

Krebs Engineering, Inc.
2100 River Haven Drive
Suite 100
Birmingham, AL 35244
205-987-7411

ADDENDUM NO. 2

CONTRACT NO.: 22022

OWNER: GUIN WATER & SEWER BOARD

PROJECT: WATER TREATMENT PLANT IMPROVEMENTS PHASE 2 (1.5 MGD WTP)

BID DATE: June 6, 2023

TO: ALL PROSPECTIVE CONTRACTORS AND SUPPLIERS

The changes, modifications, and/or additions covered by and set forth in this Addendum No. 2 shall become part of and be incorporated in the Contract Documents for the above-referenced project:

BIDDING REQUIREMENTS TO BE REVISED BY ADDENDUM:

AD2.1 Delete DIVISION 0 – PROPOSAL FORM in its entirety and replace it with the attached.

SPECIFICATIONS TO BE REVISED BY ADDENDUM:

AD2.2 SECTION 33 11 16.11 – PLASTIC PIPE AND FITTINGS

1. Page 2, Part 2 – PRODUCTS

Article 2.2, B shall be revised as follows:

Pipe conforming to ASTM D3034, latest revision, shall have a minimum wall thickness of **SDR 24**.

AD2.3 SECTION 44 32 00 – FILTERING EQUIPMENT AND MEDIA

1. Page 3, Part 1 – GENERAL

Article 1.5, C shall be revised as follows:

Warranty Period: **Five Years** from date of Substantial Completion

2. Page 9, Part 2 – PRODUCTS

Article 2.9, B shall be revised as follows:

1. Specific Gravity: **1.60-1.80**

4. Moisture Content: less than **15.00 percent** as shipped

AD2.4 Delete SECTION 44 32 10 STAINLESS STEEL PACKAGE RAPID MIX, FLOCCULATION, AND SEDIMENTATION in its entirety and replace it with the attached specification. Changes have been made to Parts 2 and 3.

AD2.5 Delete SECTION 44 42 56 – WATER SUPPLY AND TREATMENT PUMPS in its entirety and replace it with the attached specification. Changes have been made to the pump parameters in articles 2.3 and 2.5.

AD2.6 SECTION 44 42 56.19 – SEWAGE AND SLUDGE PUMPS

1. Page 4, Part 2 – PRODUCTS

Article 2.1, A shall include the following addition:

Grundfos is an approved manufacturer of Submersible Pumps

2. Page 5, Part 2 – PRODUCTS

Article 2.2, A shall be revised as follows:

SUBMERSIBLE PUMP SCHEDULE				
PUMP INFORMATION	PUMP NO. 1		PUMP NO. 2	
	Point	Point	Point	Point
	No. 1	No. 2	No. 1	No. 2
Capacity (GPM):	200	250	200	250
TDH (ft.):	13	10.5	13	10.5
Minimum Efficiency	42	40	42	40
Motor Size (HP):	2		2	
RPM	1,165		1,165	

AD2.7 SECTION 44 44 13 WATER CHEMICAL FEED EQUIPMENT

1. Page 3, Part 2 – PRODUCTS

Article 2.1, A Shall include the following addition:

ProMinent is an approved manufacturer of Metering Pumps

2. Page 2, Part 2 – PRODUCTS

Article 2.1, B Shall include the following addition:

Vanton is an approved manufacturer of Transfer Pumps

AD2.8 Delete SECTION 44 44 13.01 LIME SLURRY SYSTEM in its entirety and replace it with the attached specification. Changes have been made to Part 2.

SPECIFICATIONS TO BE ADDED BY ADDENDUM:

AD2.9 SECTION 01 23 00 - ALTERNATES

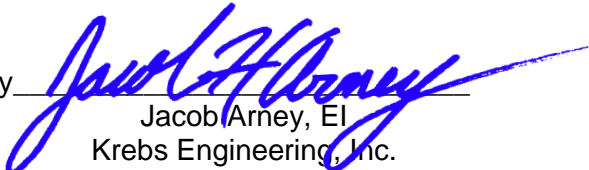
AD2.10 SECTION 12 34 50 – LABORATORY CASEWORK

AD2.11 SECTION 44 25 80.15 – MOTOR DRIVEN BYPASS PUMP

AD2.12 SECTION 44 32 10.10 – ALTERNATIVE PRE-TREATMENT PACKAGED UNITS

This Addendum No. 2 shall be attached to the front of your set of specifications and made a part of the Contract Documents. Receipt of this Addendum No. 2 shall be acknowledged on Page 4 of the Proposal Form.

Krebs Engineering, Inc.

By  _____
 Jacob Arney, EI
 Krebs Engineering, Inc.

THIS IS THE LAST PAGE

Attachments to Addendum No. 2 succeeding this page:

- DIVISION 0 – PROPOSAL FORM – 6 Pages
- 01 23 00 – ALTERNATES – 2 Pages
- 12 34 50 – LABORATORY CASSEWORK – 14 Pages
- 44 25 80.15 – MOTOR DRIVEN BYPASS PUMP – 7 Pages
- 44 32 10 – STAINLESS STEEL PACKAGE RAPID MIX. FLOCCULATION, AND SEDIMENTATION – 14 Pages
- 44 32 10.10 ALTERNATIVE PRE-TREATMENT PACKAGED UNITS – 12 Pages
- 44 42 56 – WATER SUPPLY AND TREATMENT PUMPS – 13 Pages
- 44 44 13.01 – LIME SLURRY SYSTEM – 9 Pages

A total of 80 pages or sheets of drawings (including this page) have been included in Addendum No. 2.

General Contractors are requested to return this page as an acknowledgement that you have received this Addendum by Quest CDN. This will NOT be mailed. A copy of this Addendum may be picked up at the office of the Engineer.

Return to Krebs Engineering:
Jacob Arney, EI
Jacob.arney@krebseing.com

Received By _____

Contractor _____

Date _____

PROPOSAL FORM

MADE BY _____

ADDRESS _____

TO: **Guin Water and Sewer Board**

The undersigned, as Bidder, proposes and agrees, if this Bid is accepted, to enter into a Contract with Guin Waterworks and Sewer Board, in the form of Contract specified and shown in the attached Contract Documents, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation, and labor necessary to complete the construction of a **Water Treatment Plant Improvements – Phase 2** as described in the Advertisement for Bids, and in the Contract Documents, which are hereby referred to and made a part of the same extent as if fully set out herein, and in full and complete accordance with the shown, noted, described and reasonably intended requirements of the Contract Documents, to the full and entire satisfaction of the Owner, with a definite understanding that no money will be allowed for extra work except as set forth in the attached Instructions to Bidders, General Conditions, and other Contract Documents, based on the following pricing:

PROPOSAL FORM

ITEM NO.	APPROXIMATE QUANTITIES	DESCRIPTION OF ITEM	UNIT PRICE	TOTAL PRICE FOR ITEM
1.	Complete	<p>Guin Water Treatment Plant Improvements: Furnish and Install all labor, materials, equipment and appurtenances for the construction of the WTP upgrade/expansion, including demolition, sitework, yard piping, raw water pump station upgrades, pre-treatment basins, filters, clearwells, FWPS, Treatment Building to house filters, electrical, chemicals, and administration, and other modifications/improvements.</p> <p>Lump Sum</p>	Lump Sum	\$
2.	Complete	<p>Electrical: Furnish and install all labor, materials, equipment and appurtenances for the electrical work associated with this project.</p> <p>Lump Sum</p>	Lump Sum	\$
3.	Complete	<p>WTP SCADA System: Furnish and install all labor, materials, equipment and appurtenances for the SCADA System work as specified herein.</p> <p>Lump Sum</p>	Lump Sum	\$
4.	Complete	<p>WTP Lab Equipment: Allowance Item No. 1 for lab equipment to be selected by the Owner</p> <p>Lump Sum</p>	Lump Sum	\$75,000.00
5.	Complete	<p>Special Handling Equipment: Allowance Item No. 2 for lab equipment to be selected by the Owner</p> <p>Lump Sum</p>	Lump Sum	\$25,000.00
6.	Complete	<p>Office Furnishing Allowance: Allowance Item No. 3 for lab equipment to be selected by the Owner</p> <p>Lump Sum</p>	Lump Sum	\$25,000.00

7.	Complete	Kitchen Appliances: Allowance Item No. 4 for lab equipment to be selected by the Owner Lump Sum	Lump Sum	\$7,000.00
8.	200	Undercut (Below Subgrade) Unsuitable Soils, Haul, and Dispose Off-Site, as directed by the Engineer	CY	\$
9.	200	Backfill Undercut Areas w/ Crushed Stone (Including Hauling and Compaction), as directed by the Engineer	CY	\$
10.	200	Backfill Undercut Areas w/ suitable Soil from On-Site (Including Hauling and Compaction), as directed by the Engineer	CY	\$
Total Amount of Base Bid				\$

BASE BID: For construction complete as shown and specified in table above, the sum of

Dollars \$

ALTERNATES: If alternates as set forth in the Contract Documents are accepted, the following adjustments are to be made to the Base Bid.

ITEM NO.	ALTERNATE DESCRIPTION	TOTAL ADD OR DEDUCT PRICE FOR ITEM
A1.	Install upflow clarifier/tube settler pre-treatment in lieu of the rapid mix, flocculation and sedimentation basins shown on the base bid drawings Lump Sum	\$

BASE BID plus Alternate No. 1: For construction complete as shown and specified in table above (Base Bid plus Alternates), the sum of

Dollars \$

ADDENDA: The Bidder acknowledges receipt of Addenda Nos. _____ , _____ , _____ , _____ , _____ , _____ , _____ , _____ .

The award of the Contract will be based on the total/sum of the base bid price and the alternates (if any) selected by the Owner. The Owner will receive bids and all pricing will be read aloud, but the project will not be awarded until the bids are evaluated and a determination is made on which alternates are selected. Once the Alternates have been selected, the final bid amount will be calculated (base bid price plus adjustments for any alternate selected) for each bid submitted, and if an award is made, the project will be awarded to the responsive bidder with the lowest final bid amount.

The Bidder declares that he/she has examined the site of the work, and has familiarized himself/herself with the existing and proposed/new facilities (including the location, nature, sizes/dimensions, current and intended future use, etc.). The Bidder declares that he/she has fully informed himself/herself of conditions that would affect the proposed work, that, prior to the tender of his/her bid, he/she has examined the Contract Documents for the work and has read all special instructions and provisions contained in the Documents, and that he/she has satisfied himself/herself with respect to the quality and extent of work to be performed. The Bidder declares that the firm, the project manager and the superintendent are qualified and meet or exceed the experience requirements as outlined in the Instructions to Bidders and/or elsewhere in the Contract Documents.

The Bidder declares that he/she understands that, when quantities of work for which unit price bids are requested in the Proposal, such quantities are approximate only and are subject to either increase or decrease, that, should the quantities of any of the work items be increased, the Bidder proposes to perform the additional work at the unit prices bid by him, that, should the quantities of any of the work items be decreased, payment will be made only for the actual quantities of work performed and such payment will be based upon the unit prices bid by him/her, and that he/she shall make no claim for profits anticipated on the decrease in quantities of work. Actual quantities will be paid for as the work progresses, in accordance with the provisions of the Contract Agreement, and such quantities shall be subject to final measurements and determinations made upon completion of the work.

The Bidder understands that the Owner reserves the right, in the Owner's discretion, to reject any or all bids, to waive any informality in any bid, and to accept any bid considered to be advantageous to the Owner.

The Bidder agrees that his/her bid shall be valid for a period of sixty (60) calendar days after the date set for receipt of bids, and shall not be withdrawn for a period of sixty (60) calendar days after the date set for receipt of bids.

The Bidder has attached hereto a Bid Bond executed by a Surety Company authorized to do business in the state in which the project is located (with valid Power-of-Attorney attached), or a cashier's check drawn on a bank in the state in which the project is located, in favor of (made payable to) **Guin Water and Sewer Board**, the amount of 5% of the bid amount (total), but in no event more than \$10,000.

The Bidder agrees that, should he/she be notified that his/her Bid on the work has been accepted, he/she will, within ten (10) days from receipt of such notice, execute the formal Contract Agreement bound herein, and will furnish with the Contract evidence of Insurance Coverage of his/her construction operations and all of his/her operations associated with the project, all in accordance with the requirements of the General Conditions.

The Bidder further agrees that, in case of failure on his/her part to execute said Contract Agreement, and to furnish all Bonds required by the Contract Documents, within ten (10) consecutive calendar days after receipt of notice of award of Contract to him, the monies payable to the Obligee of his/her Bid Bond, in accordance with the terms and conditions of the Bond, shall be paid to the Owner as liquidated damages for the delay and additional expense to the Owner caused by such failure on the part of the Bidder.

The Bidder hereby agrees that, should the work under the Contract be awarded to him/her, he/she will commence work under this Contract on or before a date to be specified in written "Notice to Proceed" given by the Owner, and that he/she will achieve Substantial Completion of the Contract within 540 consecutive calendar days following the Notice to Proceed, and will achieve Final Completion of the Contract within 600 consecutive calendar days following the Notice to Proceed. The Bidder agrees to pay, as liquidated damages, the sum of **\$1,000** for each consecutive calendar day after the date set for Substantial Completion of the work until such time as Substantial Completion has been achieved. Once Substantial Completion has been achieved, the Bidder will not be assessed additional liquidated damages unless and until he/she fails to meet the Final Completion Date. If the Bidder fails to meet the Final Completion date, then he/she agrees to pay, as liquidated damages, the sum of **\$1,000** for each consecutive calendar day after the date set for Final Completion of the work, all as provided in the General Conditions. At no time shall the Bidder pay more than **\$1,000** per calendar day for liquidated damages. **The Bidder agrees that, once the Substantial and/or Final Completion dates have passed, the Owner/Engineer will begin deducting liquidated damages from the monthly progress payments.** The Bidder further agrees that he/she will not make any claim for extra compensation should completion of work under the Contract be effected in advance of the time specified hereinabove.

The undersigned Bidder states that he/she fully understands the meaning of "low, responsive, responsible Bidder", as defined in these Documents, and that these criteria will be applied in the evaluation of this Bid.

The undersigned, as Bidder, hereby declares that the name (or names) of the only person (or persons) interested in this Proposal, as principal (or principals), is (or are) as herein below set out and that no person other than that (or those) herein below stated has any interest in this Proposal, or in the Contract to be entered into; that this Proposal is made without connection with any other person, firm or corporation making a proposal; and that it is in all respect fair and in good faith, without collusion or fraud.

Following are the names and addresses of all persons, firms, and corporation interested in the foregoing bid:

(Type or Print Name and Address of Firm)

(Type or Print Contractor License No.)

(Type or Print Name and Title of Officer/Legal Representative of Firm Submitting Bid)

(Signature of Officer/Legal Representative of Firm Submitting Bid)

(Type or Print Date)

SECTION 01 23 00 – ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. The Owner reserves the right to select or reject alternates that are considered to be advantageous to the Owner.
- B. No adjustments to the pricing for other components of the Work will be made.
- C. No adjustments to the schedule or Contract completion dates will be made unless specifically identified for an alternate.
- D. Only those alternates selected by the Owner and incorporated into the Contract Agreement are included in the Work.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.

1.3 SCHEDULE OF ALTERNATES

A. The alternates shown in the Proposal Form are listed and described below:

1. Alternate No. 1 – Install new upflow clarifiers/tube settler pretreatment units in lieu of the rapid mix, flocculation, and sedimentation basins shown on the base bid drawings. Contractors shall include all pricing as required by the manufacturer for the equipment.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 23 00

SECTION 123450 LABORATORY CASEWORK

PART 1 GENERAL

1.00 SUMMARY

- A. Section Includes:
 - 1. Steel Casework – Painted.
 - 2. Work Surfaces
 - 3. Table Frames
 - 4. Sinks
 - 5. Special Purpose Storage Cabinets
- B. Related sections:
 - 1. Section 115313– Laboratory Fume Hoods
- C. “American Made” – Casework wholly manufactured and assembled in USA

1.01 CASEWORK DESIGN REQUIREMENTS

- A. Flush Inset construction: Surfaces of doors, drawers and panel faces\ shall align with cabinet fronts without overlap of case ends, top or bottom rails. Horizontal and vertical case shell members (panels, tops rails and bottoms) shall meet in the same plane without overlap.
- B. Interior of case units: Easily cleanable, flush interior. Base cabinets, 30" and wider, with double swinging doors shall provide full access to complete interior without center vertical post.
- C. Self-supporting units: Completely welded shell assembly without applied panels at ends, backs or bottoms, so that cases can be used interchangeably or as a single, stand-alone unit.
- D. Case openings: Rabbetted-like joints all four sides of case opening for hinged doors and two sides for sliding doors in order to provide dust resistant case.
- E. Drawers: Sized on a modular basis for interchangeability to meet varying storage needs, and designed to be easily removable in the field without use of special tools.
- F. Doors: Solid or glazed, double wall telescoping box steel construction, interior sound deadening, removable hinges standard.

1.02 CASEWORK PERFORMANCE REQUIREMENTS

- A. Structural Performance Requirements: Casework components have been tested in conformance with SEFA 8 M-2007 Recommended Practice and shall withstand the following maximum static load capacity, without damage to the component or to the casework operation, when properly leveled, supported and the load evenly distributed:
 - 1. Steel base units: 500 lbs. per lineal ft.
 - 2. Suspended units: 300 lbs.

- 3. Drawers in a cabinet: 150 lbs. per drawer
- 4. Utility tables (4 legged): 300 lbs.
- 5. Hanging wall cases: 300 lbs.
- 6. Shelves (base, wall, tall units) 40 lbs./sq.ft., up to 200lbs.

B. Metal Finish Performance Requirements: Coatings on Casework components have been tested in conformance with the full requirements of SEFA 8 M-2010 Recommended Practice. See Section 2.07 for test procedures, acceptance levels and results for each criteria listed below from SEFA 8 M-2010 Section 8:

- 1. Chemical Spot Test – Section 8.1
- 2. Hot Water Test – Section 8.2
- 3. Finish Impact Test – Section 8.3
- 4. Paint Adhesion on Steel – Section 8.4
- 5. Paint Hardness on Steel – Section 8.5

1.03 WORK SURFACE PERFORMANCE REQUIREMENTS

The following are epoxy work surface performance requirements which the Specifier may wish to select.

A. Epoxy Work Surface Performance Requirements:

- 1. Test procedure: Apply five drops of each reagent to surface and cover with 25mm watch glass, convex side down; test volatiles using one ounce bottle stuffed with saturated cotton. After 1 hour exposure flush surface, clean, rinse and wipe dry. Evaluate after 24 hours at 73°F, and 50°F at 5% relative humidity.
- 2. Evaluation ratings: Change in surface finish and function shall be described by the following ratings:
 - a. No Effect: No detectable change in surface material.
 - b. Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material.
 - c. Good: Clearly discernible change in color or gloss, but no significant impairment of work surface function or life.
 - d. Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period.
 - e. Failure: Pitting, cratering or erosion of work surface material; obvious and significant deterioration.

3. Test Results - Epoxy Resin Work Surface:

REAGENT	RATING
1. Hydrochloric Acid, 37%	Excellent
2. Sulfuric Acid, 33%	No Effect
3. Sulfuric Acid, 77%	No Effect
4. Sulfuric Acid, 96%	Failure
5. Formic Acid, 90%	Excellent
6. Nitric Acid, 20%	Excellent
7. Nitric Acid, 30%	Excellent
8. Nitric Acid, 70%	Good
9. Hydrofluoric Acid, 48%	Fair
10. Phosphoric Acid, 85%	No Effect
11. Chromic Acid, 60%	Failure

12. Acetic Acid, 98%	Excellent
13. 3 & 8 Equal Parts	Excellent
14. Ammonium Hydroxide, 28%	No Effect
15. Sodium Hydroxide, 10%	No Effect
16. Sodium Hydroxide, 20%	No Effect
17. Sodium Hydroxide, 40%	No Effect
18. Sodium Hydroxide Flake	No Effect
19. Sodium Sulfide	Excellent
20. Zinc Chloride	No Effect
21. Tincture of Iodine	Excellent
22. Silver Nitrate	No Effect
23. Methyl Alcohol	No Effect
24. Ethyl Alcohol	No Effect
25. Butyl Alcohol	No Effect
26. Benzene	Excellent
27. Xylene	No Effect
28. Toluene	Excellent
29. Gasoline	No Effect
30. Dichlor Acetic Acid	Good
31. Di Methyl Formamide	Excellent
32. Ethyl Acetate	No Effect
33. Amyl Acetate	Excellent
34. Acetone	Excellent
35. Chloroform	Excellent
36. Carbon Tetrachloride	No Effect
37. Phenol	Excellent
38. Cresol	Excellent
39. Formaldehyde	No Effect
40. Trichloroethylene	Excellent
41. Ethyl Ether	Excellent
42. Furfural	Good
43. Methylene Chloride	Excellent
44. Mono Chlor Benzene	Good
45. Dioxane	Excellent
46. Methyl Ethyl Ketone	Excellent
47. Acid Dichromate	Fair
48. Hydrogen Peroxide	No Effect
49. Naphthalene	Excellent

PART 2 PRODUCTS

2.00 MANUFACTURER

- A. "American Made" – Casework wholly manufactured and assembled in the USA by:
ICI Metal Products Division, 178 Blackstone Avenue, Jamestown, New York, 14701.

2.01 MATERIALS

- A. Typical sheet steel used in the construction of cases and related products:
1. Mild carbon, cold rolled and leveled unfinished steel, ASTM A 1008
 2. Stainless steel, #4 finish one side, ASTM A 666
 3. Mild carbon, cold rolled and hot dipped galvanized steel
- B. Unless otherwise noted, the typical gauge of steel used in the construction of cases and related products shall be 18 GA. Exceptions listed below:
1. 11 GA – table leg stretcher and leg rail support brackets
 2. 12 GA – bottom corner gussets
 3. 14 GA – hinge reinforcements, suspension channels
 4. 16 GA –table cross rails, apron rails and end rails
 5. 20 GA – inner door panels, filler stiles, fixed back panels, drawer bodies
 6. 22 GA – removable back panels
- C. Glass for glazed swinging, sliding and frameless doors as follows:
1. ¼" Clear Float Glass – standard for swinging & sliding doors
 2. ¼" Tempered Glass per ASTM C 1048 – standard for frameless doors
 3. ¼" Laminated Glass per ASTM C 1172 –optional

2.02 CASEWORK CONSTRUCTION

- A. Base and Tall Cabinets (standard 22" nominal depth):
1. Minimum height, including corner gussets, leveler fully retracted:
 - a. Base Standing 35.500"
 - b. Base Sitting 28.250"
 - c. Base ADA 31.853"
 - d. Tall 83.750"
 2. One-piece formed end panels and back with internal reinforcing front posts
 3. Front post fully closed with full height reinforcing upright.
 4. Shelf adjustment holes in front and rear posts shall be perfectly aligned for level setting, adjustable to 1/2" increments.
 5. Base cabinet drawer units provided without backs or bottoms; cupboard units provided with removable backs for service access.
 6. Tall cabinet units provided with full formed backs, recessed 1/8" for mounting purposes.
 7. One-piece bottom with formed front edge spot welded to front rail. Rabbetted as required for swinging doors and drawers; flush for sliding doors.
 8. Top rail interlocks with and welded to end panels, flush with front of unit; reinforced for suspended units.
 9. Formed steel base provides minimum 3.750" high by 3.000" deep toe-kick space; reinforcing corner gussets accommodate standard ½-13 UNC x 2.500"

zinc plated leveling bolt, accessible through bottom panel on Base and Tall Cabinets where applied.

B. Wall Cabinets (standard 12" and 16" depth):

1. Standard heights include 18", 24.5", 30", 36", 42" and 48".
2. One piece formed end panels and back with internal reinforcing front posts.
3. Front post fully closed with full height reinforcing upright.
4. Shelf adjustment holes in front and rear posts shall be perfectly aligned for level setting, adjustable to ½" increments.
5. One-piece formed back, recessed ¾" for mounting purposes.
6. One-piece top with front edge formed into front rail.
7. One-piece bottom with front edge formed into front rail.
8. Note: All exposed seams on joints will be welded, ground and polished to an equivalent mill finish.

C. Drawers:

1. Drawer fronts: 5/8" thick, double wall construction, assembled with sound deadened material, top front corners fitted smooth.
2. Drawer bodies (*Specifier's Option – choose one*):
 - a. 20 GA mild steel, 1-pc construction, bottom and sides coved and top edges formed. No sharp edges. Painted neutral color grey; reclaim used whenever possible.
 - b. 22 GA stainless steel, 1-pc construction, bottom and sides coved and top edges formed. No sharp edges.
3. No tools required for removal.
4. Drawer suspension (*Specifier's Option – choose one*):
 - a. Removable full extension Accuride® (or equivalent) slide; tested and rated 150 lb. static and dynamic.
 - b. Removable full extension, self-closing Accuride® (or equivalent) slide.
5. Provide drawer with rubber bumpers. Friction centering devices are not acceptable.
6. Provide security panels for drawers with keyed different locks (as required)

D. Doors:

1. Solid panel doors: 5/8" thick, double wall, telescoping box steel construction with interior sound deadening, outer corners fitted smooth. Hinges with screws to internal 14 gauge reinforcement in case and door. Hinges shall be removable; welding of hinges not acceptable. Doors shall close against rubber bumpers.
2. Frame glazed doors: Outer head to be one-piece construction with beaded edges. Inner head shall be one-piece construction also, telescoping, and secured with screws to outer head; removable for installation or replacement of glass. Provide vinyl glazing retainer to receive glass. In all other respects, framed glazed door construction and quality shall match solid panel doors.
3. Sliding doors - solid or framed glazed: Designed for tilt-out removal. Doors shall ride on nylon tired sleeve bearing rollers in aluminum extended bottom hung track and shall close against rubber bumpers.
4. Unframed sliding glass doors: Glass with edges ground set in extruded aluminum shoe with integral pull (top and bottom extruded aluminum

track). Provide rubber bumpers at fully opened and closed door position.

E. Shelves:

1. Casework shelves: Die formed steel, front and back edges formed down and back 1"; ends formed down $\frac{3}{4}$ ".
2. Reinforced shelves: Shelves over 36" long and 16" deep include hat channel reinforcement, full length of the shelf.
3. Pull out shelves: Same suspension as specified for drawers.

F. Base molding: 4" high typical, to be furnished and installed by others.

G. Hardware:

1. Wire pulls: Modern design, offering a comfortable hand grip, and be securely fastened to doors and drawers. Two pulls shall be required on all drawers 30" and longer.
2. Flush pulls (*Specifier's Option – choose one*):
 - a. Modern design, zinc die cast metal providing a semi- recessed appearance and comfortable finger grip.
 - b. Modern design, ABS plastic, Chameleon, providing a semi-recessed appearance and comfortable finger grip.
 - c. Modern design, ABS plastic, Black, providing a semi- recessed appearance and comfortable finger grip. Finger holes or slots machined into doors are not acceptable.
3. Hinges: Brushed stainless steel type, 5-knuckle, frictionless, not less than 2" long with fast pin and rounded ends. Hinges are attached to both door and case with three (3) screws through each leaf. Doors over 36" in height shall be hung using 3 hinges.
4. Removable Core Locks (*Specifier's Option – choose one*):
 - a. 5-disc tumbler
 - b. 5-pin tumblerApplied to doors and drawers where specifically requested in the specifications or on the equipment list, and shall be keyed and master- keyed as directed.
5. Door Catches: Adjustable nylon roller type, with strike.
6. Leveling Devices: Zinc plated $\frac{1}{2}$ "-13 UNC threaded bolt type.
7. Shelf Clips: Die formed steel, zinc plated, designed to provide shelf support and adjustment in $\frac{1}{2}$ " increments
8. Label Holders: Applied (in the field) to doors and drawers where specifically requested in the specifications or on the equipment list, shall be self adhesive type aluminum with satin finish and designed for 2-1/2" x 1-1/8" cards, unless otherwise specified.
9. Up-and-Down Bolts: Optional on hinged full height storage cases, they shall have a right hand door provided with an active knob and up-and-down bolt assembly. Left hand door shall be provided with a dummy knob. Up-and-down bolts shall be concealed in the stiles of glazed doors and between pans of solid panel doors.

2.03 WORK SURFACES

- A. A. Epoxy Resin: Chemical and abrasion resistant, durable 1" thick cast material of epoxy resins and inert products, cast flat, with a uniform low-sheen black

surface. Backsplash curb shall be the same material as the top, but provided separate for field installation. Provide where indicated on drawings or as required where tops abut wall surfaces and at reagent ledges. Include end curb where top abuts end wall as specified. Reagent ledges shall be the same material as the top. Ledge face shall permit installation of service fixtures and top shall be removable for access to service utilities.

2.04 TABLE FRAMES

- A. Table frames: 4-1/2" high "C" channel front and back aprons, end rails and cross rails.
- B. Table drawers: Provide front and back rails; drawer unit, hardware and suspension same as specified for base unit drawers.
- C. C. Legs: 2" x 2" steel tube legs with welded 11 GA leg bracket. Attach legs with two bolts to front and back aprons and weld to end rails. Each leg shall have a leveling screw.
- D. D. Leg Shoes: Provided on all table legs to conceal leveling device, unless otherwise specified. Shoes shall be pliable, black vinyl material.

2.05 SINKS

- A. Stainless Steel Sinks: Shall be fabricated from Type 304 stainless steel per ASTM A 666, except where Type 316 stainless steel is specified. All expose surfaces shall be finished in No. 4 finish. All sink surfaces (sides and bottoms) shall be full 16 gauge metal thickness unless heavier gauges are specified. Deep drawn sinks are not acceptable. All sink joints shall be continuously welded by heli-arc welding process. Inside radii shall be 1". Bottoms shall be pitched to the drain indent. Sink bowl shall be welded to the top as to form an integral part thereof where sinks are built into stainless steel tops or working surfaces. Top edges of free standing sinks shall be formed into a channel formation with all joints welded and ground smooth and polished. No soldering shall be permitted in connection with sink construction. Stainless steel sinks shall be furnished with crumb cup strainers unless otherwise specified.
- B. Sink Supports: Sink supports shall be the hanger type, suspended from top front and top rear horizontal rails of sink cabinet by four (4) 1/4" dia. rods, threaded at bottom end and offset at top to hang from two full length reinforcements welded to the front and rear top rails. Two 3/4" x 1-1/2" gauge channels shall be hung on the threaded rods to provide an adjustable sink cradle for supporting sinks. When sink capacity exceeds 3,750 cu. in., the sink supports shall be suspended from full length reinforcements welded to the two end rails. Two 1" x 2" x 10 gauge full length channels shall be hung from the four 1/4 " dia. rods to provide an alternate sink cradle.

2.06 SPECIAL PURPOSE STORAGE CABINETS

- A. Acid/Corrosive Storage Cabinets: Shall employ the same materials, hardware and construction methods as standard base and tall cabinets with the following exceptions:
1. Case:
 - a. Double-walled 18 GA steel (back and sides) provides internal backing surface for corrosion resistant inner liner.
 - b. Perforated at rear for use of venting apparatus; no penetration of liner at vent opening.
 2. Liner: One-piece welded polypropylene, secured to case with nylon screws. Includes 1" lip along at door opening for spill containment.
 3. Doors: Polypropylene lined with louvers for ventilation; locks optional as defined by specifier.
 4. Shelves: Half-depth, 0.75" thick polypropylene with 1" high lip welded along front edge, adjustable (two levels).
 5. Casters: For mobile applications, swivel type; locking casters optional.
 6. Labels: "ACID" or "CORROSIVE" shall be silk-screened onto the door. "ACID" appears as red lettering on blue background; "CORROSIVE" as black lettering on white background.
- B. Flammable Storage Cabinets: The following requirements cover cabinets intended to be used to provide a storage area for limited quantities of flammable and combustible liquids stored in containers in compliance with ANSI/NFPA 30. Construction and performance requirements for these cabinets are primarily based on ANSI/NFPA 30. A storage cabinet may have a maximum total storage capacity of not more than 120 gallons of Class I, Class II or Class IIIA flammable and combustible liquids. Of this total, not more than 60 gallons shall be of Class I or Class II liquids, or a combination thereof. No more than three cabinets shall be permitted to be located in the same fire area.
- In addition, all standard cabinets shall be constructed, tested and listed in accordance with UL 1275 "Standards for Flammable Liquid Storage Cabinets". All UL 1275 approved cabinets will bear a label from the manufacturer stating such, including the company name, model number, and cabinet capacity.

Flammable Storage Cabinets shall employ the same materials, hardware and construction methods as standard base and tall cabinets with the following exceptions:

1. Case:
 - a. Double-walled 18 GA steel with 1-1/2" air space between panels on top, bottom, sides, back and door.
 - b. Air spaces shall be filled with a 1" thick blanket of High-Temp Fiberglass.
 - c. Perforated at rear for use of venting apparatus. Note: If cabinet is vented for whatever reason, it shall be vented outdoors in such a manner that will not compromise the specified performance of the cabinet, and be acceptable to the authority having jurisdiction over this matter. If the cabinet is not vented, the vent openings shall be sealed with plugs provided by the manufacturer.
 - d. Bottom Floor Pan shall provide a 2" deep liquid tight pan to contain liquid spills and prevent leaks.

- e. Provisions for attaching grounding wire at the base of the cabinet on the outside, rear panel.
 - 2. Doors:
 - a. Provided with a three-point locking mechanism (Up-and-Down bolt type).
 - b. Three-point slam latch optional.
 - c. Self-closing mechanism and fusible link shall also be incorporated (optional with slam latch version only).
 - d. Door synchronizer shall be incorporated on double door units (optional with slam latch version only).
 - e. Provided with full length stainless steel piano hinge.
 - 3. Mobile: With four casters (2-locking), swivel-type. Vent holes factory plugged. Cabinets shall be ADA compliant for height, width and load capacity.
 - 4. Labels: "FLAMMABLE – KEEP FIRE AWAY" shall be silk-screened onto the door, appearing as red lettering on a bright yellow background.
- C. Vacuum Pump Storage Cabinets: Shall employ the same materials, hardware and construction methods as standard base cabinets with the following exceptions:
- 1. Case:
 - a. Shall include acoustical insulation on the interior of the cabinet for noise absorption, rated for flammability to UL94 HF-1.
 - b. Bottomless, to facilitate movement of the mobile pump caddy in and out of the cabinet.
 - c. Removable back for access to services behind cabinet
 - d. Perforated at rear for use of venting apparatus.
 - 2. Doors:
 - a. Hinged doors with integral toe space.
 - b. Includes acoustical insulation affixed to door inner panel, rated for flammability to UL94 HF-1.
 - 3. Mobile Pump Caddy:
 - a. 14 GA steel platform with four integral lips and welded in each corner to safely contain any accidental spills.
 - b. Includes casters, swivel type; locking casters optional.
 - c. Shall have a maximum load capacity of 300 lb.
 - 4. Additional Features:
 - a. Shall incorporate an integral electrical switch (120V, 20 amp) with pilot light to indicate the operational mode of the vacuum pump unit.
 - b. Shall include an electrical duplex, located in the rear of the cabinet, for the vacuum pump plug end. Outlet is to be accessible from the inside of the cabinet and be hard wired to the electrical switch.
 - c. Optional exhaust fan can be employed for greater heat loads or as specified. The exhaust fan assembly will be attached to the exterior of the cabinet and incorporate a 4' diameter duct collar connection. Note: connection by others.

2.07 METAL FINISH

- A. Preparation: Metal shall be treated with a heated alkaline based acid solution, rinsed with water, and a coat of epoxy-link applied; immediately dried in heated ovens, then gradually cool prior to application of finish.

B. Application: Electro-statically apply epoxy powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory furniture quality finish of the following thicknesses:

1. Exterior and interior surfaces exposed to view: 1.8 – 3 mils.
2. Backs of cabinets and other surfaces not exposed to view: 1.8 mils minimum.

C. Chemical Spot Test:

1. Test procedure: Place test panel on a flat surface, clean with soap and water and blot dry. Condition the test panel for 48 hours at 73°F ± 3°F and 50% ± 5% relative humidity. Panel will be subjected to chemical reagents according to SEFA 8 M-2010 Recommended Practice using one of the following two test methods:

- a. Method A – Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a 1-oz. bottle and inverting the bottle on the surface of the panel.
- b. Method B – Test non-volatile chemicals by placing five drops of the reagent on the surface of the panel and covering with a 24 mm watch glass, convex side down.
- c. For both test methods, leave the reagents on the panel for a period of one hour. Wash off the panel with water, clean with detergent and naphtha, and rinse with de-ionized water. Dry with a towel and evaluate after 24 hours at 73°F ± 3°F and 50% ± 5% relative humidity using the following rating system.

2. Evaluation ratings:

- a. Level 0 – No detectable change.
- b. Level 1 – Slight change in color or gloss.
- c. Level 2 – Slight surface etching or severe staining.
- d. Level 3 – Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

3. Acceptance level: No more than four (4) level 3 conditions

4. Test results: Two (2) level 3 conditions exist. See following data:

REAGENT	METHOD	RATING
Acetate, Amyl	A	0
Acetate, Ethyl	A	0
Acetic Acid, 98%	B	1
Acetone	A	0
Acid Dichromate, 5%	B	0
REAGENT	METHOD	RATING
Alcohol, Butyl	A	0
Alcohol, Ethyl	A	0
Alcohol, Methyl	A	0
Ammonium Hydroxide, 28%	B	0
Benzene	A	0
Carbon Tetrachloride	A	0
Chloroform	A	0
Chromic Acid, 60%	B	2
Cresol	A	1
Dichlor Acetic Acid	A	2

Dimethylformamide	A	1
Dioxane	A	1
Ethyl Ether	A	0
Formaldehyde, 37%	A	0
Formic Acid, 90%	B	3
Furfural	A	2
Gasoline	A	0
Hydrochloric Acid, 37%	B	0
Hydrofluoric Acid, 48%	B	1
Hydrogen Peroxide, 28%	B	0
Iodine, Tincture of	B	2
Methyl Ethyl Ketone	A	1
Methylene Chloride	A	1
Mono Chlorobenzene	A	0
Naphthalene	A	0
Nitric Acid, 20%	B	1
Nitric Acid, 30%	B	1
Nitric Acid, 70%	B	3
Phenol, 90%	A	0
Phosphoric Acid, 85%	B	0
Silver Nitrate, Saturated	B	1
Sodium Hydroxide, 10%	B	0
Sodium Hydroxide, 20%	B	0
Sodium Hydroxide, 40%	B	0
Sodium Hydroxide, Flake	B	0
Sodium Sulfide, Saturated	B	0
Sulfuric Acid, 25%	B	0
Sulfuric Acid, 77%	B	0
Sulfuric Acid, 96%	B	0
Sulfuric Acid (77%) & Nitric Acid (70%), (equal parts)	B	2
Toluene	A	0
Trichloroethylene	A	0
Xylene	A	0
Zinc Chloride, Saturated	B	0

D. Hot Water Test

1. Test procedure: Hot water (100°C±3%) shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces [177.44cc] per minute) on a finished surface, which shall be set at an angle of 45-degrees, for a period of five minutes.
2. Acceptance level: After cooling and wiping dry, the finish shall show no visible effects from the hot water.
3. Test results: The finish shows no visible effect due to the hot water.

E. Finish Impact Test:

1. Test procedure: Position the 18 GA CRS test panel with nominal paint thickness of 3 mils on a smooth concrete floor. A one-pound ball (approximately 2" in diameter) shall be dropped from a distance of 12" onto

- a flat horizontal surface.
2. Acceptance level: There shall be no visual evidence to the naked eye of cracks or checks in the finish due to impact.
 3. Test results: There is no visual evidence of any cracks or checks due to impact.

F. Paint Adhesion on Steel:

1. Test procedure: This test is based on ASTM D3359-02 "Standard Test Methods for Measuring Adhesion by Tape Test 1 – Test Method B". Two sets of six parallel lines 2mm apart shall be cut with a razor blade to intersect at right angles thus forming a grid of 25 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. Brush the grid area lightly with a soft brush, and then place a piece of tape over the grid. Rub the tape firmly with the eraser of a pencil to ensure good contact. Remove the tape by rapidly pulling it back upon itself as close to an angle of 180° as possible.
2. Acceptance level: A 4B rating or better (ninety-five percent or more of the grid area shall show finish intact).
3. Test results: 100% of the squares remained intact after the test.

G. Paint Hardness on Steel:

1. Test procedure: This test is based on ASTM D3363-01 "Standard Test Method for Film Hardness by Pencil Test". Clip a corner of the sample at 45° exposing a raw metal edge. Place the sample on a raw metal base plate so that the exposed metal edge of the sample makes contact with the turned up side of the base plate. Remove approximately 6mm of wood from a 4H pencil, being careful to leave an undisturbed smooth cylinder of lead. Holding the pencil at an angle of 90° to an abrasive paper, rub the lead against the paper maintaining an exact angle of 90° section until a flat smooth and circular cross section is obtained. On the other end of the pencil remove approximately 13mm of wood from on half of the pencil. Install the pencil into a Sheen model 720N Pencil Scratch Hardness Tester. Follow the manufacturer's instructions for conducting the test.
2. Acceptance level: The paint finish shall withstand the abrasion of a 4H pencil without penetrating through to the substrate and completing a continuous circuit.
3. Test results: The 4H pencil did not penetrate the substrate during the test.

Note: Manufacturer must provide independent certified test report on chemical resistance of finish.

2.08 QUALITY ASSURANCE

- A. Single source responsibility: Casework, work surfaces, laboratory fume hoods, equipment and accessories shall be manufactured or furnished by a single laboratory furniture company.
 1. "American Made" – Casework wholly manufactured and assembled in USA.
- B. Manufacturer's qualifications: Modern plant with proper tools, dies, fixtures and skilled workmen to produce high quality laboratory casework and equipment, and

shall meet the following minimum requirements:

1. Five years or more experience in manufacture of laboratory casework and equipment of type specified.
2. Ten installations of equal or larger size and requirements.
3. "American Made" – Casework wholly manufactured and assembled in USA.

C. Installer's qualifications: Factory trained and/or certified by the manufacturer.

D. Cabinet identification: Cabinets are identified on drawings by manufacturer's catalog numbers. Unless otherwise modified on drawings or in specifications, catalog description constitutes specific requirements for each type of cabinet.

PART 3 EXECUTION

3.00 INSTALLATION

A. Casework installation:

1. Set casework components plumb, square, and straight with no distortion and securely anchored to building structure. Shim as necessary using concealed shims.
2. Bolt continuous cabinets together with joints flush, tight and uniform, and with alignment of adjacent units within 1/16" tolerance.
3. Secure wall cabinets to solid supporting material, not to plaster, lath or gypsum board.
4. Abut top edge surfaces in one true plane. Provide flush joints not to exceed 1/8" between top units.
5. Remove and discard shipping clip and associated screws from top of shelf, (thin galvanized angle) install 4 shelf clips into integral standard and set shelf. Check for level and adjust clips as required.

B. Work surface installation:

1. Where required due to field conditions, scribe to abutting surfaces.
2. Only factory prepared field joints, located per approved shop drawings, shall be permitted. Secure joints in field, where practicable, in the same manner as in factory, with dowels, splines, adhesive or fasteners recommended by manufacturer.
3. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.

C. Sink installation: Sinks which were not factory installed shall be set in chemical resistant sealing compound and secured and supported per the manufacturer's recommendations.

D. Accessory installation: Install accessories and fittings in accordance with manufacturer's recommendations. Turn screws to seat flat; do not drive.

3.01 ADJUSTING

- A. Repair or remove and replace defective work, as directed by [Architect] [Owner] upon completion of installation.
- B. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly.

3.02 CLEANING

- A. Clean shop finished casework, touch up as required.
- B. Clean counter tops with diluted dishwashing liquid and water leaving tops free of all grease and streaks. Use no wax or oils.

3.03 PROTECTION OF FINISHED WORK

- A. Take protective measures to prevent exposure of casework and equipment from exposure to other construction activity.
- B. Advise contractor of procedures and precautions for protection of material, installed laboratory casework and fixtures from damage by work of other trades.

3.04 DELIVERY, STORAGE AND HANDLING

- A. Schedule delivery of casework and equipment so that spaces are sufficiently complete that material can be installed immediately following delivery.
- B. Protect finished surfaces from soiling or damage during handling and installation. Keep covered with polyethylene film or other protective coating.
- C. Protect all work surfaces throughout construction period with 1/4" corrugated cardboard completely covering the top and securely taped to edges. Mark cardboard in large lettering "NO STANDING".

3.05 PROJECT CONDITIONS

- A. Do not deliver or install equipment until the following conditions have been met: Windows and doors are installed and the building is secure and weather tight.

END OF SECTION 123450

SECTION 44 25 80.15 – MOTOR DRIVEN BYPASS PUMP

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes trailer mounted Motor Driven Bypass Pump:
- B. **The pump will be used during the shutdown of the Raw Water Pump Station and provided to the Owner once the Raw Water Pump Station is back in service. The Contractor shall be responsible for all fuel and maintenance of the pump during this time.**

1.3 GENERAL REQUIREMENTS

- A. Provide pump capable of handling raw unscreened wastewater. Design pumps to allow for removal and reinstallation without the need to enter the wet well and without removal of bolts, nuts or other fasteners.
- B. All castings for pumps and motor frames shall be free of pits, blisters, burrs, or other defects.
- C. Pumps shall be furnished with ¾" NPT drain taps on the volute.
- D. Review of the equipment data by the Engineer shall not relieve the Contractor or the manufacturer of responsibility for all detailed dimensions and correct fitting of all parts, or for the satisfactory operation and service of the equipment as specified.
- E. When mechanical seals are called for, the Contractor shall furnish the following packaged spare parts for each grouping of identical pumps:
 - 1. Two (2) sets of mechanical seals
 - 2. One (1) shaft sleeve
 - 3. One (1) shaft key
- F. Except on close-coupled pumps, pumps shall be connected to motors by flexible couplings of a type suitable for the service conditions.
- G. Final connection shall insure zero leakage between pump and discharge connection flange. Provide a discharge connection/ guide system so that no part of the pump bears directly on the floor of the wet well.
- H. All anti-friction bearings supporting direct driven shafting shall have B-10 life rating of not less than 50,000 hours
- I. All bearings supporting pinion shafting, worm shafting, or other gear shafting shall have

life of not less than 100,000 hours.

- J. All components requiring lubrication, except sealed bearings, shall be provided either with pressure grease connections of Alemite or buttonhead type, or with oil cups or oil reservoirs as required.

1.4 SUBMITTALS

- A. Product Data: Include performance curves, furnished specialties, and accessories for each type and size of pump indicated.
- B. Shop Drawings: Show layout and connections for pumps. Include setting drawings with templates, conduit locations, directions for installing foundation and anchor bolts, and other anchorages.
- C. Maintenance Data: For each type and size of pump specified to include any maintenance manuals specified in Division 1.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's rigging instructions for handling.
- D. Each pump shall be performance tested at the manufacturer's plant prior to shipment.
 - 1. Testing will include checking the unit at its rated speed, head, capacity, efficiency and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve.
 - 2. Certified copies of test curves will be submitted to the Engineer for review and approval prior to the shipment of any equipment to the jobsite.
 - 3. The Standard of the Hydraulic Institute shall govern the procedures and calculations for all performance testing.

1.6 WARRANTY

- A. Warranty Period: One year from date of Substantial Completion.
 - 1. Warranty shall be for unlimited usage of the equipment for the specified rated capacity over the term of the warranty.

PART 2 - PRODUCTS

2.1 PUMP MANUFACTURERS

- A. Motor Driven Backup Pumps
 - 1. Global
 - 2. Godwyn

3. Pre-approved Equivalent

2.2 MOTOR DRIVEN PUMP

A. Operating Conditions

1. MAXIMUM OPERATING SPEED: 2200 RPM
2. MAXIMUM SOLIDS HANDLING SIZE: 3 INCH
3. IMPELLER DIAMETER: 8.5 INCH
4. SUCTION SIZE: 4 INCH
5. DISCHARGE SIZE: 4 INCH
6. MAXIMUM STATIC SUCTION LIFT: 28 FEET
7. MAXIMUM FLOW AT RUNOUT AT 2200 RPM: 1,250 GPM
8. MAXIMUM HEAD AT SHUTOFF AT 2200 RPM: 116 FEET
9. DUTY POINT: 29 FEET @ 694 GPM

B. General:

1. The pump shall be a high efficiency, non-clog, impeller type with replaceable stainless steel wear rings on both impeller and suction cover. The separate suction cover shall be removable without disturbing the pump casing such that wear rings, impeller, and mechanical seal may be serviced with the casing mounted on the skid.
2. The pump shall be fitted with a fully automatic, compressor driven venturi, air ejector priming system. The air ejector shall operate on the discharge side of the compressor, eliminating the possibility of water being drawn into the air source. The venturi will be protected from contamination by a screen in the venturi hat. A check valve shall be provided between the venturi and the venturi hat to maintain prime after engine shutdown and to allow isolation of the priming system from the pump suction as required.
3. The priming system shall not use a vacuum pump or diaphragm pump, nor require the use of a foot-valve, moving parts or float gear in any part of the pump suction line. A demonstration of the pump's ability to repeatedly cycle from pump/snore/re-priming/pump shall be required.
4. The pump shall not require pre-filling with water to achieve prime.
5. The pump shall be supplied with a non-return check valve on the discharge flange of the pump.
6. The flap shall be Nitrile Rubber and field replaceable. A ball type check valve is not acceptable.
7. The pump shall be equipped with an environmental reclamation box that separates the air and any liquid ejected from the venturi priming system, recycles the liquid back to the pump suction and ejects the air.

C. Casing:

1. The pump casing shall be cast iron and constructed so that the suction flow path is in axial alignment with the impeller eye. There shall be no turns, chambers or valves between the suction line and the impeller. The casing shall be fitted with hand-hole cleanout fitted with a fully contoured and gasketed cast iron, hand-hole cover.

D. Impeller:

1. The pump impeller shall be of the open or closed, two-vane, non-clog type of cast iron construction and capable of passing a 3 inch solid. The wear ring shall be a radial clearance type, made from cast iron, gasketed, and attached to the impeller with stainless steel cap screws.

E. Suction Cover:

1. The pump casing shall have a separate and removable suction cover for easy access to the pump interior. Suction cover shall be cast iron.

F. Shaft and Bearings:

1. Pump shaft and bearings shall be supported by a rigid cast iron bearing housing. The shaft shall be of adequate size to provide an L3/D4 ratio of no more than 7.8. Shaft and bearing shall be designed to withstand all imposed all loads such as to provide a minimum L10 Bearing Life of 100,000 hours. Shaft shall be grade 431 stainless steel. Bearings shall be grease lubricated anti-friction with back to back angular contact thrust bearings and a deep groove single row ball radial bearing. Both bearing covers shall be protected from ingress of contaminants by lip seals.

G. Seals:

1. Seals shall be cartridge style mechanical self-adjusting, non-clogging spring, with tungsten or silicon carbide beveled stationary face and silicon carbide rotary face. All metal parts shall be stainless steel and elastomers shall be nitrile rubber or fluorelastomer. The mechanical seal shall be lubricated by a glycol bath from a reservoir mounted on the pump. The reservoir shall be provided with a vented refill port and two bulls-eye sight glasses. Other than glycol level, no maintenance or adjustment shall be required between services.
2. The barrier fluid must be contained against the mechanical seal by means of a secondary mechanical seal, or lip seal which has a secondary lip and a protective v-ring seal to minimize contamination. The seals ride upon a shaft sleeve that is easily replaceable during seal servicing without removing the pump shaft, and which is hardened against wear and treated for corrosion resistance by a ferritic nitrocarburization process. Expected service life of the shaft sleeve exceeds that of traditional stainless steels.
3. There is an air gap between the barrier fluid seals and inboard bearing seal, which both provides an easy visual indicator of any seal leakage, and in combination with the v-ring seal protects the bearings from contamination during a catastrophic seal failure.

H. Suction and Discharge Flanges:

1. Shall be cast iron in accordance with ANSI (B16.1) Class 125.

I. Pump Gaskets:

1. The gland gasket shall be compressed fiber.

J. Pump O-rings:

1. The casing to stuffing box cover and casing to suction cover shall be sealed by O-Rings not, gaskets. These and all o-rings shall be nitrile.

K. Engine:

1. The diesel engine shall be a water-cooled Tier 4, V1505 rated at 24.8hp (continuous) at 2,300 RPM. Governor shall be mechanical type. Exhaust system shall include muffler and silencer of suitable size and noise reduction. The engine shall have a 12 volt electrical system and shall be complete with 180 amp hour rated battery and belt driven charging system. A continuous duty engine curve shall be supplied to the owner/engineer.
2. Provide a 120VAC-powered battery charger and 1.5kW-120V-1Phase block heater.

L. Control:

1. Engine control shall display oil pressure, engine temperature, speed, battery voltage and engine hours on a large, back-lit, graphical VFD display. The "Auto/Manual" switch shall allow simple operation and the four-button keypad shall provide control of engine starting and program settings. A dual float connector input shall be located on the bottom of the enclosure for automatic on/off controls via floats. The control shall allow engine speed to be adjustable between maximum and minimum design operating speeds. Safety shut down switches for low oil pressure and high water temperature shall be included. Controller shall allow for automatic exercising of the unit at regularly scheduled periods. The controller shall allow for automatic operation of the pump based on digital input devices such as pressure transducers, level transducers, flow meters, and/or float switches. The controller must be able to reactively maintain consistent pressure levels with a predetermined threshold. The unit shall provide alert features based on engine data and log past usage data from the engine such as engine RPM, load, coolant temperature, oil pressure, etc. Engine control shall be capable of adding GPS or a remote monitoring system. The remote monitoring system shall be able to store up to 6 weeks of engine data and alerts. The controller shall have the ability to supply remote engine operation features and viewable near-real time data via a website that is both viewable via PC and mobile browsers. This feature shall allow for remote starting, stopping, and engine speed control. The controller shall also include the following Form A or C dry contacts for SCADA system monitoring:
 - a. Pump On/Off status
 - b. High Wetwell Level Alarm (as determined by high level/start float switch)
 - c. Pump Minor (Warning) Alarm
 - d. Pump Major (Shutdown) Alarm
2. Two (2) Rotofloat Type S float switches shall be provided by the pump supplier (for mounting in the wetwell by the contractor) as dedicated float switches for on/off control of the backup pump system. The "ON" float switch shall be set at an elevation as directed by the civil engineer above the normal operating level(s) of the wetwell.

M. Mounting:

1. The pump and engine shall be connected through a SAE style mount, and

mounted on a structural steel skid fitted with a minimum 50 gallon capacity fuel tank. The chassis shall be fitted with lifting bale and fork pockets.

N. Trailer/Anchoring:

1. The pump shall be furnished on the manufacturer's trailer and be anchored to the trailer per the manufacturer's standard requirements.
2. The trailer shall be adequately sized for the required load range ratings such that it can be towed on the road at 50 mph. The trailer shall be wired with lights and receptacle for towing vehicle for over the road usage, and equipped with fenders, front and rear support stands, lifting bale, safety chains, side and rear reflectors per applicable DOT standards.

O. Painting:

1. The enclosure, pump, engine, and skid shall be shop primed and finish painted at the place of the manufacturer. Materials and thickness for priming and painting shall be in accordance with manufacturer's standards.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of pumps and equipment.

3.2 INSTALLATION AND OPERATION

- A. Comply with manufacturer's detailed written instructions for installing pump equipment.
- B. Installation and operation shall be in accordance with instructions and recommendations provided by the manufacturer.
- C. Install pumps and arrange to provide access for maintenance, including removal of motors, impellers, couplings, and accessories.
- D. Support piping so weight of piping is not supported by pumps.
- E. Check installation, alignment, and provide supervision of initial startup and operation.
- F. Verify that all units are in condition suitable for installation; are properly fitted, assembled and installed; are accurately leveled and aligned; and are ready for satisfactory operation.
- G. Set and check pump controls for automatic start, stop, and alarm operation as required for system application.
- H. Final Checks before Starting: Perform the following preventive maintenance operations:
 1. Lubricate bearings.

2. Disconnect couplings and check motors for proper direction of rotation.
3. Verify that each pump is free to rotate by hand. Do not operate pump if it is bound or drags, until cause of trouble is determined and corrected.
4. Verify that pump controls are correct for required application.

3.3 CLEANING AND PROTECTING

- A. Restore marred, abraded surfaces to their original condition or replace with new.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure equipment is without damage or deterioration at the time of Substantial Completion.

3.4 START-UP ASSISTANCE AND TRAINING

- A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
 1. Factory authorized service representatives of each pump and/or pump manufacturer shall perform all necessary on-site assistance for installation supervision.
 2. Once the pumps have been installed correctly and are operating as intended, the service representatives shall perform eight (8) hours of on-site start-up assistance and operator training for each type of pump.
 3. Train Owner's maintenance personnel on procedures and schedules related to troubleshooting, servicing, and preventive maintenance.
 4. Schedule training with Owner with at least seven days' advance notice.

END OF SECTION 44 25 80.15

**SECTION 44 32 10 – STAINLESS STEEL PACKAGE RAPID MIX, FLOCCULATION,
AND SEDIMENTATION**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Stainless Steel Tanks
 2. Rapid Mix
 3. Flocculation
 4. Sedimentation with Plate Settlers

1.2 SUBMITTALS

- A. **Certification from Contractor and Manufacturer/Suppliers:** During the bid period and again prior to submitting/ordering and installing materials, products and equipment, the Contractor and all manufacturers and suppliers shall thoroughly review the materials, products and equipment being supplied and shall familiarize themselves with the existing and proposed/new facilities, as well as connections to existing facilities/utilities. This shall include field verification of the location, nature, size/dimensions, current and intended future use, etc. Prior to ordering and installation, the Contractor shall coordinate with all manufacturers and suppliers to provide all needed information including field dimensions, photographs, information on related materials and equipment, etc.). The Contractor and all manufacturers and suppliers shall include written confirmation (with the submittal) of the following:
1. The materials, products, and equipment being supplied are of the correct size, materials and type.
 2. The materials, products and equipment being supplied do not conflict with existing or proposed/new facilities.
 3. The products/equipment being supplied are intended for use in this application.
 4. All manufacturer(s) and supplier(s) shall provide (either with submittals or separately) written concurrence/acknowledgement of their review/coordination and concurrence with the items above.
 5. Shop drawings and product data submitted for review by the Engineer shall bear the Contractor's certification that he has reviewed, checked, and approved the submittals, that they comply with the requirements of the project and with the provisions of the Contract Documents, and that he has verified all sizes, dimensions, locations, field measurements, construction criteria, materials, catalog numbers, and similar data. Field dimensions, sizes and other pertinent information shall be clearly shown on the shop drawings/submittals. The Contractor shall also certify that the work represented by the shop drawings is recommended by the Contractor and that the Contractor's warranty and guaranty will fully apply.
- B. Product Data:
1. Rated capacities.
 2. Furnished specialties

3. Accessories
4. Details of construction relative to materials
5. Dimensions of individual components
6. Profiles
7. Finishes
8. Description of all materials.
9. Complete bill of materials.
10. Weight of equipment and each component.
11. Equipment structural design calculations and process design calculations.

C. Shop Drawings:

1. Drawings showing:
 - a. Complete dimensional data.
 - b. Equipment outline dimensions.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Engineer and owners, and other information specified.

E. Maintenance Data: Include in the maintenance manuals specified in Division 1. Include name, address, and telephone number of manufacturer's nearest authorized service representative.

F. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

A. The equipment specified herein shall be located as shown or described and installed in conformance with the manufacturer's suggested method as approved by the Engineer.

B. Installer Qualifications: Engage an experienced installer who is an authorized representative of the equipment manufacturer for both installation and maintenance of the type of units required for this Project.

C. Source Limitations: Obtain each equipment component as a complete unit from one source and by a single manufacturer unless otherwise specified.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store and handle equipment in a manner to avoid significant or permanent damage to equipment.

1. In general, comply with the manufacturer's written instructions for storage of equipment.
2. The equipment shall be stored in a clean, dry location free from construction dust, precipitation and excess moisture.

1.5 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

1.6 GENERAL

- A. SCOPE: This section includes performance requirements, materials, and installation of a package flocculation and sedimentation water treatment equipment including but not limited to tank housing, flocculator, inclined plate settlers, baffles, effluent troughs, sludge collection equipment, and appurtenances for a complete and operable system.
- B. CONTRACTOR: Shall furnish all labor, materials, equipment, and incidentals as shown, specified and required to provide a complete plate settler system as specified herein.
- C. GENERAL: Equipment finished under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations by the named equipment manufacturer.
- D. MANUFACTURER of the package plate settler system shall be vested with unit responsibility for the proper function of the complete system as specified. The equipment covered by this specification is intended to be standard equipment of proven ability as manufactured by reputable concerns having extensive experience in the production of such equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide a system to be supplied by one manufacturer that shall assume total responsibility for the parts operating as a whole and shall be:
 - 1. Jim Myers and Sons
 - 2. Meurer Research Inc.
 - 3. WesTech Engineering, Inc.
 - 4. AWC Solutions LTD.

2.2 SYSTEM DESCRIPTION

- A. The plate settlers shall be designed for operation in the sedimentation basin as indicated on the Contract Drawings. The equipment shall be designed for the following conditions as listed in the Process Table B below.

B. Process Description

Tanks	2 Trains
Flocculators*	30' Long x 10' wide x 12' Tall
Sedimentation*	26' Long x 10' wide x 12' Tall
Side Water Depth (maximum)	11'
Raw Water Characteristics Prior To Flocculation	
Temperature, Fahrenheit	33-90
Turbidity, NTU	2-300
pH	5.5 – 8.0
Rapid Mix	
Maximum Detention Time	30 sec
Velocity Gradient (G)	750 fps/ft
Flocculation	
Stage 1 (Velocity Gradient)	60
Stage 2 (Velocity Gradient)	45
Stage 3 (Velocity Gradient)	30
Minimum Flocculation Detention Time	30 min
Sedimentation	
Peak Design Flow (MGD) per Tank	0.75
Minimum Effective Projected Horizontal Plate Settler Surface Area per Tank	1,302 ft ² at loading rate of 0.4 gpm/ft ² (1m/hr) and 80% Eff.
Design Loading Rate (m/hr)	1
Plate Efficiency Factor (%)	80
Nominal parallel distance between plates	1.8 in (45.72 mm)
Plate Inclination Measured form the Horizontal	55 degrees
Maximum Plate Width	4.5'
Maximum Plate Length (ft)	6'
Sludge Removal	
Number of Units Required	1/Basin
Sludge Flow per Unit	150-200 gpm

*Length and Width of the Flocculators and Sedimentation Basins may be adjusted as necessary by the manufacturer. For hydraulics and adequate freeboard, the height of the Flocculators and Sedimentation Basins must remain as specified above.

2.3 TANKS

A. The treatment vessels shall be constructed of Type 304 stainless steel and shall be

suitable for installation onto a concrete foundation.

- B. Treatment vessels shall have internal nominal dimensions as shown on the General Arrangement Plan.
- C. Tank bottoms shall be AISI Type 304 stainless steel. Minimum thickness shall be 1/4 inch.
- D. Tank sides shall be AISI Type 304 stainless steel; structurally reinforced to withstand the hydrostatic pressures. Minimum thickness shall be 1/4 inch.
- E. All flanges, plates, angles, channels, beams, etc., shall be joined by full penetration welds, each side, continuous welding. All finish welds shall be ground smooth.
- F. Tank inlet and discharges shall be provided with flanged stub piping. Valves, couplings, and piping beyond this stub shall be provided by others.
- G. Tanks shall be provided with aluminum handrail and grating as indicated on the drawings in areas within the bounds of the tank. Platform with grating and handrail between tanks shall be provided by others. Contractor to coordinate final delineation of gratings and handrails with manufacturer.
- H. **Rapid Mix:**
 - 1. The rapid mix shall provide the necessary blending energy and retention time to facilitate mixing as specified here in.
 - 2. Tank shall be equipped with the following nozzles/connections:
 - 3. Influent: 8-inch
 - 4. Discharge: Rectangular opening into Flocculator
 - 5. Drain (each flocculation stage): 3-inch
- I. **Flocculation Tank:**
 - 1. The flocculation tank shall provide the necessary blending energy and retention time to facilitate the agglomeration of flocculants.
 - 2. Tank shall be equipped with the following nozzles/connections:
 - 3. Influent: 10-inch
 - 4. Discharge 10-inch
 - 5. Drain (each flocculation stage): 3-inch
- J. **Sedimentation Tank:**
 - 1. Tank shall be equipped with the following nozzles/connections:
 - 2. Influent (if separate flocculation and sedimentation tanks are provided): 12-inch
 - 3. Discharge: 12-inch
 - 4. Sludge blowdown/drain: 4-inch
 - 5. Drain: 3-inch

2.4 RAPID MIX

- A. The rapid mix shall be sized for the parameters specified here in. It shall consist of a 1

HP vertical-style mixer with 304 SS submerged shaft and impeller.

2.5 HORIZONTAL PADDLE WHEEL FLOCCULATORS

A. Shafts

1. The shafting system for each mechanism shall be sized within stress limitations at full operating load and within deflection limitations under dry load.
2. The maximum shear stress shall not exceed 6,000 psi at any point in the shaft. The maximum shear shall be determined by combining the bending and torsional stresses under full operating load through Mohr's circle stress convention. The maximum vertical deflection of the shafting system shall not exceed $L/1000$ between support reactions under dry load. The angle of twist shall be no more than $0.08^\circ/\text{ft}$ of shaft, but not exceed 5.0° total for the entire shaft length.
3. Type 304 stainless steel hubs shall be $\frac{1}{2}$ " thick minimum, and welded to the shafts for paddle arm connection. Welds shall be continuous on both sides of the hub plate. Manufacturing practices shall allow hub plates on adjacent shafts be in alignment with one another.
4. All shafting between bearings shall be Type 304 stainless steel hollow shafting, straight and true. Shafting at bearing locations shall be solid Type 17-4 ph or Type 304 stainless steel. Solid and pipe shaft sections shall be connected through a bolted flanged connection. Standard 150lb ANSI flanges shall be used, and manufactured from Type 304 stainless steel. Flange size shall be determined by pipe shaft diameter. A minimum $\frac{1}{4}$ " thick neoprene gasket shall be placed between each set of flanges.
5. All solid spool shafts at the bearing shall be Type 17-4 ph or Type 304 stainless steel utilizing a blind flanges, bored to the appropriate diameter for precise alignment, and contain continuous welds on both sides of the flange. After fabrication, each shaft assembly's flanges shall be faced to within 0.015" of parallel to one another.
6. All pipe shafting shall utilize a blind flange, grooved to the appropriate diameter for precise alignment, and joined by means of a continuous watertight weld. After fabrication, each shaft assembly's flanges shall be faced to within 0.015" of parallel to one another.
7. All pipe shafts shall be minimum 3" schedule 40 pipe.

B. Bearings

1. Submerged Bearings shall be split block bearings or journal bearings with split cast stainless steel housing.
2. Shaft bearings shall have a length to diameter ratio of 2.0.
3. Bottoms of bearing housings shall be machined to provide an accurate and uniform bearing area.

C. Flocculation Paddle Assemblies

1. The flocculator paddles shall be nominal 2" x 6" pultruded fiberglass channel manufactured with NSF-61 approved polyester resin or Type 304 stainless steel. Paddles shall be bolted to paddle arms with two $\frac{1}{2}$ " bolts and nylon insert lock nuts

at each connection. All cut edges and holes in the fiberglass paddles will be properly resin sealed.

2. The paddles shall be held in place and supported by stainless steel angle arms bolted to the fabricated stainless steel shaft hubs with two 5/8" bolts and nylon insert locknuts. The paddle arms shall be sized for a tip deflection of no more than 1/360, and shall be no smaller than L3 x 3 x 1/4" angles.

D. Drive Motor

1. Integral gearmotors shall be energy efficient squirrel cage, induction type with totally enclosed fan-cooled frames. Insulation shall be class F minimum. Maximum temperature rise above ambient shall not exceed the value specified for Class B rise.
2. Motors shall have 120 volt windings space heaters to prevent internal condensation. Thermostat overload protection shall be embedded in the windings.
3. Electrical characteristics shall be 460 volts, 3 phase, 60 Hz. Motors shall be provided with 1.15 service factor.
4. Motors shall be equipped with oil or grease lubricated anti-friction bearings have a minimum of L-10 life of 80,000 hours, as defined by AFBMA.
5. The rating of motors shall be adequate to continuously drive the flocculators under any condition of operation but shall not be less than specified above.
6. Motor shall be as manufactured by SEW Eurodrive, Baldor, or equal.

E. Gear Reducer

1. Drive units shall be as manufactured by SEW Eurodrive and contain wash down duty features.
2. Each drive unit shall be constant speed and designed to provide speed and output torque as required by process design. The gearbox will be parallel helical or helical bevel gearing as required by site constraints.
3. Each drive unit shall be designed and arranged for rotation as indicated on the drawings.
4. Each gear reducer shall be a heavy-duty, foot-mounted, concentric gear unit completely enclosed in a housing of cast iron or fabricated steel construction. The gear reducer shall be specifically designed for the application intended and shall be suitable for connection to the output shaft. General maintenance, specifically including motor changes, gear changes, bearing replacement and maintenance of the oil lubricating system shall not require the removal of the gear reducer housing from its mounting base.
5. The gear reducer shall be designed and rated for a minimum of AGMA II with a service factor of 1.4 applied to the motor nameplate rating.
6. The thermal rating of gear reducer shall exceed the design mechanical rating to preclude the need for external cooling equipment. External cooling devices are not acceptable.
7. The gear reducer output shaft shall be constructed and supported so that the shaft deflection caused by the operating loads does not affect alignment of the reducer bearings or cause misalignment of the gearing during operation of the flocculator. All bearings in the speed reducer shall be anti-friction type and shall have a minimum L-10 life of 80,000 hours. The units shall be oil lubricated. All gears and bearings shall be protected from rusting during storage by the application of a shop-applied protective coating.

F. Drive Base Plate Assembly

1. Drives shall be mounted on adjustable drive base plate assembly. The drive base plate assembly shall consist of a sole plate, a leveling plate, four 1" diameter all thread leveling rods with stainless steel nuts to adjust the elevation of the drive unit and allow for chain tensioning. A chain adjusting system using an idler sprocket or other means of chain tensioning shall not be acceptable.
2. The sole plate shall be Type 304 stainless steel, a minimum 3/4" thick, and slotted for proper drive alignment.
3. The leveling plate shall be Type 304 stainless steel and designed for all drive system loads, with a minimum 5/8" thickness. The leveling plate shall be capable of elevation adjustment providing for the maximum required take-up of the drive chain with a minimum of 4".

G. Drive Chain and Sprockets

1. Drive chains shall be NH-78, manufactured from Nylon 6/6 material with T-304 stainless steel pins and a working load limit of at least 1,740 lb.
2. The drive sprocket shall consist of a machined stainless steel sprocket hub with UHMW-PE sprocket teeth machined to accurately engage drive chain.
3. Driven sprockets shall consist of a split machined cast iron sprocket hub with segmental UHMW-PE teeth machined to accurately engage drive chain.
4. All sprocket hardware shall be Type 316 stainless steel.
5. Sprocket arrangement shall be designed so the maximum chain tension does not exceed the working load of the chain. Maximum ratio obtained through the drive and driven sprocket is 3:1.
6. Sprockets shall be equipped with a shear pin, designed to provide torque overload protection for the drive. Upon shear pin failure a trip lug pop out of the sprocket. This trip lug will engage the lever arm of a limit switch. The limit switch will send a signal to shut off the drive.
7. Limit switch shall be the model 3SE03 as manufactured by Siemens or equal.
8. Provide a Type 304 stainless steel chain guard for the portion of the chain that extends above the operating level.

H. Baffle Wall

1. T-304 stainless steel baffle walls shall be provided between the flocculation zone and sedimentation zone of the tank.
2. Walls shall be designed for a maximum 2" head differential.
3. Walls shall have openings adequate to allow a maximum flow through the basin of 0.5 ft/s at the designed flow rate. Wooden or fiberglass walls are not acceptable.

2.6 PLATE SETTLERS

A. General

1. The plate settler system shall be fabricated in accordance with the details indicated on the drawings and the requirements specified herein.

2. All plate settler system components shall be fabricated from Type 304 stainless steel.
3. The influent water shall primarily enter the inclined plate settlers through feed orifices in the side of the plates to minimize sludge re-entrainment. Feed openings shall be sized and located to maintain laminar flow and to not disturb settling solids.
4. The plate settler assemblies shall be self-supporting and shall not exceed a maximum allowable deflection $L/360$ based on all dead loads created by plates, troughs and frame assembly, a solids loading of 30 lbs per plate along with a concentrated live load of 250 lb/ft² placed anywhere on the top flow control angle.

B. Materials of Construction

1. The components of the Inclined Plate Settlers shall be made from the following material:
 - a. Plate Settler Frames: Type 304SS
 - b. Plates: Type 304SS (Minimum 24 gauge thick)
 - c. Integral Frame Baffles: Type 316SS (Minimum 16 gauge thick)
 - d. Top Flow Control Device: Type 304SS (Minimum 24 gauge thick)
 - e. Tough/Flume Assembly: Type 316SS (Minimum 16 gauge thick)
 - f. Adjustable V-notch Weirs: Type 316SS (Minimum 16 gauge thick)
 - g. Nuts, bolts, fasteners 316 SS (in accordance with Specification 05500)

C. Plate Settler System

1. The plate settler system shall be fabricated in accordance with the details indicated on the drawings and the requirements specified herein.
2. The plate length and spacing shall be as specified in Process Table 1.6.B above. The entire system shall be designed to evenly distribute the flow to every plate, and to remove the effluent evenly from the top of the plate pack.
3. The influent water shall primarily enter the inclined plate settlers through feed orifices in the side of the plates to minimize sludge re-entrainment. Feed openings shall be sized and located to maintain laminar flow and to not disturb settling solids.
4. The plate settler assemblies shall be self-supporting and shall not exceed a maximum allowable deflection $L/360$ based on all dead loads created by plates, troughs and frame assembly, a solids loading of 30 lbs per plate along with a concentrated live load of 250 lb/ft² placed anywhere on the top flow control angle.

D. Plate Settler Frame

1. The plate settler frame shall be fabricated from stainless steel, as indicated above, rectangular tubing of adequate size to achieve the deflection criteria set forth on 2.3.F.
2. The plate settler frame shall be one complete weldment including integral baffles with full watertight welds by means of the tungsten inert gas (TIG) or metal inert gas (MIG) welding process and all welds shall be cleaned per SSPC-SP3 specifications.

E. Baffles

1. The baffles being located at the air-water interface shall be constructed of Type 316 or Type 304 stainless steel with a minimum thickness of 0.0229 in. (22 gauge).

F. Top Flow Control Device

1. Each plate must be equipped with a top flow control device constructed of stainless steel (refer to Paragraph 2.6-B for stainless steel type) to ensure there is an even flow distribution across the entire surface area of the plate. The top flow device must be constructed to allow operations staff to walk on the plate settler packs for routine cleaning and maintenance with no deformation. The top flow control device must allow personnel to walk on the plates without the use of a temporary walking surface, such as plywood.
2. The top flow control device shall be a thickness to comply with the structural requirements and the walkability of the system.

G. Collection Troughs & Effluent Troughs with Weirs

1. All troughs and adjustable weirs shall be constructed of Type 304 stainless steel with a minimum thickness of 0.0598 in. (16 gauge).
2. Each effluent trough shall be equipped with adjustable weirs for leveling during initial installation and to provide an even flow distribution during operation. The weirs shall be manufactured from 0.0598 in. (16 gauge) minimum Type 304 stainless steel.
3. Troughs located above the plate settlers obstructing access to the tops of the plates shall not be accepted.

H. Supports

1. The plate packs shall be supported by Type 304 stainless steel structural members.
2. Support frames and beams shall be adequately sized to carry the load of the plate settling system under both wet and dry conditions without exceeding a maximum deflection of L/360 of the span.

2.7 SLUDGE REMOVAL SYSTEM

A. Materials of Construction

1. All components of the sludge collection system shall be fabricated of stainless steel materials.
2. Cross bracing - ASTM A276, AISI Type 304.
3. Header Assembly and Pipe - AISI Type 304.
4. Bushings, Flow Balancing Ring and Tangential Orifices – UHMW.
5. Cable Pulleys and Casters – Polyurethane.
6. Bolts, Nuts, Fasteners – IFI-104 GRADE 316.

B. Drive Assembly

1. Each drive assembly shall consist of a 3 Phase 230 Vac 1/4HP motor which shall be coupled to rotating drum(s) for manipulation of the cable that is attached to the collector assembly.
2. The cable shall be firmly attached to the rotating drum(s) to prevent slippage.
3. The complete drive mechanism provided with a 304 stainless steel or powder-coated aluminum enclosure.
4. The drive cable shall be Type 304 Stainless Steel with a minimum diameter of ¼”.
5. The drive assembly shall be capable of ceasing operation on an excessive load without physical damage to the drive unit. During an overload, protection built into the VFD will cease operation and activate an alarm. Operation will continue after alarm is reset. Back up protection in the form of a shear pin is required.
6. The drive assembly shall have integral position sensors which determine when the collector is at the end of the basin, the beginning of the basin and points in-between. No external or under-water position sensors shall be required or allowed.
7. The drive shall have an emergency disconnect button pre-wired to the assembly which shall be a large, red palm operated single button.

C. Hoseless Collection Assembly

1. The hoseless sludge collector assembly shall be manufactured entirely of Type 304 Stainless Steel, with the exception of non-metallic parts such as casters, bushings, orifices, etc. which will be manufactured of plastic, non-metallic materials.
2. The hoseless collector assembly shall be guided by means of horizontal casters on the ends of the header pipes. Guide rails are not allowed.
3. Flow through the hoseless sludge collector shall be controlled by a sludge valve as directed by the collector control panel. The control system shall prevent the two sludge collectors from discharging sludge simultaneously.
4. Each hoseless collector assembly shall be complete with polyurethane rolling casters and side wall casters located near the end of each of the four sludge collector headers. Include all necessary mounting hardware.
5. Include stainless steel end stops to be anchored to the basin floor at the header assembly's end of travel.
6. All welds shall be continuous and brushed clean.
7. All underwater bearings shall be specifically designed for underwater use.

2.8 CONTROL PANELS

- A. Refer to Specification Section 26 29 00 (“Manufactured Control Panels”) for additional control panel requirements.
- B. One control panel shall be provided to control the each sludge removal device.
- C. The control panel shall include an Allen Bradley Micro 850 series PLC based electronic control panel which shall automatically control all of the functions and operations of the sludge collector system.
- D. The control panel shall arrive to the jobsite internally pre-wired ready to connect to each drive unit.

- E. The control panel shall operate by use of a 120 VAC circuit furnished to the panel location.
- F. The main control panel shall consist of the following:
 - 1. Real time clock for programmable run initiation.
 - 2. Programmable Logic Controller.
 - 3. ¼ HP VFD with manual operation keys and speed control for sludge removal device.
 - 4. Power supply with 24 VDC control voltage.
 - 5. Properly sized protective circuit breakers and terminal blocks.
- G. HMI (touch screen) shall be a minimum of 6" and contain the following controls and indication:
 - 1. System mode – Hand /Off / Auto.
 - 2. Manual start.
 - 3. Drive mode – Reverse / Off / Forward.
 - 4. Valve position.
 - 5. Real time clock settings.
 - 6. Collector speed control.
 - 7. Alarm reset.
 - 8. Drive direction.
 - 9. Home and End position indication.
- H. Provide Ethernet switch with multi-mode fiber optic ports (for OM4 multi-mode fiber optic cabling as specified) for communication with the Plant SCADA system.
- I. The control panel components shall be installed inside a NEMA 4X stainless steel control panel housing. The panel shall include a sun shield to help maintain enclosure temperature. It shall be the responsibility of the sludge collector manufacturer to provide all of the necessary control hardware, software and components as required for a complete installation.
- J. Operation:
 - a. The sludge collection drive shall be controlled from the Plant's SCADA operator station. The sludge collector will start and stop based upon networked inputs from the plant's SCADA system.
 - b. When the Local/Off/Remote selector switch is in the local position, the sludge collectors can be turned on from the Vendor control Panel the drives will start at the speed selected from the operator station.

2.9 HARDWARE

- A. All field assembly bolts and anchor bolts, nuts, and washers shall be Type 304 stainless steel.
- B. All submerged connections shall utilize Type 304 stainless steel nylon insert locknuts.

- C. Anti-seize compound shall be applied to the threads of all stainless steel bolts before assembly.

2.10 FABRICATION

- A. All welded joints that will be fully or partially submerged shall be sealed watertight with continuous welds. All welding shall be performed in accordance with AWS standards.

2.11 SPARE PARTS

- A. Flocculator
 1. One complete drive chain for each tank
 2. One complete set of upper and lower journal bearing liners for one tank
 3. One set of drive sprocket teeth
 4. One set of driven sprocket teeth

- B. Sludge Removal
 1. Drive Cables
 2. Two brushings
 3. One v-grove pulley
 4. Five cable drive shear pin
 5. Four wire rope clip
 6. Two cable thimble
 7. One 1-pole relay
 8. One 2-pole relay

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. General: Comply with the manufacturer's detailed written instructions for installing the equipment.

- B. Install and level the plate pack units and troughs in accordance with the manufacturer's recommendations and the Drawings. All plate settler support's anchor locations shall be leveled to within +/- 1/8 of an inch. Exercise care in erecting and leveling the plate settlers, troughs, and weir plates so that the units are at the elevations shown on the Drawings or specified herein and have deflections within manufacturer's specified limits.

- C. After installation, all weirs must be leveled to within 1/16 of an inch of target elevation as shown on manufacturer's drawings.

D. Lubricants and Lubricating Equipment

1. Provide and install necessary food grade quality oils, greases and anti-seize compounds for initial operation of all equipment provided that requires oil, grease or anti-seize.
2. Food grade anti-seize shall be applied to the threads of all stainless steel bolts before assembly at the factory and field assembly.

3.3 INSTALLATION AND OPERATING

- A. **Manufacturer's Field Services:** The CONTRACTOR shall provide the following services in addition to any other services specified herein, and required by these Specifications.
- B. **Pre-installation training service:** A factory trained manufacturer's representative shall be provided for (1) trip and (1) eight hour day of onsite service to review equipment submittals and installation instructions.
- C. **Onsite field service:** A factory trained manufacturer's representative shall be provided for (2) trips each with (2) eight hour days onsite to provide installation review, instruction, and supervision. The installation services shall be coordinated between the CONTRACTOR and the manufacturer.
- D. **Start-up & O&M Training:** A factory trained manufacturer's representative shall be provided for (1) trips each with (2) eight hour days onsite to provide start-up and O&M training services. The start-up and O&M services shall be coordinated between the CONTRACTOR and the manufacturer.
- E. After installation supervision and field testing services by the manufacturer, the CONTRACTOR shall submit to the ENGINEER, a certification letter on the manufacturer's letterhead and signed by the manufacturer certifying that the equipment was installed per the manufacturer's recommendations.
- F. The manufacturer shall provide start-up reports covering installation inspection and start-up activities.
- G. The manufacturer shall provide operator training to all required plant personnel.
- H. All costs, including travel, lodging, meals and incidentals for manufacturer service shall be included in the CONTRACTOR'S bid
- I.

3.4 CLEANING AND PROTECTING

- A. Restore marred, abraded surfaces to their original condition.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure the equipment is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 44 32 10

SECTION 44 32 10.10 – ALTERNATIVE PRE-TREATMENT PACKAGED UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Stainless Steel Tanks
 2. Static Mixers
 3. Upflow Clarification
 4. Sedimentation with Tube Settlers

1.2 SUBMITTALS

- A. **Certification from Contractor and Manufacturer/Suppliers:** During the bid period and again prior to submitting/ordering and installing materials, products and equipment, the Contractor and all manufacturers and suppliers shall thoroughly review the materials, products and equipment being supplied and shall familiarize themselves with the existing and proposed/new facilities, as well as connections to existing facilities/utilities. This shall include field verification of the location, nature, size/dimensions, current and intended future use, etc. Prior to ordering and installation, the Contractor shall coordinate with all manufacturers and suppliers to provide all needed information including field dimensions, photographs, information on related materials and equipment, etc.). The Contractor and all manufacturers and suppliers shall include written confirmation (with the submittal) of the following:
1. The materials, products, and equipment being supplied are of the correct size, materials and type.
 2. The materials, products and equipment being supplied do not conflict with existing or proposed/new facilities.
 3. The products/equipment being supplied are intended for use in this application.
 4. All manufacturer(s) and supplier(s) shall provide (either with submittals or separately) written concurrence/acknowledgement of their review/coordination and concurrence with the items above.
 5. Shop drawings and product data submitted for review by the Engineer shall bear the Contractor's certification that he has reviewed, checked, and approved the submittals, that they comply with the requirements of the project and with the provisions of the Contract Documents, and that he has verified all sizes, dimensions, locations, field measurements, construction criteria, materials, catalog numbers, and similar data. Field dimensions, sizes and other pertinent information shall be clearly shown on the shop drawings/submittals. The Contractor shall also certify that the work represented by the shop drawings is recommended by the Contractor and that the Contractor's warranty and guaranty will fully apply.
- B. Product Data:
1. Rated capacities.
 2. Furnished specialties
 3. Accessories
 4. Details of construction relative to materials

5. Dimensions of individual components
 6. Profiles
 7. Finishes
 8. Description of all materials.
 9. Complete bill of materials.
 10. Weight of equipment and each component.
 11. Equipment structural design calculations and process design calculations.
- C. Shop Drawings:
1. Drawings showing:
 - a. Complete dimensional data.
 - b. Equipment outline dimensions.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Engineer and owners, and other information specified.
- E. Maintenance Data: Include in the maintenance manuals specified in Division 1. Include name, address, and telephone number of manufacturer's nearest authorized service representative.
- F. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

- A. The equipment specified herein shall be located as shown or described and installed in conformance with the manufacturer's suggested method as approved by the Engineer.
- B. Installer Qualifications: Engage an experienced installer who is an authorized representative of the equipment manufacturer for both installation and maintenance of the type of units required for this Project.
- C. Source Limitations: Obtain each equipment component as a complete unit from one source and by a single manufacturer unless otherwise specified.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle equipment in a manner to avoid significant or permanent damage to equipment.
 1. In general, comply with the manufacturer's written instructions for storage of equipment.
 2. The equipment shall be stored in a clean, dry location free from construction dust, precipitation and excess moisture.

1.5 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

1.6 GENERAL

- A. SCOPE: This equipment shall consist of two (2) Trident HSC Model HSC-2800 Water Treatment Units (or pre-approved equal) with associated equipment to comprise a complete system.
- B. CONTRACTOR: The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install and test (if applicable) the treatment, and shall furnish and install all piping and fittings, all wiring and conduit, plus valves not furnished by the plant supplier as shown on the plans, to include couplings, check and isolation valves, and all other manual valves for pneumatic or hydraulic service.
- C.
- D. GENERAL: Equipment finished under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations by the named equipment manufacturer.
- E. The following items are a part of this section and shall be furnished by one manufacturer to ensure a properly designed and integrated water treatment system.
 - 1. Factory built stainless steel modular tanks, each designed with tube settling compartment, up flow Adsorption Clarifier® compartment, and effluent buffer tank.
 - 2. The treatment system shall include chemical treatment, tube sedimentation, Adsorption Clarification, automatic process valves, controllers, air blowers, and the system control panel.
 - 3. An air scouring system including air blowers and automatic valves for the operation of this system to flush the Adsorption Clarifier section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide a system to be supplied by one manufacturer that shall assume total responsibility for the parts operating as a whole and shall be:
 - 1. WesTech Engineering, Inc.
 - 2. Pre-Approved Equivalent

2.2 SYSTEM DESCRIPTION

- A. All component parts and equipment utilized in the pre-engineered water treatment system shall be furnished as a complete integrated system by one manufacturer. The internal components and ancillaries shall be shipped loose for field installation by the Contractor. The equipment shall be as listed below:

Number of Tanks:	2
Flow per Tank (gpm):	525 gpm
Total Plant Flow (gpm):	1,050 gpm
Tube Clarifier Area (ft ²):	280
Tube Clarifier Hydraulic Loading (gpm/ft ²):	1.88
Absorption Clarifier Area (ft ²):	93.3
Absorption Clarifier Hydraulic Loading (gpm/ft ²):	5.63
Effluent Buffer Tank Capacity (gallons):	16,920

- B. A static mixer shall be provided for the common plant raw water line. Static mixer shall be sized for the common influent line and include flanged end connections.
- C. Influent operating pressure of 20-30 feet (measured from base of tank) shall be available at the inlet to the static mixer.
- D. Raw Water Characteristics:

Raw Water Characteristics	
Temperature, Fahrenheit	33-90
Turbidity, NTU	2-300
pH	5.5 – 8.0

2.3 TANKS FABRICATION

- A. The clarification processes shall be contained in single, rectangular stainless steel tanks. Major components shall be of the size and configuration shown on the drawings and fabricated of 0.3125 (5/16) inch thick minimum steel plate, except the bottom which should be a minimum of 0.250 (1/4) inch thick, suitably braced and supported.
- B. All exterior tank connections except the sludge recirculation connection shall be provided with flanged connections.
- C. Adsorption Clarifier flush trough shall be factory installed in each tank.

2.4 TUBE CLARIFIER DETAILS

- A. Primary clarification shall be provided by tube settlers with integral sludge recirculation system.
- B. The tube clarifier influent distribution system shall be constructed of 304 stainless steel headers with orifices located to provide uniform dispersion of the raw water across the bottom of the tube settlers. The header system shall be factory installed and supported from the settling tube supports.
- C. Settling tube supports shall be provided as required by the manufacturer.
- D. A fixed sludge recirculation pipe shall be provided directly below the tube settlers to allow collection of flocculated solids while minimizing grit and sand passage through the recirculation pump.

- E. A sludge removal header system shall be field installed to collect the sludge from the bottom of the tube clarifier basin. The header, guide rails, cable, and sludge withdrawal hose shall be constructed from corrosion resistant materials. The guiderails shall be designed to support the header from the tank side walls. The header shall be supported from the guiderails using V-groove roller wheels to minimize friction forces.
- F. A 3 inch diameter flexible high density polyethylene sludge extraction hose shall be provided to effectively remove sludge and operate within appropriate headloss constraints. The flexible hose shall be smooth on the interior and heavily ribbed on the exterior for strength and abrasion resistance. It shall be field installed to a tank wall connection which terminates with a flanged connection.
- G. Each sludge removal header shall include a drive unit which includes a vertical helical gear reducer driven by a ¼ horsepower TEFC, variable speed DC electric motor with stainless steel shaft, sheave arrangement and overload clutch. All drive components shall be mounted on an adjustable base. A corrosion resistant enclosure shall be provided for each drive.
- H. PVC settling tubes shall include a 60 degree incline design. Modules shall be 41 inches deep and cut to fit the tank interior. Settling tubes shall be field installed.
- I. A series of five sample lines and manual valves shall be provided for sample collection directly below and from within the tube settlers at various depths. The sample lines and associated valves shall be routed to a waste collection trough on the outside of the unit. The waste collection trough will be equipped with a drain coupling. The installing contractor shall provide and install drain piping to the waste sump.
- J. A Sch. 80 PVC header and lateral collector shall be provided for uniform collection of clarified water. The header and laterals shall be properly supported and designed for field installation.
- K. A 14 inch x 18 inch access manway shall be included near the base of the settling tube compartment to allow access to the area below the tube settlers without removing the tubes.
- L. The manufacturer shall furnish the components shipped loose for field installation by the Contractor.

2.5 ADSORPTION CLARIFIER DETAILS

- A. The contractor shall install Adsorption Clarifier components as noted below. Secondary clarification shall be accomplished using buoyant adsorption media specifically manufactured for use in water treatment. The media shall be designed to optimize the removal of coagulated particles with a minimum of headloss. The Adsorption Clarifier section shall be able to build solids to a headloss of six feet without disruption or movement of the clarifier media.
- B. A 48 inch depth of adsorption media shall be provided. Media shall be buoyant with specific gravity of less than 1.0. A media retention screen shall be provided to allow for upflow, restrained operation eliminating any chance of fluidizing the bed during operation. The retainer assembly shall be easily accessible and removable from the

top of the tank. To allow for proper cleaning, the media shall be easily fluidized by the addition of diffused air. Clarifier media that is not restrained and/or media that will not easily be fluidized by the addition of air alone shall not be considered acceptable.

- C. An aluminum grating assembly shall sit above the air scour system near the bottom of the Adsorption Clarifier unit. The grating allows for free passage of water but contains the adsorption media particles.
- D. Buoyant media shall be manufactured of 50% compressible fiber balls and 50% HDPE beads. The fiber balls shall be designed to provide additional solids storage over an all bead bed design to increase clarifier run time. At least one-half of the beads in the bed shall be rolled to produce an elliptical shape and shall also be scarified to place a groove on the media surface. The rolled and scarified shape provides improved floc retention inside of the clarifier bed. Media that does not include a dual media bed of fiber balls and HDPE beads is not acceptable. All media shall be NSF 61 certified.
- E. The Adsorption Clarifier section shall be equipped with influent water distribution and air scour system consisting of a fixed distribution grid with non-clog air diffusers consisting of a slotted plastic nozzle body. The distribution systems shall be constructed from Sch. 80 PVC.
- F. The Adsorption Clarifier media shall be capable of being floated over to the buffer tank side of the unit for clarifier internal inspection and/or service. The media shall be capable of being floated back to the clarifier section of the tank without media loss or damage.
- G. Splash guards shall outline the perimeter of the Adsorption Clarifier system to prevent water from burping over the edge during the flushing process.
- H. Non-buoyant alternates using an up flow unrestrained media are not acceptable.
- I. The manufacturer shall furnish the components shipped loose for field installation by the Contractor.

2.6 EFFLUENT BUFFER TANK DETAILS

- A. The effluent buffer tank shall be designed for storage of clarified water. A flanged effluent connection shall be provided for connection to downstream processes.

2.7 PLANT PROCESS VALVES

- A. The treatment plant manufacturer shall provide all process control valves in sizes shown on the drawings.
- B. Automatic modulating control valve system for the tube clarifier influent line shall incorporate a mag meter and modulating valve to control the flow rate. The mag meter shall be installed in the influent line upstream of the control valve.
- C. Automatic modulating control valve system for the effluent shall incorporate an ultrasonic level sensor and modulating valves to maintain buffer tank water level. Ultrasonic level sensor shall be mounted at the top of the effluent buffer tank section and positioned to properly sense the liquid level.

- D. All automatic modulating valves shall be provided with an integral filter-regulator assembly mounted at the valve actuator.
- E. Automatic open-close valves shall be provided for the Adsorption Clarifier air scour, sludge recirculation, Adsorption Clarifier influent, tube clarifier sludge blowdown, and flush waste for each tank.
- F. The automatic valves for all systems except the sludge recirculation and blowdown shall be wafer-type butterfly valves with pneumatic actuators. The sludge recirculation and blowdown valves shall be a diaphragm type valve. The modulating valves shall have positioners to accept a 4-20 mA signal. The open/close valves shall be pilot solenoid controlled and arranged so that the valves shall automatically return to the service position should power fail.
- G. All automatic and manual butterfly valves shall be of wafer construction with nylon coated disc, EPDM seat and seals, carbon steel stem and semi-steel body.
- H. Manual wafer-type butterfly valves complete with lever actuators shall be provided by the treatment plant manufacturer. Manual butterfly valves shall be provided for influent isolation and tube clarifier pump suction isolation.
- I. Manual valves for tube clarifier and Adsorption Clarifier drain, sludge recirculation isolation shall be ball valves with lever actuators.
- J. A manual plug valve shall be provided for installation in the sludge blowdown line for the purposes of controlling rate.
- K. Recirculation pump discharge, air backwash and blower check valve shall be supplied as recommended by the treatment plant manufacturer.
- L. All valves shall be shipped loose for field installation by the Contractor.
- M. The Contractor shall furnish and install all valves not furnished by the manufacturer as shown on the plans. This item to include couplings, check and isolation valves, and all other manual valves for pneumatic or hydraulic service.

2.8 CLARIFIER TRANSFER AND SLUDGE RECIRCULATION PUMP SYSTEM

- A. Each treatment unit shall include a clarifier transfer pump between the tube settler and Adsorption Clarifier sections and a sludge recirculation pump. Both pumps shall be a product of the same manufacturer.
- B. The pumps shall be designed so that they operate at maximum possible efficiency throughout the duty range, cause no overloading of motors under all operating conditions and be capable of continuous operation.
- C. The centrifugal pumps shall be direct connected to the drive motor. The electric motor shall be sized to be non-overloading at all points on the pump performance curve. Motor enclosure shall be TEFC, and suitable for operation in a humid, outdoor environment. Motors shall be 3 phase, 60 Hertz, 460 volt power. All motors shall comply with manufacturer's standard design, construction and testing procedures as

defined by applicable IEEE, NEMA, and ANSI standards.

- D. Automatic flow adjustment of the sludge recirculation pump shall incorporate a mag meter and variable speed pump controller to maintain set point flow rate.
- E. Recirculation pump and motor assemblies shall be field mounted on the treatment tanks with factory installed mounting brackets. Clarifier transfer pump and motor assemblies shall be field mounted next to the treatment tanks on a concrete base provided by the installer.
- F. Interconnecting piping for the transfer pump system shall be provided by the system supplier.
- G. Automatic flow adjustment of the transfer pump shall incorporate an ultrasonic level sensor and variable speed pump controller to maintain water level in the tube settler compartment. Ultrasonic level sensor shall be mounted at the top of the tube settler section and positioned to properly sense the liquid level.
- H. The manufacturer shall furnish the components shipped loose for field installation by the Contractor.

2.9 AIR SUPPLY BLOWERS

- A. The filter backwash blowers will be used for cleaning the Adsorption Clarifier. The treatment plant manufacturer shall confirm the specified blowers will meet their requirements.

2.10 Plant Control

- A. Influent flow to the system shall be regulated by an operator adjustable flow control loop consisting of a flow element (mag meter); PLC/PID based flow control, and modulating butterfly valve in each tank influent line.
- B. The Adsorption Clarifier section shall be equipped with a pressure transmitter to allow pressure trending and initiation of the flush sequence. Analog signals shall be continuous 4-20 mA and the discrete signals shall allow for adjustable set-points.
- C. The equipment manufacturer shall provide each tank, the following control devices, for installation by the contractor: Adsorption Clarifier pressure transmitter with local display (as noted above); ultrasonic liquid level transmitter to control the clarifier transfer pump; ultrasonic liquid level transmitter to control the effluent valve for buffer tank level control; influent magnetic flow meter with transmitter, turbidimeters.
- D. PLC based control subsystem shall be supplied to monitor and control the Package Treatment System. The PLC based system shall be capable of operating in an automatic mode, completely autonomously, or semi-automatic mode requiring some operator intervention. The control panel shall provide automatic starting and stopping of the Treatment System, based on buffer tank level or device failure.
- E. The control panels shall be supplied complete including all necessary equipment to provide a complete and functioning system. The components shall include PLC,

operator interface, control relays, push-buttons & selector switches, indicating lights, power supplies, fuses and terminal strips. The PLC shall have an interface port, capable of future interface to a SCADA System via Ethernet network.

- F. Control panels shall be shipped loose for installation by the Contractor.
- G. The contractor shall furnish and install all wiring and conduit.

2.11 TREATMENT SYSTEM CONTROL PANEL

- A. The treatment system controls shall consist of one Master Control Panel (MCP) per system working in conjunction with Unit Control Panels (UCP, one per unit). The control panels shall be supplied in a NEMA 12 steel enclosure suitable for indoor use. The front panel of the cabinet shall contain all push buttons, and operator interface (MCP only) as detailed within this specification. The internal portion of the cabinet shall contain all rail-mounted PLC equipment, power supply, processor, and interface cards. Relays and terminals shall also be contained within the cabinet. The PLC subsystem shall be as manufactured by Allen Bradley. Terminal strips for all field wiring shall be furnished within the panel.
- B. Fuses and duplex outlet shall be provided within the panel.
- C. All digital outputs shall be provided with relay contacts.

2.12 PLC BASED CONTROL PANEL I/O FIELD INTERFACE SIGNALS

- A. Within the PLC based control panel all PLC ladder logic shall reside performing all necessary process monitoring and control for the Package Treatment System. All necessary I/O cards shall be supplied to monitor and control the field signals. All PLC and I/O rails shall be supplied with 10 percent spare I/O point to accommodate future expansion.
- B. The PLC based MCP shall be comprised of the following:
 1. NEMA 12 Wall Mounted Control Panel
 2. PLC CPU Card – (dc voltage)
 3. PLC I/O Rail
 4. PLC I/O Cards
 5. Operator Interface Terminal – Allen-Bradley PanelView Plus 6 series 10” color/touch
 6. Power Supplies
 7. Pilot Lights and Pushbuttons
 8. Fuses
 9. Terminal Strips
 10. Convenience Outlet
 11. Remote I/O via Ethernet
 12. Control Relays
 13. Misc. Wire and Conduit
- C. Each UCP shall be comprised of the following:
 1. NEMA 12 Wall Mounted Control Panel
 2. Interface Module

3. PLC I/O Cards and module mounting rail
4. Power Supplies
5. Pilot Lights and Pushbutton
6. Fuses
7. Terminal Strips
8. Misc. Wire and Conduit

2.13 DEVICES FOR OPERATOR INTERFACE

- A. Pushbuttons
 1. Pushbuttons shall be as manufactured by Allen Bradley. Panel Mounted Pushbuttons shall be provided for Emergency Stop purposes.
- B. Operator Interface Terminal (MCP Only)
 1. An Operator Interface Terminal to the PLC shall be included and mounted on the front of the MCP enclosure. The Interface shall allow the operator to view and modify system variables within the PLC. The display shall be a touch screen. The color display shall be STN type, VGA 640 x 480 pixels (10 inches) with 60,000 hour backlight. The unit shall include a real-time clock, built-in alarm functionality, Ethernet communications port and RS-232 Printer port. The unit shall operate on 24 VDC with 0.6 A maximum power consumption. The display shall support the standard ASCII character set. Terminal configuration shall be via Microsoft Windows based software. The unit shall be manufactured by Allen Bradley Panel View Plus 6 series 1000, or approved equivalent.

2.14 PROCESS CONTROL SYSTEM FUNCTIONS

- A. The MCP shall automatically control the treatment process. The MCP Terminal shall provide control input for the following process and field equipment.
 1. Coagulation Pump
 2. Polymer Pumps
 3. Sludge Recirculation Pumps
 4. Sludge Collector Drive
 5. Clarifier Transfer Pumps
 6. Air Wash Blowers
 7. Trident HSC Process Valves
- B. The MCP shall control the following process functions:
 1. Buffer Tank Level Control
 2. Tube Clarifier Level Control
 3. Automatic System Start-Up and Shut Down
 4. Influent Flow Control to each unit
 5. Emergency Shutdown of each unit via pushbutton
 6. Effluent Turbidity Feedback Coagulant Feed Control with flow pacing
 7. Automatic Start/Stop Polymer Feed Control
 8. Timed Based Flush Initiation
 9. Loss of Head Flush Initiation
- C. The MCP Interface shall provide operator adjustable set points for the following parameters:
 1. Influent Flow Rate Setpoint
 2. Effluent Turbidity Coagulant Control Setpoint

3. Recirculation Flow
 4. Blowdown Frequency and Duration
- D. The MCP Interface shall provide running and alarm indication for the following devices:
1. Raw Water Pump (pump by others)
 2. Sludge Recirculation Pumps
 3. Clarifier Transfer Pumps
 4. Sludge Collector Drive
- E. The following manual control switches/pushbuttons shall be part of the Operator Interface which is mounted on the door of the MCP.
1. Sequence Start
 2. Sequence Stop
 3. Alarm Acknowledgement
 4. Fault Acknowledgement
 5. Clarifier Transfer Pump Start/Stop
 6. Sludge Recirculation Pump Start/Stop
 7. Sludge Collector Drive Start/Stop
 8. Auto/Manual Adsorption Clarifier Control
 9. Process Valve Open/Close Control
 10. Blower Start/Stop Control
- F. A Power On indicator light shall be mounted on the doors of the panels noted.
- G. The following alarm conditions shall be monitored by MCP. All alarms shall be visible via the Operator Interface Terminal.
1. Sludge Recirculation Pump Fault
 2. Sludge Collector Drive Fault
 3. Sludge Recirculation Low Flow Alarm
 4. Transfer Pump Fault
 5. Adsorption Clarifier High Pressure Alarm
 6. Buffer Tank High Turbidity Alarm
 7. Buffer Tank High High Turbidity Alarm

2.15 CHEMICAL FEED SYSTEMS

- A. Chemical feed systems shall be provided as specified in the Contract Documents.
- B. Contractor is responsible for including pricing for a polymer feed system per the manufacturer's requirements.

PART 3 - EXECUTION

PART EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. General: Comply with the manufacturer's detailed written instructions for installing the equipment.
- B. Lubricants and Lubricating Equipment
 - 1. Provide and install necessary food grade quality oils, greases and anti-seize compounds for initial operation of all equipment provided that requires oil, grease or anti-seize.
 - 2. Food grade anti-seize shall be applied to the threads of all stainless steel bolts before assembly at the factory and field assembly.

3.3 INSTALLATION AND OPERATING

- A. Manufacturer's Field Services: The CONTRACTOR shall provide the following services in addition to any other services specified herein, and required by these Specifications.
- B. **Pre-installation training service:** A factory trained manufacturer's representative shall be provided for (1) trip and (1) eight hour day of onsite service to review equipment submittals and installation instructions.
- C. **Onsite field service:** A factory trained manufacturer's representative shall be provided for (2) trips each with (2) eight hour days onsite to provide installation review, instruction, and supervision. The installation services shall be coordinated between the CONTRACTOR and the manufacturer.
- D. **Start-up & O&M Training:** A factory trained manufacturer's representative shall be provided for (1) trips each with (2) eight hour days onsite to provide start-up and O&M training services. The start-up and O&M services shall be coordinated between the CONTRACTOR and the manufacturer.
- E. After installation supervision and field testing services by the manufacturer, the CONTRACTOR shall submit to the ENGINEER, a certification letter on the manufacturer's letterhead and signed by the manufacturer certifying that the equipment was installed per the manufacturer's recommendations.
- F. The manufacturer shall provide start-up reports covering installation inspection and start-up activities.
- G. The manufacturer shall provide operator training to all required plant personnel.
- H. All costs, including travel, lodging, meals and incidentals for manufacturer service shall be included in the CONTRACTOR'S bid

3.4 CLEANING AND PROTECTING

- A. Restore marred, abraded surfaces to their original condition.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure the equipment is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 44 32 10

SECTION 44 42 56 - WATER SUPPLY AND TREATMENT PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following water supply and treatment pumps for use in water and treatment plants and systems:
 - 1. Finished Water Pumps (Vertical Turbine Can)
 - 2. Backwash Pumps (Vertical Turbine Can)
 - 3. Raw Water Pumps (Vertical Turbine)
 - 4. GAC Feed Pumps (Vertical In-line)

1.3 SUBMITTALS

- A. Product Data:
 - 1. Make, model, weight, and horsepower of each equipment assembly.
 - 2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
 - 3. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the pump, from shutoff to maximum capacity. Indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the guarantee point.
 - 4. Complete motor nameplate data, as defined by NEMA.
 - 5. Factory finish system.
 - 6. Special shipping, handling, protection, and storage instructions.
 - 7. Manufacturer's printed installation instructions.
 - 8. Suggested spare parts list.
 - 9. List of any special tools, materials, or supplies required for the maintenance of the pump.
 - 10. Operation and Maintenance Manual
- B. Shop Drawings:
 - 1. Detailed mechanical and electrical drawings showing the equipment size, dimensions, and locations of connections and weights of associated equipment.
 - 2. Power and control wiring diagrams.
- C. Quality Control Submittals:

1. A factory certified running test shall be conducted prior to shipment. Test shall conform to the standards of The Hydraulic Institute and consist of operating the pump over a range of head and capacity conditions so as to establish its performance curve. Copies of the test results shall be submitted to the Owner.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store equipment in a manner to avoid significant or permanent damage to equipment.
 1. In general, comply with the manufacturer's written instructions for the storage of equipment.
 2. The equipment shall be stored in a clean, dry location free from construction dust, precipitation, and excess moisture.

1.5 WARRANTY

- A. Warranty Period: manufacturer's warranty shall be One year from the date of Substantial Completion.
 1. The warranty shall be for unlimited usage of the equipment for the specified rated capacity over the term of the warranty.

PART 2 - PRODUCT

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Backwash and Finished Water Pumps (Vertical Turbine Can)
 - a. Floway
 - b. Goulds
 - c. Peerless
 2. Raw Water Pumps (Verticle Turbine)
 - a. Floway
 - b. Flowise
 - c. Goulds
 - d. Peerless
 3. GAC Feed Pumps (Vertical In-line)
 - a. Goulds
 - b. Patterson
 - c. Grundfos

2.2 PUMPS GENERAL

- A. Pumps should be well designed and of rugged construction and adapted to secure maximum economy in both power and maintenance under continuous operation and the service conditions specified.

- B. No consideration will be given to equipment that has not demonstrated its reliability and efficiency through results obtained from operation of similar units of approximately the same capacity and type under similar conditions.
- C. The general design shall be such that the components can be easily disassembled; that replacement parts are of standard design and readily available; and that all components and parts are suitable for the service required.
- D. Coordinate pump requirements with variable frequency (VFD) drive manufacturer if VFDs are utilized.
- E. The total dynamic heads, given in this section, have included approximate losses in the pumps. Exact allowances for such losses shall be made by the pump manufacturer; amounts of such losses shall be stated so adjustments can be made if required. The statements of losses in the pump shall be in the form of a written report and such report shall be furnished to the Engineer.
- F. The manufacturer shall make a thorough analysis of the proposed pump installations with respect to the physical locations of pumps, configurations of suction and discharge piping, elevations of piping, pump mounting, and any other features or factors that might directly or indirectly affect the operation and/or performance of the pumps proposed to be furnished by the particular manufacturer.
- G. The analysis of operating conditions shall be in the form of a written report and such report shall be furnished to the Engineer as part of the pump submittal.
- H. The materials for construction shall be generally as hereinafter specified. It is recognized that the standard metallurgy of a particular pump manufacturer may vary from that specified, but the quality of materials shall, however, equal or exceed that specified; and the assembly of materials shall result in a product equal to or exceeding all the requirements of these Specifications.
- I. Pump base drains shall be copper water tube of size not less than 1", and shall be run through floor slab and/or into adjacent floor drain lines. Tees shall be used at changes in direction in order to facilitate cleanout. Pumps shall be equipped with throttle bushing and bleed-off stuffing box where applicable.
- J. The manufacturer shall determine the maximum down thrust for the particular pump offered and shall provide thrust bearing capacity for handling the maximum down thrust with ample safety factor.
 - 1. Safety factor shall be based upon the ratio of anticipated thrust to standard thrust and average life expectancy of five years operation at twenty-four (24) hours per day.
 - 2. The manufacturer shall also determine for the particular pump offered the magnitude of the initial pr momentary up thrust, and shall provide protection to counteract the net positive up thrust.
 - 3. If continuous up thrust protection should be necessary, protection shall be provided by duplex bearings in the thrust location.
- K. Pump Mounting: Pumps shall be mounted on reinforced concrete pads doweled into the floor. The contractor shall confirm size requirements for pad with the

manufacturer and in no case shall there be less than 2-inches clearance/coverage between edge of anchor bolts and edge of pad. Mounting pads shall be of such heights as will set the centerlines of the pumps discharge ports at the necessary elevations.

2.3 BACKWASH AND FINISHED WATER PUMPS (VERTICLE TURBINE CAN)

- A. The Contractor shall furnish and install, ready for operation the following pumps in the locations specified:

Finished Water Pumps - Finished Water Pump Station								
Pump No.	RPM	HP	Operation Point No. 1			Operation Point No. 2		
			Flow (gpm)	TDH (Ft.)	% Effncy.	Flow (gpm)	TDH (Ft.)	% Effncy.
1	1180	75	694	314	78	725	310	82
2	1180	75	694	314	78	725	310	82
3	1770	125	1042	334	83	1200	254	82

Backwash Pumps – Filter Building									
Pump No.	RPM	HP	Stages	Operating Point No. 1			Operating Point No. 2		
				Flow (gpm)	TDH (ft.)	% Effncy.	Flow (gpm)	TDH (ft.)	% Effncy.
1	720	60	2	5,200	25	78	5500	22	84

- B. Discharge Head Assembly:

1. The discharge head shall be fabricated steel type “L”
2. For above ground service, the discharge head shall be fitted with a flanged discharge connection. The flange shall be a 150 LB R.F. ANSI flange for fabricated steel heads. The discharge head shall be designed to carry the entire weight of the complete pump and driver without distortion when spanning an opening of sufficient size to permit removal of the complete pump assembly. The discharge head shall be provided with a coupling guard. Lifting lugs shall be provided as standard. Shall be fabricated from ASTM A36/53 Steel. All discharge heads shall incorporate a quad style design located 90° apart connecting the motor mounting flange to the head base plate.
3. Shall be accurately machined to be free of blow holes, sand holes, and other detrimental defects.
4. Discharge nozzle shall provide smooth flow transition from the head cavity and shall incorporate vertical vane for minimizing turbulence.
5. Discharge outlet shall be flanged and drilled ANSI B16.1 Class 150 and shall be tapped 1/2" NPT for connection of a pressure gauge.
6. Head design shall permit the drive shaft be coupled to the motor shaft above the stuffing incorporated in the head using a flanged, adjustable coupling.
7. The head shaft shall be 416 Stainless Steel and shall be turned and ground. The head shaft or top shaft shall not exceed 10 feet in length. The pump

manufacturer shall include a method of adjusting the impellers at the top of the head shaft.

8. The discharge head shall be designed to carry the entire weight of the complete pump and driver without distortion when spanning an opening of sufficient size to permit removal of the complete pump assembly. The discharge head shall be provided with a coupling guard. Lifting lugs shall be provided as standard.
9. Stuffing Box
 - a. The stuffing box shall be cast iron and designed for 6 rings of packing and lantern ring. An extra-long bearing shall be located below the packing in the stuffing box. Packing lubrication leakage through the stuffing box shall be drained back to the sump. The packing gland shall be of a two piece design.
10. The head shall be bolted to a cast iron or steel base plate anchored to the concrete foundation pad.
11. Bolts and anchor bolts shall be stainless steel.

C. Column Assembly:

1. Seamless steel pipe (ANSI/ASTM A 53, Grade B, weight not less than schedule 30).
2. The column shall include flanged connections and shall be of open design with product lubrication.
3. Column pipe shall be furnished in interchangeable sections that do not exceed 9 feet in length. The top and bottom column sections shall not exceed 5 feet in length. The ends of each section shall be machined parallel.
4. The bearing spacing shall be selected to insure operation at a minimum of 25% above or below the first critical speed. Bearing spacing shall not exceed 10 feet. Bearings above static water level shall be constructed of Vesconite bearing material, allowing dry run for at least 60 seconds without any damage to bearings.
5. The column shall be designed with drop-in steel or cast-iron bearing retainers. The interior of the column shall be free of offsets, burrs, discontinuities and irregularities. Drop in spiders shall be Stainless Steel with rubber dogbone bearing inserts below static water level.
6. Column surfaces shall be protected, both exterior and interior, by approved epoxy coating system to dry film thickness of not less than 11 mils. Coating system shall be similar and equal to Tnemec, N140F Pota-Pox, Engard #480, Flexcote #707, Mobil 78 Series, or equivalent.

D. Line Shafting:

1. Lineshaft shall be 416 Stainless Steel.
2. Size shall be no less than that determined by ANSI/AWWA specification E101, section A4.15, line shaft selection and shall be such that elongation due to hydraulic thrust will not exceed the actual clearance of the impellers in the pump bowl.
3. The lineshaft shall be 416 stainless steel and of adequate size to transmit the full power of the pump without slip, excessive vibration or elongation, and shall have threaded joints. Lineshaft lengths shall not exceed 10 feet. The lineshaft shall have left hand threads that tighten during pump operation.

4. Ends of shafting shall be machined square to axis of shaft for butt fit, threaded and designed with a safety factor of 1.5 times the shaft safety factor.
5. Lineshaft shall be furnished in interchangeable sections not over 10 feet in length.

E. Bowl Assembly:

1. The suction bowl shall be designed to provide conservative entrance velocities and direct the flow to the first stage impeller. The inner surface of the suction bowl shall be smooth and free of sharp projections which could cause turbulence or cavitation. The suction casing shall be designed to house the suction bell bearing by means of four vanes.
2. The bowls shall be smooth and free of sharp projections and shall have register fits for alignment and be connected by flanged and bolted construction. Bowl sizes 6" to 15" shall be porcelain enameled on the bowl interior. Bowl sizes 16" and larger shall be epoxy-lined.

F. Impellers:

1. A743-CA6NM (316 Stainless Steel) accurately cast, machined, filed and polished; and impellers shall be statically and dynamically balanced. Impeller material shall be the following for each set of pumps:
2. Impellers shall be enclosed type.
3. Split Rings and Keys, Bolts and Nuts shall be stainless steel ANSI/ASTM A 582-80 Type 303 or Type 416, or ANSI/ASTM A276-81a Type 303 or Type 416.
4. Impeller shafting shall be stainless steel ANSI/ASTM A314-81 Type 410 or Type 416.

G. Can

1. The can diameter shall be sized such that the velocity in the can does not exceed the standards recommended by the Hydraulic Institute. The suction can shall be supplied by the manufacturer.

G. Drive Motor:

1. Shall be weather-protected (Type WPI) machines, vertical hollow shaft, heavy duty squirrel cage induction type.
2. Temperature rise at maximum load shall not be greater than Class F Limits
3. Insulation shall not be less than Class F with copper magnet wire (Class H minimum).
4. The motor shall be equipped with copper or copper alloy rotor bars and end rings.
5. The motors shall be guaranteed to continuously carry 115% of rated load without development of injurious heating, and shall be capable of operation on 460 V, 3 Ø, 60 Hz.
6. Thrust bearing shall be designed to carry the weight of all rotating parts plus the maximum hydraulic thrust load which may occur.
7. Motor efficiency shall conform to "NEMA Premium & Inverter Duty Rated", values for horsepower, speed, and enclosure, and motor shall be equipped with anti-backspin couplings.

8. The design and manufacture of the motors shall be in compliance with the General Specifications of the IEEE and with NEMA Standards.
9. Motors for each pump shall be provided with integral condensation heaters to prevent corrosion.
10. Motors for each pump shall be provided with integral thermostats to prevent overheating.
11. Acceptable manufacturers:
 - a. G.E.
 - b. U.S. Motors

H. Pump Vibration:

1. The completed installation of pump and driver shall be smooth-running and vibration free.
2. Vibration testing shall be in accordance with HI 2009 standards and measured at the pump/motor interface.

I. Coating:

1. The bowl assembly exterior shall be coated with Tnemec 141; minimum dry film thickness 8 mils.
2. The column OD and ID assembly exterior shall be coated with Tnemec 141; minimum dry film thickness 8 mils.
3. The head assembly exterior shall be coated with Tnemec 141; minimum dry film thickness 8 mils.
4. The suction can exterior shall be coated with Tnemec 141; minimum dry film thickness 8 mils.

2.5 RAW WATER PUMPS (VERTICLE TURBINE)

- A. The Contractor shall furnish and install, ready for operation the following pumps in the locations specified:

Raw Water Pumps – Raw Water Pump Station									
Pump No.	RPM	HP	Stages	Operating Point No. 1			Operating Point No. 2		
				Flow (gpm)	TDH (ft.)	% Effncy.	Flow (gpm)	TDH (ft.)	% Effncy.
1	1170	7.5	2	694	25	79	830	17	70
2	1170	7.5	2	694	25	79	830	17	70

B. Pump Heads:

1. Cast Iron surface discharge assembly, 175 psi standard design, and of standard NEMA sizes as shown on data sheets.
2. Cast from high strength, fine gray iron (ANSI/ASTM A48), Class 30.

3. Head shall be of the high profile type to allow shaft to be coupled above tension plate/tension nut assembly.
4. A tension plate and tension nut assembly shall be installed in the discharge head to allow proper tension to be placed on the shaft enclosing tube. The tension plate nut shall be cast iron with O-ring at the bottom end to provide the seal. The tension nut/bearing shall be made of silicon bronze to maintain tube tension and support for the head shaft.
5. Discharge nozzle shall provide smooth flow transition from the head cavity and shall incorporate vertical vane for minimizing turbulence.
6. Discharge outlet shall be flanged and drilled ANSI B16.1 Class 125 and shall be tapped ¼" NPT for connection of a pressure gauge to be supplied by Contractor.
7. Headshaft shall be ASTM A582, type 416 stainless steel ground and polished with surface finish better than 40 RMS. Lineshaft to headshaft coupling shall be flanged.
8. The head shall be bolted to a cast iron or steel base plate anchored to the concrete foundation pad.
9. Bolts and anchor bolts shall be stainless steel.

B. Column Pipe:

1. Seamless steel pipe (ANSI/ASTM A 53, Grade B), not less than Schedule 30.
2. Column pipe of sizes through 12" shall have threaded ends of reduced taper, and shall have ends machined and faced at right angles to the axis of the pipe so as to have full butt against machined shoulders in the pipe couplings.
3. Threaded couplings shall be of cast iron (ANSI/ASTM A48), not less than Class 30 or cast steel (ANSI/ASTM A 487) of Class suitable for pressure service (cold water).
4. The couplings shall have steel or rubber retainers fitted to maintain the rigidity and the alignment of the enclosing tube.
5. Column pipe of sizes 14" and larger shall have flanged ends equipped with stainless steel bolts and nuts.
6. Enclosing tube shall be ASTM A120, Schedule 80 pipe. The top section shall be designed for applying proper tension to the tube. Ends of tube shall be bored, faced and inside threaded to butt square with the pump axis and ensure accurate alignment.
7. Column surfaces shall be protected, both exterior and interior, by NSF 61 approved epoxy coating system to dry film thickness of not less than 12 mils. Coating system shall be similar and equal to Engard 460/480, Flexkote 707, Mobil 78 Series, ScotchKote 323 or equivalent.
8. The lineshaft bearing which serves as a coupling for the shaft tubing shall be bronze material, machined, threaded and grooved for proper lubrication.

C. Journals (Shafting Sleeves) shall be Monel, or stainless steel ANSI/ASTM A269 Grade TP 304, or brass ANSI/ASTM B124 Copper Alloy No. UNS C37700 or equivalent.

D. Line Shafting:

1. Lineshaft shall be ASTM A582, type 416 stainless steel ground and polished with surface finish better than 40 RMS.

2. Ends of shafting shall be machined square to axis of shaft for butt fit, threaded and coupled with 18-8 stainless steel couplings designed with a safety factor of 1.5 times the shaft safety factor.

E. Pump Bowls:

1. Fine grain gray iron (ANSI/ASTM A48) not less than Class 30. Suction and intermediate bowls shall be fitted with replaceable stainless steel wear rings ANSI/ASTM A276a Type 416 or bronze wear rings ANSI/ASTM B505 Copper Alloy No. 836, or of molded neoprene reinforced by embedded steel core.
2. If wear rings are not used, the bowls shall be cast from gray iron ANSI/ASTM A48 Class 40 or Meehanite, and the manufacturer shall show that he has provided extra thickness of metal in the necks of the bowls and in the skirts of the impellers so that necks can be bored and skirts turned down when running clearances must be adjusted.
3. Bowls shall be fitted with bronze bushings ANSI/ASTM B505 Copper Alloy No. 836, or ANSI/ASTM B584 Copper Alloy No. 836, for support and guidance of shafting.
4. Intermediate bowls shall be interchangeable. Suction bowl shall be fitted with hot-dipped galvanized strainer.
5. An oil lubricated adapter with drain ports and adapter bearing shall be used to connect the intermediate bowl to the enclosed column assembly.
6. The suction bowl bearing shall be bronze and shall be permanently lubricated with provision for recirculation of lubricant from reservoir in the suction case hub. The bearing housing shall have sufficient opening at the bottom for easy removal of the bearing.
7. Sand collar of rubber or bronze ANSI/ASTM B505 Copper Alloy No. 836 shall be provided for protecting the suction bowl bearing from abrasives in the liquid being pumped.

F. Impellers:

1. Bronze, enclosed or semi-open, accurately cast, machined, filed and polished. Impellers shall be statically and dynamically balanced.

Note: For corrosive or high chlorine applications, use ANSI/ASTM B505, Alloy 927 zincless bronze instead of ANSI/ASTM B584, Alloy 836.

2. Bronze castings shall conform to the requirements of ANSI/ASTM B584 Copper Alloy No. 836.
3. The impeller shall be securely fastened to the bowl shaft with stainless steel collets, ANSI/ASTM A582 Type 303 or Type 416.
4. Impeller shafting shall be stainless steel ANSI/ASTM A582 Type 416, and shall be ground and polished with surface finish better than 40 RMS.

G. Split Rings and Keys, Bolts and Nuts shall be stainless steel ANSI/ASTM A 582 Type 303 or Type 416, or ANSI/ASTM A276 Type 303 or Type 416.

H. Drive Motor:

1. Shall be weather-protected (Type WPI) machines, vertical hollow shaft, heavy duty squirrel cage induction type.
2. Temperature rise at maximum load shall not be greater than Class F Limits
3. Insulation shall not be less than Class F with copper magnet wire (Class H minimum).
4. The motor shall be equipped with copper or copper alloy rotor bars and end rings.
5. The motors shall be guaranteed to continuously carry 115% of rated load without development of injurious heating, and shall be capable of operation on 480 V, 3 Ø, 60 Hz.
6. Thrust bearing shall be designed to carry the weight of all rotating parts plus the maximum hydraulic thrust load which may occur.
7. Motor efficiency shall conform to "NEMA Premium" values for horsepower, speed, and enclosure, and motors shall be equipped with anti-backspin couplings.
8. The design and manufacture of the motors shall be in compliance with the General Specifications of the IEEE and with NEMA Standards.
9. Acceptable manufacturers:
 - a. G.E.
 - b. U.S. Motors
 - c. Westinghouse

I. Pump Vibration:

1. The completed installation of pump and driver shall be smooth-running and vibration free.
2. Maximum eccentricity of shaft rotation at top and bottom of driver (with pump coupled) shall not exceed 0.003" and maximum difference in eccentricity of shaft rotation at top and bottom of driver shall not exceed 0.002".
3. Vibration of the pump and motor installation shall be measured using an IRD Model 34S or IRD Model 350 vibration analyzer, with accompanying X-Y plotter.
4. Background vibration shall first be determined with all equipment at rest. Next, un-clutched motor vibration shall be determined. The coupled pump and motor vibration shall then be measured. Measurements shall be made at the top of the motor in the vertical plane, and both horizontal planes, parallel to and perpendicular to the discharge pipeline.
5. Vibration at the design point on the pump curve during normal operation shall not exceed 0.60 mils peak-to-peak, excluding background vibration.
6. The pumps manufacturer shall co-ordinate the vibration testing for attendance by the Engineer and shall provide the Engineer with a complete written summary of the test procedures and results.

2.6 GAC FEED PUMPS (VERTICLE IN-LINE)

- A. The Contractor shall furnish and install, ready for operation the following pumps in the locations specified:

GAC Feed Pumps - Filter Building					
Pump No.	RPM	HP	Operation Point		
			Flow (gpm)	TDH (Ft.)	% Efficy.
1	1760	15	521	60	75
2	1760	15	521	60	75

- B. All pumps shall be the vertical single-stage inline type, consisting of an impeller that is mounted directly to an extended JM motor shaft. Pumps shall be high efficiency close coupled design, and shall be of the pullout design, capable of being removed for service without disturbing suction or discharge piping connections.
- C. Pump volute cases and volute covers shall be fabricated of ASTM A48 Class 30 cast or ductile iron, rated for a minimum of 175 PSI working pressure. Casings shall be provided with tapped holes on the suction and discharge to accommodate the provision of suction and pressure gauges, various fittings, and drain ports. All casings shall be provided with integrally-cast discharge flanges of the size as noted above, conforming to ANSI standard 125# drilling, and with bolt holes straddling the vertical centerline.
1. Pumps shall be provided with replaceable casing wear rings located below the impeller. Impellers will be provided with extended upper and lower skirts to allow engagement with the upper volute cover and the lower casing wear ring. Wear rings shall be fabricated of ASTM B505-932 bronze.
 2. Suction and discharge gauges shall be provided with each pump as outlined elsewhere in these Specifications, for installation by the contractor as shown on the Plans.
- D. Pumps shall be designed for a maximum shaft deflection of .002” at the seal face.
- E. The pump impellers shall be precision cast from ASTM B584-875 low lead bronze, and shall be dynamically balanced. Impellers shall be the fully enclosed type, and shall be secured directly to the motor shaft with an AISI 316 stainless steel bolt and an AISI 416 stainless steel impeller nut washer. Impellers shall be affixed to the motor shaft by means of an ASTM A276-TY303 stainless steel key. All impellers shall have an annular pressure reducing clearance, with impeller balance holes to reduce axial thrust.
- F. Each pump shall be provided with a replaceable ASTM B505-954 bronze or AISI 316 stainless steel shaft sleeve to protect the motor shaft in the area directly under the mechanical seal. The shaft sleeve shall be sealed to the motor shaft by means of a Nitrile O-ring. Each pump shall be provided with a mechanical seal utilizing carbon vs. silicon carbide faces. A seal water flush line shall be factory-installed on each pump to provide proper lubrication and cooling.
- G. Each pump will be direct-driven by a vertical motor of the size and speed as noted above. Motors shall be manufactured in accordance with all applicable standards of NEMA, IEEE, AFBMA, NEC, and ANSI, and shall be suitable for operation on 480/3/60 electrical service. Motors shall be provided with aluminum or cast iron frames and end bells. Motor enclosures shall be open drip-proof design for

installation and operation in a weather protected environment, or totally enclosed for installation and operation in any location exposed to weather.

1. All motors shall be provided with a minimum 1.15 service factor, and shall incorporate all-copper windings with non-hygroscopic Class F insulation, and shall conform to Class B or better temperature rise characteristics. Frames and end bells shall be configured for grease lubrication of all shaft bearings. The motor shall be the "premium efficiency" squirrel cage induction type with normal starting torque and slip characteristics, designed for maximum economy of operation. Motors shall be capable of carrying full load current continuously, without injurious temperature rise in an ambient temperature of 40 degrees C.
2. Pump motors shall be sized as non-overloading above the rated nameplate horsepower under any condition of operation from shut-off head to runout capacity. All motor thrust bearings shall be adequate to carry continuous thrust loads under all conditions of operation from zero head to shut-off.
3. Each motor and pump assembly shall be connected so as to comprise an integral pumping unit. Motors shall incorporate a standard "JM" shaft design to allow direct mounting of the impeller to the motor shaft. The use of shaft extensions or intermediate couplings is specifically prohibited and will not be allowed.
4. Motors designated on the electrical plans as operated with variable frequency drives shall be "inverter duty" design, and shall be designed for and specifically labeled by the manufacturer as such.
5. Motors installed in any outdoor unprotected locations shall be provided with TEFC enclosures as outlined above, and shall be provided with 120VAC space heaters. Leads from space heaters shall be routed to the motor junction box, for connection to power by the installing electrician.
6. All motors, regardless of their location relative to weather and exposure, shall be provided with normally-closed thermostats mounted on the winding coils, which shall be designed to automatically open when the winding temperature exceeds the recommendation of the motor manufacturer. One thermostat shall be provided for each phase of the motor windings, with leads from the same to be routed to the motor conduit box for connection by the installing electrician.

H. FACTORY TESTING:

1. Each pump provided for this project shall undergo a certified hydrostatic test at a minimum of 150% of the pressure developed at shutoff head. Certified tests shall be performed on each unit utilizing its actual drive motor.
2. Each pump shall be provided with a certified performance test in the facility of the pump manufacturer. All tests shall be performed in accordance with the Hydraulic Institute Test Standards for Centrifugal Pumps - 1.6 (1988). A minimum of six (6) evenly spaced test points shall be taken and shall include conditions at shut-off (zero flow) and the operating points specified herein. Preliminary test data must be submitted to the engineer not less than seven days prior to the actual test date.
3. The engineer and/or a representative of the owner shall be given sufficient notice of the testing dates and shall have the opportunity to witness these test if desired.

I. ADDITIONAL REQUIREMENTS:

1. A pressure gauge shall be provided with the pump by the pump supplier, for installation by the contractor as indicated on the Plans. Pressure gauges shall be sized so that the specified pressure for each pump is approximately in the middle of the scaled range for each gauge. Gauges mounted on the suction side of the pumps shall be pressure or compound type, depending on the inlet pressure conditions. All gauges shall be provided with 6" diameter stainless steel cases and movements, and stainless steel bourdon tubes. Bronze or non-metallic internals will not be allowed.
2. Accuracy of all pressure gauges shall be not less than ½% of full scale. Gauge faces shall be white, with black numerals. Pressure gauges shall be installed by the contractor, and the gauge shall be provided with an isolation petcock. All piping and valves associated with the pressure gauges shall be stainless steel.
3. Pressure gauges shall be provided with a snubber, and shall be liquid filled by the manufacturer to dampen pulsations. Gauges shall be provided with stainless steel piping and ball-type isolation valves.
4. The finished pumps and motors shall be provided with a manufacturer's standard paint finish, for field finishing by the installing contractor in accordance with these specifications. The Contractor shall be responsible for the field finish painting of all equipment and accessories, as outlined elsewhere in these Specifications or as directed by the Engineer. Finish color of all pumping equipment and related piping, etc. shall be as selected by the Engineer or the Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturer's printed instructions.
- B. Level base using steel wedges. Wedge taper not greater than 1/4 inch per foot. Wedging should be done so that there is no deformation of base plate and base plate assembly should be level upon completion of anchor bolt tightening.
- C. Adjust pump assemblies so that the driving units are properly aligned, plumb, and level with the driven units and all connected shafts and couplings.
- D. Upon completion of leveling of base plate and setting of pump and appurtenances, fill void with grout as specified in these Specifications. After the grout has set, remove steel wedges and fill wedge void with grout.
- E. Suction and discharge piping shall be connected without placing any strain on the pump flanges.

3.2 FIELD FINISHING

- A. Provide sufficient paint to touch up pump as necessary after installation. Paint according to the requirements in Section 9.

END OF SECTION 44 42 56

SECTION 44 44 13.01 – LIME SLURRY SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following Lime Slurry System for use in water treatment plants and systems:
 - 1. Lime Slurry System

1.3 SUBMITTALS

- A. **Certification from Contractor and Manufacturer/Suppliers:** During the bid period and again prior to submitting/ordering and installing materials, products and equipment, the Contractor and all manufacturers and suppliers shall thoroughly review the materials, products and equipment being supplied and shall familiarize themselves with the existing and proposed/new facilities, as well as connections to existing facilities/utilities. This shall include field verification of the location, nature, size/dimensions, current and intended future use, etc. Prior to ordering and installation, the Contractor shall coordinate with all manufacturers and suppliers to provide all needed information including field dimensions, photographs, information on related materials and equipment, etc.). The Contractor and all manufacturers and suppliers shall include written confirmation (with the submittal) of the following:
 - 1. The materials, products, and equipment being supplied are of the correct size, materials and type.
 - 2. The materials, products and equipment being supplied do not conflict with existing or proposed/new facilities.
 - 3. The products/equipment being supplied are intended for use in this application.
 - 4. All manufacturer(s) and supplier(s) shall provide (either with submittals or separately) written concurrence/acknowledgement of their review/coordination and concurrence with the items above.
 - 5. Shop drawings and product data submitted for review by the Engineer shall bear the Contractor's certification that he has reviewed, checked, and approved the submittals, that they comply with the requirements of the project and with the provisions of the Contract Documents, and that he has verified all sizes, dimensions, locations, field measurements, construction criteria, materials, catalog numbers, and similar data. Field dimensions, sizes and other pertinent information shall be clearly shown on the shop drawings/submittals. The Contractor shall also certify that the work represented by the shop drawings is recommended by the Contractor and that the Contractor's warranty and guaranty will fully apply.
- B. Product Data:

1. Make, model, weight, and horsepower of each equipment assembly.
2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
3. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the pump, from shutoff to maximum capacity. Indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the guarantee point.
4. Complete motor nameplate data, as defined by NEMA.
5. Factory finish system.
6. Special shipping, handling, protection, and storage instructions.
7. Manufacturer's printed installation instructions.
8. Suggested spare parts list.
9. List of any special tools, materials, or supplies required for maintenance of pump.
10. Operation and Maintenance Manual

C. Shop Drawings:

1. Detailed mechanical and electrical drawings showing the equipment size, dimensions, and locations of connections and weights of associated equipment.
2. Power and control wiring diagrams.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Comply with the pertinent provisions of the delivery schedule.
- B. Equipment and materials to be shipped F.O.B. shipping points, with freight prepaid to the jobsite. Fabricated parts when delivered to the site shall be stored off the ground and protected from weather and damage. Control and electrical devices shall be stored indoors.
- C. Ship fabricated assemblies in largest sections permitted by carrier regulations.
- D. Handle so as to prevent damage to equipment during handling and transportation.

1.5 WARRANTY

- A. Warranty Period: One year from the date of Substantial Completion.

PART 2 - PRODUCT

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Lime Slurry System
 - a. Burnett Lime Company

2.2 LIME SLURRY TANK

- A. Tank with baffles shall be single compartment, welded steel reinforced top, having a nominal capacity of 16,000-gallons and a maximum diameter of 12 feet.
- B. Tank shall be fabricated using steel as specified by ASTM A36.
- C. Tank design shall be in accordance with AWWA D100 with minimum top and bottom plate thickness of 1/4" and minimum wall plate thickness of 1/4".
- D. Tank appurtenances shall be as follows:
 - 1. 12" mixer mounting nozzle (top)
 - 2. 24" atmospheric manhole / inspection port (top)
 - 3. 24" manhole (3-1/2 feet above bottom)
 - 4. Two 6" nozzle (pump suction, 9" above bottom)
 - 5. 3" nozzle (drain, 2" above bottom)
 - 6. 4" threaded connection (overflow, 6" below top)
 - 7. 2" nozzle (spare, top)
 - 8. 6" nozzle (level sensor – 18" off wall, top)
 - 9. 2" nozzle (water fill, top)
 - 10. 2" nozzle (slurry fill, top)
 - 11. 3" nozzle (re-circulation)
 - 12. Six Anchor lugs
 - 13. Ladder, ladder cage, and full tank perimeter handrail (carbon steel)
 - 14. Standoff pipe supports and clamps (maximum 8 feet on center for overflow, slurry, and water lines)
 - 15. Two Lift lugs
 - 16. 2" Fill pipe with quick-connect
 - 17. 4" Overflow pipe
 - 18. Six 1" diameter stainless steel anchors furnished and installed by Burnett
- E. Surface Preparation and Painting.
 - 1. The exterior of the tank dome, wall, and appurtenances shall be prepared by commercial sandblast followed by one coat of Tnemec Series N69 self-primer by Tank Manufacturer. Field painting, by **General Contractor**, of exterior tank dome and wall per specifications by Tnemec Co.
 - 2. **Tank Manufacturer** shall coat the bottom of the tank with coal tar epoxy.

2.3 PUMP ENCLOSURE

- A. The pump enclosure shall be a nominal 10'-4" x 10'-6" metal building with the tank shell forming one wall. The minimum clear height of the enclosure shall be 8'.
- B. The pump enclosure building shall be (Stainless Steel Frame 2" Square Tube) with 3" vinyl backed insulation. The 26-gauge exterior wall panels, roof panels, and flashings shall be coated with a factory finish of Valspar Corporation Polar White PMW1614 (MBCI Signature 200) minimum .8 mil over a minimum .2 Valspar Corporation Dynaprime primer.

- C. The enclosure accessories shall include:
1. One 36" by 84" access door with stainless steel hardware.
 2. One 1500-watt UL-listed heater with thermostat/on-off switch as manufactured by Marley CZ1512-T.
 3. One 115-volt fan having minimum free air capacity of 524 CFM. The fan shall be thermostatically controlled. The fan shall be fitted with a wire guard and removable interior vent door. Provide manually adjustable FRP air intake vent with FRP screen. The exhaust fan shall be Dayton Model 1BLH6.
 4. Interior lighting shall be by one, 4-foot long, surface-mounted LED fixture controlled by weatherproof interior switch.
 5. Provide one 120-volt interior GFI Type outlet with gasketed, spring-loaded cover.
 6. All process equipment, instruments, panels, lighting, heater, ventilation, switches, and outlets shall be pre-wired by the equipment supplier and shall only require a single point 480V-3phase input power connection, supplemental grounding, and an Ethernet SCADA network connection by the electrical contractor. All lighting, heater, ventilation, switches, and outlets shall be pre-wired using 3-wire, color-coded, #12 THHN copper wire in PVC Schedule 80 conduit.
- D. Provide lime system tank and pump enclosure with grounding lugs.

2.4 CONTROLS

- A. Lime System Control Panel (LCP-LS-1)
1. Refer to Specification Section 26 29 00 ("Manufactured Control Panels") for additional control panel requirements.
 2. All motor starters, relays, and devices for the control and operation of the equipment shall be housed in a control panel mounted in the pump enclosure. A PLC within the Control Panel shall provide remote signal/equipment interface with the plant system via **Owner/Contractor** provided Ethernet cable.
 3. The CAL~FLO[®] Lime Slurry system with PLC is designed to be a stand-alone manually operated self-contained lime delivery system or may be remotely operated from a plant SCADA System via Ethernet cable provided by the **Owner/General Contractor** to the **Burnett** supplied Allen-Bradley Micro 800 series PLC (with Ethernet port) in the Control Panel. A list of addresses will be provided to the HMI Programmer for status display/control. Remote input to the lime system is necessary for the stroke adjustment (0-100%). This stroke adjustment is generally calculated by the plant's own Supervisory PLC/HMI system, based on flow rates, pH, anticipated lime needs, etc. as a 0-100% value of stroke adjustment. The CAL~FLO[®] Lime Slurry System PLC shall be Micro 800 series as manufactured by Allen-Bradley.
 4. Power Supply: The **Owner/General Contractor** shall provide a 480 VAC, three-phase power feed to the flange-mounted circuit breaker located in the lime system control panel. All controls shall operate on 24 VDC maximum. A 3000 VA control

power transformer with primary and secondary over current protection will be provided.

5. Enclosure: NEMA 4X 304 SS, bottom entry, flange-mounted disconnect. A grounding lug is provided within the panel to assure positive system ground.
6. Components
 - a. Circuit Breaker: Isolation Breaker for the Panel shall be a 60 Amp Type M breaker /ITED 43B060L equal.
 - b. Starters and Motor protection: Motors will be controlled and protected by Allen-Bradley Model 100-C and 140M-C2, Type E self-protected manual starters with adjustable amperage breakers. Motor Protection shall conform to IEC Circuit Breaker requirements as defined by IEC 947-2 and UL/CSA listed.
 - c. Relays: Relays shall be general-purpose control type, 10 amps, 600-volt reversible contacts. Relays shall be equal to Allen-Bradley Type 700H.
 - d. Selectors: 30.5 mm, NEMA 4X rated; contacts shall be rated 10 amps continuous, 6 amps breakers at 24 VDC, manufactured by Allen-Bradley, Type 800H.
 - e. Weatherproof Horn: Horn shall generate a loud audible alarm when activated by 24 VDC power. The horn shall surface mount with sealable side conduit entry and shall be rated for NEMA 4X. Horn shall be equal to Federal, Model 450E and will be mounted on the exterior of the Pump Enclosure.
 - f. Indicator Lights: Provide 30.5 mm PTT transformer type LED indicator lights as equal to Allen-Bradley type 800H.
 - 1) Green: Run
 - 2) Amber: Fault and Low Level
 - 3) Red: High/Low Pressure, High Level, and Re-ordered.
 - 4) White: Power On
7. Panel Construction: Terminal strips will be numbered for all field-wiring terminations.
8. Engraved Nameplates: Engraved nameplates with white background and black letters on all front panel-mounted devices.
9. Surge Protection: AC power wiring shall be protected against lightning spikes and other transient surges at control panel. Protection shall be as manufactured by Siemens TPS series.
10. Cater pump control shall be provided for managing the high- and low-pressure status of each lime slurry pump. A red indicator light for high/low pressure alarm

and the Red Lion digital readout are located on the door of the lime control panel LCP-LS-1. Pressure shall be read by the system PLC.

B. LEVEL INDICATOR TRANSMITTER (LIT-1)

1. Lime level control shall be the Milltronics MultiRanger tank level transmitter and indicator. The level indicator will be utilized to produce an audible high-level alarm located on the exterior of the pump enclosure and high level, low level, and re-order indicator lights are located on the exterior of the system control panel. Level signal may be obtained by the plant supervisory system through the lime system PLC.
2. Panel Enclosure shall be a polycarbonate enclosure rated NEMA 4X located in the pump enclosure.
3. The level transducer/transmitter shall be a 6" flange mounted Model XPS15 transducer as manufactured by Milltronics.

2.5 TANK MIXER

- A. The tank mixer shall be vertical, flange mounted with two axial flow and one radial flow impeller sized and positioned to maintain a homogenous mixture of up to 30% Lime Slurry at ambient temperature. Mixer shall be suitable for operation in a 12' diameter by 19' straight shell atmospheric tank.
- B. The motor shall be furnished by Tesco, Inc. specifically for direct mounting to gear reducer. Motor shall be a TEFC, Frame, with a severe duty canopy with the following characteristics:

Horsepower: 7.5
Maximum Speed: 1750 rpm
460 volt, 3-phase, 60 Hz
Continuous Duty
TEFC

- C. A local mixer disconnect switch is located within visible sight of the mixer motor and the top entrance manway to the tank. All tank-mounted conduit shall be PVC schedule 80.
- D. The speed reducer shall be designated for mixing service and operation in an outdoor environment.
- E. The speed reducer shall be constructed and supported so that the shaft deflection, caused by operation loads, does not affect alignment of the anti-friction bearings or cause misalignment of gearing during mixer operation.
- F. All reducer bearings shall be severe duty, anti-friction type, oil or grease-lubricated. The speed reducer shall be splash lubricated, by means of gears or a slinger rotating on a horizontal shaft in an oil bath, to ensure positive displacement of the oil upward for lubrication of critical bearings. A single oil drain shall be provided at the low point of

the speed reducer to allow oil drainage and leave a maximum residual of oil of no more than 1/4" in the drive housing.

- G. The shaft and impellers shall be carbon steel. The maximum operating speed of the unit shall be 0.5 times the natural frequency of the shaft and impeller assembly. The shaft diameter shall be determined by an analysis of torque and bending moment as well as critical speed. Minimum shaft diameter shall be 2.75". The shaft supporting the turbine shall be removable from the speed reducer without disturbing the gears of the speed reducer using a rigid flange coupling on the impeller shaft.
- H. The mixer shall be Tesco Model LSM-16-20 with Nord motor and gear reducer.

2.6 SLURRY METERING PUMPS

- A. Metering Pumps shall be a tubular diaphragm type. Pumps shall have a minimum turndown ratio of 10 to 1 by variation of the stroke of the pump. Capacity shall be adjusted by manually changing piston stroke length or by automatic stroke adjustment.
- B. For CAL~FLO® Lime Slurry Systems with a System PLC, the pump selector switch is placed in Auto, ready to receive a remote input signal (0-100%) from the remote plant integration system to the Lime system PLC via Ethernet interface provided by the **Owner/General Contractor**. The CAL~FLO® system PLC shall send the 4-20mA corresponding input to the metering pump to adjust the stroke length 0-100 percent and provide an output signal back to the CAL~FLO® System PLC for monitoring. Remote connection via Ethernet cable provided by **Owner/General Contractor**.
- C. The motor shall be Baldor as required by pump size and shall have the following characteristics:
 - Horsepower: 1/3 or 1/2
 - 460 volt, 3-phase, 60 Hz
 - TEFC: Continuous Duty
 - Service Factor 1.15
- D. Pumps shall be mounted on a stainless-steel pump stands and secured to the pump platform of the enclosure.
- E. Pumps shall be Pulsafeeder Model PULSAPRO® 680 or 880.

2.7 CHEMICAL FEED LINES

The slurry feed lines shall be accessible in a PVC conduit (conduit provided by the **Owner/General Contractor**). The feed tubing to the Feed Point shall be either 1/4", 3/8", 1/2", 5/8" or 3/4" ID clear flexible reinforced PVC hose (as determined by manufacturer) and shall be equal to Kuri Tec Series #K3150 or Nylobrade®.

2.8 VALVES AND APPURTENANCES

- A. Water isolation valves shall be true union PVC ball valves.
- B. Automatic flush valves shall be true union 3-way actuated stainless steel ball valves.

- C. Provide one ¾-inch hose bibb on water supply header.
- D. Isolation valves for liquid lime service shall be 2" flanged, pinch valves, ONYX Controls or equal. There are two limit switches on all pinch valves. One limit switch is interlocked in the pump run circuit to assure positive position of the valve for pump protection. The second limit switch is to provide indication to the PLC.
- E. Water meter shall be 2", positive displacement AWWA approved water meter with pulse output. The water meter shall have maximum range of 170 gpm.

2.9 INSTRUMENTATION

- A. Level transducer/ transmitter shall be a 6" flange mounted transducer as manufactured by Milltronics model XPS15. The level display Milltronics MultiRanger shall be mounted near the control panel.
- B. A pressure transducer /transmitter shall be as manufactured by Endress-Hauser and provided for each pump discharge line. Red Lion Indicators shall mount in the door of the control panel and receive the pressure signal.
- C. A Dilution Water Control Panel (DWCP) shall be mounted near the water meter consisting of a NEMA 4X Enclosure housing a Red Lion PAXI digital readout and a start/pause pushbutton Allen-Bradley Model 800H. Connection shall be made to the Water Meter.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Supplier shall furnish a qualified factory-trained field technician for equipment check, start up and instruction of operating personnel on proper operation and maintenance of the equipment, with a maximum of one eight hour day at the jobsite in one trip.
- B. Installation inspection, start-up and operator instruction shall be coordinated with the Installing Contractor. All equipment must be in operating condition and ready for Supplier's Field Technician when called to the project location.
- C. Effluent quality laboratory analysis shall be provided by the Owner.
- D. The Contractor is responsible for purchasing and coordinating delivery of the first liquid lime shipment from Burnett Lime.

3.2 FIELD FINISHING

- A. Provide sufficient paint to touch up pump as necessary after installation. Paint according to requirements in Section 9 "Painting".

3.3 START-UP ASSISTANCE AND TRAINING

- A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
1. Factory authorized service representatives of the manufacturer shall perform all necessary on-site assistance for installation supervision.
 2. Once the aerators have been installed correctly and are operating as intended, the service representatives shall perform eight (8) hours of on-site start-up assistance and operator training.
 3. Train Owner's maintenance personnel on procedures and schedules related to troubleshooting, servicing, and preventive maintenance.
 4. Schedule training with Owner with at least seven days' advance notice.

END OF SECTION 44 42 19.05