to remove those substances. After the surface has been made free of grease, oil or other substances, all areas to receive the protective compounds shall be abrasive blasted using sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering oxide may be left on the surface. Any area where rust reappears before lining must be re-blasted.
- 2. After the surface preparation and within 8 hours of surface preparation, the interior of the pipe shall receive 40 mils nominal dry film thickness of Protecto 401. No lining shall take place when the substrate or ambient temperature is below 40 degrees Fahrenheit. The surface also must be dry and dust free. If flange pipe or fittings are included in the project, the

lining shall not be used on the face of the flange.

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3. Due to the tolerances involved, the gasket area and spigot end up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum using Protecto Joint Compound. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

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16 17 4. The number of coats of lining applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining material manufacturer. To prevent delamination between coats, no material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.

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5. Protecto Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.

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23 2.08 EXTERIOR COATINGS

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- A. The exterior of all pipe and fittings to be submerged in water and for underground installation shall be given a bituminous coating at the point of manufacture, in accordance with ANSI/AWWA Specification C 151/A 21.51.
- 28 29
- B. The exterior of all above ground shall be per Section 09900 Painting and Protective Coatings.

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31 2.09 PIPE APPURTENANCES

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Α. Threaded flanges shall be ductile iron and shall meet the requirements of ANSI/AWWA C115/A21.15. Flanges with long hubs for flanged pipe shall be screwed on the threaded end of the pipe in the shop. The face of the flange and the end of the pipe shall be refaced together. There shall be no leakage through the pipe threads, and the flanges shall be designed to prevent corrosion of the threads from outside. Flanges shall meet the requirements of ANSI B16.1, and shall be faced and drilled to that standard, unless special drilling is called for or required. The Contractor shall be responsible for assuring that the flanges of the pipe are compatible with the flanges of the various components and/or appurtenances. They shall be faced accurately at right angles to the pipe axis, drilled smooth and true, and the machined faces covered with zinc dust and tallow or equivalent material. The back of the flanges and bolt holes shall be coated with asphaltic coating meeting the requirements of ANSI/AWWA C151/A21.51, Section 51-8.1. Coating material shall be applied immediately after facing and drilling. Where tap or stud bolts are required, flanges shall be

> DUCTILE IRON PIPE AND FITTINGS 15062-11

tapped. All flanged joints shall be thoroughly bolted through, stud or tap bolts of required size. All flanged joints buried underground shall also be protected as specified under Section 2.08. Only flanges made in USA shall be supplied to the Project.

B. All bolts, studs, and threaded rods used in the finished work for flanges shall be of Type 316 stainless steel and shall conform to the ASTM A 307 Grade B. The ends of all bolts shall be finished to the standard radius in an acceptable manner. All screw threads shall be "American Standard, Coarse Thread (N.C.). Stud bolts shall be hexagonal, cold pressed semi-finished and made of medium open-hearth steel. All dimensions shall be in accordance with "American Standard, Heavy." Nuts used shall be "Grade A Heavy Hex" in conformance with ASTM A563 and be compatible with the bolts. Bolts and nuts shall be Type 316 stainless steel.

C. All nuts and bolts that come into contact with water or that are to be buried shall be painted with two (2) heavy coats of an approved coat tar pitch, in accordance with Section 09900.

 D. Gaskets for flanged joints shall be full-faced type EPDM gaskets one-eighth (1/8) inch thick. All gaskets for flanged joints shall be EPDM having a Durometer of 75 to 85 or neoprene having a Durometer of 55 to 65. As an alternate, the Contractor may supply the pipe Supplier's (manufacturer's) gasket such as American Cast Iron Pipe Company's "Toruseal" gasket or U.S. Pipe's "Flange Tyte" gasket. Gaskets for bell and spigot joints shall be fabricated and tested in accordance with AWWA C111.

E. Subject to the Engineer's approval, welded outlets shall be allowed; however, the welded-on outlet diameter shall not be greater than one quarter the diameter of the main line.

32 2.10 COMPRESSION SLEEVE COUPLINGS

 A. The Contractor shall furnish and install where required or where shown on the Drawings, manufactured compression couplings equal to Style 38 or Style 39 where isolating dielectric couplings are required, as manufactured by the Dresser Manufacturing Division of Dresser Industries or an approved equal. The compression couplings shall consist of two (2) steel follower flanges, one (1) steel middle ring with pipe stops removed, and sufficient rolled thread, track-head bolts to properly compress the gaskets. After fabrication, the middle and follower rings shall be cold expanded to size and dimension. Thickness of the middle ring shall be suitable for the pressures specified, and the application, and in no case be less than one-half (1/2) inch thick. All parts of the compression coupling shall be galvanized or heavily cadmium plated at the point of manufacture and shall be epoxy coated in accordance with AWWA C210 or AWWA C203.

B. The entire compression sleeve coupling unit shall be rated for working pressure DUCTILE IRON PIPE AND FITTINGS

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plus surge pressure as a minimum.

C. The Contractor shall provide field coating for buried couplings in accordance with AWWA C203 and these Contract Documents.

D. Small deflections in the pipe alignment shall be allowed at compression type coupling joints, but such deflections shall not exceed three (3) degrees between any two (2) adjacent pipe sections. Where changes in line and/or grade in excess of three (3) degrees are required the deflections shall be made by deflecting multiple joints or by using fittings approved by the Engineer.

12 PART 3 - EXECUTION

14 3.01 HANDLING PIPE AND FITTINGS

 A. The Contractor shall transport, deliver and distribute along the line of the work, the pipe, specials and appurtenances. All Work shall be in strict accordance with the provisions of applicable permits and easements.

 B. Pipe shall be loaded for shipment upon suitable cars or trucks that shall be provided with padded bunks with nylon belt tie-down straps or padded banding. In loading and unloading the pipe, more than ordinary care shall be taken to prevent any injury to the pipe, ends, coatings and connections. Such work shall be done slowly with the pipe at all times under control, and under no condition shall the pipe be dropped. Field repair of damaged pipe shall not be allowed, except for linings and coatings. The pipe shall be protected during shipping by covering or some other means acceptable to the Engineer to prevent contamination of the pipe and to protect the lining from drying during transport.

 C. All pipe, fittings, etc., shall be carefully handled and protected against damage to the lining and coating/interior and exterior surfaces, impact shocks, and free fall. All pipe handling equipment shall be acceptable to the Engineer. Pipe handling equipment shall consist of wide belt slings, padded cradles, or other devices designed and constructed to prevent damage to the pipe or coatings. The use of forks, chains, hooks, or other equipment that may damage the pipe or its lining or coating shall not be allowed.

D. In distributing the pipe in the field, each pipe shall be placed as nearly as possible to the point where it is to be laid, and facing in the proper direction. Pipe shall not be placed directly on rough ground but shall be supported in a manner that will protect the pipe against injury whenever stored at the trench site or elsewhere. Coated pipe shall be stored on padded skids, sand or dirt berm, sand bags, or other suitable means so that coating will not be damaged. Coated pipe shall be handled with wide belt slings. Pipe fittings and specials which are placed in storage, streets or drives must be so arranged as not to cause undue inconvenience to traffic and must be protected sufficiently to prevent any damage including but not limited to the interior lining and exterior

 coatings. Chains, cables or other equipment likely to cause damage to the pipe, fitting or special coating or lining shall not be used. Pipe which has been improperly distributed and which must be moved longitudinally along the trench shall be reloaded on a suitable car or truck or lifted and swung by a derrick or moved by such means as may be satisfactory to the Engineer.

- E. If in the process of manufacture, transportation, or handling, any ductile iron pipe, fitting or special receives any deformation to the pipe wall, ends or connections, such pipe, fitting or special shall be rejected and replaced at the Contractor's expense.
- F. In the presence of the Engineer, the Contractor shall inspect upon delivery all pipe, fittings, and specials and mark as "rejected" all pipe lengths and fittings or specials exhibiting signs of damage to the exterior coating, interior cement mortar linings, joint ends, or pipe wall and the Contractor shall at the Contractor's expense immediately remove the same from the job site, or repair to the Engineer's satisfaction. Any pipe, fittings or specials deemed not suitable for installation shall be replaced in kind by the Contractor at the Contractor's own expense.
- G. The Contractor shall inspect each pipe and fitting to insure that there are no damaged portions of the pipe. If any defective pipe is discovered after having been laid, it shall be removed and replaced with a sound pipe or fitting in a satisfactory manner, by the Contractor at the Contractor's own expense.
- H. The Contractor shall thoroughly clean each pipe or fitting of any foreign substance that may have collected on or in it prior to the pipe or fitting being placed in the trench. The openings of all pipes and fittings in the trench shall be closed during any interruption of the Work. As pipe laying progresses, the Contractor shall keep the pipe interior free of all debris. The Contractor shall completely clean the interior of the pipe of all sand, dirt, mortar splatter, and any other debris following completion of pipe laying, pointing of joints and any necessary interior repairs prior to testing and disinfecting the completed pipeline.

36 3.02 INSTALLATION OF PIPE

- A. Ductile iron piping shall be installed in strict accordance with the manufacturer's instructions. Pipe shall be laid only after the trench has been excavated as described Division 2 of the Specifications. Pipe laid in trench shall be laid to a firm and even bearing for its full length. Precautions shall be taken against flotation. The pipe shall be backfilled with selected fine excavated material as shown on the Drawings and thoroughly compacted to one foot above the top of the pipe and thereafter backfilled as specified in Section 02221.
- B. Precautions shall be taken against flotation. Pipe shall be laid directly on the bedding material. Pipe shall be laid in the trench where the bedding forms a

 continuous and uniform support for the full length of the pipe except that the grade may be disturbed for the removal of lifting tackle. Bell holes shall be formed at the ends of the pipe to prevent point loading at the bells or couplings. Excavation shall be made as needed outside the normal trench section at field joints to permit adequate access to the joints for field connection operations.

- C. Each section of pipe shall be laid in the order and position shown on the laying schedule. In laying pipe, it shall be laid to the set line and grade, within plus or minus one inch.
- D. The maximum obtainable separation between raw water, potable water, reclaimed water ad sewage lines shall be practiced. A minimum horizontal separation of 3 feet, outside to outside, shall be maintained between raw water lines, potable water mains and reclaimed water mains or a minimum of 6 feet separation between sewage lines and either water or potable water lines. In instances where water lines cross a potable water main or a sewage collection line, a minimum vertical separation of 12 inches shall be maintained between the invert of the upper pipe and the crown of the lower pipe. In instances where a vertical separation of 12 inches between a raw water line and a potable water main or a sewage collection line cannot be achieved, then the raw water line shall be placed in a cast iron sleeve or encased in concrete centered at the point of crossing.
- E. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the Engineer may change the alignment and/or the grades. Such change shall be made by the deflection of joints, or by the use of additional fittings.
- F. Except for short runs that may be permitted by the Engineer, pipe shall not be laid uphill on grades exceeding 10 percent. Pipe that is laid on a downhill grade shall be blocked and held in place until sufficient support is furnished by the following pipe to prevent movement.
- G. Contractor shall coordinate yard piping installation such that a minimum of 36 inches of cover is maintained over piping at all times, unless otherwise indicated on the plans. At crossings, a minimum of 6 inches of vertical separation between pipes shall be maintained while also maintaining 36-inch minimum cover, unless otherwise indicated on the Drawings.
- H. Bedding and backfilling shall be in accordance with Section 02221 of these Specifications and the details shown on the Construction Drawings.
- I. Bedding shall be carefully worked into the area between the trench bottom and the pipe wall to keep it round. Bedding shall not be deposited on top of the pipe, but alongside it, and in such a way that it rises evenly on both sides.
- J. All joints shall be assembled in accordance with the Manufacturer's

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recommended procedures. In general the procedure shall be as described herein. Immediately before jointing pipe, the bell of the pipe shall be thoroughly cleaned, and a clean gasket shall be placed in the bell groove. The spigot shall be carefully cleaned and the bell containing the gasket and the spigot lubricated with a vegetable-based lubricant. The spigot of the pipe section shall then be aligned with the bell end and inserted into the bell of the previously laid joint and telescoped into its proper position. Tilting of the pipe to insert the spigot into the bell will not be permitted.

- K. Restrained joints shall be assembled in a similar manner as described above except that the restraining device shall be installed in accordance with the Manufacturer's recommended procedures.
- L. Bolt holes of flanges shall straddle the field horizontal and field vertical centerlines of the pipe. The Contractor shall clean flanges by wire brushing before installing flanged fittings. The Contractor shall clean flange bolts and nuts by wire brushing.
- M. The Contractor shall insert the nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension. The Contractor shall execute care when tightening joints to prevent any strain upon valves, pumps and other equipment. After tightening all bolts any stulls shall be removed from the interior of the pipe if it is not to be buried.
- N. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Flanged joints shall be watertight.
- Ο. Pipe stulls, if recommended by the Supplier, shall be left in place until bedding and backfilling operations have been completed. After the backfill has been placed, the stulls shall be removed and shall remain the property of the Contractor.
- Ρ. After stulls are removed, the Contractor shall check the inside diameter of the pipe to verify that deflection has not exceeded the allowable 3 percent. The frequency of checking shall be as directed by the Engineer but in no case shall be less than the frequency of soil density testing.
- All pipes shall be laid with a 2-inch metallic tape, appropriately color coded and Q. imprinted with the type of service, 12 inches below final grade and directly above the utility, for identification and ease of location. The appropriate tape color codes are as follows:
 - 1. Sanitary Force Main: Green
 - Potable Water: Blue 2.
 - 3. Reclaimed Water: Purple

- R. Care shall be taken in bolting flanged joints so that there is no restraint on the opposite end of one piece which would induce stresses in the pipe or fitting or prevent pressure from being evenly and uniformly applied upon the gasket. The pipe or fitting shall be free to move in any direction while bolting. Bolts shall be gradually tightened, each in turn, at a uniform rate of gasket compression around the entire flange.
- S. No pipe shall be installed upon a foundation into which frost has penetrated or at any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation. No pipe shall be laid unless it can be established that the trench will be backfilled before the formation of ice and frost occurs.
- T. Pipes underneath structures and slabs shall be ductile iron and shall have a 6-inch minimum concrete encasement for pipes 24 inches and smaller (except pipes 3 inches and smaller, which shall be SCH 80 PVC). 8-inch minimum concrete encasement for pipes larger than 24 inches up to and including 36 inches and 9 inches minimum concrete encasement for pipes larger than 36 inches. Concrete encasement shall extend a minimum of 12 inches past edge of structure or slab.
- U. All pipe and fitting joints occurring within restrained joint limits as required on the Construction Drawings, or as ordered, shall be properly secured to prevent thrust forces from pulling the pipeline joints apart. All tied joints shall be harnessed by using the pipe Manufacturer's standard restrained joint arrangements conforming to these Specifications. Where approved by the Engineer, joints may be restrained by the use of rods and clamps. The rods and clamp harnessing arrangements shall be installed utilizing lugged fittings and pipe with saddle clamps placed to bear against the pipe bells. Saddle clamps around the barrel of the pipe that depend on friction or set screws to prevent sliding of the clamp are not acceptable. The pipe clamps, tie rods and their assembly shall meet the requirements of the National Fire Protection Association Bulletin No. 24. After each tied joint is connected up, all pipe clamps, bolts, heads, tie rods and nuts shall be coated as recommended by the Supplier.
- V. Careful inspection shall be made of every joint to insure a smooth continuous interior surface. The Contractor shall thoroughly clean the interior of the pipe and remove any obstructions that may reduce the pipe's carrying capacity. Following completion of pipeline progressively or in sections, including completion of inside inspections, insofar as might be possible or practicable, the line shall be kept partially filled with water.
- W. The Contractor shall patch the cement mortar lining of any pipe that has a crack exceeding the allowable crack as determined by the Engineer. Lining failures that exceed 100 square inches and that have dimension greater than 12-inches shall be cause for the pipe to be rejected. There shall not be more than one patch on the lining of any one joint of pipe, fitting or special.

DUCTILE IRON PIPE AND FITTINGS 15062-17

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DRILLING AND TAPPING 47

Α.

DUCTILE IRON PIPE AND FITTINGS 15062-18

X. Wherever necessary and approved by the Engineer, patches shall be made by the Contractor with a mortar of one part Portland cement and two parts clean, sharp sand; all measurements to be by weight. No pipe requiring the lining to be patched shall be installed until the patch is placed. Pipe thus patched shall not be installed until the patch has been properly and adequately cured and approved for laying by the Engineer.

Y. All buried process piping (excluding drainage and stormwater piping) shall be restrained in accordance with the restrained joint table provided in the Drawings. Pipes subject to pressure or being fed by a pumping system shall be restrained based on a 150 psi working pressure. Pipes subject to gravity flow shall be restrained based on a 30 psi working pressure. Restrained joint length indicated in the Tables represents the length on all sides of fittings and valves within which all joints must be restrained. As a minimum, the joints at all fittings and valves shall be restrained. Restrained joints shall be capable of holding against withdrawal for line pressures 50 percent above the normal working pressure but not less than 150 psi on pipe subject to pressure and 30 psi on pipe subject to gravity flow. The pipe and fittings shall be restrained mechanical joints.

A. Whenever pipes require cutting to fit into the lines, the work shall be done in a satisfactory manner so as to leave a smooth end, at right angles to the axis of the pipe. Pipe cutting shall only be done by saws specifically designed for that purpose. After cutting, the end of the pipe shall be beveled to the dimensions of the Manufacturer's specifications.

COMPRESSION SLEEVE COUPLINGS 29 3.04.

CUTTING PIPE

- The Contractor shall thoroughly clean with a wire brush all surfaces that will be Α. in contact with the gaskets.
- B. The follower rings shall be placed over the pipe ends, then the Contractor shall slip the gaskets that have been lubricated with an approved vegetable based lubricant over the pipe ends. The Contractor shall place the middle ring over the previously laid pipe then insert the end of the joining pipe into the middle ring, and position both gaskets evenly in the middle ring gasket grooves. The Contractor shall insert bolts in bolt holes of follower rings and tighten nuts in the sequence and with the torque requirements of the coupling manufacturer. After tightening all bolts the stulls shall be removed from the interior of the pipe if it is not to be buried.

Where shown on the Construction Drawings or where required, ductile iron pipe,

1 2 3 4 5			fittings or specials shall be drilled and tapped to receive drainage outlets, air relief outlets, or other pipe or plugs for pressure testing and/or chlorination. Holes shall be drilled accurately and at right angles to the axis of the pipe or fitting.
6 7 8 9		B.	Where size of the outlet pipe to be connected is such as to require bosses or reinforcement saddles for making the connection, the Contractor shall furnish such outlet connections with bosses or reinforcement saddles drilled and tapped as indicated on the Construction Drawings or as approved by the Engineer.
11	3.06	SURF	ACE PREPARATION AND PAINTING
13 14 15		A.	The Contractor shall remove all debris, dirt, grease, mortar and other foreign material by the use of soap and water or other solvent as may be required.
16 17 18 19		B.	After each joint has been made the Contractor shall give all steel bolts and nuts a chemical wash of the phosphate type followed by one (1) coat of primer especially prepared for the finish of the bolt and nut installed. After this pretreatment, the Contractor shall coat all bolts and nuts as follows:
20 21		C.	Give all bolts and nuts that will be exposed one (1) coat of primer.
22 23 24 25		D.	Paint all bolts and nuts that will be underground in accordance with these Contract Documents.
26 27		E.	All piping and fittings shall have its surface prepared and painted as specified in Section 09900.
28 29 30	3.07	SUPP	LIER'S FIELD SERVICE
31 32 33 34 35 36 37		Α.	Contractor shall, at no additional cost to Owner, arrange for pipe Manufacturer's field representative to be on-site and provide instruction to each crew working during the installation of a minimum of four push-on joints and four restrained joints The Manufacturer's field representative shall certify that the installations observed were satisfactorily completed and all pipe installation crews were familiar with the proper methods and procedures for the pipeline installations.
38 39	3.08	FLUS	HING AND TESTING
40 41 42 43 44 45		Α.	The Contractor shall remove all sand and foreign matter from the pipeline as work progresses. The ends of all pipes shall be suitably closed, in a manner approved by the Engineer, at each break or pause in pipe laying, and at the end of each work day, so as to minimize the amount of materials that can enter the pipe.
46 47 48		B.	Prior to pressure testing, all 24-inch and smaller mains shall be flushed to remove all sand and other foreign matter. The velocity of the flushing water shall not be less than 2 feet per second. Flushing shall be terminated at the DUCTILE IRON PIPE AND FITTINGS

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direction of the Engineer. The Contractor shall dispose of the flushing water without causing property damage or violation of environmental regulations or permits.

C. Prior to pressure testing, all 30-inch and larger mains shall be televised. All dirt and foreign matter shall be removed and the pipe shall be cleaned in a manner approved by the Engineer. After cleaning, the mains shall be re-televised. Preand post-cleaning videotapes shall be furnished to the Owner.

END OF SECTION

			SECTION 15064		
			POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS		
PART	- 1 - G	ENERA	AL		
1.01	SCO	SCOPE OF WORK			
	A.	locati	sh all labor, materials, equipment and incidentals required and install in the ons as shown on the Drawings, the PVC piping, fittings and appurtenances ecified herein.		
1.02	DES	CRIPTI	ON OF SYSTEM		
	A.	Pipin	g shall be installed in the locations as shown on the Drawings.		
1.03	QUA	LIFICA	TIONS		
	A.	manu manu cons	PVC pipe, fittings and appurtenances shall be furnished by a single a single of the items to be furnished. The equipment shall be designed, tructed, and installed in accordance with the best practices and methods shall comply with these Specifications.		
1.04	SUBI	MITTAI	_S		
	A.	the	drawings shall be submitted to the Engineer for review in accordance with General Conditions and shall include dimensioning and technical fication for all piping to be furnished.		
	B.	Subn	nit to the Engineer, for review, samples of all materials specified herein.		
1.05	тоо	LS			
	A.	•	ial tools, solvents, lubricants, and caulking compounds required for normal lation shall be furnished with the pipe.		
PART	2 - P	RODU	CTS		
2.01	MAT	ERIALS	3		
	A.	Poly	vinyl Chloride (PVC) Pipe:		
		1.	Except where otherwise indicated on the Drawings, pressure rated PVC pipe smaller than 4" shall be 200 psi SDR-21 conforming to the requirements of ASTM D2241. Potable water main pipe shall have EPDM gasket push-on joints conforming to ASTM F 477. Force main		
			POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS		

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pipe shall have SBR gasket push-on joints conforming to ASTM F-477.

- Class-rated PVC pipe and accessories four to twelve inches (4"-12") in diameter, where shown or as specified on the Drawings, shall meet the requirements of AWWA Specification C900 "Polyvinyl Chloride (PVC) Pressure Pipe." Pipe shall be Class 235, meeting requirements of Dimension Ratio (DR) 18 with cast iron outside diameters. Each length of pipe shall be hydrotested to four (4) times its class pressure by the manufacturer in accordance with AWWA C900. W3 RCW piping shall be pipe Class 200 meeting requirements of Dimension Ratio (DR) 14.
- 3. PVC pipe less than 4" in diameter which is exposed to view shall be ASTM D-1785 Schedule 80 pipe with UV inhibitors.
- 4. All PVC pipe shall be new, unused and manufactured for this project. Polyvinyl chloride sewer pipe shall conform to ASTM D-3034, F794, and D-1784 (PVC compound). The PVC pipe shall be manufactured by Johns-Manville Corporation, Certain-Teed Corporation, or equal. All PVC sewer pipe shall be green and conspicuously labeled with the manufacturer's name, nominal pipe size, applicable material code or PVC cell classification, standard dimension ratio number, product type, standard specification designation, and production record code.
- 5. Pipe shall be listed by Underwriters Laboratories. Provisions shall be made for expansion and contraction at each joint with an elastomeric ring, and shall have an integral thickened bell as part of each joint. PVC Class pipe shall be installed in accordance with the Uni-Bell Plastic Pipe Association Guide Specification UNI-B-3-76, and as recommended by the manufacturer.
- 6. Pipe shall be furnished in nominal lengths of approximately 20 feet, unless otherwise directed by the Engineer. Pipe for potable water supply and accessories shall bear the NSF mark indicating pipe size, manufacturer's name, and AWWA and/or ASTM Specification number, working pressure and production code. Pipe and couplings shall be made from Class 12454-A or Class 12454-B virgin compound, as designed in ASTM D1784.
- 7. Above-grade PVC pipe shall be color coded as indicated in Section 09900, or to match the adjacent structure, as directed by the Owner.

B. Joints:

1. The PVC joints for buried pipe shall be of the push-on type unless otherwise directed by the Engineer so that the pipe and fittings may be connected on the job without the use of solvent cement or any special equipment. The push-on joint shall be a single rubber gasket joint

POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS 15064-2

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designed to be assembled by the positioning of a continuous, molded rubber ring gasket in annular recess in the pipe or fitting socket and the forcing of the plain end of the entering pipe into the socket, thereby compressing the gasket radially to the pipe to form a positive seal. The gasket and annular recess shall be designed and shaped so that the gasket is locked in place against displacement as the joint is assembled. The rubber ring joint shall be designed for thermal expansion or contraction with a total temperature change of at least 75 degrees F in each joint per length of pipe. The bell shall consist of an integral wall section with a solid cross-section elastomeric ring which shall meet requirements of ASTM D1869. The thickened bell section shall be designed to be at least as strong as the pipe wall. Lubricant furnished for lubricating joints shall be nontoxic, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket or pipe material, and shall not impart color, taste, or odor to the water.

2. PVC joints for exposed pipe shall be threaded or solvent welded joints where called for on the Drawings, unless otherwise directed by the Engineer. Teflon thread tape or liquid Teflon thread lubricant shall be used on all threaded joints to serve as both a sealer and lubricant. Threaded joints should be made hand tight (hard). When the joint is hand tight a strap wrench should be used to make up one to two (1-2) additional full turns past the hand tight point. Do not use pipe wrenches or pump pliers on plastic pipe or fittings.

C. Fittings:

- Fittings for pressure rated PVC pipe smaller than 4" in diameter shall be 1. solvent weld Schedule 80 PVC and shall conform to ASTM Specification D 2467 or D D2464 as appropriate. Threaded fittings shall not be used unless specifically allowed by the Engineer on a case-by-case basis.
- 2. The manufacturer of the pipe shall supply all polyvinyl chloride accessories as well as any adaptors and/or specials required to perform the work as shown on the Drawings and specified herein. Standard double bell couplings will not be accepted where the pipe will slip completely through the coupling.

RESTRAINED JOINTS 2.02

All buried piping shall be restrained in accordance with the restrained joint table Α. provided in the Drawings. Pipes subject to pressure or being fed by a pumping system shall be restrained based on a 150 psi working pressure. Restrained joint length indicated in the Tables represents the length on all sides of fittings and valves within which all joints must be restrained. As a minimum, the joints at all fittings and valves shall be restrained.

- B. Restrained joints shall be capable of holding against withdrawal for line pressures 50 percent above the normal working pressure but not less than 150 psi. The pipe and fittings shall be restrained push-on joints or restrained mechanical joints.
- C. PVC push-on pipe bell and spigot joints shall be restrained with the Uni-Flange Corp. Series 1390 Restrainer or approved equal. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A-536, Grade 65-45-12. Clamping bolts and nuts shall be manufactured of corrosion resistance high strength, low alloy CORTEN steel meeting the requirements of ASTM A-242.
- D. Ductile iron mechanical joint fittings used with PVC pipe shall be restrained with the Uni-Flange Corp. Series 1300 Restrainer, EBAA Iron, Inc., Series 2000PV Mechanical Joint Restraint Gland, or approved equal. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A-536, Grade 65-45-12. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy CORTEN steel meeting the requirements of ASTM A-242.
- E. Thrust blocks shall not be permitted unless specifically shown on the Drawings.

PART 3 - EXECUTION

3.01 HANDLING PIPE AND FITTINGS

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe. Pipe or fittings shall not be dropped. Any damaged pipe or fittings shall be replaced.
- B. All pipe and fittings shall be subjected to a careful inspection just prior to being laid or installed, and no piece shall be installed which is found to be defective.
- C. If any defective pipe is discovered after it has been laid or installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Owner. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.

3.02 INSTALLING EXPOSED PVC PIPE AND FITTINGS

- A. All piping and fittings shall be installed true to alignment and rigidly supported thrust anchors shall be provided where required. Each length of pipe shall be cleaned out before erection.
- B. Sleeves shall be installed of proper size for all pipes passing through floors or walls as shown on the Drawings. Where indicated on the Drawings or required

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for liquid or gas-tightness the pipe be sealed with a mechanical seal equal to Link-Seal as manufactured by Thunderline Corp., Wayne, Michigan.

- C. Concrete inserts for hangers and supports shall be furnished and installed in the concrete as it is placed. The inserts shall in accordance with the requirements of the piping layout and jointing method and their locations shall be verified from approved piping layout drawings and the structural drawings. Pipe hangers and supports are specified in Section 15094 of these specifications.
- D. All valves, fittings, equipment, and appurtenances needed upon the pipelines shall be set and jointed as indicated on the Drawings or as required. Valves and appurtenances are included in Section 15100 of these specifications. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, a certification shall be submitted stating that such requirements have been complied with.

3.03 FLUSHING AND TESTING

- A. Prior to pressure testing, all mains shall be flushed to remove all sand and other foreign matter. The velocity of the flushing water shall not be less than 2 feet per second. Flushing shall be terminated at the direction of the Engineer. The Contractor shall dispose of the flushing water without causing a nuisance or property damage.
- B. Complete PVC piping systems shall be field pressure tested after installation and including all components to 150 psi for 2 hours. Any leaks discovered during testing shall be repaired. The repaired component or portion must be retested until the entire system passes the pressure testing.
- C. Contractor shall test to the satisfaction of the Engineer all piping in accordance with the requirements of Section 01625 of these specifications, and applicable municipal standards as related to testing.

3.04 SURFACE PREPARATION AND PAINTING

A. All piping and fittings exposed to view shall have its surface prepared and be painted as specified in Sections 09900 of these specifications. Surface preparation and shop priming is a part of the work of this Section. Pipe marking is included in Section 09900, but it shall be part of the work of this Section to assist as required by the Engineering in identifying pipe contents, direction of flow and all else required for proper marking of pipe.

END OF SECTION

POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS 15064-5

		SECTION 15094
		PIPE HANGERS AND SUPPORTS
PART	1 - GI	ENERAL
1.01	SCO	PE OF WORK
	A.	Furnish all labor, materials, equipment and incidentals and install hangers, supports, concrete inserts, and anchor bolts, including metallic hanging and supporting devices for supporting exposed piping.
	C.	All new pipe supports, hangers, straps hardware, clips, unistrut, and anchors shall be 304 stainless steel and shall match the number, type, location, and capacity of the existing supports.
1.02	QUAI	LIFICATIONS
	Α.	Hangers and supports shall be of approved standard design and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor for pipe supports shall be five (5) times the ultimate tensile of the material, assuming 10 feet of water filled pipe being supported.
	B.	All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, the Contractor shall submit a certification stating that such requirements have been complied with.
1.03	SUBN	MITTALS
	A.	Submit to the Engineer for review, as provided in the General Conditions, shop drawings of all items to be furnished under this section.
	B.	Submit to the Engineer, for review, samples of all materials specified herein.
PART	2 - PF	RODUCTS
2.01	GEN	ERAL
	Α.	All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves and fittings, and to support and secure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces
		PIPE HANGERS AND SUPPORTS

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1 2				as equipment, pipe and poved prior to installation.	personnel contact. All pipe supports shall be
3			арріс	ved prior to installation.	
4 5 6 7		B.	meet	ing, the respective ASTM S	ring hangers and supports shall be capable of Standard Specifications with regard to tests and s, and be in accordance with MSS SP-58.
8 9 10		C.	_	naximum unsupported spa	spaced in accordance with ANSI B31.1.0 that n shall not exceed 10 feet otherwise specified
11 12 13 14 15 16		D.	manu to a s of an	factured by Piping Techno pecific figure or number is f	erein, pipe hangers and supports shall be blogy & Products, Inc. or equal. Any reference or the purpose of establishing a type and quality as proprietary. Any item in type, style, quality, for approval.
17 18 19	2.02	PIPE	HANG	ERS AND SUPPORTS FO	OR METAL PIPE
20 21		A.		O , ,	e supported by 304 SS hangers suspended by ts, beam clamps or ceiling mounting as follows:
22 23			1.	Hangers:	
24 25 26 27 28 29				Pipe Size, Inches 1/2" to 3" 3" to 30" Above 30"	Piping Technology & Products Fig. No. 50 83 See SPECIAL SUPPORTS, Paragraph 2.04
30					i alagiapii 2.04
31 32 33 34			2.	load ratings conforming t	led 304 stainless steel machine threaded with o ASTM Specifications and the strength of the diameter. Hanger rods shall have the following
35 36				Pipe Size, Inches	Min. Rod Diameter, In.
37				Less than 2-1/2	3/8
38				2-1/2 though 4	1/2
39				4	5/8
40				6	3/4
41				8-12	7/8
42				14-16	1
43				20-30	1-1/2
44				Above 30	See SPECIAL SUPPORTS,
15					Paragraph 2.04

PIPE HANGERS AND SUPPORTS 15094-2

Paragraph 2.04

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- 3. Where applicable, structural attachments shall be beam clamps. Beam clamps, for rod sizes 1/2-inch through 3/4-inch shall be equal to Grinnell Fig. No. 229, and for rod sizes 7/8-inch through 1-1/4 inches shall be equal to Grinnell Fig. No. 228 or equal.
- 4. Concrete inserts for pipe hangers shall be designed to be used in ceilings, walls or floors, spot inserts for individual pipe hangers or ceiling mounting bolts for individual pipe hangers, and shall be as manufactured by Ramset/Red Head, or equal, and shall be as follows:
 - a. 304 SS Multi Set II drop in style anchors shall be used where applicable and shall be used for hanger rods up to and including 7/8-inch diameter.
 - b. Ceiling mounting plates shall be used, where applicable, and be for hanger rod sizes 1-inch through and including 1-1/4 inches, shall be Fig. 47, Fig. 49 or Fig, 52 as manufactured by Grinnell or approved equal. All pipe hangers shall be capable of vertical adjustment under load and after erection. Turnbuckles, as required and where applied, shall 304 SS be equal to Grinnell Fig. No. 230. Wall or column supported pipes shall be supported by welded steel brackets equal to Grinnell Fig. 194, 195, and 199, as required, for pipe sizes up to and including 20-inch diameter. Additional wall bearing plates shall be provided where required.
- 5. Where the pipe is located above the bracket, the pipe shall be set on a 0.5-inch neoprene pad and U-bolt assembly supported by the bracket for pipes 4-inches and larger or by a U-bolt for pipes smaller than 4-inches. U-bolts shall be equal to Grinnell Fig. 120 and 137.
- 6. Where the pipe is located below the bracket, the pipes shall be supported by pipe hangers suspended by steel rods from the bracket. Hangers and steel rods shall be as specified above.
- 7. Wall or column supported pipes 8-inches and smaller may be supported by hangers equal to Grinnell Figures 103, as required.
- B. Floor supported pipes 3-inches and larger in diameter shall be supported by either cast-in-place concrete supports or adjust-able pipe saddle supports as directed by the Engineer. In general, concrete supports shall be used when lateral displacement of the pipes is probable (unless lateral support is provided), and adjustable pipe saddle type supports shall be used where lateral displacement of the pipes is not probable.
 - 1. Each concrete support shall conform to the details shown on the Drawings. Concrete shall be poured after the pipe is in place with

PIPE HANGERS AND SUPPORTS 15094-3

 temporary supports. Top edges and vertical corners of each concrete support shall have 1-inch bevels. Each pipe shall be secured on each concrete support by a wrought iron or steel anchor strap anchored to the concrete with cast-in-place bolts or with expansion bolts. Where directed by the Engineer, vertical reinforcement bars shall be grouted into drilled holes in the concrete floor to prevent overturning or lateral displacement of the concrete support. Unless otherwise approved by the Engineer, maximum height shall be five (5) feet.

- 2. Concrete piers used to support base elbows and tees shall be similar to that specified above. Piers may be square or rectangular.
- 3. Adjustable pipe saddle support shall be screwed or welded to the corresponding size 150 lb. companion flanges or slip-on welding flanges respectively. Supporting pipe shall be of Schedule 40 steel pipe construction of the size recommended by the pipe support manufacturer. Each flange shall be secured to the concrete floor by a minimum of two (2) expansion bolts per flange. Adjustable saddle supports shall be equal to Grinnell Fig. No. 259. Where used under base fittings, a suitable flange shall be substituted for the saddle. Floor supported pipes less than 3-inches shall be supported by fabricated steel supports.
- C. Vertical piping shall be supported as follows:
 - 1. Where pipes change from horizontal to vertical, the pipes shall be supported on the horizontal runs within 2 feet of the change in direction by pipe supports as previously specified herein.
 - 2. For vertical runs exceeding 15 feet pipes and greater than eight-inches in diameter shall be supported by the fabricated pipe support as shown in the drawings.
 - 3. Where vertical piping passes through a steel floor sleeve, the pipe shall be supported by a friction type pipe clamp which is supported by the pipe sleeve. Pipe clamps shall be equal to Grinnell Fig. 262. Anchor bolts shall be equal to Kwik-Bolt as manufactured by the McCullock Industries, Minneapolis, Minnesota or Wej-it manufactured by Wej-it Expansion Products, Inc., Bloomfield, Colorado.
- D. All rods, hangers, inserts, brackets, and components shall be 304 Stainless Steel.

2.03 PIPE HANGERS AND SUPPORTS FOR PLASTIC PIPE

A. Single plastic pipes shall be supported by pipe supports as previously specified herein.

PIPE HANGERS AND SUPPORTS 15094-4

- B. Multiple, suspended, horizontal plastic pipe runs, where possible, and rubber hose shall be supported by ladder type cable trays such as the Electray Ladder by Husky-Burndy, the Globetray by the Metal Products Division of United States Gypsum, or equal. Ladder shall be of mild steel construction. Rung spacing shall be approximately 18 inches for plastic pipe and 12 inches for rubber nose. Tray width shall be approximately 6 inches for single runs of rubber hose and 12 inches for double runs of rubber hose. Ladder type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc., required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps fasteners equal to Globe Model M-CAC, Husky-Burndy Model SCR or equal. Spacing between clamps shall not exceed 9 feet. The cable shall provide continuous support along the length of the pipe.
- C. Individual clamps, hangers, and supports in contact plastic pipe shall provide firm support, but not so firm as to prevent longitudinal due to thermal expansion and contraction.

2.04 SPECIAL SUPPORTS

- A. Pipes, requiring special supports as defined in this specification or shown on the drawing, shall be supported by means of a supporting framework anchored into the floor or curbing. The vertical piping shall be suitably secured to horizontal support members connected at each end vertical support members and spaced as required to provide a rigid installation.
 - The complete supporting system shall be as manufactured by the Unistrut Corporation, Globe-Strut as manufactured by the Metal Products Division of U.S. Gypsum, or equal. Vertical and horizontal supporting members shall be U-shaped channels similar to Unistrut Series P1000.
 - 2. Vertical piping shall be secured to the horizontal members by pipe clamps or pipe straps equal to Unistrut Series P1100M and Series P2558. All components shall be of 304 stainless steel.
 - 3. The assemblies shall be furnished complete with all nuts, bolts, and fittings required for a complete assembly.
 - 4. The design of each individual framing system shall be the responsibility of the Contractor. Shop drawings shall be submitted and shall show all details of the installation including dimensions and types of supports.
- B. Any required pipe supports for which the supports specified in this Section are not applicable, including pipe supports for above 30-inch diameter pipe; high temperature and high pressure (greater than 150 psi) shall be fabricated or

PIPE HANGERS AND SUPPORTS 15094-5

constructed from standard aluminum shapes in accordance with Specifications, concrete and anchor hardware similar to items previously specified herein and shall meet the minimum requirements listed below and be subject to review by the Engineer.

- 1. Pipe support systems shall meet all requirements of this Section and all related Sections of this Specification.
- 2. Complete design details of the entire pipe support systems shall be provided, for review by the Engineer.
- 3. The pipe support system shall not impose loads on the supporting structures, in excess of the loads for which the supporting structure is designed.
- 4. Hanger rods for above 30-inch pipe shall be a minimum of 1-1/2-inch diameter and shall not exceed the Manufacturer's standard maximum recommended safe load.

2.05 PIPE HANGER AND SUPPORT SPACING

A. Pipe hanger and support spacing shall be in accordance with ANSI B31.1.1.0 and MSS SP-69. In no case shall the spacing of hangers or supports exceed the following:

Maximum unsupported pipe span (FEET)

Nominal Pipe Size -	Ductile Iron	Steel	PVC-1 and PVC-2
Inches			(Sch. 80)
1/2	N/A	5	3.5
3/4	N/A	6	3.5
1	N/A	7	3.8
1-1/4	N/A	7	4.0
1-1/2 - 3	N/A	9	4.0
4	7	10	5.5
5-10	10	10	10
12-48	10	per manufacturer	10
		or as shown on	
		drawings	

PART 3 - EXECUTION

3.01 INSTALLATION

PIPE HANGERS AND SUPPORTS 15094-6

- A. All pipes, horizontal and vertical, shall be rigidly supported from the building structure by approved supports. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or specified herein. No piping shall be supported from other piping or from metal stairs, ladders and walkways, unless it is so indicated on the Drawings, or specifically directed or authorized by the Engineer.
- B. All pipe supports shall be designed with liberal strength and stiffness to support the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement, and pressure forces, thermal expansion and contraction, vibrations and all probable externally applied forces. Prior to installation, all pipe supports shall be approved by the Engineer.
- C. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings, and sleeve type couplings and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.
- D. Pipe supports shall be provided as follows:
 - 1. Cast iron and ductile iron shall be supported at a maximum support spacing of 10 feet-0-inches with a minimum of one support per pipe section at the joints.
 - 2. Supports for multiple PVC pipes shall be continuous wherever possible. Individually supported PVC pipes shall be supported as recommended by the manufacturer except that support spacing shall not exceed five (5) feet.
 - 3. Support spacing for galvanized steel pipe and copper tubing shall not exceed five (5) feet.
 - 4. All vertical pipes shall be supported at each floor or at intervals of at least 15 feet by approved pipe collars, clamps, brackets or wall rests, and at all points necessary to insure rigid construction.
- E. Pipe supports shall not result in point loadings but shall distribute pipe loads evenly along the pipe circumference.
- F. Effects of thermal expansion and contraction of the pipe shall be accounted for in pipe support selection and installation.
- G. Inserts for pipe hangers and supports shall be installed on forms before concrete is poured. Before setting these items, all Drawings and figures shall be checked

1 2			which have a direct bearing on the pipe location. Responsibility for the proper location of pipe supports is included under this Section.
3 4 5		H.	Continuous metal inserts shall be embedded flush with the concrete surface.
6 7	3.02	PRIM	E COATING
8 9 10		A.	Prior to prime coating, all pipe hangers and supports shall be thoroughly clean, dry, and free from all mill-scale, rust, grease, dirt, paint and other foreign substances to the satisfaction of the Engineer.
12 13 14 15		B.	All submerged pipe supports shall be prime coated with Koppers 654 Epoxy Primer or equal. All other pipe supports shall be prime coated with Rust-Inhibitive Primer No. 621 as manufactured by Koppers Company, Inc., Pittsburgh, Pa. or equal.
16 17 18 19		C.	Finish coating shall be compatible with the prime coating used and shall be applied, as specified in Section 09900.
20	3.03	PROT	TECTION AGAINST ELECTROLYSIS
21 22 23 24 25 26		A.	Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces to eliminate direct contact and any resulting electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or upon approval by the Engineer.
27 28 29			END OF SECTION

1 **SECTION 15100** 2 3 VALVES AND APPURTENANCES 4 5 6 PART 1 – GENERAL 7 8 SCOPE OF WORK 1.01 9 10 Α. Furnish all labor, materials, equipment and incidentals required and complete 11 and ready for operation all valves and appurtenances shown on the Drawings 12 and as specified herein. 13 14 B. All valves and appurtenances shall be of the size shown on the Drawings. 15 Insofar as possible, all equipment of the same type shall be from one 16 manufacturer. 17 18 All valves and appurtenances shall have the name of the maker and the 19 pressure for which they are designed cast in raised letters some appropriate 20 part of the body. 21 22 D. The equipment shall include, but not be limited to, the following: 23 24 1. Resilient Wedge Gate Valves 25 2. Ball Valves 26 3. **Butterfly Valves** 27 4. Plug Valves 28 5. Valve Actuators 29 Valve Boxes 6. 30 31 DESCRIPTION OF SYSTEMS 1.02 32 33 Α. All of the equipment and materials specified herein are intended to be standard 34 for use in chlorinated potable water, reclaimed water or wastewater. 35 36 B. Valves and appurtenances for use with potable water shall be NSF-61 certified. 37 38 C. All buried valves shall have polyethylene encasement. 39 40 D. Flanged valves shall be equipped with EPDM gaskets and shall be fastened to 41 piping using 316 S.S. nuts and bolts. 42 43 1.03 QUALIFICATIONS 44 45 All of the types of valves and appurtenances shall be products of well established 46 firms, who are fully experienced, reputable and qualified in the manufacture of the 47 particular equipment to be furnished. The equipment shall be designed, constructed

and installed in accordance with the best practices and methods and shall comply with these Specifications, as applicable.

1.04 SUBMITTALS

Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer for review, in accordance with the requirements of Section 01340.

1.05 TOOLS

Special tools, if required for normal operation and maintenance, shall be supplied with the equipment.

1.06 VALVE INDICES

The Contractor shall be responsible for furnishing tags for all valves required on the work and installing the tags required for his own work. Tags on above ground valves shall be noncorrosive metal or plastic, 2 inches in diameter, 19 gauge thick. Tags for buried valves shall be secured to a concrete base as shown on the Drawings. Submit to the Engineer for approval, two (2) samples of each type of tag proposed and manufacturer's standard color chart and letter styles. Tags shall have stamped on them the information shown on the Drawings and the data described herein

PART 2 - PRODUCTS

2.01 RESILIENT SEATED AND RESILIENT WEDGE GATE VALVES

 A. All gate valves 4 inches to 24 inches in diameter shall be resilient seated or resilient wedge, manufactured to meet or exceed the requirements of AWWA C515 of latest revision and in accordance with the following Specifications. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.

B. The valves are to be non-rising stem with the stem made of cast, forged or rolled bronze shown in AWWA C515. Two stem seals shall be provided and shall be EPDM of the O-ring type, one above and one below the thrust collar.

C. The sealing mechanism shall consist of a cast iron gate having an EPDM coating. The resilient sealing mechanism shall provide zero leakage at the valve design pressure when installed with the line flow in either direction.

D. The valve body, bonnet, and bonnet cover shall be cast iron ASTM A126, Class B. All ferrous surfaces inside and outside shall have a minimum 10 mil fusion-bonded epoxy coating. A handwheel or wrench nut shall be provided for operating the valve. All Valves are to be tested in strict accordance with AWWA C515.

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- E. Handwheels or chain wheels shall be turned left or counterclockwise to open the valves. Handwheels shall be of ample size and shall have an arrow and the word OPEN cast thereon to indicate the direction of opening.
- F. Valves shall have a factory-applied, internal and external, fusion bonded epoxy resin coating with a minimum thickness of 8 mils, conforming to all applicable requirements of the American Water Works Association Standard C550-90 entitled "Protective Interior Coatings for Valves and Hydrants".
- G. Valves shall be equal to those as manufactured by American, M&H, Mueller, Kennedy, Clow, or equal.

2.02 **BALL VALVES**

- Α. PVC ball valves shall be of Type 1, Grade 1 PVC with true union, socket, threaded or flanged ends as required. Ball valves shall be full port, full flow, all plastic construction, 150 psi rated with Teflon seat seals and T-handles. PVC ball valves shall be as manufactured by Asahi, Spears, Plastiline, or equal.
- B. Vented PVC ball valves shall be manufactured to ASTM F 1970 and constructed from PVC Type I, ASTM D 1784 Cell Classification 1245. All Orings shall be Latharge Viton. All valves shall have stem with double O-ring seals. All valve handles shall be polypropylene with built-in lockout mechanism. All valve union nuts shall have Buttress threads. All seal carriers shall be Safe-T-Blocked. All valve components shall be replaceable. All valves shall be certified by NSF International for use in potable water service. All 1/2-inch through 2-inch valves shall be pressure rated to 235 psi, all 2-1/2inch through 6-inch, 8-inch Venturied and all flanged valves shall be pressure rated to 150 psi for water at 73° F. Valve shall have a 1/8-inch vent hole in the ball to equalize internal fluid pressures. Install valve with ball vent on the pressure (upstream) side when in closed position. Vented ball valves shall be True Union 2000 Industrial Ball Valves as manufactured by Spears or approved equal.
- C. Bronze, brass or stainless steel ball valves shall be of 2-piece (1-inch and smaller) or 3-piece (1-1/2-inch and larger) construction. Valves shall be rated for 150 psi saturated steam pressure and 400 psi WOG pressure. Valves shall have stainless steel, bronze or brass body, stainless steel or chrome plated brass ball, replaceable Teflon or TFE seats and seals, blowout proof stem and vinyl covered steel handle. All end connections shall be threaded.
- D. All valves shall be mounted in such a position that valve position indicators are plainly visible when standing on the floor.

2.03 BUTTERFLY VALVES

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- Butterfly valves shall conform to the AWWA Standard Specifications for Α. Rubber Seated Butterfly Valves, Designation C504, except as hereinafter specified. Valves, except as specified hereinafter, shall be Class 150A or B, and equal to those manufactured by Henry Pratt Company, DeZurik, American, Kennedy, Mueller, Val-Matic or equal. The valve discs shall be constructed of ductile iron conforming ASTM A536, Grade 65-45-12.
- B. The face-to-face dimensions of flanged end valves shall be in accordance with Table 2 of above-mentioned AWWA Specification for short-body valve. Adequate two-way thrust bearings shall be provided. Flange drilling shall be in accordance with ANSI B16.1.
- C. Valve seats shall be EPDM synthetic rubber compound. Valve seats 24 inches and larger shall be field adjustable and replaceable without dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material with stainless Nylock screws and be capable of a 1/8-inch adjustment. Valves 20 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C504. Where elastomer seat is mounted on the valve body, the mating edge of the valve disc shall be 18-8 stainless steel or Nickel-Chrome, 80-20%. Where elastomer seat is mounted on the valve disc, the valve body shall be fitted with an 18-8 stainless steel seat offset from the shaft, mechanically restrained and covering 360 degrees of the peripheral opening or seating surface.
- D. The valve body shall be constructed of cast iron per ASTM A-126, Class B with integrally cast hubs for shaft bearing housings of the through boss-type. Butterfly valves for water service of the "wafer" or "spool" type will not be accepted.
- E. The valve shaft shall be turned, ground, and polished constructed of 18-8, ASTM A-276, Type 304 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft on 24" and smaller shall be one-piece unit extending full size through the valve disc and valve bearing. 30" and larger may be of a stub shaft design. Shaft bearings shall be Teflon or nylon, self-lubricated type.
- F. All valves shall be subject to hydrostatic and leakage tests at the point of manufacture. The valves shall be tested in conformance with AWWA C-504.
- G. Gearing for the operators shall be totally enclosed in a gear case in accordance with Paragraph 3.8 of the above-mentioned AWWA Standard Specification. All valve hardware shall be 316 SS.

- H. The manufacturer shall certify that the required tests on the various materials and on the completed valves have been satisfactory and that the valves conform with all requirements of the Specification and the AWWA standard.
- Where indicated on the Construction Drawings extension stems, floor stands, couplings, stem guides and floor boxes, as required, shall be furnished and installed.
- J. Valves shall have a factory-applied, internal and external, fusion bonded epoxy resin coating with a minimum thickness of 8 mils, conforming to all applicable requirements of the American Water Works Association Standard C550-90 entitled "Protective Interior Coatings for Valves and Hydrants".

2.04 ECCENTRIC PLUG VALVES

- A. All plug valves shall be manufactured and installed in accordance with standard ANSI/AWWA C517 Table 1, Resilient-Seated Cast-Iron Eccentric Plug Valves, of the latest revision unless otherwise specified. Manufacturer shall provide affidavit of compliance with AWWA Standard. Valves shall be as manufactured by DeZurik, Val-Matic, Homestead or approved equal.
- B. Plug valves shall be tested in accordance with AWWA C517, latest edition. Each valve shall be performance tested in accordance with Paragraph 5.2 of the above reference and shall be given a leakage test and hydrostatic test as described in Paragraphs 5.2.2 and 5.2.3 of the above reference. The leakage test shall be applied to the face of the plug tending to unseat the valve. The manufacturer shall furnish certified copies of reports covering proof of design testing as described in Section 5.2.4 of the above reference.
- C. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanged valves shall be faced and drilled to the ANSI B16.1 125/150 lb. standard. Mechanical joint ends shall be in full compliance with ANSI/ AWWA C111/A21.11. Screwed ends shall be to the NPT standard.
- D. Valve bodies shall be of ASTM A126 Class B cast iron.
- E. Port areas for valves shall have a minimum port area of 100 percent of full nominal pipe area.
- F. All exposed nuts, bolts, springs, washers, etc., shall be zinc or cadmium plated. 3" and larger valve plugs shall be constructed of ASTM A-536 ductile iron. Resilient plug facings shall be of Neoprene fully encapsulated.
- G. Valves shall be furnished with permanently lubricated stainless steel, oil-impregnated bronze or non-metallic upper and lower plug stem bearings.

- H. Valve seats shall be either nickel or stainless steel. Epoxy seats are not acceptable.
- I. Plug valves greater than 6 inches in diameter shall be supplied with manual gear actuators unless otherwise shown on the Drawings. All valve hardware shall be 316 SS.
- J. Shaft seals shall be of the multiple V-ring type with a packing gland follower. Shaft seals shall be externally adjustable and repackable without removing the actuator or bonnet from the valve.
- K. Valves shall have a factory-applied, internal and external, fusion bonded epoxy resin coating with a minimum thickness of 8 mils, conforming to all applicable requirements of the American Water Works Association Standard C550-90 entitled "Protective Interior Coatings for Valves and Hydrants".

2.05 VALVE ACTUATORS

A. General

- 1. All gate and plug valve actuators shall conform to AWWA C541 for Hydraulic and Pneumatic Actuators and to AWWA C542 for Electric Actuators.
- 2. Butterfly valve actuators shall conform to AWWA C504.
- All actuators shall be capable of seating and unseating the disc or plug against the full design pressure and velocity, as specified for each class, into a dry system downstream, and shall transmit a minimum torque to the valve. Actuators shall be rigidly attached to the valve body.
- 4. The valve or gate manufacturer is responsible for installation and setup of the actuator that is properly sized for the rated valve pressure.
- The Contractor is responsible for handling and installing the valve and actuator in strict accordance with manufacturer's instructions. The Contractor shall replace any actuator damaged, including voiding of warranty, without cost to the Owner.

B. Manual Actuators

1. Manual actuators shall have permanently lubricated, totally enclosed gearing with hand wheel and gear ratio sized on the basis of rated valve pressures and actual velocities. Actuators shall be equipped

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with hand wheel, position indicator, and mechanical stop-limiting locking devices to prevent over travel of the disc in the open and closed positions. They shall turn counter-clockwise to open valves and have an arrow and the word OPEN cast thereon to indicate the direction of opening.

- Manual actuators for eccentric plug valves shall be a worm gear type with self-locking features designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering.
- 3. Actuators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 pounds on the hand wheel or chain wheel. Actuator components shall withstand an input of 450foot pounds for 30-inch and smaller and 300-foot pounds for larger than 30-inch size valves at extreme actuator positions without damage.
- 4. Valves located above grade shall have hand wheel or chain wheel and position indicators.
- 5. Valves located below grade shall be equipped with an extension to raise the 2-inch square AWWA operating nut to ground level and with a cast iron extension type valve box.
- 6. Manually operated valves located six (6) feet or more above the floor level shall be equipped with a chain wheel actuator that allows operation of the valve from the floor without the use of a ladder or steps.

C. Electric Motor-Operated Actuators

- Motor-Operated actuators shall be provided as indicated and in accordance with AWWA C542. Each actuator shall include the electric motor, reduction gearing, valve stem drive nut/bushing, position sensor, overload torque sensor, ductile iron gear case, automatic de-clutchable handwheel, local control & mechanical position indication, and remote control & position indication.
- 2. All actuators that are installed greater than five (5) feet above the finished floor surface shall be provided with a remote control unit, such that the valve can be operated while standing at floor grade. The remote control unit shall be hardwired to the actuator and be equipped with all the controls/functionality as on the face of the actuator. Remote controllers shall be mounted between 3 feet and 5 feet from the nearest operator accessible floor surface.

- 3. Motors shall be totally enclosed, non-ventilated 480 volt, 3 phase and specifically designed for high torque, non-continuous, low inertia duty. Motors for actuators shall also be specifically designed and rated for 15-minute duty operation at 104°F (40°C). Output capacity shall be sufficient to open or close the valve against the maximum differential pressure when the voltage is 10% above or below normal at the specified service conditions. Motors shall have Class F insulation. Motors must be protected by 3 thermal contacts, which are embedded in the motor windings. The actuator shall be suitable for up to 60 starts per hour for open/close service and 1200 starts per hour for modulating service.
- 4. The actuators shall be suitable for use on nominal 3 phase power supply and must include motor, integral reversing starters, local controls and terminals for remote control and indication housed within a self-contained, sealed enclosure. The actuator gearing shall be totally enclosed in a lubricant filled cast iron gearcase suitable for operation in any orientation. Non-metallic gearing is not acceptable. For rising stem valves the output shaft shall be hollow to accept a rising stem, and incorporate thrust bearings of the roller type at the base of the actuator. All gearing and bearings shall be oil or grease lubricated and suitable for year-round service based on prevailing ambient temperature conditions.
- 5. The actuator shall be furnished with a handwheel with a maximum rim pull requirement of 60 pounds for valve travel loads. An external manual declutch lever shall be included to place actuator in the manual mode. The lever shall not require more than 10 pounds of force to engage even when the valve has been tightly seated. The lever is to be padlockable in either handwheel or motor mode.
- 6. Operation by motor shall not cause the handwheel to rotate, or operation of the handwheel shall not cause the motor to rotate. Handwheel shall operate in the clockwise direction to close.
- 7. Manual operation shall be by handwheel. Manual operation will be via power gearing to minimize required rimpull and facilitate easy changeover from motor to manual operation when the actuator is under load. A seized or inoperable motor shall not prevent manual operation.
- 8. Two nameplates, made of stainless steel, shall be attached to each actuator; one on the motor housing, showing all relevant motor data, one on the actuator housing showing all relevant actuator data. Special information, such as the valve tag no., shall be shown if required. The nameplates shall be securely fixed to the actuator and

motor, so that they cannot be removed or scratched off during shipment, installation, operation or maintenance.

- 9. The rated output torque of the motor actuator shall be at least 1.5 times the maximum torque required to open or close the valve at any position including seating and unseating conditions when subjected to the most severe operating condition including any mechanical friction and/or other restrictive conditions that are inherent in the valve assembly. Do not include hammer-blow effect in sizing the actuator to comply with this torque requirement.
- 10. The valve manufacturer is responsible to assure that the motor actuator stall torque output does not exceed the torque limits of the valve operating stem or shaft. Maximum torque shall include seating or unseating torque, bearing torque, dynamic torque, and hydrostatic torque. Assume that the differential pressure across the valve is equal to the pressure or head rating of the valve.
- 11. Actuator housings, supports, and connections to the valve shall have a minimum safety factor of five based on the ultimate strength or three based on the yield strength of the material used. Actuators shall be 0-ring sealed, watertight to NEMA 4/6 (6 feet for 30 minutes). All external fasteners shall be of stainless steel. Gear case shall be cast iron.
- 12. Torque switch bypass to be provided for the torque sensing system to inhibit torque switch trip during unseating or during starting in mid travel against high inertia loads.
- 13. Test each actuator prior to shipment in accordance with AWWA C542. The application torque shall be the maximum torque required to open or close the valve at any position including seating and unseating conditions.
- 14. The operator face plate shall include as a minimum:
 - a. Buttons for OPEN STOP CLOSE RESET.
 - b. Backlit LCD display showing the actuator status in plain English text.
 - c. Lockable selector switch with LOCAL OFF REMOTE function.
 - d. Indication lights for CLOSED, OPEN, RUNNING, and FAULT.
- 15. The terminal compartment shall provide sufficient space to accommodate the possible maximum number of incoming wires. A minimum of three cable entries must be provided. Each cable entry

shall be properly sealed by cable glands during site installation. The cable glands size shall be chosen by the Contractor, responsible for wiring during the commissioning phase.

- 16. Liquid Crystal Display (LCD) back-lit for setting menu showing status indication and diagnostic information. The actuator shall include a digital position indicator with a display from fully open to fully closed in 1% increments. For all actuators that utilize a battery, the actuator manufacturer shall furnish one (1) spare battery for each actuator furnished.
- 17. Setting of all actuator parameters including the torque levels, position limits, configuration of the indication contacts, and positioner functionality shall be accomplished without removing covers from the actuator control assemblies or housing.
- 18. Actuators shall be suitable for indoor and outdoor use. The actuator shall be capable of functioning in an ambient temperature ranging from -20 °F to +140°F, up to 100% relative humidity. In order to prevent condensation, a space heater shall be installed inside the actuator, suitable for continuous operation. The actuator shall be stored according to the Manufacturer's instructions. If the Contractor voids the actuator warrantee in any way, he shall replace the actuator at no cost to the Owner.
- 19. Actuators are to receive remote input commands for OPEN, CLOSE, and POSITION (as required).
- 20. Contractor is to provide startup, inspection, and instruction services from the Manufacturer's authorized technical representative. Startup and inspection shall not be less than one (1) day for each actuator and one (1) additional day to provide training for plant personnel in the proper operation and maintenance of all electric actuators.
- 21. The Contractor shall furnish all programming of the PLC and the SCADA HMI and HMI graphics (specified in Division 13) so as to display all available signals/I/O from the actuator.
- 22. All electric actuators for this project shall be provided by one Manufacturer. Contractor shall coordinate installation on valves and gates with valve and gate manufacturers. Electric actuators shall be as manufactured by Rotork, Auma, or approved equal.
- 23. Each actuator shall be warranted for a minimum of 24 months from the date of system acceptance by the Owner.

2.06 VALVE BOXES

A. All buried valves shall have cast-iron three-piece valve boxes. Valve boxes shall be provided with suitable heavy bonnets and to extend to such elevation at or slightly above the finished grade surface, as directed by the Engineer. The barrel shall be two-piece, sliding type, having 5-1/4-inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with cast iron covers.

 B. All valves shall have actuating nuts extended within 12 inches of the top of the valve boxes. Valve boxes shall be provided with concrete base and valve nameplate engraved with lettering 1/8-inch deep as shown on the Construction Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.

B. Valves above grade or in vaults

1. Position valve with the actuator in the position indicated by the drawings; or positioned to be accessible from the floor, vault access, or cabinet opening. Valve position indicators shall be plainly visible when standing on the floor or ground surface.

2. All hydraulic tubing/piping 1-inch or less on hydraulic control valves shall be wrapped with pipe insulation to prevent from freezing. Insulating foam shall be wrapped with aluminum tape by 3M or approved equal.

C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.

3.03 INSPECTION AND TESTING/STARTUP

A. Valve and service components shall be inspected for damage and shall be repaired to the satisfaction of the Engineer before they are installed.

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- B. Completed pipe, valves and service lines shall be subjected to a hydrostatic pressure and leakage test in accordance with technical specifications. All leaks shall be repaired and lines retested. Prior to testing, the pipelines shall be restrained to prevent movement during tests. If any joint, connection, or device proves to be defective, it shall be repaired or replaced to the satisfaction of the Engineer.
- C. The Contractor shall furnish the services of the valve manufacturer's field technician or manufacturer's representative to startup/test all valves for proper installation and operations.

END OF SECTION

1			SECTION 16010
2			BASIC ELECTRICAL REQUIREMENTS
4 5 6 7 8 9 10	PART	1 - GE	NERAL
	1.01	RELA	TED DOCUMENTS:
			ngs and general provisions of Contract, including General and Supplementary tions, Divisions 00 & 01 Specification sections, apply to work of this Section.
11 12 13	1.02	CODE	es s
13 14 15		A.	The work shall be in conformance with the latest adopted version of the following:
16 17 18			NFPA National Fire Protection Association Codes NFPA 70 National Electrical Code FBC Florida Building Code
19 20 21 22 23 24 25		В.	The installation shall also comply with all applicable rules and regulations of local and state laws and ordinances. Include in the work, without extra cost, any labor, materials, services, apparatus and drawings required to comply with all applicable laws, ordinances, rules and regulations. Inform the architect of any work or materials which conflict with any of the applicable codes, standards, laws, and regulations before submitting their bid.
26 27	1.03	ROUG	SH-IN
28 29 30		A.	Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
31 32		B.	Refer to equipment specifications in for rough-in requirements.
33 34 35	1.04	ELEC	TRICAL INSTALLATIONS
36 37 38 39		A.	Existing services shall not be interrupted without prior consent of the owner's authorized representative and may be interrupted only at, and for, the specific time designated by the owner's authorized representative.
40 41 42 43		B.	Make a thorough examination of the site and the contract documents. No claim for extra compensation will be recognized if difficulties are encountered which an examination of site conditions and contract documents prior to executing contract would have revealed.
44 45 46		C.	Coordinate electrical equipment and materials installation with other building components.

- D. Verify all dimensions by field measurements.
- E. Arrange for chases, slots, and openings in other building components to allow for electrical installations.
- F. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
- G. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.
- H. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.
- J. Temporary electrical service and construction lighting shall be provided under this section. Provide for all electrical service for construction period, making all connections and removal of same at job conclusion. Furnish and install temporary lighting for construction period. At job completion, all temporary lamps shall be removed and replaced with new lamps.
- K. All existing and new conduit/raceways within the project area shall be properly supported; minimum spacing of conduit supports shall be 4 feet. Add support to existing conduit as required to comply with the NEC.
- L. All enclosures for new electrical equipment shall be NEMA 4X stainless steel (type 316). All outdoor enclosures for Programmable Logic Controllers (PLC), Control Panels, Process Monitoring Panels shall have solar shield panels located at top, bottom, back and sides of enclosures. All enclosures shall be painted white to match existing. All enclosures shall have internal mounting plates for components and an interior safety door.
- M. All conduits entering wet wells, pits, tanks, aerators and similar vessels or containment structures shall have conduit seals installed as prescribed by the NFC.
- N. There shall be no penetrations of existing clarifier tank or process basin walls. All conduits shall be run surface mounted or on top of walls. Conduit

1 2 3			upports or associated hardware shall NOT penetrate existing clar valls or process basin walls.	ifier tank
4 5	1.05	CUTT	IG AND PATCHING	
6 7 8		A.	Do not endanger or damage installed work through procedurocesses of cutting and patching.	res and
9 10		B.	arrange for repairs required to restore other work because of aused as a result of electrical installations.	damage
1 2 3		C.	No additional compensation will be authorized for cutting and patch nat is necessitated by ill-timed, defective, or non-conforming insta	_
4 5 6		D.	Perform cutting, fitting, and patching of electrical equipment and required to:	naterials
7 8 9			. Uncover work to provide for installation of ill-timed work.	
20			Remove and replace defective work.	
21 22 23 24 25			 Remove and replace work not conforming to requirement contract documents. 	ts of the
25 26			Remove samples of installed work as specified for testing.	
27 28			Install equipment and materials in existing structures.	
29 30 31			 Upon written instructions from the architect/engineer, uncorrestore work to provide for architect/engineer observ concealed work. 	
32 33 34 35 36		E.	Cut, remove and legally dispose of, selected electrical eq components, and materials as indicated; including, but not limited to, of electrical items indicated to be removed and items made obsole new work.	removal
37 38 39		F.	Protect the structure, furnishings, finishes, and adjacent mate ndicated or scheduled to be removed.	rials not
10 11 12 13		G.	Provide and maintain temporary partitions or dust barriers ade revent the spread of dust and dirt to adjacent areas.	quate to
14 15 16		H.	ocate, identify, and protect electrical services passing through remolemolition area and serving other areas required to be maperational. When transit services must be interrupted, provide te	aintained
			16010-3	12/10/21

BASIC ELECTRICAL REQUIREMENTS

services for the affected areas and notify the owner prior to changeover. 1 2 3 **ELECTRICAL SUBMITTALS** 1.06 4 5 Α. Refer to the Section 01300 for submittal definitions, requirements, and 6 procedures. 7 8 B. Submittal of shop drawings, product data, and samples will be accepted only 9 when submitted by the contractor. Data submitted from subcontractors and 10 material suppliers directly to the architect/engineer will not be processed. 11 C. 12 As a minimum, shop drawings shall be furnished for the following; control 13 panels, cables, conductors, Variable Frequency Drives, Soft Starters, 14 raceways, conduits, supports and accessories, grounding devices and hardware, surge protectors, motors, wiring devices, connection lugs, outlet 15 and pull boxes, identification devices and materials, lights and control 16 17 stations. 18 19 1.07 PRODUCT OPTIONS AND SUBSTITUTIONS 20 21 Refer to the Section 01670 for requirements in selecting products and requesting 22 substitutions. 23 24 1.08 PRODUCT LISTING 25 26 Prepare listing of major electrical equipment and materials for the project. Α. 27 28 В. Submit this listing as a part of the submittal requirement specified in Section 29 01300. 30 31 C. When two or more items of the same material or equipment are required, 32 they shall be of the same manufacturer. Product manufacturer uniformity 33 does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar 34 equipment units, and similar items used in work, except as otherwise 35 indicated. 36 37 38 D. Provide products which are compatible within systems and other connected 39 items. 40 41 E. No substitution will be considered unless written request has been submitted 42 to the architect at least ten (10) days prior to the date for receipt of bids. 43 F. 44 If the architect approves any proposed substitutions, such approval will be 45 set forth in an addendum.

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1 1.09 DELIVERY, STORAGE, AND HANDLING 2 3 Α. Deliver products to project properly identified with names, model numbers, 4 types, grades, compliance labels, and similar information needed for distinct 5 identifications; adequately packaged and protected to prevent damage during 6 shipment, storage, and handling. 7 В. Store equipment and materials at the site, unless off-site storage is 8 authorized in writing. Protect stored equipment and materials from damage. 9 10 C. Coordinate deliveries of electrical materials and equipment to minimize 11 construction site congestion. Limit each shipment of materials and 12 equipment to the items and quantities needed for the smooth and efficient flow of installation. 13 14 15 1.10 RECORD DOCUMENTS (AS-BUILTS) 16 17 Refer to Section 01720 for requirements. The following paragraphs Α. 18 supplement the requirements of Division 01. 19 20 1. Mark drawings to indicate revisions to conduit size and location, both 21 exterior and interior; actual equipment locations, dimensioned from 22 column lines; concealed equipment, dimensioned to column lines; 23 distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; change orders; 24 25 concealed control system devices. Wiring diagram and/or schedule 26 shall be furnished indicating identification of all wiring run and labeled from point-to-point (power source to end-of-use). 27 28 29 2. Mark Specifications to indicate approved substitutions; change orders; actual equipment and materials used. 30 31 32 3. Contractor shall provide engineer with record drawings (AutoCAD 33 compatible file format) and one set of blueprints. 34 35 4. Furnish one set of conductor meggar readings as listed in Section 16120 36 37 38 1.11 WARRANTIES 39 40 Α. Refer to Section 01740 for procedures and submittal requirements for 41 warranties. Refer to individual equipment specifications for warranty

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requirements.

B. Compile and assemble the warranties specified in Division 16 into a separated set of vinyl-covered, three-ring binders, tabulated and indexed for easy reference.

1 2 C. Provide complete warranty information for each item to include product or 3 equipment; date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for 4 5 filing a claim and obtaining warranty services. 6 7 1.12 CLEANING 8 9 Refer to Section 01700 for general requirements for final cleaning. Α. 10 Clean all light fixtures, lamps, and lenses prior to final acceptance. Replace 11 B. 12 all inoperative lamps. 13 14

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16010-6 BASIC ELECTRICAL REQUIREMENTS

END OF SECTION

1 2			SECTION 16110
3			RACEWAYS
4 5	PART	1 – GI	ENERAL
6 7	1.01	RELA	TED DOCUMENTS
8 9 10 11		A.	Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this Section.
12 13 14 15		В.	This Section is a Division 16 Basic Electrical Materials and Methods section and is part of each Division 16 section making reference to electrical raceways specified herein.
16 17	1.02	DESC	CRIPTION OF WORK
18 19		A.	Extent of raceway work is indicated by drawings and schedules.
20 21 22		B.	Types of raceways specified in this section include the following:
23 24 25			Heavy Wall Aluminum PVC Schedule 80 Liquid-tight flexible PVC coated metal conduit
26 27	1.03	QUAL	LITY ASSURANCE
28 29 30 31		A.	Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes require, whose products have been in satisfactory use in similar service for not less than five (5) years.
32 33 34 35		B.	Installer's Qualifications: Firms with at least three (3) years of successful installation experience on projects with electrical raceway work similar to that required for this project.
36 37		C.	Codes and Standards:
38 39 40 41 42 43 44 45			 UL Compliance Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL listed and labeled.

PART 2 - PRODUCTS

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METAL CONDUIT AND TUBING 2.01

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- Α. General: Provide aluminum conduit, tubing and fittings of types, grades, sizes and weights (wall thickness) for each service indicated.
- Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements and comply with applicable portions of NEC for raceways.
- C. Rigid aluminum Conduit: Provide rigid aluminum, heavy wall, threaded type.
- Liquid-Tight Flexible Metallic Conduit: Provide liquid-tight flexible PVC D. coated metallic conduit for all motor connections.
- E. Conduit Fittings: Couplings and connectors for conduit sizes 2" and smaller shall be aluminum hex-nut, expansion-gland type. Aluminum set screw type fittings may be used for conduit sizes 2½" and larger.

2.02 NONMETALLIC CONDUIT AND DUCTS

- General: Provide nonmetallic conduit, ducts and fittings of types, sizes Α. and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements which comply with provisions for NEC for raceways.
- **Electrical Plastic Conduit:** B.
 - 1. Heavy Wall Conduit: Schedule 80, 90°C, UL-rated, constructed of Schedule 80, 90 polyvinyl chloride. For direct burial, UL listed and in conformity with NEC Article 347.
- C. Conduit and Tubing Accessories: Provide conduit, tubing and duct accessories of types, sizes and materials, complying with manufacturer's published product information, which mate and match conduit and tubing.
- D. Conduit Bodies: Provide aluminum cast-metal conduit bodies of types, shapes and sizes as required to fulfill job requirements and NEC requirements. Construct conduit bodies with threaded conduit-entrance ends, removable covers, either cast or galvanized aluminum and corrosion-resistant screws.

PART 3 - EXECUTION

3.01 OBSERVATION

A. Examine areas and conditions under which raceways are to be installed and substrate which will support raceways. Notify contractor in wiring of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.02 INSTALLATION OF RACEWAYS

A. General: Raceways run below grade, under floors on grade or in concrete shall be PVC heavy wall type (Schedule 80) conduit, provided rigid aluminum conduit is used on elbows and risers to boxes, cabinets, etc.

 B. Sizes of raceways shall be not less than NEC requirements and shall not in any case be less than indicated on drawings. Larger size raceways and/or pull boxes shall be installed if there is excessive length unbroken run or excessive number of bends. Combining of circuits other than those indicated on the drawings will not be permitted.

C. Coordinate with other work, including wires/cables, boxes and panel work as necessary to interface installation of electrical raceways and components with other work.

 Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coast surfaces with corrosion inhibiting compound before assembling.

 2. Use roughing-in dimensions of electrically operated unit furnished by supplier. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.

3. Provide nylon pullcord in empty conduits where indicated. Test all empty conduits with ball mandrel. Clear any conduit which rejects ball mandrel. Pay costs involved for restoration of conduit and surrounding surfaces to original condition.

4. Use liquid-tight flexible conduit where subjected to one or more of the following conditions:

a. Exterior location.

- b. Moist or humid atmosphere where condensate can be expected to accumulate.
- c. Corrosive atmosphere.

- d. Subjected to water spray or dripping oil, water or grease.
- D. Cut conduits straight, ream properly and cut threads for heavy wall conduit deep and clean.
- E. Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.
- F. Fasten conduit terminations in sheet metal enclosures by two (2) locknuts and terminate with bushing. Install lock nuts inside and outside enclosure.
- G. Conduits are not to cross pipe shafts or ventilating duct openings.
- H. Keep conduits a minimum distance of 6" from parallel runs of flues, hot water pipes or other sources of heat. Do not install horizontal raceway runs below water and steam piping.
- I. Support riser conduit at each floor level with clamp hangers.
- J. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split couplings.
- K. Complete installation of electrical raceways before starting installation of cables/wires within raceways.
- L. Concealed Conduits:
 - Metallic raceways installed underground or in floors below grade, or outside are to have conduit threads painted with corrosion-inhibiting compound before couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure water tightness.
 - 2. For floors-on-grade, install conduits under concrete slab.
 - 3. Install underground conduits a minimum of 24" below finished grade.
 - 4. All conduits installed below grade or under concrete slab to be minimum of 3/4 inch.
- M. Conduits in Concrete Slab:
 - 1. Place conduits between bottom reinforcing steel and top reinforcing steel. Place conduits either parallel or at 90° to main reinforcing steel.

- 2. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond.
- 3. Conduits crossing in slab must be reviewed for proper cover by engineer.
- 4. Embedded conduit diameter is not to exceed one-third (1/3) of slab thickness.
- N. Install conduits as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.

O. Exposed Conduits:

- 1. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with or at right angles to walls of building.
- 2. Install exposed conduit work as not to interfere with ceiling inserts, lights or ventilation ducts or outlets.
- 3. Support exposed conduits by use of hangers, clamps or clips. Support conduits minimum of 18" on each side of bends and outlet boxes and on spacing not to exceed 6'-0".
- 4. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.
- 5. Above requirements for exposed conduits also apply to conduits installed in space above hung ceilings and in crawl spaces.
- 6. Provide rigid aluminum, heavy wall, threaded type for all exposed and in-wall installations.

P. Non-Metallic Conduits:

- 1. Make solvent cemented joints in accordance with recommendations of manufacturer.
- 2. Install PVC conduits in accordance with NEC and in compliance with local utility practices.

Q. Conduit Fittings:

1. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal and ridged outside circumference for proper fastening.

- 2. Bushings for terminating conduits smaller than 1" and are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.
- 3. Install insulated type bushings for terminating conduits 1" and larger. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.
- 4. Bushing of standard or insulated type to have screw type grounding terminal.
- 5. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings and plugs to be specifically designed for their particular application.

3.03 FIELD QUALITY CONTROL

- A. General: Mechanically assemble metal enclosures and raceways for conductors to form continuous electrical conductor and connect to electrical boxes, fittings and cabinets as to provide effective electrical continuity and rigid mechanical assembly.
- B. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion-inhibiting compound before assembling.
- C. Install expansion fittings in all raceways wherever structural expansion joints are crossed.
- D. Make changes in direction of raceway run with proper fittings supplied by raceway manufacturer. No field bends of raceway sections will be permitted.
- E. Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported.
- F. Use boxes as supplied by raceway manufacturer wherever junction, pull, or device boxes are required. Standard electrical "handy" boxes, etc. shall not be permitted for use with surface raceway installations.
- G. Raceway penetrations of fire-rated walls and/or floors shall be sealed to maintain integrity of construction. All products, materials and methods of installation shall be UL approved and meet NFPA requirements.
- H. Unless otherwise noted on drawings, notified by engineer and/or authorities having jurisdiction, the following materials may be used:

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- 1. Rock Wool: Minimum four pound cubic foot density; flame spread 15, smoke developed 0, fuel contribution 0 by ASTM 384; minimum melting point 2000°F.
- 2. Concrete and masonry are also approved fire stop materials by NFPA 90A.
- 3. UL approved products such as Nelson Type CLK Silicon Sealant. Manufacturer's recommendations shall be strictly followed.
- I. Submit complete data on fire-stopping materials and construction methods for review by engineer before proceeding with work.

END OF SECTION

1			SECTION 16120	
2			WIRES AND CABLES	
4 5	PART 1 – GENERAL			
6 7	1.01	RELA	TED DOCUMENTS	
8 9 0 1		A.	Drawings and general provisions of Contract, including General and Supplementary Conditions, Divisions 00 & 01 Specification sections, apply to work of this Section.	
3 4 5		В.	This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 section making reference to wires and cables specified herein.	
7	1.02	DESC	CRIPTION OF WORK	
18 19 20 21		A.	Extent of electrical wire and cable work is indicated by drawings and schedules.	
22 23 24		B.	Types of electrical wire, cable, and connectors specified in this Section include the following:	
25 26 27			Copper conductors (copper only conductors) Split-bolt connectors Polaris insulated type lug splice connectors	
28 29 30		C.	Applications of electrical wire, cable, and connectors required for project are as follows:	
31 32 33 34 35			 For power distribution circuits For motor-branch circuits For equipment circuits For control circuits 	
36 37	1.03	QUAL	ITY ASSURANCE	
38 39 40 41 42		A.	Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than five years.	
13 14 15 16		B.	Installer's Qualifications: Firm with at least three years of successful installation experience with projects utilizing electrical wiring and cabling work similar to that required for this project.	

1 2		 NEC Compliance: Comply with NEC requirements as applicable construction, installation, and color-coding of electrical wires and cables 		• • • • • • • • • • • • • • • • • • • •
D. IEEE Compliance: Comply with applicable restricted in Commercial Buildings" pertaining to wiring			"Test Procedures for Impulse Voltage and Std. 241, "IEEE Recommended Procedures for Impulse Voltage and Std. 241, "IEEE Recommended Procedures for Impulse Voltage and Std. 241, "IEEE Recommended Procedures for Impulse Voltage and Std. 241, "IEEE Recommended Procedures for Impulse Voltage and Std. 241, "IEEE Recommended Procedures for Impulse Voltage and Std. 241, "IEEE Recommended Procedures for Impulse Voltage and Std. 241, "IEEE Recommended Procedures for Impulse Voltage and Std. 241, "IEEE Recommended Procedures for Impulse Voltage and Std. 241, "IEEE Recommended Procedures for Impulse Voltage and Std. 241, "IEEE Recommended Procedures for Impulse Voltage and Std. 241, "IEEE Recommended Procedures for Impulse Voltage and Std. 241, "IEEE Recommended Procedures for Impulse Voltage Impulse Impulse Voltage Impulse Impulse Voltage Impulse Impul	Tests on Insulated Conductors", ractice for Electric Power Systems
8 9 10 11		E.	ASTM Compliance: Comply with applic 3, 8 and D-753. Provide copper conduthan 98% at 20°C (68°F).	
13 14 15 16 17 18		F.	The following systems of color-coding sl Isolated Grounded Leads Grounded Leads Grounded Neutral Leads 277/480 Volt, Ungrounded Phase Wires 120/208 Volt, Ungrounded Phase Wires	Green and Yellow Green White (Brown, Orange and Yellow)
20 21 22		G.	The color code assigned to each phase throughout.	
23 24 25 26 27 28		H.	Where existing base building color- assigned herein. Contractor shall use a maintain consistency. Advise engines used.	existing color coding as required to
28 29 30 31 32 33		I.	All conductors (power and controls) solocations, pull boxes and cabinets a identification of circuit, instrument number or other means for identifying the equiprocess.	and panels. Labels shall include per, or equipment terminal number;
34 35	1.04	DELI	VERY, STORAGE, AND HANDLING	
36 37 38		A.	Deliver wire and cable properly pac containers, or wound on NEMA specified	
39 40		B.	Store wire and cable in clean dry spa products from weather, damaging fumes	
41 42 43 44 4 6		C.	Handle wire and cable carefully to avoid wire and cable insulation and sheathing integrity of wires/cables is maintained.	J

1			PART 2 - PRODUCTS
2	2.01	BUIL	DING WIRES
4 5 6 7		A.	All conductors shall be copper and be rated for 600 volt use. Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated.
8 9 10 11		B.	Conductor insulation shall be dual type THHN/THWN 75°C (167°F) for dry, damp, and wet locations. Conductor insulation with single type marking THHN 90°C (194°F) may be used for above grade and dry locations only.
13 14	PART	3 – EX	KECUTION
15 16	3.01	INSTA	ALLATION OF WIRES AND CABLES
17 18 19 20 21 22		A.	General: Install electrical cables, wires and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation" and in accordance with recognized industry practices.
23 24 25		B.	Unless otherwise noted, all branch circuit conductors shall be No. 12 AWG. Branch circuits over 75 feet in length shall be No. 10 AWG unless noted otherwise.
26 27		C.	Install UL Type XHHW wiring in conduit, for feeders and branch circuits.
28 29 30		D.	Pull conductors simultaneously where more than one is being installed in same raceway.
31 32 33		E.	Use pulling compound or lubricant, where necessary. Compound used must not deteriorate conductor or insulation.
34 35 36 37		F.	Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceway.
38 39		G.	Keep conductor splices to minimum.
40 41 42		H.	Install splices and tapes which possess equivalent-or-better mechanical strength and insulation ratings than conductors being spliced. Use splices and tap connectors which are compatible with conductor material.
43 44 45	3.02	FIELD	QUALITY CONTROL

1 2 3 4 5 6 7 8 9 10	A.	Prior to energization of circuitry, check installed feeder wires and cables with megohm meter to determine insulation resistance levels to ensure requirements are fulfilled. Readings shall be taken at 30 second, 1 minute, and 3 minutes (at a 1 kV) at test voltage applied. A list of feeders tested shall be submitted to the engineer indicating the insulation resistance level for each cable. As a minimum the following feeders shall be tested: • New VFD feeders • Branch circuit conductors in excess of 100 feet • Pump motor feeders
12 13 14	B.	Prior to energization, test wires and cables for electrical continuity and for short-circuits.
15 16 17 18 19 20	C.	Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.
21		END OF SECTION

		SECTION 16135
		ELECTRICAL BOXES, CONTROL PANELS AND FITTINGS
PART	Γ1 – G	ENERAL
1.01	RELA	ATED DOCUMENTS
	A.	Drawings and general provisions of Contract, including General and Supplementary Conditions, Divisions 00 & 01 Specification sections, apply to work of this Section.
	B.	This Section is a Division 16 Basic Electrical Materials and Methods section, and is a part of each Division 16 section making reference to electrical wiring boxes and fittings specified herein.
1.02	DESC	CRIPTION OF WORK
	A.	Extent of electrical box and associated fitting work is indicated by drawings and schedules.
	B.	Types of electrical boxes and fittings specified in this Section include the following:
		 Turbidimeter Enclosures (2) – Reference Section 13620 Process Instrumentation and Equipment
		2. Outlet boxes
		3. Junction boxes
		4. Pull boxes
1.03	QUAL	LITY ASSURANCE
	A.	Manufacturers: Firms regularly engaged in the manufacture of electrical boxes and fittings of types, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than three (3) years.
	B.	Installer's Qualifications: Firms with at least three (3) years of successful installation experience on projects utilizing electrical boxes and fittings similar to those required for this project.
	C.	NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.

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ELECTRICAL BOXES, CONTROL PANELS AND FITTINGS

- D. UL Compliance: Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL listed and labeled.
- E. ASTM C857: Comply with applicable requirements for design load capability for concrete pull boxes, covers and supporting members.

1.04 CODES

A. The work shall be in conformance with the latest adopted version of the following:

NFPA 70 National Electric Code FBC - Florida Building Code

B. The installation shall also comply with all applicable rules and regulations of local and state laws and ordinances. Include in the work, without extra cost, any labor, materials, services, apparatus and drawings required to comply with all applicable laws, ordinances, rules and regulations. Inform the architect of any work or materials which conflict with any of the applicable codes, standards, laws, and regulations before submitting their bid.

PART 2 - PRODUCTS

2.01 FABRICATED MATERIALS

- A. Outlet Boxes: Provide galvanized coated flat-rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes (including box depths as indicated), suitable for installation at respective locations. Construct outlet boxes with mounting holes and with cable and conduit-size knockout openings in bottom and sides. Exterior located boxes shall be cast metal boxes with suitable stainless steel gasketed covers, or, if located in a classified hazardous area, NEMA 7 box.
 - Outlet Box Accessories: Provide outlet box accessories as required for each installation; including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations.
 - 2. Ceiling boxes shall be 4" square or octagonal, 1¹/₈" deep for exposed work or furred ceiling work and 3" deep for concrete work. Plaster rings and/or fixture studs shall be provided where required.

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- B. Device Boxes: Provide galvanized coated flat-rolled sheet-steel, non-gangable device boxes, of shapes, cubic inch capacities, and sizes (including box depths as indicated), suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends and with threaded screw holes in end plates for fastening devices. Provide cable clamps and corrosion-resistant screws for fastening cable clamps and for equipment type grounding. Exterior located boxes shall have suitable stainless steel gasketed covers, or, if located in a classified hazardous area, NEMA 7 box.
 - Device Box Accessories: Provide device box accessories as required for each installation; including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations.
 - 2. Flush mounted wall outlets shall be 4" square boxes or gang boxes, not less than 1½" deep. Boxes shall be provided with extension rings and/or covers with sufficient depth to bring the covers flush with the finished wall.
 - 3. Boxes for flush mounting in concrete block work with one or two devices shall have covers with square corners on the raised portion of the cover. The covers shall have a sufficient amount of depth to be flush with the face of the block. Covers shall be Steel City 52-C series. Boxes for more than two devices shall be Steel City "GW" gang boxes. The bottom side of the covers or boxes shall be installed at the masonry course nearest to the dimension specified or noted.
 - 4. Outlet boxes for exposed wall mounting and outdoor installation shall be cast metal type "FS" or "FD" boxes with suitable cast aluminum covers. Weatherproof receptacle covers shall have spring hinged lids.
- C. Rain-Tight Outlet Boxes: Provide corrosion-resistant, cast-metal, rain-tight outlet wiring boxes; of types, shapes and sizes (including depth of boxes), with threaded conduit holes for fastening electrical conduit, stainless steel face plates with spring-hinged watertight caps suitably configured for each application, including face plate gaskets and corrosion- resistant stainless steel plugs and fasteners. All hardware shall be stainless steel.
- D. Junction and Pull Boxes: Provide stainless steel junction and heavy walled PVC pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with stainless steel nuts, bolts, screws and washers.

- E. In-Grade Pull Box: Provide concrete pull box, minimum of 13 inches wide by 24 inches long, 18 inches deep with cast iron bolted down cover, open bottom. Pull box shall be capable of withstand 8,000 pounds of live load and comply with AASHTO and ASTM C857 design load of 22,568 pounds.
- F. Control Panels/Enclosures:
 - 1. The control panel/enclosures shall contain, as a minimum, devices and equipment indicated on the drawings or other sections of these specifications. All control panel/enclosures shall contain interior mounting plate.
 - 2. The control panel enclosure(s) shall be NEMA 4X stainless steel (type 316), Underwriters Laboratories (UL) 50 type 4 listed.
 - 3. The control panel enclosure(s) shall be coated in a white polyester powder finish to reduce absorption of solar radiation.
 - 4. The control panel enclosure(s) shall have a type 316 stainless steel padlocking PowerGlide Handle and 3-point latching system.
 - 5. There shall be permanently affixed to the interior side of the exterior enclosure door both a nameplate and a 10" x 12" pocket for drawing storage. The nameplate shall contain the following information: voltage, phase, date manufactured and intended use equipment service or function.
 - 6. Contractor shall furnish shop drawings for control panel. Include dimension, mounting and material requirements of control panel. Furnish wiring diagrams of all internal components and devices. Schematic diagram of system and PLC connection diagrams and data sheet and programming functions. Furnish operating and maintenance and programming manuals.
 - 7. Enclosures provided for the two (2) turbidimeters shall be manufactured by Hoffman (Catalog Number A36H3012SSLP3PTW), or equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, and in accordance with recognized industry practices to fulfill project requirements.

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ELECTRICAL BOXES, CONTROL PANELS AND FITTINGS

- B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
- C. Provide weather-tight outlets for interior and exterior locations exposed to weather or moisture.
- D. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring. All existing and new junction boxes within the project area shall be made accessible. Relocate existing junction boxes as required to comply with the NEC.
- F. Metallic and approved nonmetallic electrical outlet boxes may be installed in vertical fire resistive assemblies classified as 2-hour or less without affecting the fire classification, provided such openings occur on one side only in each framing space and that openings do not exceed 16 square inches. Boxes located opposite sides of walls or partitions shall be separated by a horizontal distance of 24".
- G. In openings larger than 16 square inches, the wall shall be built around openings so as not to interfere with the integrity of the wall rating.
- H. All clearances between such boxes and the gypsum board shall be completely filled with joint compound or other approved material.
- I. Position recessed outlet boxes accurately to allow for surface finish thickness.
- J. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.
- K. Subsequent to installation of boxes, protect boxes from construction debris and damage.
- L. For in grade concrete pull boxes; excavate approximately 6 inches deeper than the overall height of the pull box. The length and width of the excavation shall be determined by adding 4 to 6 inches to the overall length and width of the pull box. Place approximately 6 inches of compacted fine gravel; level compacted gravel so that the top of the pull box is flush with finished grade. Place fine sand backfill into the excavation and compact the material.

END OF SECTION

1			SECTION 16142
2			ELECTRICAL CONNECTIONS FOR EQUIPMENT
4 5 6 7 8 9 10 11	PART 1 – GENERAL		ENERAL
	1.01	RELA	ATED DOCUMENTS
		A.	Drawings and general provisions of Contract, including General and Supplementary Conditions, Divisions 00 & 01 Specification sections, apply to work of this Section.
12 13 14 15		В.	This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 section making reference to electrical connections for equipment specified herein.
16 17	1.02	DES	CRIPTION OF WORK
18 19 20 21		A.	Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.
22 23 24 25		B.	Electrical connections for equipment, not furnished as integral part of equipment, are specified in other Division 16 sections, and are work of this Section.
26 27 28 29		C.	Motor starters and controllers not furnished as integral part of equipment are specified in applicable Division 16 sections and are work of this Section.
30 31 32 33 34 35 36 37 38 39 40		D.	Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this Section.
		E.	Electrical identification for wire/cable conductors is specified in Division 16 section, "Electrical Identification", and is work of this Section.
		F.	Raceways and wires/cables required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this Section.
41 42	1.03	QUA	LITY ASSURANCE
43 44 45		A.	Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary
			16142-1 12/10/21 ELECTRICAL CONNECTIONS FOR EQUIPMENT

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connection materials, including electrical insulating tape, soldering fluxes, and cable ties; whose products have been in satisfactory use in similar service for not less than five (5) years.

- B. Installer's Qualifications: Firms with at least two (2) years of successful installation experience with projects utilizing electrical connections for equipment similar to that required for this project.
- C. NEC Compliance: Comply with applicable requirements of NEC as to type products used and installation of electrical power connections (terminals and splices) for junction boxes, motor starters, and disconnect switches.
- D. UL Compliance: Comply with UL Std 486A, "Wire Connectors and Soldering Lugs for Use With Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL listed and labeled.

PART 2 – PRODUCTS

2.01 MATERIALS AND COMPONENTS

- A. General: For each electrical connection indicated, provide complete assembly of materials; including, but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, cable ties, solderless wirenuts, and other items and accessories as needed to complete splices and terminations of types indicated.
- B. Conduit and Fittings, General: Provide PVC conduit and fittings of types, grades, sizes and weights (minimum sch 80 for above grade installation) indicated for each type service. Where types and grades are not indicated, provide proper selection as determined by installer to fulfill wiring requirements and comply with NEC requirements for raceways. Provide products complying with Division 16 Basic Electrical Materials and Methods section "Raceways", and in accordance with the following listing of metal conduit, tubing and fittings:

PVC Schedule 80 for underground installation

- C. Wires, Cables, and Connectors:
 - General: Provide wires, cables, and connectors complying with Division 16 Basic Electrical Materials And Methods section "Wires and Cables".

16142-2 ELECTRICAL CONNECTIONS FOR EQUIPMENT

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- 2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match (including sizes and ratings) wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).
- D. Connectors and Terminals: Provide electrical connectors and terminals which mate and match (including sizes and ratings) with equipment terminals, and are recommended by equipment manufacturer for intended applications. All conductor connections shall be made with terminal lugs, #PSR type, as manufactured by Polaris; or equal.

PART 3 - EXECUTION

3.01 OBSERVATION

A. Observe area and conditions under which electrical connections for equipment are to be installed and notify contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.02 INSTALLATION OF ELECTRICAL CONNECTIONS

- A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions, with recognized industry practices, and complying with applicable requirements of UL and NEC to ensure that products fulfill requirements.
- B. Coordinate with other work, including wires/cables, raceway, and equipment installation as necessary to properly interface installation of electrical connections for equipment with other work.
- C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
- D. Maintain existing electrical service and feeders to occupied areas and operational facilities unless otherwise indicated, or when authorized otherwise in writing by owner or architect/engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.

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- E. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.
- F. Prepare cables and wires by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.
- G. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing, and maintenance.
- H. Provide flexible conduit for motor connections and other electrical equipment connections where subject to movement and vibration.
- I. Provide liquid-tight flexible conduit for connection of motors and other electrical equipment where subject to movement and vibration; and also where connections are subjected to one or more of the following conditions:
 - 1. Exterior location.
 - 2. Moist or humid atmosphere where condensate can be expected to accumulate.
 - 3. Corrosive atmosphere.
 - 4. Water spray.
 - 5. Dripping oil, grease, or water.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

3.04 INSTALLATION OF WIRING DEVICES

A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.

16142-4
ELECTRICAL CONNECTIONS FOR EQUIPMENT

1 2 3		B.	Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.	
3 4 5		C.	Install wiring devices after wiring work is completed.	
6 7		D.	Install wallplates after painting work is completed.	
	3.05	PROT	ECTION OF WALLPLATES AND RECEPTACLES	
10 11 12 13 14		A.	Upon installation of wallplates and receptacles, advise contractor regarding proper and cautious use of convenience outlets. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty plugs.	
	3.06	GROL	GROUNDING	
17 18 19		A.	Provide equipment grounding connections for all wiring devices, unless otherwise indicated.	
	3.07	TEST	ING	
22 23 24 25 26		A.	Prior to energizing circuitry, test wiring for electrical continuity and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.	
27 28 29			END OF SECTION	

		SECTION 16143	
WIRING DEVICES			
PART 1 – GENERAL			
1.01	RELATED DOCUMENTS		
	A.	Drawings and general provisions of Contract, including General and Supplementary Conditions, Divisions 00 & 01 Specification sections, apply to work of this Section.	
	B.	This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 section making reference to wiring devices specified herein.	
1.02	DESC	RIPTION OF WORK	
	A.	The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.	
	B.	Types of electrical wiring devices in this section include the following:	
		Receptacles Ground-fault circuit interrupters Wallplates Switches	
1.03	QUAL	LITY ASSURANCE	
	A.	Manufacturers: Firms regularly engaged in manufacture of electrical wiring devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than three (3) years.	
	B.	Installer's Qualifications: Firm with at least two (2) years of successful installation experience on projects utilizing wiring devices similar to those required for this project.	
	C.	NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.	
	D.	UL Compliance: Provide wiring devices which are UL listed and labeled.	
1.04	SUBM	MITTALS	
	1.02	1.01 RELA A. B. 1.02 DESC A. 1.03 QUAL A. B. C. D.	

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WIRING DEVICES

4			
1 2 3		A.	Product Data: Submit manufacturer's data on electrical wiring devices per Section 01300.
4 5	PART	2 – Pl	DDUCTS
6 7	2.01	ACCE	TABLE MANUFACTURERS
8 9 0 1 2		A.	Manufacturers: Subject to compliance with requirements, manufacturers providing wiring devices which may be incorporated in the work include; but are not limited to, the following (for each type and rating of wiring levice):
3 4 5 6 7			Arrow-Hart, Cooper Industries Harvey Hubbell Inc. Pass and Seymour Inc.
8	2.02	FABR	CATED WIRING DEVICES:
19 20 21 22 23		A.	General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Stds. Pub/No. WD1. Provide ivory color devices except as otherwise indicated.
24 25		B.	Receptacles:
26 27 28 29			Duplex receptacles for 20 ampere, 120 volt service shall be two-pole, three-wire receptacles, rated 20 amperes at 125 volts. Receptacles shall be Harvey Hubbell, Inc., Catalog No. 5362-I.
30 31 32 33			Single receptacles for 20 amps, 120 volts service shall be two-pole, three-wire rated 20 amperes at 125 volts. Receptacles shall be Harvey Hubbell Inc., Catalog No. 5361-I.
34 35	2.03	WIRI	B DEVICE ACCESSORIES
36 37		A.	n Use' covers for receptacles.
38 39		B.	Veatherproof caps for switches.
10 11	PART	3 – E	CUTION
12 13 14	3.01	INSTALLATION OF WIRING DEVICES	

1 2 3 4 5		A.	Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
6 7 8		B.	Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.
9		C.	Install wiring devices after wiring work is completed.
10 11		D.	Install wallplates after painting work is completed.
12 13 14	3.02	PROT	TECTION OF WALLPLATES AND RECEPTACLES
15 16 17 18		A.	Upon installation of wallplates and receptacles, advise contractor regarding proper and cautious use of convenience outlets. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty plugs.
19 20	3.03	GRO	JNDING
21 22 23		A.	Provide equipment grounding connections for all wiring devices, unless otherwise indicated.
24 25	3.04	TEST	ING
26 27 28 29 30 31		A.	Prior to energizing circuitry, test wiring for electrical continuity and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.
33 34			END OF SECTION
35 36			
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1			SECTION 16190	
2	SUPPORTING DEVICES			
4 5	PART	1 – G	ENERAL	
6 7	1.01	RELA	ATED DOCUMENTS	
8 9 10 11 12		A.	Drawings and general provisions of Contract, including General and Supplementary Conditions, Divisions 00 & 01 Specification sections, apply to work of this Section.	
13 14 15		B.	This Section is a Division 16 Basic Electrical Materials and Methods section, and is a part of each Division 16 section making reference to electrical supporting devices specified herein.	
16 17 18	1.02	DESC	CRIPTION OF WORK	
19 20 21		A.	Extent of supports, anchors, sleeves, and seals is indicated by drawings and schedules and/or specified in other Division 16 sections.	
22 23 24 25 26 27 28 29 30 31 32 33 34 35		B.	Types of supports, anchors, sleeves, and seals specified in this Section include the following: Concrete Posts. Clevis hangers. One-hole conduit straps. Two-hole conduit straps. Round steel rods. Expansion anchors. Toggle bolts. Wall and floor seals. U-Channel Strut. Steel/Aluminum Pipes/Angles.	
35 36 37 38		C.	Supports, anchors, sleeves, and seals furnished as part of factory fabricated equipment are specified as part of that equipment assembly in other Division 16 sections.	
39 40	1.03	QUAI	LITY ASSURANCE	
41 42 43 44		A.	Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than three (3) years.	

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2 3 4		B.	Installer's Qualifications: Firm with at least three (3) years of successful installation experience with projects utilizing electrical supporting devices work similar to that required for this project.			
5 6 7 8		C.	NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation", pertaining to anchors, fasteners hangers, supports, and equipment mounting.			
9 10 11		D.	UL Compliance: Provide electrical components which are UL listed and labeled.			
12 13 14	1.04	SUBN	MITTALS			
15 16 17 18		A.	Product Data: Submit manufacturer's data on supporting devices including catalog cuts, specifications, and installation instructions for each type of support, anchor, sleeve, and seal per Section 01300.			
19 20	PART	2 – PI	RODUCTS			
21 22	2.01	MAN	JFACTURED SUPPORTING DEVICES			
23 24 25 26 27 28		Α.	General: Provide stainless steel supporting devices with stainless steel hardware which comply with manufacturer's standard materials, design and construction, in accordance with published product information and required for complete installation and as herein specified. Where mothan one type of supporting device meets indicated requirement selection is installer's option.			
30 31		B.	Supports (Interior locations): Provide supporting devices of types, sizes and materials indicated and having the following construction features:			
32 33 34 35			1. Clevis Hangers: For supporting conduit; stainless steel with ½ diameter hole for round steel rod, approximately 54 pounds per 100 units.			
36 37 38 39			2. Reducing Couplings: A stainless steel rod reducing coupling, ½" by 5/8", approximately 16 pounds per hundred 100 units.			
40 41			3. One-Hole Conduit Straps: For supporting conduit; stainless steel.			
42 43			4. Two-Hole Conduit Straps: For supporting conduit; stainless steel.			
14 15			5. Hexagon Nuts: For ½" rod size, stainless steel.			

1 2			6. Round rod: ½" diameter, stainless steel.
3 4 5			7. Offset Conduit Clamps: For supporting 2" rigid metal conduit; stainless steel.
6 7 8		C.	Anchors: Provide anchors of types, sizes, and materials indicated with the following construction features: (all stainless steel)
9 10			1. Expansion Anchors: ½".
11 12			2. Toggle Bolts: Springhead, 3/16" by 4".
13 14 15		D.	Sleeves and Seals: Provide sleeves and seals (all as manufactured by 3M), of types, sizes and materials indicated, with the following construction features:
16 17 18 19 20 21			1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated, suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with PVC sleeves, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws. Seals shall be fire-rated where required.
23 24 25 26 27 28		E.	U-Channel Strut Systems for exterior locations: Provide U-channel strut system for supporting electrical equipment on walls or from ceilings. All materials shall be stainless steel of types and sizes required. Construct with 3/16" diameter holes, 8" O.C. on top surface, and with the following fittings which mate and match with U-channel:
29 30 31 32 33 34			Channel hangers. End caps. Beam clamps. Wiring studs. Rigid conduit clamps. Conduit hangers.
36 37	2.02	FABR	RICATED SUPPORTING DEVICES
38 39 40 41		A.	Pipe Sleeves: Provide pipe sleeves of PVC Pipe: Fabricate from schedule 40 PVC pipe. Remove burrs.
42 43 44 45 46		B.	Sleeve Seals: Provide sleeves for piping which penetrate foundation walls below grade or exterior walls. Caulk between sleeve and pipe with nontoxic, UL classified caulking material to ensure watertight seal. Seals shall be fire-rated where required.

1 C. Stainless steel pipe, 6061-TS, Schedule 40, Plates, angles and struts. 2 Stainless steel bolts, washers and nuts shall be used to fasten stainless 3 steel supports. See drawings for details. 4 5 PART 3 - EXECUTION 6 7 INSTALLATION OF SUPPORTING DEVICES 8 9 Α. Install hangers, anchors, sleeves, and seals as indicated, in accordance 10 with manufacturer's written instructions and with recognized industry 11 practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installation of supporting devices. 12 13 14 B. Coordinate with other electrical work, including raceway and wiring work, 15 as necessary to interface installation of supporting devices with other 16 work. 17 18 C. Install hangers, supports and attachments to support piping properly from 19 building structure. Arrange for grouping of parallel runs of horizontal 20 conduits to be supported together on trapeze type hangers where 21 possible. Install supports with spacing indicated and in compliance with 22 NEC requirements. 23

END OF SECTION

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1			SECTION 16195				
2 3	ELECTRICAL IDENTIFICATION						
4 5	PART	PART 1 – GENERAL					
6 7	1.01	RELA	ATED DOCUMENTS				
8 9 10 11		A.	Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.				
13 14 15 16		B.	This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 section making reference to electrical identification specified herein.				
17	1.02	DESC	CRIPTION OF WORK				
18 19 20		A.	Extent of electrical identification work is indicated by drawings and schedules.				
21 22 23		B.	Types of electrical identification work specified in this Section include the following:				
24 25			Equipment/panels/boxes/conduit//system identification signs.				
26 27	PART	2 – P	RODUCTS				
28 29	2.01	ELEC	CTRICAL IDENTIFICATION MATERIALS				
30 31		A.	Engraved Plastic-Laminate Signs				
32 33 34 35 36 37			 General: Provide engraving stock melamine plastic laminate in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated; black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening. 				
38 39			2. Signs shall be black face with white core plies (letter color).				
40 41			a. Thickness: 1/16", except as otherwise indicated.				
42 43 44 45 46			b. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot, or should not, penetrate substrate. Screens shall be sealed with high temperature RTV sealant.				

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ELECTRICAL IDENTIFICATION

12/10/21

1 2 3 4				 Nameplates shall be furnished and installed for VFDs, Terminal Boxes, power panels, control panels, PLC cabinets, equipment disconnect switches and pull boxes.
5 6	2.02	LETT	ERING	AND GRAPHICS
7 8 9 10 11 12		Α.	in election indicate or as	al: Coordinate names, abbreviations, and other designations used ctrical identification work with corresponding designations shown, ed, or scheduled. Provide numbers, lettering and wording as ed or, if not otherwise indicated, as recommended by manufacturer required for proper identification and operation/maintenance of cal systems and equipment.
14	PART	3 – E	XECUTI	ON
15 16	3.01	APPL	.ICATIO	N AND INSTALLATION
17 18		A.	Genera	al Installation Requirements
19 20 21				Install electrical identification products as indicated, in accordance with manufacturer's written instructions and requirements of NEC.
22 23 24 25				Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
26 27 28				Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.
29 30		B.	Equipn	nent/System Identification
31 32 33 34 35 36 37 38 39 40				General: Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/ control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:
41 42 43 44 45				 a. Electrical cabinets and enclosures. b. Access panels/doors to electrical facilities. c. Disconnect switches, motor starters, contactors, including current origination.

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- 2. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not, or cannot, penetrate substrate.
- 3. Emergency Systems: Where the grounded circuit conductor from an emergency source is connected to a grounding electrode conductor anywhere except at the source, install an engraved plastic-laminate sign stating "WARNING: STANDBY AND NORMAL POWER SYSTEMS BOTH GROUNDED AT THIS LOCATION". Install at the location of the remote grounding connection.

END OF SECTION

SECTION 16452 1 2 3 **GROUNDING** 4 5 PART 1 – GENERAL 6 7 1.01 RELATED DOCUMENTS 8 9 Α. Drawings and general provisions of Contract, including General and 10 Supplementary Conditions, Divisions 00 & 01 Specification sections, apply 11 to work of this Section. 12 13 B. This Section is a Division 16 Basic Materials and Methods section, and is 14 part of each Division 16 Section making reference to grounding specified 15 herein. 16 17 1.02 SUMMARY 18 19 Α. The extent of electrical grounding and bonding work is indicated by 20 drawings and schedules, and as specified herein. Grounding and bonding 21 work is defined to encompass systems, circuits, and equipment. All new 22 grounding electrodes (rods) and new ground conductors shall be bonded 23 to the existing grounding grid at four locations, minimum. All new control 24 panels, electrical panels and cabinets shall be grounded with new ground 25 rods and shall also be bonded to the existing grounding grid. All new 26 connections to the existing grounding grid shall be made by exothermic 27 weld process. Contractor shall obtain approval the grounding connections 28 from owner before installation. Contractor shall furnish and install one 29 grounding test station at each control panel. Test station shall include in grade box with removable lid to exposed top of ground rod and grounding 30 31 conductor; all connections in test station shall be mechanical type - not 32 exothermic weld. 33 The type of electrical grounding and bonding work specified in this Section 34 B. 35 includes the following: 36 37 Solidly grounded system. 38 39 C. Applications of electrical grounding and bonding work in this Section 40 include the following: 41 42 Electrical power systems. 43 Grounding electrodes. 44 Separately derived systems. 45 Raceways. Enclosures/Control Panels/PLC. 46

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Equipment.

D. Refer to other Division 16 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work; not work of this section.

1.03 SUBMITTALS

Α. Product Data: Submit manufacturer's data on grounding and bonding products (Ground rods, connectors, clamps, exothermic welds and grounding conductors) and associated accessories per Section 01300.

1.04 QUALITY ASSURANCE

- Manufacturer's Qualifications: Α. Firms regularly engaged the manufacture of grounding and bonding products, of types and ratings required, and ancillary grounding materials; including stranded cable, copper braid and bus, grounding electrodes and plate electrodes, and bonding jumpers; whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience on projects with electrical grounding work similar to that required for project.
- C. Codes and Standards:
 - 1. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits, and equipment.
 - 2. Comply with applicable requirements of UL UL Compliance: Standards No.'s 467, "Electrical Grounding and Bonding Equipment", and 869, "Electrical Service Equipment", pertaining to grounding and bonding of systems, circuits, and equipment. In addition, comply with UL Std. 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products that are UL listed and labeled for their intended usage.

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING

Α. Materials and Components, General: Except as otherwise indicated, provide electrical grounding and bonding systems to all new electrical

> 16452-2 **GROUNDING**

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equipment (power and controls) 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 a complete installation. Where more than one type component product meets indicated selection is installer's option. Where materials requirements. components are not indicated, provide products that comply with NEC and UL, requirements, and with established industry standards for those applications indicated.

- B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC. All conductors shall be copper.
- C. Bonding Plates, Connectors, Terminals and Clamps: Provide copper bonding plates, connectors, terminals, lugs, and clamps as recommended by bonding plate, connector, terminal, and clamp manufacturers for indicated applications.
- D. Ground Electrodes: Solid copper, 5 Ohms, three-quarter inch (3/4") diameter by twenty feet (20').

PART 3 - EXECUTION

3.01 **EXAMINATION**

Α. Examine areas and conditions under which electrical grounding and bonding connections are to be made, and notify contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.02 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

- General: Install electrical grounding and bonding systems as indicated, in Α. accordance with manufacturer's instructions; applicable portions of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices, to ensure that products comply with requirements.
- B. All power, lighting, control circuits shall have a fully sized insulated copper conductor run the entire length of the circuit. The raceway/conduit system shall not be used as a means of the grounding system.
- C. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

- D. All raceways with No. 10 or 12 AWG phase conductors for receptacles, lighting fixtures, and similar circuits shall be provided with a parity-sized (same size as phase conductor) green equipment ground conductor. Ground conductor shall be installed in entire raceway system, including wall switches and flexible conduit to light fixtures. Equipment ground conductor sizes for circuits with phase conductors larger than No. 12 AWG are indicated on drawings. Ground conductors shall be connected to ground buss in panelboards.
- E. Terminate feeder and branch circuit insulated equipment-grounding conductors with grounding lug, bus, or bushing. Conductors looped under screw or bolt heads will not be permitted.
- F. All raceways with No. 10 or 12 AWG phase conductors for receptacles, lighting fixtures, and similar circuits shall be provided with a parity-sized green equipment ground conductor. Ground conductor shall be installed in entire raceway system, including wall switches and flexible conduit to light fixtures. Equipment ground conductor sizes for circuits with phase conductors larger than No. 12 AWG are indicated on drawings. Ground conductors shall be connected to ground buss in panelboards.
- G. Install clamp-on connectors on clean metal contact surfaces to ensure electrical conductivity and circuit integrity.
- H. Provide a grounding bushing and a continuous copper bonding jumper from the bushing to the equipment ground bus in all feeders. The bonding jumper shall be the same size as the equipment ground conductor.
- 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 piping systems.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of new installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over ten (10) ohms, take appropriate action to reduce resistance to ten (10) ohms or less by driving additional ground rods; then retest to demonstrate compliance.
- B. Submit test results (3 copies) to engineer of record. Test results shall include grounding test method used, equipment used (manufacturer and model number) with certification of calibration and data results.

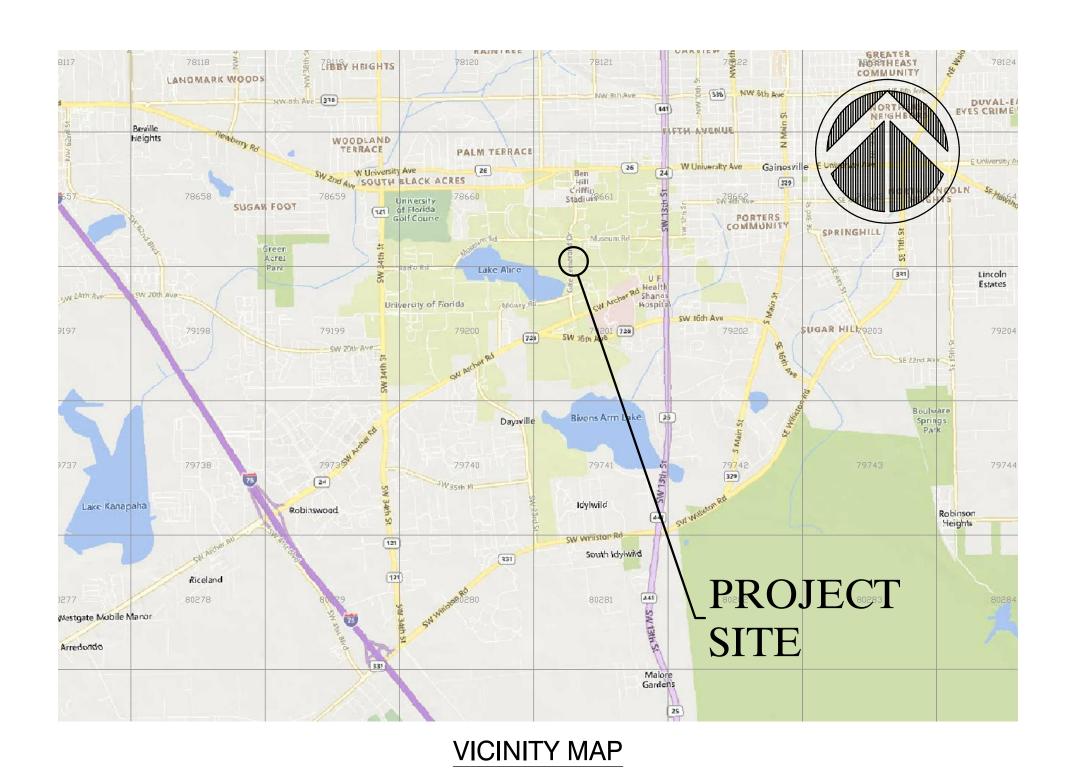
END OF SECTION

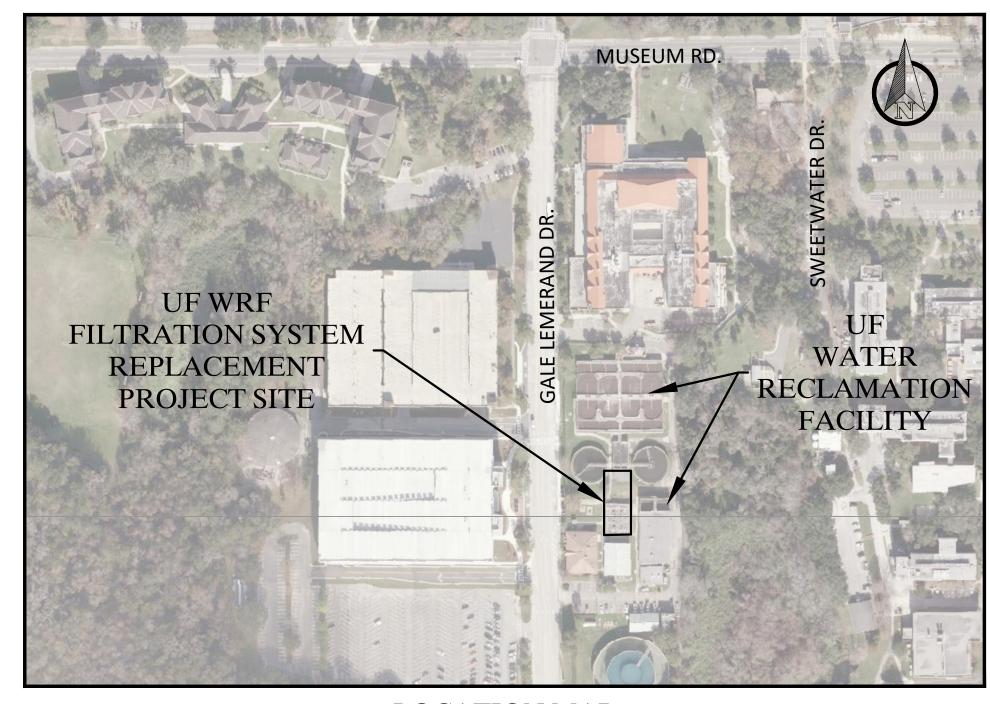
16452-4 GROUNDING 12/10/21

UNIVERSITY OF FLORIDA WRF

FILTRATION SYSTEM REPLACEMENT PROJECT NO: UT00348-1070

SECTION 07, TOWNSHIP 10 S, RANGE 20 E GAINSVILLE, FLORIDA





LOCATION MAP

FOR:

UNIVERSITY OF FLORIDA

PHYSICAL PLANT DIVISION PO BOX 117735 GAINSVILLE, FL 32611-7735



4921 Memorial Highway
One Memorial Center, Suite 300
Tampa, Florida 33634
Phone: (813) 880-8881
www.Ardurra.com
License #2610



Building 1070, Room 103
Water Reclamation Admin. Bldg.
PO Box 117735
Gainesville, Fl. 32611-7735
Main Phone 352-392-1103

Main Phone 352-392-1103 Office Phone 352-294-0695

Sheet List Table				
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G1.00	GENERAL NOTES, LEGENDS, AND ABBREVIATIONS			
G2.00	AERIAL SITE PLAN KEY MAP			
G3.00	CONTRACTOR STAGING AND PARKING SITE PLAN			
G4.00	EXISTING FILTRATION SYSTEM PROCESS FLOW DIAGRAM			
G5.00	PROPOSED FILTRATION SYSTEM PROCESS FLOW DIAGRAM			
G5.01	PROPOSED FILTRATION SYSTEM PROCSS FLOW DIAGRAM			
G6.00	HYDRAULIC PROFILE			
G6.01	FILTER UNIT HYDRAULIC PROFILES			
C1.00	EXISTING YARD PIPING PLAN			
C2.00	UTILITY MODIFICATIONS SITE AND YARD PIPING PLAN			
C3.00	PROPOSED TERTIARY FILTERS SITE AND PIPING PLAN			
M1.00	EXISTING FILTRATION SYSTEM DEMOLITION PLAN			
M1.01	EXISTING FILTRATION LOWER DEMOLITION PLAN - PHASE 1			
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M1.06	EXISTING FILTRATION SYSTEM PIPING AND CONTROL PANELS DEMOLITION			
M2.00	PROPOSED TERTIARY FILTERS PLAN			
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M2.03	PROPOSED TERTIARY FILTER PLAN AND SECTION DETAILS			
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D1.00	MISCELLANEOUS DETAILS			
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D5.00	MISCELLANEOUS DETAILS (5)			
D6.00	MISCELLANEOUS DETAILS (6)			
I1.01	PROCESS AND INSTRUMENTATION ABBREVIATIONS, LEGENDS, AND SYMBOLS			
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I1.10	PROPOSED SCADA NETWORK			
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E7.00	POWER ONE-LINE DIAGRAM (MCC-5)			
E8.00	POWER ONE-LINE DIAGRAM (MCC-6)			
E9.00	POWER ONE-LINE DIAGRAM & SCHEDULE PANEL			

BID DOCUMENTS

	DID DOGGINEIVIO					
					JOB NO: PLOT DATE:	, ,
				DAVID A. WEBER	SCALE:	0.00
				29323	BID DO	DCUMENTS
NO.	DATE	REVISION	BY		FEBRU	JARY 2022

HT 2015 KING ENGINEERING ASSOCIATES, INC. DRAWINGS AND CONCEPTS MAY NOT BE USED OR REPRODU. T IS HEREBY GRANTED SPECIFICALLY TO GOVERNMENTAL AGENCIES TO REPRODUCE THIS DOCUMENT IN CO

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- THESE DESIGN PLANS WERE PREPARED BASED ON THE BEST AVAILABLE RECORD DRAWINGS/AS-BUILTS. ALL RIGHT-OF-WAY AND PROPERTY LINES SHOWN ON THESE DRAWINGS ARE APPROXIMATE.
- 2. THE CONTRACTOR SHALL CALL SUNSHINE STATE ONE (1 800 432-4770) 48 HOURS PRIOR TO ANY EXCAVATION.
- 3. THE INDICATED LOCATION OF UNDERGROUND UTILITIES, STRUCTURES AND FACILITIES IS APPROXIMATE AND REFLECTS THE BEST INFORMATION AVAILABLE FROM SURVEYS AND RECORDS. THE CONTRACTOR SHALL VERIFY THE ACTUAL LOCATION AND EXTENT OF UNDERGROUND FACILITIES PRIOR TO PROCEEDING WITH ANY CONSTRUCTION ACTIVITY THAT MAY AFFECT SUCH FACILITIES. CONTRACTOR IS RESPONSIBLE FOR OBTAINING A UF DIG PERMIT. DIG PERMITS ARE REQUIRED ANY TIME THE GROUND IS PENETRATED. CONTRACTOR TO CALL 352—392—5781 TO INITIATE THE DIG PERMIT PROCESS. CONTRACTORS MUST ALSO CALL SUNSHINE ONE CALL (DIAL 811).
- 4. EXCEPT WHERE THE PLANS AND SPECIFICATIONS PROVIDE THAT SUCH WORK SHALL BE PERFORMED UNDER THE CONTRACT FOR THIS PROJECT, ALL UTILITIES INTERFERING WITH CONSTRUCTION SHALL BE REMOVED, RELOCATED OR ADJUSTED BY THEIR OWNERS, AT THEIR EXPENSE AND/OR THE EXPENSE OF THE CONTRACTOR. THE CONTRACTOR SHALL ARRANGE HIS SCHEDULE TO ALLOW UTILITY OWNERS TIME FOR THE NECESSARY RELOCATION AND ADJUSTMENT OF UTILITIES AND RELATED STRUCTURES.
- 5. THE CONTRACTOR SHALL REMOVE ALL ABANDONED/OUT OF SERVICE UTILITY LINES, PIPES, STRUCTURES AND OTHER SUBTERRANEAN OBJECTS ENCOUNTERED DURING EXCAVATION TO A MINIMUM DEPTH OF FOUR (4) FEET BELOW GRADE, OR AS SHOWN ON THE DRAWINGS.
- 6. MATERIALS INTERFERING WITH CONSTRUCTION AND ALL ABANDONED OR OUT OF SERVICE UTILITY LINES, PIPES, STRUCTURES AND OTHER SUBTERRANEAN OBJECTS TO BE REMOVED SHALL BE DISPOSED OF BY THE CONTRACTOR AT HIS EXPENSE. ALL MATERIALS NOT CLAIMED BY THE OWNER SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE DISPOSED OF BY THE CONTRACTOR IN AREAS PROVIDED BY THE CONTRACTOR.
- 7. THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE FACT THAT ALL CONSTRUCTION ACTIVITIES SHALL CONFORM TO THE UNIVERSITY OF FLORIDA NOISE ORDINANCE.
- 8. DAMAGED CURBING, SIDEWALK, & ASPHALT SHALL BE REPLACED AT THE CONTRACTORS EXPENSE. CONTRACTOR TO CONTRACT PROJECT MANAGER TO ARRANGE A MEETING WITH UF FACILITIES SERVICES GROUNDS DEPARTMENT PRIOR TO RESTORATION.
- 9. LIMITS OF CONSTRUCTION STAGING AREAS SHALL BE LIMITED. IF CONTRACTOR REQUIRES ADDITIONAL AREA, HE SHALL PROCURE AN OFFSITE AREA AT HIS EXPENSE. STAGING SHALL BE REQUESTED AT THE TIME OF THE PRE—CONSTRUCTION CONFERENCE AND DELINEATED ON THE SITE UTILIZATION PLAN.
- 10. ALL UNUSED/UNSUITABLE EXCESS MATERIALS RESULTING FROM EXCAVATION FOR CONSTRUCTION OF THE PROJECT SHALL BE LEGALLY DISPOSED OF BY THE CONTRACTOR AT A SITE PROVIDED BY THE CONTRACTOR, COST TO BE INCLUDED IN CONTRACT BID PRICES.
- 11. ALL EXISTING POTABLE WATER, WASTEWATER, RECLAIMED, IRRIGATION SERVICE LINES, CHILLED WATER, STEAM LINES MAY NOT BE SHOWN ON THE DRAWINGS. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO FIELD LOCATE ALL EXISTING POTABLE WATER, WASTEWATER, RECLAIMED, IRRIGATION SERVICE LINES, CHILLED WATER, STEAM LINES. POTABLE WATER SERVICE AND WASTEWATER SERVICE SHALL BE MAINTAINED AT ALL TIMES. UNLESS SPECIFICALLY INSTRUCTED BY THE OWNER OR ENGINEER, ALL WORK SHALL BE CONDUCTED BETWEEN THE HOURS OF 7:00 A.M. TO 6:00 P.M. MONDAY THRU FRIDAY, EXCLUDING HOLIDAYS.
- 12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PERFORMING TEST HOLES, POTHOLES, AND, ETC. TO LOCATE EXISTING UTILITIES ONSITE PRIOR TO EXCAVATION.
- 13. THE CONTRACTOR SHALL COORDINATE WITH THE OWNER THE EXACT LOCATION FOR THE STAGING AREA. THE CONTRACTOR SHALL RESTORE THE AREA USED FOR STAGING BACK TO PRE-CONSTRUCTION CONDITIONS.

SPECIAL PERMIT CONDITIONS

- 1. ANY ADDITIONAL PERMITS FOR CONSTRUCTION, INCLUDING STORMWATER/EROSION CONTROL, BUILDING PERMITS, ETC. SHALL BE OBTAINED BY THE CONTRACTOR ENTIRELY AT HIS OWN EXPENSE PRIOR TO CONSTRUCTION. NO CONSTRUCTION EQUIPMENT WILL BE ALLOWED ON SITE UNTIL ALL PERMITS ARE ISSUED. PERMITS BEING OBTAINED BY THE OWNER (IF ANY) ARE LISTED IN THE SPECIFICATIONS.
- 2. ALL SPECIAL PERMIT CONDITIONS INCLUDED IN PERMITS ISSUED FOR THIS PROJECT SHALL BE CONSIDERED PART OF THE CONTRACT REQUIREMENTS. COPIES SHALL BE KEPT ON SITE AT ALL TIMES.

SPECIAL PROJECT CONDITIONS

- 1. THE WRF TREATMENT PLANT IS DIVIDED INTO TWO SEPARATE PARALLEL TREATMENT TRAINS, EACH WITH ONE SECONDARY CLARIFIER AND THREE FILTER CELLS. ONE SECONDARY CLARIFIER MUST BE REMOVED FROM OPERATIONS AT A TIME FOR EACH NEW CLOTH FILTER UNIT TIE—IN. CONTRACTOR SHALL COORDINATE WITH PLANT OPERATIONS STAFF REGARDING REQUIRED SCHEDULED TIE—IN AND DEMOLITION ACTIVITIES.
- 2. THE TWO TERTIARY CLOTH FILTERS WILL BE PURCHASED BY THE UNIVERSITY FOR INSTALLATION, STARTUP, AND TESTING BY THE GENERAL CONTRACTOR.

EROSION & SEDIMENTATION CONTROL NOTES

- 1. ALL PRACTICABLE EFFORT SHALL BE TAKEN DURING CONSTRUCTION TO CONTROL AND PREVENT EROSION AND TRANSPORT OF SEDIMENT MATERIALS TO INLETS & SURFACE DRAINS, PER SFWMD "BEST MANAGEMENT PRACTICES" AND F.D.O.T. INDEX 102. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL RESTORATION EFFORTS THAT MAY BE REQUIRED.
- 2. THE CONTRACTOR IS TO CONTROL ALL FUGITIVE DUST ORIGINATING ON THIS PROJECT BY WATERING OR OTHER METHODS AS REQUIRED.
- 3. PROVIDE ALL DISTURBED AREAS WITHIN THE LIMITS OF THE WORK WITH TEMPORARY SOIL EROSION CONTROL AND SEDIMENT CONTROL, UTILIZING EARTH DAMS & PONDS, GRADE TO DRAIN SWALES, SETTLING BASINS, MULCH, SILT FENCES, STONE FILTERS, SYNTHETIC HAY BALE FILTERS, ETC., TREATING ALL SOIL SURFACES WITH SEEDED TOPSOIL AND / OR MULCH AFTER GRADING.
- 4. ALL SOIL EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE INSTALLED PRIOR TO ANY MAJOR SOIL DISTURBANCE OR IN THEIR PROPER SEQUENCE, AND MAINTAINED UNTIL PERMANENT PROTECTION IS ESTABLISHED.
- 5. REQUIRED EROSION CONTROL MEASURES MUST REMAIN INTACT THROUGHOUT CONSTRUCTION. ENCROACHMENT INTO OR FAILURE TO MAINTAIN THESE BARRICADES WILL RESULT IN ENFORCEMENT ACTION WHICH MAY INCLUDE CITATIONS AND/OR PERMIT REVOCATION.
- 6. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND AIR AND WATER POLLUTION WILL BE MINIMIZED. STATE AND LOCAL LAWS SHALL BE COMPLIED WITH AT ALL TIMES.
- 7. MINIMIZE THE AMOUNT OF BARE SOIL EXPOSED AT ONE TIME AND INSTALL SOIL EROSION CONTROL DEVICES AS SHOWN AND IN SUCH A MANNER AS TO CAPTURE AND FILTER SURFACE WATER DURING CONSTRUCTION.
- 8. PERMANENT STABILIZATION SHALL BE BY SODDING ALL EXPOSED AREAS WITHIN THREE DAYS AFTER FINAL GRADING. MULCH SHALL BE USED AS NECESSARY FOR PROTECTION UNTIL 75% GROWTH IS ESTABLISHED. AT THE TIME WHEN THE SITE PREPARATION FOR PERMANENT VEGETATIVE STABILIZATION IS GOING TO BE ACCOMPLISHED, ANY SOIL WHICH WILL NOT PROVIDE A SUITABLE ENVIRONMENT TO SUPPORT ADEQUATE VEGETATIVE GROUND COVER SHALL BE REMOVED OR TREATED IN SUCH A WAY AS TO PERMANENTLY ADJUST THE SOIL CONDITIONS AND RENDER IT SUITABLE FOR VEGETATIVE GROUND COVER. SLOPES STEEPER THAN 3:1 (H:V) ARE PROHIBITED.
- 9. ALL NEW EROSION AND SILT CONTROL METHODS AND LOCATIONS INDICATED ON THIS DRAWING ARE FOR START-UP AND GENERAL REFERENCE AND SHALL BE ADJUSTED, AS REQUIRED, TO SUIT THE PROCESS OF THE CONSTRUCTION.
- 10. THE TYPE OF EROSION CONTROL BARRIERS USED SHALL BE GOVERNED BY THE NATURE OF THE CONSTRUCTION OPERATION AND SOIL TYPE THAT WILL BE EXPOSED. SILTY AND CLAYEY MATERIAL USUALLY REQUIRE SOLID SEDIMENT BARRIERS TO PREVENT TURBID WATER DISCHARGE, WHILE SANDY MATERIAL MAY NEED ONLY SILT SCREENS OR SYNTHETIC HAY BALES TO PREVENT EROSION. FLOATING TURBIDITY CURTAINS SHOULD BE USED IN OPEN WATER SITUATIONS. DIVERSION DITCHES OR SWALES MAY BE REQUIRED TO PREVENT TURBID STORM WATER RUNOFF FROM BEING DISCHARGED OFFSITE. IT MAY BE NECESSARY TO EMPLOY A COMBINATION OF BARRIERS, DITCHES, AND OTHER EROSION/TURBIDITY CONTROL MEASURES IF CONDITIONS WARRANT.
- 11. WHERE PUMPS ARE TO BE USED TO REMOVE TURBID WATERS FROM THE CONSTRUCTION AREA, THE WATER SHALL BE TREATED TO REDUCE TURBIDITY TO STATE WATER QUALITY STANDARDS PRIOR TO DISCHARGE. TREATMENT METHODS INCLUDE, FOR EXAMPLE, TURBID WATER BEING PUMPED INTO GRASSED SWALES OR APPROPRIATE VEGETATED AREAS (OTHER THAN UPLAND PRESERVATION AREAS AND WETLAND BUFFERS), SEDIMENT BASINS, OR CONFINED BY AN APPROPRIATE ENCLOSURE SUCH AS TURBIDITY BARRIERS, AND KEPT CONFINED UNTIL ITS TURBIDITY LEVEL MEETS STATE WATER QUALITY STANDARDS.
- 12. THE CONTRACTOR SHALL PROVIDE SILTATION REDUCTION DEVICES FOR THE DISCHARGE FROM THE DEWATERING PROCESS SO THAT DIRECT DISCHARGE DOES NOT OCCUR.
- 13. THE CONTRACTOR MUST APPLY TO THE FDEP FOR COVERAGE UNDER THE GENERIC PERMIT FOR THE DISCHARGE OF PRODUCED GROUNDWATER FROM ANY NON-CONTAMINATED SITE ACTIVITY PURSUANT TO 62-621.300 (2), F.A.C. CONTRACTOR IS RESPONSIBLE FOR ALL ASSOCIATED SAMPLING AND TESTING.
- 14. THE CONTRACTOR SHALL PROVIDE ROUTINE MAINTENANCE OF PERMANENT AND TEMPORARY EROSION CONTROL FEATURES UNTIL THE PROJECT IS COMPLETE AND ALL BARED SOIL STABILIZED. SILTATION ACCUMULATIONS GREATER THAN THE LESSER OF 12 INCHES OR ONE—HALF THE DEPTH OF THE SILTATION CONTROL BARRIER SHALL BE IMMEDIATELY REMOVED AND PLACED IN UPLAND AREAS.
- 15. THE CONTRACTOR SHALL CHECK ALL EROSION AND SILTATION CONTROL DEVICES AFTER EACH RAINFALL OR AT LEAST WEEKLY, WHICHEVER IS MORE FREQUENT, AND REPAIR OR REPLACE THEM AS REQUIRED (THE REPAIR AND/OR REPLACEMENT SHALL BE AT THE CONTRACTOR'S EXPENSE).
- 16. WATER REMAINING IN THE EXCAVATIONS AFTER CONSTRUCTION MUST BE KEPT CONFINED WITHIN THE EXCAVATIONS PRIOR TO DISCHARGE (IF APPLICABLE), UNTIL THE TURBIDITY LEVEL OF THE WATER MEETS STATE WATER QUALITY STANDARDS.
- 17. THE REQUIREMENTS LISTED ABOVE SHALL BE CONSIDERED MINIMUM REQUIREMENTS AND THE CONTRACTOR SHALL USE WHATEVER METHODS HE DEEMS NECESSARY & ALLOWED BY PERMIT TO PREVENT EROSION AND SILTATION AS MAY BE REQUIRED FOR THE PROJECT.

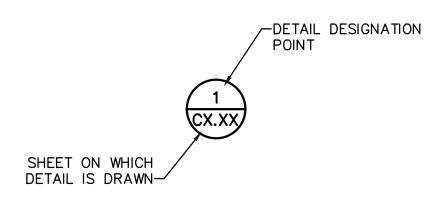
ABBREVIATIONS

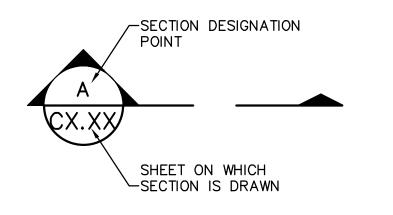
A.E.	APPROVED EQUAL	O.C.	ON CENTER	UTILITY POLE	U.P. 🖋 or 🔟
ALUM	ALUMINUM	OHW	OVERHEAD WIRE	6' CHAIN LINK FENCE	
APP	APPARENT	PL	PROPERTY LINE	RIGHT OF WAY	
APPROX	APPROXIMATE	PLC	PROGRAMMABLE LOGIC	EX. PAVED ROAD	
BLDG	BUILDING		CONTROLLER	TCE = TEMPORARY CONST. EASEMENT	
BNR	BIOLOGICAL NUTRIENT REMOVAL	PV	PLUG VALVE	CURB-GUTTER (EXISTING)	
BV	BALL VALVE	PROP.	PROPOSED	EX. SIDEWALKS	
CLF	CHAIN LINK FENCE	PVC	POLYVINYL	EX. CHAIN-LINK FENCE	
CONC	CONCRETE		CHLORIDE	EX. FENCES	
DI	DUCTILE IRON	RAS	RETURN ACTIVATED	EX. BURIED TELEPHONE	—— — вт ——
DR.	DRIVE		SLUDGE	EX. STORM PIPE	STM
EL	ELEVATION	RD.	ROAD	FIBER OPTIC CABLE	FOC
EOP	EDGE OF PAVEMENT	RCW	RECLAIM WATER	EX. BURIED ELECTRIC	—— — ВЕ ——
EX	EXISTING	R/W	RIGHT OF WAY	EX. FORCE MAIN	——— — FM ———
FB	FILTER BACKWASH	SCADA	SUPERVISORY CONTROL	EX. GAS	——— — GAS ———
FO	FIBER OPTIC		AND DATA ACQUISITION	EX. CABLE TELEVISION	—— — стv ——
FM	FORCE MAIN	SE	SECONDARY EFFLUENT	EX. WATER MAIN	——— — WM ———
GV	GATE VALVE	SS	SANITARY SEWER	EX. OVERHEAD WIRE	——— — ОНЖ ———
HW	HAND WHEEL	S.S.	STAINLESS STEEL	EX. RECLAIMED WATER	RCW
HYP0	SODIUM HYPOCHLORITE	TOS	TOP OF SLAB	EX. RAW WATER MAIN	RWM
1/0	INSTRUMENT/OPERATION	TYP	TYPICAL	EX. SANITARY SEWER	SAN
INV	INVERT	UTIL	UTILITY	EX. ITEMS TO BE REMOVED	(XXXXXXXXXX
LCP	LOCAL CONTROL PANEL	VFD	VARIABLE FREQUENCY		
MG	MILLION GALLON		DRIVE		, , , , , , , , , , , , , , , , , , , ,
		WAS	WASTE ACTIVATED		
			SLUDGE		
		WM	WATER MAIN		
		WRF	WATER RECLAMATION		
			FACILITY		

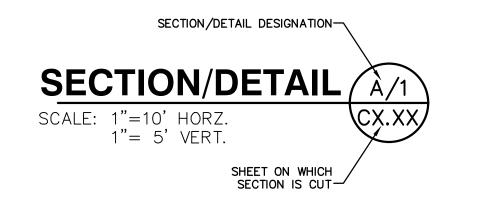
TRANSFER

LEGEND

SECTION AND DETAIL







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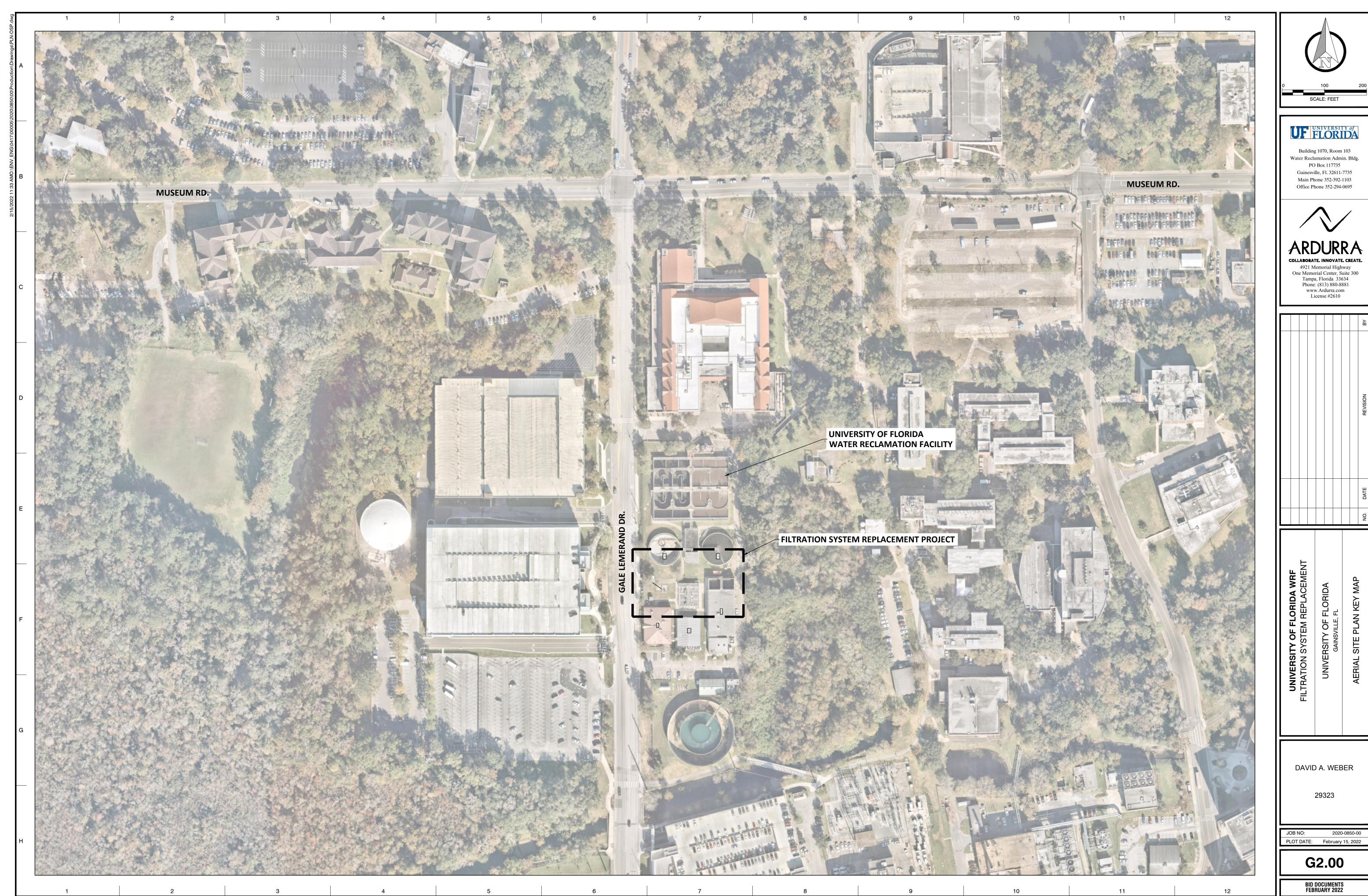
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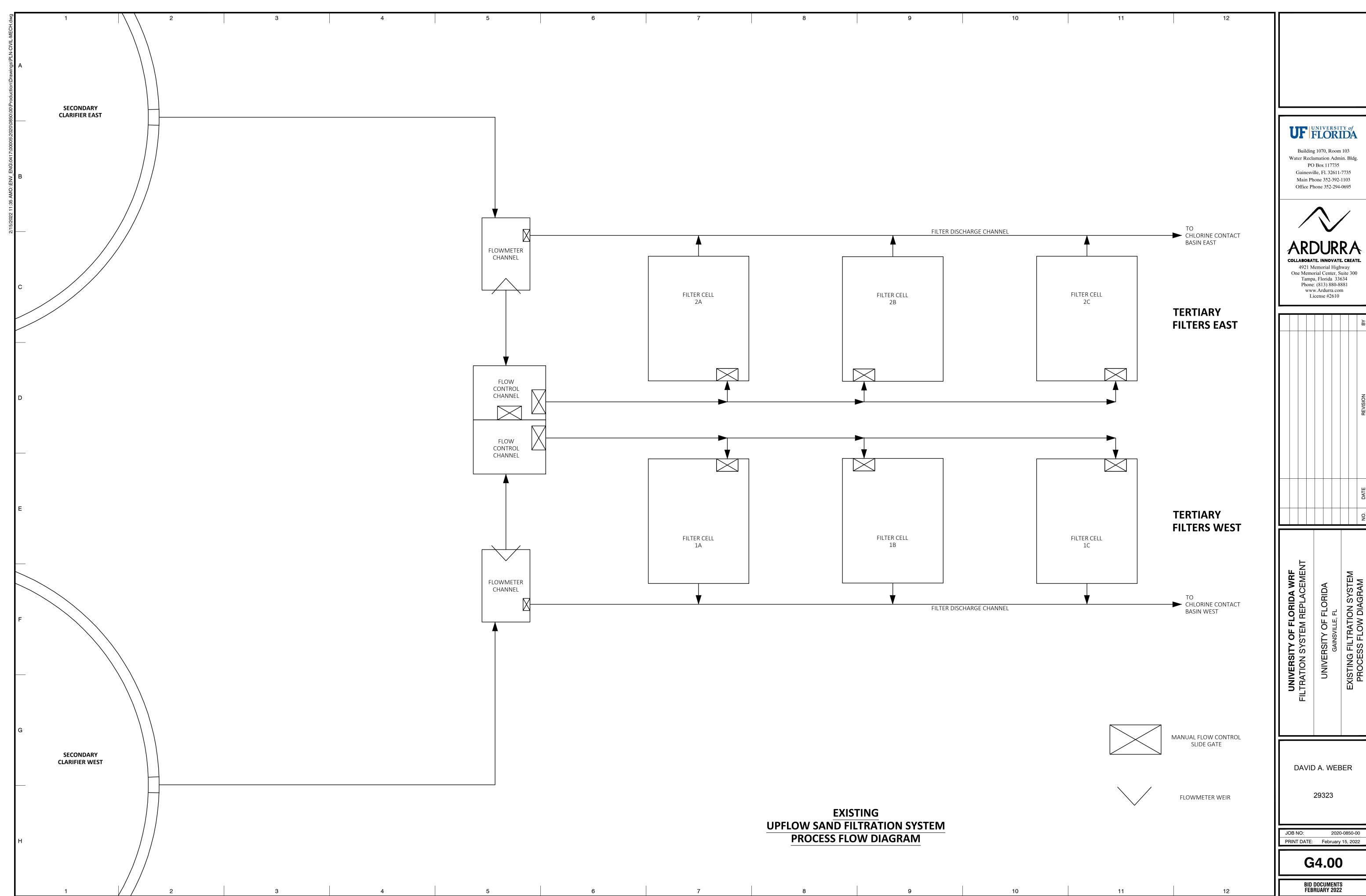
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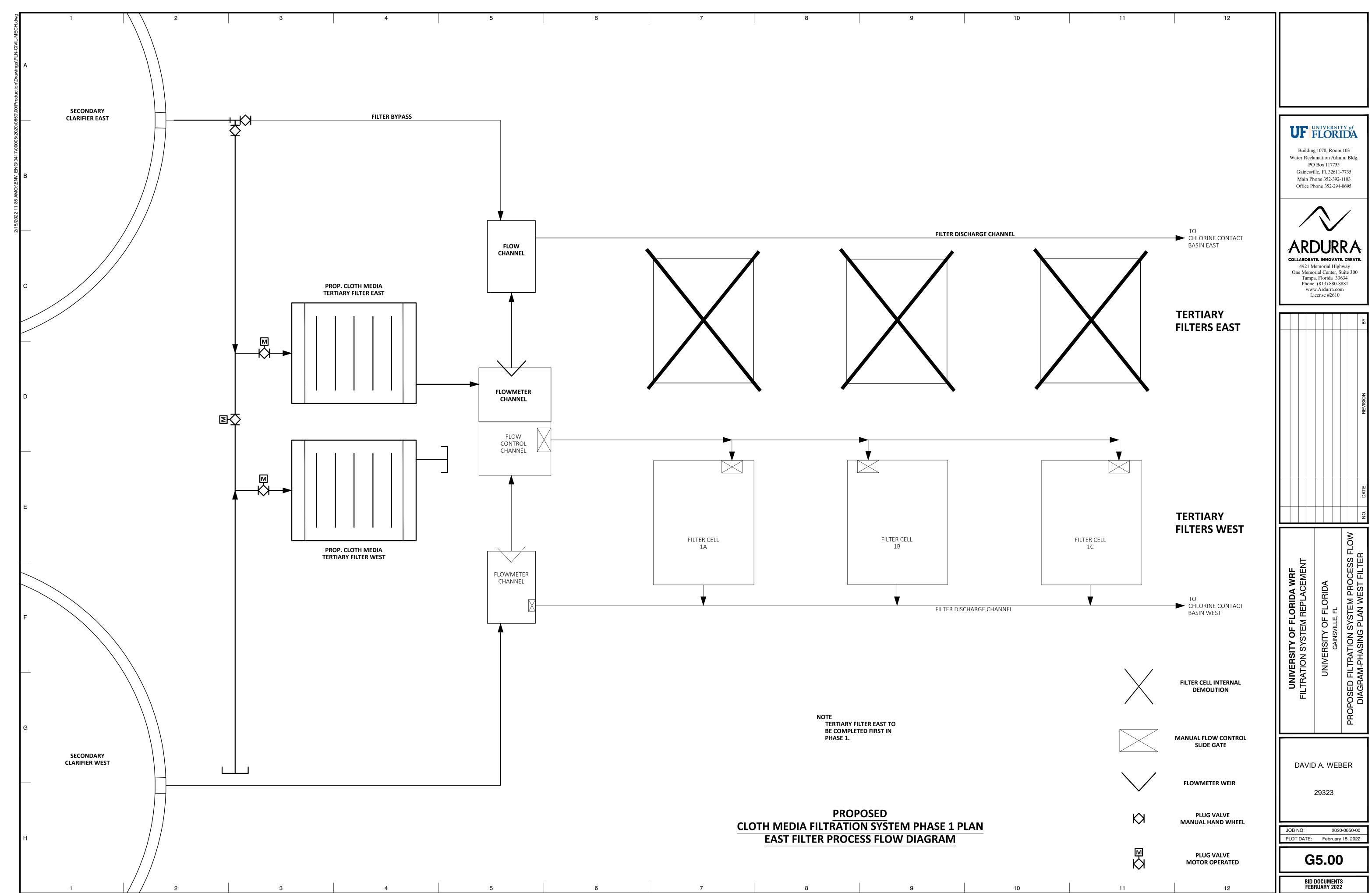
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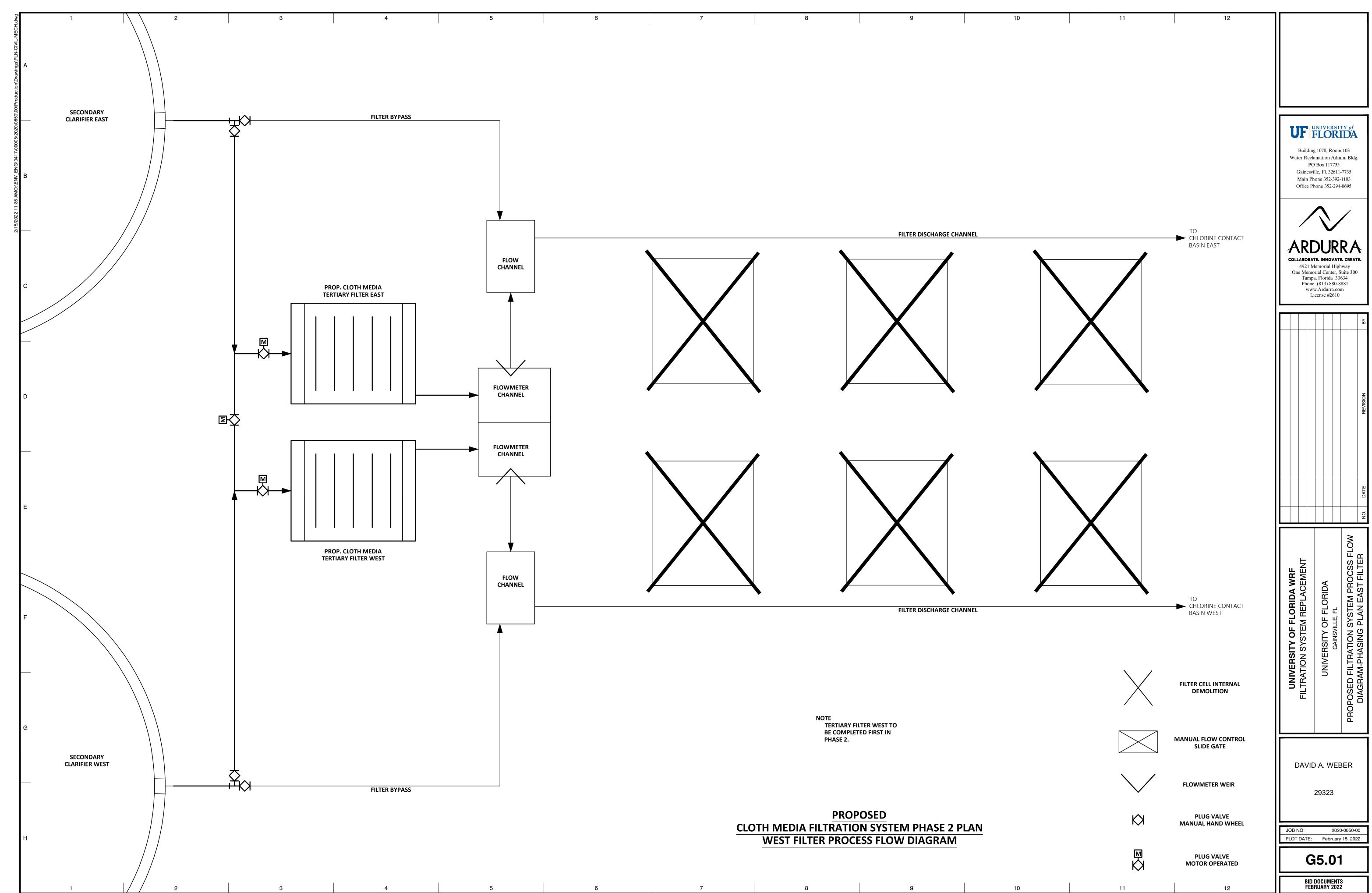
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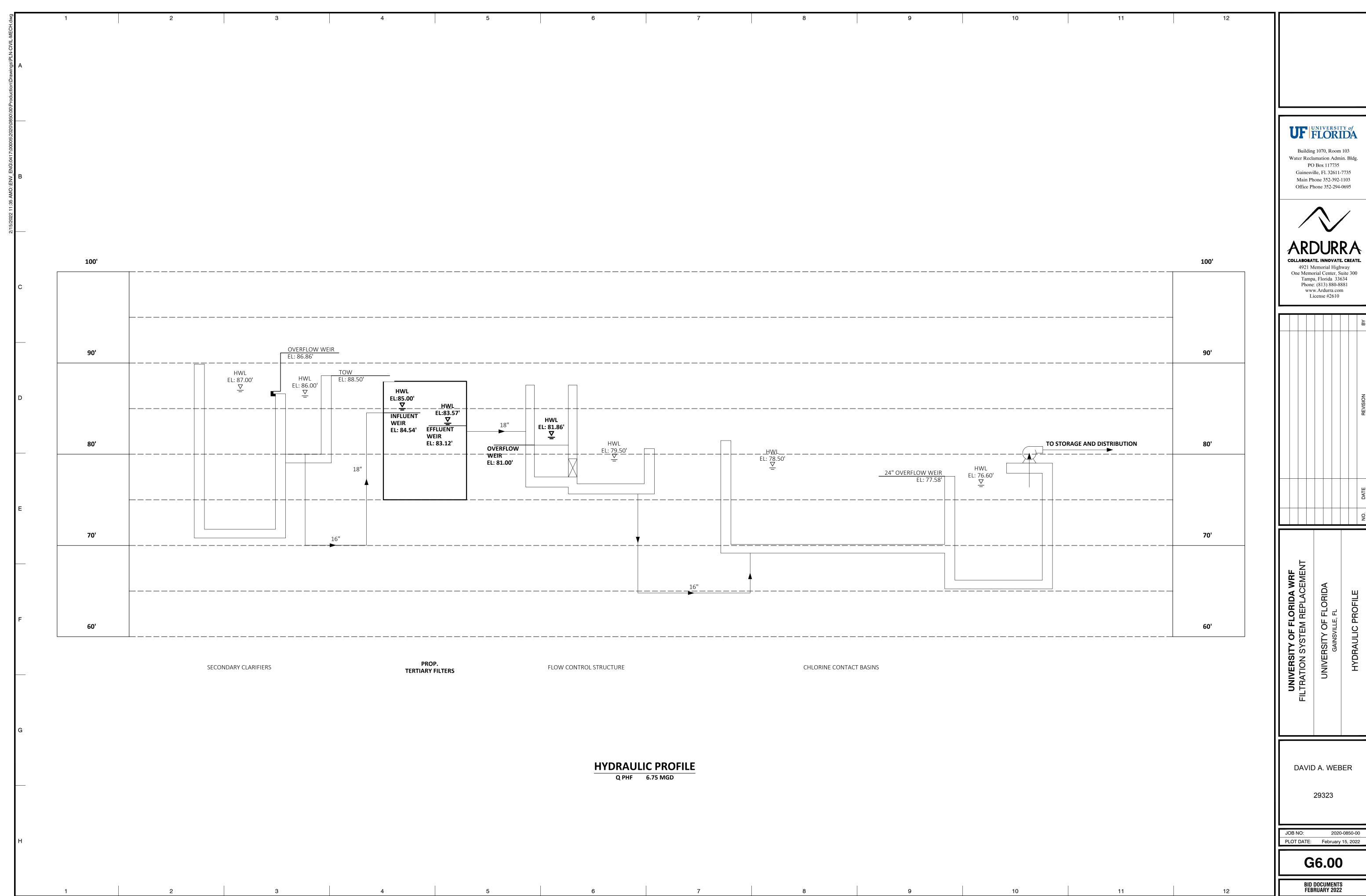


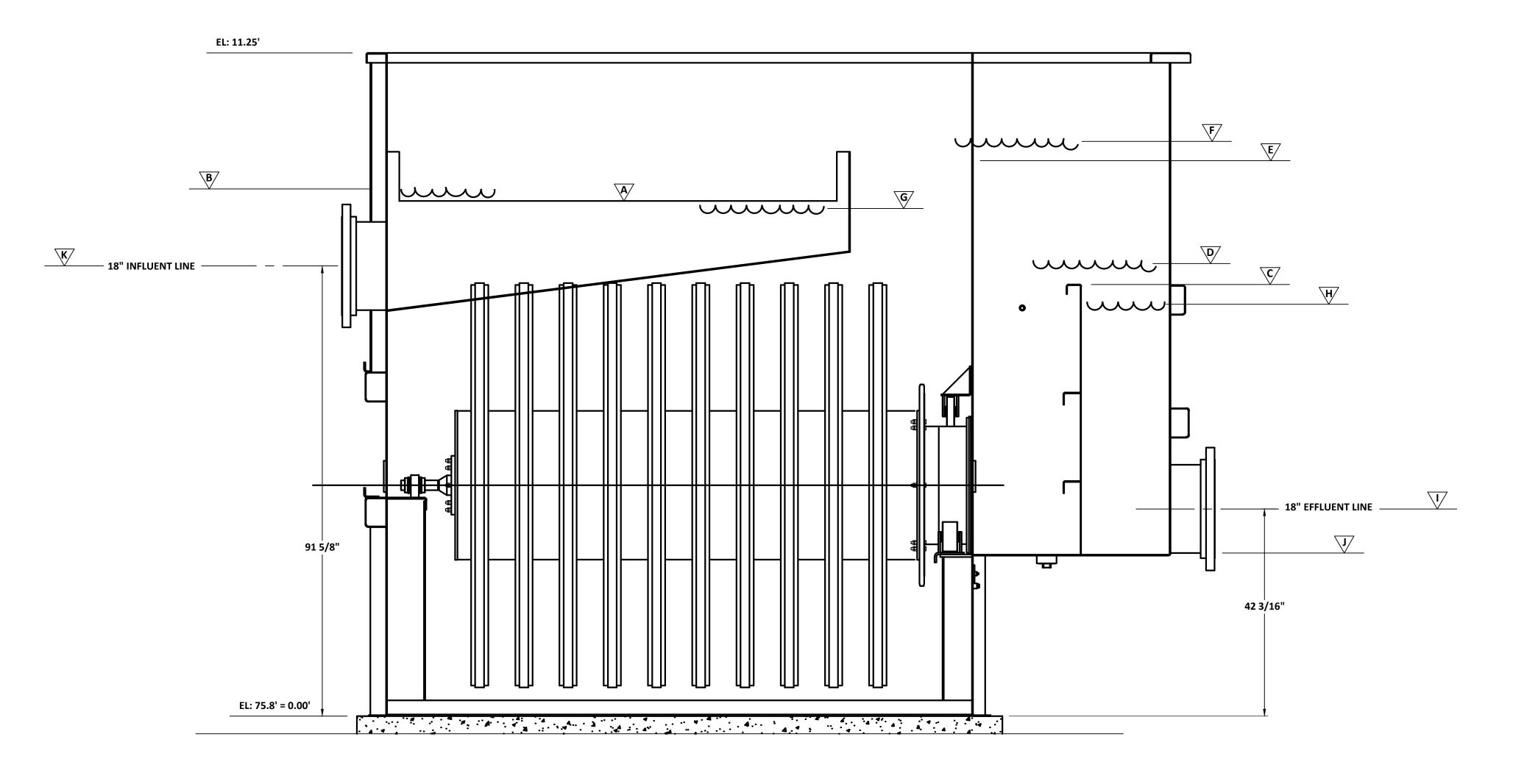












FILTER UNIT HYDRAULIC PROFILE

NO. OF FILTER UNITS: 2

10 DISCS @ 53.8 SF/DISC = 538 SF EACH, TOTAL 1076 SF FILTER MEDIA:

INFLUENT = 7.42' EFFLUENT = 7.75' OVERFLOW = 5.33' **WEIR LENGTHS:**

HYDRAULIC PROFILE: BASED UPON AVERAGE FLOW RATE OF 3.25 GPM PER SQUARE FOOT (2.5 MGD) BASED UPON MAXIMUM FLOW RATE OF 6.5 GPM PER SQUARE FOOT (5.0 MGD)

HYDRAULIC LOADING RATES				
NO. UNITS OPERATING	PROCESS FLOW (EACH)	PROCESS LOADING RATE (GPM/SF EACH)		
2	1.5 MGD ADF	1.96		
2	3.375 MGD PHF	4.4		
1	3.0 MGD ADF	3.9		
1	5.0 MGD 75% PHF	6.5		
1	6.75 MGD PHF	8.8		

ELEVATION

84.54' INFLUENT WEIR ELEVATION

84.83' NAPPE OVER INFLUENT WEIR AVERAGE FLOW __85.00' NAPPE OVER INFLUENT WEIR MAXIMUM FLOW

83.12' EFFLUENT WEIR ELEVATION

83.40' NAPPE OVER EFFLUENT WEIR AVERAGE FLOW __83.57' NAPPE OVER EFFLUENT WEIR MAXIMUM FLOW

85.22' OVERFLOW WEIR ELEVATION

85.58' NAPPE OVER OVERFLOW WEIR AVERAGE FLOW 85.79' NAPPE OVER OVERFLOW WEIR MAXIMUM FLOW

84.50' BACKWASH INITIATE LEVEL

82.62' MAXIMUM AVAILABLE LIQUID FOR EFFLUENT CONVEYANCE

79.31 18" EFFLUENT CENTERLINE

78.56' 18" EFFLUENT INVERT

83.53' 18" INFLUENT CENTERLINE

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COLLABORATE. INNOVATE. CREATE.

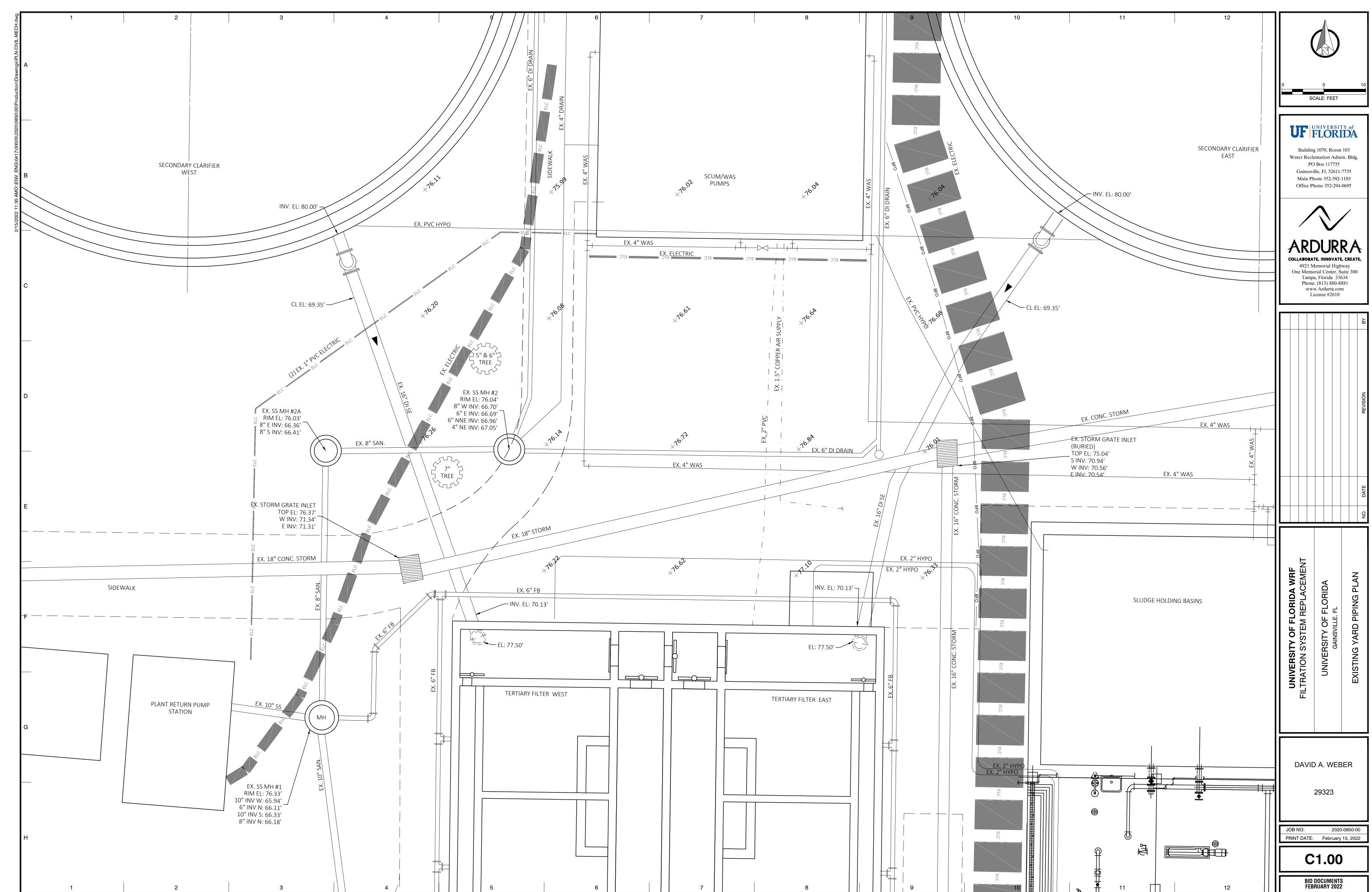
UNIVERSITY OF FLORIDA WRF FILTRATION SYSTEM REPLACEMENT

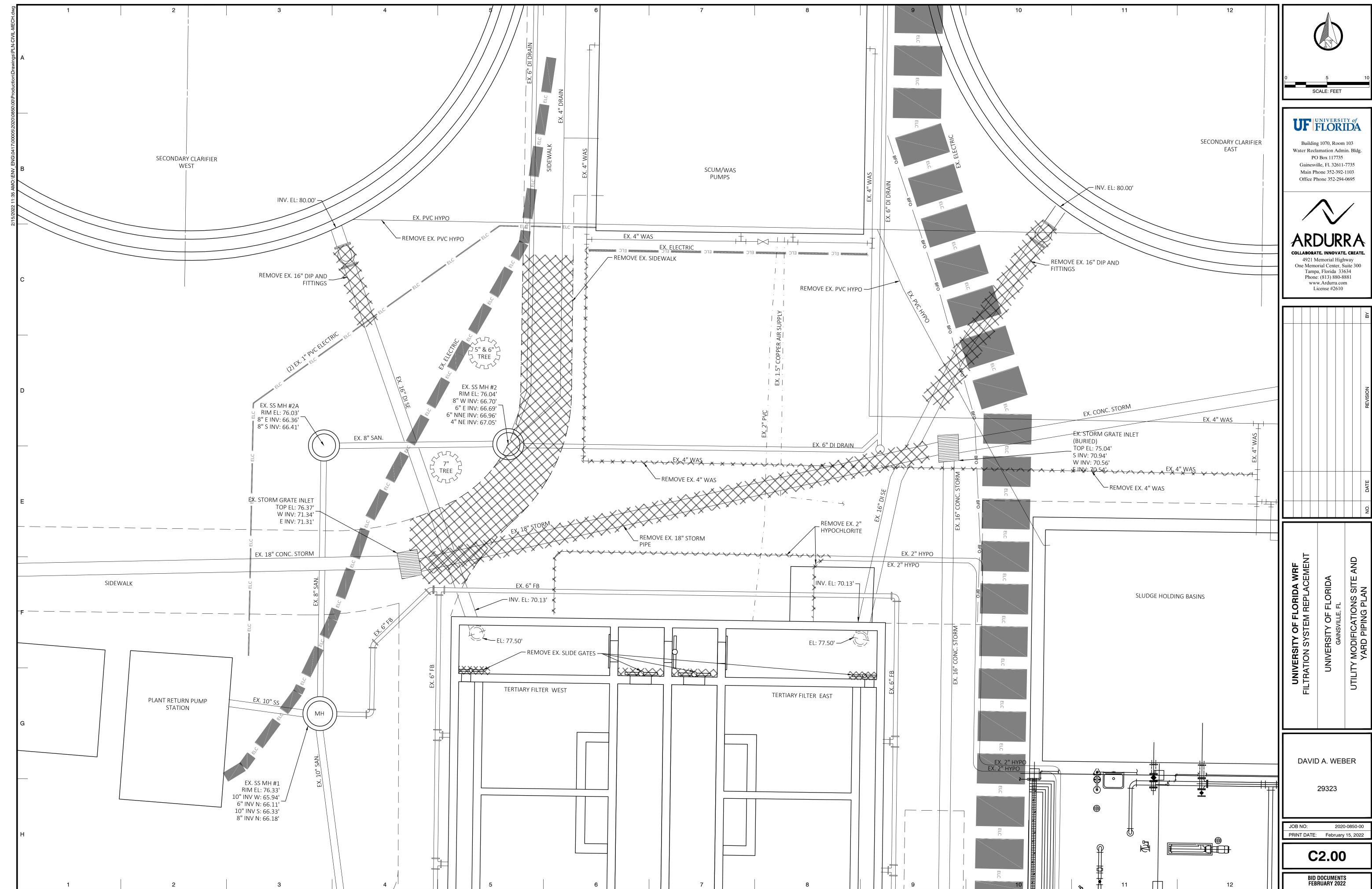
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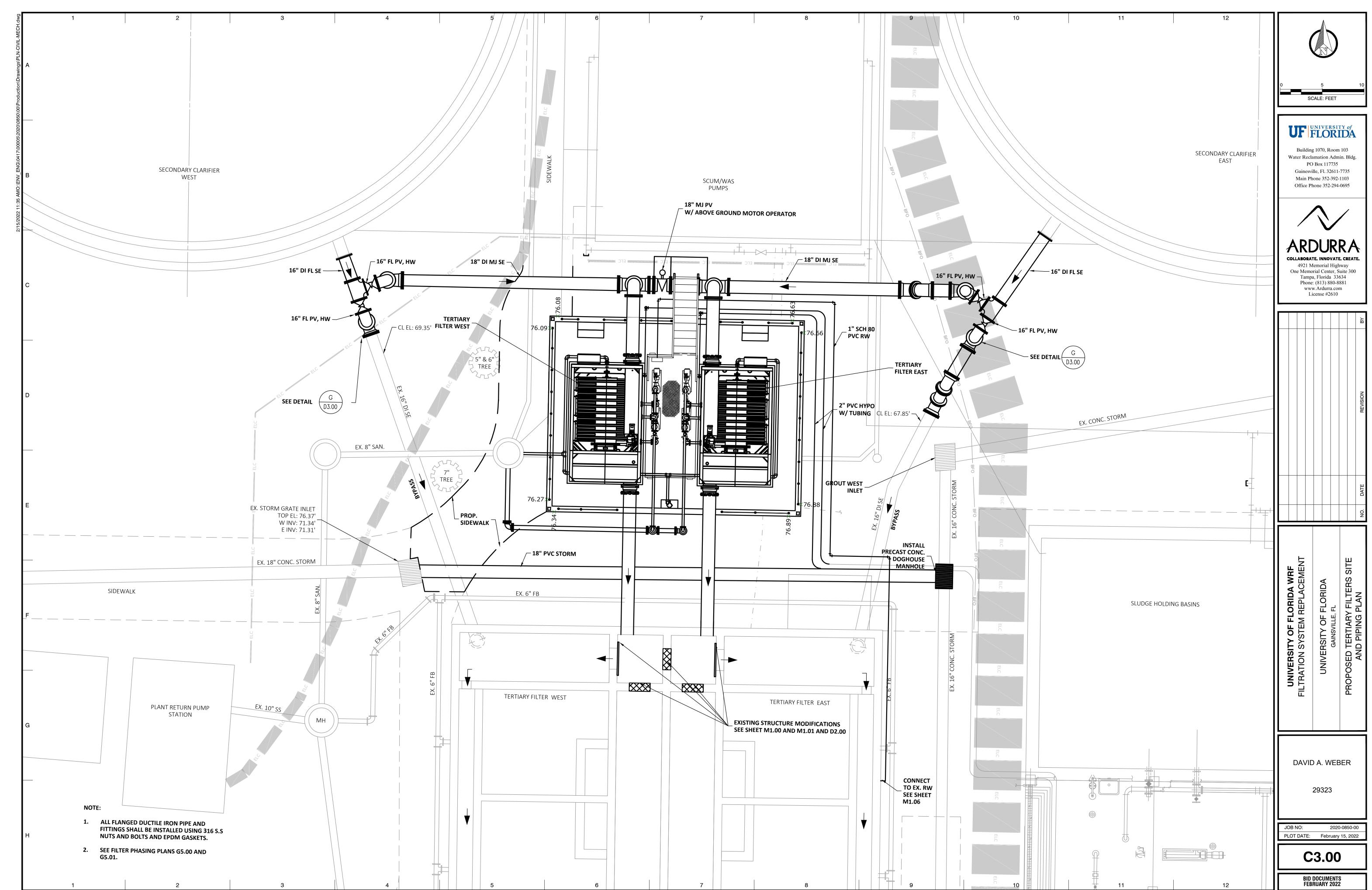
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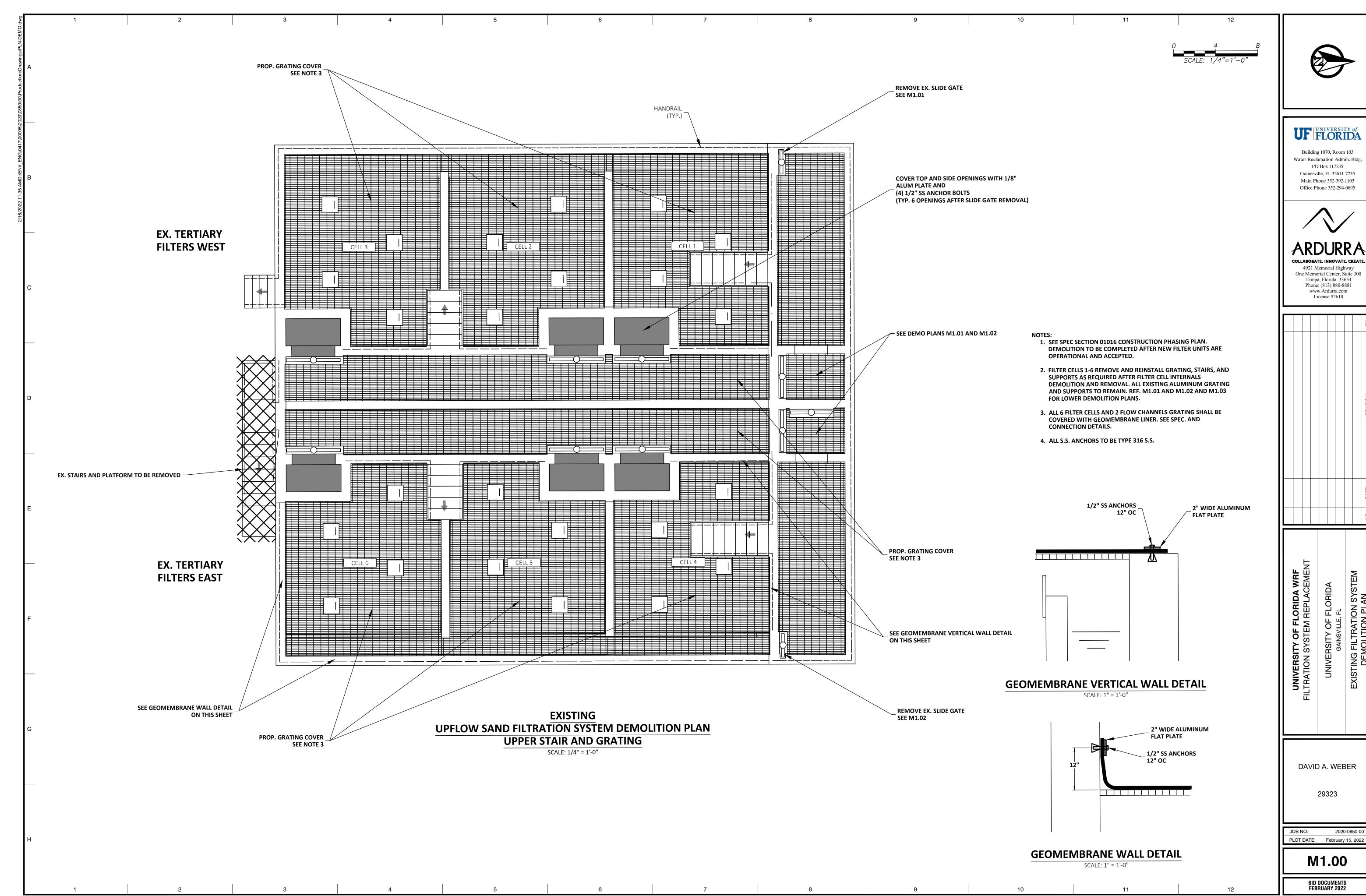
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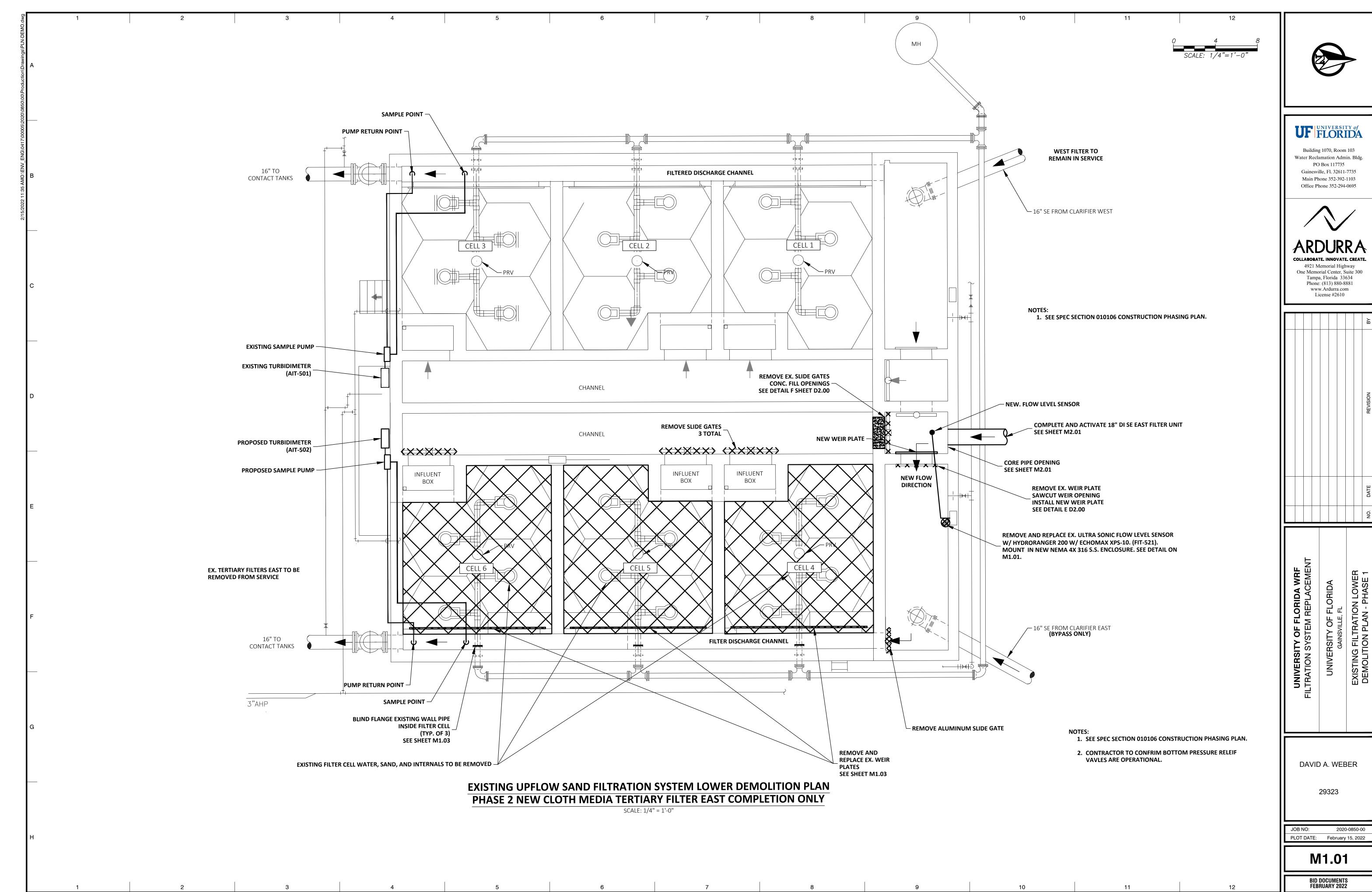
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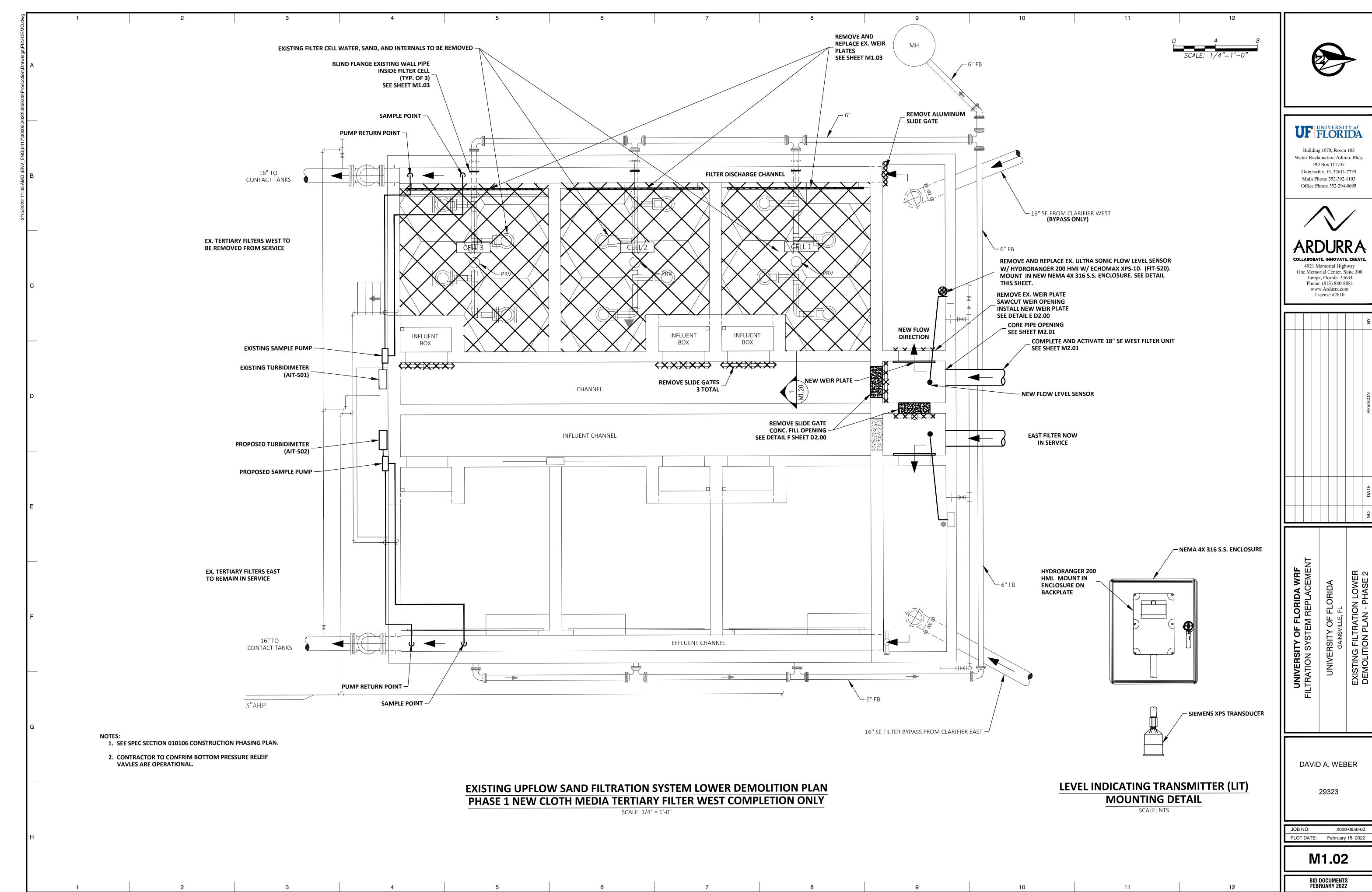


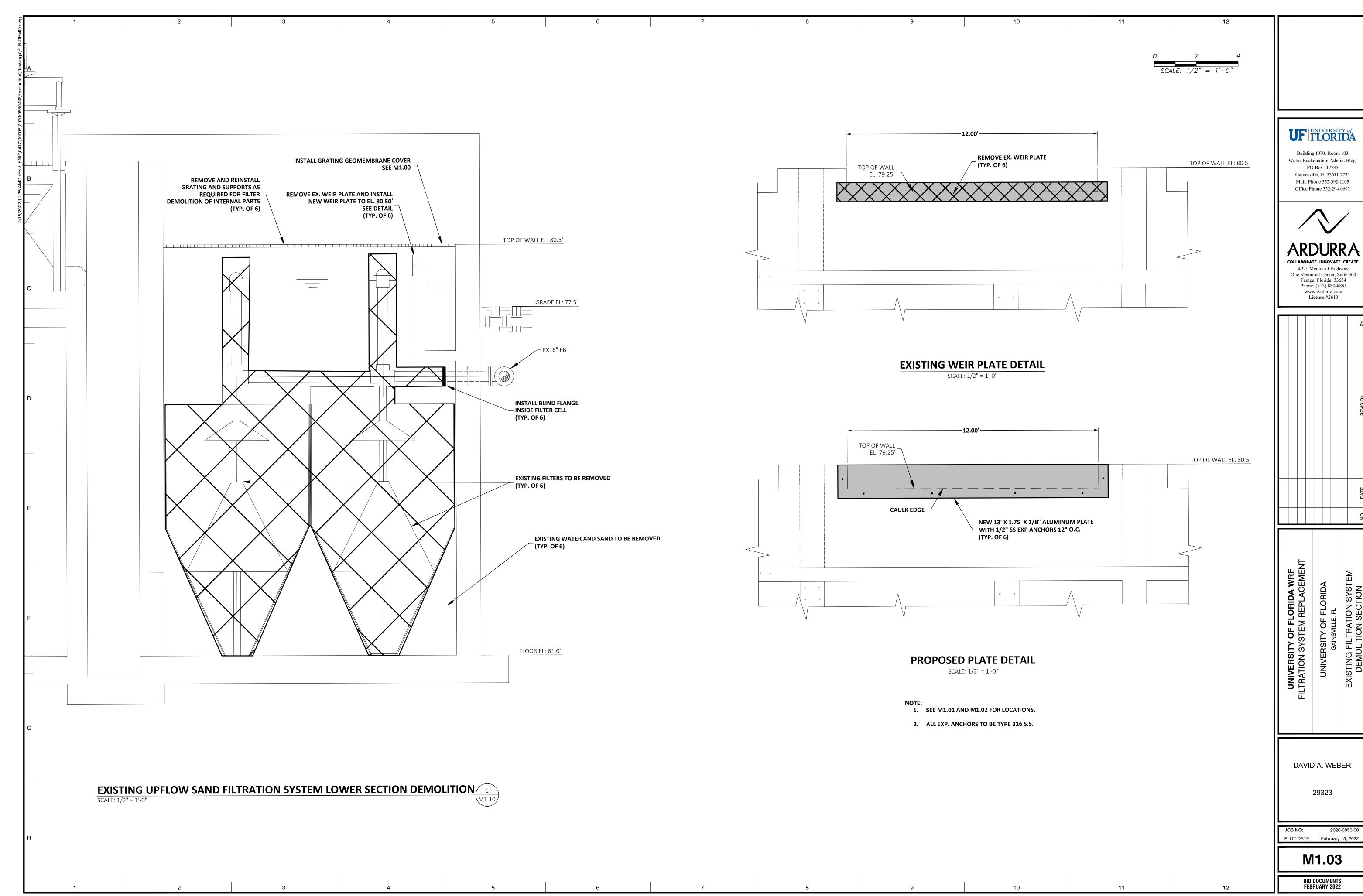












EXISTING CONTROL PANEL TO BE REMOVED

EXISTING CONTROL PANEL TO BE REMOVED

EXISTING CONTROL PANEL TO BE REMOVED



- NOTE:

 1. ALL EXISTING SAND FILTER CONTROL PANELS AND ASSOCIATED AIR AND ELECTRICAL PIPING AND CONDUITS FOR EXISTING FILTRATION SYSTEM TO BE REMOVED BACK TO THE SOURCE.
- 2. SEE SPECS. SECTION 01016 CONSTRUCTION PHASING PLAN AND M1.01 AND M1.02 PHASING PLANS.
- 3. CONTRACTOR SHALL REMOVE ALL EX. CONDUCTORS BACK TO SOURCE. ALL UNNECESSARY CONDUCTORS SHALL BE CUT AND CAPPED AT GRADE.

EXISTING FILTRATION SYSTEM DEMOLITION

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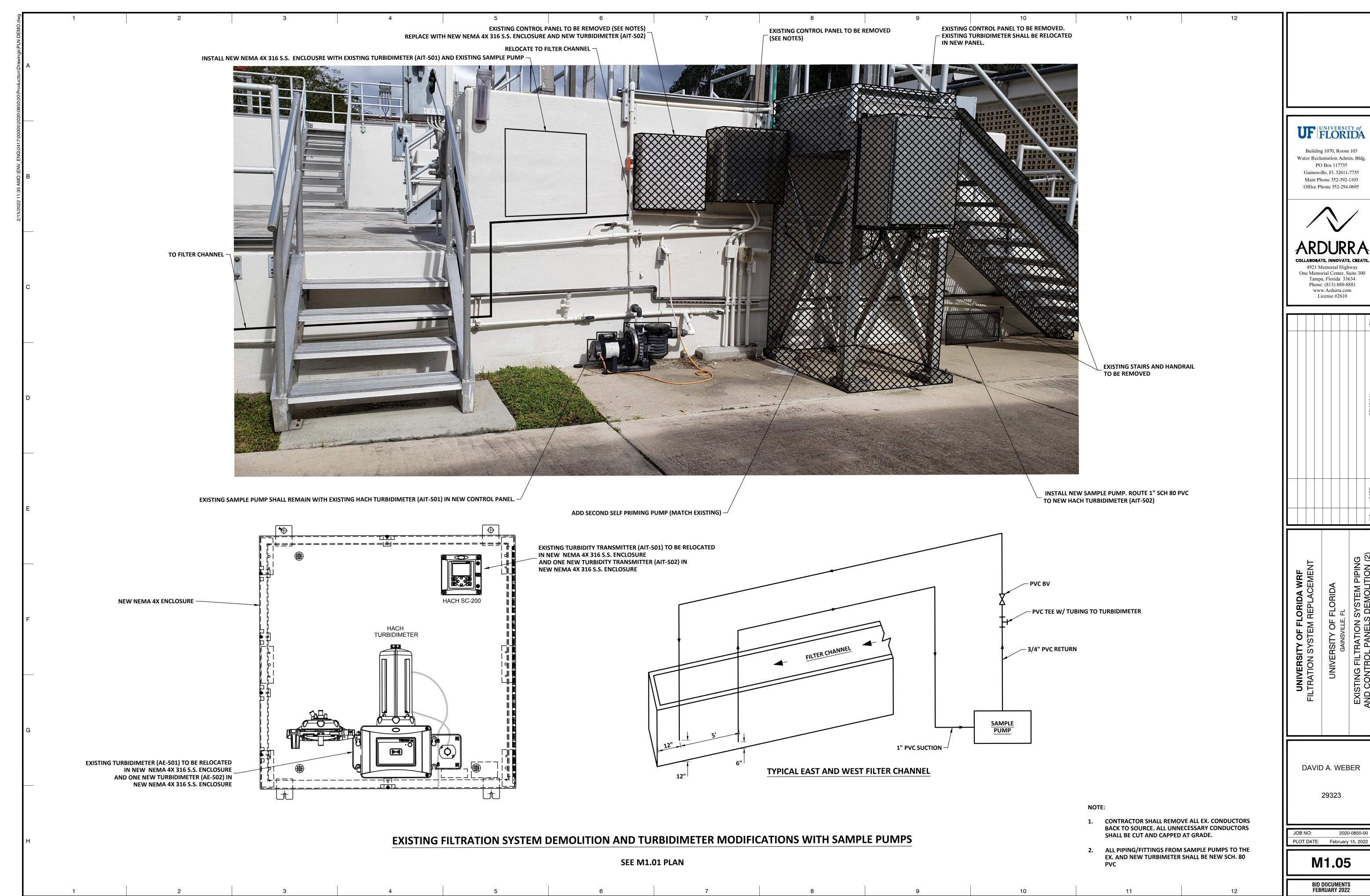
DAVID A. WEBER

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PLOT DATE: February 15, 2022

M1.04

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EXISTING CONTROL PANEL TO BE REMOVED \neg

EXISTING CONTROL PANEL TO BE REMOVED -



ELECTRICAL CONDUITS TO BE CUT AND CAPPED AT GRADE (TYP.)

CONNECTION POINT TO

NEW FILTERS RW HOSE FEED
SEE SHEET C3.00

1. CONTRACTOR SHALL REMOVE ALL EX. CONDUCTORS BACK TO SOURCE. ALL UNNECESSARY CONDUCTORS SHALL BE CUT AND CAPPED AT GRADE.

EXISTING FILTRATION SYSTEM DEMOLITION

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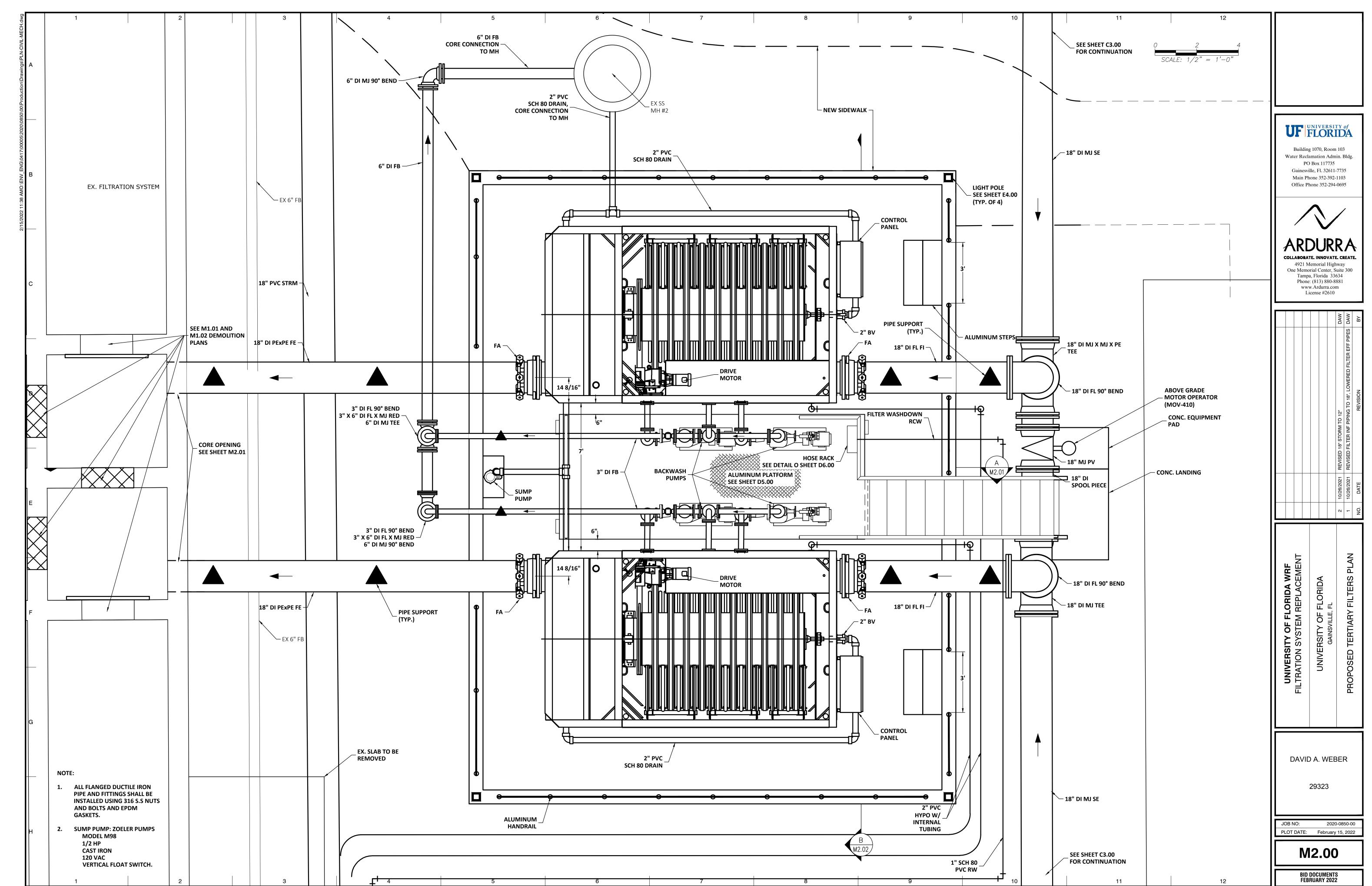
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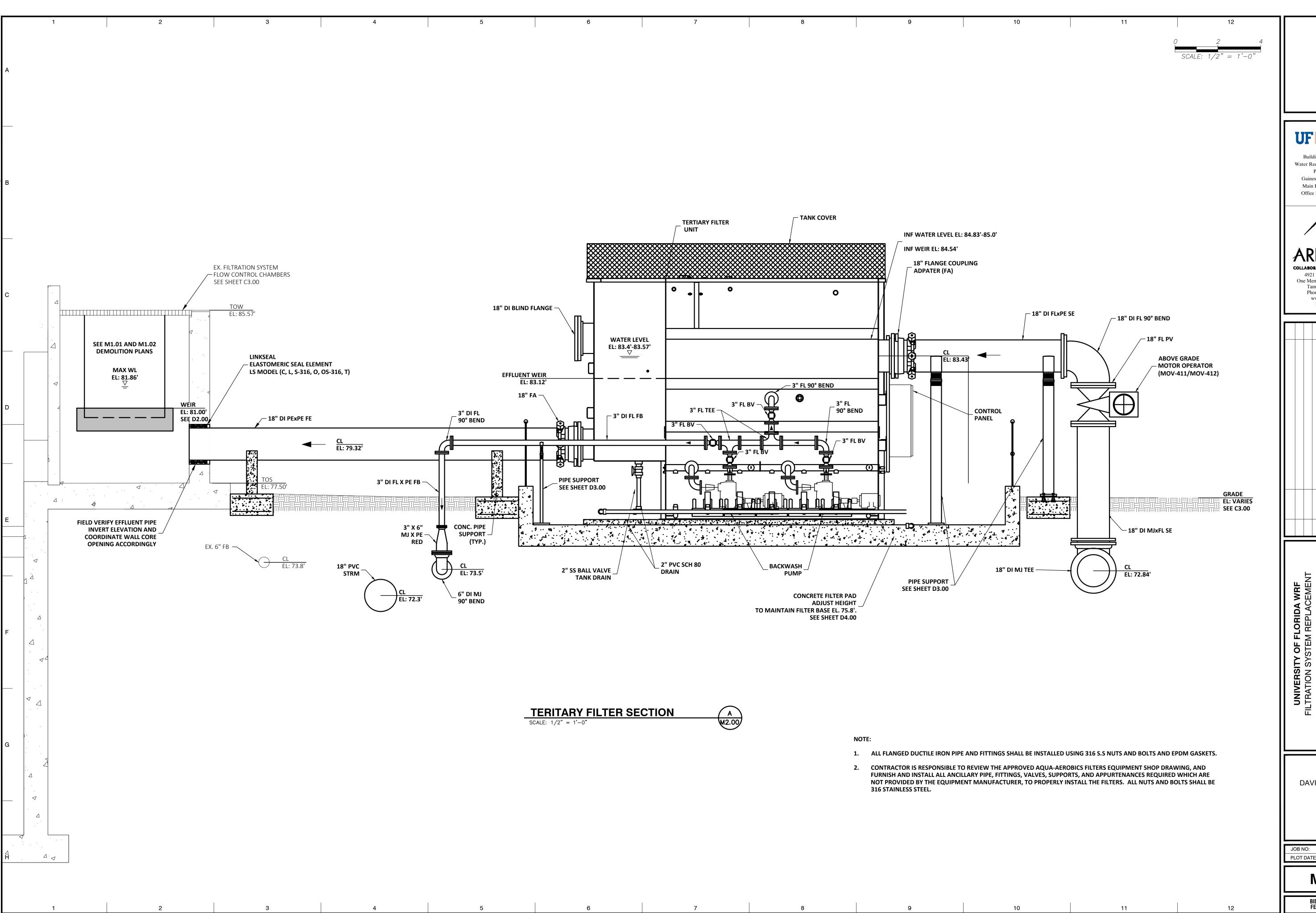
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M1.06





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No. Date REVISION

HIL I HATION SYSTEM HEPLACEME

UNIVERSITY OF FLORIDA

GAINSVILLE, FL

PROPOSED TERTIARY FILTERS

SECTION

DAVID A. WEBER

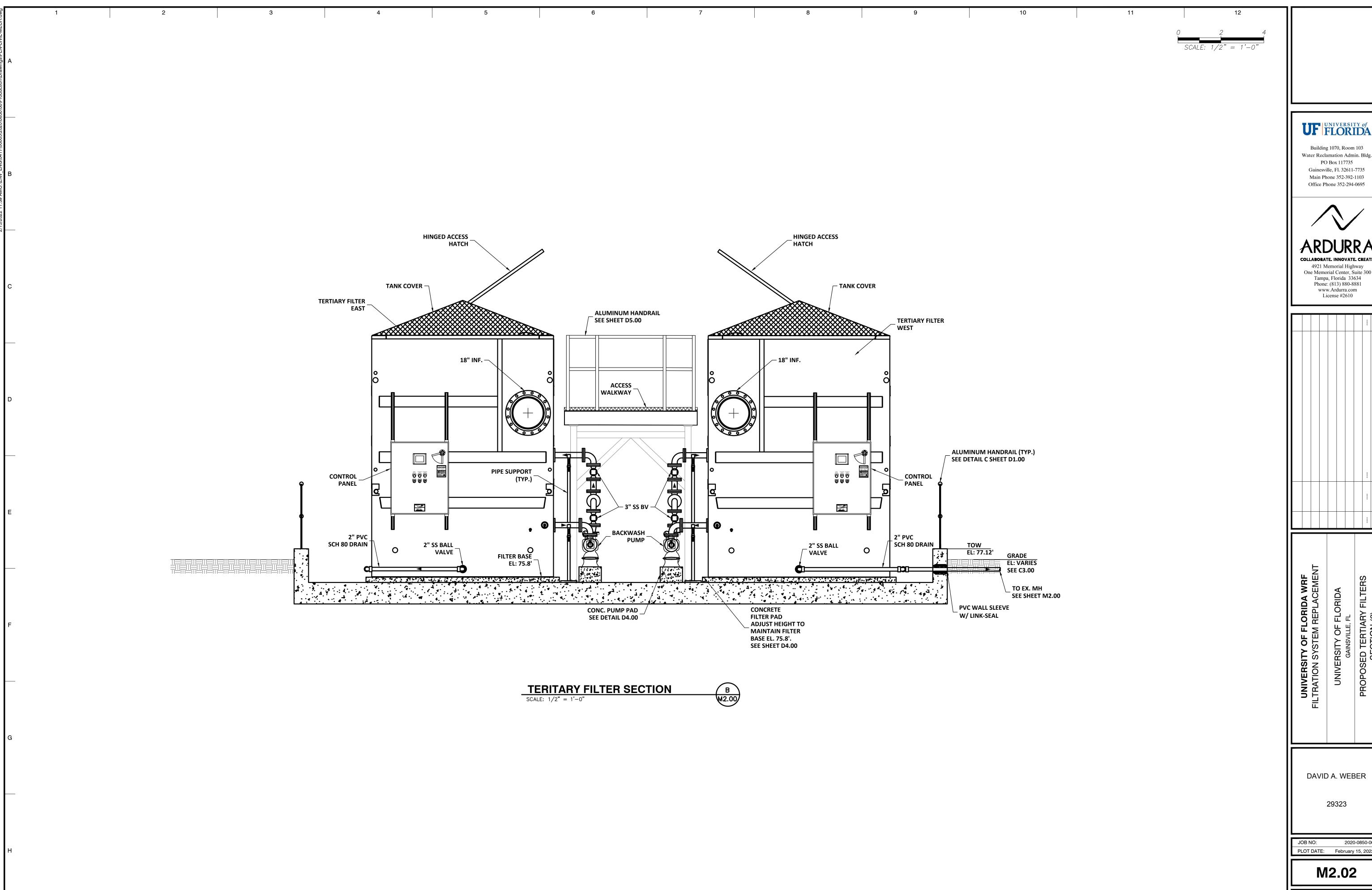
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JOB NO: 2020-0850-00

PLOT DATE: February 15, 2022

M2.01

BID DOCUMENTS FEBRUARY 2022



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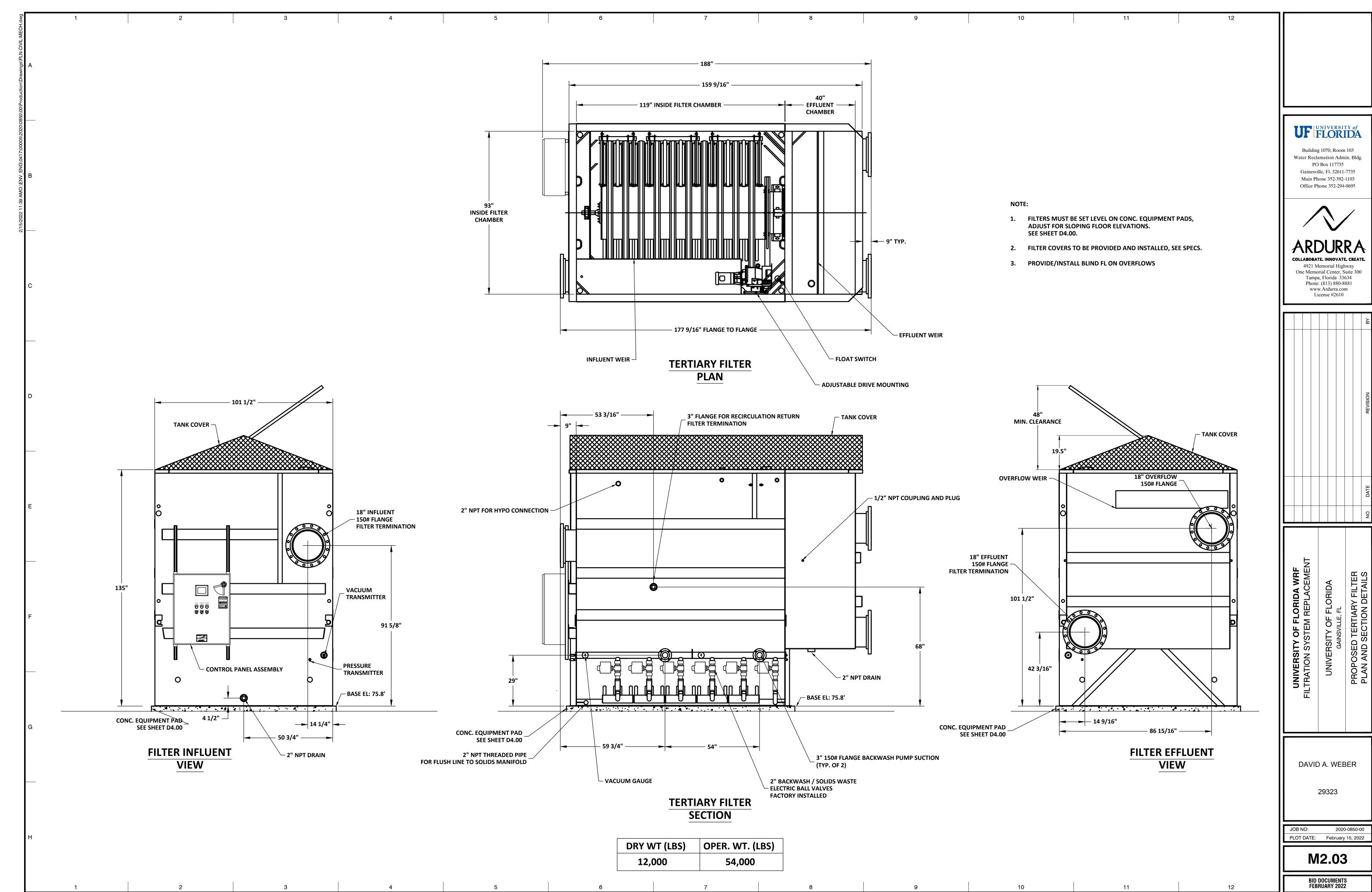
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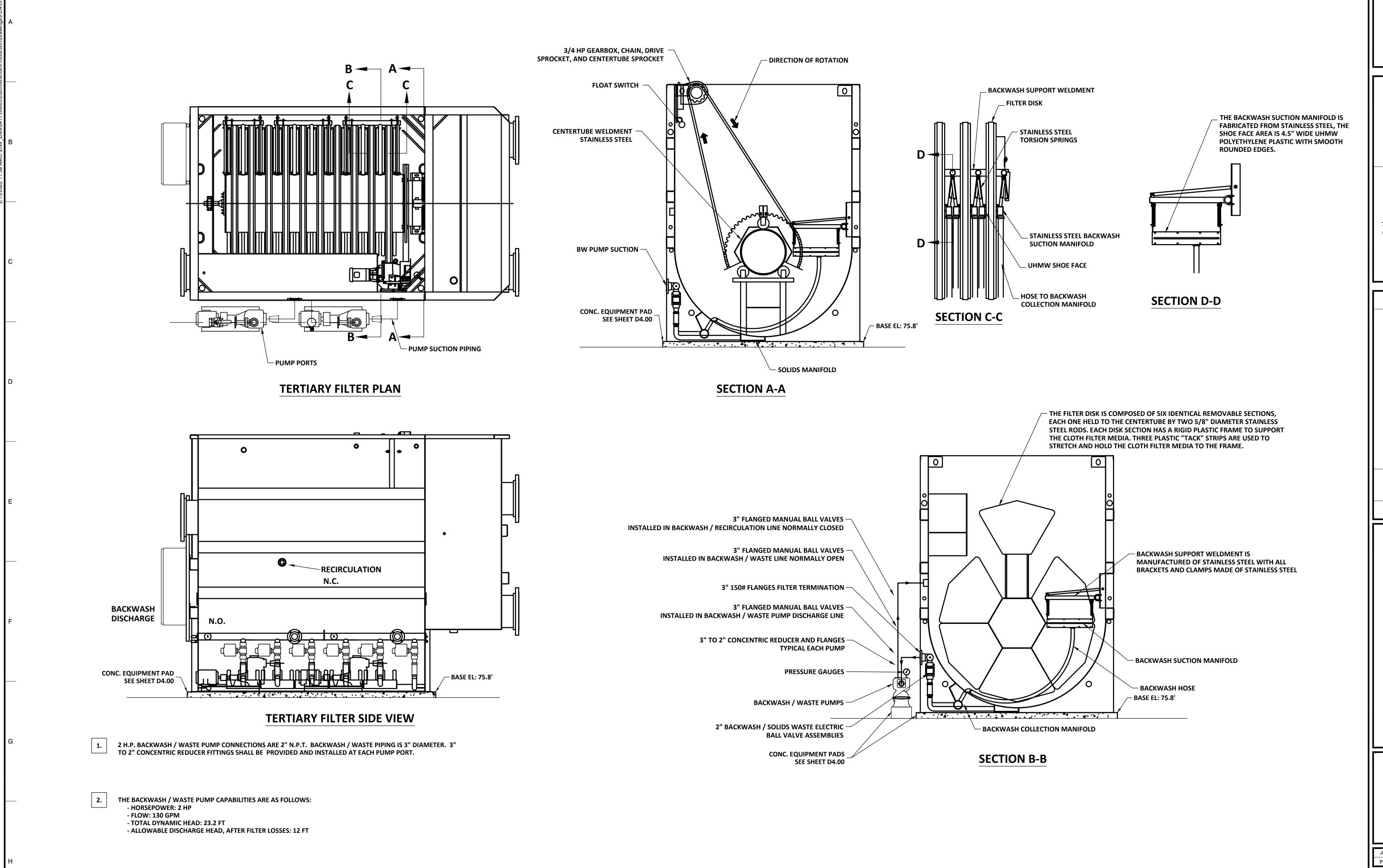
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PLOT DATE: February 15, 2022

M2.02





FILTER COVERS

- ALUMINUM FRAME MEMBRANE COVER

UNIVERSITY of FLORIDA

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NO. DATE REVISION

UNIVERSITY OF FLORIDA WRF
FILTRATION SYSTEM REPLACEMENT
UNIVERSITY OF FLORIDA
GAINSVILLE, FL
PROPOSED TERTIARY FILTER
PLAN AND SECTION DETAILS (2)

DAVID A. WEBER

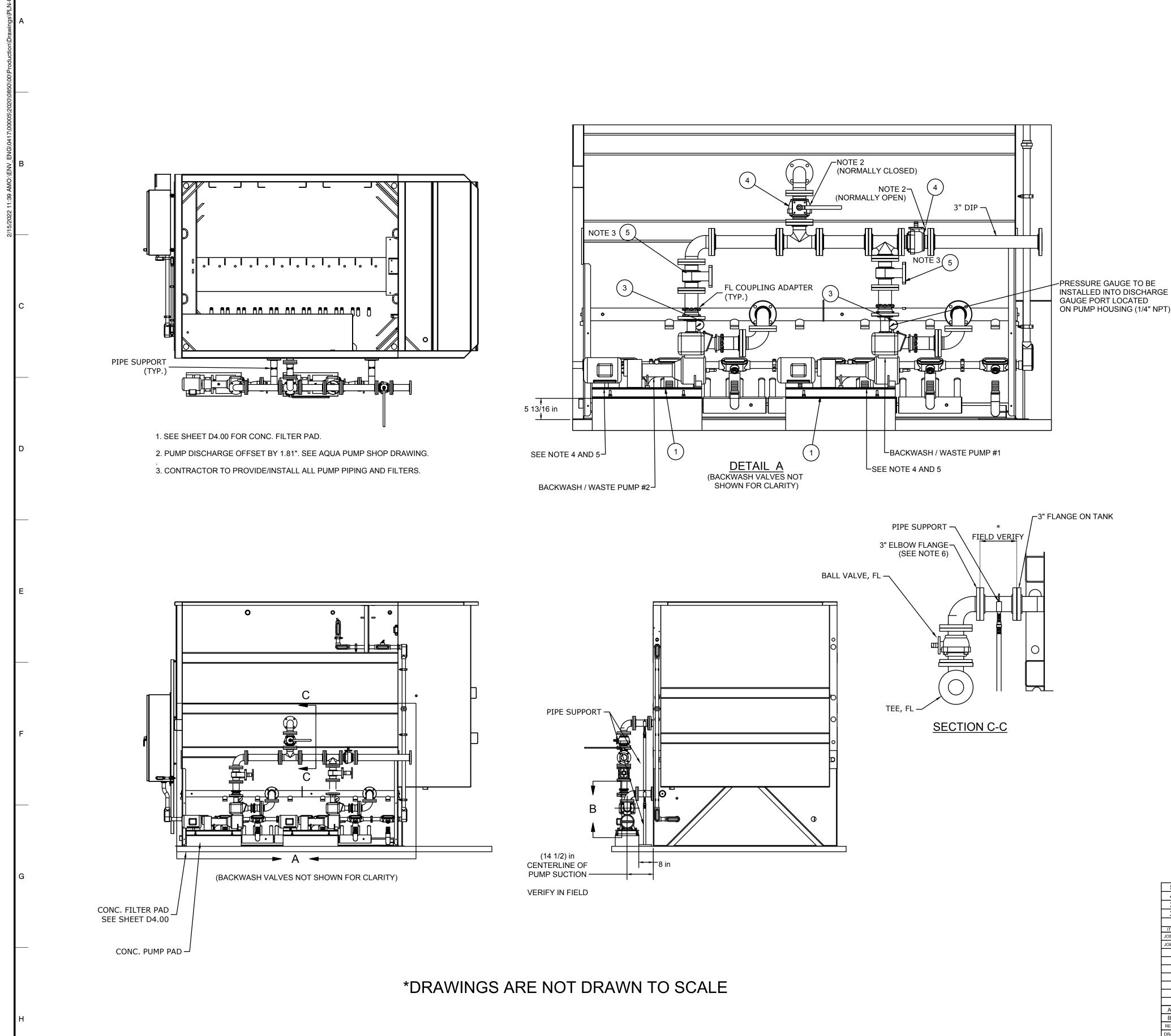
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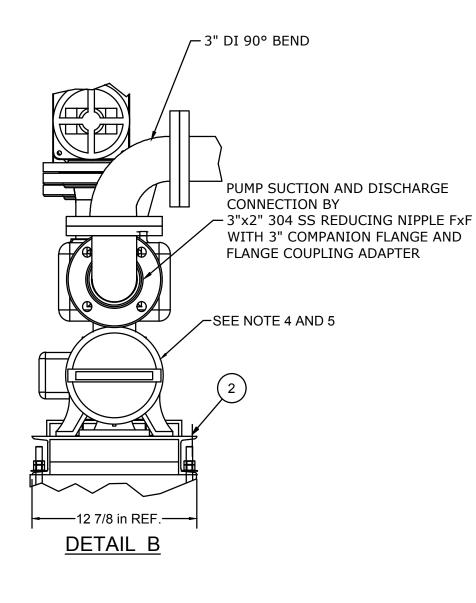
JOB NO: 2020-0850-00
PLOT DATE: February 15, 2022

M2.04

BID DOCUMENTS February 2022

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NOTES:

- 1. AQUA SHOP DRAWING REVISION TO FLANGE PIPNG AND VALVES FOR BACKWASH PUMP
- 2. THE PURPOSE OF THESE VALVES IS FOR RECIRCULATING DURING CHEMICAL CLEANING.
- 3. THE PURPOSE OF THESE VALVES IS TO ALLOW ADJUSTMENT OF DISCHARGE PRESSURE IN RELATIONSHIP TO VACUUM FROM THE SUCTION MANIFOLD TO OBTAIN THE CORRECT BACKWASH NOZZLE SUCTION AND PUMP DISCHARGE FLOW.
- 4. THE BACKWASH / WASTE PUMP CAPABILITIES ARE AS FOLLOWS. PIPING FROM EACH BACKWASH / WASTE PUMP TO THE FINAL DISCHARGE LOCATION MUST ALLOW FOR OPERATION OF ALL PUMPS SIMULTANEOUSLY WITHOUT EXCEEDING THIS ALLOWABLE DISCHARGE HEAD.
- CONNECTION: 2" - MOTOR: 2 HP
- MOTOR: 2 HP - FLOW: 130 GPM
- TOTAL DISCHARGE HEAD: 23.2 FT
- ALLOWABLE DISCHARGE HEAD AFTER FILTER LOSSES: 12.2 FT
- 5. AFTER ELECTRICAL HOOKUP, THE FOLLOWING IS A PROCEDURE FOR THE PUMP SPIDER COUPLING INSTALLATION:
 - OUPLING INSTALLATION:

 A. REMOVE COUPLING GUARD.
- B. CONFIRM COUPLING HAS BEEN SEPARATED.C. CHECK THE MOTOR FOR PROPER ROTATION.
- D. INSTALL THE SPIDER AND CONNECT THE COUPLING.
- E. REINSTALL THE COUPLING GUARD. F. REMOVE TAG.
- 6. PIPING, GASKETS, AND FASTENERS ARE SUPPLIED BY CONTRACTOR. PIPING IS SHOWN FOR REFERENCE ONLY. DESIGN, MATERIAL, AND ASSEMBLY ARE THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR. ONLY PARTS LABELED AND LISTED IN THE BILL OF MATERIAL ARE SUPPLIED BY AQUA-AEROBIC SYSTEMS, INC.
- 7. PUMP SUCTION AND DISCHARGE PIPING MUST HAVE A FLANGED OR UNION CONNECTION (BY OTHERS) TO FACILITATE PUMP REMOVAL FOR SERVICE.
- 8. EACH BACKWASH / WASTE PUMP ASSEMBLY WEIGHS: 200 lbs (90.7 kg).
- 9. CONDUIT FITTING WITH 10 FT. LEAD WIRES FOR PUMP. WIRE IS COILED AND PROTECTED FOR SHIPMENT. CONTRACTOR MUST LOCATE PUMPS WITHIN DISTANCE OF THE FACTORY WIRING.

5	2	2610	681	VALVE 3" TCI FLANGED GATE	·		316 SS		-
4	2	26207	37-1	VALVE, 3", BALL, FLANGE, TCI TC-5000			316 SS		-
3	2	2607	690	PRESSURE GAUGE, 2.5", 0-15 PSI			STEEL		-
2	8	2962	622	KIT, WEDGE ANCHOR, 1/2"			316 SS		Υ
1	2	296530	08-35	PUMP, G-R 12B20B, 2HP BALDOR MTR PE F1, T	STATS		-		Υ
ITEM	QTY	PART NU	IMBER	DESCRIPTION			MATERIAL		DWG
					DO NOT SCALE DRAWING	FRACTIONAL DALL TWO PLACE		1/16 0.010 (· H
			+		MATERIAL: _	ALL ANGLES		1/2°	
					SIMILAR TO: 2	965875			
Α	-	2022-01-11	BJW	SUBMITTAL	TYPE: ADF	SP-54X1	0E		
В	R20519	2022-01-27	BJW	RELEASE TO PRODUCTION	DRAWN BY: B	JW	DATE: 20)22-01-	11
REV	ERN/ECO	DATE	BY	REVISION DESCRIPTION	WEIGHT:		SHEET:	1 OF	1
	NG NAME:	PUMP INSTL,	10 DIS	SK RH	DRAWING NUM 9115312			SCALE: NTS	SIZE:

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WRF IMENT

UNIVERSITY OF FLORIDA WRF
FILTRATION SYSTEM REPLACEMENT
UNIVERSITY OF FLORIDA
GAINSVILLE, FL
PROPOSED TERTIARY FILTER
PLAN AND SECTION DETAILS (3)

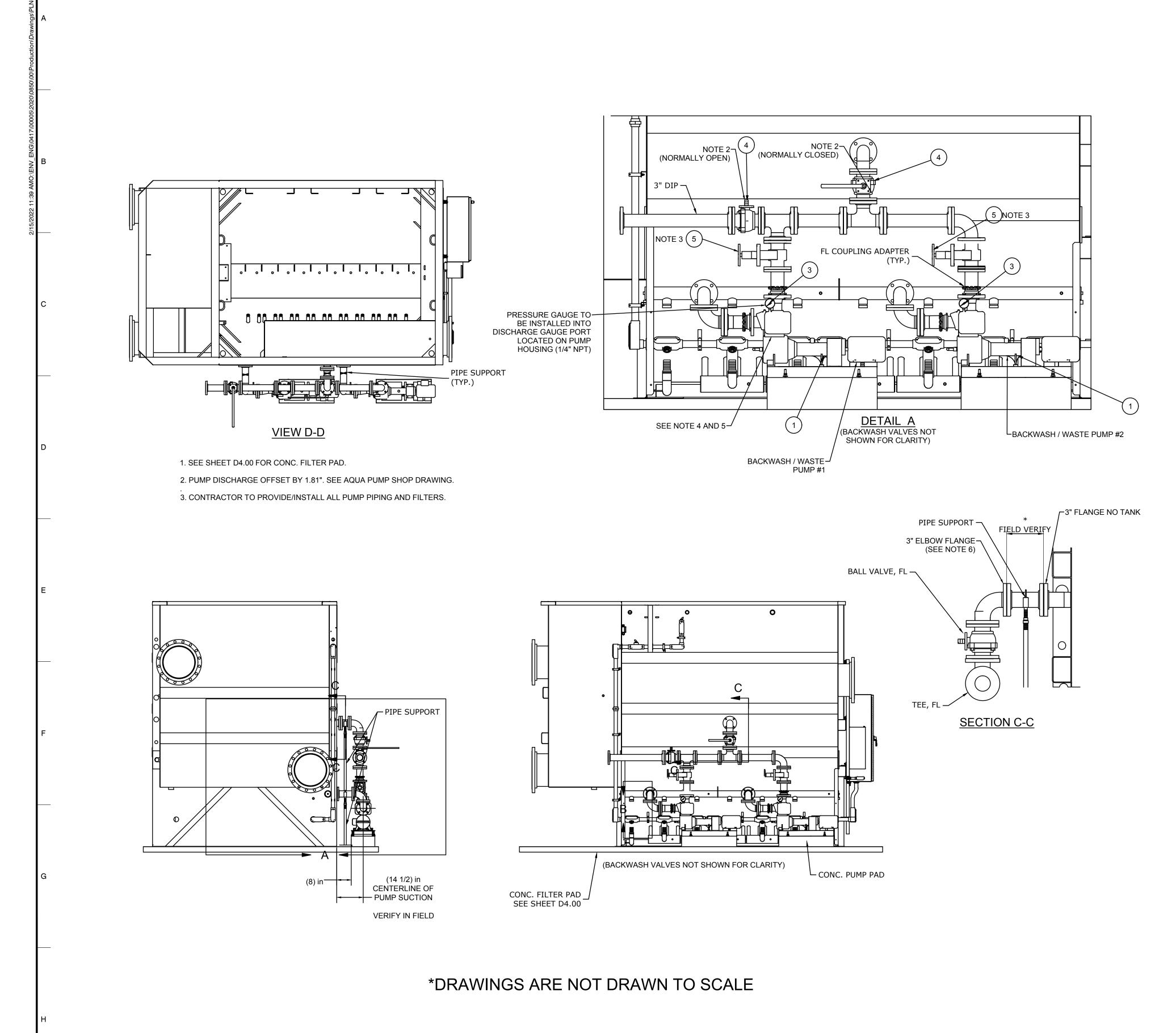
DAVID A. WEBER

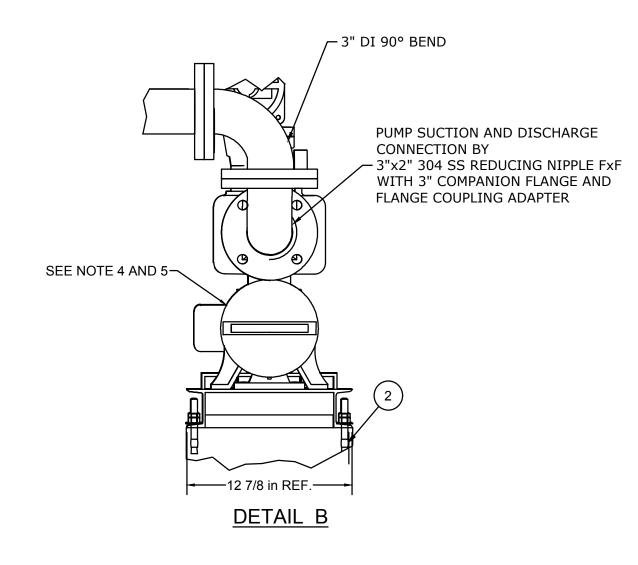
29323

JOB NO: 2020-0850-00
PLOT DATE: February 15, 2022

M2.05

BID DOCUMENTS FEBRUARY 2022





NOTES:

- 1. AQUA SHOP DRAWING REVISION TO FLANGE PIPNG AND VALVES FOR BACKWASH PUMP
- 2. THE PURPOSE OF THESE VALVES IS FOR RECIRCULATING DURING CHEMICAL CLEANING.
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- D. INSTALL THE SPIDER AND CONNECT THE COUPLING. E. REINSTALL THE COUPLING GUARD.
- E. REINSTALL THE COUPLING GUARD. F. REMOVE TAG.
- REFERENCE ONLY. DESIGN, MATERIAL, AND ASSEMBLY ARE THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR. ONLY PARTS LABELED AND LISTED IN THE BILL OF MATERIAL ARE SUPPLIED BY AQUA-AEROBIC SYSTEMS, INC.

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4	2	26207	37-1	VALVE, 3", BALL, FLANGE, TCI TC-5000			316 SS	-
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2	8	2962	622	KIT, WEDGE ANCHOR, 1/2"			316 SS	Y
1	2	296530	08-35	PUMP, G-R 12B20B, 2HP BALDOR MTR PE F1,	TSTATS		-	Y
ITEM	QTY	PART NU SITY OF FLO		DESCRIPTION			MATERIAL	DWG
					DO NOT SCALE DRAWING	FRACTIONAL I ALL TWO PLAI ALL THREE PL	THERWISE SPECIF SIONS ARE IN INCI DIMENSIONS +/-1 CE DECIMALS +/- (ACE DECIMALS +/- (HES 0.010 0.005 ANSI
					MATERIAL: -	ALL ANGLES	+/- 1	1/2"
					SIMILAR TO: 2	965980		
Α	-	2022-01-11	BJW	SUBMITTAL	TYPE: ADFS		0E	
В	R20519	2022-01-27	BJW	RELEASE TO PRODUCTION	DRAWN BY: B	JW	DATE: 20	22-01-05
REV	ERN/ECO	DATE	BY	REVISION DESCRIPTION	WEIGHT:	222 LI	SHEET:	1 of 1
	NG NAME:	UMP INSTL,	10 DIS	SK I H	DRAWING NUME 91153120			SCALE: SIZ

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NO. DATE REVISION

UNIVERSITY OF FLORIDA WRF
FILTRATION SYSTEM REPLACEMENT
UNIVERSITY OF FLORIDA
GAINSVILLE, FL
PROPOSED TERTIARY FILTER

DAVID A. WEBER

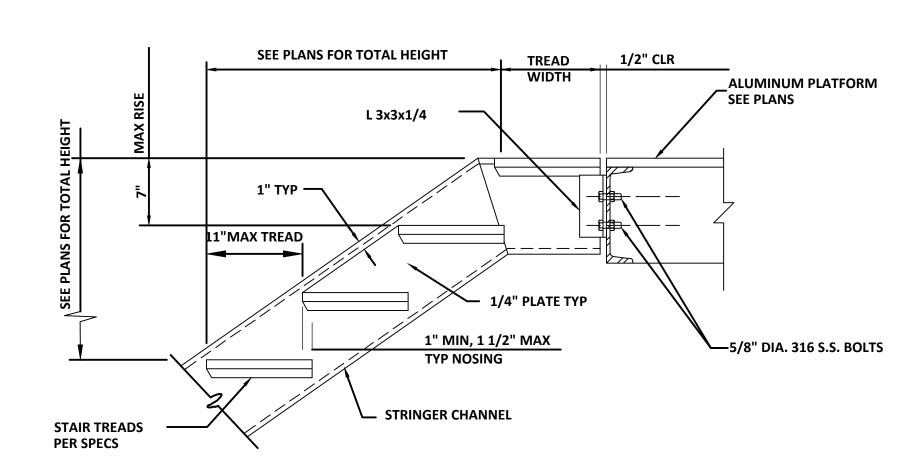
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2020.0850

PLOT DATE: February 15, 2022

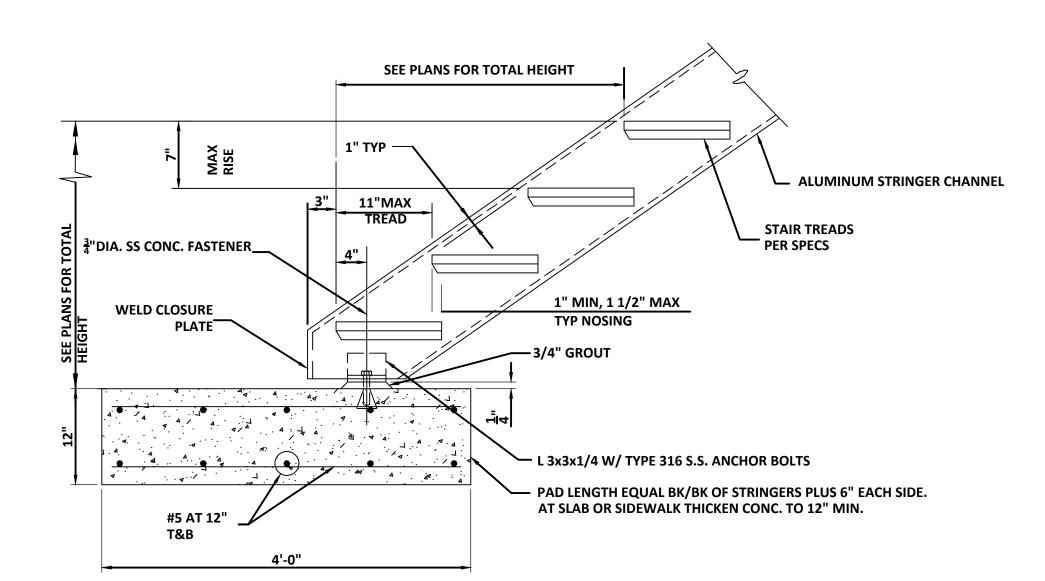
BID DOCUMENTS FEBRUARY 2022

M2.06



ALUMINUM STAIR STRINGER TO PLATFORM TOP

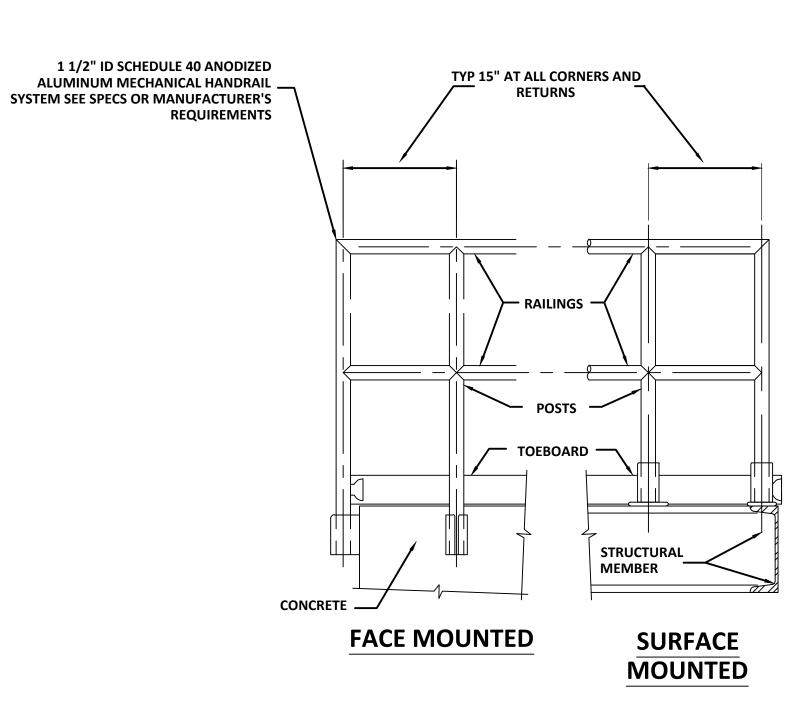
SCALE:NTS



ALUMINUM STAIR STRINGER TO PLATFORM

SCALE:NTS

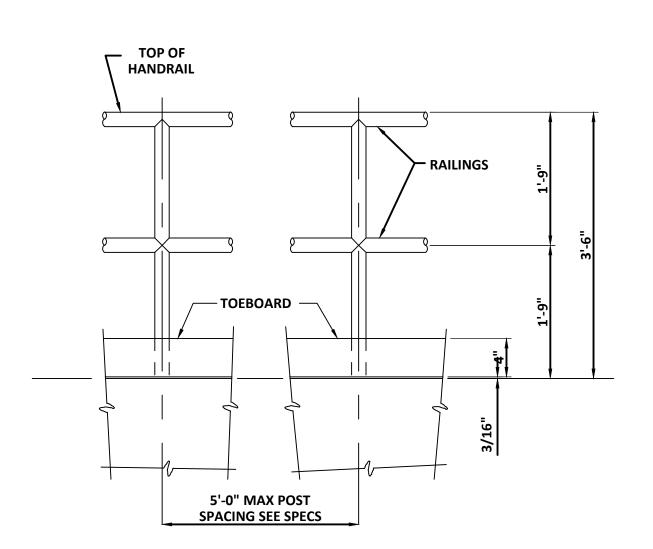
D5.00



ALUMINUM HAND & GUARD RAILS

SCALE:NTS

C
D5.00



ALUMINUM RAIL-POST ARRANGEMENT D
D5.00

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SSITY OF FLORIDA WRF

IN SYSTEM REPLACEMENT

VERSITY OF FLORIDA

GAINSVILLE, FL

INO. DATE

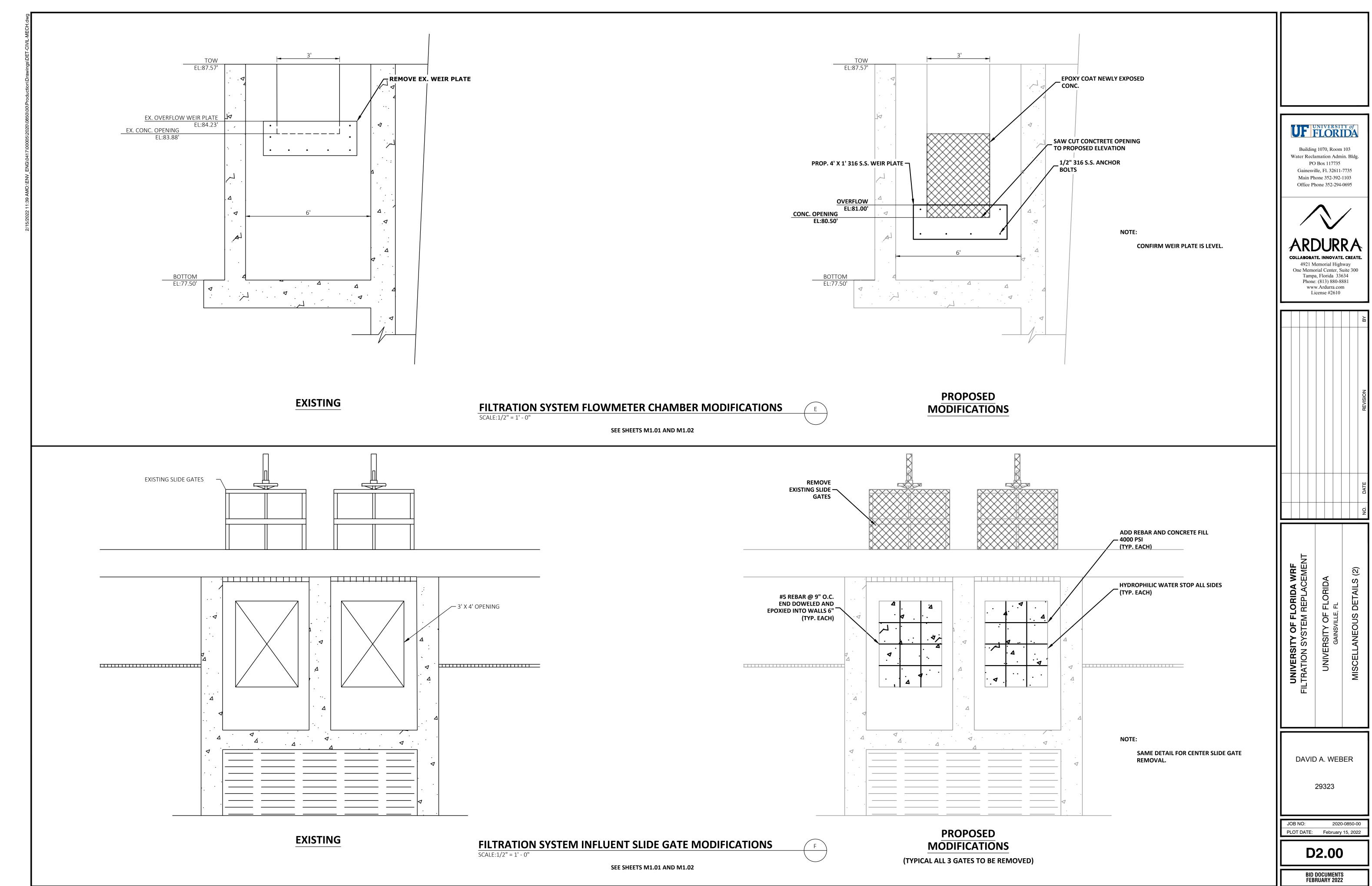
REVISION

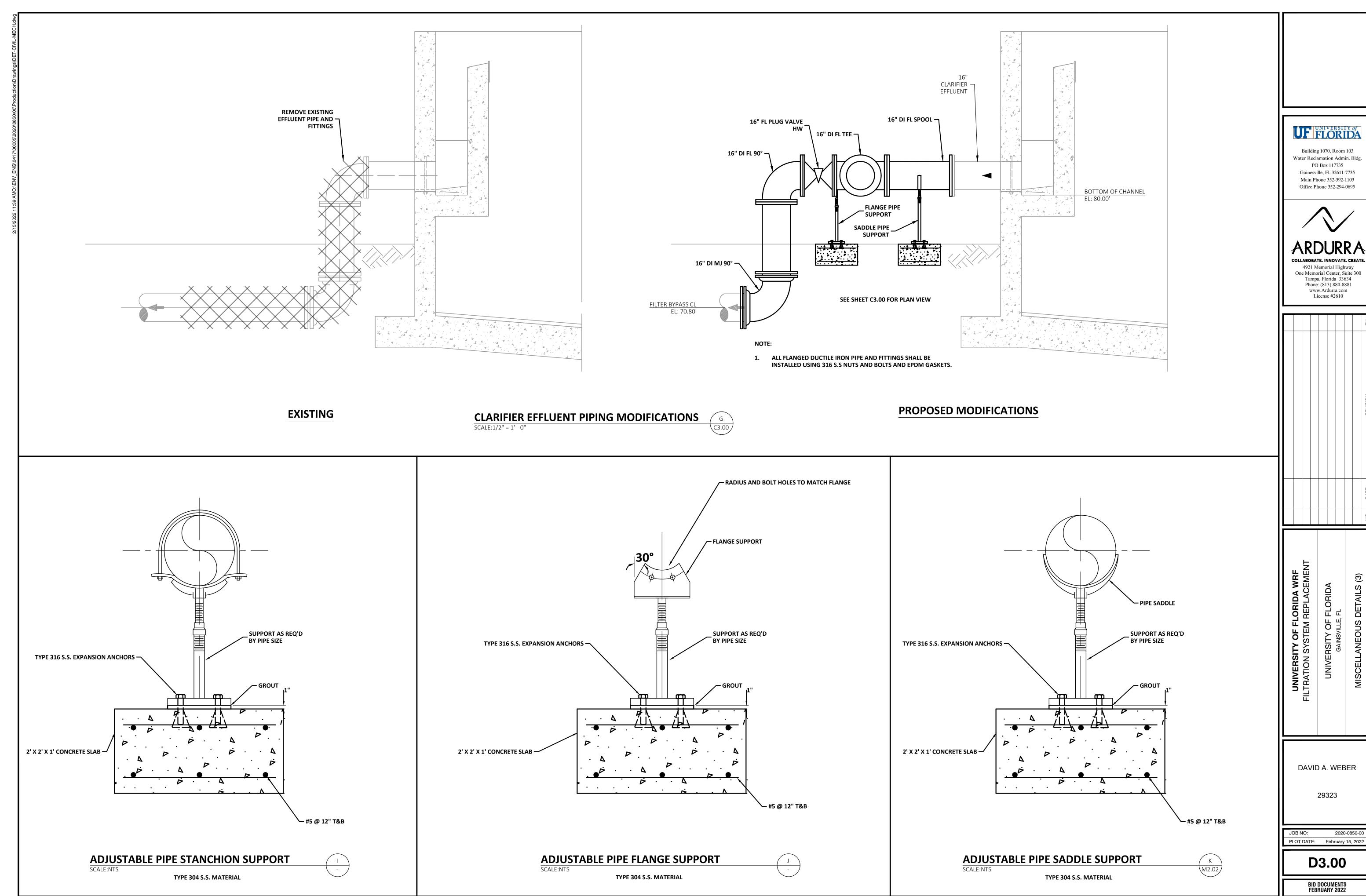
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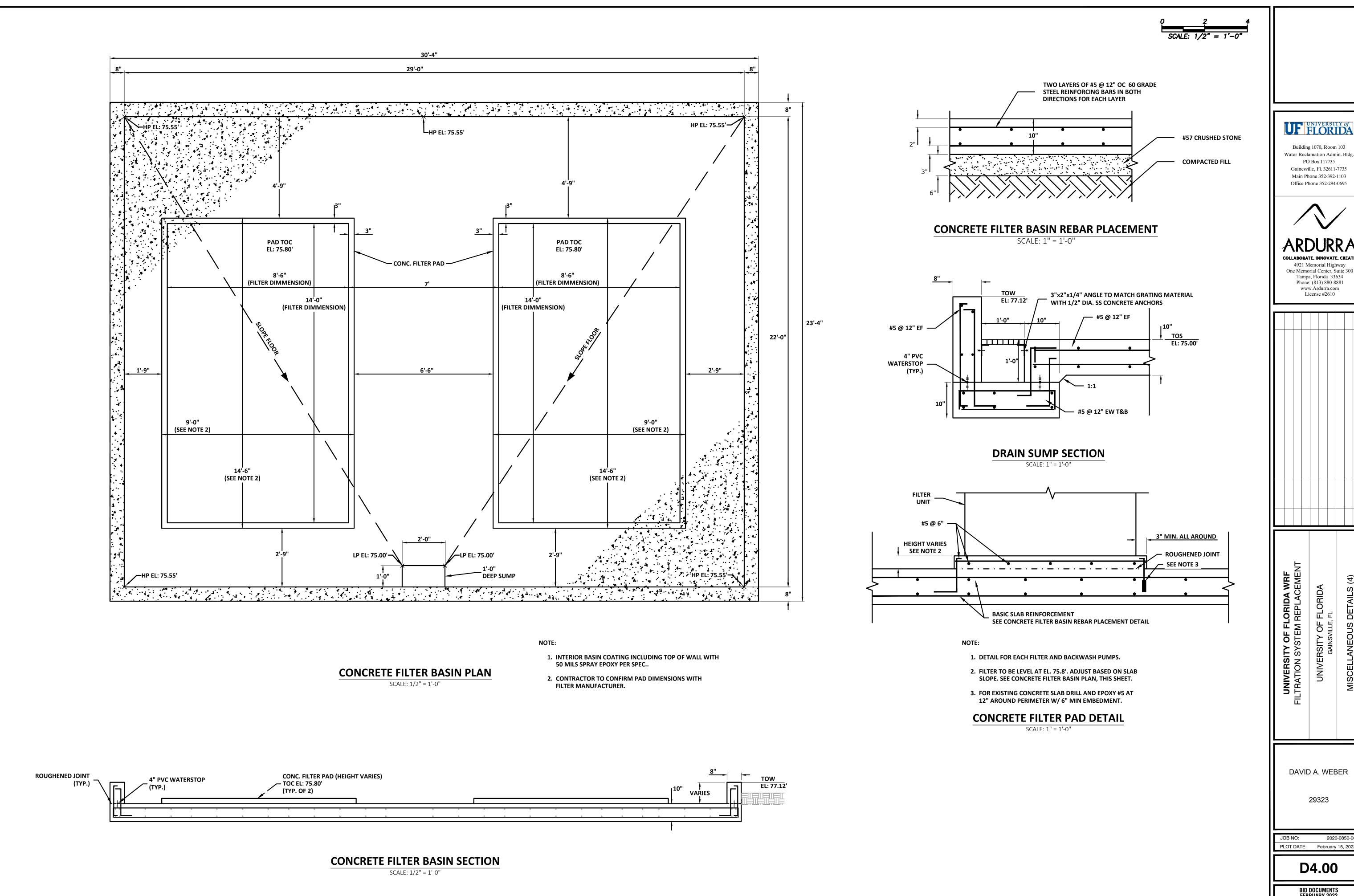
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JOB NO: 2020-0850-00
PLOT DATE: February 15, 2022

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366 of 383

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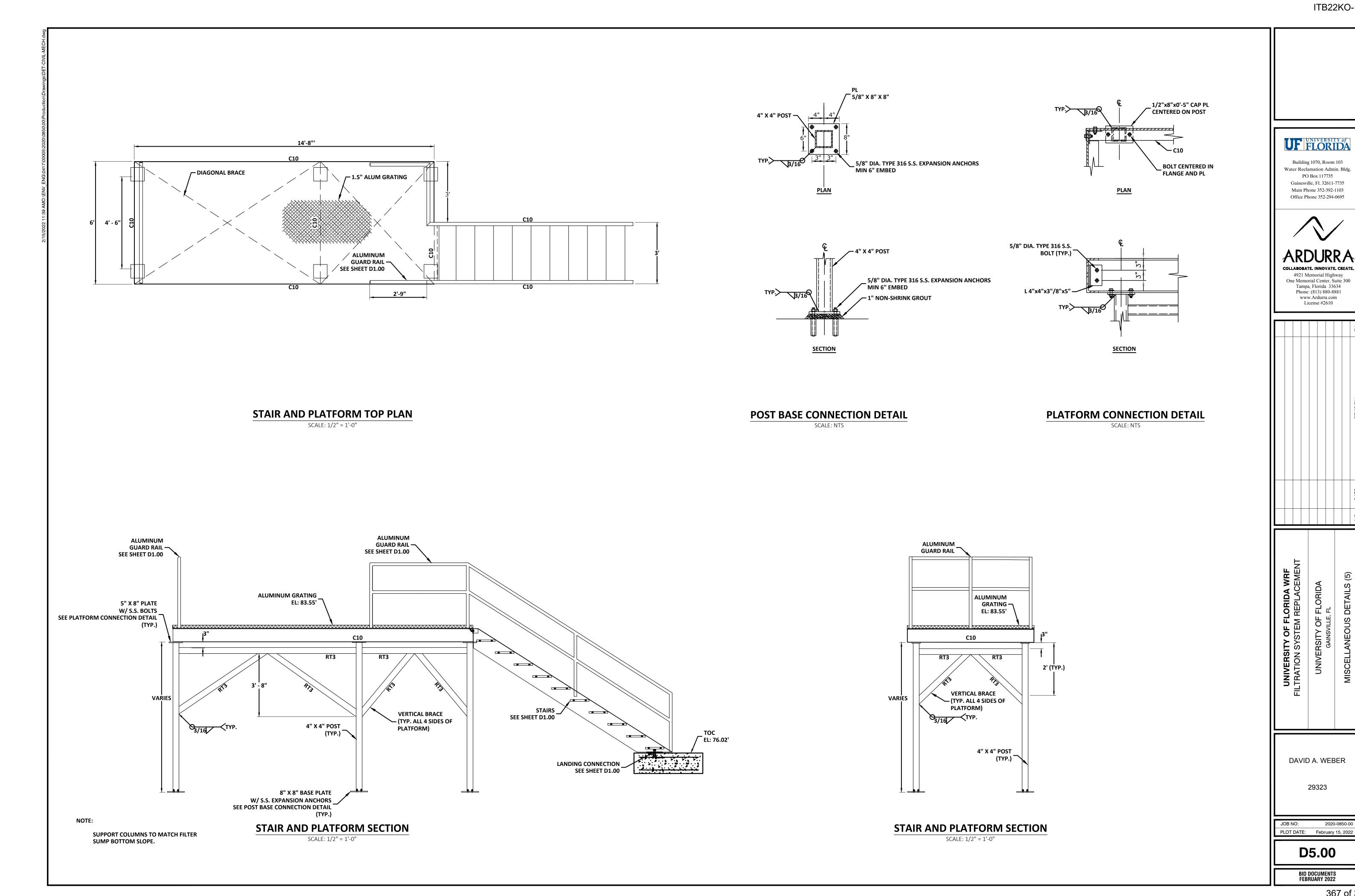
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PLOT DATE: February 15, 2022

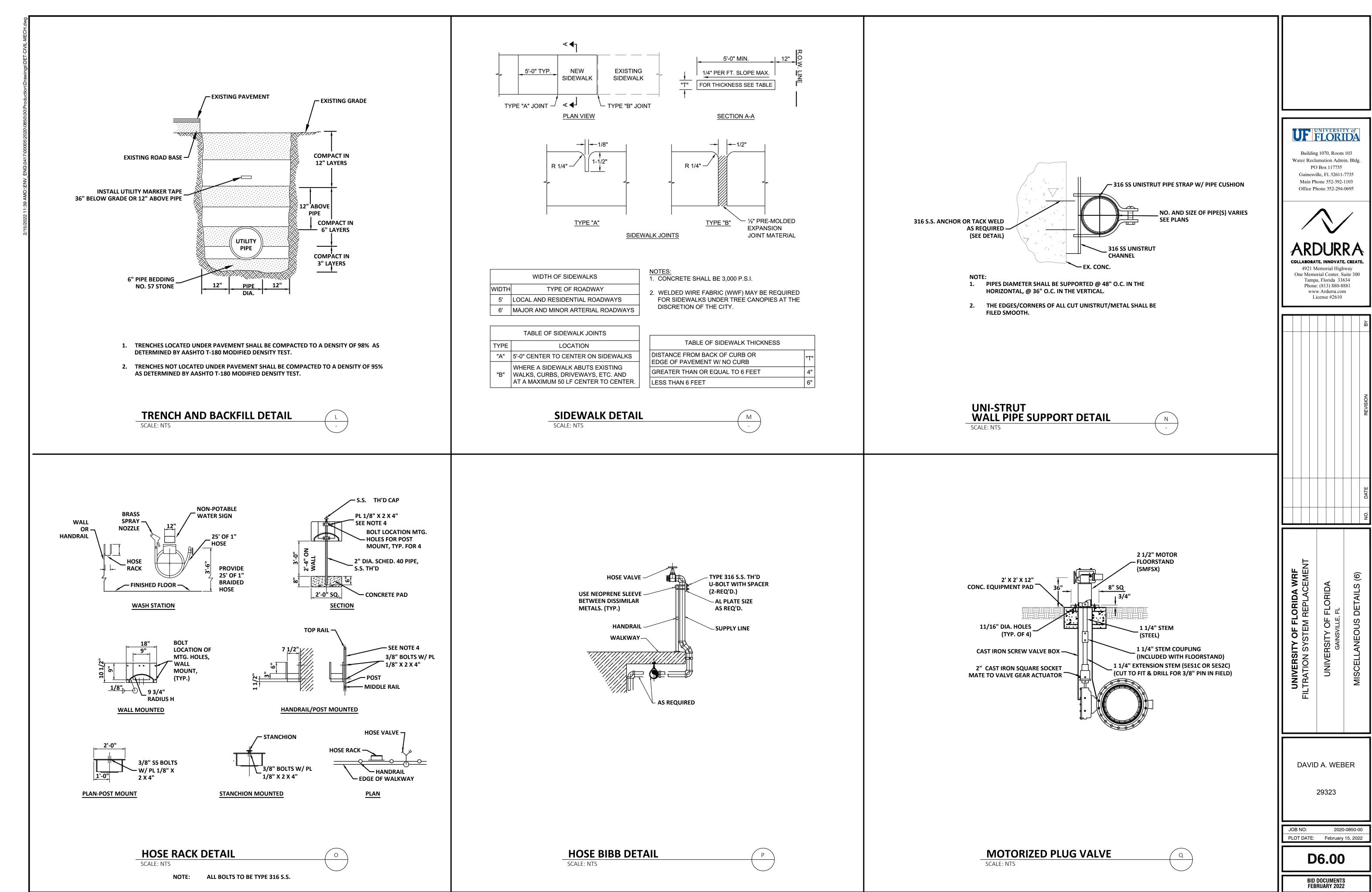
D4.00 BID DOCUMENTS FEBRUARY 2022



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BID DOCUMENTS February 2022

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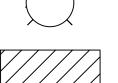


GENERAL INSTRUMENT OR FUNCTION SYMBOLS

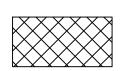
	DISPLAY/ CONTROL			
PRIMARY CHOICE	SECONDARY CHOICE	COMPUTER SOFTWARE	DISCRETE	LOCATION AND ACCESSIBILITY
				FIELD MOUNTED AND NORMALLY OPERATOR ACCESSIBLE
				PRIMARY CONTROL PANEL MOUNTED AND NORMALLY OPERATOR ACCESSIBLE
				PRIMARY CONTROL PANEL MOUNTED AND NOT NORMALLY OPERATOR ACCESSIBLE
				SECONDARY CONTROL PANEL MOUNTED AND NORMALLY OPERATOR ACCESSIBLE
				SECONDARY CONTROL PANEL MOUNTED AND NOT NORMALLY OPERATOR ACCESSIBLE

PILOT LIGHT

INSTRUMENTS SHARING COMMON HOUSING



DENOTES EQUIPMENT PROVIDED BY VENDOR

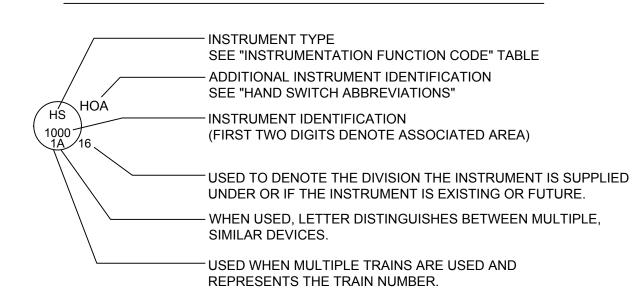


DENOTES EXISTING EQUIPMENT OR EQUIPMENT PROVIDED BY OTHERS UNDER A SEPARATE CONTRACT

GENERAL NOTES

- THIS LEGEND APPLIES TO P&IDS ONLY AND MAY DIFFER FROM LEGENDS FOR OTHER SHEETS.
- IN GENERAL THIS LEGEND SHEET AND THE P&IDS ARE BASED ON THE INTERNATIONAL SOCIETY OF AUTOMATION (ISA) STANDARDS FOR PRACTICES FOR INSTRUMENTATION. SOME MODIFICATIONS, ADDITIONS AND ALTERATIONS HAVE BEEN MADE AS REQUIRED TO ACCOMMODATE PROJECT REQUIREMENTS.
- CONTRACTOR SHALL PROCURE THE SERVICES OF A SYSTEM INTEGRATOR TO FURNISH AND INSTALL ALL MATERIALS, EQUIPMENT, LABOR, AND SERVICES, REQUIRED TO ACHIEVE A FULLY INTEGRATED AND OPERATIONAL SYSTEM AS SPECIFIED AND SHOWN ON THE
- 4. SEE ELECTRICAL AND MECHANICAL SHEETS AND SPECIFICATIONS FOR ADDITIONAL CONTROL AND INTERLOCK REQUIREMENTS.
- LIGHTER WEIGHT LINES, SHOWN AS ————, INDICATE EQUIPMENT, INSTRUMENTS OR PIPING THAT ARE EXISTING. WEIGHTED LINES, SHOWN AS — OR HEAVIER — INDICATE EQUIPMENT, INSTRUMENTS OR PIPING THAT ARE NEW. DASHED WEIGHTED LINES, SHOWN AS ______, INDICATED EQUIPMENT, INSTRUMENTS OR PIPING THAT ARE GROUPED AS A PACKAGE.

TYPICAL TAG NUMBERS & DESIGNATION



HAND SWITCH ABBREVIATIONS

A/O = AUTO/OFF A/M = AUTO/MANUALC/M = COMPUTER/MANUAL C/L = COMPUTER/LOCAL D/S = DUTY/STANDBY F/R = FORWARD/REVERSE F/O/R = FORWARD/OFF/REVERSE F/S = FAST SLOW F/O/S = FAST/OFF/SLOW H/O/A = HAND/OFF/AUTO L/L/S = LEAD/LAG/STANDBY

L/O/C = LOCAL/OFF/COMPUTER

L/O/R = LOCAL/OFF/REMOTE L/O/S = LOCKOUT/STOP L/A = LOCAL/AUTO L/R = LOCAL/REMOTE O/C = OPEN/CLOSE O/C/A = OPEN/CLOSE/AUTO O/O = ON/OFFO/A/O = ON/AUTO/OFFO/S/C = OPEN/STOP/CLOSE R/S/L = RAISE/STOP/LOWER S/S = START/STOP S/O/R = START/OFF/RESET

INSTRUMENTATION FUNCTION CODE

	EIDOT I	ETTERS		SUCCEEDING LETTERS	
	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5
<u> </u>	MEASURED/INITIATING	VARIABLE MODIFIER	READOUT/PASSIVE	OUTPUT/ACTIVE	FUNCTION MODIFIER
	VARIABLE	VARIABLE MODIFIER	FUNCTION	FUNCTION	FONCTION WODIFIER
_	ANALYSIS		ALARM	1 614011014	
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE		OSEIVS CHOICE	CONTROL	CLOSED
		DIFFEDENCE	+	CONTROL	CLOSED
D	USER'S CHOICE	DIFFERENCE, DIFFERENTIAL			DEVIATION
E	VOLTAGE		SENSOR, PRIMARY ELEMENT		
F	FLOW, FLOW RATE	RATIO			
G	USER'S CHOICE		GLASS, GAUGE, VIEWING DEVICE		
Н	HAND				HIGH
Т	CURRENT		INDICATE		
J	POWER		SCAN		
K	TIME, SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
М	MOISTURE				MIDDLE, INTERMEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
0	USER'S CHOICE		ORIFICE, RESTRICTION		OPEN
Р	PRESSURE		POINT (TEST CONNECTION)		
Q	QUANTITY	INTEGRATE, TOTALIZE	INTEGRATE, TOTALIZE		
R	RADIATION		RECORD		RUN
S	SPEED, FREQUENCY	SAFETY		SWITCH	STOP
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	
V	VIBRATION, MECHANICAL, ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL, PROBE		
X	,	X-AXIS	ACCESCODY DEVICES	UNCLASSIFIED (1)	UNCLASSIFIED (1)
Y	EVENT, STATE, PRESENCE	Y-AXIS		AUXILIARY DEVICES	
Z	POSITION, DIMENSION	Z-AXIS, SAFETY INSTRUMENT SYSTEM		DRIVER, ACTUATOR, UNCLASSIFIED, FINAL CONTROL ELEMENT	
 ΤΔ	BLE NOTES:	I	1	<u>I</u>	

(1) WHEN USED SYMBOL OR SIGNAL LINE IS ANNOTATED.

INSTRUMENT LINE SYMBOLS

	ELECTRICAL SIGNAL
-0-0-0-0-0-	ETHERNET CAT 6 CABLE
FOC	FIBER-OPTIC CABLE
	SOFTWARE

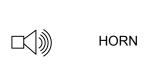
MISCELLANEOUS SYMBOLS

<	ASD	ADJUSTABLE SPEED DRIVES
<	MCC	INDICATES INTERLOCK OR LOGIC IN A MOTOR CONTROL CENTER
‹		INDICATES GENERAL OR MISCELLANEOUS HARDWIRED INTERLOCK
<	MS	MOTOR STARTER
<	VFD	VARIABLE FREQUENCY DRIVE

CONSTANT SPEED MOTOR

VARIABLE SPEED MOTOR

BEACON



GENERAL ABBREVIATIONS

AUTOMATIC TEMPERATURE CONTROL

COMBUSTIBLE GAS DETECTOR

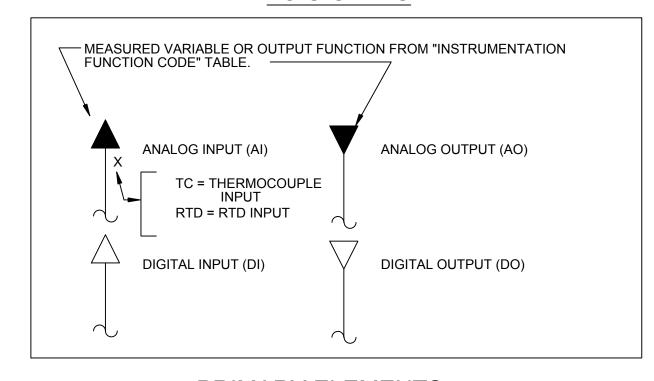
ANALOG IN ANALOG OUT

BEYOND LIMITS

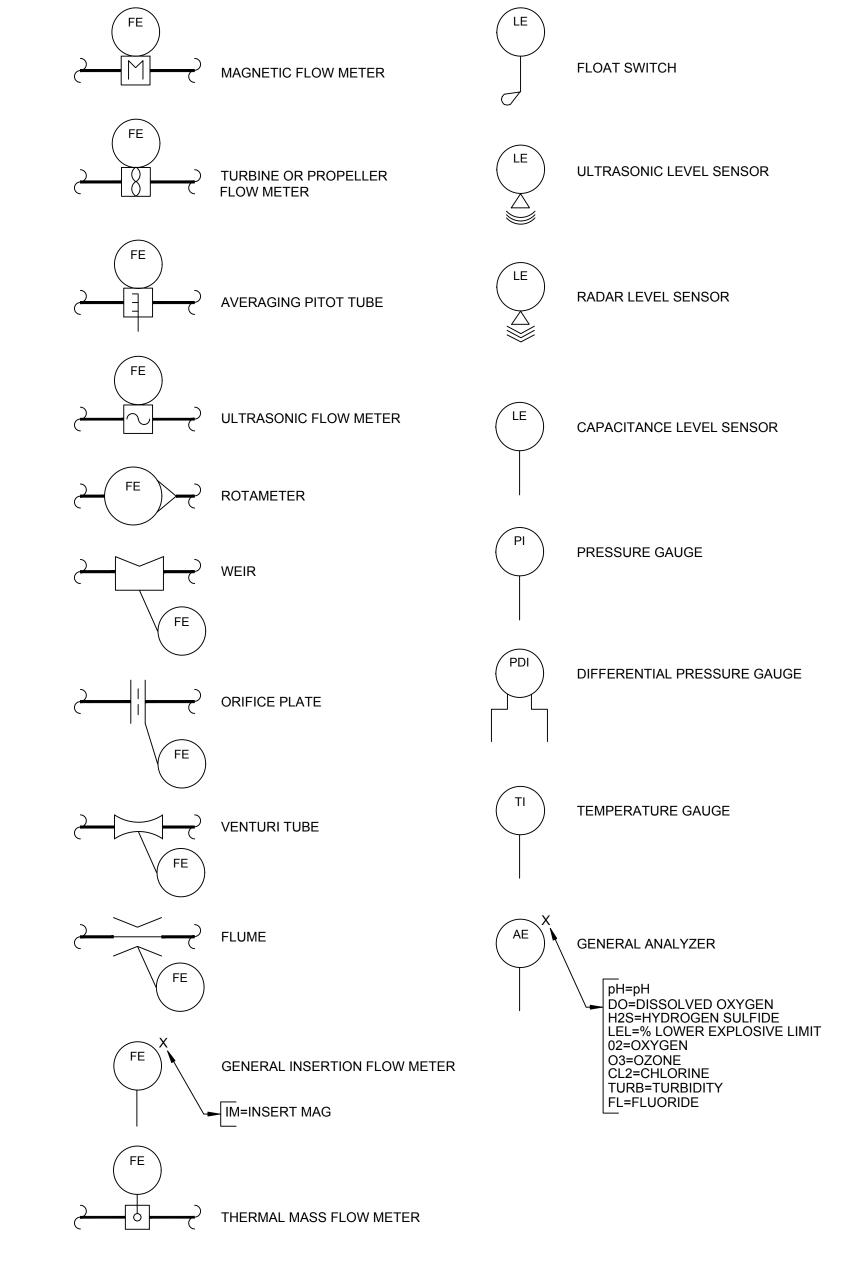
CLG	CHLORINE GAS VACUUM
CLS	CHLORINE SOLUTION
CPU	CENTRAL PROCESSOR UNIT
CESW	CONTROL ETHERNET SWITCH
DI	DIGITAL OR DISCRETE INPUT
DIV	DIVISION
DO	DIGITAL OUTPUT
DR	DRAIN
ESTOP	EMERGENCY STOP
ESW	ETHERNET SWITCH
FC	FAIL CLOSED
FMM	FLOW METER
FO	FAIL OPEN OR FIBER OPTIC
HMI	HUMAN MACHINE INTERFACE
MCC	MOTOR CONTROL CENTER
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
OIT	OPERATOR INTERFACE TERMINAL
OWS	OPERATOR WORKSTATION
Р	PUMP
PA	PROCESS AIR
PAC	PROGRAMMABLE AUTOMATION CONTROLLER
PLC	PROGRAMMABLE LOGIC CONTROLLER
PPM	PUMP PROTECTION MODULE
PQM	POWER QUALITY METER
RIO	REMOTE INPUT/OUTPUT
SWGR	SWITCH GEAR
UPS	UNINTERRUPTIBLE POWER SUPPLY
\	

VARIABLE FREQUENCY DRIVE

I/O SIGNALS



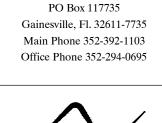
PRIMARY ELEMENTS



ELECTRICAL / AIR SOURCES

UPS — UPS POWERED ELECTRICAL SOURCE ES ELECTRICAL SOURCE IA — INSTRUMENT AIR SOURCE

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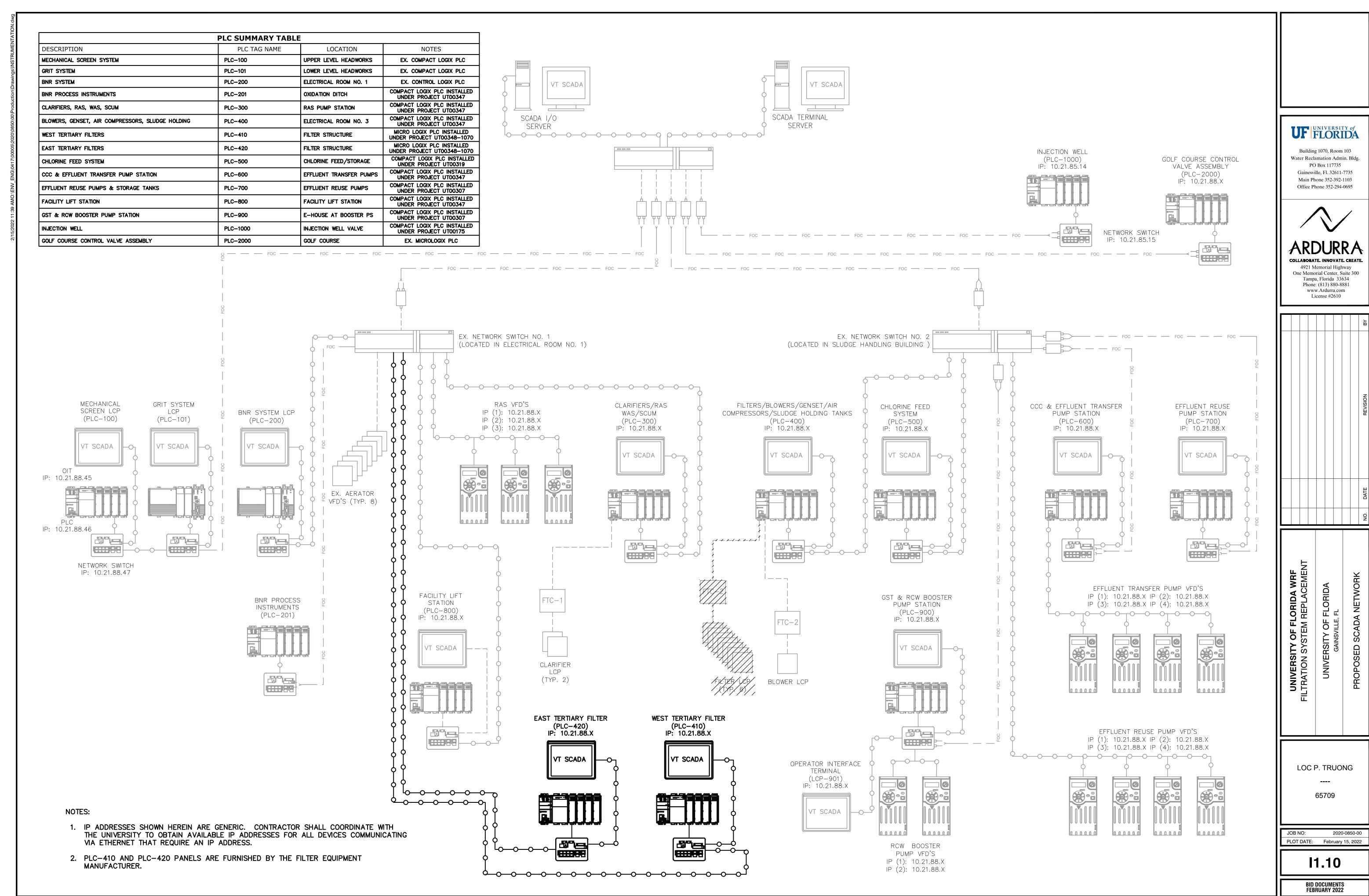
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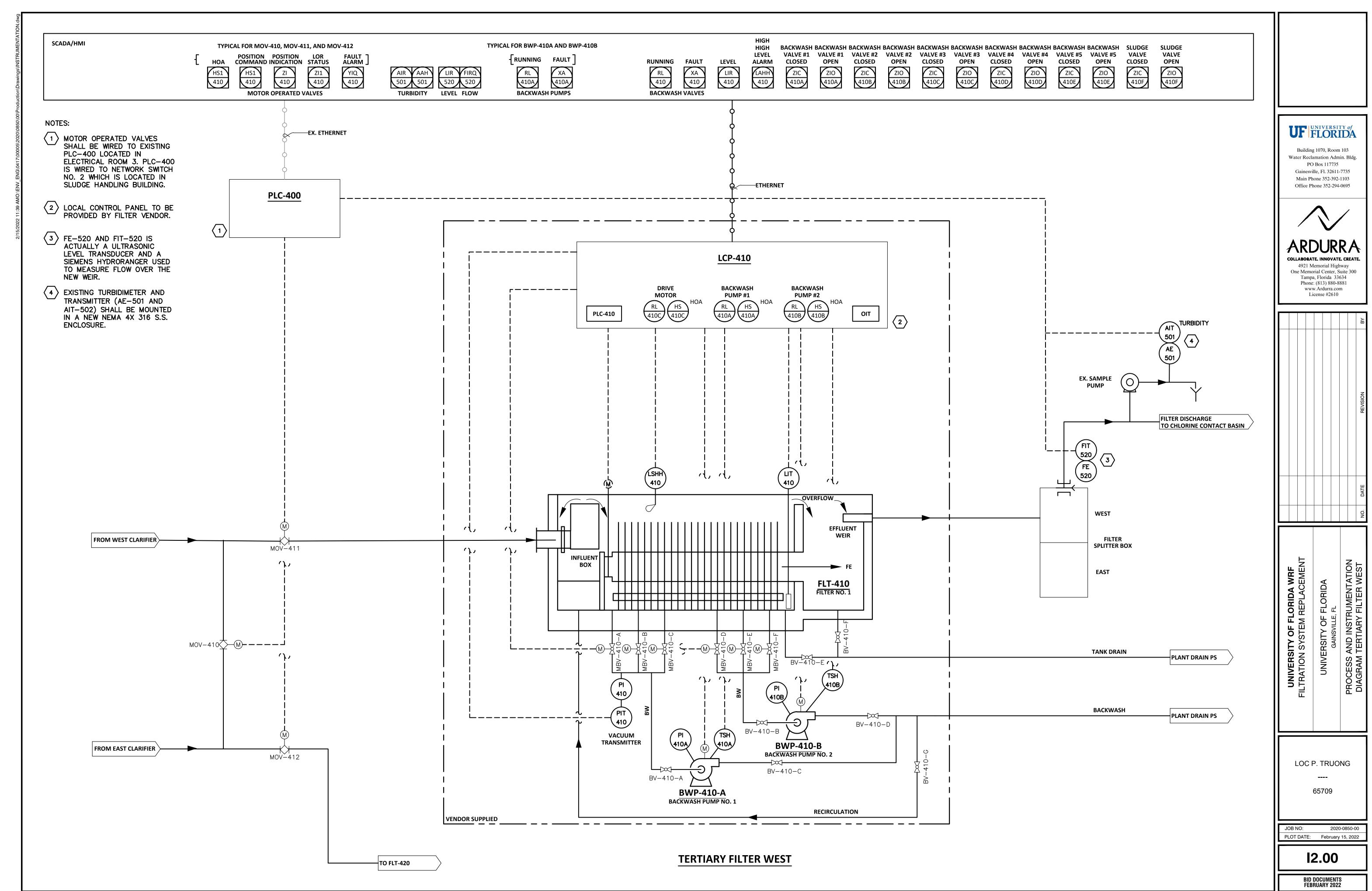
2020-0850-00 PLOT DATE: February 15, 2022

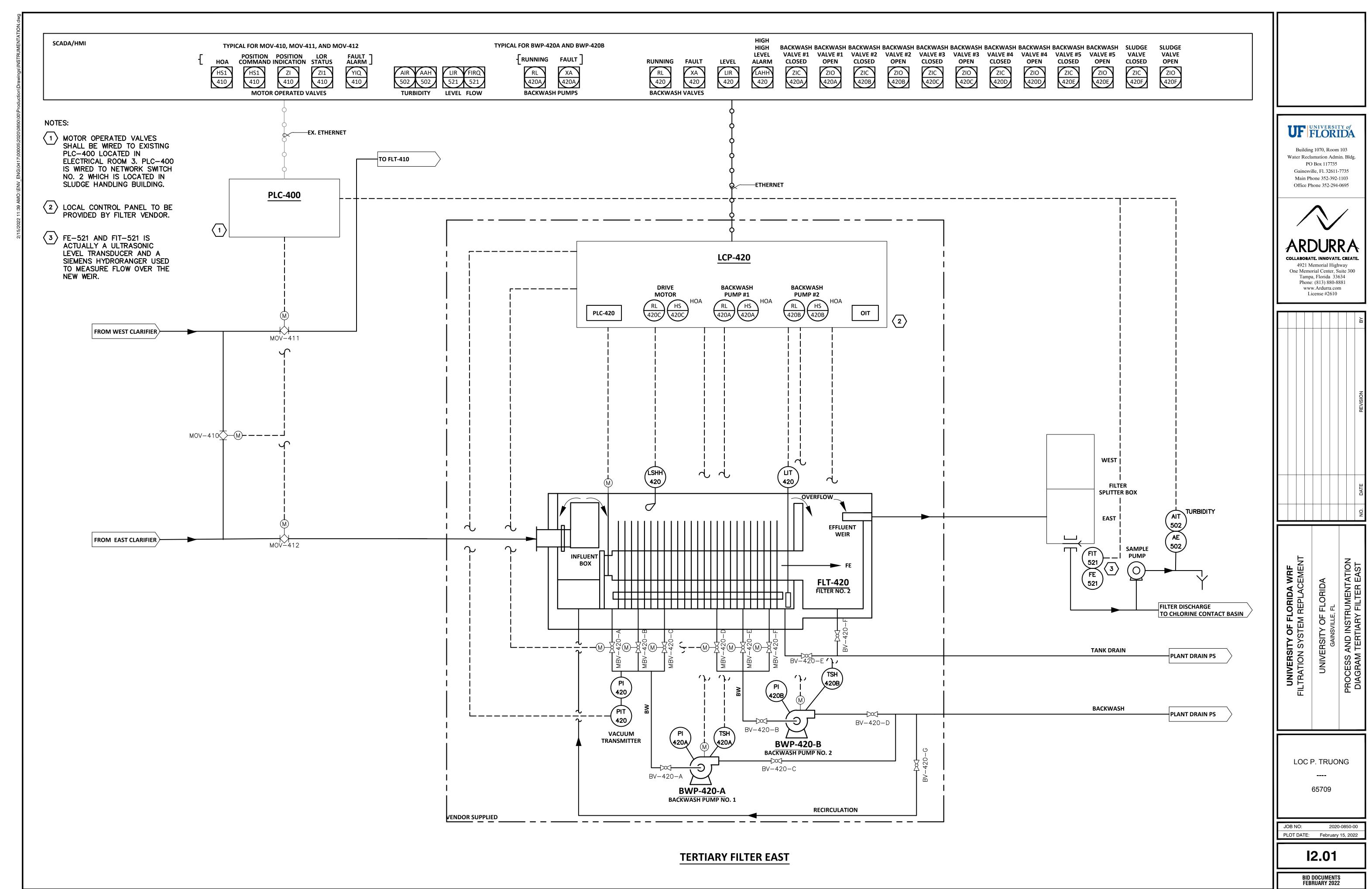
> **I1.01** BID DOCUMENTS FEBRUARY 2022

BID DOCUMENTS FEBRUARY 2022

I1.02







	ABBREVIATIO
А	AMPS
AFF	ABOVE FINISHED FLOOR
AIC	AMPERE INTERRUPTING CURRENT
A/C	AIR CONDITIONING
BNR	BIOLOGICAL NUTRIENT REMOVAL
С	CONDUIT
САН	CONDUCTIVITY ALARM HIGH
СВ	CIRCUIT BREAKER
DN	DOWN
DP	DOSING PUMP
EG	EQUIPMENT GROUND
EWH	ELECTRIC WATER HEATER
EX	EXISTING
FACP	FIRE ALARM CONTROL PANEL
FCV	FLOW CONTROL VALVE
FT	FLOAT SWITCH
FIT	FLOW INDICATING TRANSMITTER
FM	FLOW METER
FOPP	FIBER OPTIC CABLE PATCH PANEL
FS	FLOW SWITCH
FV	FLOW VALVE
FVNE	FULL VOLTAGE NON REVERSING
GALV	GALVANIZED
GC	GROUND CONDUCTOR
GFI	GROUND FAULT INTERRUPTER
GND	GROUND
нсч	HYDRAULIC CONTROL VALVE
НМІ	HUMAN MACHINE INTERFACE
НОА	HAND OFF AUTOMATIC
HP	HORSE POWER
HTR	HEATER
1/0	INPUT/OUTPUT
JB	JUNCTION BOX
LCP	LOCAL CONTROL PANEL
LE	LEVEL ELEMENT
LEP	LEVEL ELEMENT POWER SUPPLY
LIT	LEVEL INDICATING TRANSMITTER

NC	LE	GEND
	LEV	LEVEL SWITCH
	LT	LEVEL TRANSDUCER
	LSIG	LONG TIME, SHORT TIME, INSTANTANEOUS GROUND FAULT PROTECTION FEATURES
	LS	LIMIT SWITCH
	LOC	LOCAL
	MA	MOTOR ACTUATOR
	мсв	MAIN CIRCUIT BREAKER
	мсс	MOTOR CONTROL CENTER
	MFR	MANUFACTURER
	MLO	MAIN LUGS ONLY
	MSB	MAIN SWITCHBOARD
	MTD	MOUNTED
	MOV	MOTOR OPERATED VALVE
	O.C.	ON CENTER
	OLM	OPTICAL LIGHT MODULE
	Р	POLE
	PIT	PRESSURE INDICATING TRANSMITTER
	PLC	PROGRAMMABLE LOGIC CONTROLLER
	PS	PRESSURE SWITCH
	R	RELOCATED
	RAS	RETURN ACTIVATED SLUDGE
	REM	REMOTE
	RTU	REMOTE TERMINAL UNIT
	RIO	REMOTE INPUT/OUTPUT CABINET
	SCADA	SUPERVISORY CONTROL AND DATA ACQUISITION
	SOV	SOLENOID VALVE
	SPD	SURGE PROTECTION DEVICE
	SS	STAINLESS STEEL
	SWS	SEAL WATER SOLENOID
	TAH	TEMPERATURE ALARM HIGH
	TSP	TWISTED SHIELDED PAIR
	TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
	UPS	UNINTERRUPTABLE POWER SOURCE
	VFD	VARIABLE FREQUENCY DRIVES
	WAS	WASTE ACTIVATED SLUDGE
	WP	WEATHER PROOF
	WS	WASHWATER SOLENOID
_		

	ELECTRICAL SYMBOL LEGEN	1 D
SYMBOL	DESCRIPTION	MOUNTING
	POWER PANELBOARD, VOLTAGE AS NOTED	M.H. 6'-6" MIN. TO TOP
	EQUIPMENT CONTROL PANEL	M.H. 6'-6" MIN. TO TOP
=	DUPLEX RECEPTACLE (20A, 125V)	M.H. 18" TO CENTERLINE
	RACEWAY CONCEALED IN WALL OR ABOVE CEILINGS	SEE SPECIFICATIONS
/->	RACEWAY CONCEALED UNDER FLOOR OR BELOW GRADE	SEE SPECIFICATIONS
	RACEWAY EXPOSED ON WALL OR CEILING	SEE SPECIFICATIONS
L1A-1,3	HOMERUN TO PANEL, LETTERS INDICATE PANEL, NUMBERS INDICATE CIRCUIT. NOTE: ANY CIRCUIT WITHOUT FURTHER DESIGNATION INDICATES A TWO WIRE CIRCUIT. A GREATER NUMBER OF WIRES IS INDICATED AS SHOWN: // (3 WIRES & EQUIPMENT GROUND), /// (4 WIRES & EQUIPMENT GROUND), ETC. EG	SEE SPECIFICATIONS
O _{UP} O _{DN}	RACEWAY RISER, UP OR DOWN AS NOTED.	SEE SPECIFICATIONS
	JUNCTION BOX OR OUTLET BOX, 4"x2 1/8" DEEP BOX UNLESS OTHERWISE NOTED	SEE SPECIFICATIONS
<u>③</u>	MOTOR, NUMERAL INDICATES HORSEPOWER	BY OTHER DIVISION
	NON-FUSIBLE DISCONNECT SWITCH (ENCLOSED SWITCH)	SEE SPECIFICATIONS

GENERAL NOTES:

- 1. ALL WORK SHALL BE PERFORMED DURING TIME PERIODS ACCEPTABLE TO THE OWNER. SCHEDULE ALL WORK WITH THE OWNER'S REPRESENTATIVE BEFORE PROCEEDING.
- 2. THE CONTRACTOR SHALL PERFORM ALL TEMPORARY WORK NECESSARY TO MAINTAIN CONTINUITY OF ELECTRICAL SERVICE WHEN CONNECTION IS MADE TO EXISTING SYSTEMS AND FACILITIES. EXISTING SERVICE SHALL NOT BE INTERRUPTED WITHOUT PRIOR CONSENT OF THE OWNER'S REPRESENTATIVE AND MAY BE INTERRUPTED ONLY AT AND FOR THE SPECIFIED TIME DESIGNATED BY OWNER'S REPRESENTATIVE. THE CONTRACTOR SHALL BE GUIDED BY THE OWNER'S REPRESENTATIVE AT ALL TIMES IN MATTERS AFFECTING THE EXISTING FACILITIES.
- 3. UPON COMPLETION OF THE WORK, THE CONTRACTOR SHALL ENSURE THAT ALL SYSTEMS OPERATE AS DESIGNED AND REQUIRED AND SHALL REVIEW THEIR OPERATION WITH THE OWNER. COMPLETE SET OF AS-BUILT DRAWINGS SHALL BE COMPILED (BY THE CONTRACTOR) AND ISSUED (1 EACH) TO THE ENGINEER UPON COMPLETION OF CONSTRUCTION AND TESTING.
- 4. ALL ELECTRICAL AND INSTRUMENTATION WIRING AND CONDUIT SHALL BE INSTALLED BELOW GRADE AND SHALL NOT CROSS SIDEWALKS OR WALKWAYS.
- 5. NOTE: BY DEFINITION; WHEREVER THE TERM "DISCONNECT SWITCH" IS USED, IT SHALL BE UNDERSTOOD TO MEAN "ENCLOSED SWITCH".
- 6. CLASS 1, DIVISION 2 SITE; ALL ELECTRICAL AND INSTRUMENTATION WIRING ENTERING AND LEAVING NEW ELECTRICAL PANELS, NEW CONTROL PANELS AND NEW EQUIPMENT DEVICES TO INCLUDE EXPLOSION-PROOF (VAPOR LEAK SEAL) FITTING IN CONDUIT.
- 7. ABOVE GRADE CONDUITS SHALL BE CONSTRUCTED OF RIGID ALUMINUM PER SPECIFICATION SECTION 16110, 2.01.
- 8. BELOW GRADE CONDUITS SHALL BE CONSTRUCTED OF SCHEDULE 80 PVC PER SPECIFICATION SECTION 16110, 2.02.



Building 1070, Room 103 Water Reclamation Admin. Bldg. PO Box 117735 Gainesville, Fl. 32611-7735 Main Phone 352-392-1103 Office Phone 352-294-0695



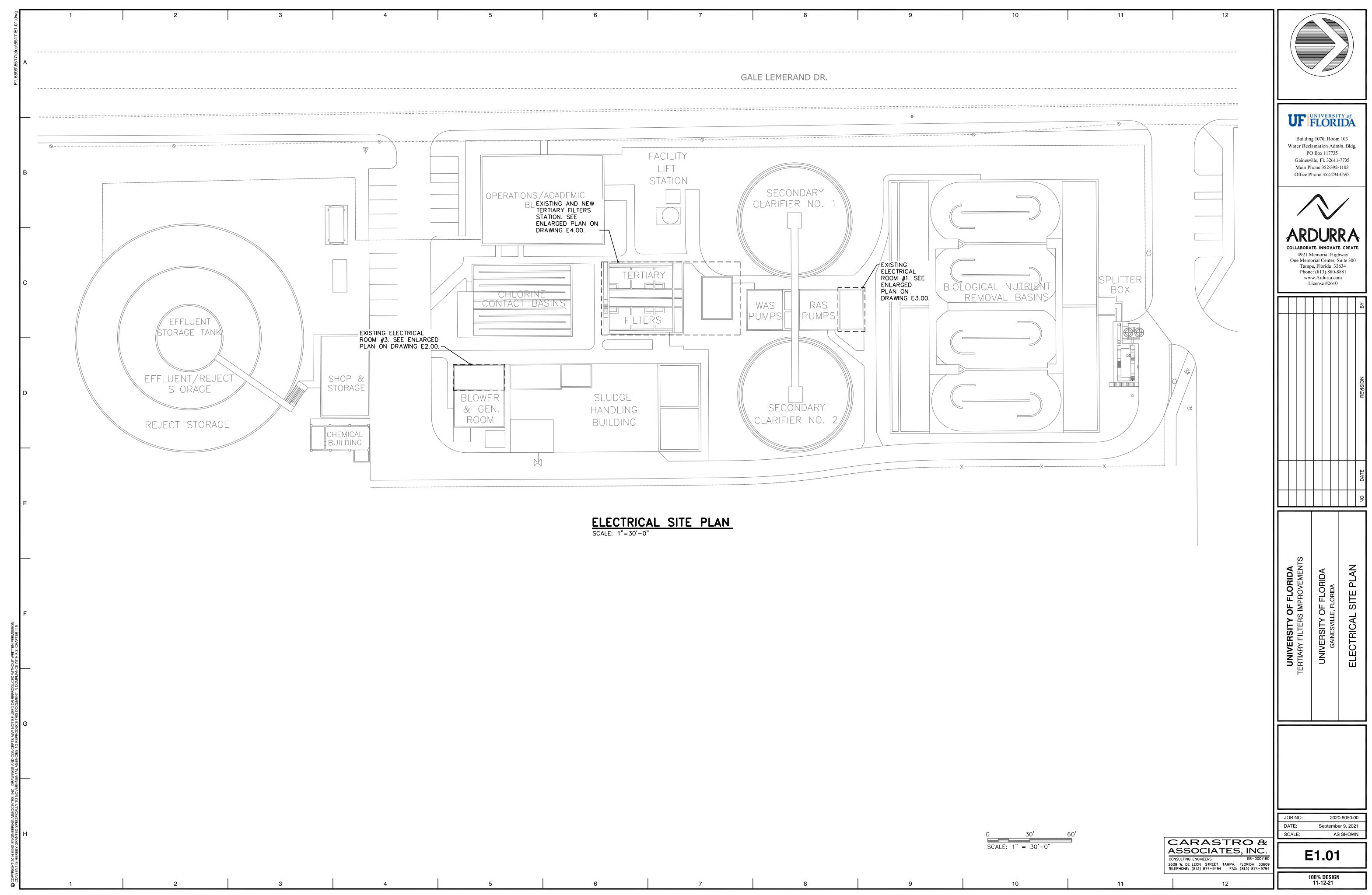
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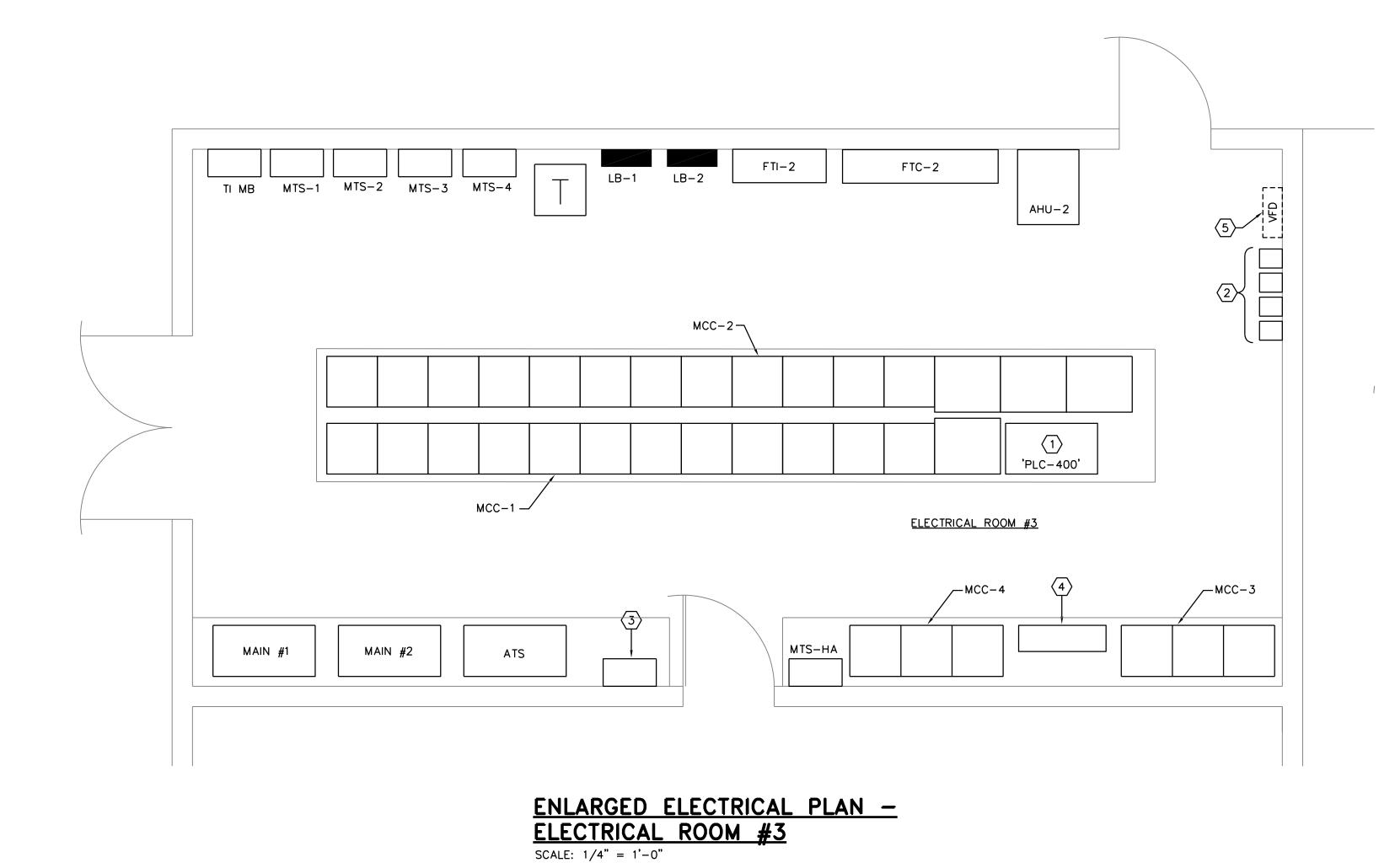
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JOB NO: 2020-8050-00 DATE: September 9, 2021 AS SHOWN

100% DESIGN 11-12-21

CARASTRO & ASSOCIATES, INC. CONSULTING ENGINEERS 2609 W. DE LEON STREET TAMPA, FLORIDA 33609 TELEPHONE: (813) 874–9494 FAX: (813) 874–9794





GENERAL NOTES:

- 1. REMOVE AND/OR RELOCATE ALL CONDUIT WIRE, OUTLET BOXES, ETC. WHICH ARE MADE UNNECESSARY BECAUSE OF DEMOLITION/NEW CONSTRUCTION. VERIFY LOCATIONS AND QUANTITIES OF ELECTRICAL EQUIPMENT AND WIRING AT THE SITE. CONDUIT TO BE REMOVED OR ABANDONED SHALL BE REMOVED COMPLETELY IF POSSIBLE. WHERE (ABOVE GRADE) REMOVAL IS NOT POSSIBLE, CONDUIT SHALL BE CAPPED AND TAGGED AS SPARE. WHERE (BELOW GRADE) REMOVAL IS NOT POSSIBLE, CONDUIT SHALL BE CUT BELOW THE SURFACE AND CAPPED. ALL MATERIALS REMOVED SHALL BE DISPOSED OF BY THE CONTRACTOR. PATCH CONCRETE FLOOR TO MATCH EXISTING.
- 2. ANY DEMOLITION OR REMOVAL INDICATED IS SHOWN TO PROVIDE THE GENERAL EXTENT OF DEMOLITION. THIS INFORMATION IS NOT A RECORD DRAWING OF EXISTING CONDITIONS.
- 3. ANY DEMOLITION OF EXISTING ELECTRICAL EQUIPMENT (AS INDICATED IN NOTES 1 & 2 ABOVE) SHALL BE APPROVED BY OWNER BEFORE EXISTING EQUIPMENT IS DISCONNECTED AND REMOVED.

RENOVATION NOTES:

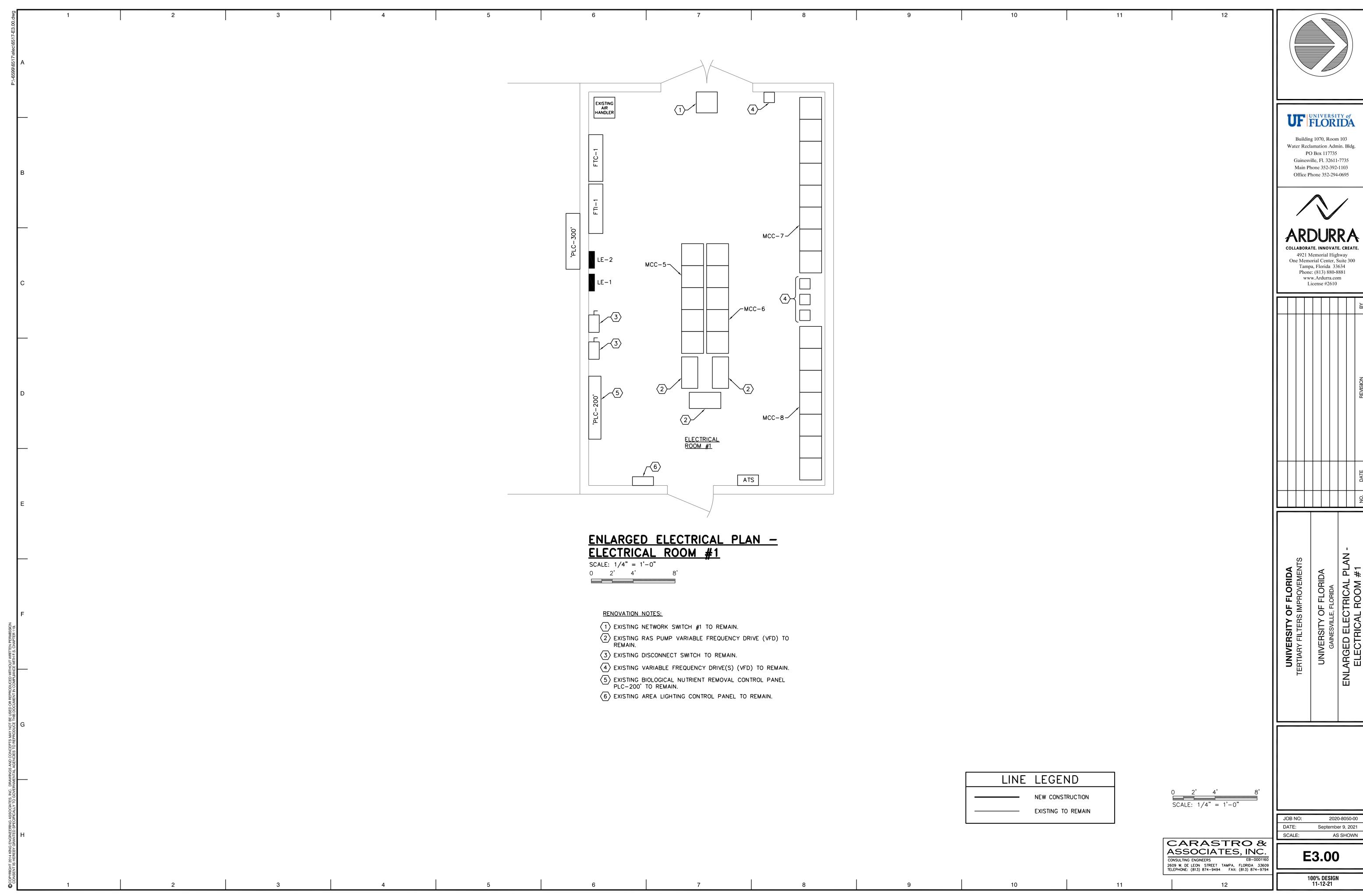
- $\langle 1 \rangle$ EXISTING LOCAL CONTROL PANEL 'PLC-400' TO REMAIN.
- (2) EXISTING EFFLUENT TRANSFER PUMP (VFDs) TO REMAIN.
- (3) EXISTING AREA LIGHTING CONTROL PANEL TO REMAIN.
- 4 EXISTING DIGESTER BLOWERS 1 & 3 CONTROL PANEL TO
- (5) EXISTING VARIABLE FREQUENCY DRIVE (VFD) FOR EXISTING PILOT FILTER FEED PUMP TO BE REMOVED.

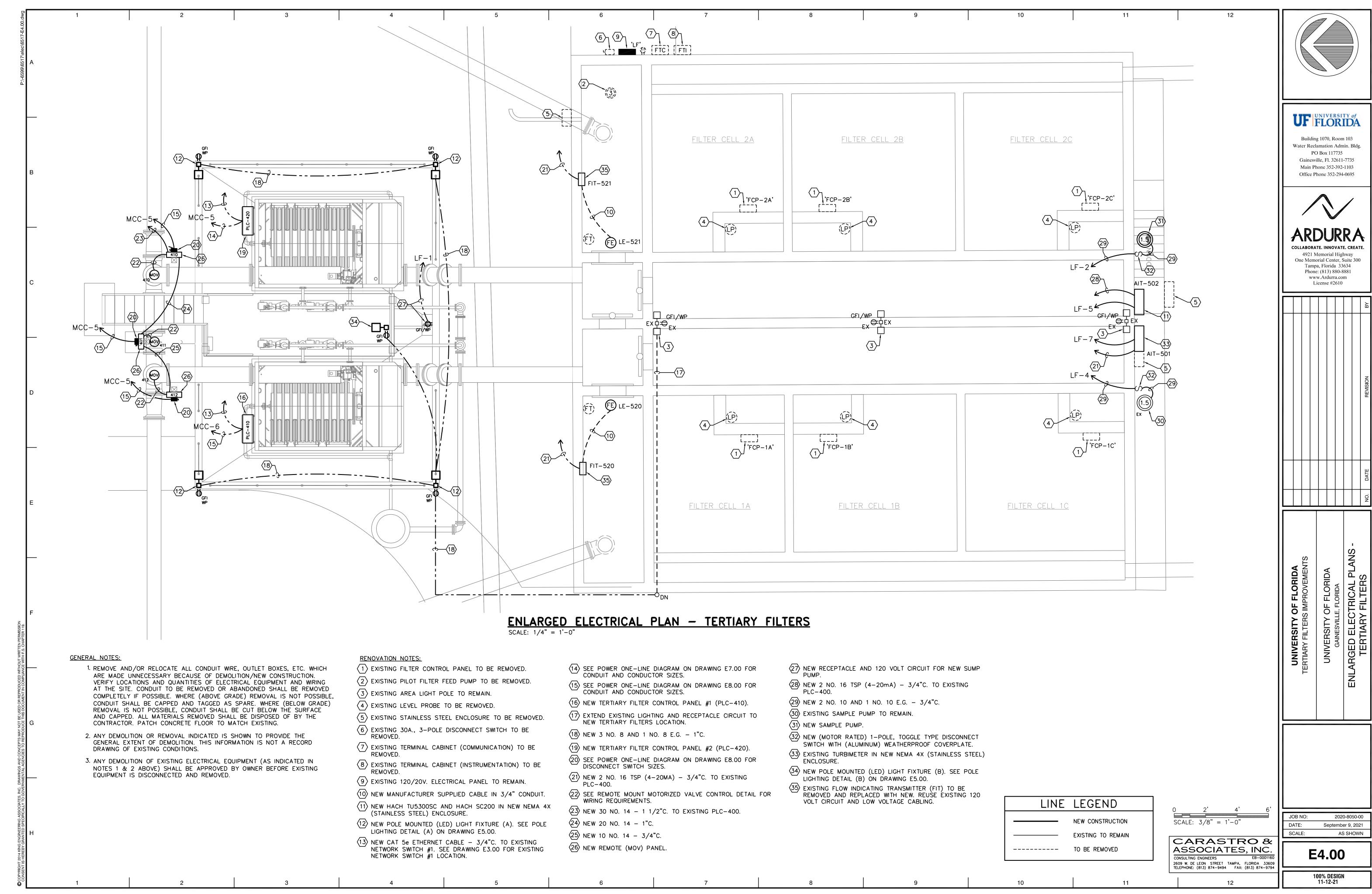
LINE LEGEND NEW CONSTRUCTION EXISTING TO REMAIN ---- TO BE REMOVED

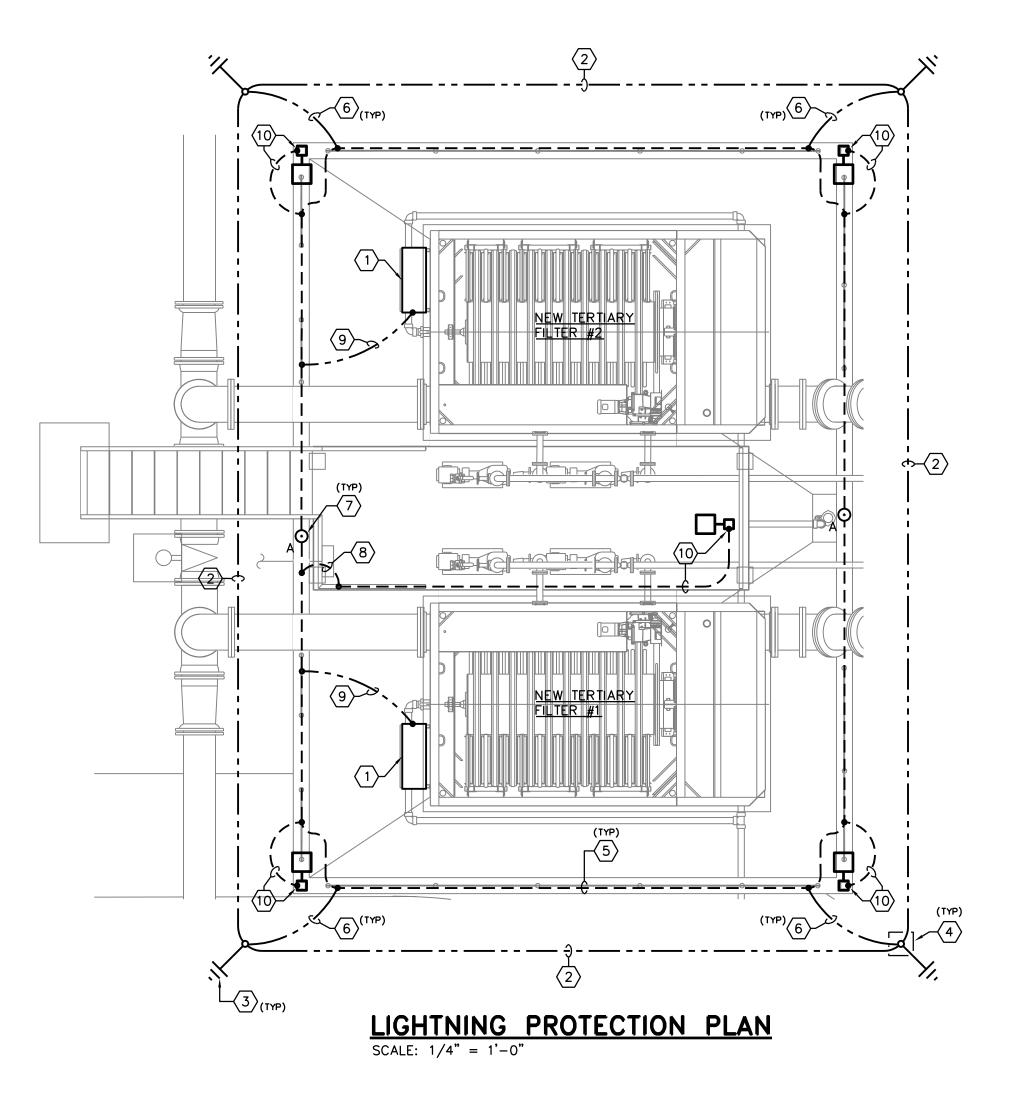
SCALE: 3/8" = 1'-0"

CARASTR ASSOCIATES, CONSULTING ENGINEERS 2609 W. DE LEON STREET TAMPA, TELEPHONE: (813) 874-9494 FAX:

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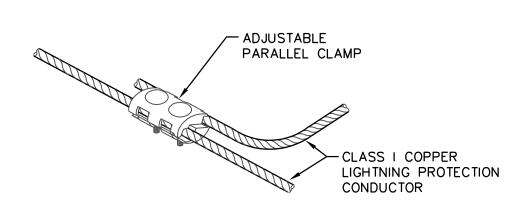




DRAWING NOTES:

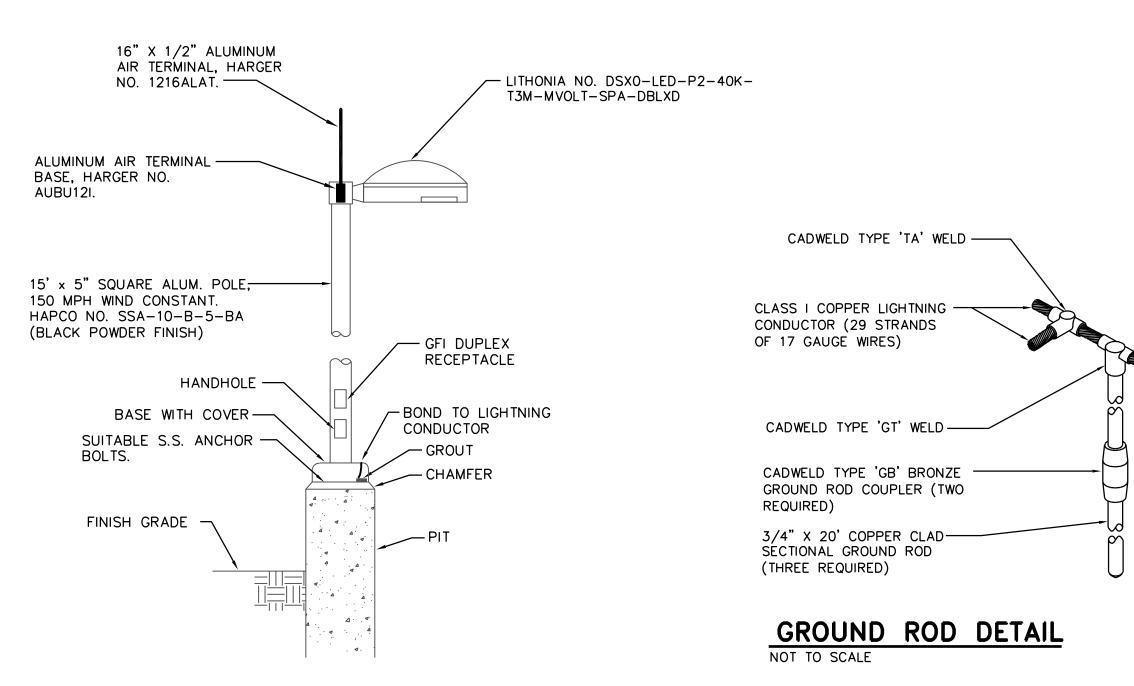
- 1 NEW TERTIARY FILTER LOCAL CONTROL PANEL.
- 2 CLASS I COPPER LIGHTNING PROTECTION SYSTEM GROUND RING CONDUCTOR INTERCONNECTING GROUND RODS BELOW GRADE. INSTALL AT 36 INCHES BELOW FINISHED GRADE.
- $\stackrel{\textstyle \checkmark}{}$ 3/4" × 20' DEEP COPPER CLAD GROUND ROD. 36 INCHES BELOW FINISHED GRADE.
- 4 FURNISH AND INSTALL GROUND TEST WELL FOR GROUND ROD AT THIS LOCATION.
- 5 NO. 29X, CLASS I COPPER LIGHTNING CONDUCTOR RUN EXPOSED ON PIT. FASTEN EVERY 3 FEET MAX.
- 6 DOWN CONDUCTOR RUN IN 3/4 INCH PVC CONDUIT ON EXTERIOR FACE OF PIT.

 7 1/2" X 24" SOLID COPPER BLUNT TIP AIR TERMINAL WITH BASE. SEE DETAIL 'A'.
- 8 BOND TO NEW ALUMINUM STAIRS AND PLATFORM WITH NO. 2 SOLID TINNED GROUND CONDUCTOR.
- $\overline{9}$ NO. 6 GROUND CONDUCTOR.
- (10) BOND TO NEW LIGHT POLE WITH NO. 6 GROUND CONDUCTOR.

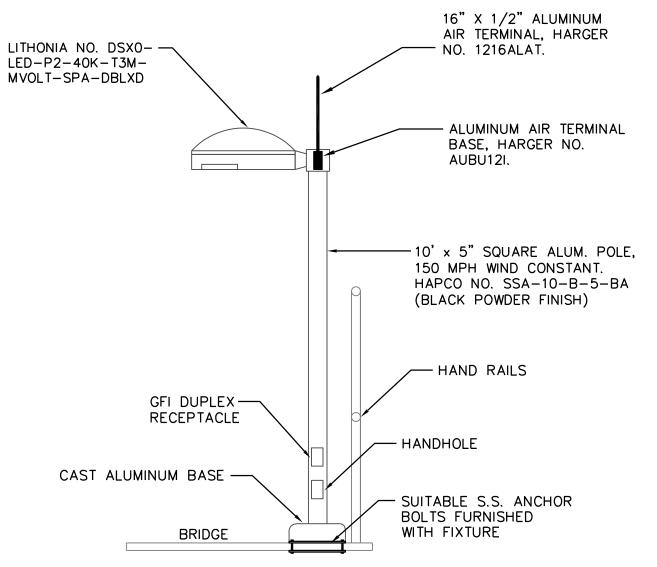


ABOVE GRADE SPLICE DETAIL

NOT TO SCALE



POLE MOUNTED LIGHT FIXTURE (A) DETAIL



POLE MOUNTED BRIDGE LIGHT FIXTURE (B) DETAIL

NOTES:

1. COORDINATE LIGHT POLE MOUNTING WITH BRIDGE MANUFACTURER.

LIGHTNING PROTECTION AND GROUNDING SYSTEM GENERAL NOTES:

- 1. THE COMPLETED INSTALLATION SHALL MEET THE REQUIREMENTS OF THE LATEST ACCEPTED EDITION OF THE NATIONAL FIRE PROTECTION ASSOCIATION'S "STANDARD FOR THE INSTALLATION OF LIGHTNING PROTECTION SYSTEMS" (NFPA 780) AND THE "INSTALLATION REQUIREMENTS FOR LIGHTNING PROTECTION SYSTEMS, UL 96A" OF UNDERWRITERS LABORATORIES INC. THE MASTER LABEL SHALL BE FURNISHED TO THE OWNER UPON COMPLETION.
- 2. COPPER LIGHTNING PROTECTION SYSTEM COMPONENTS SHALL NOT BE MOUNTED TO ALUMINUM SURFACES. ALUMINUM COMPONENTS SHALL BE USED TO AVOID ELECTROLYTIC CORROSION.
- GROUNDED METAL BODIES WITHIN 6' SHALL BE BONDED TO THE SYSTEM IN ACCORDANCE WITH THOSE REQUIREMENTS.
- 4. UNDERGROUND METALLIC PIPING ENTERING THE BUILDING OR STRUCTURE SHALL BE BONDED TO THE NEAREST DOWN CONDUCTOR OR GROUND ELECTRODE.
- 5. ADHESIVE USED WITH ADHESIVE AIR TERMINAL BASES AND CONDUCTOR FASTENERS SHALL BE COMPATIBLE WITH ROOFING MEMBRANE VERIFY WITH ROOFING CONTRACTOR.
- 6. THE DESIGNS SHOWN FOR THESE SYSTEMS ARE SCHEMATIC AND ARE INTENDED TO SHOW BASIC SYSTEM DESIGN. CONTRACTOR SHALL VERIFY DIMENSIONS AND SITE CONDITIONS AND PROVIDE SYSTEMS THAT COMPLY WITH CODE REQUIREMENTS.
- 7. AIR TERMINALS ARE TO BE LOCATED AS SHOWN. THEY ARE TO BE A MAXIMUM OF 24" FROM THE ROOF EDGE AND PROJECT A MINIMUM OF 10" ABOVE THE PROTECTED EDGE. THE SPACING BETWEEN AIR TERMINALS SHALL NOT EXCEED 20'. AIR TERMINALS THAT EXTEND 24" ABOVE THE PROTECTED EDGE SHALL NOT EXCEED A SPACING GREATER THAN 25', EXCEPT FOR MID-ROOF AREAS (50' MAX.).
- 8. LIGHTNING CONDUCTORS ARE TO MAINTAIN A HORIZONTAL OR DOWNWARD PATH, AND ALL BENDS IN THE CONDUCTOR SHALL HAVE A RADIUS OF NOT LESS THAN 8" AND SHALL NOT BE LESS THAN 90°.
- ATTACH ALL EXPOSED ROOF, DOWN LEAD, AND BONDING CABLES AT 3'-0" ON CENTER MAXIMUM. VERIFY COMPATIBILITY OF ADHESIVE ON MEMBRANE ROOF APPLICATIONS PRIOR TO INSTALLATION.
- INSTANCE SHALL THEY BE LESS THAN 36 INCHES BELOW GRADE AND 6'-0" FROM FOUNDATION WALL.

 11. ALL MATERIAL TO BE UNDERWRITER'S LABORATORIES APPROVED WITH

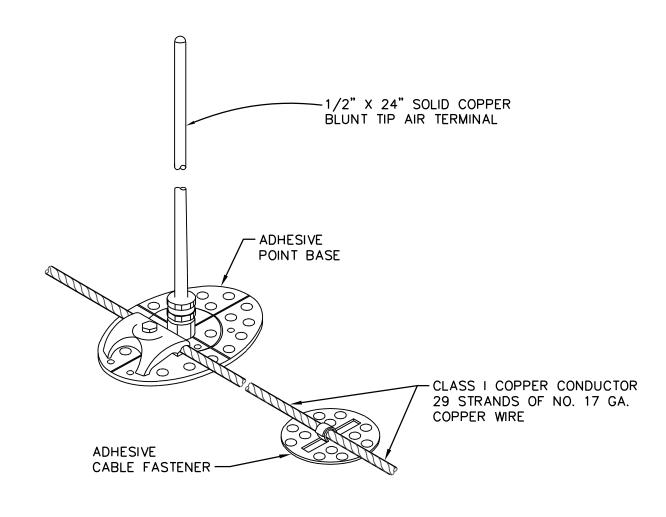
LABELS ON CONDUCTORS @ 10'-0" INTERVALS AND LABELS ON AIR

10. GROUND ELECTRODES SHALL BE INSTALLED AS SHOWN BUT IN NO

12. UPON COMPLETION OF GROUNDING AND LIGHTNING PROTECTION SYSTEMS, FURNISH COPY OF DRAWING RECORD SET FOR USE BY OWNER. FURNISH 4" PVC TUBE WITH REMOVABLE END CAPS FOR STORING DRAWINGS AND SECURELY MOUNT ON WALL IN CEP

BUILDING WHERE DIRECTED BY OWNER.

- 13. EQUIPMENT NOT SHOWN ON THIS DRAWING SHALL BE PROTECTED AS REQUIRED TO MEET THE REQUIREMENTS LISTED ABOVE INCLUDING THE INSTALLATION OF AIR TERMINALS AND OR BONDING. IF THE METAL THICKNESS OF AN OBJECT IS 3/16" OR GREATER, AIR TERMINALS MAY BE ELIMINATED IF THE OBJECT IS PROPERLY CONNECTED TO THE SYSTEM.
- 14. PVC CONDUITS CONTAINING LIGHTNING PROTECTION SYSTEM CONDUCTORS SHALL BE FREE OF ALL METAL SUPPORTS AND CLAMPS. USE NON-METALLIC STRAYS AND FASTENERS.
- 15. ALL ABOVE GRADE BONDING CONNECTIONS UNLESS OTHERWISE NOTED SHALL BE STAINLESS STEEL OR SOLID COPPER. NO STEEL CADMIUM PLATED MATERIALS WILL BE ACCEPTED.
- 16. UPON COMPLETION OF LIGHTNING PROTECTION AND GROUNDING SYSTEMS, FURNI8SH U.L. MASTER LABEL AND INSTALL ON EXTERIOR WALL OF BUILDING WHERE DIRECTED BY OWNER.



AIR TERMINAL DETAIL 'A'

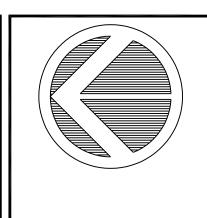
LINE LEGEND

NEW CONSTRUCTION
EXISTING TO REMAIN

SCALE: 3/8" = 1'-0"

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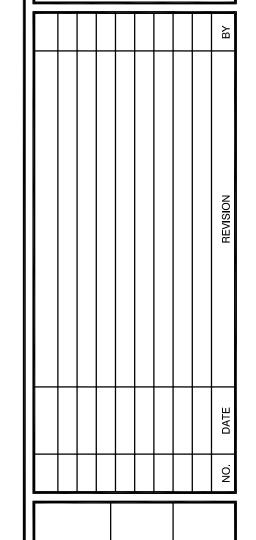


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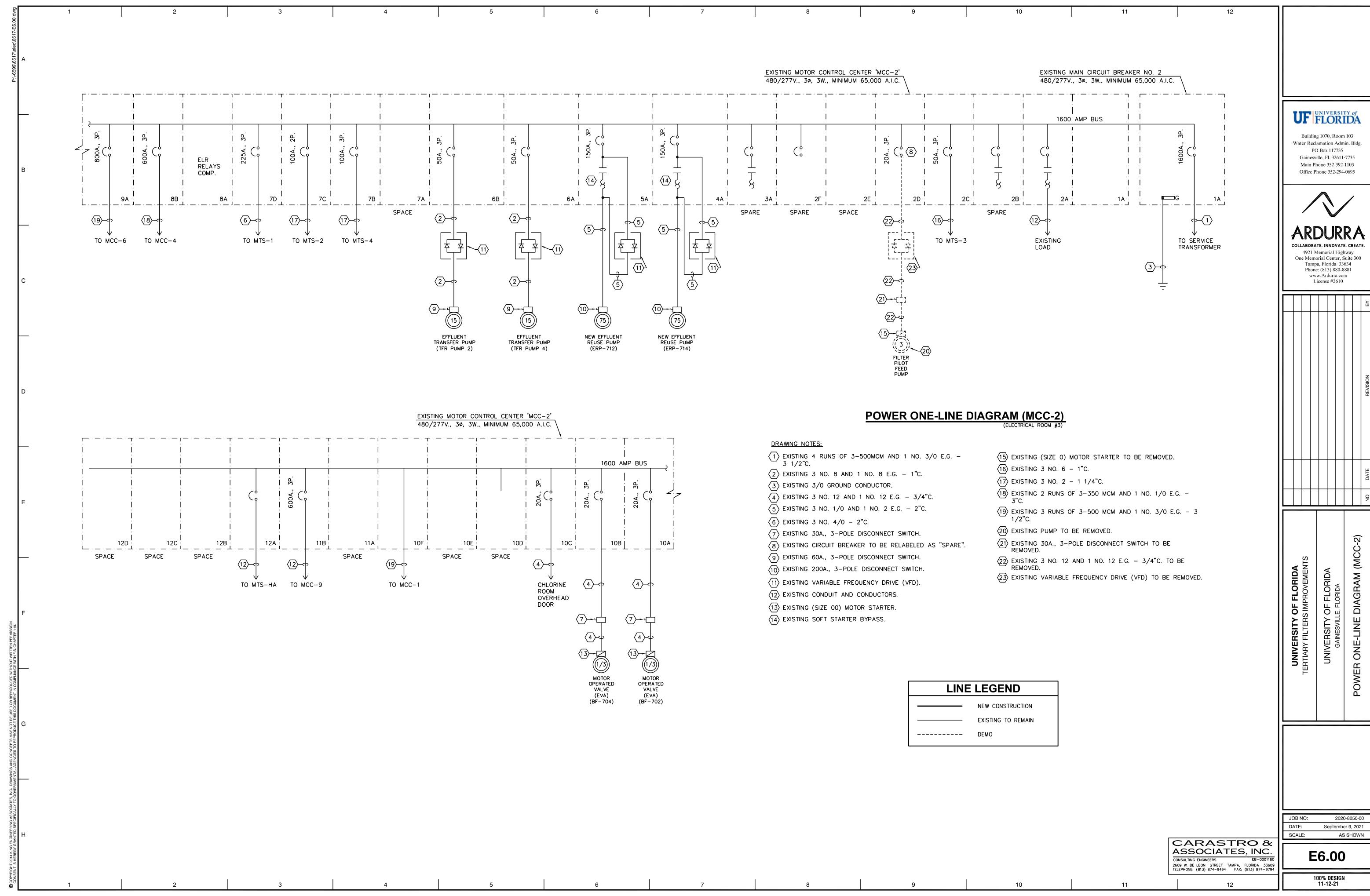
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UNIVERSITY OF FLORIDA
GAINESVILLE, FLORIDA
LIGHTNING PROTECTION PLAN -

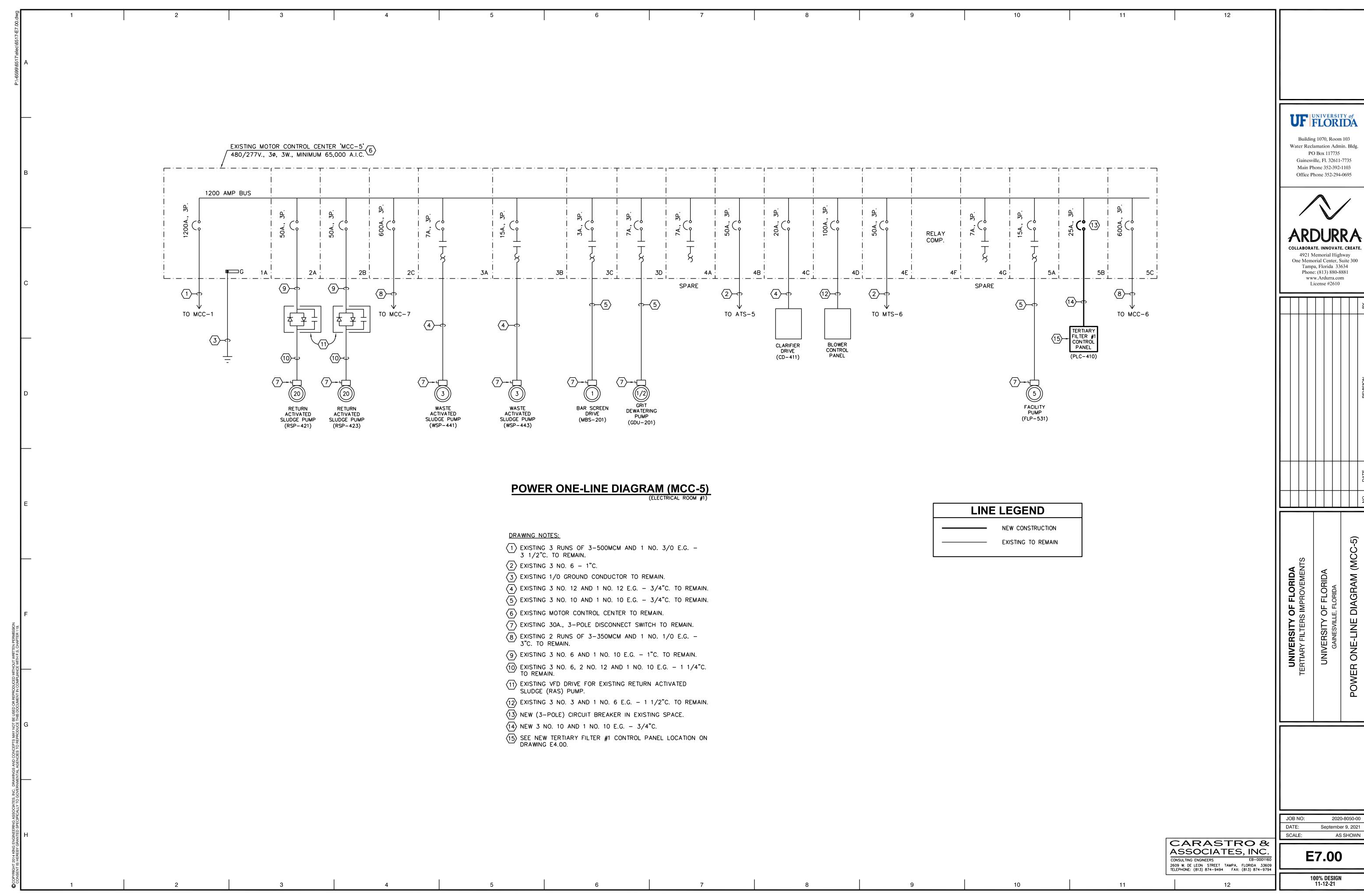
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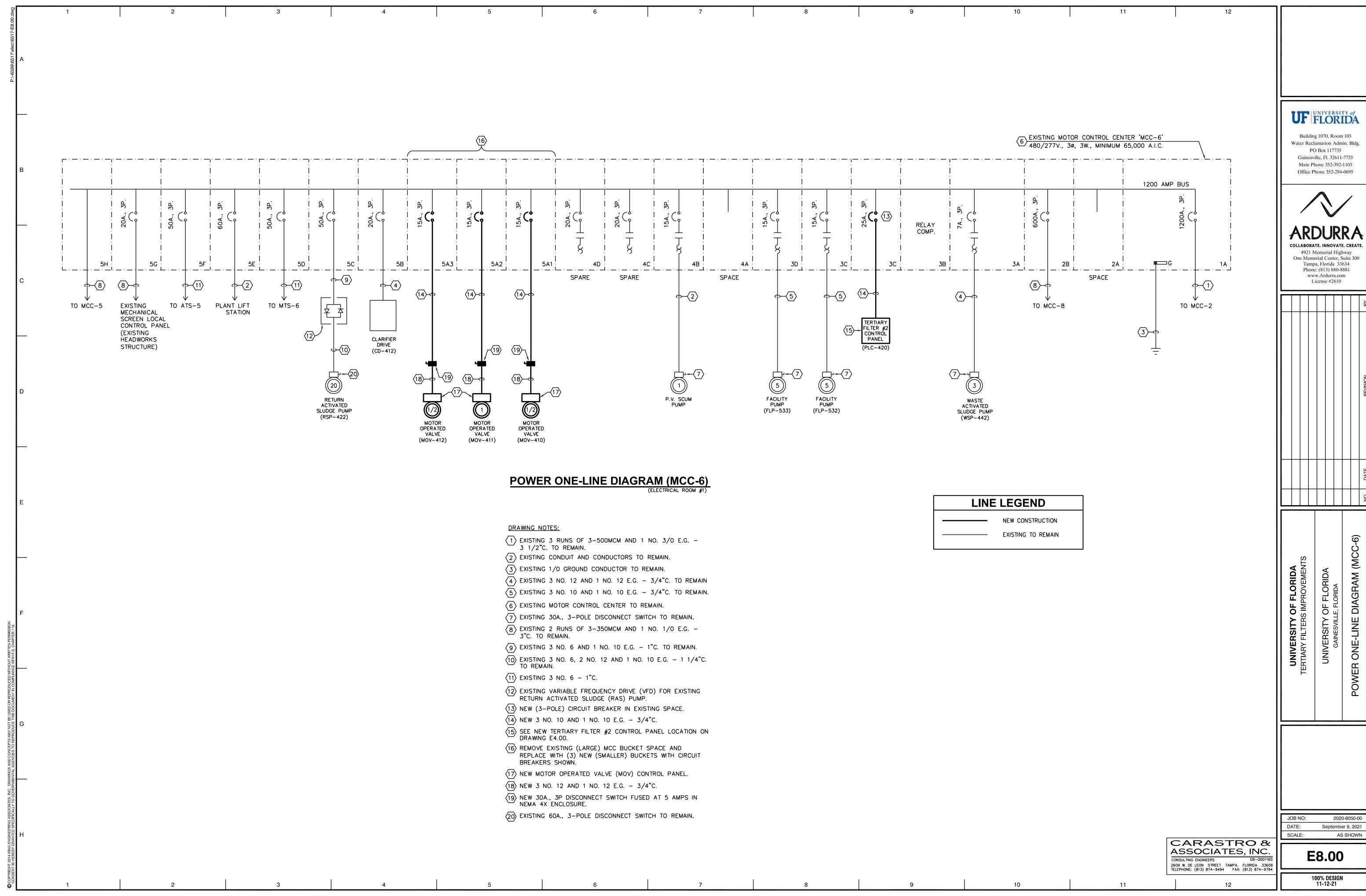
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_	D GENERAL NOTES: 1. ALL NEW CIRCUIT BREAKERS TO MATCH ALC. RATING OF EXISTING BREAKERS AND SHALL BE OF THE SAME MANUFACTURER AS EXISTING PANEL. GENERAL NOTES: PANELBOARD SCHEDULE NOTES: (1) EXISTING CIRCUIT BREAKER TO BE RELABELED AS "SPARE". (2) REUSE EXISTING "SPARE" CIRCUIT BREAKER FOR NEW LOAD. (3) REMOVE EXISTING (2) 20A., 1-POLE CIRCUIT BREAKERS AND REPLACE WITH NEW CIRCUIT BREAKERS SHOWN.			
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