

**RFP**  
**City of Clare**  
**Wastewater Treatment Plant Maintenance - Ultraviolet Disinfection**  
**Replacement**  
**Manufacturer Request for Proposal (RFP)**

Sealed Bids for the construction of the Wastewater Treatment Plant Maintenance – Ultraviolet Disinfection Replacement will be received by the **City of Clare**, at the Water Treatment Plant located at **202 West Fifth Street Clare, MI 48617**, until **3:00 PM** local time on **Wednesday August 17, 2022**, at which time the Bids received will be publicly opened and read.

Mail or Deliver Sealed Proposals to:

Wastewater Treatment Plant Maintenance – Ultraviolet Disinfection Replacement  
Department of Public Services  
Attention: Dale Clark, Director of Water Treatment  
City of Clare  
202 West Fifth Street  
Clare, MI 48617

Direct all questions to City Engineer:

Jennifer Hodges, P.E.  
Gourdie-Fraser, Inc.  
123 W Front Street  
Traverse City, MI 49684f  
[jennifer@gfa.tc](mailto:jennifer@gfa.tc)  
231-946-5874

General Scope:

We have been asked by our client, City of Clare to provide this request to qualified contractors and request for proposal to complete the following work:

The project would consist of purchase, installation and testing to replace three (3) existing ultraviolet disinfection units that are located in the basement of Lab/Office building at the existing Wastewater Treatment Plant (WWTP) located at 11175 S Eberhart Ave, Clare, MI 48617. The information contained below are the specific qualifications each contractor must meet in order to provide an accurate proposal. Attachments including site photos, technical specifications and drawings are included for reference.

Background:

City of Clare owns and operates an onsite WWTP capable to treat 1.3 million gallons per day of sewage. The plant is a full functioning facility providing influent, screening, secondary and tertiary treatment of sewage collected from the residents of Clare. The plant is regulated under NPDES MI0020176 for surface water discharge into the South Branch Tobacco River of the treated effluent.

### Design Requirements

#### Standards:

- All materials and their construction and installation shall conform with applicable provisions and recommendation of the following: ASTM, NEC, NEMA, OSHA, AWS, UL, and "Municipal Wastewater Disinfection" US EPA Design Manual.

### Requirements - General:

- Work must comply with all applicable federal, state, and local laws and regulations
- All equipment shall be installed compliant with manufacturers recommendations
- Contractor shall be responsible for obtaining all local regulatory permits (including fees) which may include plumbing, electrical and mechanical
- Date of completion to be within 20 days of equipment delivery as coordinated with the City Engineer and City Staff.
- Provide in addition to all other equipment factory warranties, a (1) year full labor and material warranty on all workmanship, material and equipment furnished for this project.
- Prospective bidders may conduct a site visit prior to bidding although not required. Coordinate with the City for site access:  
-Dale Clark, WWTP Director - (989) 386-2321

### Terms of Agreement:

The contractor shall agree to the above terms and conditions stipulated and will certify that their equipment will be able to operate under the requirements that have been stated above. The contractor shall include the following in addition to price with their submitted proposal:

#### General:

- To hold bid open for 30 consecutive calendar days from the bid due date
- To enter into and execute a contract with City of Clare
- References:  
-Provide minimum of three (3) references of similar municipality projects located within the Michigan and have been completed within the last five (5) years.

#### Insurance:

- Contractor will have Worker's Compensation Insurance in limits required by state law and Comprehensive General Liability Insurance coverage in force for all of its operations under this contract. City and GFA shall be listed as additional insureds on policy

#### Bonds:

- The Contractor shall include in the proposal price the cost to provide the following:
  - Performance and Payment Bond in the amount of 100% of the proposal amount.
  - Maintenance and Guarantee Bond in the amount of 50% of the proposal amount, guarantying for a period of one (1) year from final acceptance of the project work

– Letter of Surety and licensed to do business in the State of Michigan.

**Start-up and Training:**

- Provide two (2) days for start-up and training services.

**Shop Drawings / Operation and Maintenance Submittals:**

- Provide one hard and one pdf copy of material specification sheets, O&M manuals and warranty information to City Engineer. Do not proceed until written approval is received

**Warranty:**

- A minimum one (1) year from date of start-up warranty

**Services / materials to be provided:**

Contractor shall provide all equipment and materials necessary to complete the work described herein. The scope of work shall include but shall not be limited to the following. Refer to the attached Drawings and Technical Specifications for additional information.

- Procurement and installation of three (3) closed vessel ultraviolet disinfection units and associated components. Refer to attached material specifications. All equipment to be installed compliant with manufacturer recommendations, refer to specifications that are attached. Any concrete work, patching, electrical work, painting, etc. to facilitate installation shall be included.
- Existing and Proposed drawings are attached for reference. Contractor shall be responsible to field verify all conditions prior to beginning work.
  - Final location of equipment to be same as existing location, placement and orientation must be coordinated and approved by the City and Engineer prior to completing.
  - Replacement is intended to be in-kind and fit within the existing constraints of the channel. Contractor is responsible to field verify and measure in addition to completing any modifications to facilitate new installation including but not limited to electrical service, wiring upgrades, concrete pad adjustments, etc.
- Provide for the complete removal of three (3) UV units and accessories including disposal and cleanup. All items to be salvaged shall be coordinated with the DPW
- Provide and install all required or necessary NEC compliant wiring, conduit, junction boxes, terminations for a complete installation of ultraviolet disinfection units.
  - Updates to existing power supply. Including additional conduit and power supply / control wiring to accommodate operation and compliance with NEC.
  - All conduit to be installed shall be corrosion resistance (PVC) and will be mounted using S.S. brackets.
- SCADA programming as completed by Perceptive Controls (Ryan Fisher, 269-207-4207)
- Any wall work, coring, patching, etc., shall be included.
- Provide factory and field authorized training and start-up.
- Mobilization, site access and storage of equipment and restoration and cleanup
- Coordination of delivery and unloading of new equipment.
- Contractor shall conduct all work so as to not interfere with the existing treatment system operations.
- Coordination with City Staff and consultants

**Services / Materials Not To Be Included:**

- Site accessibility, power and potable water supply (provided by owner).
- Contractor shall be responsible to coordinate and provide construction schedule and minimum 24 hour notice before completing work.

**Contractors Proposal Form**

Bidders are instructed to submit bids for this project on a unit cost basis as stated in the Proposal. All labor, materials and equipment are considered incidental and to be included in total bid price. All work shall be performed in compliance with the terms identified in the RFP and applicable laws.

NO.	ITEM DESCRIPTION	EST QTY	ITEM UNIT	UNIT PRICE	ITEM COST
1	Mobilization	1	LS		
2	Closed Vessel Ultraviolet Disinfection Unit	3	EA		
3	12" DI Piping, Valves and fittings	1	LS		
4	Automatic Lamp Cleaning System	3	EA		
5	Electrical Upgrades	1	LS		
6	SCADA Programming	1	LS		
7	Site Cleanup	1	LS		
TOTAL BID					

\_\_\_\_\_  
Bidders Signature

\_\_\_\_\_  
Printed Name:

\_\_\_\_\_  
Business Name:

\_\_\_\_\_  
Address:

\_\_\_\_\_  
MI Contractor License No.:

\_\_\_\_\_  
Telephone:

\_\_\_\_\_  
Cell Phone:

\_\_\_\_\_  
Email:



The Owner may make such investigations as deemed necessary to determine the ability of the Bidder to perform the Work and the Bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any / all bids if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the work as requested.

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***USDA, Assistant Secretary for Civil Rights  
Office of the Assistant Secretary for Civil Rights  
1400 Independence Avenue, S.W. Stop 9410  
Washington, DC 20250-9410***

***Or call toll free at (866) 632-9992 (English) or (800) 687-8339 (TDD) or (866) 377-8642 (English Federal-relay) or (800) 845-6136 (Spanish Federal-relay). USDA is an equal opportunity provider, employer, and lender”***



Engineering  
Surveying  
Testing &  
Operations

123 West Front Street  
Traverse City, Michigan 49684  
231.946.5874   
231.946.3703 

# TECHNICAL SPECIFICATIONS FOR

## ULTRAVIOLET DISSINFECTION SYSTEM



GFA PROJECT NO.: 21309  
DATE: July 2022

**PROJECT SPECIFICATIONS  
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**CITY OF CLARE SPECIFICATIONS**

<b>SECTION 1</b>	GENERAL REQUIREMENTS
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## SECTION 09900 - PAINTING

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
  - 1. Exposed exterior items and surfaces.
  - 2. Exposed interior items and surfaces.
  - 3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Painting includes field painting of exposed masonry, concrete, gypsum board, wood, pipes, hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
  - 1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

#### 1.02 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
  - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
  - 2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
  - 3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
  - 4. Semi-gloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
  - 5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

#### 1.03 SUBMITTALS

- B. Product Data: For each paint system specified. Include block fillers and primers.
  - 1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
  - 2. Manufacturer's Information: Provide manufacturer's technical information, including instructions for handling, storing, and applying each coating material proposed for use.

- C. Samples for Selection: Manufacturer's color charts showing the range of colors available for each type of finish-coat material indicated. Owner will supply general color scheme.

#### 1.04 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
  - 1. Product name or title of material.
  - 2. Product description (generic classification or binder type).
  - 3. Manufacturer's stock number and date of manufacture.
  - 4. Contents by volume, for pigment and vehicle constituents.
  - 5. Thinning instructions.
  - 6. Application instructions.
  - 7. Color name and number.
  - 8. VOC content.
- B. Store materials, not in use, in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
  - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

#### 1.06 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F (7.2 and 35 deg C).
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
  - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Products manufactured by Benjamin Moore & Co., PPG Industries, Inc., Sherwin-Williams Co., and TNEMEC will be considered acceptable.

### 2.02 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block filters, primers, undercoats, and finish-coat materials that are compatible with one another and the substrate and under actual service conditions, as demonstrated by manufacturer testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
- C. Colors: Provide colors as selected by the Owner from manufacturer's full range of standard colors.

## PART 3 – EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
  - 1. Notify the Owner about anticipated problems using the materials specified over substrates primed by others.

### 3.02 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to

manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and re-prime.
  2. Cementitious Materials: Prepare concrete and masonry surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grout, and oils.
  3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
    - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood.
  4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances.
    - a. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    - b. Touch up bare areas and shop-applied coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
  5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
  2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
  3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

### 3.03 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
  2. Provide finish coats that are compatible with primers used.
  3. Paint surfaces behind movable equipment and furniture the same as similar



- exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
4. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
  5. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, then sand between applications.
  2. Omit primer on metal surfaces that have been shop primed and touchup painted.
  3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
  4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
  2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
  3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer, or as specified herein, whichever is greater.
- E. Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers, and supports.
  2. Motors and mechanical equipment not factory finish painted.
  3. Accessory items.
  4. Miscellaneous structural supports.
- F. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
  2. Electrical equipment not factory finished painted.
- G. Block Fillers: apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

- H. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
- I. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

### 3.04 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
  - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

### 3.05 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Engineer.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
  - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.06 EXTERIOR PAINT SCHEDULE

- A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
  - 1. Low-Luster Acrylic Finish: 2 finish coats over a rust-inhibitive primer.
    - a. Primer: Rusts-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).
    - b. First and Second Coat: Low-sheen (eggshell or satin), exterior, acrylic-latex paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).

### 3.06 INTERIOR PAINT SCHEDULE

- A. Concrete Masonry Units: Provide the following finish systems over interior concrete masonry block units:
  - 1. Semi-gloss-Alkyd-Enamel Finish: 2 finish coats over an undercoat and a filled surface.
    - a. Block Filler: High-performance, latex-based, block filler applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 5.0 mils (0.13 mm).

- b. Undercoat: Interior, alkyd-or latex-based, enamel undercoater, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
    - c. Finish Coat: Odorless, semi-gloss alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).
- B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
  - 1. Eggshell, Alkyd-Enamel Finish: 2 finish coats over a primer.
    - a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
    - b. First and Second Coats: Odorless, semigloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).
- C. Woodwork: Provide the following paint finish systems over new, interior wood surfaces:
  - 1. Semi-gloss, Alkyd-Enamel Finish: 2 finish coats over a primer.
    - a. Primer: Alkyd or latex-based, interior enamel undercoater applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
    - b. First and Second Coats: Odorless, semi-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils (0.061 mm).
- D. Ferrous Metal: Provide the following finish systems over ferrous metal:
  - 1. Semi-gloss, Alkyd-Enamel Finish: One finish coat over an enamel undercoater and a primer.
    - a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).
    - b. Undercoat: Alkyd, interior enamel undercoat or semi-gloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
    - c. Finish Coat: Odorless, semi-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils (0.036 mm).
- E. Zinc-Coated Metal: Provide the following finish systems over zinc-coated metal:
  - 1. Semi-gloss, Alkyd-Enamel Finish: One finish coat over an undercoat and a primer.
    - a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than

- 1.2 mils (0.031 mm).
- b. Undercoat: Alkyd, interior enamel undercoat or semigloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
- c. Finish Coat: Odorless, semigloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils (0.036 mm).
- d. Iron Removal Filter: Refer to manufacturers painting requirements. Submit to Engineer for approval.

### 3.07 WATER MAIN COLOR SCHEME

- A. Piping Color Coding and Labeling for piping (by Contractor). Labeling shall include name of liquid/gas on pipe and arrows indicating direction of flow.

- 1. Waste Lines:
  - a. Sewer (Sanitary or other)                      Gray

END OF SECTION 09900

## SECTION 11397 – CHAMBERED ULTRAVIOLET DISINFECTION SYSTEM

### PART 1 GENERAL

#### 1.01 SCOPE OF WORK

- A. Furnish, install, test and put into operation closed vessel, gravity flow low-pressure, high output (non amalgam), self-cleaning ultraviolet (UV) light system (SYSTEM) for the disinfection of wastewater, complete, in place as shown on the Drawings and as specified herein.
- B. The EQUIPMENT SUPPLIER shall furnish all components of the SYSTEM as specified herein, including:
  - 1. Three (3) Horizontally oriented self cleaning disinfection chamber with inlet and outlet matching existing piping.
  - 2. Three (3) Ballast Control Center (BCC)
  - 3. One (1) Air Compressor for automatic cleaning system
  - 4. One (1) System Control Center
  - 5. One (1) Set of spares
- C. The EQUIPMENT SUPPLIER shall provide the following services to ensure the safe and efficient operation of the SYSTEM:
  - 1. SYSTEM commissioning and installation inspection
  - 2. SYSTEM startup
  - 3. Operator training
- D. The CONTRACTOR shall furnish all labor, materials, equipment and appurtenances required to install, test and place into satisfactory operation the SYSTEM furnished by the EQUIPMENT SUPPLIER, including, but not limited to:
  - 1. Mechanical installation of SYSTEM components, anchor bolts, air piping, air piping supports, fittings, valves and appurtenances.
  - 2. Electrical installation of SYSTEM components, motor control centers, motor starters, MCC breakers, transformers (unless specified), raceways, fittings, conduits and cable trays, wires and cables (unless specified), panel boards, grounding systems, power factor correction capacitors, surge protection.

#### 1.02 QUALITY ASSURANCE

- A. All SYSTEM components shall be supplied to the CONTRACTOR by a single EQUIPMENT SUPPLIER.
- B. The EQUIPMENT SUPPLIER shall have at least five (5) years experience in furnishing UV systems of similar design to the equipment specified herein. As part of their submittal package, the EQUIPMENT SUPPLIER shall submit following documentation:

1. Evidence that UV systems of similar design have been in successful operation for at least two (2) years in at least five (5) separate installations. Provide location of installation, contact person name and phone number, capacity of generation system and year installed
- C. The ultraviolet disinfection system shall be as manufactured by Glasco UV or approved equal and shall only incorporate low pressure lamp technology (no amalgam systems will be acceptable).
- D. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
  1. American Society for Testing Materials (ASTM)
  2. National Electric Code (NEC)
  3. National Electrical Manufacturer's Association (NEMA)
  4. Occupational Safety and Health Association (OSHA)
  5. "Municipal Wastewater Disinfection" US EPA Design Manual, EPA/625/1-86/021
  6. American Welders Society (AWS)
  7. Underwriter's Laboratories (UL)
- E. Manufacturer's Representative
  1. The services of a full-time employee of the EQUIPMENT SUPPLIER shall be provided on the project site as the EQUIPMENT SUPPLIER representative. The representative shall have complete knowledge of the SYSTEM including proper installation, operation and maintenance.
  2. The EQUIPMENT SUPPLIER'S representative shall inspect the installation and supervise any required modifications, additions, or other changes required to allow the EQUIPMENT SUPPLIER to certify that the complete installation is appropriate and is expected to operate as expected.
  3. The EQUIPMENT SUPPLIER'S representative shall instruct the OWNER and ENGINEER'S personnel on the operation and maintenance of the SYSTEM. The instruction shall include classroom training on UV Technology and the specific installation, and field training on proper operation and maintenance procedures, along with complete demonstration of the same.
  4. The EQUIPMENT SUPPLIER'S representative shall provide minimum services in accordance with the following table:

<u>Purpose</u>	<u>No. of Days</u>
Startup and Functional Testing	1
Operator Training	1
  5. The number of days indicated above shall be provided on an 8-hour day on-site basis.

### 1.03 SUBMITTALS

- A. The EQUIPMENT SUPPLIER shall submit complete shop drawings to establish compliance with this section. Submittals shall include the following and all other information requested in other paragraphs of this specification section for approval:
  1. Manufacturers Data - The following information shall be submitted to the engineer as required by this specification:
    - a. Complete description of equipment being proposed in sufficient detail to permit a thorough comparison with this specification

- b. UV system equipment layout including chamber dimensions and installation requirements
    - c. Electrical schematics and enclosure dimensions
    - d. Documentation on cleaning and maintenance requirements of the equipment
    - e. Manufacture's literature including cut sheets on all components and accessories.
  2. Nominal average intensity within each chamber.
  3. Retention time of effluent within each chamber.
  4. Maximum headloss through each module at peak flow conditions.
  5. Control Panel ladder diagrams.
- B. Design Data
  1. Supporting documentation from the US EPA UV DIS calculations or manufacturers' bioassay demonstrating that the dose required in the performance section is being met or exceeded. Only bioassay results using MS2 phage or similar bacteria shall be acceptable as a means of determining dosage and validating the calculations.
- C. The EQUIPMENT SUPPLIER shall submit three (3) copies of complete Instructions Manuals with detailed operation and maintenance data for each component of the SYSTEM. The instructions manual shall include:
  1. Safety Precautions
  2. Protective Equipment and Clothing
  3. Technical Data, including detailed descriptions of SYSTEM operation, and each component.
  4. Installation data, procedures and recommendations
  5. Operation instructions, including startup and shutdown procedures and sequence.
  6. Service and Maintenance data, include all information and instructions required by plant personnel to keep equipment properly cleaned, lubricated and adjusted so that it functions economically throughout its full design life
  7. Illustrations
  8. Project Parts List
  9. Name, address and phone number of manufacturer and manufacturer's local service representative.

#### 1.04 SPARE PARTS AND SPECIAL TOOLS

- A. Included in the proposal, the EQUIPMENT SUPPLIER shall furnish spare parts required to ensure adequate operation of the SYSTEM. Spare parts shall include as a minimum:
  1. Two (2) UV lamps
  2. Two (2) Quartz sleeves
  3. Two (2) ballast
  4. Six (6) wiper rings
  5. Six (6) oring seals
- B. The EQUIPMENT SUPPLIER shall furnish all special tools required for the proper installation, operation and maintenance of any component of the SYSTEM.
- C. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the CONTRACTOR at the completion of the contract.



## 1.05 DESCRIPTION OF SYSTEM

A. The equipment specified herein shall be low pressure high output UV light disinfection equipment designed to reduce the fecal coliform microorganisms of a domestic, wastewater with UV influent characteristics as specified in Paragraph 1.05C so that the final effluent shall meet the final effluent discharge conditions as specified in Paragraph 1.05E. The UV systems shall be hydraulically rated for 0.65 MGD peak flow per chamber, and shall provide a minimum dose of 30,000 uWs/cm<sup>2</sup> at this peak rate.

B. The lamp array configuration shall be horizontal, with a uniform staggered array, with all lamps parallel to each other and parallel to the flow.

## C. Influent Characteristics to Disinfection

1. The UV disinfection system shall be designed to disinfect at the flow rates and with the characteristics shown below per chamber:

a. Peak Flow (MGD)	0.65
b. Minimum Flow (MGD)	0
c. Total Suspended Solids (mg/L)	<30
d. BOD (mg/L)	18 (average) / 31 (peak)
e. UV Transmittance @ 253.7-nm	65%
f. Wastewater Temperature (°F)	32-113
g. Fecal Coliform Concentration (MPN/100 mL)	126 colonies /100ml
h. Maximum Residual Iron Concentration (mg/L)	0.5

## D. UV Chamber Configuration

1. The minimum design requirements of the UV system supplied shall be as follows:

a. Number of UV Chambers	3
b. Number of UV lamps per chamber	12
c. Total Number of Lamps	36
d. Lamp type	Low pressure high output
e. UV lamp wattage	155
f. Minimum UVC Lamp Output (W)	52
g. Number of UV Intensity Sensors per chamber	1
h. Chamber Dimensions (approximate)	
i Channel Length (Inlet to Outlet C/L)	68"
ii Chamber Diameter (in)	12"
iii Chamber Height (in)	Match existing piping
iv Flange type (in)	Match existing piping
v Space required for lamp removal	80"

## E. Bacteriological Inactivation Requirements

1. Flow Characteristics	
a. Number of chambers in Service	3 (2 normal, 1 backup)
b. Maximum flow per unit	0.65 US MGD
2. Fecal Coliform Testing Criteria	
a. 30 Day Geometric Mean of Daily Samples	126 MPN/100 mL

## F. System Performance

1. The end of lamp life UV dose produced by the system shall not be less than 30,000 uWs/cm<sup>2</sup> in an effluent with 65% UV transmittance @ 253.7-nm. Lamp output must be at least 90% of initial level after 12,000 hrs of operation and with no fouling on the quartz sleeves.
2. The system design shall be based on the US EPA UV DIS calculations with the following criteria:
  - a. UV transmission (T10) 65%
  - b. UV Lamp End of Life Factor 90%
  - c. Quartz Sleeve Fouling Factor 90%  
(based on clean sleeves)

## PART 2 PRODUCTS

## 2.01 MATERIALS AND EQUIPMENT

## A. General

1. The UV disinfecting system shall be furnished complete with UV disinfection chamber, Ballast Control Center (BCC), UV intensity monitoring system and automatic wiping system.
2. All metal components exposed to or in contact with plant effluent, including all anchoring hardware, shall be Type 316L SS. All materials exposed to UV light shall be unaffected by prolonged exposed to same and shall be Type 316L SS, Type 214 quartz, Viton, EPDM or Teflon.
3. All metal components not in contact with plant effluent and/or UV light shall be Type 304L SS.
4. The UV system shall be able to continuously provide disinfection while replacing UV lamps, quartz sleeves, and ballasts and while cleaning the UV lamp sleeves.
5. The UV system will be designed to match the existing elevations, and centerlines of the equipment that is being replaced

## 2.02 ULTRAVIOLET LAMPS

## A. The UV lamps shall be low-pressure high output UV lamps.

## B. UV Lamps shall have the following characteristics:

1. Lamp shall be low-pressure high output with a UV output per lamp of 52 watts and lamp input of 155 watts.
2. Lamps shall be low-pressure high output mercury slim line type of the pre-heat design with a 4-pin connection at one end.
3. Lamps shall be equal to or exceed the performance of type GH064T5L 155 watt.
4. Medium pressure lamps shall not be acceptable.

## C. Lamps shall have electrical connections at one end with four pins per connection and shall be dielectrically tested for 2,500 volts. Lamp bases shall be of ceramic construction resistant to UV and ozone. Lamp socket should also be of ceramic construction resistant to UV and ozone and should be of a multi level (step) design to prevent arcing. Lamp tubes shall be of a material capable of transmitting 94 percent of the radiation produced therein.

- D. Changing lamps will not require removal of the quartz sleeves from the UV lamp chamber. Lamps shall be capable of being replaced by plant operating personnel without tools.
- E. The UV system manufacturer shall guarantee operating life of lamps for a period of 13,000 hours.
- F. Lamps shall be non-ozone producing type.

#### 2.03 QUARTZ SLEEVES

- A. Lamp sleeves shall be type GE TYPE 214 clear fused quartz circular tubing. Sleeves shall be rated for transmission of 94% or more and sleeves shall not be subject to solarization over the length of their life. The nominal wall thickness shall be between 1.0 and 2.0 mm.
- B. Each sleeve shall be open ended and sealed by a lamp end seal and compressed O-ring.

#### 2.04 UV LAMP CHAMBER

- A. The UV chamber shall be fitted in a horizontal position within the existing layout. The UV lamps shall be symmetrically installed to maximize the dosage of UV radiation seen by the wastewater effluent.
- B. The inlet and outlet flanges will be of the Van Stone type – This is a two piece flange with a rotating ring that makes bolt alignment simple
- C. Chamber shall consist of 12 (12) lamps with each lamp placed in its individual quartz sleeve.
- D. Chamber shall be constructed from Type 316L electropolished and passivated stainless steel. Electropolishing shall be inside and outside parts of the vessel.
- E. Chamber shall be constructed in a manner not to allow UV light to radiate. Chambers shall be designed such that operating personnel at the plant can change the lamps and quartz sleeves.
- F. The chambers shall be directly wired to the Ballast Control Centers via a junction box on the top of UV chamber. The J-box shall be wired in a UL watertight flexible conduit and shall be connected to the BCC.
- G. The sleeve nut shall not require special tools for removal.
- H. Automatic Cleaning System
  - 1. The UV chamber shall have an automatic quartz wiping system to allow the protective sleeves to be cleaned on a predetermined basis.
  - 2. Wiping system should be air driven and should be constructed of Type 316 stainless steel (piston and wiper blades).
  - 3. The cleaning system shall be pneumatically driven. A solenoid valve located within the UV module shall control the cleaning stroke.
  - 4. The cleaning system shall integrate a quick stroke approach.

#### 2.05 UV INTENSITY SENSOR

- A. Each chamber shall have one (1) UV intensity sensor.
- B. The sensor shall be enclosed in a watertight stainless steel probe that goes into its own quartz sleeve. Quartz sleeve housing the UV sensor shall be wiped as part of the automatic cleaning process.
- C. Sensor shall be able to be removed without system shut down to clean probe.
- D. The sensor shall be solar blind and shall measure only the germicidal spectrum wavelength (254 nm).
- E. The UV intensity shall be displayed in the window kit through a digital meter with a 0 to 100% output reading.

## 2.06 AIR COMPRESSOR

- A. The SYSTEM SUPPLIER shall provide an air compressor to actuate the automatic cleaning system.
- B. Air compressor shall be oil lubricated type.
- C. Air compressor shall be sized for a minimum air flow of 5 cfm @ 40 psi.
- D. The customer shall independently power air compressor.
- E. Control of the air compressor shall be via pressure switch mounted on the air receiver.
- F. Air outlet shall be ¼" FNPT.
- G. Air compressor shall be v-belt driven.
- H. Accessories
  - 1. Air Receiver
    - a) Air receiver shall be 13 gallon, cast iron construction. [portable 120v]
  - 2. Motor
    - a) Motor shall be 2 HP, 120 VAC, 50/60hz, 1ph – 15 amps
  - 3. The air compressor discharge piping shall include:
    - a) ASME safety valve
    - b) Festo Filter/Regulator
    - c) Norgren Excelon 74 Desiccant Compressed Air Dryer

## 2.07 BALLAST CONTROL CENTER / SYSTEM CONTROL CENTER - ELECTRICAL

- A. The UV electrical control system shall be designed to provide maximum reliability of the UV disinfection system. Plant services and supplies shall be segregated into sensible groups to allow for safe and simple maintenance or servicing whilst ensuring maximum possible disinfection capability is maintained.

All heat sensitive components shall be adequately cooled with dry air utilizing forced or natural ventilation.

Systems that lack positive mechanical heat transfer such as fans (or air conditioning) for the sensitive electronic components are not acceptable.

- B. The Each chamber shall be powered from a single central Ballast Control Center (BCC). Power requirement of **120V, 3ph, 60hz**, 15 amps shall be provided per chamber.
- C. Ballast Control Center (BCC)
  - 1. The BCC shall be a wall mounted stainless steel modified NEMA 4x enclosures with forced air fan cooling. The BCC shall house electronic ballasts that are specially designed for use with low pressure high output lamps. BCC shall be equipped with breakers and power cut of switches.
    - a) Each electronic ballast shall control, operate and display information for low-pressure high intensity lamps.
    - b) Ballasts shall be wired using quick connects and shall be readily removed from the electrical enclosure.
  - 2. Maximum power consumption per chamber shall be 2 kW per chamber.
- D. BCC Controls and Displays  
The BCC shall house and displays the following:
  - a) Electronic ballasts
  - b) Ultraviolet meters
  - c) Temperature monitors
  - d) Electrically held contactors
  - e) Window kit showing the following:
    - i Lamp status – The status of each lamp (on/off) shall be displayed via a dedicated LED. An energized LED will indicate proper functioning of the UV lamp. The LED shall indicate lamp off status when extinguished.
    - ii Running time meter - Each chamber shall have a corresponding non-resettable digital running time meter.
    - iii Digital UV meter
  - f) 4-20 mA output to be configured System Control Center and with existing plant SCADA.

## 2.08 UV CONTROL SYSTEM

- A. UV vessels will be capable of being placed in Hand, Off, or Auto mode.
- B. There shall be one control panel (System Control Center) with an AB Micrologix 1400 PLC that collects signals necessary for each vessel in the disinfection system package.
  - 1. Each I/O module shall have individual fused inputs and outputs to protect and isolate each input or output.
  - 2. PLC shall control the automatic quartz wiping system, provide UV output from the UV sensors, and monitor the temperature of the electronics.
  - 3. The OIT display screen will be menu driven with automatic fault message windows appearing upon alarm conditions
  - 4. PLC will turn units based on signal from flow valves. Each valve will be opened at intervals of .65 MGD flow signal to the valves by others.

5. PLC will control will turn units on via a flow signal by other
    - a) Unit one will come on at any flow from 1 to 0.65 MGD
    - b) Unit two will come on any flow over 0.65 MGD to 1.3 MGD
    - c) Unit three will come on any flow past 1.3 MGD
  6. The lead unit will be switched by the PLC on a time interval so the lamps wear evenly.
  7. The PLC will accept information from the flow control gates and send their status to the plant SCADA (PLC).
- C. The UV control system shall communicate with the plant PLC via an Ethernet/IP network, and Manufacturer shall furnish gateways as needed for compatibility with SCADA communication protocol. All programing and updates to SCADA shall be completed by Perceptive Controls. All controller I/O shall be accessible via the Ethernet network to the Plant Control System, including but limited to:
1. Vessel Status
  2. Vessel Lamp Status
  3. UV Intensity
  4. Minor alarms, to indicate to plant operators that maintenance attention is required:
    - a) Low UV intensity warning
    - b) Individual lamp failure
  5. Major alarms, to indicate an extreme alarm condition in which the disinfection performance may be jeopardized:
    - a) Wiper system inoperable (malfunctioned or blocked)
    - b) Adjacent lamp failure
    - c) Multiple lamp failure.
    - d) Vessel failure:
      - i When a current leakage to ground occurs, or excess current draw.
      - ii If a vessel is unplugged without first being placed in the OFF position.
    - e) Low UV intensity
  6. Elapsed time and run time of each vessel shall be monitored and displayed.
  7. Start/stop cycle per vessel shall be monitored and displayed, in addition a start for the 2<sup>nd</sup> and 3<sup>rd</sup> unit feature to be provided.
  8. The system shall be capable of being placed in manual, auto, or off (HOA switch).
  9. Alarms shall identify the affected lamps by an address system and shall specify the lamp (i.e. Lamp No. ##). Individual lamp status shall be displayed on the operator interface.
  10. The following signals will be calculated at the plant PLC based on other inputs:
    - a) Low UV Intensity Alarm
    - b) Low UV Intensity Warning
  11. The panel manufacturer shall provide a data/memory map to the project's systems integrator which includes all produced tags and coordinated IP addresses as required in order to enable communication between the control panel and the communication network.
    - a) The manufacturer shall be responsible for programming and verifying the IP Addresses, Subnet, and Default Gateways, when applicable, for all devices on the network.

- b) The network IP addresses shall be defined based on the Ethernet Network TCP/IP Addresses provided later

## PART 3 EXECUTION

### 3.01 SHIPPING AND EQUIPMENT DELIVERY

- A. All equipment and materials shall be inspected against approved Shop Drawings at time of delivery. Equipment and materials damaged or not meeting requirements of the approved Shop Drawings shall be immediately returned to the EQUIPMENT SUPPLIER for replacement or repair.
- B. The CONTRACTOR shall handle and store the equipment and materials in a dry location and protect them from the elements according to the manufacturer's instructions.

### 3.02 INSTALLATION

- A. The ultraviolet disinfection equipment shall be installed by the CONTRACTOR in compliance with the manufacturer's recommendations.
- B. Removal of the existing ultraviolet disinfection systems and accessories shall be completed by the Contractor.
- C. The installation of new ultraviolet disinfection systems and accessories shall include coordination and scheduling with the Manufacturer.
- D. Service and scope shall include the following:
  - 1. Field verification and measurements of existing system Provide required cranes, lifts, or forklifts,
  - 2. Removal of existing ultraviolet disinfection systems
  - 3. Installation of the new UV systems, and
  - 4. Installation of all anchorage and grouting as required.

### 3.03 COMMISSIONING AND START-UP

- A. The EQUIPMENT SUPPLIER shall inspect equipment installation, piping and wiring to ensure proper installation of each component in accordance with approved submittals. CONTRACTOR shall make at its own cost any modifications required to meet EQUIPMENT SUPPLIER installation recommendations. A written statement certifying that the equipment has been properly installed and interconnected shall be provided by the EQUIPMENT SUPPLIER.
- B. The EQUIPMENT SUPPLIER shall coordinate commissioning of the system and verify that each component of the SYSTEM is ready for operation. SYSTEM commissioning shall include testing and calibration of each component of the system. A written statement certifying that the SYSTEM has been commissioned and is ready for operation shall be provided.
- C. The EQUIPMENT SUPPLIER shall coordinate initial SYSTEM start-up to ensure operating procedures are followed in accordance with approved submittal's instructions manuals.



### 3.04 START UP TRAINING

- A. The EQUIPMENT SUPPLIER shall provide installation support at the site for a period no less than one (1) 8-hr day. Installation support shall incorporate installation of quartz sleeves, installation of lamps and review of electrical installation.
- B. The EQUIPMENT SUPPLIER shall provide operator training at the site for a period no less than one (1) 8-hr day. Training shall include operation, maintenance and trouble shooting for each component of the SYSTEM.

### 3.05 WARRANTY

- A. The SYSTEM shall be free from defects in materials and workmanship for a period of 12 months from Final Acceptance of the system, or 18 months from shipment, whichever occurs first.
- B. Lamps shall be warranted for a period of 13,000 hours operating time under normal operating conditions.
  - 1. Lamps are warranted on a non pro rated basis.

END OF SECTION.

## SECTION 15110 - VALVES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes butterfly valves located upstream and are associated with the disinfection piping.

#### 1.2 SUBMITTALS

- A. Product Data for each valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.
- B. Maintenance data for valves to be include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

#### 1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.
- B. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set globe and gate valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Set butterfly valves closed or slightly open.
  - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the

following:

1. Valves:
  - a. Hayward Industrial Products
  - b. DeZurik
  - c. Tyco/Grinnell Corporation
  - d. Hammond Valve Corporation
  - e. Keystone
  - f. Milwaukee Valve Corporation
  - g. Engineer approved equal

## 2.2 BUTTERFLY VALVES

- A. Butterfly Valves: 150-psi pressure differential, Full body, extended neck, stainless-steel stem and disk, EPDM liner, conform to ANSI B16.10, with electric actuator and include handwheels.
- B. Electrical Actuators: Quarter-turn actuator with proportional control, four limit switches, position indicator, manual override, and 3,500 in. lb minimum torque output.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

### 3.2 INSTALLATION

- A. Install valves as indicated, according to manufacturer's written instructions.
- B. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.
- C. Install valves with Victaulic fittings at each piece of equipment arranged to allow

servicing, maintenance, and equipment removal without system shutdown.

- D. Locate valves for easy access and provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above the center of the pipe.
- F. Install valves in a position to allow full stem movement.

### 3.4 THREADED CONNECTIONS

- A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.
- B. Align threads at point of assembly.
- C. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.
- D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

### 3.5 FLANGED CONNECTIONS

- A. Align flange surfaces parallel.
- B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

END OF SECTION 15110

## SECTION 15220 - WASTEWATER PROCESS PIPING

### PART 1 – GENERAL

#### 1.01 APPLICABLE PROVISIONS

- A. Applicable provisions of Division 1 shall govern the work of this section.

#### 1.02 DESCRIPTION OF WORK

- A. The work under this section shall cover the furnishing of all materials, equipment, supervision and labor necessary to install all aeration piping and appurtenances as indicated on the contract drawings and specified herein. This section shall not apply to electrical conduit.

#### 1.03 RELATED WORK

- A. Section 1 (City of Clare Standard Specification)

#### 1.04 SHOP DRAWINGS

- A. Contractor shall submit such product literature and catalog cuts of materials to be supplied to relate these materials to the specifications. Information shall be in conformance with requirements of Submittals - Division 1 of these specifications.

### PART 2 – PRODUCTS AND MATERIALS

#### 2.01 PIPE, GENERAL

- A. All piping shall conform to the sizes shown on the contract drawings and shall be of the type and quality as scheduled, unless otherwise designated on the contract drawings.

#### 2.02 WASTEWATER PROCESS PIPE

- A. Exposed Process Pipe
  - 1. Galvanized Steel. Pipe shall meet the requirements of ASTM A53, Schedule 40. Joint construction shall be threaded. Joints constructed of thread couplings and fittings shall meet the requirements of ASTM A865.
  - 2. Ductile Iron (DI). Pipe shall meet the requirements of ANSI A21.51 (AWWA C151); Class 53. Joint construction shall be flanged type with required bolts and full face gasket, meeting the requirements of ANSI A21.11 (AWWA C111). Fittings shall be ductile iron, meeting the requirements of ANSI 21.10 (AWWA C110). Standard cement mortar lining shall meet the requirements of ANSI 21.04 (AWWA C104). All exposed ductile iron pipe shall be factory primed in accordance with Painting - Division 9 of these specifications.
  - 3. Steel, Black/Alloy. Pipe shall meet the requirements of ASTM A53, Schedule 40. Joint construction shall be threaded. Joints constructed of

thread couplings and fittings shall meet the requirements of ASTM A865. Pipe shall be painted with an epoxy enamel after installation.

4. Cast Iron (CI). Pipe shall meet the requirements of ANSI A21.06 (AWWA C106) or ANSI A21.08 (AWWA C108); Class 52. Joint construction shall be flanged type with required bolts and full face gasket, meeting the requirements of ANSI A21.11 (AWWA C111). Fittings shall be cast iron, meeting the requirements of ANSI 21.10 (AWWA C110). Standard cement mortar lining shall meet the requirements of ANSI 21.04 (AWWA C104)

## 2.03 WALL SLEEVES AND WALL PIPES

- A. Wall sleeves and wall pipes shall conform to the requirements of the process piping as indicated on the contract drawings.

## 2.04 MODULAR RUBBER WALL SEAL

- A. Modular rubber wall seal shall be mechanical type, consisting of inter-locking synthetic rubber links. The elastomeric element shall be sized and selected per manufacturer's recommendation and have the following properties as designated:
  1. Standard service application (-40 degrees F to 250 degrees F) EPDM: ASTM D2000 M3BA510.
  2. Hydrocarbon service application (-40 degrees F to 210 degrees F)  
Nitrile: ASTM D2000 M1BF510
  3. High temperature or fire seal application (-67 degrees F to 400 degrees F)  
Silicone: ASTM D2000 M1GE505
- B. Assembly of synthetic rubber links connected with stainless steel bolts. When the bolts are tightened, pressure plates shall compress the rubber links to fill the annular space between the pipe and the wall sleeve to form a watertight seal.
- C. Modular rubber wall seal shall be used where pipes penetrate existing walls and as otherwise indicated on the contract drawings.
- B. Modular rubber wall seal shall be Link-Seal, manufactured by Thunderline Corporation or equal.

## 2.05 PIPING IDENTIFICATION

- A. Identify all process piping with its process designation and direction of flow; identify with semi-rigid, snap-on acrylic-plastic identification markers at 15 foot intervals, at each change of direction, and adjacent to each point it passes through a wall, floor or ceiling; comply with ANSI and OSHA pipe mark requirements.

## 2.06 FLANGE ADAPTERS

- A. Flange adapters shall consist of a flange, gasket and set screws. The flange shall be ductile iron, ASTM A536, Grade 65-45-12. The gasket shall be SBR Buna-S, suitable for use with wastewater. The set screws shall be AISI 4140 steel, Tensile 190,000 psi minimum, heat

treated to Rockwell C42-50 and zinc plated for corrosion resistance. Set screws on sizes 2" through 16" shall have a breakaway head that shears at the recommended torque leaving a square head.

- B. All flange adapters shall have a minimum working pressure equal to the pipe on which they are installed.
- C. Flange adapters shall be Uni-Flange, manufactured by the Ford Meter Box Company, Inc. or equal.
- D. Flange adapters shall only be installed as shown on the contract drawings or where approved by the Engineer.

## 2.07 VALVES

- A. Valves shall conform to the requirements of equipment and process control specified, as indicated on the contract drawings and as specified in Wastewater Process Valves - Division 15. This shall include ball valves, gate valves, plug valves, butterfly valves, relief valves, and all valves operated electrically or mechanically.

## 2.08 PIPE HANGERS

- A. Pipe hangers shall consist of ceiling flange threaded rod, and adjustable clevis type hanger constructed of carbon steel.

## 2.09 PIPE SUPPORTS

- A. Pipe supports shall consist of a base flange, support rod with threaded ends for height adjustment, and a saddle type or stanchion type support as required.

## 2.10 EXPANSION JOINTS

- A. Expansion joints shall be of the bellow type with filled arches suitable for temperatures of minus 20 degrees F to plus 180 degrees F equipped with limit bolts to restrict maximum extension.

# PART 3 – CONSTRUCTION METHODS

## 3.01 MATERIAL HANDLING

- A. All pipe shall be carefully unloaded so it will not be chipped, cracked or have the surface coating damaged. It shall be carefully stored so it is in no way damaged or made unsuitable for its purpose. Pipe shall not be skidded upon the ground. Damaged pipe shall be immediately removed from the work site.

## 3.02

- A. Pipes shall be laid with ends abutting and true to line and elevation. Joints shall be full depth or rigidly fixed and located for proper alignment of piping. Pipe suspended or exposed shall be placed at the elevations indicated and supported as shown on the drawings.



Any work which has been disturbed or which does not conform to line and elevation before final acceptance, shall be removed and reconstructed by the Contractor at his expense.

- B. Pipes shall be fitted together and matched to form a smooth and uniform invert. Pipes shall be laid with straight alignment such that one can see through the pipe between two adjacent manholes. No pipe shall be laid in water or when in the opinion of the Engineer trench conditions are unsuitable. The ends of the pipe line shall be clean and protected from the entrance of foreign materials by means of covering or plugging. All pipe must be cleaned before laying and no joints made under water. Immediately before placing each pipe with a gasket, the spigot and bell end of the mating pipes shall be coated with an approved lubricating material.
- C. Pipes shall be installed with the minimum depth of cover as called for on the contract drawings.
- D. Manufacturer's recommended installation procedures shall be followed.

### 3.03 VALVE INSTALLATION

- A. Valves shall be installed per the manufacturer's recommendations. Valves shall be operated prior to system start-up to ensure proper installation and full range of operation.

### 3.04 GAUGE INSTALLATION

- A. Gauges shall be installed per the manufacturer's recommendations. Gauges shall be tested prior to system start-up to ensure proper operation, which shall include range of motion, lack of oscillations caused by vibration and correct calibration for the installation.

### 3.05 PERMISSIBLE LEAKAGE

- A. Leakage is not permissible on any exposed line or any line that will be placed under pressure or suction. The Contractor shall at his own expense locate and repair the defective joints until the leakage is within the limits described above.

### 3.06 TESTING

- A. General. The following tests shall be performed by the Contractor in the presence of the Engineer. The Contractor shall be responsible for providing all labor, materials and equipment for the testing.
- B. Deflection Test. All buried polyvinyl chloride pipe installations shall be tested for deflection by using a rigid ball or mandrel and shall be performed in accordance with ASTM D2321 and without the use of mechanical pulling devices. Deflection may not exceed 5 percent if tested within 30 days of placement of final backfill or 7.5 percent if tested more than 30 days after final backfill is placed. Final backfill must be in place prior to testing.
- C. Pressure Test. All pressure lines shall be tested until successfully meeting the requirements of ANSI/AWWA C600/A26.00, latest edition, for pressure and leakage testing excepting exposed lines which are allowed no leakage. Temporary capping and thrust restraint of open lines will be required for testing.

- D. Acceptance. If any of the tests are not met, the Contractor shall, at his own expense, determine the source of the problem and repair or replace all defective materials.

### 3.07 PIPE HANGERS AND SUPPORTS

- A. Piping hangers and their supports shall be sized per the pipe manufacturer's requirements for the process fluid carried, but in no case shall this be less than 3/4" wide, 18 gauge steel strap or ring type hangers secured by screw fasteners. Hangers in contact with uninsulated copper tubing or brass piping shall be electrolytically coated and shall be sized accordingly for the outside diameter of the pipe.
- B. The location of the hangers and supports shall be coordinated with the structural work to assure that the structural members will support the intended load. In lieu of separate hangers or supports, the Contractor shall submit for approval a detailed drawing of the type of hanger or support he proposes to furnish for handling and supporting multiple pipes.

### 3.08 HORIZONTAL PIPING

- A. Hangers and their supports shall be installed at intervals specified below, at locations not more than 3 feet from ends of each runout and not over 1 foot from each change in direction of piping. Hangers shall be adjustable type. Hangers and supports shall be spaced as follows:

1. Schedule 40 or Schedule 80 Plastic Pipe. The maximum spacing between supports for pipe carrying liquids less than 100 degrees F shall be as follows:

<u>Nominal Pipe Size (In.)</u>	<u>Maximum Span (Ft.)</u>
1/2 thru 1	4
1-1/4 thru 2	5
2-1/2 thru 4	6
6	7
8 and 10	8
12	9
14 and 16	10

2. Steel Pipe. The maximum spacing between supports shall be as follows:

<u>Nominal Pipe Size (In.)</u>	<u>Maximum Span (Ft.)</u>
1/2 thru 1-1/4	7
1-1/2	9
2	10
2-1/2	11
3	12
3-1/2	13
4	14
5	16
6	17
8	19

### 3.09 VERTICAL PIPING

- A. Plastic vertical piping shall be banded at intervals determined by the vertical load involved. Riser clamps shall be supported on spring hangers. Short risers shall include a saddle at the bottom and may require an additional hanger at the top. Longer risers may require over-sized U-bolts or similar devices to prevent lateral motion.
- B. Steel vertical piping shall be banded at intervals determined by the vertical load involved. Riser clamps shall be supported on spring hangers. Short risers shall include a saddle at the bottom and may require an additional hanger at the top. Longer risers may require over-sized U-bolts or similar devices to prevent lateral motion.

### 3.10 FIXTURE SUPPORTS

- A. Wall hung fixtures, hanger plates, support arms or mounting lugs shall be fastened to the wall by through bolts where appearance of the bolts is not objectionable. Exposed bolt heads in finished areas shall be hexagonal and painted. Exposed nuts shall be chromium plated hexagonal cap nuts. Washers shall be painted or chromium plated to match bolt heads or nuts.

### 3.11 THRUST RESTRAINTS

- A. Provide all pressure pipelines with concrete thrust blocking at all bends, tees, caps, plugs and changes in direction.
- B. All bends, tees, caps, plugs and changes in direction under structures shall have both restrained joints and thrust blocks.
- C. Concrete thrust blocks shall be poured against firm, undisturbed ground, with a minimum size as shown on the contract drawings. Where it is not possible to pour thrust blocks against undisturbed ground, thrust blocks shall be poured against backfill compacted to 95 percent modified proctor density. All fittings shall be wrapped in polyethylene prior to placement of concrete thrust blocks. Thrust blocks shall be formed in such a way that joints will be kept free of concrete.

END OF SECTION 15220

## SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. This section supplements all sections of this division and shall apply to all phases of work hereinafter specified, shown on drawings, or required to provide a complete installation of electrical systems.

#### 1.02 WORK INCLUDED

- A. Furnish all labor, material, services, and skilled supervision necessary for construction, erection, installation, connections, testing, and adjustments of all circuits and electrical equipment specified herein, as shown or noted on drawings, and its delivery to the Owner, complete in all respects and ready for use.

#### 1.03 QUALIFICATIONS

- A. All materials and equipment shall be installed by qualified tradesmen, experienced in installing respective material and equipment. Materials and equipment shall be manufactured in accordance with the applicable National Electrical Manufacturers' Association (NEMA) standards where such a standard has been established for the particular material and equipment.

#### 1.04 CONTRACT DRAWINGS

- A. Contract drawings are shown in part diagrammatic, intended to convey the scope of work, indicating the general arrangement of panelboards, switches, equipment, conduit, and outlets. Due to the diagrammatic nature of the drawings, many of the necessary individual component parts are not indicated but shall be included by the Contractor for a complete and operative electrical system. Follow drawings in laying out work, and verify places for installation of materials and equipment. Whenever a question exists as to exact intended location of outlets or equipment, obtain instructions from the Engineer before proceeding with the work. Information presented on these drawings is as accurate as preliminary surveys and planning can determine, but extreme accuracy is not guaranteed, and field verification of all dimensions and conditions is required.

#### 1.05 BASIC INSTALLATION

- A. All materials and equipment shall be installed in a first class, orderly manner. The Owner reserves the right to direct rearrangement and/or replacement of any item or part of work that, in his/her opinion, does not present a neat, orderly, workmanlike installation. Such rearrangement and/or replacement, when so directed, shall be made at the Contractor's expense without additional cost to the Owner.
- B. Accessibility: No part of the electrical systems shall be installed in non-accessible locations to prevent normal maintenance and operation of equipment.

#### 1.06 SUPPORT FROM STRUCTURE

- A. The Contractor shall be responsible for all supporting equipment necessary for the installation of his/her work. All support steel shall be prime painted as a minimum. All fastenings to exposed steel purlins, subpurlins, joists, and structure shall be of the clamping type, and in no case shall any of these members be drilled without specific approval of the Engineer. No electrical work shall be installed to impair the structural members, sleeves at stress points, excessive conduit in poured concrete, etc.

#### 1.07 CLEANING, PATCHING, AND PAINTING

- A. Upon completion of the installation, this Contractor shall thoroughly clean all fixtures and equipment. All patching, painting, and repairing of surfaces damaged in the performance of this work shall be made by this Contractor or by others, when directed by the Owner, at this Contractor's expense. It shall be the responsibility of the Contractor to paint all exposed conduits in finished areas of the building in compliance with the painting requirements.

#### 1.08 SPECIFICATION COMPLIANCE

- A. All materials and equipment shall be new, unless specifically indicated otherwise and shall be in strict accordance with this specification and/or as approved in writing by the Engineer. Where manufacturers' names, trade names, or catalog numbers are specified, it is for the purpose of describing type, design, and minimum quality of equipment and material required. Equivalent equipment to that specified by other manufacturers listed may be used with approval prior to bidding. Unlisted manufacturers' products, similar and equal in all respects, must be submitted to the Engineer for approval eight (8) days prior to bid opening. Only approved materials will be acceptable for this work.

#### 1.09 MATERIAL LISTING AND LABELING; CODE COMPLIANCE

- A. Material and equipment shall be laboratory listed and labeled by a nationally recognized testing laboratory with equipment listing and follow-up service.
- B. All material and equipment and their installation shall be in compliance with the applicable portions of the National Electrical Code (NEC) and any local codes having jurisdiction.

#### 1.10 EQUIPMENT IDENTIFICATION

- A. All panelboard, switchboard circuit breakers, enclosed switches, motor controllers, and contactors shall be provided with laminated nameplates with a white surface, black core, and 1/4 inch high engraved letters. Nameplates shall be attached to equipment with two (2) screws. Clearly identify, on the nameplate, equipment or equipment served and spell out the full name of the equipment. Panelboards shall have typewritten directories with all circuits accurately identified and plastic covers over the directories.
- B. Main primary conduit feeders and main 480 volt feeders are desired to be field marked and labeled as noted in the respective specification section.

**1.11 ELECTRIC MOTOR CONTROL**

- A. All electrical controls, starters, push-button stations, and disconnect switches used to control motors will be furnished and installed by the Contractor unless specifically noted otherwise.

**1.12 HOUSEKEEPING PADS**

- A. All switchboards, transformers, or other electrical equipment that will be floor mounted shall reuse existing concrete housekeeping pads, if possible. Pads shall extend 2 inches beyond the edge of the equipment base and shall have beveled edges. If pads are not poured with the floor, provide tie anchors into the concrete floor to secure the pad to the floor.

**1.13 FIRESTOPPING**

- A. Electrical contractor shall provide fire-stopping for all openings and sleeves through floors and firewalls. Sleeves provided for telephone, data, sound or other communication cables shall be fire-stopped after the respective contractor has finished his work.

**1.14 AS-BUILT DRAWINGS**

- A. EC to keep detailed notes on the changes of panels, wire sizes, conduit sizes, main feeder routing, etc., so as at the completion of this project a well documented as-built drawings can be assembled for future use.
- B. Notification and authorization to proceed with any field corrections or changes must be made by the Owner/Engineer in writing prior to start of any work.

**1.15 BACKFILLING**

- A. Contractor shall compact all backfill for trenches to meet the same compaction for the soil as before trenching.

**1.16 UNDERGROUND CONDUIT MARKER**

- A. Provide a 4 inch wide red plastic identification tape marked with "ELECTRIC LINE" over feeder and conduits buried underground outside building. Tape shall be placed in trench at 12 inches below finished grade.

**PART 2 PRODUCTS**

Not used.

**PART 3 EXECUTION**

Not used.

END OF SECTION 16010

## SECTION 16111 - CONDUIT

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Conduit and couplings.
- B. Flexible conduit.

### PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. Steel Conduit: Rigid or intermediate threaded, galvanized steel conduits with threaded couplings, except threadless, concrete tight connectors may be used where required. Use double locknuts and bushings. O-Z/Gedney Type A for 1 inch and smaller; O-Z/Gedney Type B for 1-1/4 inches and larger; O-Z/Gedney Type BLG where grounding bushings are required.
- B. Electrical Metallic Tubing: Galvanized steel with insulated throat, steel, watertight, compression, and/or steel set screw type fittings.
- C. Flexible Metal Conduit: Steel armor, minimum 1/2 inch size with UL listed, insulated throat, and grounding connectors.
- D. Liquidtight Flexible Conduit: Flexible plastic jacketed steel armor conduit with grounding type connectors. Connectors for 1-1/4 inches and larger shall be O-Z/Gedney Ground-Tites. Box connectors shall have insulated throat.
- E. Nonmetallic Conduit: Rigid heavy wall Schedule 40 PVC with solvent weld couplings. Nonmetallic cable (Romex), armored cable (BX), or metal clad (MC) cable will not be permitted unless specifically noted otherwise.

#### 2.02 CONDUIT USE

- A. Use rigid steel conduit for primary power feeders.
- B. Use rigid steel or intermediate metal conduit for runs embedded in concrete on grade or in formed walls, in wet locations, and where exposed within 10 feet of the floor.
- C. Use electrical metallic tubing in interior areas where rigid conduit or flexible conduit is not specified.
- D. Use rigid nonmetallic conduit below grade outside the building or as noted on the drawings.
- E. Provide flexible conduit for motor connections, transformer connections, and other equipment connections where subject to movement or vibration. Use minimum 1/2 inch size, except 3/8 inch may be used for light fixture whips not exceeding 6 feet where permitted by code.
- F. Provide liquidtight flexible conduit for motor connections and other equipment connection where subject to movement or vibration and where, in an exterior location, refrigerated area, or corrosive atmosphere, subjected to water spray, or subjected to dripping oil, grease, or water.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Conduit in a floor slab shall be 3/4 inch minimum and 1-1/4 inch maximum with a 1 inch minimum concrete cover. Only branch circuits for receptacles are permitted to be poured in floors.
- B. Conduit home runs concealed in block, brick, or concrete walls shall be 3/4 inch minimum size.
- C. Panel feeder conduits shall not be run in the floor or below slab-on-grade unless noted otherwise on the drawings.
- D. Size conduits per number of conductors based on NEC tables for THW wire.

- E. Install conduit concealed in all finished areas.
- F. No pulling elbows shall be used above ceilings.
- G. Conduit for circuits in drywall partition systems shall be run overhead and shall not be stubbed out of the floor into partitions.
- H. Secure conduits to building structure with 1 hole, malleable iron straps; 2 hole, galvanized steel straps; or galvanized rod with channel (uni-strut) and conduit straps. Do not attach to ceiling system, ductwork, piping, or roof deck.
- I. Install exposed conduits true and square with the building.
- J. Install conduit free from crimps and dents. Plug ends to prevent entry of dirt or moisture after installed.
- K. Clean out conduit before installation of conductors.
- L. Seal conduit with silicone caulk where conduits leave or enter a refrigerated area.
- M. Install UL approved expansion fittings, complete with grounding jumpers, where conduits cross building expansion joints; O-Z/Gedney Type AX-50. Provide bends or offsets in conduit adjacent to building expansion joints where conduit is installed above a suspended ceiling.
- N. Allow a minimum of 12 inch clearance at flues, steam pipes, and heat sources and a 6 inch clearance with other pipes.
- O. Conduit drops from above to motors on bases or the floor shall be rigid or intermediate steel and shall terminate in a floor flange. Provide a conduit tee fitting to serve the motor.
- P. Conduits outside the building shall be buried 36 inches below grade unless noted otherwise.
- Q. Underground conduits shall have a minimum of 2 inch spacing between conduits and shall be backfilled and compacted to the density specified elsewhere to eliminate all air pockets.
- R. Conduits shall not be run horizontally in mechanical, storage, utility rooms, etc., below 9 feet 0 inch AFF so as to maintain open wall space for mounting of other equipment.

### 3.02 PATCHING AND REPAIRING

- A. Patch or repair all roof, wall, or floor penetrations. This work shall be performed by skilled tradesmen of the respective trade at this Contractor's expense. All existing warranties are to be maintained for roofs. Coordinate with the Owner.

### 3.03 PENETRATIONS

- A. Provide sleeves for all conduits that pass through wastewater facility floors or walls. Seal around conduits with fire-rated sealant, and grout all unused sleeves.
- B. Provide through-wall sleeves for all conduits passing through exterior concrete walls below grade. Use O-Z/Gedney Type WSK (in new walls and Type CSM for existing walls).
- C. Seal conduit with silicone caulk where conduits leave or enter a refrigerated area. Insulate conduits for 3 feet where exiting from refrigerated areas into nonair conditioned spaces with Type C insulation per Section 15260 - Pipe Insulation.
- D. Provide conduit seal offs for conduits entering office space from treatment rooms. Install on treatment side of wall. Provide conduit seal-offs at exterior locations as shown on the drawings.

### 3.04 LABELING

- A. High Voltage Interior Conduit:
  - 1. Provide warning identification of interior mounted high voltage conduits of greater than 10 feet in length. Apply directly to each respective conduit in clear visible location.
  - 2. Labels shall be applied at minimum of 75 feet on center within same space and/or within each room or space as passing through.
  - 3. Labels shall be 4 mil vinyl and have 1 inch black lettering on orange background and be securely attached to conduit.



4. Labels shall read “Warning – “X” Volts” specific for the actual system voltage. Examples: “Warning - 2400 Volts; Warning - 12400/7200 Volts; Warning - 12.47/7.2 KiloVolts.”
- B. Interior 480 Volts Conduits:
  1. Provide identification of interior mounted 480 volt panelboard, motor control centers feeder conduits greater than 20 feet in length. Apply directly to each respective conduit in clear visible location.
  2. Labels shall be applied at minimum of 75 feet on center within same space and/or within each room or space as passing through.
  3. Labels shall be 4 mil vinyl and have ½ inch black lettering on orange background and be securely attached to conduit.
  4. Labels shall read “Warning - 480 Volts” or “Warning 480/277 Volts.”

END OF SECTION 16111

## SECTION 16123 - BUILDING WIRE AND CABLE

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Building wire and cable.
- B. Connectors.

### PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. Building Wire: 98 percent conductivity stranded copper conductor, 600 volt rated, 90/75 degree C insulation THHN/THWN.
- B. Connectors: Insulated spiral mechanical for No. 10 and smaller wire and compression or mechanical for No. 8 and larger wire.
- C. Wire Tie Wraps: Plenum rated, fire retardant, 6/6 nylon type where used in plenum rated spaces.

#### 2.02 USE

- A. Minimum Size: No. 12 AWG except for control wire, which may be No. 14 AWG for low voltage and No. 18 AWG 1 or 2 pair twisted shielded cable for analog signals/devices.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Make the conductor length for parallel feeders identical.
- B. Lace or clip groups of feeder conductors at distribution centers, pull boxes, and wireways.
- C. Provide copper grounding conductors and straps.
- D. Install wire and cable in code conforming raceway.
- E. Use wire pulling lubricant for pulling No. 4 AWG and larger wire.
- F. Install wire in conduit runs after concrete and masonry work is complete and after moisture is swabbed from conduits.
- G. Splice only in accessible junction or outlet boxes.
- H. No more than 8 conductors shall be installed in a branch circuit conduit unless noted otherwise on the drawings. Derate wire ampacity per the National Electric Code for number of wires.
- I. Use No. 10 AWG wire where the distance to the first outlet from the panel exceeds 75 feet for branch circuits not exceeding 150 volts to ground and 200 feet for branch circuits between 150 and 300 volts to ground.

- J. Lights and outlets shall be grouped on circuits as shown on the drawings.
- K. Different types of circuits, such as feeders, branch circuits, control circuits, and signal circuits, shall not be mixed in common conduit runs but shall be run separately.
- L. Each feeder shall be run in a separate raceway unless noted otherwise on the drawings.
- M. No wire may be pulled until the walls and conduits are in place. Leave at least 6 inches of free conductor at all outlets except where conductors are intended to loop without joints through outlets. All wiring shall be installed to permit withdrawal and reinstallation of conductors between outlets without damage to the finished building structure.
- N. Low voltage cables shall be installed under the following guidelines:
1. Shall be tagged at both ends for identification and be routed in conduit or the cable tray.
  2. Above ceilings, low voltage cables shall be protected with eyelets where the cables cross steel edges and shall be installed no closer than 4 feet from lighting fixtures, transformers, or electric motors.
  3. Dropping from joist space to equipment, cables must be enclosed in raceway as noted on the plans or, where not noted, shall be installed in conduit by the Electrical Contractor to protect against mechanical injury. Raceways are to be installed from ceiling plenum space or bottom chord of joist to equipment location. Conduits are to be securely fastened and bushed at both ends; raceways shall have no sharp edges.
  4. Where low voltage cables and raceways must go through countertops, the Electrical Contractor shall subcontract all openings through countertops with the General Trades Contractor and shall provide grommets for cable protection.
  5. Unless cables are installed in raceways or noncombustible tubing, they shall meet the fire resistance requirements of NEC Article 725 and shall be low smoke producing with UL listing for use in plenum ceilings.
- O. Branch circuit conductors shall be color coded to differentiate the phases and voltage, the same color being assigned to the same phase and voltage throughout the job. (Do not mix voltage in same conduit.) Phase indication shall be as follows:
- |                      |                            |
|----------------------|----------------------------|
| <u>120/208 Volts</u> | <u>277/480 Volts</u>       |
| Phase A - Black      | Phase A - Brown            |
| Phase B - Red        | Phase B - Orange           |
| Phase C - Blue       | Phase C - Yellow           |
| Neutral - White      | Neutral - Gray with Stripe |
| Ground - Green       | Ground - Green             |
- P. Each feeder cable shall be labeled and color coded with tape, 1 inch wide, at terminals and at all accessible points in equipment and in pull boxes. Each control wire shall be labeled at both ends. Labels shall be self sticking wire markers.
- Q. Conductors routed through high ambient areas such as boiler rooms shall be de-rated per NEC thus resulting in the increase of wire size to meet the conditions. All wire size changes shall be approved by Engineer or Owner with notations made to one-line drawings for as-built corrections.

- R. Existing conduit and wire where taken out of service or not in use shall be removed from building and properly disposed. Do not leave un-used conduit and wire in place unless specification indicated or directed by Owner/Engineer.

3.02 IDENTIFICATION

- A. Tag, by circuit and panel number, each conductor in the panelboard gutter. Where several conductors pass through a pull or junction box, permanently tag with circuit and panel number with wire markers.

END OF SECTION 16123

## SECTION 16141 - WIRING DEVICES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Switches.
- B. Receptacles.
- C. Cover plates.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Hubbell.
- B. Leviton.
- C. Arrow Hart.
- D. Pass & Seymour.

#### 2.02 120/277 VOLT SWITCHES

- A. UL listed, quiet, slow make/slow break design, side and back wired, with totally enclosed case. Provide matching 2 pole, 3-way, 4-way, lock type, illuminated, and pilot light switches where called for on the drawings.

		<u>Hubbell</u>	<u>AH</u>	<u>P &amp; S</u>	<u>Leviton</u>
Standard Toggle	20A	1220	1990	20AC	1220

#### 2.03 KEYED SWITCHES

- A. UL listed, single pole, 125 volt, 20 ampere, cam lock type with stainless steel cover plate and tamperproof screws.

#### 2.04 STANDARD RECEPTACLES

- A. UL listed, polarized, parallel blade, U-grounding slot, back and side wired, 125 volts with amperages as shown below.

		<u>Hubbell</u>	<u>AH</u>	<u>P &amp; S</u>	<u>Leviton</u>
Duplex	15A	5252	5252	5262	5262
Isolated Ground	15A	IG5262	IG5262	IG6300	5262-IG

#### 2.05 GROUND FAULT INTERRUPTER (GFI) RECEPTACLES

- A. UL listed, polarized duplex, parallel blade, U-grounding slot, 125 volt, with ground fault protective circuitry, operable from -30 degrees F to +150 degrees F, test push button, reset push button, designed for feed through service.

		<u>Hubbell</u>	<u>AH</u>	<u>P &amp; S</u>	<u>Leviton</u>
Duplex	15A	GF5252	GF5242	1591-SL	6599

#### 2.06 SURGE SUPPRESSION (SP) RECEPTACLES

- A. UL listed, polarized, parallel blade, U-grounding slot, active suppression circuit indicator light, damage alert beeper, normal and common mode protection or 140 joules minimum, provide downstream protection to receptacles on the same circuit, meet UL 1449 and 498, blue color.
- |        |     |                |           |                  |                |
|--------|-----|----------------|-----------|------------------|----------------|
|        |     | <u>Hubbell</u> | <u>AH</u> | <u>P &amp; S</u> | <u>Leviton</u> |
| Duplex | 15A | 5252S          | 5262S     | 6262-?SP         | 6598           |

## 2.07 STEEL SURFACE MOUNTED RACEWAY WITH OUTLET DEVICES

- A. Provide two compartment, UL listed, surface mounted steel raceways with internal divider for power and communication cabling. Provide all corners, fittings, end plates, covers, receptacle mounting plates, telephone/data mounting plates and any other mounting hardware required for complete system.
- B. Receptacles, telephone, and data outlets shall be as specified in other sections or paragraphs in this specification.
- C. Provide Wiremold No. 4049 style snap-in cover plate for receptacles and telephone/data outlet mounting so as to overlap the adjacent cover cut seam.
- D. Where receptacle and telephone or combination telephone/data outlets are shown on drawings, provide combination receptacle and telephone outlet mounting and cover. Where single device is shown, provide dual mounting with blank cover position for future mounting of alternate device.
- E. See the drawings for run lengths and devices quantities.
- F. Finish shall be grey and field painted to match background wall. Coordinate with General Contractor.
- G. Manufacturer shall be Wiremold Model G4000.

## 2.08 DEVICE COLORS

- A. Switches shall be brown.
- B. Receptacles shall be brown.
- C. Surge Protection Receptacles: Blue.

## 2.09 DEVICE COVER PLATES

- A. Provide smooth metal satin finish, stainless 302/304 cover plates in office areas. Hubbell, Series S.
- B. Surface Boxes: Provide 1/2 inch raised steel covers for surface mounted boxes.
- C. GFI Receptacles: Provide an interior cover plate, Hubbell HPS1; or cast aluminum weatherproof plate for exterior, Hubbell WPFS-26.
- D. Weatherproof Duplex Receptacles: Provide impact resistant cast metal for wet locations on FS box mounted horizontal as by Red Dot.

## PART 3 EXECUTION

3.01 INSTALLATION

- A. Coordinate switch mounting location with the architectural detail.
- B. Coordinate mounting height of receptacles with equipment.
- C. Mount switches on the latch side of the door or as noted on the drawings.
- D. Mount general use receptacles vertically with the grounding pole at the bottom.
- E. In office or utility areas, coordinate the receptacle height with benches and countertops. Mount receptacles vertical with the grounding pole at the bottom above countertops.

END OF SECTION 16141

## SECTION 1

### GENERAL REQUIREMENTS

#### 1.01 PROJECT DESCRIPTION

The project consists of the replacement of three (3) Ultraviolet Disinfection Chambers at the Wastewater Treatment Plant according to manufactures specifications.



1.02 DEFINITIONS

The intent of this section is to identify certain persons involved in the project.

DPW	The agency performing the system operations and maintenance typically identified as a Department of Public Works.
City Engineer	Engineer whose services are procured by the City to review sanitary sewage and/or water system plans and installation methods. When the City is the owner, the engineer will function as the owner's engineer.
Design or Owner's Engineer	Engineer who provided the sanitary sewage and/or water system design, plans and specifications for the owner.
Owner	Project developer or City who is having sanitary sewage and/or water facilities installed.
Contractor	Contractor is prime Contractor who is so identified by the Owner and is responsible for the sanitary sewage and/or water system facilities installation.
City	The governing City is the City of Clare.

1.03 PRECONSTRUCTION CONFERENCE

Prior to commencement of any construction activities involving the sanitary sewer system and/or water system, a principal member representing the Owner, the Contractor, the Design Engineer, the City Engineer and the DPW shall meet at a pre-determined location and time to discuss the project. It shall be the responsibility of the Owner or his/her Design Engineer to organize this meeting. At that time, the Contractor schedule, as well as the City Engineer's requirements, will be discussed to obtain a mutual understanding of the project and the City's inspection process.

1.04 PROGRESS SCHEDULE

The Owner shall, as soon as practical, prepare and submit to the City Engineer three (3) copies of the Progress Schedule regarding sanitary sewer and/or water main construction. This schedule shall show in a clear, graphical manner the proposed date for commencement, progress and completion of the work.

1.05 INTERFERENCE WITH EXISTING SEWAGE TREATMENT WORKS

No bypassing of treated sewage will be allowed during the construction of this project. The Contractor shall provide a plan of work to the City Engineer for approval before starting work on the project. The City Waste Water Treatment Operator will maintain all control overflows.

1.06 RELATIONS TO OTHER CONTRACTORS AND UTILITY FORCES

The Contractor shall so conduct his operations as not to interfere with or injure the work of other contractors or adjacent force account work, and he shall promptly make good any injury or damage which may be done to such work by him or his employees or agents.

The Contractor shall grant to other contractors and forces necessary means of access to their work.

1.07 PERMITTING AGENCIES

The Contractor shall perform all work in accordance with any and all applicable permit requirements. The Owner or his Design Engineer shall present the City Engineer with a copy of all documentation and calculations for the permit process. The City, with the assistance of the City Engineer, will obtain the necessary permit for construction/installation prior to commencement of any work.

1.08 ACCESS TO WORK

The City Engineer or City Resident Project Representative shall have access maintained to all sanitary sewer or water main work at all times. Proper notification (48 hours) shall be given to the City Engineer prior to the start of any construction or testing.

1.09 SHOP DRAWINGS

Shop drawings of all equipment shall be issued to the Design Engineer during the shop drawing review stage for his approval. The Design Engineer shall forward these (2 copies) to the City Engineer for his review regarding compliance with the City requirements. The City Engineer will not perform a technical review. That shall remain the responsibility of the Design Engineer. The Contractor should supply a minimum of six (6) copies of all equipment shop drawings to the Design Engineer. Final record shop drawings shall be issued to the City Engineer as part of the close-out procedure in accordance with the close-out section of these specifications.

1.10 MAINTENANCE BOND REQUIREMENTS

The Contractor shall supply the Owner and City with a maintenance bond for 50% of the cost of the installation of the sanitary sewer and/or water system that is to be turned over to the City. The maintenance bond shall be effective from the date of City acceptance for a period of one (1) year.

1.11 INSURANCE REQUIREMENTS

Where the contract involves construction in a public right-of-way, the Contractor shall provide proof of insurance in the type and amounts required by the City prior to start of the construction. In addition to the City of Clare, the City's Engineer shall be named as additional insured.



Engineering  
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Operations

123 West Front Street  
Traverse City, Michigan 49684  
231.946.5874   
231.946.3703 

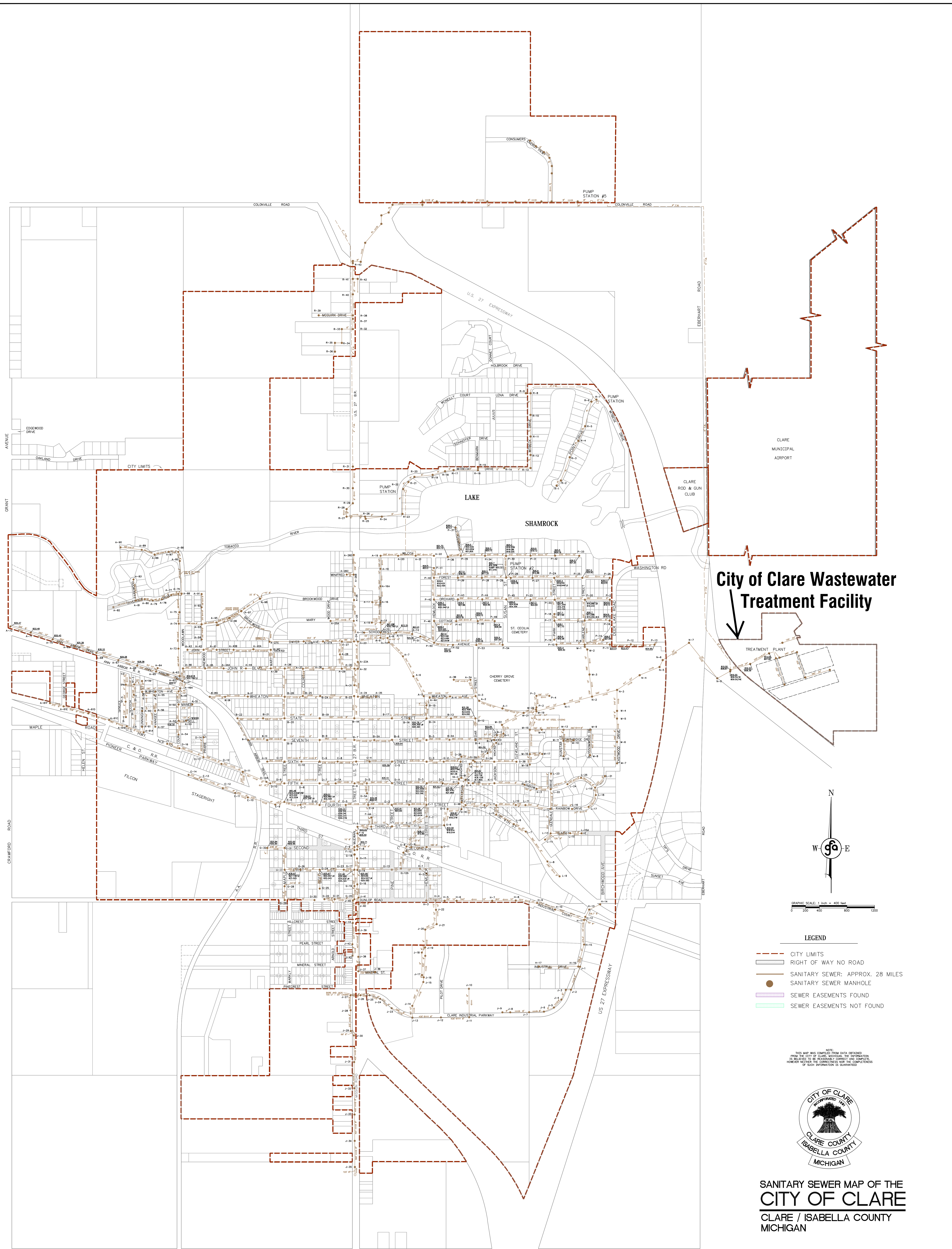
# EXISTING WASTEWATER TREATMENT SYSTEM & PROCESS MAP FOR

## ULTRAVIOLET DISSINFECTION SYSTEM

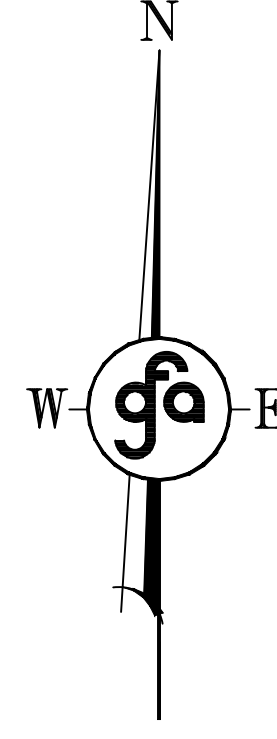
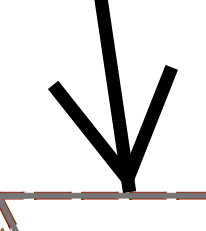


GFA PROJECT NO.: 21309  
DATE: July 2022





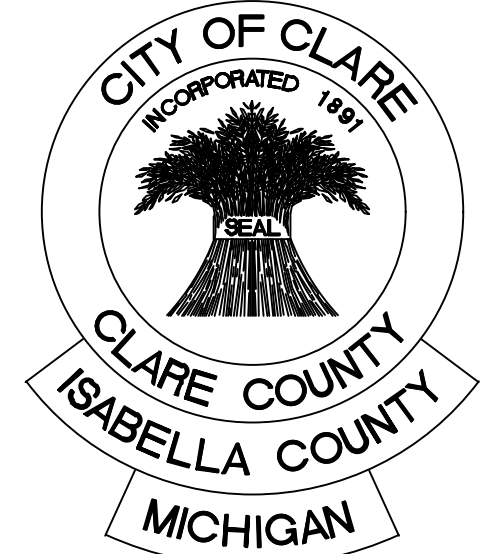
**City of Clare Wastewater Treatment Facility**



**LEGEND**

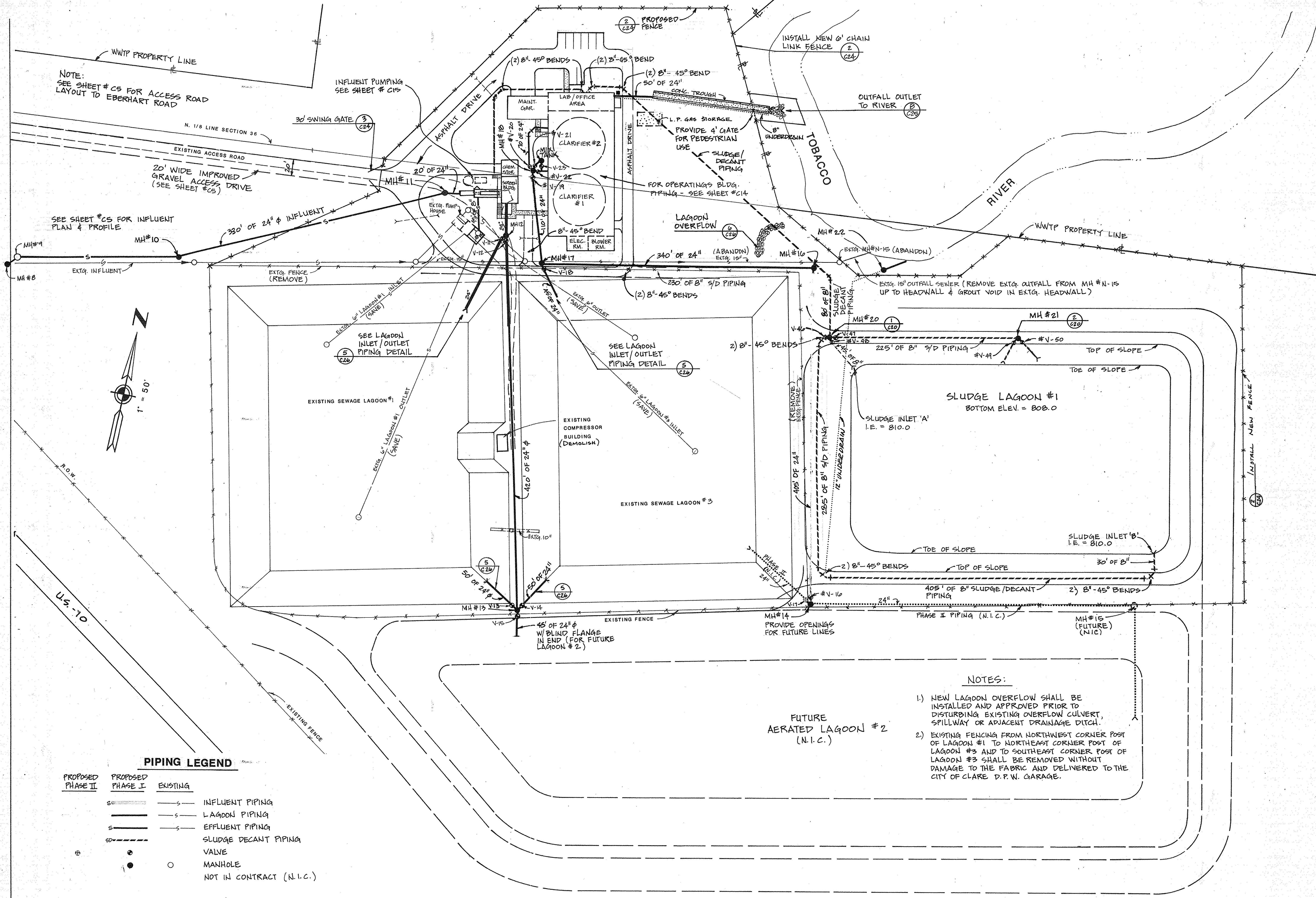
- CITY LIMITS
- RIGHT OF WAY NO ROAD
- SANITARY SEWER: APPROX. 28 MILES
- SANITARY SEWER MANHOLE
- SEWER EASEMENTS FOUND
- SEWER EASEMENTS NOT FOUND

NOTE:  
THIS MAP WAS COMPILED FROM DATA OBTAINED FROM THE CITY OF CLARE, MICHIGAN. THE INFORMATION IS BELIEVED TO BE REASONABLY CORRECT AND COMPLETE, HOWEVER NEITHER THE CORRECTNESS NOR THE COMPLETENESS OF SUCH INFORMATION IS GUARANTEED.



**SANITARY SEWER MAP OF THE  
CITY OF CLARE**  
CLARE / ISABELLA COUNTY  
MICHIGAN





**PIPING LEGEND**

PROPOSED PHASE II	PROPOSED PHASE I	EXISTING	
SD	---	---	INFLUENT PIPING
---	---	---	LAGOON PIPING
S	---	---	EFFLUENT PIPING
SD	---	---	SLUDGE DECANT PIPING
●	●	●	VALVE
○	○	○	MANHOLE
			NOT IN CONTRACT (N.I.C.)

**NOTES:**

- 1) NEW LAGOON OVERFLOW SHALL BE INSTALLED AND APPROVED PRIOR TO DISTURBING EXISTING OVERFLOW CULVERT, SPILLWAY OR ADJACENT DRAINAGE DITCH.
- 2) EXISTING FENCING FROM NORTHWEST CORNER POST OF LAGOON #1 TO NORTHEAST CORNER POST OF LAGOON #3 AND TO SOUTHEAST CORNER POST OF LAGOON #3 SHALL BE REMOVED WITHOUT DAMAGE TO THE FABRIC AND DELIVERED TO THE CITY OF CLARE D.P.W. GARAGE.

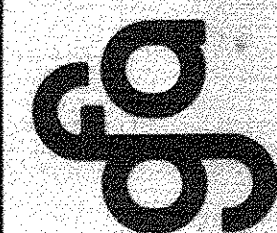
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CONTRACTOR TO FIELD VERIFY**

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105 E. Washington Street  
Marquette, Michigan  
49855  
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Traverse City  
124 West State Street  
P.O. Box 927  
Traverse City, Michigan  
49664  
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Planners

**Gourdier/Fraser  
& Associates, Inc.**



**SEWAGE & SLUDGE PIPING LAYOUT  
CLARE WASTEWATER TREATMENT PLANT**

CITY OF CLARE, MICHIGAN

REV. 1/16/21  
APR. 1/16/21  
CHKD. 7-17-87  
DRN. 5-26-87

860098A

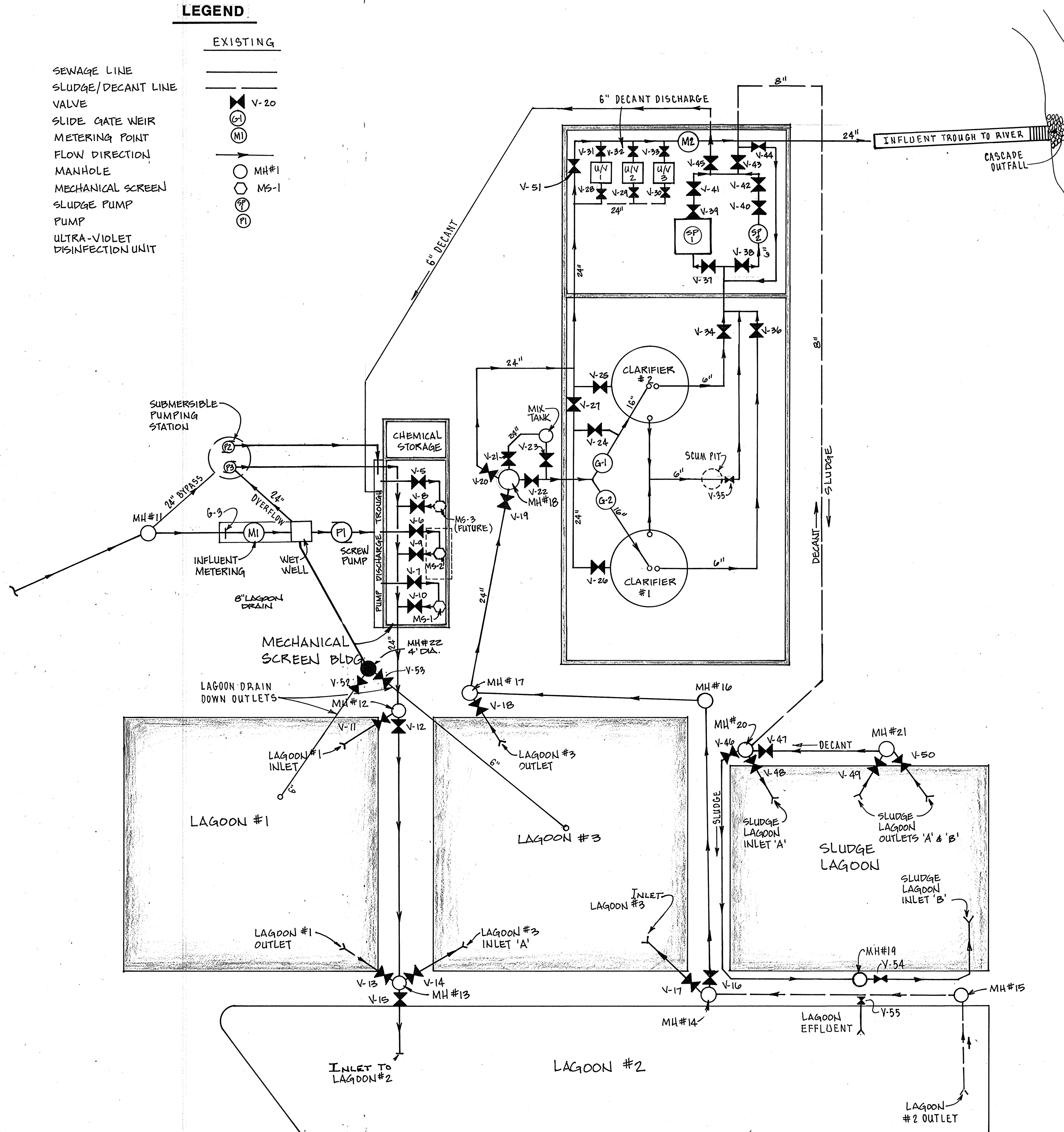
**DIVISION B**

**SHEET C7 OF 26**



# LEGEND

EXISTING  
 SEWAGE LINE  
 SLUDGE/DECANT LINE  
 VALVE  
 SLIDE GATE WEIR  
 METERING POINT  
 FLOW DIRECTION  
 MANHOLE  
 MECHANICAL SCREEN  
 SLUDGE PUMP  
 PUMP  
 ULTRA-VIOLET  
 DISINFECTION UNIT



## SEWAGE VALVE & SLUDGE VALVE SCHEDULE

VALVE NUMBER	SIZE	OPERATOR	VALVE FUNCTION	TYPE	SHEET NUMBER
V-1	8"	-	SUBMERSTIBLE PUMP #1 DISCHARGE	CV	
V-2	8"	-	SUBMERSTIBLE PUMP #2 DISCHARGE	CV	
V-3	8"	HW	SUBMERSTIBLE PUMP #1 DISCHARGE	PV	
V-4	8"	HW	SUBMERSTIBLE PUMP #2 DISCHARGE	PV	
V-5	12"	HW	MECHANICAL SCREEN #3 INLET	GV	
V-6	12"	HW	MECHANICAL SCREEN #2 INLET	GV	
V-7	12"	HW	MECHANICAL SCREEN #1 INLET	GV	
V-8	16"	HW	MECHANICAL SCREEN #3 OUTLET	GV	
V-9	16"	HW	MECHANICAL SCREEN #2 OUTLET	GV	
V-10	16"	HW	MECHANICAL SCREEN #1 OUTLET	GV	
V-11	24"	SE, PL	LAGOON #1 INLET	BFV	
V-12	24"	SE, PL	LAGOON #1 BYPASS TO MANHOLE #13	BFV	
V-13	24"	SE, PL	LAGOON #1 OUTLET	BFV	
V-14	24"	SE, PL	LAGOON #3 INLET "A"	BFV	
V-15	24"	SE, PL	LAGOON #2 INLET	BFV	
V-16	24"	SE, PL	LAGOON #3 BYPASS TO MANHOLE #16	BFV	
V-17*	24"	SE, HW	LAGOON #3 INLET "B"	BFV	
V-18	24"	SE, PL	LAGOON #3 OUTLET	BFV	
V-19	24"	SE, PL	CLARIFIER BUILDING SHUT-DOWN	BFV	
V-20	24"	SE, PL	CLARIFIER BYPASS	BFV	
V-21	24"	SE, PL	MIX TANK INLET	BFV	
V-22	24"	SE, PL	MIX TANK BYPASS	BFV	
V-23	24"	SE, PL	MIX TANK OUTLET	BFV	
V-24	16"	SE, VB	STEP CLARIFICATION CL#2 TO CL #1	BFV	
V-25	16"	SE, VB	CLARIFIER #1 EFFLUENT	BFV	
V-26	16"	SE, VB	CLARIFIER #2 EFFLUENT	BFV	
V-27	16"	SE, VB	CLARIFIER #2 EFFLUENT	BFV	
V-28*	16"	EA	U/V DISINFECTION UNIT #1 INLET	BFV	
V-29*	16"	EA	U/V DISINFECTION UNIT #2 INLET	BFV	
V-30*	16"	EA	U/V DISINFECTION UNIT #3 INLET	BFV	
V-31*	16"	PL	U/V DISINFECTION UNIT #1 OUTLET	BFV	
V-32*	16"	PL	U/V DISINFECTION UNIT #2 OUTLET	BFV	
V-33*	16"	PL	U/V DISINFECTION UNIT #3 OUTLET	BFV	
V-34	6"	L	CLARIFIER #1 SLUDGE DRAW-OFF	PV	
V-35	6"	L	CLARIFIER #1 & #2 SCUM TROUGH DRAW-OFF	PV	
V-36	6"	L	CLARIFIER #2 SLUDGE DRAW-OFF	PV	
V-37	6"	L	SLUDGE PUMP #2 SUCTION	BV	
V-38	6"	-	SLUDGE PUMP #1 SUCTION	BV	
V-39*	6"	-	SLUDGE PUMP #2 DISCHARGE	CV	
V-40	6"	-	SLUDGE PUMP #1 DISCHARGE	CV	
V-41	6"	L	SLUDGE PUMP #2 DISCHARGE	BV	
V-42	6"	L	SLUDGE PUMP #1 DISCHARGE	BV	
V-43	6"	L	SLUDGE DISCHARGE TO LAGOON (OPEN)	BV	
V-44	6"	L	DECANT DRAW-OFF FROM LAGOON (CLOSED)	BV	
V-45	6"	L	SLUDGE DISCHARGE TO LAGOON (CLOSED)	BV	
V-46	6"	SE, FB, LW	DECANT DRAW-OFF FROM LAGOON (OPEN)	BV	
V-47	6"	SE, FB	DISCHARGE TO SLUDGE LAGOON INLET "B"	BV	
V-48	8"	SE, FB	DISCHARGE TO SLUDGE LAGOON INLET "A"	BV	
V-49	8"	SE, FB, LW	DECANT DRAW-OFF FROM SLUDGE LAGOON	BV	
V-50	8"	SE, FB	LOW LEVEL DECANT DRAW-OFF	BV	
V-51	24"	HW	HIGH LEVEL DECANT DRAW-OFF	BV	
V-52*	6"	HW	U/V DISINFECTION BYPASS	BFV	
V-53*	6"	VALVE KEY	LAGOON #1 DRAIN OUTLET (W/ BOX)	PV	
V-54*	6"	VALVE KEY	LAGOON #2 DRAIN OUTLET (W/ BOX)	PV	
V-55*	6"	SE, FB, LW	SLUDGE LAGOON BYPASS	BV	
V-56*	6"	SE, FB	LAGOON #2 SUCTION DRAIN OUTLET	BV	

## WEIR GATE SCHEDULE

GATE NUMBER	SIZE	OPERATOR	GATE FUNCTION	SHEET NUMBER
G-1	24" CREST	HW	LAGOON EFFLUENT CONTROL WEIR GATE TO CLARIFIER #1	
G-2	24" CREST	HW	LAGOON EFFLUENT CONTROL WEIR GATE TO CLARIFIER #2	
G-3	48"		SLIDE GATE SHUT DOWN INFLUENT TROUGH FOR REPAIR	

### OPERATOR LEGEND

F = FLOOR STAND  
 FB = FLOOR BOX  
 VB = VALVE BOX  
 HW = HAND WHEEL W/ OPERATOR BOX  
 HWM = HAND WHEEL WITH WRENCH  
 L = LEVER  
 LW = LEVER WITH WRENCH  
 PL = POSITION LEVER  
 SE = STEM EXTENSION W/ SQUARE NUT TOP (PROVIDE GEAR BOX OPERATOR)  
 EA = ELECTRIC ACTUATORS

\*NOTE: ONLY VALVES V-17 & 28-33, 52-55, AND V-59 WILL BE PROVIDED UNDER THIS CONTRACT. (ALL OTHERS ARE EXISTING)

## SEWAGE AND SLUDGE PIPING SCHEMATIC

WASTEWATER TREATMENT PLANT (PHASE II)

CITY OF CLARE, MICHIGAN

PROVIDED FOR REFERENCE ONLY  
 CONTRACTOR TO FIELD VERIFY

Marquette  
 105 E. Washington Street  
 Marquette, Michigan  
 49830  
 (906) 228-5171

Traverse City  
 124 West State Street  
 P.O. Box 927  
 Traverse City, Michigan  
 49606  
 (616) 946-5874

Consulting  
 Engineers  
 Surveyors  
 Planners

Gourdie/Fraser  
 & Associates, Inc.

gfa

SEWAGE & SLUDGE PIPING SCHEMATIC  
 WASTEWATER TREATMENT PLANT (PHASE II)  
 CITY OF CLARE, MICHIGAN

10/13/89  
 REVISED FOR  
 PHASE II WORK AND  
 PHASE I AS-BUILTS  
 REV. 9/1/89

APR.

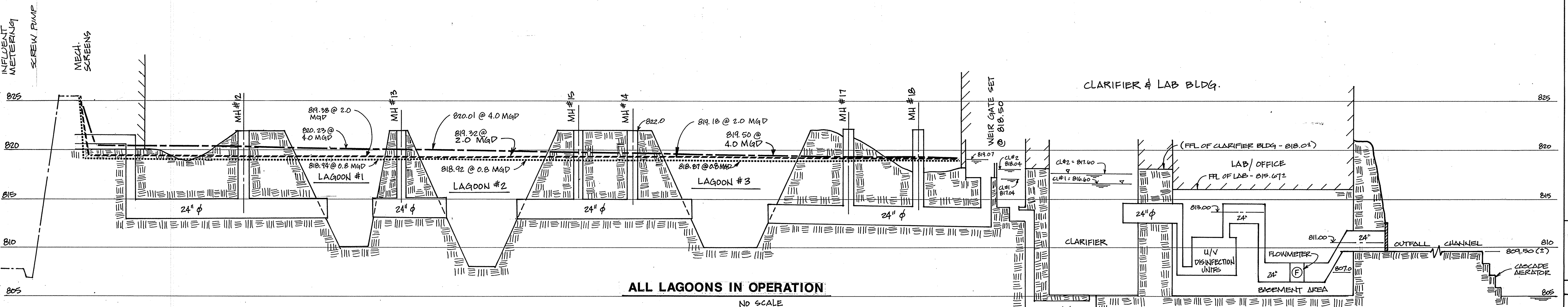
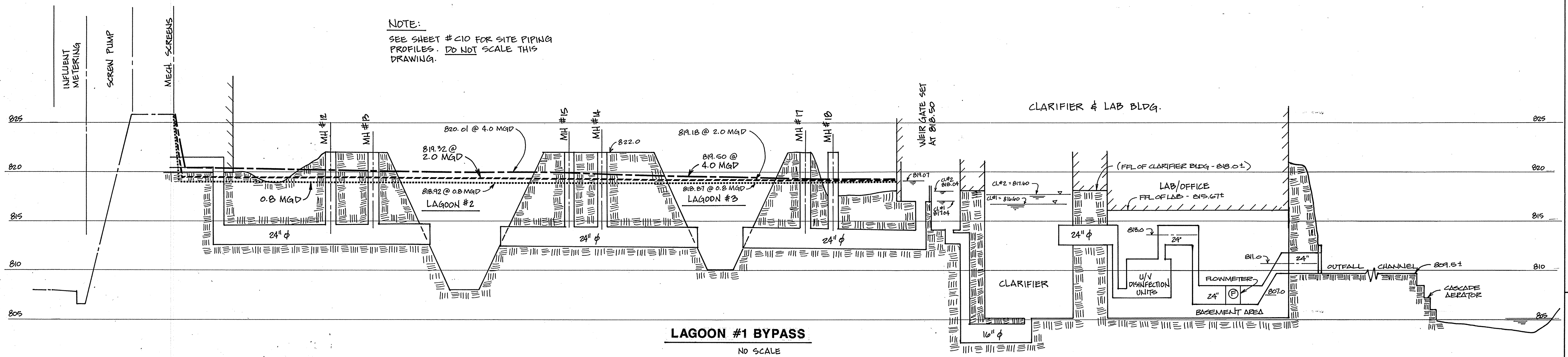
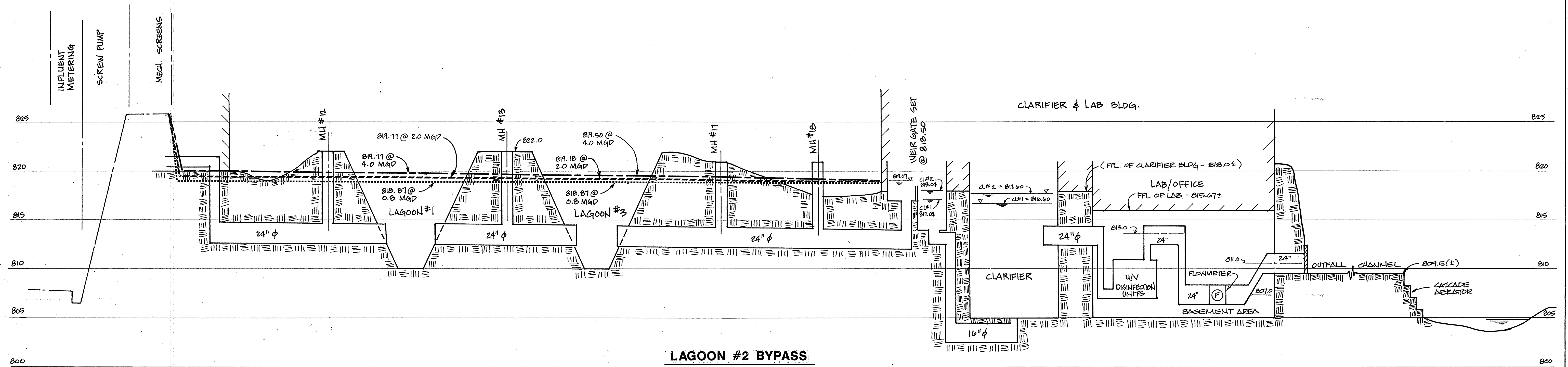
CKD. JHE 7-17-87

DRN. JLM 5-21-87

860098-A

SHEET C8 OF 26





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**DIVISION B**

**HYDRAULIC PROFILES**  
**CLARE WASTEWATER TREATMENT PLANT**  
CITY OF CLARE, MICHIGAN

**Gourdie/Fraser  
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Surveyors  
Planners**

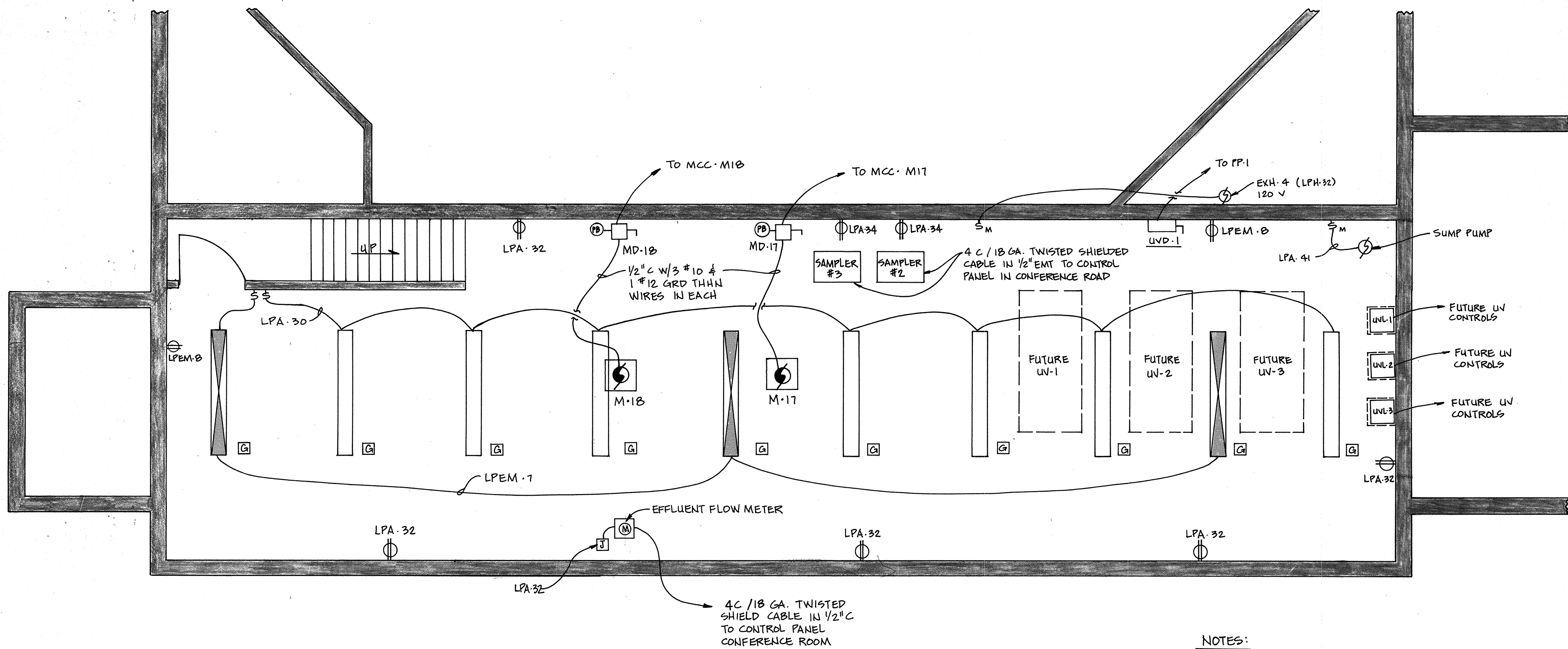
**Marquette**  
105 E. Washington Street  
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49855  
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**Traverse City**  
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P.O. Box 827  
Traverse City, Michigan  
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REV. 2-19-90  
APR.  
JHE 7-17-87  
JHL 5-21-87  
860098A

SHEET 09 OF 26





# **BASEMENT LIGHTING & POWER PLAN**

SCALE: 1/4" = 1'-0"

## **ELECTRICAL SYMBOL LEGEND**

SYMBOL	DESCRIPTION	MTG. HTG.
S	SINGLE POLE SWITCH	48"
S <sub>3</sub>	3-WAY SWITCH	48"
S <sub>4</sub>	4-WAY SWITCH	48"
S <sub>M</sub>	MOTOR TOGGLE SWITCH W/OVERLOAD PROTECTION	48"
S <sub>SSU</sub>	RUSS TYPE "SSU" EDISON BASE FUSE W/TOGGLE SWITCH	AS INDICATED
⊕	DUPLEX OUTLET	18"
⊕ <sub>GF</sub>	GROUND FAULT DUPLEX OUTLET	AS INDICATED
⊕ <sub>GF</sub> <sub>W</sub>	GROUND FAULT DUPLEX OUTLET W/WEATHERPROOF COVER	AS INDICATED
⊕ <sub>D</sub>	DEDICATED DUPLEX OUTLET	AS INDICATED
⊕ <sub>220V</sub>	220V OUTLET	AS INDICATED
⊠	JUNCTION BOX	AS INDICATED
▽	TELEPHONE OUTLET	18"
⊕ <sub>120V</sub>	120V MOTORS	---
⊕ <sub>208V, 3φ &amp; 480V, 3φ</sub>	208V, 3φ & 480V, 3φ MOTORS	---
⊠	DISCONNECT	---
⊠ <sub>CS</sub>	COMBINATION STARTER/DISCONNECT	---
⊕ <sub>T</sub>	THERMOSTAT	---
⊕ <sub>D</sub>	DATA OUTLET	---
⊕ <sub>GD</sub>	GAS DETECTOR HEAD	18"
⊕	LIGHT FIXTURE	---
⊕ <sub>E</sub>	LIGHT FIXTURE	---
⊕ <sub>EC</sub>	EMERGENCY CIRCUIT LIGHT FIXTURE	---
⊕ <sub>NL</sub>	LIGHT FIXTURE (NIGHT LIGHT)	---
⊕ <sub>SS</sub>	STOP/START PUSH BUTTON	---

## **NOTES:**

- 1) ALL CONDUIT IN THIS AREA SHALL BE SURFACE MOUNTED.
- 2) MOUNT ALL SWITCHES AND OUTLETS 48" A.F.F.
- 3) USE LIQUID-TITE FLEXIBLE METAL CONDUIT ON ALL MOTOR CONNECTIONS.

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CONTRACTOR TO FIELD VERIFY



**BASEMENT LIGHTING & POWER PLAN**  
CLARE WASTEWATER TREATMENT PLANT  
CITY OF CLARE, MICHIGAN

REV.  
APR HSR 7-20-87  
CKD. JHE 7-20-87  
DRN JHL 7-15-87

DIVISION B 860098A

SHEET 14 OF 10

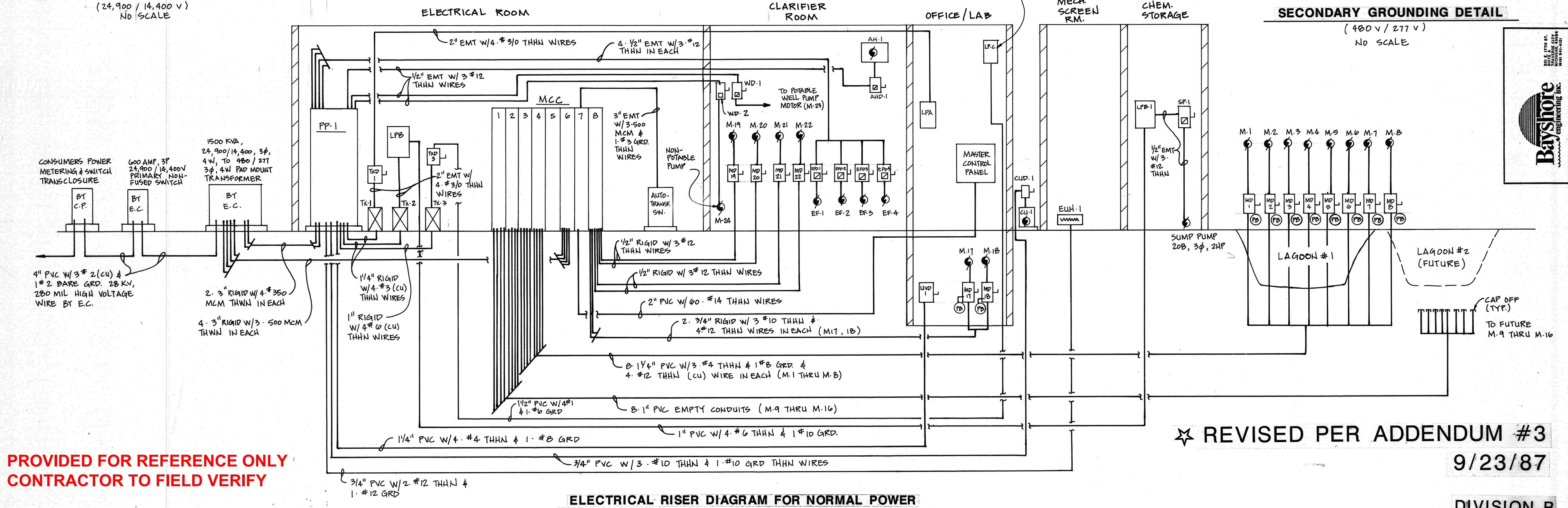
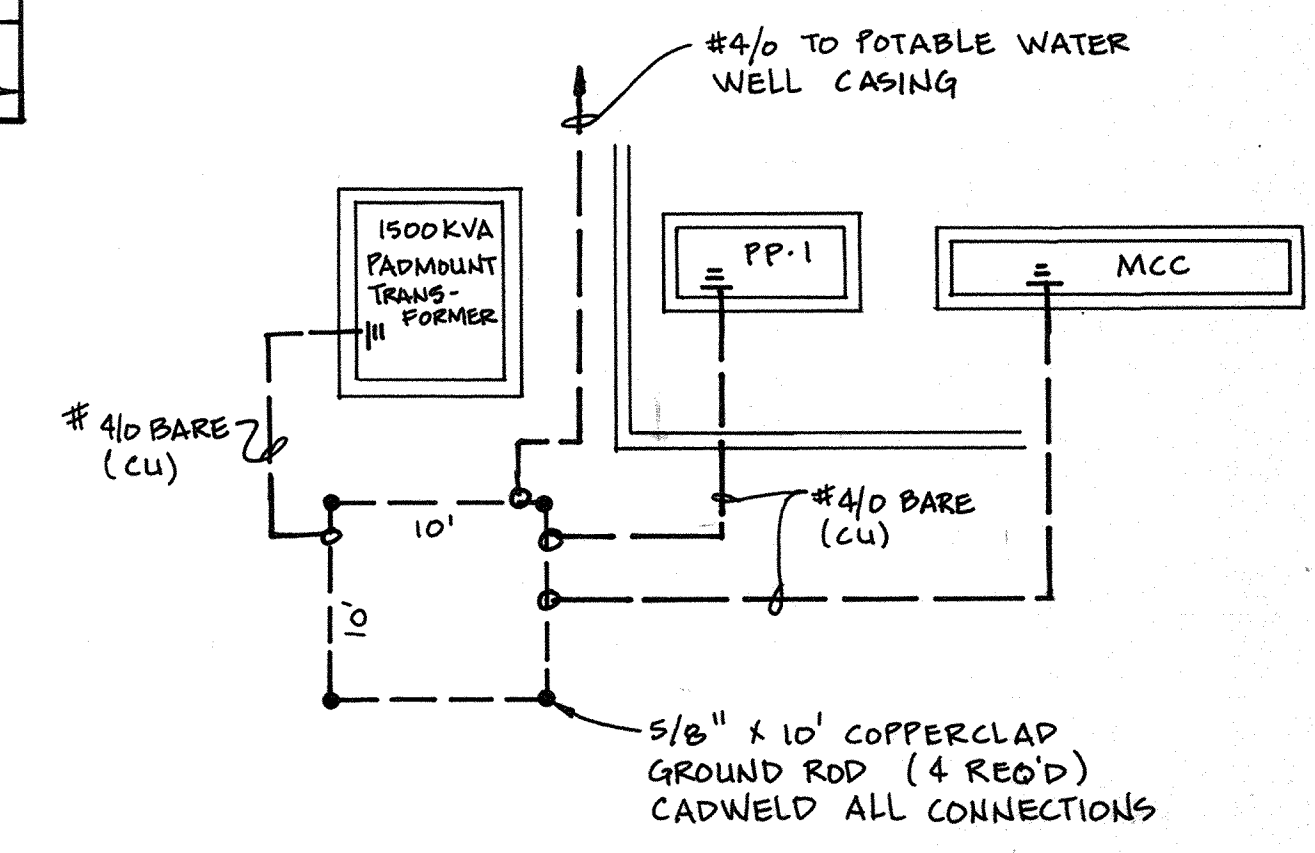
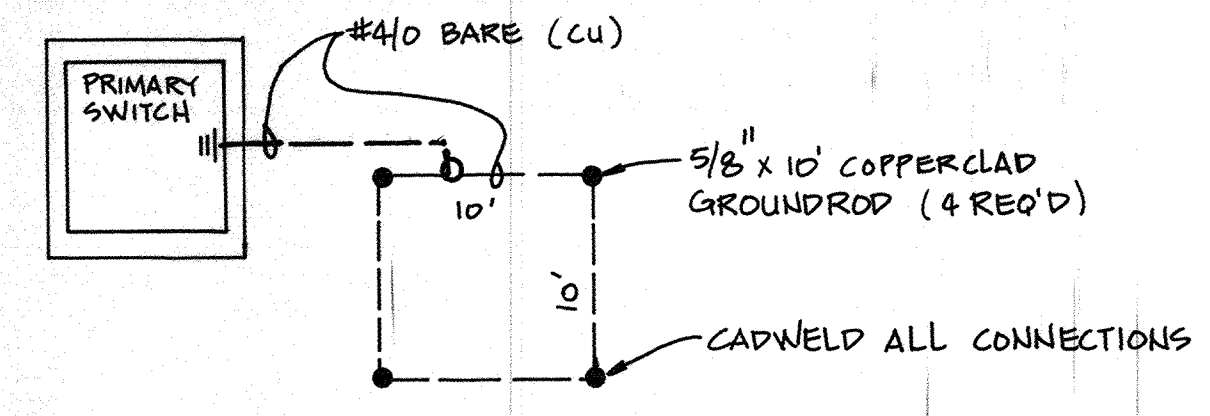
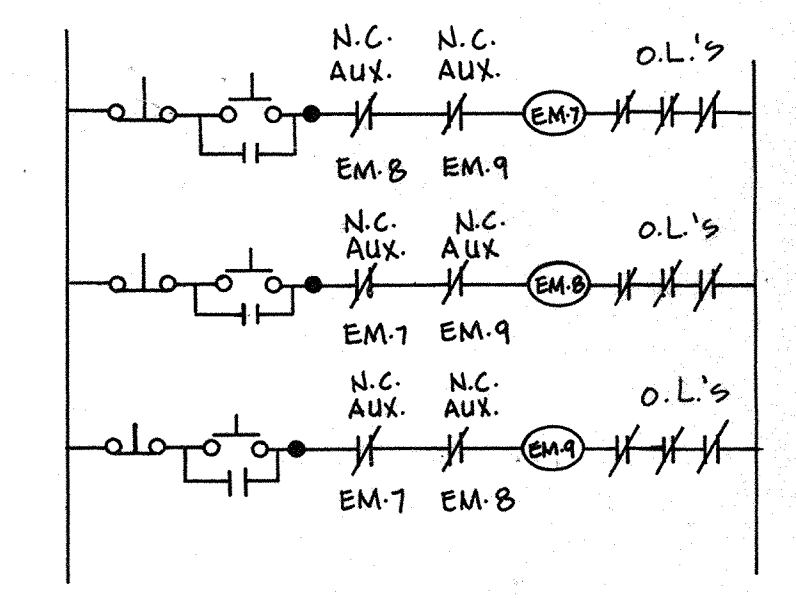
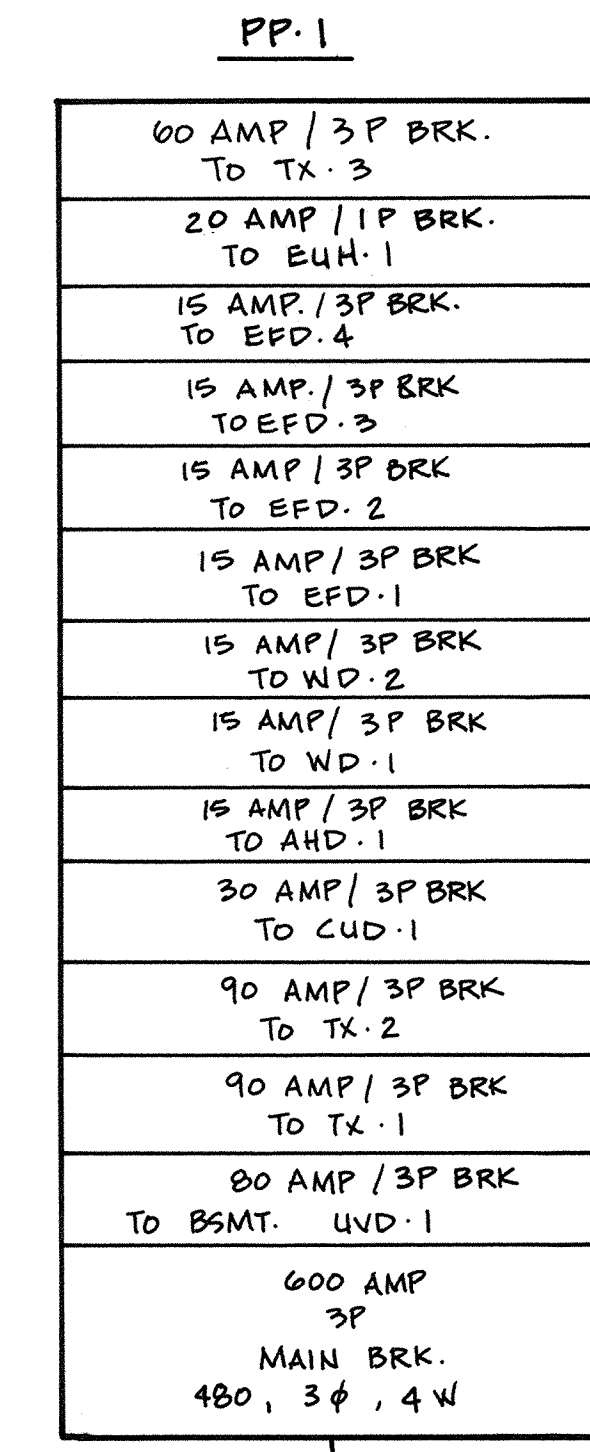
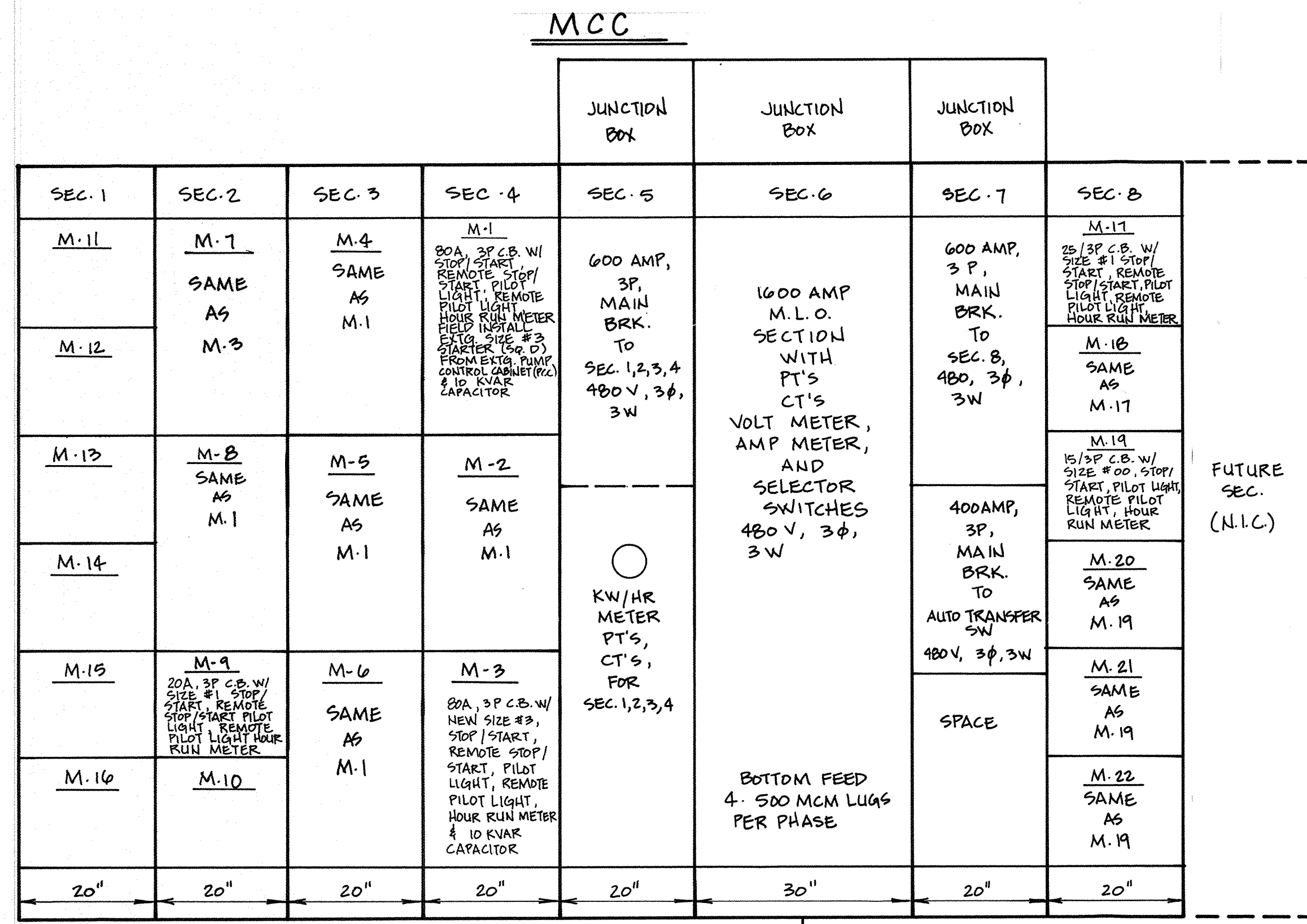
**ga**  
Gourdie/Fraser & Associates, Inc.

Consulting Engineers Surveyors Planners

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(906) 228-5171





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★ REVISED PER ADDENDUM #3

9/23/87

DIVISION B

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Consulting Engineers Surveyors Planners

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(906) 228-5171

**Bayshore Engineering Inc.**

124 West State Street  
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Traverse City, Michigan 49684  
(616) 946-5874

**ELECTRICAL RISER DIAGRAM FOR NORMAL POWER**

**CLARE WASTEWATER TREATMENT PLANT**

CITY OF CLARE, MICHIGAN

REV. 9/23/87 JLH APPEN. #3

APR HSR 7-20-87

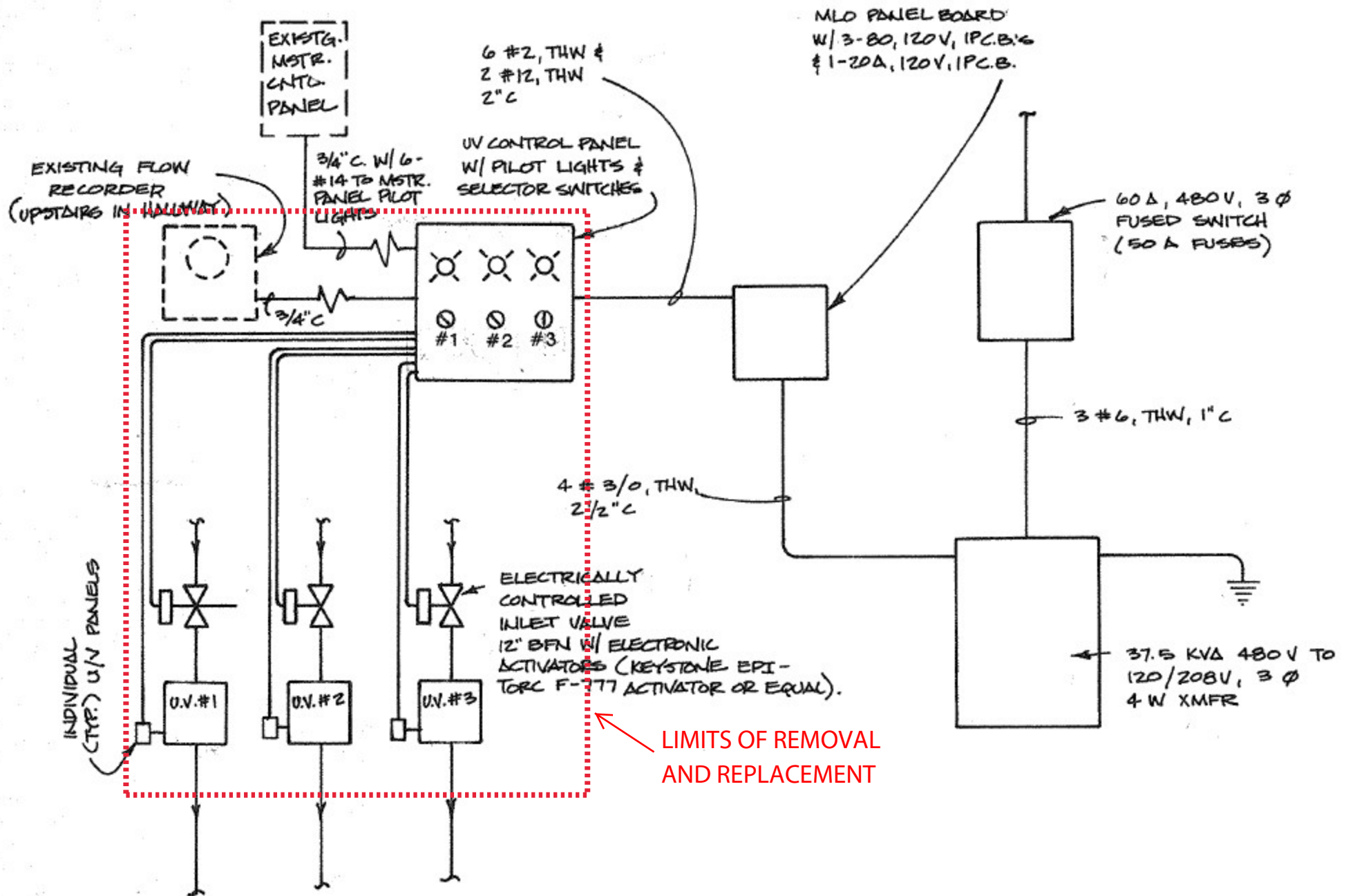
CKD JHC 7-20-87

DRN JLH 7-20-87

860098A

SHEET 88 OF 10





# UV DISINFECTION ELECTRICAL RISER DIAGRAM

NO SCALE

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FIELD VERIFY



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# EXISTING UV DISSINFECTION SYSTEM SITE PHOTOS FOR

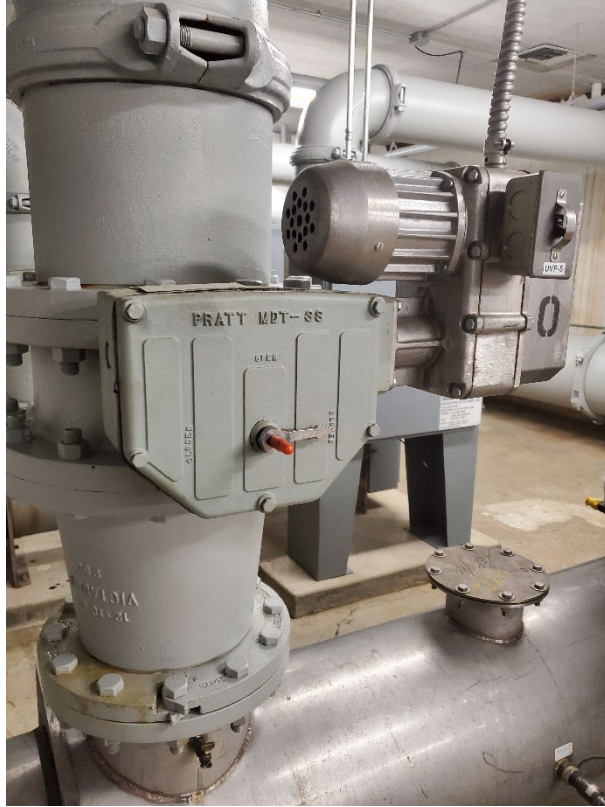
## ULTRAVIOLET DISSINFECTION SYSTEM



GFA PROJECT NO.: 21309  
DATE: July 2022









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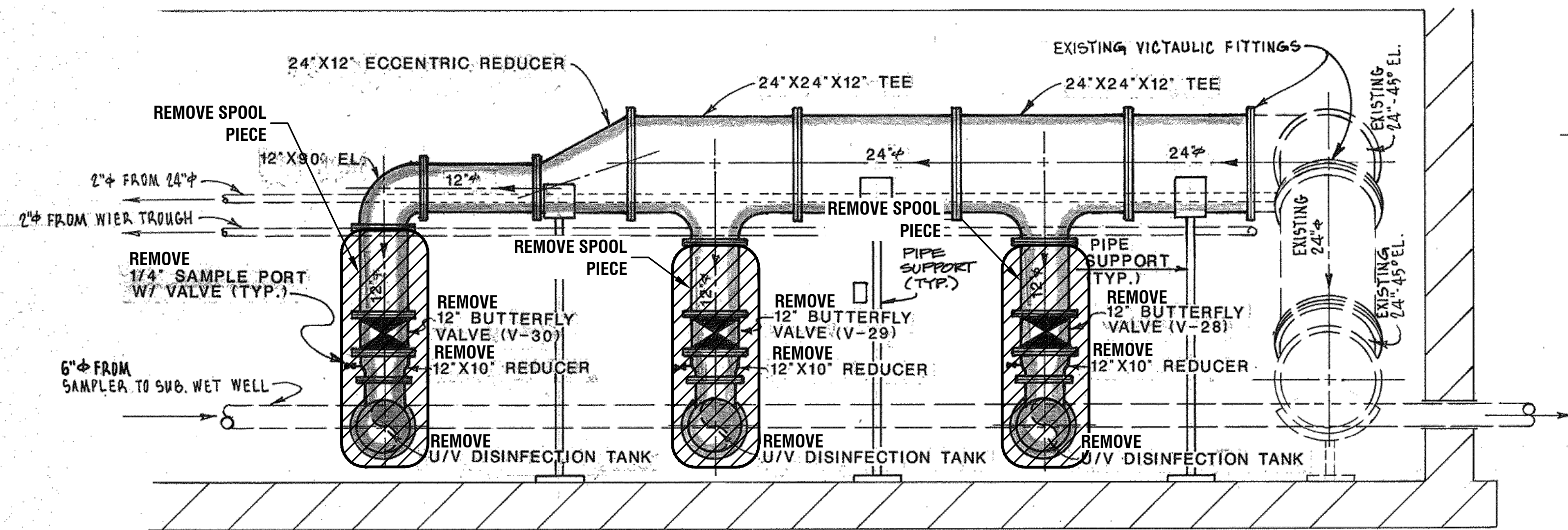
# PROPOSED ULTRAVIOLET DISINFECTION SYSTEM LAYOUT FOR

## ULTRAVIOLET DISSINFECTION SYSTEM

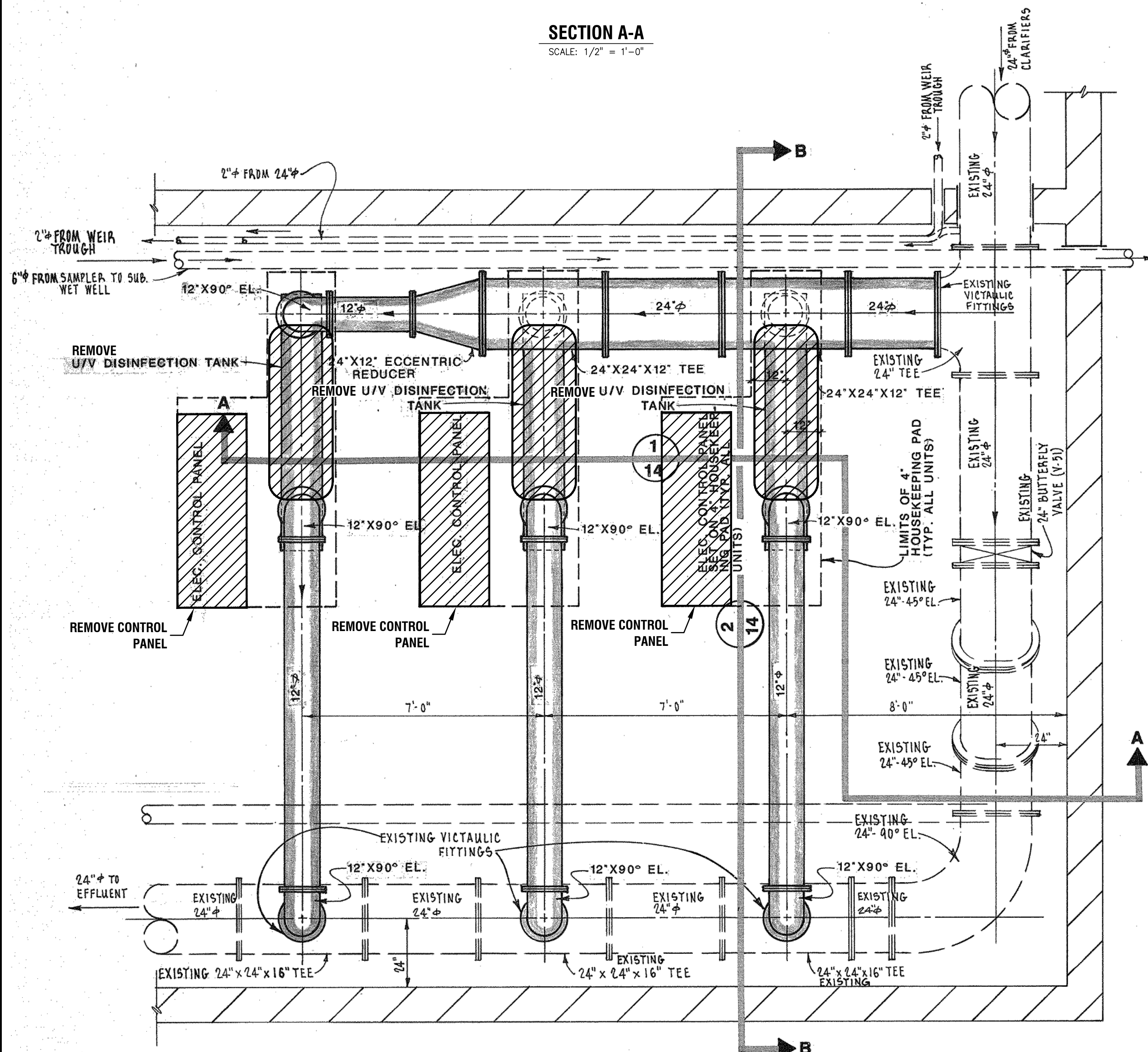


GFA PROJECT NO.: 21309  
DATE: July 2022

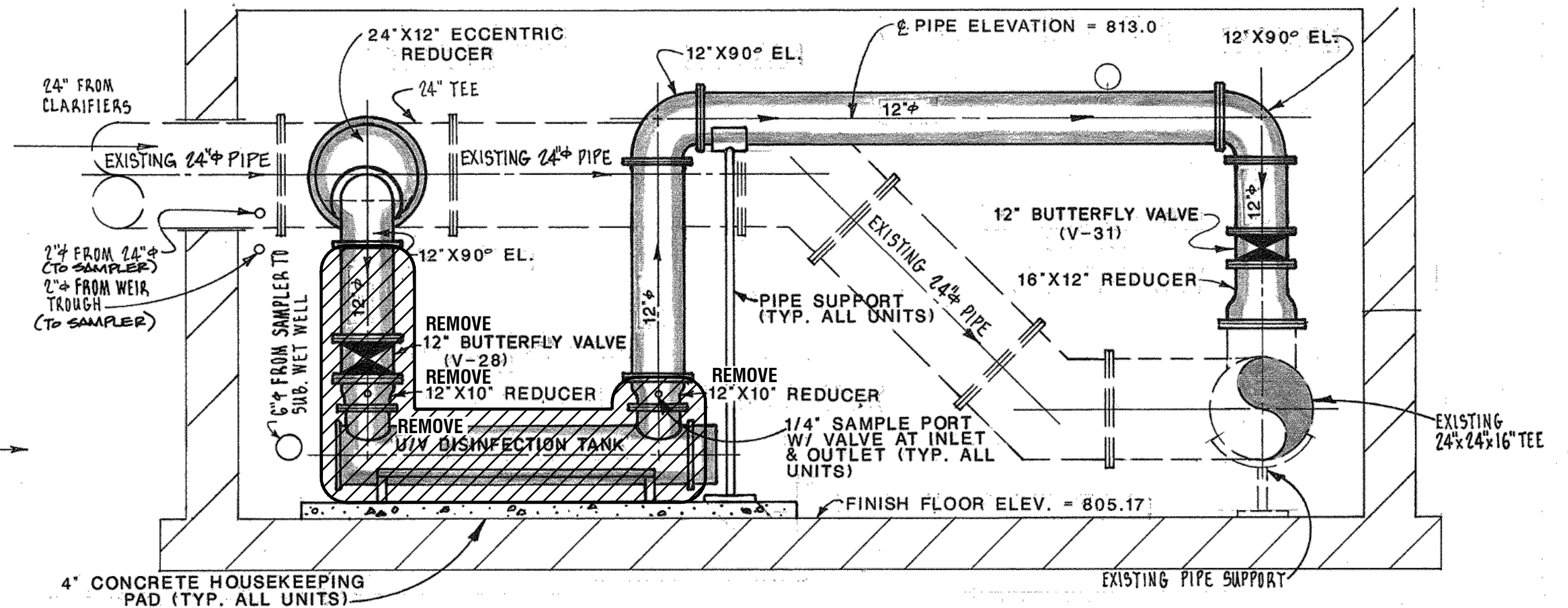




**SECTION A-A**  
SCALE: 1/2" = 1'-0"



**EXISTING PLAN**  
SCALE: 1/2" = 1'-0"



**SECTION B-B**  
SCALE: 1/2" = 1'-0"

**NOTES:**

1. THE EXISTING INFORMATION PROVIDED ARE SCANNED IMAGES OF THE ORIGINAL DRAWINGS AND ARE FOR REFERENCE ONLY. ALL COMPONENTS SHOWN IN GRAY SCALE ARE EXISTING AND SHALL REMAIN. CONTRACTOR SHALL BE RESPONSIBLE TO FIELD VERIFY PRIOR TO CONSTRUCTION.
2. ALL DIMENSIONS ARE SHOWN FOR BIDDING PURPOSES AND ARE FOR REFERENCE ONLY. CONTRACTOR SHALL BE RESPONSIBLE TO FIELD VERIFY.
3. CONTRACTOR SHALL DISPOSE OF MATERIALS AS DIRECTED BY OWNER. ALL COORDINATION SHALL BE WITH THE CITY OF CLARE WWTP OPERATOR FOR ITEMS TO EITHER BE SALVAGED OR DISPOSED OF AT NO ADDITIONAL COST TO THE PROJECT.
4. HOUSE KEEPING PAD REMOVAL AND/OR ADJUSTMENT MAY BE NECESSARY AT NO ADDITIONAL COST TO THE PROJECT.
5. ANY DAMAGE TO EXISTING COMPONENTS TO REMAIN AND/OR TO BE RE-USED WILL BE REPAIRED/REPLACED AT NO ADDITIONAL COST TO THE PROJECT.
6. REFER TO ELECTRICAL SHEETS FOR ELECTRICAL UPGRADES.



**SITE PHOTO #1**  
SCALE: NOT TO SCALE



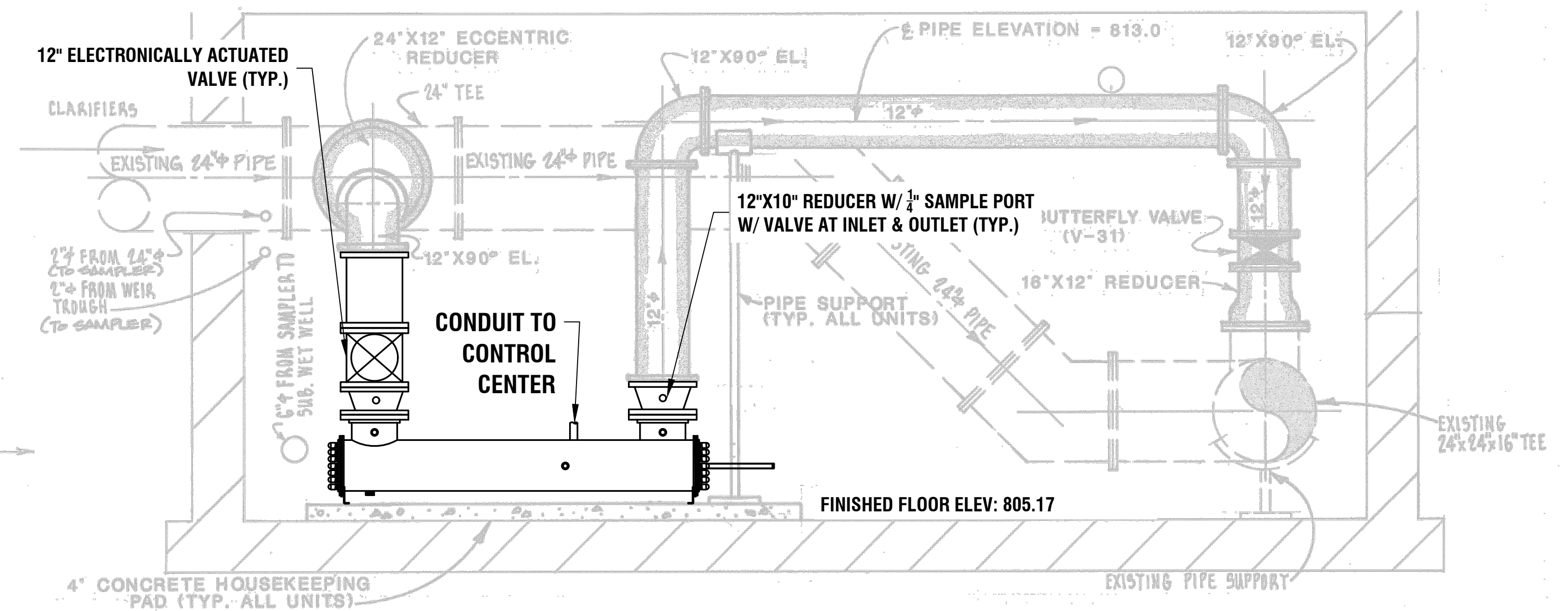
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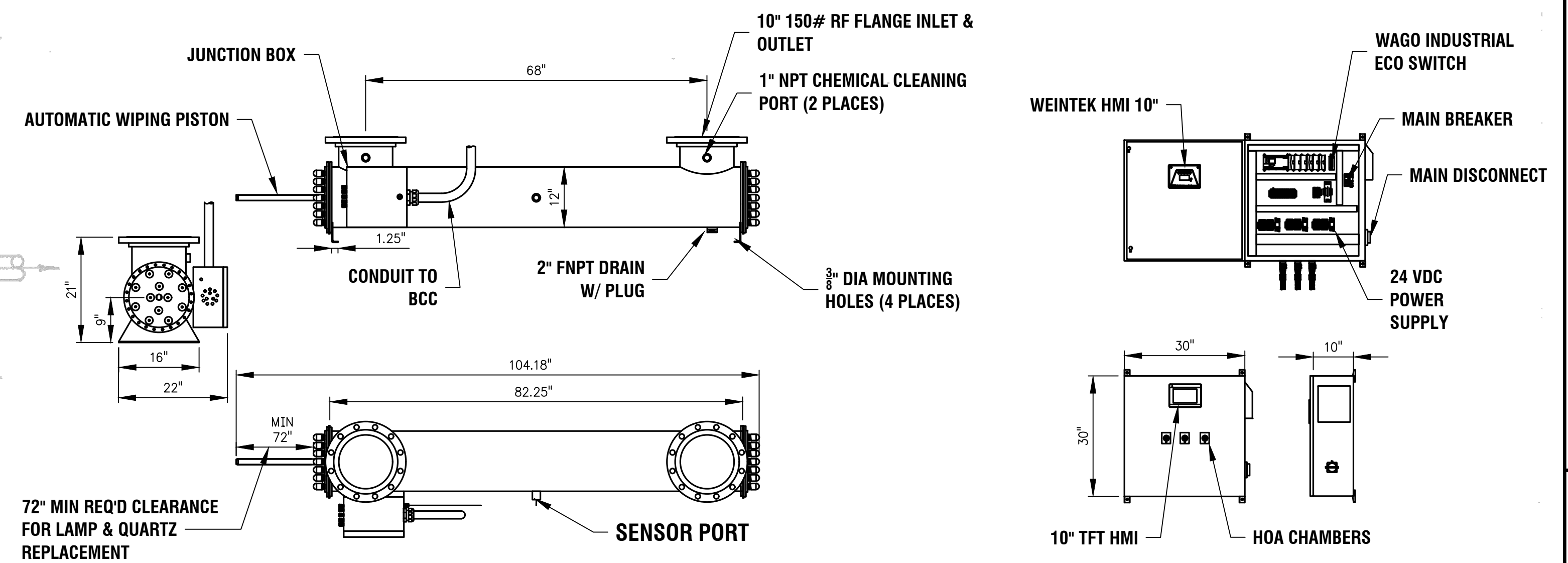
**SITE PHOTO #3**  
SCALE: NOT TO SCALE

REV#	DATE	BY	DESC.
A			REV. CHECK REVIEW
B			REV. CHECK REVIEW





**SECTION B-B**  
SCALE: 1/2" = 1'-0"



**C SYSTEM CONTROL CENTER DETAIL**  
C1.2 SCALE: NOT TO SCALE



- NOTES:**
1. ALL INFRASTRUCTURE SHOWN IN GRAYSCALE IS EXISTING AND ARE FOR REFERENCE ONLY. CONTRACTOR TO FIELD VERIFY.
  2. ALL PIPING SHALL BE DUCTILE IRON WITH VICTAULIC FITTINGS AND PAINTED IN ACCORDANCE WITH THE SPECIFICATIONS UNLESS OTHERWISE NOTED.
  3. ALL VALVES SHALL BE ELECTRICALLY OPERATED AND PROVIDED WITH HAND WHEELS TO OPEN COUNTERCLOCKWISE UNLESS OTHERWISE NOTED.
  4. CONTRACTOR SHALL ENSURE A RIGID STRUCTURE AND PROVIDE RESTRAINTS SECURELY ANCHORED TO FLOOR, WALL, CEILING, AS NECESSARY AS APPROVED BY THE ENGINEER.
  5. GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING WITH MECHANICAL, AND ELECTRICAL CONTRACTORS.
  6. ALL EQUIPMENT SHALL BE INSTALLED TO MANUFACTURER'S RECOMMENDATIONS.
  7. ALL DISINFECTION UNITS TO BE IDENTICAL.
  8. FLANGED SPOOL PIECE LENGTH WILL VARY WITH UNITS, LENGTHS TO BE FIELD VERIFIED.
  9. SYSTEM TO REMAIN ONLINE WITH NO DISRUPTIONS TO TREATMENT PROCESS. ANY DISRUPTION TO BE COORDINATED WITH THE CITY AS EFFLUENT WILL BE SHUT OFF AND STORED IN LAGOONS. ALL VALVE OPERATIONS TO BE PERFORMED BY DPW STAFF. NEW EQUIPMENT TO BE FULLY TESTED AND ACCEPTED BY THE CITY BEFORE PLACING ONLINE.

**CITY OF CLARE**  
**UV DISINFECTION REPLACEMENT**  
**PROPOSED PLAN AND SECTIONS**  
**CITY OF CLARE, CLARE COUNTY, MICHIGAN**





Engineering  
Surveying  
Testing &  
Operations

123 West Front Street  
Traverse City, Michigan 49684  
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231.946.3703 

# EQUIPMENT MANUFACTURE INSTALLATION MANUAL FOR

## ULTRAVIOLET DISSINFECTION SYSTEM



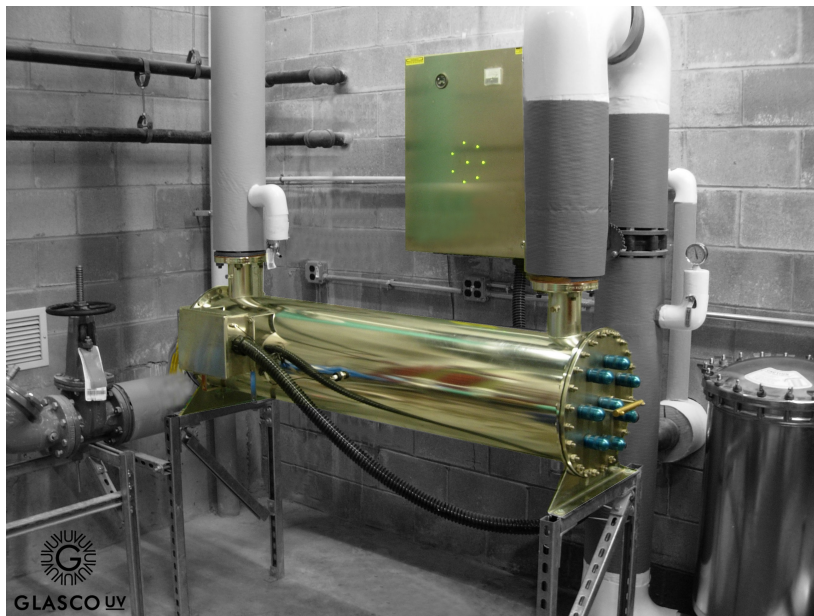
GFA PROJECT NO.: 21309  
DATE: July 2022



# INSTALLATION, OPERATION AND MAINTENANCE MANUAL

## GLASCO “IL” SERIES *Ultraviolet Disinfection System*

This is a specialty unit that has been designed to the highest standards.  
The Unit comes with automatic quartz cleaning (air driven) and UV monitoring.



DRAWINGS ARE OF TYPICAL SYSTEMS

*IL SERIES*

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## SAFETY INSTRUCTIONS

In order to protect end users and operators from injury, safety precautions must be followed. This Installation, Operation and Maintenance Manual outlines important safety issues. The following WARNING SYMBOLS will be found throughout the manual to alert the end users to take important precautions:



**INFORMATION.** This symbol signifies helpful information.



**CAUTION** This symbol indicates a potentially dangerous situation. Failure to adhere to this warning may lead to serious injury and or death.



**ELECTRIC SHOCK.** This symbol signifies warning.



**EYE PROTECTION.** This symbol indicates that eye protection must be worn to protection from UV light as well as debris.



**HAND PROTECTION.** This symbol signifies that hand protection must be worn to protect the lamps from skin oils as well as protect the operator from UV light and sharp materials caused by a broken lamp/quartz.



## 1) Information

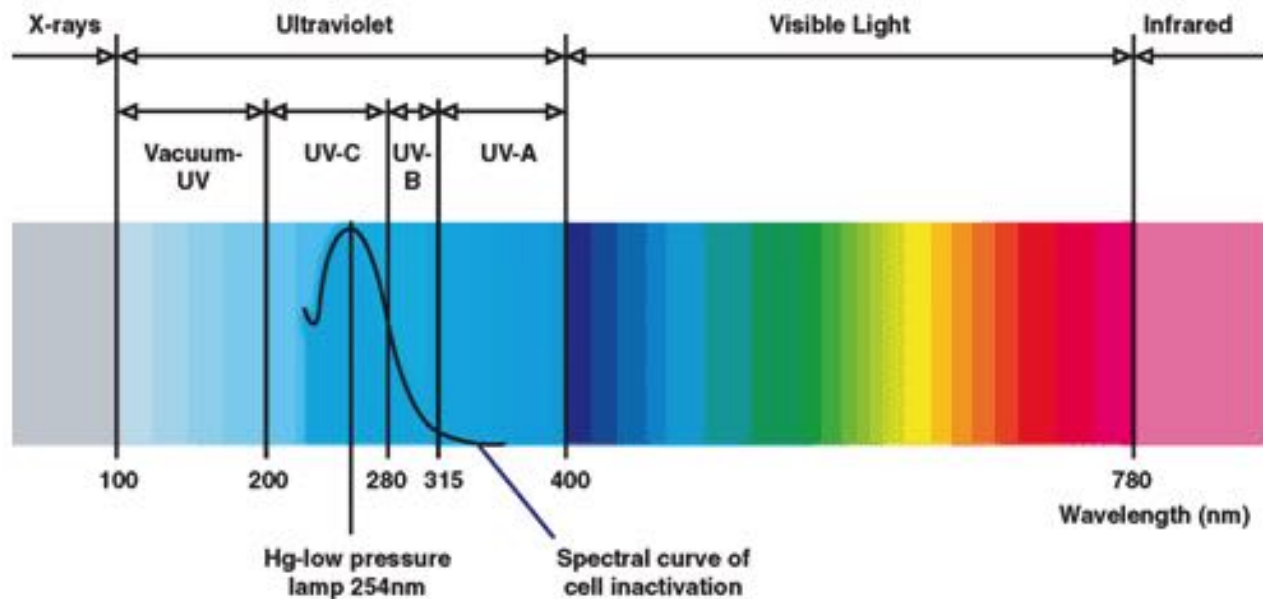
Please read this manual prior to installing, starting up and operating the equipment. The equipment uses sophisticated technology, but has been designed to make operation and maintenance easy.

The UV system needs to be maintained and does require replacement parts. Factory recommends that key spare and replacement parts be kept on hand. In order for the system to operate properly, please only use genuine factory parts. Failure to use genuine parts will void the warranty and may damage the system.

## 2) About Ultraviolet (UV) Disinfection

The technology uses UV light to target and disable disease-causing microorganisms (pathogens).

Over 100 years ago, scientists discovered that if you exposed pathogens to UV light, their reproduction was limited. The UV light source that they used, resided in the UVC range of the light spectrum. Specifically, they discovered that light in the 254 nanometer (nm) range was the most effective wavelength.



When many pathogens are exposed to UV light, their cells become damaged and this damage inhibits reproduction. The UV light, produced by a special UV lamp, damages the cell's DNA and RNA and once damaged, they are unable to replicate. This physical process renders them harmless. The amount of damage is a result of the intensity of the UVC output multiplied by the time the pathogens are exposed to the light. The applied dosage is commonly referred to as microwatts and is often expressed as mJ/cm<sup>2</sup>. Most drinking water systems generally require a dosage of 40 mJ/cm<sup>2</sup>. Most wastewater systems generally require a dosage of 30 mJ/cm<sup>2</sup>.

The lamps used produce their light in the 254 nm range. Certain projects integrate another type of lamp called an Ozone lamp. This lamp produces 185 nm in addition to the 254 nm. These lamps are used for applications like TOC reduction and other disinfection projects that require the oxidizing properties of the 185 nm lamp.

"VH" germicidal lamps generate energy at 185nm in addition to the 253.7nm line. This UV emission produces abundant amounts of ozone in air. Ozone is an extremely active oxidizer, and destroys microorganisms on contact. Ozone also acts as a deodorizer. One of ozone's advantages is that it can be carried by air into places that the UV radiation cannot reach directly.

When using the 185 nm lamps, ensure that the room is well ventilated and that the lamp and end caps are installed on the compression nuts.

*Why are plants and operators selecting UV technology?*

- a) UV is considered a green technology
- b) No chemicals are added, so there is no need for chemical removal
- c) No chemical storage
- d) UV works instantly without requiring a residence time
- e) Easy maintenance

*What are limitations of UV technology?*

- a) The quality of the liquid entering UV system needs to be monitored.
- b) The UV system needs to be cleaned on a periodic basis based on liquid conditions.

### 3) Preparation for Installing UV System

The following information is meant to be used by engineers, contractors, operators and owners to help better understand the technology, its benefits and potential hazards.



#### **a) Important Safety Information**

UV light is extremely harmful to eyes and skin and will cause burns. Do not look directly or indirectly at the UV light. Do not expose your skin for any prolonged time. Use protective clothing



and eyewear



(make sure it is UV resistant) when servicing

equipment.

If accidentally exposed to UV light for an extended period, immediately seek medical attention. Symptoms for eye exposure include burning, itching and redness. Symptoms for skin exposure are similar to sun burn.

Use gloves when handling lamps and quartz. The reason why is that skin oils will adhere to the lamps and sleeves and prevent UV light from properly emanating. If the sleeves become dirty, wipe them with a lint free cloth with denatured alcohol.

UV lamps and their quartz sleeves can become razor sharp if broken. Take care when installing and removing the quartz sleeves. Only hand-tighten compression fittings. Do not use wrenches or other tools..

#### **b) Optimizing System Performance**

The UV lamps and their corresponding quartz sleeves need to be maintained. As a general rule, the lamps need to be changed after a year of usage (9,000-12,000 hours). Quartz sleeves should be changed every three (3) to five (5) years or when they show wear.

Quartz sleeves also need to be cleaned on a periodic basis based on real world plant conditions. The factory recommends using a ScotchBrite™ pad and a commercially available cleaning product like LimeAway™ or CLR™. In addition to cleaning, please remember to wear gloves when handling lamps and sleeves.

#### **c) Plant Design**

Your UV system has been designed on a set of parameters. These parameters are described below and are based on the entire plant operating properly. Ensure that pre-processes are providing liquid that meets the design parameters.



***d) Environmental Issues Relating to UV Lamps***

UV lamps need to be recycled like fluorescent lamps because they contain mercury. Please follow your local recycling laws. Please visit [www.lamprecycle.org](http://www.lamprecycle.org) to find a recycler in your area. In the event that you are unable to find a disposal location, please contact manufacturer's representative.

***e) Receiving UV Equipment and Spare Parts***

It is important to compare the shipment's contents to the actual packing list. Any deviations must be brought to the factory's attention. Additionally, lamps and quartz sleeves need to be inspected for damage. If shipment or parts are damaged, immediately contact factory and hold broken contents and their containers for inspection by shipping company.

***f) Electrical Configuration and Maintenance***

The UV disinfection system uses sophisticated electronics and specialty lamps. Unlike other equipment in the plant, the UV system's electronics require clean power. The system has been designed to use a certain specified voltage. UV equipment must be protected from surges. If the plant is susceptible to brown outs, please contact factory.

#### 4) Major Components SPECIFIC TO THIS PROJECT

- a) Disinfection chamber with two (2) gasketed heads.
- b) Remote Ballast Control Center (BCC) – fiberglass enclosure with window kit displaying run time, UV output and lamp status LEDs.
- c) Ultraviolet lamps
- d) Quartz sleeves
- e) UV monitor
- f) Quartz cleaning system – ***Automatic – dry clean air at 20-40 psi***
- g) Spare parts
- h) Safety and cleaning supplies
- i) Warranty information



TYPICAL

### **a) Disinfection Chamber**

The chamber is manufactured from high-grade stainless steel. All welded surfaces have been ground and smoothed. The vessel has been passivated and electropolished to insure a higher purity finish.

The chamber has been designed for 150 psi operation. Due to high pressure, a manual wiper and the use of quartz sleeves, operators should not stand in front of the heads when servicing or working near the unit.



***Do not stand in front of the quartz sleeve's compression nut when unit is pressurized. Do not stand in front of the manual quartz cleaning handle as it will shoot out. A pressurized system can cause the quartz to shoot out of the unit and cause serious injury or death. Always depressurize unit before working on it. Change o-rings on a periodic basis and ensure that compression nuts are hand tightened.***

The chamber will have an inlet and outlet. These are interchangeable.



***b) Ballast Control Center (BCC) and Junction Box.***



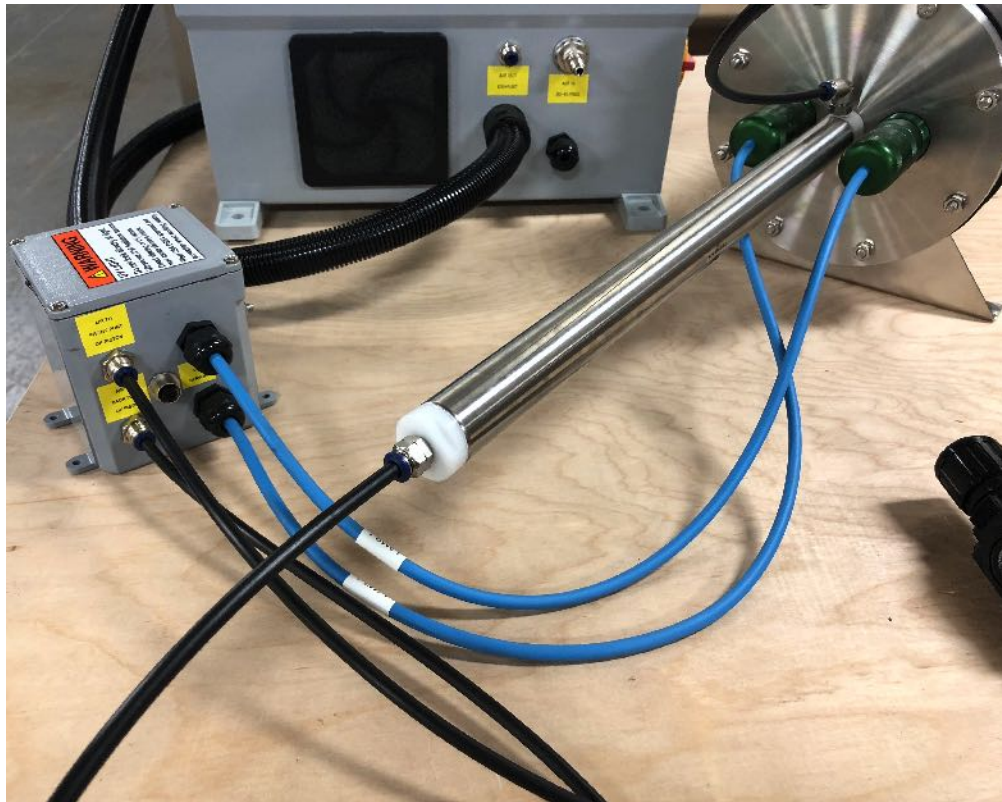
The BCC will need to be mounted near the chamber. Prior to final placement on a wall or unistruts, insure that the factory-supplied cable length is adequate to reach between the BCC and the chamber. The BCC attaches to the vessel via a junction box. This junction box holds the lamp harnesses. It may also hold connections for a high heat shut off, a UV monitor and or connections for the automatic quartz cleaning system.

The BCC requires clean power. Information on voltage and cycle will be on the nameplate. Equipment should be kept off lines where there are surges or brownouts.

The BCC will contain the ballasts and other electrical controls. Fans have been integrated to cool the electrical components. The BCC will display operation status (individual lamp status, run time and optional UV output).







Junction Box has lamp harnesses, air connection and UV sensor connections.

The Junction box has a Ground Lug. Please ground to earth.



Front head showing Piston for the automatic quartz cleaning system

**c) Lamps and Quartz Sleeves Inspection**



Insure that lamps and quartz have not been broken in transit. Use gloves when handling lamps and quartz sleeves to prevent them from becoming dirty. If lamps or quartz have broken, take extra care to prevent yourself from becoming injured.

If the lamps and sleeves have been damaged in shipment, please put to the side in the original packaging and contract factory. A claim will have to be made immediately to the shipping company.

## 5) Installation

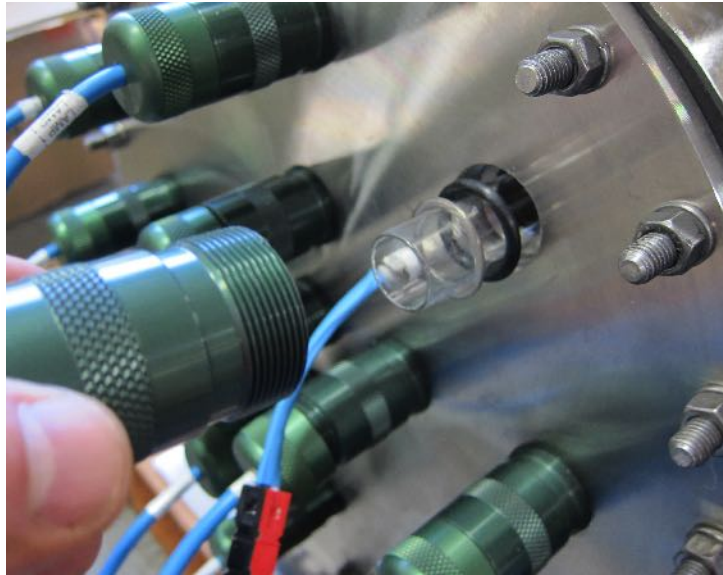
Qualified professionals (contractors, plumbers and electricians) should install the mechanical and electrical components as per code as per the engineering documents.

### a) *Chamber*



Insure that you had adequate space on the side of the vessel to insert and remove the quartz sleeves and UV lamp (40 or 70" depending on unit). If thought is not given to this aspect, the lamps and sleeves will be impossible to install.

***b) Quartz Sleeve Installation – Moisten Quartz Sleeve and Orings***



Installation of the quartz sleeves is perhaps the most difficult part of the installation as well as the most difficult process for continued operation and maintenance. Proper planning and space allocation are the most important.

The quartz sleeves seal by using a compression nut and compressing a stainless steel washer over an oring. This task requires no tools. Prior to that, the quartz sleeve needs to be inserted into the head and slowly and steadily directed through to the other side. A technician will need to stand on the other end of the vessel to guide and configure the quartz sleeve.

Clean water is good to lubricate both the oring and sleeve. Once on and pushed in snugly, the stainless steel washer should be slid on.





The quartz sleeve should extend out of the head about ½”.

The compression fittings should be hand tightened and the process should be completed for each sleeve.

Once secure and once all other ports are closed, it is time to pressurize the system to look for any leaks at the compression seals.



***Do not stand in front of the quartz sleeve's compression nuts when unit is pressurized. A pressurized system can cause the quartz to shoot out of the unit and cause serious injury or death. Always depressurize unit before working on it. This also pertains to the wiper system. The arm extends out of the unit and will shoot out if water is pressurizing.***

Slowly fill the vessel with water. Prevent any onrush of water or water hammer as this may damage the sleeves. Also insure that the UV lamps have not been placed in the vessel. In the event of a water hammer, the quartz sleeves may break and if the lamps are installed, they too will break.

Once pressurized, let stand for 10 minutes and inspect the seals. If some are found to be leaking, stop water, release pressure, drain system and then redo the seals. Once redone, run the pressurization test and insure that all seals are good.

**c) Lamp Installation**



The attached junction box houses the lamp connectors and other optional connections (UV sensor, high heat shut off). UV sensor and high heat will connect via push to connect electrical connectors.



Slide the lamp into the sleeve (making sure that the end with the pins stays on the side where the socket is). Once in, connect the socket to the lamp base and insure that the connectors are pushed firmly in. Repeat for each lamp.

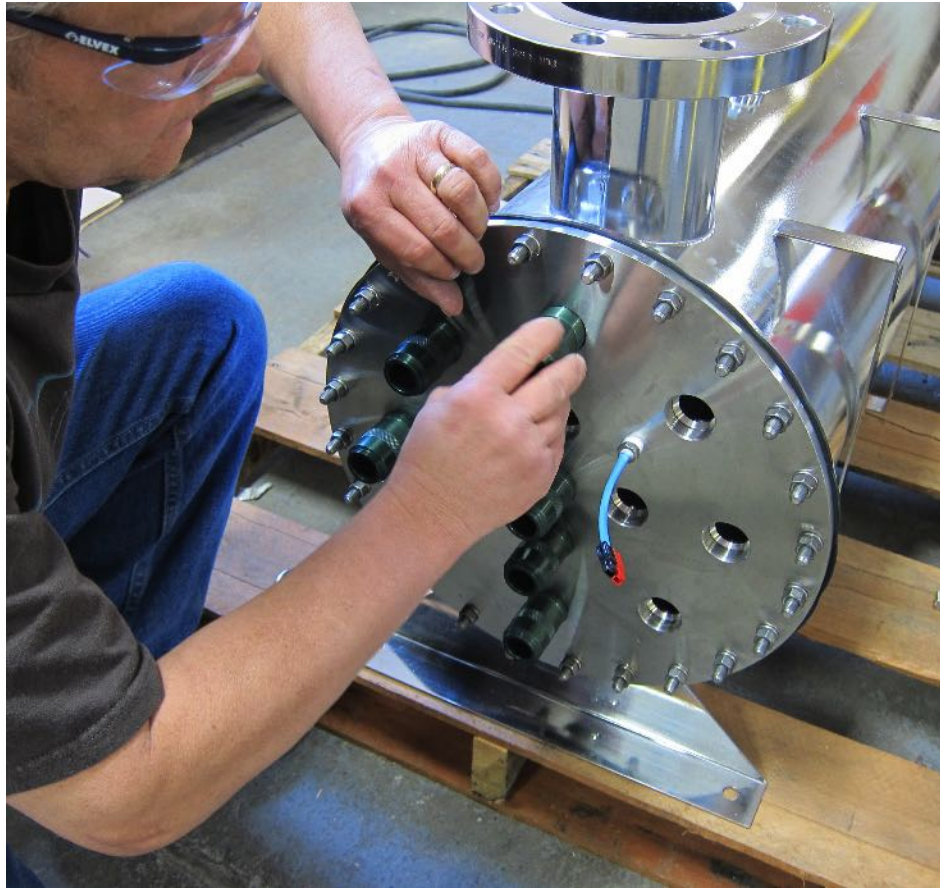




Screw the protective cap on to the compression nut. This will prevent UV light from coming out. It also acts as a stop if the quartz sleeve were to break (does not prevent water from leaking during a breakage).

## **6) Operation, Monitoring and Maintenance**

### ***a) Chamber***



Once the chamber has been installed and pressure tested, it is ready for operation. Throughout the year, certain operational issues need to be addressed.

The vessel should be wiped down from time to time with a glass cleaner and then with a stainless steel polish. This will help maintain the physical appearance of the unit. The same care should be given to the stainless steel Ballast Control Centers.

**b) Ballast Control Center (BCC)**

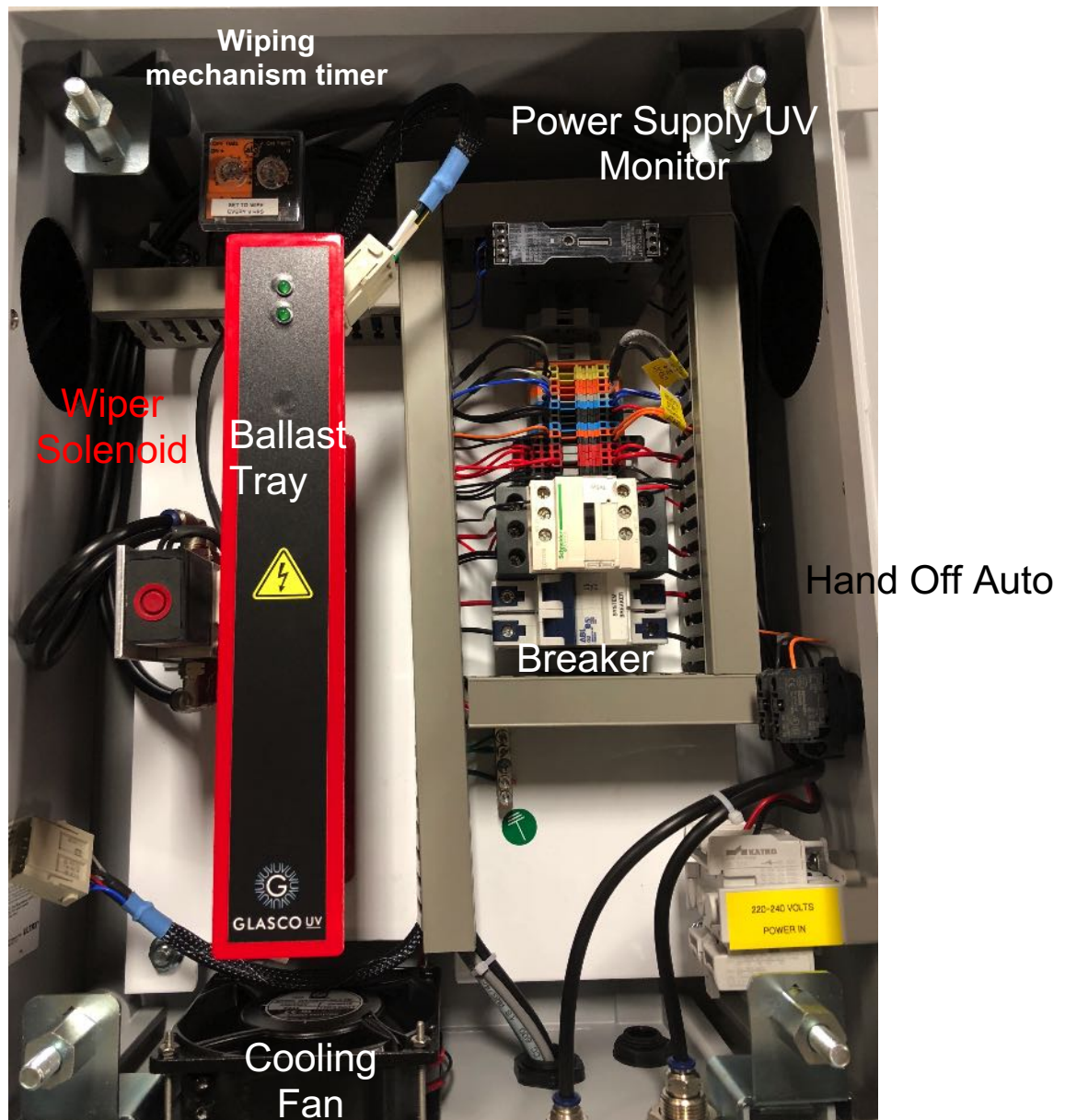


The BCC will be the focal point for system Operation and Monitoring. There are many BCC options that will have been reviewed and proposed prior to the project. Enclosures may be manufactured from fiberglass, painted steel or stainless steel. Enclosures may be provided with a window kit. No matter which type has been provided, they all provide the same basic function. That is houses the ballasts and displaying operational status.









### 1. **Lamp Status**

The BCC will display lamp status indicators in the form of Light Emitting Diodes (LEDs) located on the front door. The LEDs glow green when the lamp is on. An extinguished LED indicates a lamp problem.

If the LED goes off, then it may mean that a lamp is no longer functioning. However, it may indicate a problem with the LED, the lamp's corresponding ballast or a problem located within the lamp harness.

## 2. ***Run Time Monitoring Built into UV Monitor***

A digital non-resettable time meter has been integrated into the front door of the BCC. This run time meter tracks operational hours on the system as a whole. It does not track individual lamp run hours nor does it indicate when to service. The run time meter is a tool to help track running hours to help operators know when it is time to change lamps.

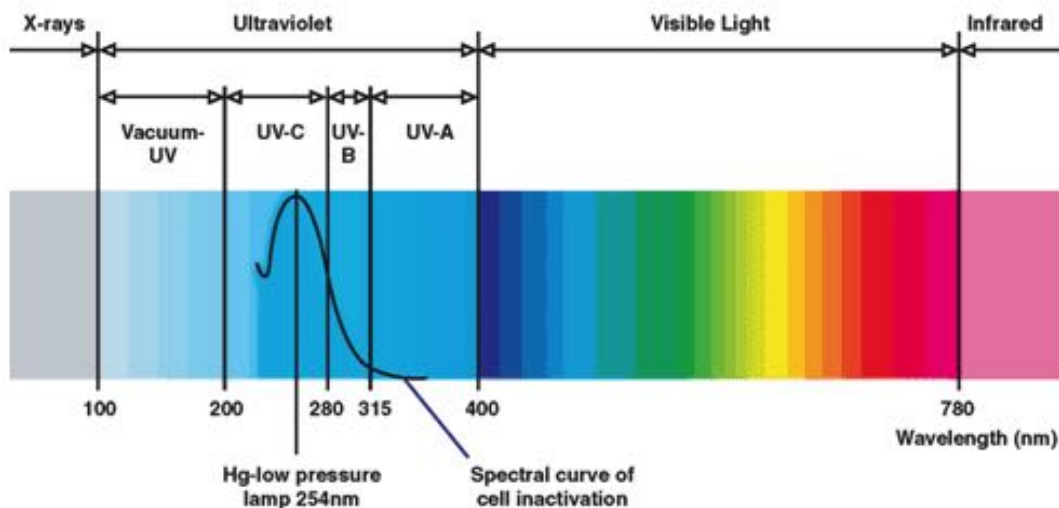
Operators should keep tracking logs in order to know when it is time to change lamps. (Many facilities decide to replace on a yearly basis, which is approximately 9,000 hours).

## 3. ***Ultraviolet Monitoring – If equipped - O&M Attached***

### **Theory of Operation**

A UV monitoring system is designed to provide the relative UV output of a lamp. The system provides a representative overview of how the lamps are performing. Low readings may indicate that the lamp is coming to the end of life, that the quartz sleeve is dirty, that the sensor window is dirty or that there has been a change to the transmission of the wastewater.

The monitoring package is a true ultraviolet (UV) sensing system. It senses only the germicidal energy spectrum as shown on the following chart. Unlike light sensors, which register any wavelength including daylight, the UV monitor is a precision instrument designed to work on a particular wavelength.



Standard low-pressure lamps produce close to 95% of its light in the 254-nanometer range. The sensor head contains a quartz-filtering device that blocks all wavelengths except those required for the destruction of microorganisms.

### **Alarming Capabilities**

The UV monitoring system provides a 4-20 mA output.



## 7) Maintenance and Optional Features

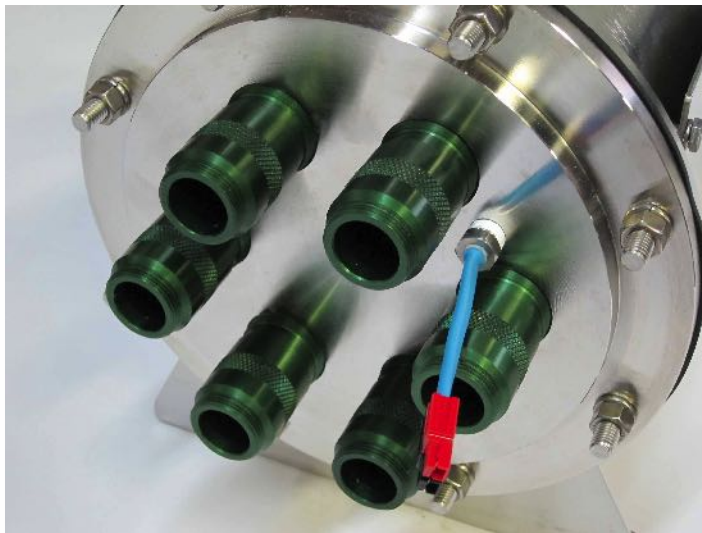
### ***a) Lamp Maintenance***

Lamps need to be replaced on a yearly basis. Lamp status should also be checked on a periodic basis by inspecting LEDs on the BCC. Keep spare lamps available.

### ***b) High Heat Control aka Thermistor - Optional***

Many applications only require periodic treatment. To prevent the lamps from overheating and the quartz jacket fouling, a thermistor (high heat cut off).

A sensor is screwed into a port in the vessel head. Teflon tape is used to insure a tight seal. The probe is attached to the electronics via a plug in connector. The probe generally shuts down at 140F. The system will turn back on with fresh cool water is introduced.



In the event that the thermistor is no longer required, please contact plant for instructions on how to by pass (jumper) the heat sensing system.

### ***c) Manual Wiper - Quartz Sleeve Maintenance – (If equipped with automatic air driven the O&M would be attached.)***

In order to insure proper disinfection, the quartz sleeves need to be inspected, monitored and maintained.

The system may be equipped with a quartz sleeve wiper system. This manual plunger style system moves a plate across the quartz sleeves. The wicking action provides for the ability to clean the system while it is operating.

## Manual Cleaning

Plant operators would have to remove the sleeves and clean by hand. Denatured alcohol, mild citric acid or a lime/calcium/rust removal product (LimeAway or CLR) and a ScotchBrite pad can be used to aid in the cleaning of the sleeves.

### *d) BCC Maintenance*

The primary concern is to maintain proper clean protected manner to the BCC.

Routine maintenance should include checking and cleaning the filters on the air intake fans. Fans have been integrated to keep the electronics cooler to insure optimum performance.



Prior to cleaning the filters, power down the BCC. Spinning fans can cause injury. Once powered off, snap the covers off by hand, remove and wash the filter with warm water, dry and then reinstall.

Since the BCC has been modified to include displays, controls and fans, do not hose clean or wash down the enclosure. Water will damage the electronics and will cause corrosion.





Comes with automatic quartz cleaning mechanism. Instructions are outlined elsewhere.

#### ***e) Chamber Maintenance***

The chamber requires periodic maintenance. The scope and complexity of the maintenance will be dictated by quality of the liquid. Some liquids introduce solids, minerals and other debris into the vessel. Systems operating in these types of environment require regular cleaning as well as gasketing replacement.

Investigating Internal Parts of the Vessel:

Since the vessel is sealed by the inlets and outlets as well as having all the ends sealed, it is difficult to look inside the chamber. There are a few ways to accomplish this observation task.



Prior to performing inspection, insure that the power to the BCC and that the water supply has been turned off before and after the chamber. Once isolated, drain the system. Prior to draining, release pressure in line by opening a valve. Failure to do these tasks can result in serious injury and property damage.

Once drained, the operator can remove a lamp (make sure not on or not still hot) and quartz sleeve and look through the quartz hole in the machined head. Use a small flashlight to shine inside to see if there is debris. This same observation can be done using another monitoring port.

### **Chamber Break Down – Removal of Heads**

Once determined that there is reason to believe that the vessel needs to be cleaned, the operators will need to set aside some work time to perform a complete system break down.

As with inspection, the vessel needs to be powered off, completely drained and allowed to cool down.

The operators will need to remove the lamps, the compression nuts, washers, orings and quartz sleeves. All of these parts should be checked for wear and should be stored in an area where they will not get lost.

At this point, there should be two (2) operators depending on the complexity of the system and weight of the heads.

Operators will need to loosen the nuts and bolts on one head (to start with). Once loosened, the nuts, bolts and washers need to be removed and stored.



The head will need to be replaced in the exact position in which it was removed. A good trick is to use a Sharpie to mark the head and the end flange. This will allow for easy alignment when reassembling.

Lower the head to the ground. The gasket should be inspected for wear and also stored in a safe place. Having one head off will allow for both visual inspection and cleaning.

Once cleaned, perform maintenance on the quartz sleeves and replace any gaskets/orings.

When re-installing the head, use a crisscross pattern to tighten the nuts. This is similar to putting a tire on a car.

-END-

The E-10624M UV monitor can be used with a variety of sensors. The UV meter is designed to work in conjunction with a UV sensor to provide operational status of a UV lamp. Depending on the sensor and the requirements, the E-10624M can display UV lamp output UV-values displayed in “W/m<sup>2</sup>”, “mW/cm<sup>2</sup>” or “%”.

The monitor can reduce maintenance costs by determining exactly when lamps need to be serviced. The continuously monitors relative lamp output from 0% to 100%. It provides a method of determining exactly when lamps need to be cleaned or replacement.

As the lamps age, the monitor tracks the lamp output through the display. A warning threshold can be set to turn on a warning indicator and activate a relay for external control.

Thresholds are programmable from 0% to 100% levels. In addition to the display and alarms, the monitor has a 4 to 20ma output which represents the 0% to 100% on the display. This output can be used for remote monitoring or sent to a data collection systems/

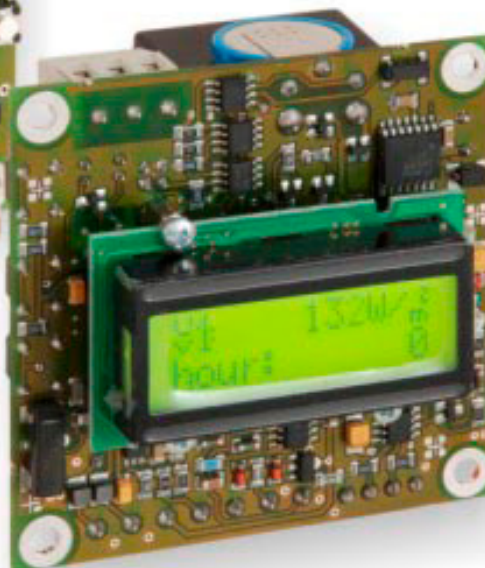


The system is “calibrated” after initial installation of the lamp bank and readjusted after after 100 hour burn in. The monitor is adjusted to indicate 100% for new/clean lamps. Then appropriate operator alert levels are set for the specified decrease in intensity.





rear view



front view

Part #	E-10624M
Meter type	Digital for 254 nm
Supply voltage	24 v
Lamp monitored	1 to array
Operation temperature	113F
Ambient temperature	32 to 104 F
Size	3" x 3" x 2"
Hour counter	Resettable
Display	Multicolor 2 line LCD backlight
UV alarm	Potential free relay
UV value	Forwarded via 4-20 mA
Country of origin	Germany





## Ultraviolet Meter – Part# E-10624M “PRO-16” - Digital

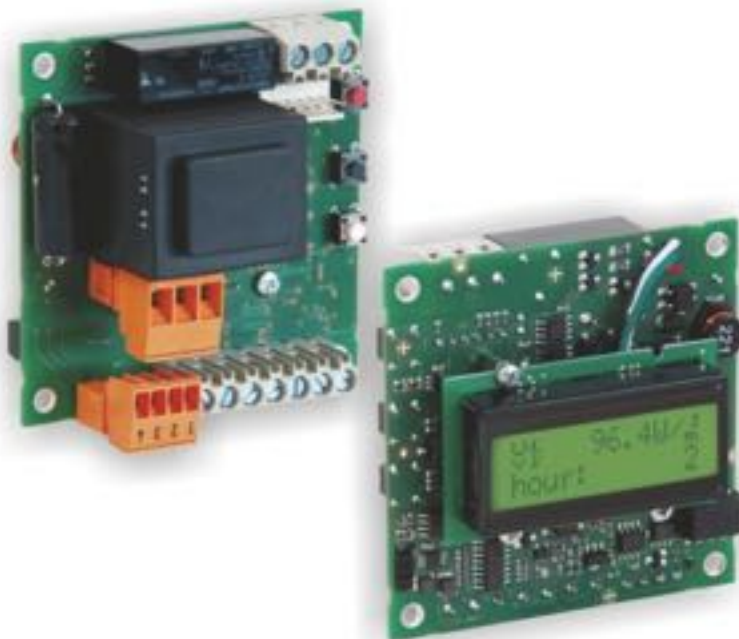
**Type:** Digital 0-100%  
**Applications:** Vertical Wastewater  
**Components:** UV Meter  
**Sensors:** Vertical

### Theory of Operation

A UV monitoring system is designed to provide the relative UV output of a lamp. The system provides a representative overview of how the lamps are performing. Low readings may indicate that the lamp is coming to the end of life, that the quartz sleeve is dirty, that the sensor window is dirty or that there has been a change to the transmission of the wastewater.

The monitoring package is a true ultraviolet (UV) sensing system. It senses only the germicidal energy spectrum as shown on the following chart. Unlike light sensors, which register any wavelength including daylight, this is a precision instrument designed to work on a particular wavelength.

Standard low-pressure lamps produce close to 95% of its light in the 254-nanometer range. The sensor head contains a quartz-filtering device that blocks all wavelengths except those required for the destruction of microorganisms.



## Alarming Capabilities

The UV monitoring system provides a 4-20 mA output.


## Operation



**ELECTRIC SHOCK.** Indicates risk of electrical shock, which may cause serious injury and or death. While the UV monitor is a 24 Volt device, you will be working with UV lamps and water and we recommend being careful.

1. The meter face provides an “ENTER” button as well as an “UP ARROW” and a “DOWN ARROW”. The UVM-1624 is a 24 volt UV monitor. It can displays relative UV output (0-100%) or absolute UV output (W/m2). It also will display run time.
2. The UVM-1624 UV monitoring system has been factory calibrated. You will find, however, that it is necessary to Re-Calibrate it once the system is in use.
3. Factory Presets (editable):
  - a. Low UV warning at 70%
  - b. Low UV alarm at 50%
  - c. End value 110% (limits the percentage that the UV monitor can display



4. Recalibration *must* occur whenever a lamp change is performed (new lamp) and with the water in the system.
  - a. Press and hold ENTER to enter settings menus.
  - b. Press ENTER repeatedly to see a list of user definable fields.
  - c. The re-calibration function focuses on finding the sensor input screen. By pressing the enter button, you will cycle through the various functions.
  - d. Hit enter until “sensor input signal” is shown to be DIGITAL is confirmed to be set. If it is not, use UP and DOWN to select DIGITAL. (depending of the type of unit you have purchased) Your unit is equipped with a **Digital sensor.**  

  - e. Press ENTER and you will see the end value (%). We recommend setting to 100%. To adjust, use the up and down arrows. Once selected, hit enter.
  - f. You will be brought to another function screen. The Adjust screen also you to confirm your changed settings. Toggle to Yes or No and hit Enter.
  - g. The UV meter will read “scanning” and it will confirm the new settings. Once scanned, hit enter to get to the next function.
  - h. The next functions will allow the user to select Alarm and Pre Alarms at certain %. Once entered, you will be brought to another screen “CONFIG”.
  - i. Simply allow it to run and it will set the system.

The UV Monitor can be a standalone product or can be located in a Ballast Control Center. When performing re-calibration or other trouble shooting operations, please be careful as UV system operates at 120 volts or 230 volts.



GLASCO UV

## Programmable Functions

There are many settings that can be programmed into your UVM-1624.

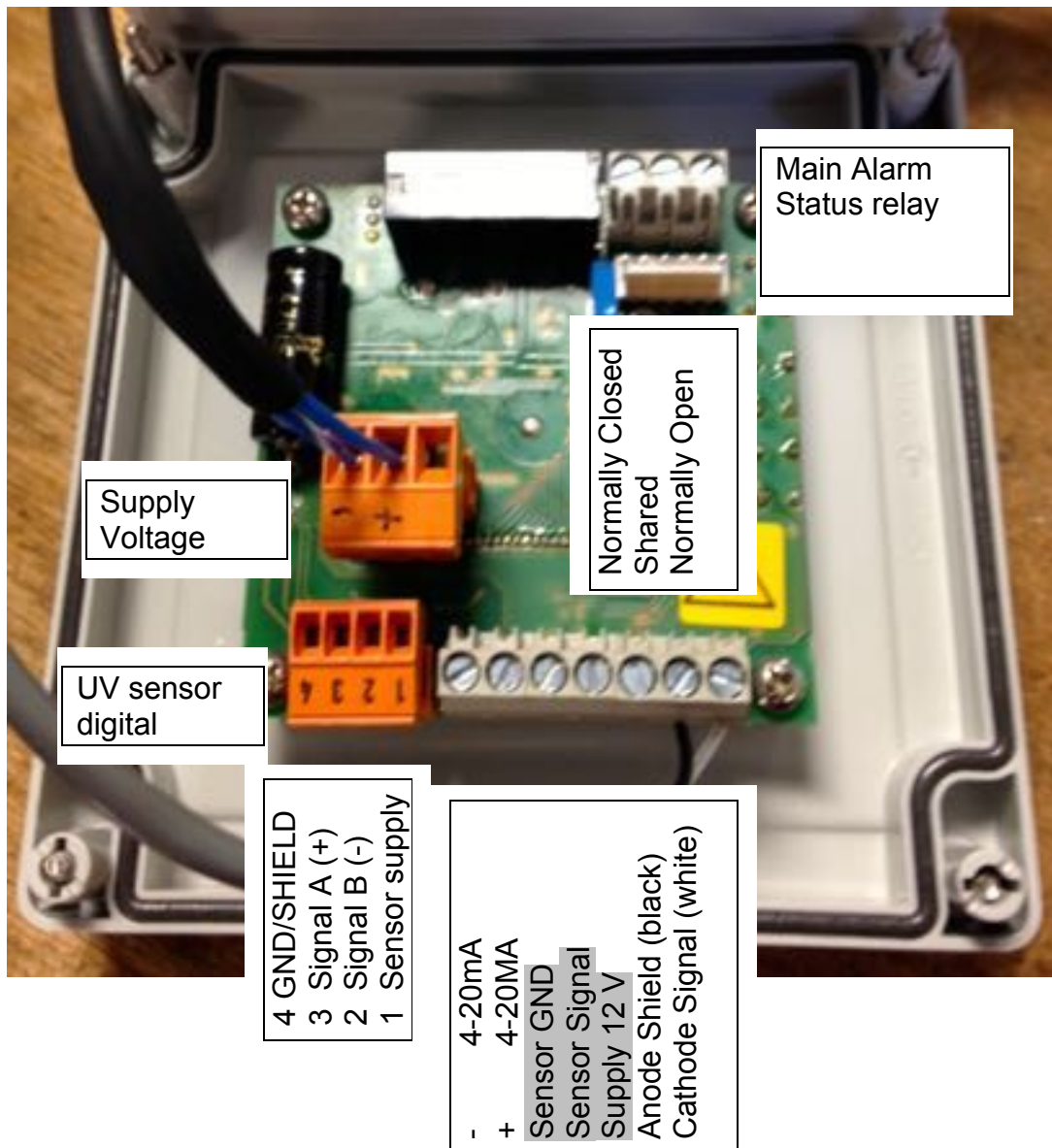
Basic settings: language, date, time, lock code and display contrast.

Operation settings: start up delay, lamp replacement time.

Settings: sensor type, measurement unit, reference value, alarm setpoints

Statistics: on/off cycles, lamp hours and total monitor operation hours

## Utilities





**GLASCO UV**

The UV monitor allows the end user to use various sensors. It also allows for the end user to take a signal (4-20mA) or dry contacts for remote monitoring.

### **TECHNICAL**

Supply Voltage	24V DC, 1 W
Operating Temperature	max 45C (113F)
Ambient Temperature	0-40 C (32-104F)
Running time of clock battery	8 years
Operating Status	LCD – 2 line alpha numeric
Status LCD Colors	Green, Yellow, Red
Languages available	English, Germany, French



GLASCO UV

## Calibration Screenshot Walkthrough



Power On



Enter



Wait



Enter



Wait



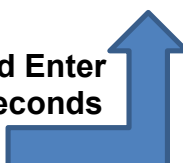
Enter



Hold Enter  
2 seconds



Enter

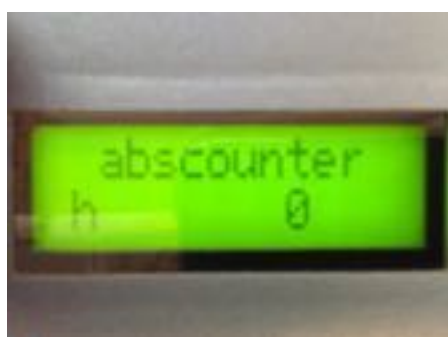




Enter



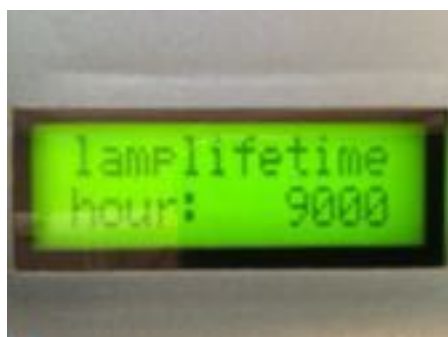
Enter



Enter



Down Arrow "YES"



Enter

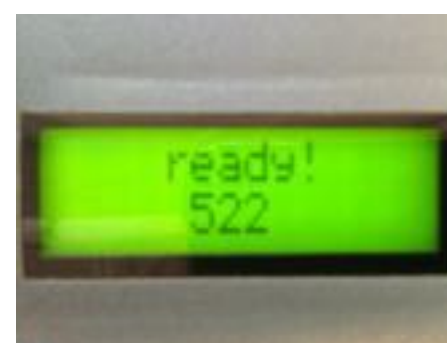


Wait



DIGITAL

Enter



Wait



GLASCO UV



Enter



Complete



Enter



Enter



Enter & Wait



## Ultraviolet Sensor – Part# E-4025SM “Side Looking”

### Theory of Operation

A typical wastewater UV monitoring system is designed to provide the relative UV output of lamps. The system is comprised of a UV Monitor and a UV Sensor. The system provides a representative overview of how the lamps are performing from the time they were brought on line. Low readings may indicate that the lamp is coming to the end of life, that the quartz sleeve protecting the sensor is dirty or that there has been a change to the transmission of the wastewater.

The UV monitor is a true ultraviolet (UV) sensing system. It senses only the germicidal energy spectrum as shown on the following chart. Unlike light sensors, which register any wavelength including daylight, the UV monitor is designed to work on a particular wavelength.

Standard low-pressure lamps produce close to 95% of its light in the 254-nanometer range. The sensor head contains a quartz-filtering device that blocks all wavelengths except those required for the destruction of microorganisms.

The “Side Looking” sensor detailed in this document is used for a variety of applications. The one commonality is that the Sensor is installed in its own quartz sleeve. A single quartz sleeve is used to house the Sensor and in most cases is cleaned as part of an automatic or manual quartz sleeve cleaning process. This can include Clean In Place “CIP” processes.

The “Side Looking” sensor is commonly used on the following:

1. Vertical open channel wastewater systems that incorporate auto-cleaning
2. Horizontal open channel wastewater systems that incorporate auto-cleaning
3. Chambered wastewater systems that incorporate auto-cleaning
4. Chambered water systems that incorporate auto-cleaning



**E-4025SM Sensor will be attached to a stainless tube with a connector. Part numbers may change due to different connectors.**



## Chambered UV Systems

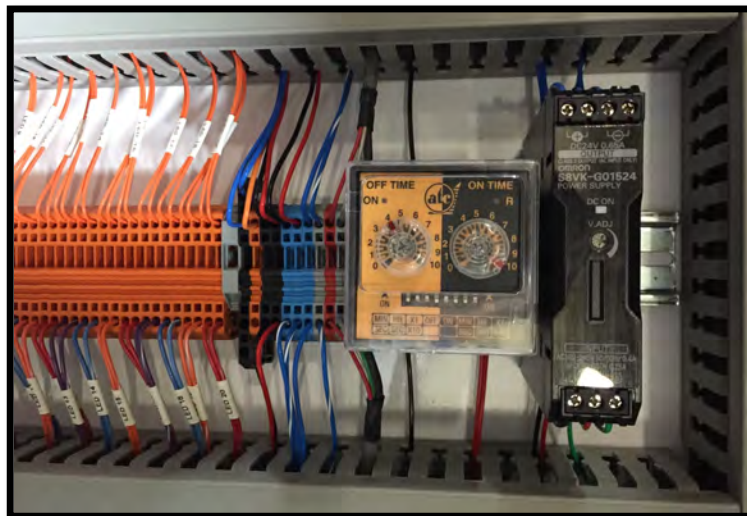
The chambered UV system requires that the UV sensor be installed into the quartz sleeve as shown. Once in the sleeve, it will need to be connected to the associated connector.





### **Automatic Quartz Cleaning - Using a timer (non PLC)**

The system is provided with an air driven quartz cleaning system. The air driven system is designed to clean on a periodic basis for a certain number of strokes.



Actual instructions for timer are attached at the end of the manual.

When?  
Every 6 hours



How long?  
10 seconds

Dip switches are shown at correct positions.

The wiping system is controlled via a timer and a solenoid. The wiper timer (in the BCC) is adjustable. The timer allows you to set when the system will clean and also sets the duration of the cleaning cycle. The solenoid is in the junction box.

The timer will come factory programmed to clean every 10 hours (4 x per day) and will make a cleaning pass that lasts approximately 10 seconds.

The dip switches have been set and should not have to be moved. Refer to the diagram found on the attached information data sheet to insure that the switches are in the appropriate position.

If you want to have the system clean more or less frequently, change the setting on the orange side.

### MODE AND RANGE SELECTION

**Dip switch settings for time range selection**

OFF TIME				ON TIME			
RANGE	SWITCH SETTING			RANGE	SWITCH SETTING		
	Sw1	Sw2	Sw3		Sw6	Sw7	Sw8
1 sec	OFF	OFF	ON	1 sec	OFF	OFF	ON
1 min	ON	OFF	ON	1 min	ON	OFF	ON
1 hr	OFF	ON	ON	1 hr	OFF	ON	ON
10 sec	OFF	OFF	OFF	10 sec	OFF	OFF	OFF
10 min	ON	OFF	OFF	10 min	ON	OFF	OFF
10 hr	OFF	ON	OFF	10 hr	OFF	ON	OFF

**Dip switch settings for mode selection**

MODE	SW5	SW4
OFF First	OFF	ON
ON First	ON	OFF

Switch setting example :  
Off time range: 1sec  
On time range: 10min  
Mode :Cyclic off first

ON

1	2	3	4	5	6	7	8
MIN	HR	X1	OFF	ON	MIN	HR	X1
SEC	SEC	X10			SEC	SEC	X10

### OPERATING MODES

**SUPPLY**

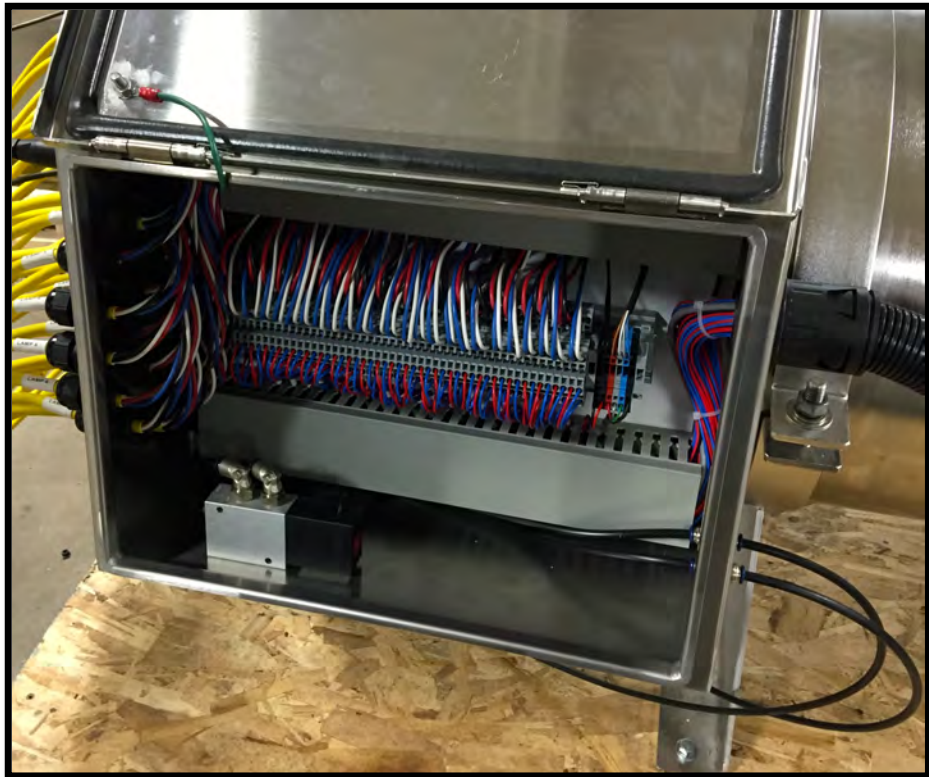
ON NO  
first contact

OFF NO  
first contact

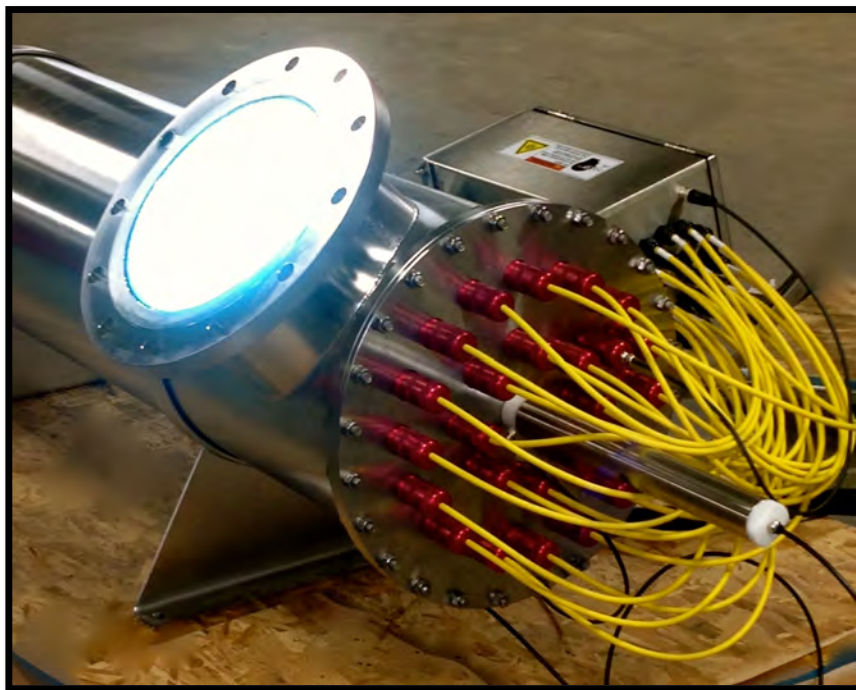
t1 = On time, t2 = Off time.

**SEE MANUFACTURER'S CUT SHEET ATTACHED**





Solenoid Valve in the junction box



Piston shown

The 422AR Flip-Flop timer are available with Repeat Cycle operations. During Repeat Cycle operation the 422AR cycle ON and OFF repeatedly, allowing periodic cycling of a load. Two knobs are available to individually adjust the ON-time and the OFF-time. The 422AR can be configured with either the relay being energized during the first timing period or de-energized during the first timing period.

The 422AR have 6 selectable timing ranges available for both ON-time and OFF-time periods. The ranges are 1 and 10 SEC/MIN/HRS dip switch selectable. Having this flexibility allows for a load to be energized for a brief time over a cycle that lasts up to 10 hours. This is ideal for lubrication or other maintenance functions that must occur each shift or day during a plant operation.

The 422AR 1/16 DIN housing is compact, and designed for panel mounting. The timer is mounted in an 8-pin round socket. The front of the 422AR features 2 knobs. One knob is used to set the ON-time and the other knob is used to set the OFF-time for the timer's cycle.

The 422AR is universal powered by 20 to 240 VAC or 12 to 240 VDC operation voltage.

The output of the 422AR has a DPDT mechanical relay which is rated for 10 amps @ 250 VAC resistive. The 422AR can be ordered in a terminal option which is only available with 5 amp Relay output.

The 422's have individual LED indicators for ON time and OFF time. These LED's provide a unique and effective method of cycle progress indication.



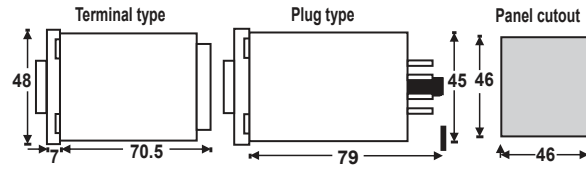
### 1/16 DIN Flip-Flop Timer

- Six Selectable Ranges:  
1 and 10 SEC/MIN/HRS
- Individual adjustable ON-time and OFF-time
- Cycle can begin with relay energized or de-energized
- Relay rated 10A @ 250 VAC Resistive
- Compact Size (1/16 DIN)
- DPDT Relay Output
- Power: 20VAC to 240VAC  
12VDC to 240VDC
- LED Indicator for Power and Relay energized output
- Can be DIN Rail mounted with DIN RAIL socket

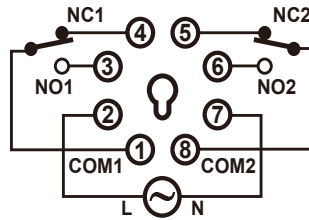
## SPECIFICATIONS

<b>SUPPLY VOLTAGE</b>	20 to 240 VAC, 12 to 240 VDC. (AC: 50/60 Hz)
<b>OUTPUT CONTACT</b>	DPDT
<b>DELAY MODES</b>	Cyclic ON first or OFF first (selectable by DIP switches)
<b>TIME RANGES</b>	1 / 10 SEC/ MIN / HR for both On & Off time (selectable by DIP switches)
<b>RELAY RATING</b>	10A @ 250 VAC, resistive
<b>POWER CONSUMPTION</b>	2 VA max.
<b>ACCURACY</b>	Setting: $\pm 5\%$ of full scale. Repeat: $\pm 0.5\%$ or 50 msec (whichever is greater).
<b>LED INDICATION</b>	Power ON, Relay ON
<b>RESET</b>	On interruption of power
<b>RESET TIME</b>	Less than 100 mSEC.
<b>HOUSING</b>	Flame retardant plastic.
<b>HUMIDITY</b>	Up to 95% RH.
<b>TEMPERATURE OPERATING</b>	0 - 50°C, Storage: 5 - 50°C
<b>MOUNTING</b>	Panel mounting
<b>WEIGHT</b>	115 gms

## DIMENSIONS (MILLIMETERS)



## WIRING



## DIP SWITCH SETTINGS

Dip switch settings for time range selection

OFF TIME				ON TIME			
RANGE	SWITCH SETTING			RANGE	SWITCH SETTING		
	Sw1	Sw2	Sw3		Sw6	Sw7	Sw8
1 sec	OFF	OFF	ON	1 SEC	OFF	OFF	ON
1 min	ON	OFF	ON	1 MIN	ON	OFF	ON
1 hr	OFF	ON	ON	1 HR	OFF	ON	ON
10 sec	OFF	OFF	OFF	10 SEC	OFF	OFF	OFF
10 min	ON	OFF	OFF	10 MIN	ON	OFF	OFF
10 hr	OFF	ON	OFF	10 HR	OFF	ON	OFF

Dip switch settings for mode selection

Mode	Sw4	Sw5
OFF First	ON	OFF
ON First	OFF	ON

Switch setting example:

Off time range: 1sec

On time range: 10min

Mode :Cyclic off first



## MODEL NUMBER

MODEL NUMBER	422AR	100	S	O	X
DPDT					
VOLTAGE			S		
			20-240 VAC		
			12-240 VDC		
CYCLE				O	
				Repeat Cycle	
FEATURES					X
					Standard Unit

# DATA SHEET

## (Part # P-2000FS) FACE-SHIELD

UV light is harmful to your eyes and skin. Exposure to UVC light can cause blindness or other permanent damage. Make sure your product protects from “UVC” light.

If you work safely, you will not encounter problems. We REQUIRE operators to use protective eye protection and faceshields when performing work on the system.

The faceshield described below are good for UVC light systems. This particular model has a brand name of ELVEX, but others are commercially available.

Color:	Clear
Material:	Lexan Polycarbonate
Thickness:	0.07 inches
Heat Tolerance:	up to 265 F
UV Protection:	99.9%
Standard:	ANSI Z87.1-2003 requires protective glasses under face shields.



Glasses, sunglasses, goggles or face shield should always be worn when near UV light. It is important to ensure that they wrap around and protect the entire eye. If exposed, immediately go to the hospital and be treated for arc welding type burn. You may be exposed to UVC light, but not feel the pain until later when you close your eyes. Be careful with light. If you are careful, you will never have an issue.

## TYPICAL SPECIFICATIONS

### Protect from UVC light

- 100% Polycarbonate, impact resistant, light weight, high clarity safety glasses with wrap around uninterrupted panoramic view
- Orange lens filters 100% of UV light, reduces glare, and provides sharp contrast
- Built-in brow guard contoured for comfort. Defensive side shield with splatter-preventing louvered air vents designed for comfortable extended wearing
- One-size-fits-all suitable as either stand-alone glasses or over glasses
- Serve well as a guard against UV light as well as safety glasses

Typical standards: Meets CE EN 166 & ANSI Z87+ Compliance Test as well as CE EN 166 Clause 7.2.2 Impact Test.



Work Safe! UVC light is invisible. You may be getting exposed without knowing. If exposed, please visit hospital to be treated for arc welding type injury. UV light damage is often felt when you first close your eyes.



Safety Data Sheet	revised: 05.08.2011
trade name: <b>Ultraviolet wave emitter filled with mercury lesser 2.5 %</b>	Rev. Nr.: 2 Ident.- Nr.:

**Informations about manufacturer/supplier**

Heraeus Holding GmbH  
Reinhard-Heraeus-Ring, D-63801 Kleinostheim  
D – 63801 Kleinostheim

contact person: Mr. Köhler      phone: +49-(0)6181-355607

**Composition/information on ingredients****Chemical characterization (substance)**

Emitter consistent of quartz glass filled with small amounts of mercury (< 2.5 %).

CAS-No.	Compo	Content [%]
7439-97-6/	Mercury	< 2.5

**Hazard identification****Hazard information**

The emitter is not dangerous under regular conditions.

Overexposition of radiation to skin or eyes causes burns.

Mechanical destruction may cause danger by splinter of glass and liberation of mercury. Mercury is harmful to aquatic organisms and may cause long-term adverse effects in the aquatic environment.

Liberated mercury may cause chronic toxic effects to human (see chap. "Toxicological information").

**First-aid measures****General information**

Burns caused by overexposition of radiation or severe injuries caused by splinter of glass should be treated by a physician.

Ultraviolet wave emitter Hg < 2.5 %\_e201108

Heraeus Noblelight

Safety Data Sheet	revised: 05.08.2011
trade name: <b>Ultraviolet wave emitter filled with mercury lesser 2.5 %</b>	Rev. Nr.: 2 Ident.- Nr.:

**Exposure controls / Personal protection****Advice on limits**

<b>Japan:</b>	OEL:	0.05	mg/m <sup>3</sup> (Mercury)
<b>Australia:</b>	TWA:	0.1	mg/m <sup>3</sup> (Mercury)
<b>Russia:</b>	TWA:	0.005	mg/m <sup>3</sup> (Mercury)
<b>France:</b>	VME:	0.05	mg/m <sup>3</sup> (Mercury)
<b>Germany:</b>	<b>MAK:</b>	<b>0.1</b>	<b>mg/m<sup>3</sup> (Mercury)</b>
<b>USA:</b>	REL:	0.05	mg/m <sup>3</sup> (Mercury)
<b>Mexico:</b>	TWA:	0.05	mg/m <sup>3</sup> (Mercury)

**Personal protective equipment**

**Respiratory protection:** If mercury is liberated and ventilation of the working place is not sufficient use filter with combination Hg-P3.

**Hand protection:** If glass is broken use cut resistance gloves.

**Eye protection:** If glass is broken use eye protection.

**Body protection:** ---

**Protective and hygiene measures:** Skin contaminated with mercury wash immediately with soap and plenty of water.  
Contaminated clothes change immediately.

**Physical and chemical properties****Appearance**

Form :	Solid
Colour:	Colourless
Odour :	Odourless

**Aspects relevant for security**

Melting point :	appr. 2000 °C (quartz glass)
Boiling point :	not applicable
Flash point :	not applicable
Solubility in water :	insoluble

**Test method****Toxicological information**

Ultraviolet wave emitter Hg < 2.5 %\_e201108

Safety Data Sheet	revised: 05.08.2011
trade name: <b>Ultraviolet wave emitter filled with mercury lesser 2.5 %</b>	Rev. Nr.: 2 Ident.- Nr.:

**Accidental release measures****Personal precautions:**

If the emitter is mechanical destroyed amounts of mercury can be liberated. In this case provide sufficient air exchange and/or ventilation in working rooms.

Avoid any contact with mercury.

Balls of mercury take up with a special mercury tongs and put it in a closable containment out of plastic material.

Very small balls which can not take up with the tongs grit with zinc powder or a special mercury absorber to bind the mercury. These materials eliminate very accurately from the surfaces and put it in a closable containment as described before.

Mercury and the materials with the fixed mercury forward to disposal in accordance with locally valid waste-disposal-regulations.

(For the danger caused by vapours of mercury see chap. "Toxicological information".)

**Environmental precautions:**

Mercury do not allow to enter surface and ground water, the sewage system or soil.

**Methods for cleaning up/taking up:**

Clean up the decontaminated surfaces with wet cleaning rags. The rags forward to disposal as described before.

**Further information:**

---

**Handling and storage****Handling****Advice on safe handling**

Avoid mechanical stress (danger of broken glass).

Ensure adequate ventilation at the working place.

**Storage****Requirements for storage rooms and vessels**

Storage must be made according to legal regulations.

Ultraviolet wave emitter Hg < 2.5 %\_e201108

Heraeus Noblelight

Safety Data Sheet	revised: 05.08.2011
trade name: <b>Ultraviolet wave emitter filled with mercury lesser 2.5 %</b>	Rev. Nr.: 2 Ident.- Nr.:

**Acute toxicity**

No acute toxicity is caused by mercury.

**Chronic toxicity**

Inhalation of mercury vapour for a longer period of time can damage the central nerve system. Symptoms are: trembling of muscles, degeneration of muscles, emotional instability, lack of concentration, impaired vision.

(Important! Liberated mercury remove completely as described in chap. "Accidental release measures".)

**Ecological information**

Mercury is harmful to aquatic organisms and may cause long-term adverse effects in the aquatic environment.

**Advice on disposal****Disposal**

Dispose the product according to legal regulations.

Disposal of the materials which are generated in the case of a broken emitter (see chap. "Accidental release measures") must also be done according to legal regulations.

**Disposal of packing**

Packages which are not contaminated with mercury should be recycled.

**Transport information**

Contact the manufacturer/ supplier for the mercury content of the emitter.

**Land transport**

Transportation must be done according to the legal regulations of the concerned countries.

**Marine transport (IMDG)**

No dangerous good in the sense of IMDG if mass of Hg is lesser 1 Kg per emitter (chap. 3.3.1; special provision: 941).

**Air transport (IATA/CAO)**

No dangerous good in the sense of IATA if mass of Hg is lesser 100 mg per emitter and additionally the quantity of mercury per package is 1 g or less (chap. 4.4; special provision: A69).

Ultraviolet wave emitter Hg < 2.5 %\_e201108

Safety Data Sheet	revised: 05.08.2011
	Rev. Nr.: 2
	Ident.- Nr.:
trade name: <b>Ultraviolet wave emitter filled with mercury lesser 2.5 %</b>	

Otherwise following classification is correct:

<b>UN-No.:</b>	UN 2809
<b>Proper Shipping Name:</b>	MERCURY CONTAINED IN MANUFACTURED ARTICLES)
<b>Main risk:</b>	8
<b>Subsidiary risk:</b>	---
<b>Packing group:</b>	III
<b>Label:</b>	8

## **Further information**

The data given here is based on today`s stand of our knowledge and experience. The purpose of this Safety Data Sheet is to describe the product in terms of their safety requirements. The data does not signify any warranty with regard to the products properties.

**This is a general MSDS handling sheet for UV  
mercury lamps.**

**UV lamps contain mercury and should be disposed  
of properly.**

**For further information [www.lamprecycle.org](http://www.lamprecycle.org)**

# Updated Education Program Plan for Massachusetts Consumers and Municipalities For the Proper Use and Disposal of Mercury-added Lamps

Submitted By

National Electrical Manufacturers Association



On Behalf Of Participating Manufacturers of Mercury-Containing Lamps

PURSUANT TO  
*An Act Relative to Mercury Management*  
The Commonwealth of Massachusetts  
Chapter 190 of the Acts of 2006, Section 6J

Updated January 25, 2012

## Program Participants

This Lamp Recycling Education Program Plan is developed and supported by members of the National Electrical Manufacturers Association (NEMA) Lamp Section and non-Lamp Section companies who manufacture or import mercury-containing lamps that are sold in Massachusetts and who have agreed to participate in supporting the Program ("Program Participants"). Other manufacturers of mercury-added lamps that are not members of NEMA have been invited to participate as well.

The following companies are the current Program Participants in this Lamp Recycling Education Program:

- AAAA World Import Export, Inc.
- Advanced Lighting Technologies, Inc./Venture Lighting
- Bulbrite Industries, Inc.
- Casio, Inc.
- Do It Best Corp.
- Earthtronics
- Eiko Limited
- Energetic Lighting, Inc.
- EYE Lighting International of N.A., Inc.
- Fanlight Corporation, Inc.
- Feit Electric Company, Inc.
- GE Consumer & Industrial Lighting
- Globe Electric Company, Inc.
- Greenlite Lighting Corp.
- Halco Lighting Technologies
- Light Sources, Inc.
- Lights of America, Inc.
- Litetronics International, Inc.
- Lumiram
- Maxlite, Inc.
- OSRAM SYLVANIA, Inc.
- OttLite Technologies, Inc.
- Overdrive Lighting/Global Consumer Products
- Panasonic Corporation of North America
- Philips Electronics N.A. Corp.
- P.Q.L., Inc.
- Ruud Lighting, Inc., a subsidiary of Cree Inc.
- Satco Products, Inc.
- SLi Lighting
- Sunshine Lighting
- Technical Consumer Products, Inc.
- Ushio America, Inc.
- Verilux, Inc.
- Westinghouse Lighting Corp.

This Lamp Recycling Education Program ("the Program") remains open to other mercury-added lamp manufacturers who desire to participate.

## I. Overview of Updated Lamp Recycling Education Program

The overall goals of the Updated Lamp Recycling Education Program continue to be:

- Increase the number of mercury containing lamps recycled in Massachusetts
- Comply with applicable Massachusetts regulations
- Build on prior years' efforts
- Expand public awareness of the legal obligation to properly dispose mercury containing lamps

To date, the Program has produced educational materials in the form of posters, brochures, web pages, articles for publication, and other items aimed at informing business owners, facility managers, state and local government offices, lamp distribution channel partners (wholesale and retail), lighting installers, the solid waste industry, lighting specifiers, and households and consumers. Specifically, the program has supplied information concerning:

- The economic and environmental benefits of mercury-added lamps
- The hazards mercury can pose to human health and the environment
- Proper disposal and recycling methods for mercury-added lamps
- Where and how to recycle mercury-added lamps

These educational materials will continue to be deployed as part of the Program.

Entering the fifth year of this effort, manufacturers are building on lessons learned in previous years. The majority of growth in collections in previous years has come from commercial and industrial generators of waste lamps. However, as the installed base of fluorescent lamps ages in homes, targeting retail consumers will become more important.

## II. Updated Lamp Recycling Education Program Plan Activities

### A. Update of [www.lamprecycle.org](http://www.lamprecycle.org)

#### 1. Activity Description

The web site [www.lamprecycle.org](http://www.lamprecycle.org) is an important element of manufacturers' national and state specific outreach efforts. The site already generates significant traffic. NEMA member companies, as well as virtually all other lamp manufacturers, print the URL [www.lamprecycle.org](http://www.lamprecycle.org) on the packaging of every mercury-containing lamp they sell, which leads to a significant portion of site visits. More than 60% of visitors go directly to the site, as opposed to using search engine or clicking on a link found at another web address.

Updates for the site in 2012 will be based on continued monitoring of information for further improvements of recycling.

#### 2. Schedule

Upgrades to the web site will be on a rolling basis throughout 2012. Marketing and promotion of the site will continue to be an ongoing activity.

### B. Advertising Campaign

#### 1. Activity Description

The Program plan for 2012 includes web display, pay per click, outdoor, local, event, and social advertising. The advertising campaign will focus on raising consumer awareness of the need to properly dispose mercury-added lamps and provide direction to more information (*e.g.* [www.lamprecycle.org](http://www.lamprecycle.org)) for information on free or low-cost options for disposing waste mercury lamps.

- Web

##### *Pay Per Click*

Using Pay Per Click (PPC) in an education/awareness campaign such as this a unique benefit. PPC advertising is traditionally used to drive web visits to a particular site. While we will allot money for click-through's to [lamprecycle.org](http://lamprecycle.org), more impressions will be generated due to the message being visible to the general public, without them clicking on the ad.

These efforts will be geographically focused to drive the message to the largest percentage of the population.

##### *Display*

The program will again use display advertising as part of the campaign. The approach is to blitz a media outlet for approximately 30 days. (this advertising is based on number of impressions; the campaign would run for 30 days or longer if the minimum number of impressions was not reached in 30 days).

Advertisements will be placed in the [www.boston.com](http://www.boston.com), [www.telegram.com](http://www.telegram.com) and [www.wickedlocal.com](http://www.wickedlocal.com). This campaign will cover the Boston designated market area (DMA) and central Massachusetts (Worcester County).

This method is used to remind readers who have become aware through ads of past years, as well as introducing new readership to the message, over a focused 30 days.

- Radio

The Program will develop a public service announcement (PSA) for radio to promote the availability of lamp recycling locations throughout the state. Radio PSAs can geographically target Massachusetts residents and quickly inform them about their legal

obligation to recycle mercury-containing lamps and where they can locate additional information (e.g. [www.lamprecycle.org](http://www.lamprecycle.org)).

NEMA will request a letter of support for the PSA from the Governor or another state official or agency as this will increase the likelihood of the PSA garnering airtime.

#### • Outdoor

The Program again plans to utilize the Commuter Rail Platform Advertising. This large (46"x60" poster), colorful media form draws the attention of daily commuters. NEMA has been advised that this form of advertising will put the recycling message in front of an estimated 3.4 million Commuter Rail riders over a four week period.

#### 2. Schedule

NEMA plans to arrange for the placement of rail platform, web-based, and radio ads in the 2<sup>nd</sup> quarter 2012.

### C. Local Media/Community/Business Outreach

#### 1. Activity Description

The Center for EcoTechnology (CET), a non-profit organization based in Pittsfield, MA, will be contracted by NEMA on behalf of the Program Participants to aid in providing media outreach and linkages to local business sectors to promote lamp recycling, primarily in Western, MA. The CET activities that the Program plans to support include:

- Identify and promote existing hardware store recycling programs, while creating press releases and attending local community events to make public aware of these opportunities. Work with existing municipal outreach mechanisms to include the retail take-back option - This also includes promoting use of the retail collateral available on the [lamprecycle.org](http://lamprecycle.org) website (Sec. F below).
- Follow-up with participants of "Green Business" workshops previously conducted by CET to disseminate recycling message and provide technical assistance on establishing a recycling program.
- Identify media opportunities including inserts in local papers and/or America Recycles Day.
- Coordinate with Covanta Energy to engage partnerships at their facilities across the Commonwealth.
- Work with Municipal Health and Building Departments.

- Work with local colleges and universities to engage the student population and identify collaborative methods for encouraging lamp recycling.
- Give technical assistance to local businesses, smaller hauling companies, and their customers.

The Program plans to continue its ongoing efforts to work with counterparts in other trade associations such as the Associated Industries of Massachusetts to spread the message to their respective memberships.

#### 2. Schedule

The timing or certainty of these earned media placements and engagements with third-parties is not readily predictable and outside of CET's control. CET was retained in early 2012 and the planned program will be rolled out on a schedule mutually agreeable to both CET and NEMA over the course of 2012.

### D. Local Events

#### 1. Activity Description

The Program plans to participate in public events in Massachusetts. The objective is to raise awareness among various groups of the legal obligation to recycle mercury-containing lamps and various mechanisms available in Massachusetts to comply with law. The contract with CET will add much support to the local effort of the event listed below.

Where applicable, the NEMA recycling brochure and poster (developed in 2008) will be distributed.

#### 2. List of Potential Events/Venues

Event	Audience	Location	Date
EarthFest	Consumers	Boston	May, 2012

### E. Member Company Customer/Marketplace Outreach

#### 1. Activity Description

Certain Program Participants have agreed to engage their MA based sales staff in training initiatives and/or provide materials of the Program to their customers.

Member Company	Meetings	Training Initiatives	Other
GE Consumer & Industrial Lighting	Resend PowerPoint presentation on MA Disposal to MA sales force for use in local meetings	Incorporate state Disposal regulations in National Training Programs	
OSRAM SYLVANIA, Inc.	All meetings for MA businesses include information about lamp recycling requirements.	State disposal regulations incorporated into national training programs	Post PowerPoint presentation on MA Disposal on website accessible to sales staff
Philips Electronics N.A. Corp.	All seminars for MA business include segment on lamp recycling requirements in MA.	All MA distributor product training includes segment on lamp recycling requirements in MA.  Philips Lighting Center in Somerset, NJ plans to include MA recycling requirements in classes it plans to conduct in 2012.	
Ushio America, Inc.		Plans to include reminders about state disposal programs in National Sales Meetings	Incorporate Message asking that distributors encourage recycling on invoices for mercury containing lamps.  Email customers at least once per year to encourage them to urge their customers to recycle mercury containing lamps.

### F. Amendment

Circumstances may change in the course of the Program year that require a change in planned activities or the addition or deletion of Program Participants, and NEMA will submit on behalf of Program Participants an amended Lamp Recycling Education Program Plan as circumstances require.

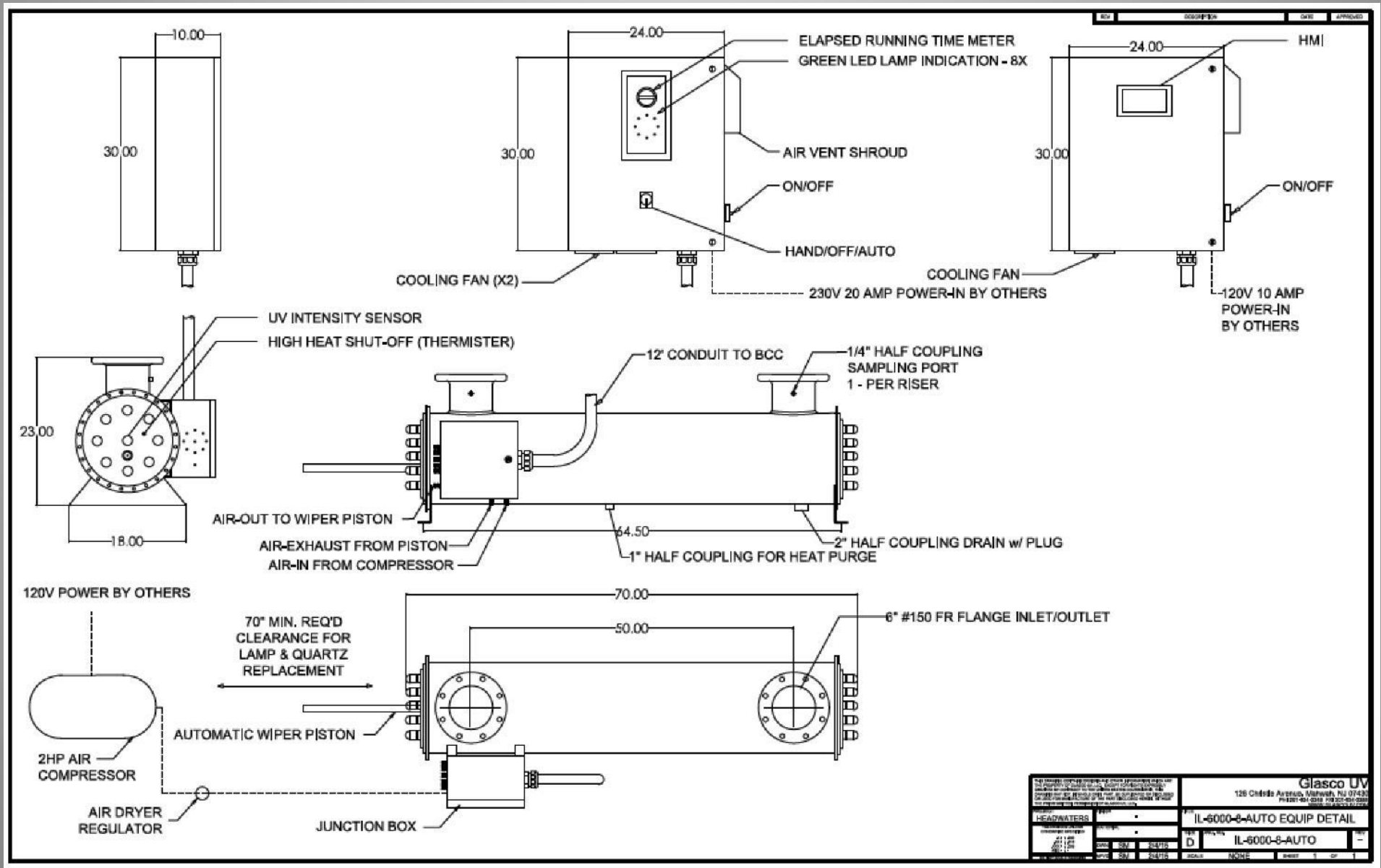


**GLASCO UV**

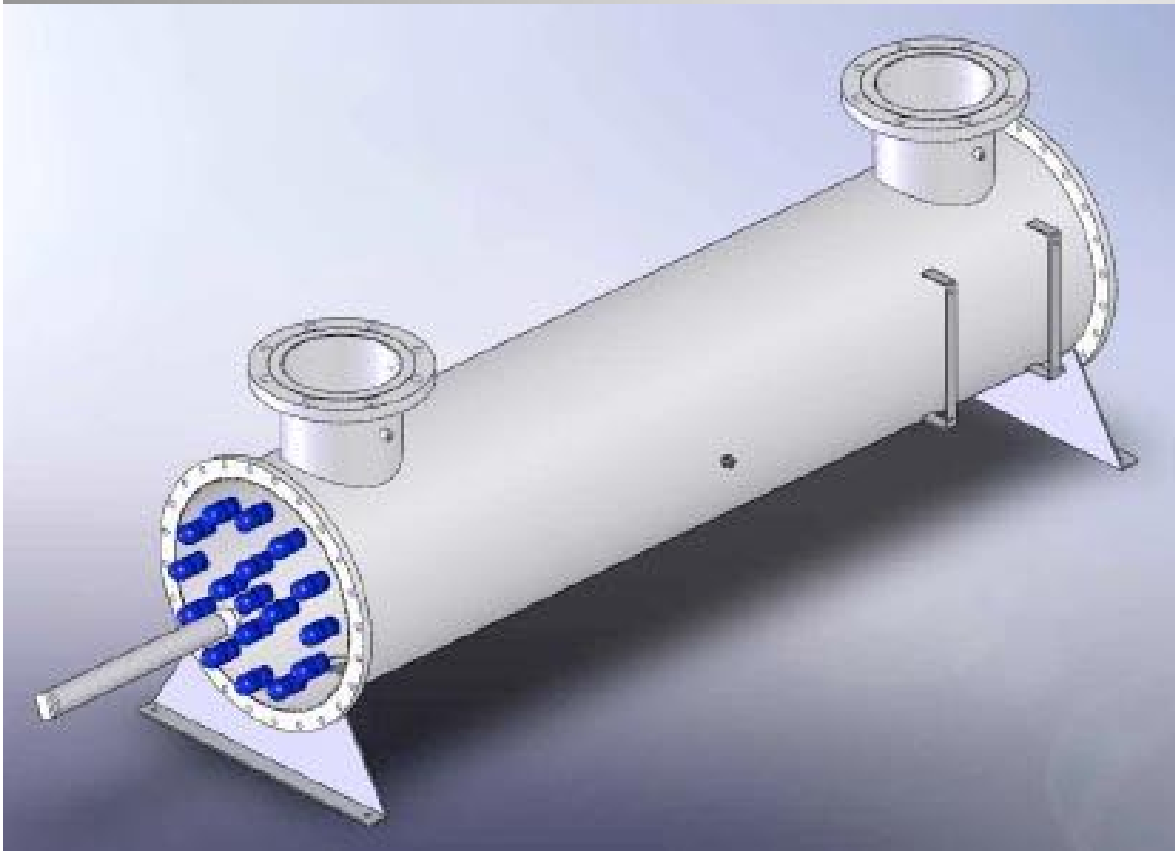
Operator Training  
IL Chambered Series

[www.glascouv.com](http://www.glascouv.com)

# Closed Vessel - Various types



# IL SERIES



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# How does all of this work? (1 of 2)

- It is hard to tell what is happening inside the system. As water enters the unit, it is exposed to UV light, which is invisible to the naked eye. The light comes from specialty mercury vapor lamps. The lamps are protected from the water by the use of clear like tubes, called quartz sleeves.
- The UV light destroys the microorganisms ability to reproduce by scrambling the DNA/RNA. This prevents reproduction.
- Sizing is based on a peak flow rate, the quality of the water (UV Transmission %) and the required discharge permit. Based on those inputs and a safety factor, a certain number of lamps are used. Lamps come in different wattages and different operating characteristics.
- Once through the UV system, the water goes to discharge. At this point, periodic samples are taken to insure that the permit is being met.
- While the technology is very effective in disabling microbes, it does require maintenance and inspection.
  - The protective quartz sleeves can foul due to impurities in the water. Minerals can “plate” to the sleeves due to electrical charges. When fouled, less light is able to get to the target organisms. The system is equipped with a pneumatic wiper system that pushes a cleaning mechanism over the arc length of the lamp.





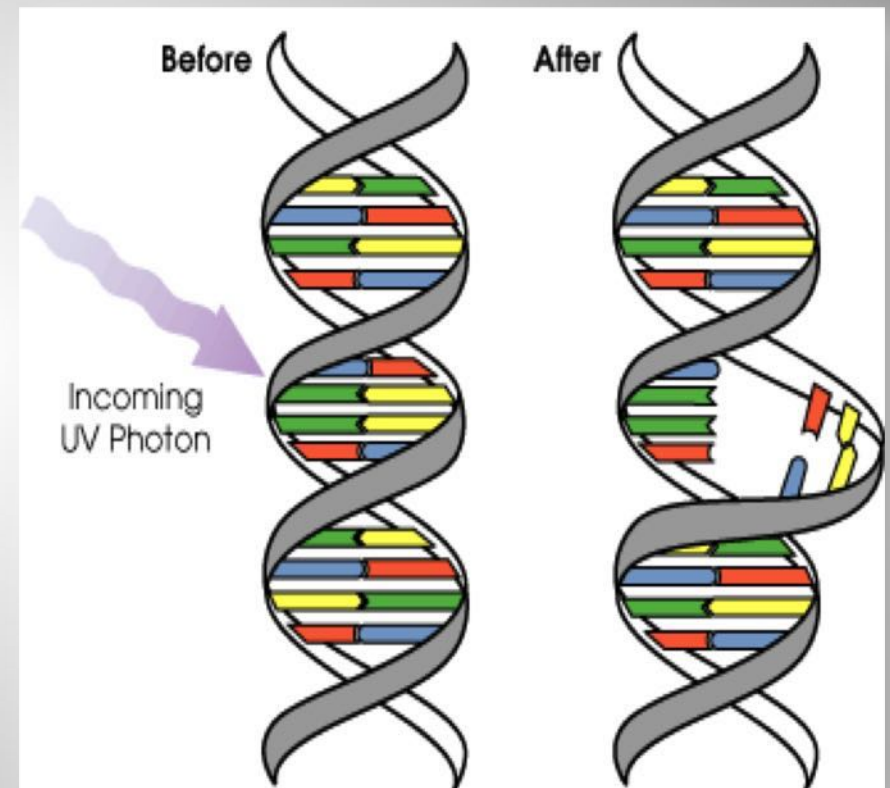
# How does all of this work? (2 of 2)

- The UV lamps need to be replaced every 12,000 hours.
- To help manage the system, a UV sensor has been placed inside a dedicated quartz sleeve. This sensor reads the actual UVC output at 100% from new. In the event of dropping, it could be aging lamps, lower transmission effluent, fouling of the quartz sleeve or something else. This is meant as a helpful tool, but a low reading or a Zero reading may not indicate that the system is not working. The % on the meter has nothing to do with the kill.
- UV lamps are meant to be used 24 x 7, but they do have the ability to be cycled On/Of during the day.
- In the event of low flow or no flow, the UV system may become overheated. This may lead to quartz fouling or lamp damage. Sometimes a small flow will keep the system cool.
- The UV system's wiper mechanism will need to be removed every 3 to 5 years to replace the wiper rings. This requires the removal of a head. This allows the end users to get inside for inspection and cleaning.
- The UV system is powered from a remote Ballast Control Center / System Control Center. The main component is the ballast. This electronic device needs to be cooled. Fans and filter need to be inspected regularly.



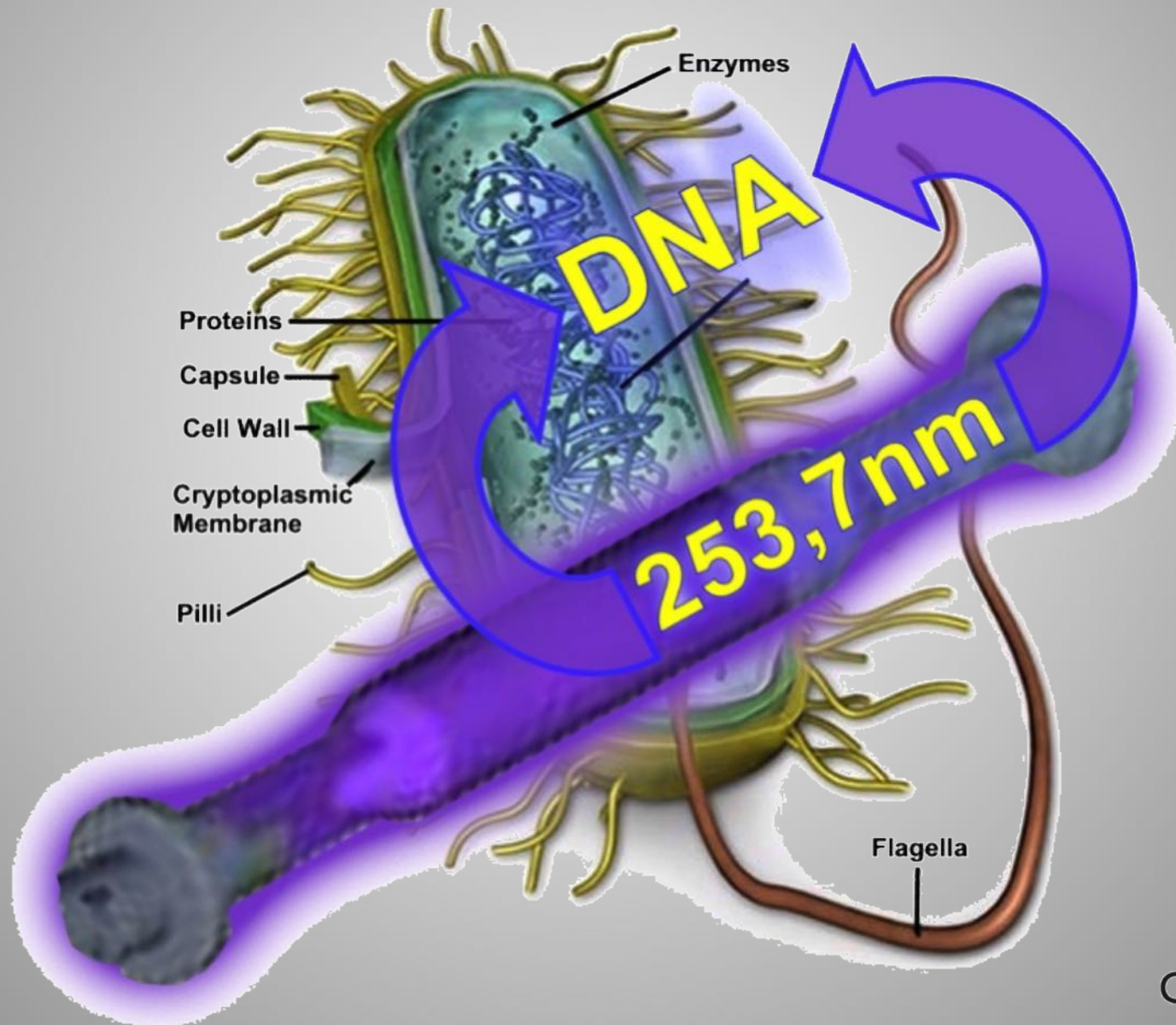
# About UV Light Disinfection

- UVC light damages DNA
- 254 nm wavelength most effective
- Dosage expressed millijoules/cm<sup>2</sup> (mJ/cm<sup>2</sup>)
- Sizing Intensity (mW/cm<sup>2</sup>) x Contact Time (sec)
- *Chlorine is concentration (mg/L) x Contact Time (minutes)*
- *Typical Dosage 30 mJ = 30,000 uWs/cm<sup>2</sup>*



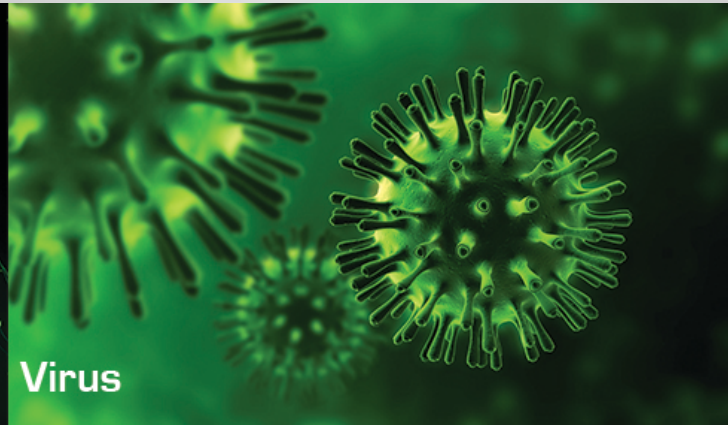
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# UV Light Disinfection



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# Microorganisms



- E-Coli
- Salmonella
- Legionella
- Virbrio Cholerae
- Fecal Coliform

- Hepatitis
- Poliovirus
- Cocksackie
- Rotavirus

- Giardia
- Cryptosporidium



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# E-Coli (bacteria) Common

- 90% (1 log) 1.5 mJ
- 99% (2 log) 2.4 mJ
- 99.9% (3 log) 4.1 mJ
- 99.99% (4 log) 5.6 mJ
- MOST Systems Sized at 30 mJ



# Safety



- UV light is dangerous - you must protect your eyes and skin.
- Electricity is present in the Ballast Control Center and the chamber. Always Power Off and lock out system.
- Lamps and quartz if broken can be sharp. Wear gloves.
- Units are pressurized. No work should be done unless depressurized. Projectiles can shoot out of the vessel and cause serious harm or death.



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# What Comprises System?

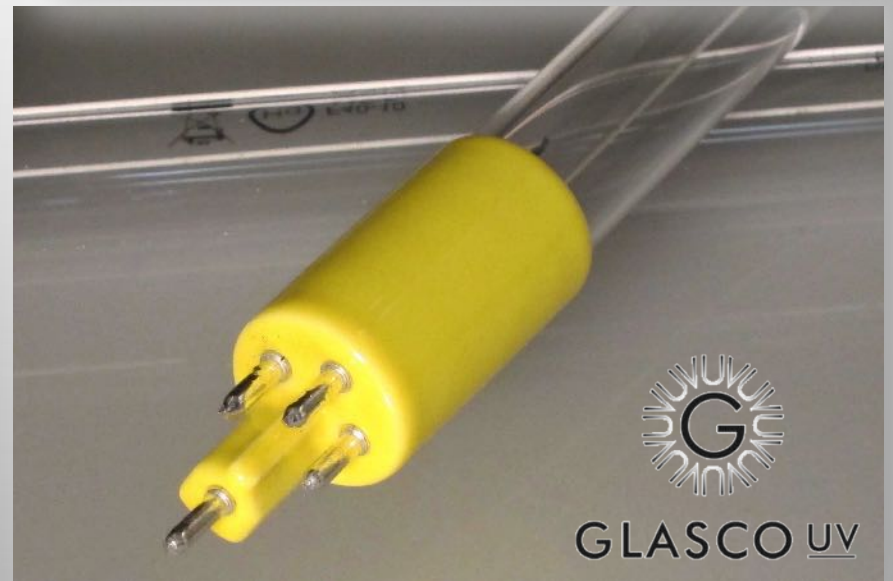
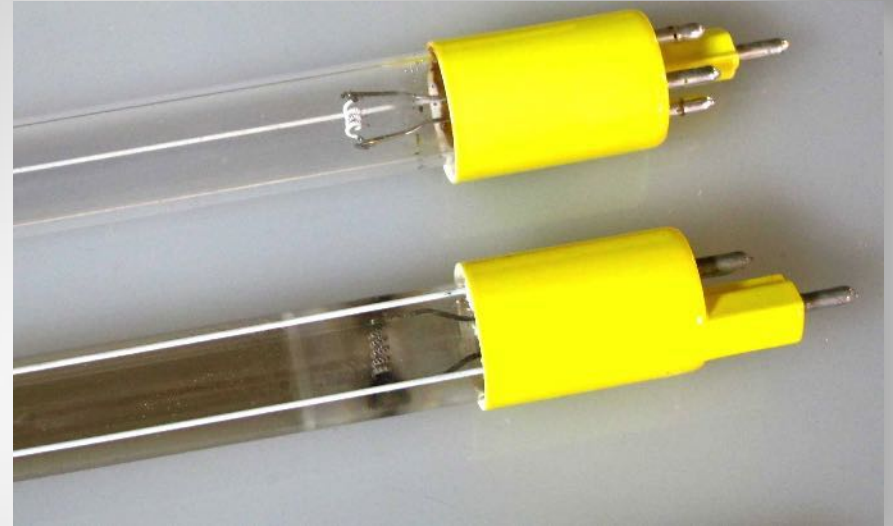
- Major Components
  - Pressure vessel
  - Quartz sleeves to protect lamps
  - Remote electronics power and control UV lamps
  - UV monitoring sensor
  - Automatic quartz cleaning



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# UV Lamps

- Low pressure mercury
  - High Intensity Amalgam
- 90%+ output in 254 nm
- 12,000 hours
- Rated in watts & UVC watts
- Solarizes (darkens) end life
- Sharp if broken





# Quartz Sleeves

- GE Type 214 material
- Protects lamp
- Allows UVC light to pass through
- Can foul with minerals



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# Ballast Control Center



# Ballasts

- Mercury (Hg) Vapor Lamps require a ballast to operate
- Converts line current into the proper voltage, amperage and waveform
- Provides proper warm up and cool down
- Built in protection and controls (input power quality correction, end of lamp life, dimming)
- Needs to be kept cool and dry
- Life >10 years
- Ballast Control Centers house ballasts



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# UV Monitoring

- A UV Sensor monitors output of a lamp offer lifetime (new 100%)
- Some sensors view an array of lamps and are auto cleaned - others monitor a single lamp
- Low UV reading may mean (lamps aging, fouled quartz or changes in wastewater quality)



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# Pressure Vessel

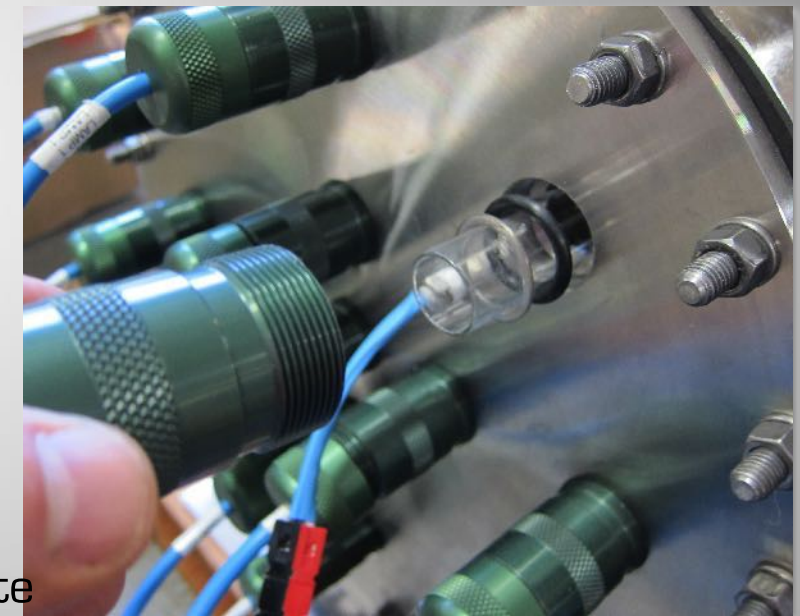
- Gasketed sealed heads are bolted to the end plates
- Quartz sleeves are inserted into the vessel and sealed with compression nuts and orings. Creating a water tight environment.



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# Quartz Seal

- Quartz is fed through the vessel.
- Orings put over quartz and a stainless flat washer over the oring
- A compression fitting is hand-tightened.
- Chamber is allowed to slowly pressurize while looking for leaks.



**You Tube** 3 minute video on start up - cut and paste

[https://www.youtube.com/watch?v=xqxCwCimLcQ&index=3&list=PL0\\_LValzW\\_TtjGy6NScZsejLG182cBcHX](https://www.youtube.com/watch?v=xqxCwCimLcQ&index=3&list=PL0_LValzW_TtjGy6NScZsejLG182cBcHX)



# Lamp Connections

- Junction box attaches to vessel
  - Lamp harnesses
  - UV sensor connections
  - Automatic cleaning components



# Lamp Connections

- Lamp slides into the quartz sleeve
- Lamp is plugged in.
- Protective cap is put on.  
Cap is used to prevent the lamp from shining.



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# Quartz Wiper

- Air driven
- Wiper cage inside vessel
- Houses EPDM wiper rings
- Piston pushes and pulls the cage in a quick stroke fashion



**You Tube** 17 sec video. Cut and paste link.

[https://www.youtube.com/watch?v=vkvLZTISgs4&index=5&list=PL0\\_LValzW\\_TtjGy6NScZsejLG182cBcHX](https://www.youtube.com/watch?v=vkvLZTISgs4&index=5&list=PL0_LValzW_TtjGy6NScZsejLG182cBcHX)



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# UV Sensor

- Reads UVC (0-100 or mW)
- Goes in own sleeve
- Sleeve cleaned
- Gives snapshot of lamps from day 1.



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# Start Up Checklist

- Prior to Start Up:
  - Verification that components have been received
  - Verify that lamps and quartz sleeves are not damaged
  - Install UV lamps and Quartz sleeves
  - Install UV sensor
  - Verify that Ballast Control Center power is accurate
  - Power On UV System
  - Operate system breakers for individual modules
  - Check air flow in BCC



# Start Up Checklist (2)

- Check to see if all lamps are working via PLC or lamp indicators
- Check to see that system is recording hours
- Check to see UV monitors output
  - Calibrate with new lamps in the wastewater to 100%
- Operate the automatic cleaning system
  - Calibrate with new lamps in the actual wastewater to 100





# Training Checklist

- Training:
  - How to install lamps and sleeves
    - Preventing seal failures
  - How to Power On/Off system as well as other breakers and disconnects
  - How to check the fans or air handling system
    - Check compressor for oil and maintenance
  - How to operate the wiper (proper pressure and air cleaning)
  - How to re-calibrate the UV sensor



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# How UV Systems are Sized

- Basic information required:
  - Peak Flow Peak instant flow rate (avg and min)
  - UVT% UV % transmission of effluent (typ 70-99%)
  - TSS Total Suspended Solids (<30 mg/l)
  - BOD5 Biological Oxygen Demand (<30 mg/l)
  - Fe Iron Level (<0.3 mg/)
  - Influent Count in (???,??? mpn/ 100 ml) – Usually unknown
  - Discharge Permit ??/100 ml
  - Location (indoor or outdoor)



# How To Size

- Methods for sizing
  - Bioassay (biology)
    - Systems biologically tested
    - Always used for municipal drinking water
  - EPA Point Source Summation Method – UV DIS (light physics)
    - Uses flow rate, UVT, lamp spacing, lamp output, end of lamp life, fouling
    - CON: UV manufacturer's can overstate their lamp output and the lamp life. This makes it harder for engineers to design specifications



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For further information

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[www.glascouv.com](http://www.glascouv.com)