18. *Bulk Tank Access:* Design-Builder is to evaluate ability to access bulk tank level monitoring and mixing equipment. Where necessary, provide FRP platforms adjacent to each bulk tank to enable access to maintain and replace level monitoring and mixing equipment. Platforms must not obstruct ability to remove and replace bulk tanks in the future, or must be configured in a manner that allows disassembly and reassembly for tank replacement.

Table 2.0

Summary of Existing Chemical Dosage for the WTF

Treatment Chemical	Average	Maximum	Minimum
Sodium Hypochlorite (lb/MG)[1]	30	60	12
Hydrofluosilicic Acid (lb/MG)[1]	4.6	8.0	2.5
Phosphoric Acid (lb/MG)[2]	16.0	25.0	10.0

1. Dosage based on active chemical compound.
2. Dosage based on neat product solution and not on active chemical compound.

Chlorination System

1. *General*: A bulk sodium hypochlorite system shall be provided in the Treatment Building.

2. *Specific Chemical*: Sodium hypochlorite

3. *Product Form*: Liquid

4. *Product Density*: 12.5%

5. *Type of Storage Required*: 15 days of bulk storage

6. Bulk Tanks: Provide two 750-gallon bulk tanks

7. *Points of Application*:

    a. Raw water vault prior to Aeration/Detention facility, dual application points with manual flush/relief

    b. Combined filter influent, dual application points with manual flush/relief

    c. Combined filter effluent, dual application points with manual flush/relief

    d. Downstream of the finished water storage tank, prior to the distributive pumps, dual application points with manual flush/relief

8. *Feed Method*: Peristaltic metering pump(s)

9. *Cascade Loop Control*: Free chlorine residual analyzers (pre, intermediate, and post)

10. *Isolation*: Located in an isolated room with adequate ventilation and no windows. All piping and equipment in room to be suitable corrosion resistant material.

11. *HVAC:* HVAC system shall maintain room temperature between 55°F and 65°F year-round.

Fluoridation System

1. *General:* This chemical feed system will be utilized to feed fluoride.

2. *Specific Chemical:* Hydrofluosilicic Acid

3. *Product Form:* Liquid

4. *Product Density*: To be determined during the design phase and verified with product supplier.

5. *Type of Storage Required*: Bulk and Day tank.

6. *Point of Application*:

    a. Combined filter effluent

7. *Feed Form*: Liquid

8. *Feed Method*: Peristaltic metering pump(s)

9. *Isolation*: Located in an isolated room with adequate ventilation and no windows. All piping and equipment in room to be suitable corrosion resistant material. Consideration should be given to automation of exhaust system for removing built up fumes.

Corrosion Inhibitor Feed System

1. *General:* This chemical feed system will be utilized to feed phosphoric acid.

2. *Specific Chemical:* Phosphoric Acid

3. *Product Form:* Liquid

4. *Product Density*: To be determined during the design phase and verified with product supplier.

5. *Type of Storage Required*: Bulk and Day tank, with tote delivery of product.

6. *Point of Application*: Combined filter effluent

7. *Feed Form*: Liquid

8. *Feed Method*: Peristaltic metering pump

9. *Isolation*: Located in an isolated room with adequate ventilation.

L. TREATMENT RESIDUALS MANAGEMENT

Backwash Equalization

1. *General*: Spent filter backwash will be disposed of to the Sanitary Sewer.

2. *Number of Equalization Basins*: One (1)

3. *Size of New Equalization Basin*: Size basin to provide equalization of one complete backwash from all filter vessels, plus a minimum 25% factor of safety.

4. *Residuals Pump Station*: Provide a pump station and force main to route spent backwash water to the Winchester Wastewater Treatment Facility.

5. *Residuals Pump Type*: Provide redundant submersible pumps.

6. *Residuals Pump Capacity*: To be determined by Designer based on Sanitary Sewer Owner requirements.

7. *Residuals PS Appurtenances*: Provide a magnetic flow meter to measure the wastewater rates and volumes being discharged to the Sanitary Sewer. Designer shall coordinate pumping system design to satisfy Sanitary Sewer Owner requirements.

M. ELECTRICAL

General

1. *Electrical Design Criteria and Standard:* Refer to Attachment G for detailed electrical design requirements.

2. *Electric Service to the Site:* Indiana Michigan Power owns the existing electric power distribution grid in the vicinity of the proposed plant. A new electric service shall be provided based on the provisions outlined in Attachment G for the proposed facility with new transformer equipment as outlined therein. All service equipment and installations to be provided in accordance with Code and Utility Company requirements.

3. *Number of Services*: 1

4. *Type of Feed*: Indiana Michigan Power. Design/Builder shall coordinate directly with utility supplier but shall keep INAW informed of any design decisions that may have a financial impact on INAW's electric bills. Design/Builder shall account for lightning protection for buildings and other structures as appropriate.

5. *Outdoor Transformers and other Electrical Power Distribution Equipment*: Install equipment above the greater of the 500-year flood elevation or 3 feet above the 100-year flood elevation. Provide elevated pads or bases as necessary; coordinated with facility structures and regulatory requirements

6. *Electric Meter*: Primary electric meter shall be designed in accordance with electric utility requirements. Sub-metering shall be provided to allow INAW to measure and record power usage and demand from major equipment components.

7. *Surge Suppression*: Design using the appropriate level of transient threat as defined in ANSI/I.E.E.E. Standard C62.41. All transient voltage surge suppression equipment shall be tested in accordance with the appropriate parts of ANSI/I.E.E.E. Standard C62.45 and UL Standard 1449. The Design/Builder shall review the following issues and summarize their findings to INAW: length and amplitude of spikes caused by capacitor switching, recloser switching, or other pieces of equipment that can cause problems on a customer's power system and provide the appropriate protective equipment on INAW's side of the power system.

8. *Voltage Drops*: Develop a protection scheme to ensure that the transfer switch and other items (such as induction motors) are adequately protected from under voltage, voltage unbalance, contact chatter, etc.

9. *Harmonic Evaluation*: Perform harmonic analysis in accordance with IEEE 519 at each site where variable frequency drives are used.

10. *Grounding*: The electrical system and equipment will be grounded in compliance with the National Electrical Code. Conductors shall be No. 4/0 AWG copper, minimum, for interconnecting ground rods and for connection to transformers and MCC's and other major electrical equipment. A grounding ring will be required for the proposed building and major structures. Electrical equipment, devices, panelboards, and metallic raceways will be connected to the ground conductors.

<u>Motor Control Centers</u>

1. *Type of Equipment*: 600V, 3-phase, 4-wire plus ground operating at 60Hz. All components are U.L. listed. MCC equipment shall consist of standardized, freestanding structures bolted together for form a single dead-front panel assembly containing combination motor control units; feeder units; metering, relaying, and interlocking and miscellaneous control devices and will be of the per definitions in the latest edition of NEMA ICS 3 and UL 845.

2. *Factory Testing of Equipment*: Witnessed by INAW or by certified test report. This will be determined during detailed design.

3. *Enclosure Type*: NEMA 1. Design/Builder shall provide HVAC equipment designed with air filtration to ensure that particulate matter cannot track on to

pieces of electrical equipment.

4. *Heat Dissipation*: Design/Builder shall provide for adequate heat dissipation based on guidelines listed in I.E.E.E. Standard 141, Typical Efficiencies of Electrical equipment. Calculations shall be submitted to INAW prior to final design specification review.

5. *Main Bus Capacity*: Design for 1.1 times present connected and identified future loads for other potential future loads.

6. *Momentary and Interrupting Ratings*: Determined by the Design/Builder during detailed design. Calculations must be supplied to INAW before final specifications are approved. Calculations can be computer or other INAW approved method per the guidelines listed in I.E.E.E. 141 (latest edition). The Design/Builder shall provide documentation of all assumptions for machine impedances, cable impedances (both resistance and inductance), and transformer impedances to complete the computations. Since INAW prefers a grounded secondary service, both balanced and unbalanced fault computations will be prepared and presented to INAW for review and approval. The equipment vendor will make detailed final calculations during construction and shop drawing approval. The Design/Builder shall develop fault conditions under minimum, maximum, and average power consumption scenarios based on the way the plant is to be operated. The Design/Builder shall also develop fault scenarios with local generators used instead of the electric utility.

7. *Circuit Breaker Compartments and Circuit Breakers*: Control center disconnects shall be three-pole, single-throw, 600-volt, molded-case air circuit breakers. Circuit breakers of combination starters shall be magnetic motor circuit protector type. Feeder circuit breakers shall be thermal-magnetic type and shall be manually operated with quick-make, quick-break, trip-free toggle mechanism.

8. *Power Monitoring*: Provide microprocessor-based GE Multi-Lin unit on main incoming feed. Unit shall compute voltage, amperes, power factor, kilowatt-hour, etc. Communications will be ethernet communication back to a port on a plant remote terminal unit (RTU). Provide individual power transducers on all rotating loads larger than 25 horsepower using Load Controls Inc. PH-3A or equal. Transducers shall be wired to plant RTU for monitoring, trending and archiving.

9. *Surge Suppression*: Transient voltage surge suppressors shall be provided integral to each MCC assembly. Design using the appropriate level of transient threat as defined in ANSI/I.E.E.E. Standard C62.41. All transient voltage surge suppression equipment shall be tested in accordance with the appropriate parts of ANSI/I.E.E.E. Standard C62.45 and UL Standard 1449. The Design/Builder shall review the following issues and summarize their findings to INAW: length and amplitude of spikes caused by capacitor switching, recloser switching, or other pieces of equipment that can cause problems on a customer's power system and provide the appropriate protective equipment on INAW's side of the power system.

10. *Main Circuit Breaker*: Microprocessor based with adjustable trip and delay settings for long-time and short time tripping characteristics in addition to instantaneous and I^2t (for ground fault).

11. *Starters*: Full-Voltage combination magnetic starters shall be utilized as required. Solid-state reduced voltage motor starters may be utilized where required due to power utility requirements and/or engine-generator sizing considerations.

12. *Power Factor Correction*: Power factor correction capacitors will be applied to correct motor power factor to within 90 to 95 percent for all motor starters rated 50 hp and larger. Capacitors will be installed at the motor. Capacitors will not be applied where the motor is served by a VFD.

13. *Variable Frequency Drives:* VFD's shall be remotely mounted and be fed from a dedicated 480 volt, three-phase MCC feeder breaker. The drives shall be 6 pulse, 18 pulse or Active Front End (AFE), fully digital, microprocessor controlled and shall incorporate a diode bridge rectifier and a transistorized inverter section. IGBT type power transistor modules shall be utilized in the inverter section to invert a fixed DC bus voltage to a symmetrical three-phase pulse-width modulated (PWM) output voltage. VFD's for motors smaller than 50 hp shall be 6 Pulse. VFD's for motors 50 hp and larger shall be 18 Pulse or Active Front End.

14. *Compartment*: Equipped with the ability to lock out the starter for testing during maintenance.

15. *Pilot Lights*: Oil, dust, and water resistant with push to test type operation.

16. *Bus*: Tin plated copper.

17. *Control Power Transformers*: Sized for at least 110% of the required load to allow for future expansion.

18. *Wiring Configuration*: NEMA Class 2B

19. *Gasketing*: Required

20. *Lightning Arrestors*: Provide on the incoming lines based on the isokeraunic number (number of thunderstorms per year).

21. *Surge Capacitors*: To be provided for steep wave transient capacitors.

22. *Basic Impulse Level (BIL) Requirements*: Design/Builder to coordinate to establish a protective margin based on the perceived transient threat caused by switching of capacitor banks.

23. *Thermostats*: Design/Builder shall evaluate the need for the use of condensation control inside each starter to prevent moisture build-up on

components and install if required.

24. *Arc Flash*: Provide arc flash protection in accordance with American Water Health & Safety Procedures Manual. Refer to Attachment G for the power system & arc flash study requirements.

Miscellaneous Power Distribution

1. *Circuit Panel*: Circuit breakers will be of the bolt-on type. Push-on type circuit breakers are not allowed. Use copper type bus and ensure U.L. labeling of entire system. Provide a transient voltage surge suppresser on the main of each power distribution panel. For more specific requirements for the protection of sensitive electronic instrumentation, see Instrumentation section. All distribution panels will have hinged doors.

2. *Cables*: Those rated for 480V and below shall be dual listed as XHHW-2 type insulation listed for at least 90 degrees centigrade. In order to maintain a 90 degrees centigrade rating, all of the connectors and lugs at each end of the cable shall be U.L. listed for 90 degrees centigrade per the U.L. Green and White Books.

3. *Lighting and Power Transformers*: Dry type to limit maintenance items. A minimum of (2) taps will be provided above rated voltage (in 2.5% increments) and a minimum of (2) taps will be provided below rated voltage (in 2.5% increments). Open type transformer cases are not allowed. All units will be of sealed type construction. The Design/Builder shall examine the need to install transformers with a higher than average Basic Impulse Level (BIL) that is not normally required in the 480V class.

Lighting Fixtures

1. *LED Type Fixtures*: Units shall be sealed and water resistant, and of the highest efficiency available. In order to facilitate conformance with NFPA 101 (the Life Safety Code), the facilities shall include separate emergency lighting fixtures to ensure that all passages and exits remain illuminated in the event of a power failure. Design shall achieve adequate lighting at lowest possible energy demand.

2. *Exit Signs*: LED type and placed inside the facility per the latest requirements of NFPA 101 (the Life Safety Code). Ensure exit lights are connected to backup power with bug eye lighting.

3. *Exterior Lighting*: LED with light pollution shielding, photocell type, wall mounted, and vandal proof. Pole lighting is acceptable but must not compromise surveillance video camera effectiveness.

Automatic Transfer Switch

1. *General*: Furnish and tested by the generator set manufacturer to function as one standby power system. The transfer switch shall be UL listed per Standard

1009 and rated for total system load. The Design/Builder shall be expected to specify the close and withstand ratings of the switch components based on the available fault current at the point of installation (based on length of feeder cable run, presence of local generation, etc.). The switch shall be of the contactor type and shall be designed to carry 100% of rated current continuously based on ambient temperature of 120-degree Fahrenheit. Transfer switches using interlocked circuit breakers or molded case switches are not acceptable. The transfer switch shall be performance tested per the requirements of IEEE-587 (latest edition) for voltage surge and withstand capability.

2. *Type of Construction*: Over center double throw. This construction allows for positive electrical and mechanical interlocking via a mechanical beam to prevent simultaneous closing (break-before make-operation).

3. *Lugs*: Double set to allow connection of a load bank to the unit for generator testing. The lugs shall be rated for normal, standby, and neutral load conductors inside the cabinet.

4. *Main Switch Contacts*: High pressure silver alloy to resist burning and pitting for long life operation.

5. *Transition*: Closed transition with storm mode.

Automatic Transfer Switch Controls

1. *General*: Solid state and accessible from the front of the lockable enclosure. The voltage rating of the transfer switch depends upon the selection of the in-plant voltage.

2. *Voltage Sensors*: Solid state and simultaneously monitoring all phases of the normal source and all phases of the standby source. The sensor pick-up settings shall be adjustable from a minimum of 85% to a maximum of 98% of nameplate voltage. Dropout settings shall be adjustable from a minimum of 75% to a maximum of 98% of the pick-up settings with a fixed dropout time delay of .5 seconds. Voltage sensors shall be temperature compensated. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase of the normal or emergency source. A reverse voltage sequence relay shall be interlocked to the operation of the transfer switch.

3. *Frequency Sensors*: Solid state and monitoring normal and emergency power sources. Sensors shall be adjustable for a pick-up of minimum of +4/-4% to a maximum of +/-20% of nominal frequency. Drop out and time delay settings shall be adjustable.

4. *Operation*: The engine-generator set shall start upon signal from normal source voltage sensors. Solid-state time delay start shall be adjustable and shall avoid nuisance start-ups on momentary voltage dips or interruptions. The switch shall transfer the load to the standby power system when the voltage and frequency are within the limits after a specified time delay. The transfer switch shall

retransfer the load to the normal source after normal power restoration. An adjustable solid-state time delay retransfer and controls shall be provided to match phases and achieve seamless transfer back to normal service. The retransfer shall be interlocked with the generator to stop after the retransfer of the load to the normal source. Generator run times shall be recorded and tracked through SCADA.

5. *Built-In LED Status Indicator*: Functions to include shall consist of source 1 OK, start genset, source 2 OK, transfer timing, transfer complete, retransfer timing, retransfer complete.

6. *Auxiliary Switch*: Include a Form C 10 Amp 250 VAC auxiliary switch on both the normal and emergency side of the switch. These contacts shall be factory wired to a terminal block to allow interface to the remote telemetry unit digital inputs for transfer switch status.

7. *Test Switch*: Simulates loss of power to the control unit. Controls shall allow for a system test with or without load transfer.

8. *Normal Operating Position Switch*: Restores the load to the normal source after test and time delays.

9. *Retransfer Switch*: Momentary type to allow for a bypass of the retransfer time delays and cause immediate return to normal source after outage.

10. *Pilot Lights*: Provided on the front of the switch to indicate the switch is on normal power, the switch is on standby power, normal source available, and emergency source available.

Generator Set

1. *Existing Generator*: An existing 450 kW (563 kVA) generator set at the Winchester Water Treatment Facility is capable of maintaining operation of the treatment facility under all demand conditions.

N. INSTRUMENTATION

General

1. *Operation of the Treatment Plant*: Designed to operate in an unattended, totally automated mode. A supervisory/maintenance staff will be on site periodically; however, the plant will be unattended most of the time.

2. *Remote Control/Monitoring*: The ability to monitor/control the proposed facility, including the well pumps, from a remote site or sites by means of a wide area network (WAN) will be required as part of this project. Only designated, authorized operators and supervisors shall have remote access to control systems via laptops or otherwise. This facility will have a dedicated HMI system. An interface to Richmond will remain for management oversight and

assistance from Richmond staff, as necessary. This does not preclude remote "monitoring only" access by others. Routers, firewalls, and other security functions shall be furnished to prevent unauthorized access to the plant control network.

3. *System Architecture:* The communication link between RTUs within the WTF shall be via fiber optic cable. Provide a certified fiber optic cable test report which details the wavelength that is used to test the cable as well as the fiber optic testing equipment used. The master RTU shall communicate with the remote sites via cellular modem operating on the AW VPN. The SCADA system shall consist of a process control local area network (LAN) controlled from redundant HMI computers. The HMI software used will be Ignition Software. Ignition Software will be used to dial out alarms to local operations. System architecture shall provide for remote access from the office and business network.

4. *Conventional/Redundant Instrumentation*: Not required.

Modes of Operation

1. *Local/Remote Capabilities*: Each piece of process equipment will be equipped with a Hand-Off-Auto selector switch (at the piece of equipment) to allow the location of control to be changed. In order to ensure that the RTU in the Remote Manual or Remote Automatic Mode has control, an additional contact blocks will be added to the selector switch to monitor the Hand and Auto positions. The output of the contact block will drive a digital input that will serve as a permissive in the DCS. If the DCS attempts to control a device from the RTU when it is not in the Auto mode, a failure condition will be delineated at the operator's interface. Package systems with a local control panel may not be used.

2. *Local-Manual*: An operator at a piece of process equipment will turn the device on and off and make adjustments. Required for all equipment.

3. *Local-Automatic*: Controls are hardwired into pieces of equipment by a vendor (such as prepackaged process equipment).

4. *Remote-Manual*: An operator turns items on and off via the operator interface terminal (OIT) connected to the DCS. Required for all equipment.

5. *Remote-Automatic*: The DCS turns items on and off and performs all control. Required for equipment as necessary for overall plant coordinated control.

Remote Telemetry Units

1. *Processors*: For the treatment facility and the well pumps, two Allen Bradley Control Logix Controllers in a redundant configuration.

2. *Cabinets*: Include compact lighting fixture activated by a door switch. Each RTU shall have battery backup/DC UPS Units. RTU's shall be located indoors in a controlled environment with fans and heaters. RTU's for the well pumps

shall be outdoor rated enclosures (NEMA 4X, SS) with sunshades, thermostatically controlled heaters and coolers.

3. *Terminal Blocks*: Multilevel terminal blocks are not permitted.

4. *Spare Wired Terminals*: Provide in each cabinet to facilitate future expansion (10% minimum).

5. *Convenience Receptacles*: Use ground-fault interrupter type only.

6. *Separation of Power Cable and Signal Wires*: 120 VAC control cable shall be physically separated from 4-20 mA signals and DC wiring as much as practicable inside control cabinets.

7. *I/O Slots*: As required.

8. *Remote Input/Output (RIO) Boards*: Remote I/O, Flex I/O or Remote Racks will be permitted. 20% spare equipment, rounded to the higher quantity should be provided for all components.
9. *3 Wire Control*: Required for all pieces of equipment (one normally closed contact for stop and one normally open for start, etc.) except for metering pumps (which only require 1 contact for the start and the stop functions).

10. *Modulating Valves*: Analog control with full open and full closed feedback or open closed control with position feedback and full open and full closed feedback.

11. *Signal Configuration:* Analog inputs and outputs shall be 4-20 mA DC: Interrogation voltage for discrete inputs shall be 24 VDC. Isolated dry relay contacts shall be furnished for all discrete outputs – relays may be integral to the I/O module. Interposing relays shall be furnished in cases where the I/O module relay contacts do not have adequate electrical ratings.

12. *Uninterruptible Power Supply:* A smart type, ethernet connected 24VDC UPS shall be furnished to power the control room personal computers, printers, data concentrators, and other network equipment. The control room UPS shall be a floor mounted type with static bypass switch and alarms for overload, equipment over temperature, low battery and load on bypass. All RTU's and analyzers containing programming shall be powered from a battery backup. Battery backups for RTU's and field analyzers shall be mounted in the RTU panels. The UPS or battery backup shall provide a minimum of 30 minutes of backup power.

<u>Server Configuration</u>

1. Software will be a redundant Ignition package with three Stratus 4910 servers, two designated as redundant control servers and one as a database server.

2. Ignition Gateways will be configured with 4 CPUs, 16GB of RAM, and a minimum of 200 GB of Disk Space.

3. The Database Server will be configured with 4 CPUs, 32GB of RAM, a minimum of 200 GB of OS Disk Space and an additional 2 TB of Data Storage for Historical Data.

4. Synology NAS Backup Server DS1821+ with 4 TB RAID one configuration.

5. Ignition Software Modules will be configured with the following:

    - Alarm Notification
    - Voice Notification
    - SMS Notifications
    - TTS Voice_en_us_Katherine
    - SQL Bridge
    - Tag Historian
    - Enterprise Administration Agent
    - Ignition Platform
    - OPC-UA / OpcCom
    - Modbus Driver
    - Allen-Bradley Driver
    - Perspective (Unlimited)
    - Symbol Factory
    - Reporting
    - Cirrus Link MQTT Transmission
    - **Redundancy (for redundant systems)**
    - **Total-care Support (includes upgrades)**

6. The Database Server will be configured with Microsoft Sequel 2019 with a 5 CAL configuration.

Operator Interface Hardware and Software

1. *General*: Since computer technology rapidly changes, the DESIGN/BUILDER will specify all items listed under this section at the time of purchase.

2. *Personal Computers*: Two computers and monitors at the proposed facility to allow monitoring and control of the treatment facility and well field while an operator is on site. Users shall employ cryptic passwords complying with the American Water SCADA Acceptable Use Practice and related Company policies. INAW will purchase the computers.

    - Workstations will be Dell 7090 with two 24 inch monitors each.
    - Workstations to be configured for a total of 4 video outputs.

3. *Software*: The software shall be Ignition Software human-machine interface software. INAW will provide the software.

4. *Local Area Network*: The personal computers and printers shall be placed on a process control local area network (LAN). The LAN shall be implemented

using Ethernet type cards in each operator interface personal computer. The LAN shall be interconnected to various computers using a 100-base T stackable hub. The cable between devices on the LAN shall be Category 6 type cable or fiber optic. LAN cables between devices in different buildings shall be fiber optic.

5. *LAN Connection*: Shall be provided in the filter gallery (and other strategic locations in the plant) to allow for connection of a laptop computer should an operator desire to watch a filter while it is backwashing.

Operator Interface Functions

1. *Screens*: The Design/Builder shall include paragraph descriptions of the OIT and HMI screens (including a listing of each specific I/O point required on each screen) to give the system integrators an understanding of the level of detail required. Each screen shall utilize INAW's standard color conventions for stop, run, open, closed, and intermediate conditions. Text- based screens shall be considered in the design. An operator (or supervisor only) shall have the capability to manually enter data onto the screen that is not generated by the system but is appropriate to be displayed on a screen, such as a manual valve change for a chemical feed point of application. Control programs shall include limiting parameters for operator inputs, such as chemical feed dosages, to prevent excursions. Only supervisors shall have access to modify those parameters. Provide a list of all screens to be created by the system integrator. Provide sample screens to establish the minimum acceptable level of graphic detail.

    - Screen designs and configuration to be per AW standards related to the utilization of High Performance Graphic designs designated by the company.

2. *Reports*: Reporting shall be from one Ignition Reporting System. At a minimum, the reports shall consist of Form 100, System Hydraulic, Plant Data and Well Withdrawal. Provisions shall be made for the data to be edited. The original data shall not be changed; however, additional fields shall allow a manual value to be entered into reports. User entering manual data and a comment shall be maintained to explain the reason for the change. The person logged in shall be recorded as a field. Reporting data not provided by the SCADA PLCs will have the ability to be manually entered on the Data Entry Screen. This screen shall allow operators to enter lab data and other data for use in the Form 100 and other reports as needed.

3. *Alarms*: An alarm summary table shall be developed by the Design/Builder and reviewed with INAW during design. The table shall include specific initial values for all high and low alarm set points. Analog set points are also to be configurable on the graphic displays. The specific software package that is ultimately selected must have auto dialing capabilities such that alarms conditions can notify On-Call personnel without the need for a separate auto dialer. Operators shall not have access to modify alarm set points without special authorization.

4. *Database*: Provide Ignition Database package to store process data and act as a server to database users outside the process control system. This shall be installed on an existing server and fully integrated into the existing control system. INAW will provide the software.

System Factory Test

1. INAW and Design/Builder shall witness a complete factory acceptance test (FAT) of the entire control system prior to its shipment to the job site. The Design/Builder shall provide written approval for shipment following acceptance of the factory test.

2. The factory test shall be conducted by the Systems Integrator using simulated inputs to assure all I/O are provided and all inputs, outputs and application software is functioning according to the intent of the plans and specifications. Additional distributed control units shall be provided, if necessary, to accommodate the project phasing requirements. The test procedure shall include simulated system faults and failures. The factory tests shall be staged in two parts: the first to review all I/O and hardware and the second to assure functionality of the system.

3. The factory test shall demonstrate all graphics, report generation and alarm functions of the system.

4. Provide at least a four-week written notification to INAW prior to the start of the witnessed factory test. Provide a written factory acceptance test procedure for INAW review prior to the start of the factory acceptance test.

Training

1. *General*: INAW shall advise the Design/Builder as to the amount of training to be performed relative to the distributed control system. It is expected that the DCS system supplier will furnish videotapes of the training. These videotapes will be turned over to INAW at the end of training program. All training received during the startup and calibration of equipment is considered incidental training and does not count for the requirements listed below.

2. *Operator Training:* Operating training has the following goals:

    a. Use workstations, touch screens, and keyboards

    b. Retrieve and interpret all standards displays including graphics, overview displays, group displays, trends, point summaries, and alarm summaries.

    c. Enter data manually

    d. Change control parameters and set points

    e. Assume manual control of equipment and control it from the HMI

f. Print Reports

g. Acknowledge Alarms

h. Respond to software and hardware errors

i. Historical Data Collection, archival and retrieval

j. Capabilities and configurability: reports, alarm reporting, setting passwords, and system hardware configuration.

k. Database backup and recovery

3. *Maintenance Training*: This training equips INAW personnel with the skills required to diagnose, trouble shoot, and repair the components of the system. As a minimum, maintenance training shall provide technicians with the ability to:

   a. Power-up, boot strap, and shut down all of the hardware devices

   b. Perform scheduled maintenance functions on all components

   c. Describe the theory of operation for all circuit boards.

   d. Setup and use off-line diagnostics to determine hardware failures to the fault board or module.

   e. Use workstations, keypads, or keyboards to retrieve and interpret displays which shall provide on-line diagnostic information

   f. Remove and replace all removable boards/modules.

   g. Maintenance training shall be at least 75% hands-on instruction and shall be designed for personnel that do not have any familiarity with the equipment furnished.

4. *Supervisor Training*: This training is for personnel who will need to make access changes to the DCS. This training consists of the following basic tasks:

   a. Log-on and log-off to the HMI and OIT

   b. Setting and clearing passwords

   c. Configuring access levels for various process parameters and set points

   d. Printing and configuring reports

5. *Calibration*: It is expected that a detailed calibration plan will be developed during the construction phase of the project. The Design/Builder will review the instrumentation installed and provide guidance to INAW as to the number of

follow-up visits for calibration, the type of calibration documentation to be furnished, and the calibration equipment to be furnished to allow INAW personnel to maintain the equipment after project completion.

Protection of Sensitive Electronic Equipment

1. *General*: The Design/Builder shall follow guidelines for the powering and grounding of sensitive electronic equipment listed in I.E.E.E. Standard 1100-1999. Controls and power voltage are not permitted to be mixed.

2. *Transient Voltage Surge Suppression (TVSS)*: Provide TVSS at point of use for all instrumentation loads. Required for all 4 wire instruments (such as a chlorine residual analyzer) and placed on the 120 VAC branch circuit and on the 4-20 mA portion of the circuit. The transient voltage surge suppression on the 4-20 mA wiring shall be located on the RTU end. For all two wire 4-20 mA instruments that have signal cable running from outdoor to indoor locations (or signal wire run between buildings), transient voltage surge suppression on the field side of the 4-20 mA signal is required.

3. *Grounding*: Each RTU cabinet shall be provided with a direct connection to the ground grid via a driven rod in addition to the equipment safety ground required by the National Electrical Code. Daisy chaining of grounds is not acceptable. A grounding detail showing the interface between the RTU cabinet and the proposed grounding system is required. Instrumentation shields shall be grounded at the DCS end only. The electrical grounding specifications must be cross referenced to the instrumentation and control specifications so that it is understood that the system integrator monitors the quality of system grounding. In order to facilitate an electrically conductive ground mass, provide connections to structural steel and interface them to the grounding system that results in a ground impedance of 1 ohm or less.

4. *Power Supplies*: Separate power supplies shall be provided for analog inputs and PLC's, and digital outputs.

5. *Conduit Spacing*: Required between power and signal/control cables as listed in I.E.E.E Standard 518-1982.

Communications Equipment

1. *Data Highway*: Fiber optic cable is required between RTU's. Cable runs should be installed in metal conduit.

2. *Spare Parts*: The Design/Builder shall confer with INAW for the required spare parts associated with communication cables.

    - 20% Minimum, rounding to the higher quantity, for PLC equipment.

Signal/Control Wiring for Corrosive Areas

1. Use Schedule 80 PVC conduit in all chemical storage areas. Where possible, enclosures for control and electrical components should be located outside of the chemical storage rooms. Where this is not possible, the enclosures shall be fiberglass NEMA 4X type enclosures.

O. BUILDING REQUIREMENTS

General

1. The proposed treatment building shall be as specified herein, and as determined by the Design/Builder during the design phase.

Administrative Area

1. *Office Space:* Provide two offices, a lobby with space for an operations support representative, a conference room for 12 people, a break room and restrooms. Approximately 1600 square feet. The conference and break room shall have at least one large screen monitor per room and shall be connected to the business network.

2. *Operator/lab Area*: Approximately 200 ft^2. Provide operator worktable/desk and UPS. Provide lab cabinet, counter space with sink and a service sink for samples and analyzer waste. Provide countertop space to perform routine wet chemistry. Other details to be provided by INAW during design phase.

3. *Maintenance Storage Area*: Approximately 100 ft^2. Provide space for INAW provided wall shelving units.

4. *Restroom:* One women's restroom and one men's restroom, which shall be ADA compliant

5. Furniture: Will be purchased by the Design/Builder with the exception of the maintenance shelving, which will be provided by INAW.

6. Local Area Network: The office space is to be equipped for a business services local area network (LAN2). This network will be completely separate from the process control local area network (LAN1). The LAN shall be interconnected to various devices using a 100-base T stackable hub. The cable between devices on the LAN shall be Category 6 type cable. At least two LAN connections are to be provided in each office and in the break room, and at least six LAN connections are to be provided in the conference room.

7. LAN Room: Approximately 100 ft^2.

Garage Bay

1. *Office Space:* Provide a 4 bay approximately 36 ft deep by 40 ft wide garage area for vehicles, heated storage for meters and other equipment, and a work area.

2. *Overhead Doors:* Provide two (2) 18 ft wide by 14 ft heigh overhead doors.

Utilities and HVAC

1. *Water Service*: In plant water service to be metered and individual backflow preventers provided where necessary. Provide redundant booster pumps if distribution system pressure is not adequate for plant service needs when plant is not running. The Design/Builder shall review this requirement with the OWNER during preparation of the Design Memorandum to determine if booster pumps will be required.

2. *Sanitary Waste*: Coordinate design of sanitary sewer line with backwash waste disposal and design and construct an onsite sanitary lift station if required.

3. *Heating*: Electric heat or natural gas, if available and cost effective, for heat and hot water.

4. *Air Conditioning*: Provide air conditioning in the sodium hypochlorite room and administrative areas. Provide dehumidification equipment for all necessary spaces.

5. *Telephone Service*: Design/Builder shall coordinate with the local telephone utility to provide this connection.

6. *Broadband Internet:* Broadband internet service will be required to support the business service local area network (LAN 2), security communications and the fire alarm system.

Architecture

1. *Treatment Plant Layout*: A common structure is preferred.

2. *Exterior*: Exterior appearance to meet local building ordinance. Anticipate brick or color-tinted split face block; color selections by Owner.

3. *Roof*: Precast concrete panels with built up insulation and single ply membrane system. Metal deck and standing seam metal roof is acceptable provided it is cost effective and not exposed to chemical areas.

4. *Interior Walls*: The chemical areas shall have painted block. Drywall with metal frame and/or painted block in remainder areas of the plant as required.

5. *Floors*: Sealed concrete in process areas. Provide chemical resistant concrete coatings in all chemical rooms per T-2 Standard. Provide epoxy coated flooring or commercial tile in operator/lab area and restroom.

Control Room / Operator's Office

1. *Construction*: Totally enclosed room (no outside doors).

2. *Configuration*: Area dedicated to operator control workstations.

3. *Fire Suppression Equipment*: Include equipment such as a fire extinguisher that will not damage computer equipment in the event of a fire. Equipment to comply with the latest requirements of the National Fire Protection Association Codes and standards.

4. *Control Room Furniture*: Will be purchased by Design/Builder.

Safety/Security

1. *Smoke and Fire Alarms*: Provided in areas where fire potential is high. Suppression system(s) shall be designed only if required by code or local ordinance.

2. *Security System*: Designed by Others. Security requirements will be determined by the Owner based on the 60 percent complete design drawings. The Owner will provide the Design/Builder with details of the security system design to incorporate into the final design documents. The Design/Builder will be required to furnish and install basic electrical components, such as conduit, conductors, switches, support poles, wire, etc., to support the final installation of the security system, which shall be completed by others.

   Security system is to provide badge access and gate operator for the main gate to the treatment facility.

3. *Lighting:* Lighting will be placed on structures such that CCTV cameras are not blinded by perimeter lights.

4. *Fencing:* Fence surrounding property will be set back from property line as required by local codes. Design/Builder to verify during design. Area outside of fence will be kept clear so as to provide indication of intrusion. Fencing concept will be further developed during design phase.

5. *Site Design:* Site grading and access drives shall be sloped to facilitate drainage away from the buildings and structures.

1. GENERAL (Applies to More Than One Area of the Plant)

Equipment Description	Manufacturers
Ductile Iron Pipe	American Ductile Iron Pipe Griffin Pipe Products United States Pipe and Foundry
PVC Pipe 6” and larger	HD Supply (AW supplier)
PVC Pipe 4” and smaller	Certainteed
Butterfly Valves w/Electric Operators	DeZurik Valve Henry Pratt
Butterfly Valves w/Manual Operators	Henry Pratt DeZurik Clow Valve
Resilient Seat Gate Valves	Mueller Clow Valve United States Pipe and Foundry American Flow Control
Plug Valves	DeZurik Valve Keystone Valve Pratt
Check and Air Valves	Golden Anderson Cla-Val APCO Val-Matic
Pump Control Valves	Cla-Val Rodney Hunt Golden Anderson Bermad Ross Valve Henry Pratt
Sluice Gates	Mueller Rodney Hunt
Slide Gates	Golden Harvest
Pipe Expansion Joints	Red Valve Mercer
Backflow Preventers	Ames Watts Wilkins
Pressure Gauges	Ashcroft Trerice
Electric Valve Actuators	Auma Beck EIM Rotork
Pneumatic Valve Actuators	Auma Aro Pratt
Pneumatic Valve Actuators – Rotary Vane	Kinetrol K-tork

Rotary Lobe Blowers	Ingersoll Rand-Dresser Roots Blowers Gardner Denver Sutorbilt Duroflow MD
Centrifugal Blowers	Continental Lamson Hoffman HSI
Air Compressor	Ingersoll-Rand Champion
Static Mixers	Komax Chemineer Koch
Welded Steel Tanks D100	Advance Tanks Caldwall Chicago Bridge & Iron Hungerford & Terry
Hot Water Heaters	A O Smith
Floor Drains	Zurn
Hoist/Cranes	Harrington Yale Shaw-Box ACCO
Paint & Coatings	Tnemec Carboline Sherwin Williams MAB
Laboratory Furnishing	Celtech Duralab Equipment Fischer Hamilton Scientific Kewaunee Scientific
WW Sludge Presses	Bell Filter Press KCSF Screw Press
Gear Drives	Philadelphia Koellman

2. PUMPING

Equipment Description	Manufacturers
Vertical Turbine Pumps	Layne Western Flowserve Peerless/Grundfos Fairbanks Morse
Well Pumps	Bryon Jackson Grundfos Fairbanks Morse American Marsh
Horizontal Split-Case Centrifugal Pumps	Fairbanks Morse Flowserve Aurora Peerless
End Suction Pumps	Peerless Flowserve Gorman-Rupp Aurora
Sample Pumps	March Moyno Berks Netzsch
Sump Pumps	Hydromatic KSB Weil ABS
Chemical Pumps (Magnet Drive)	Iwaki Walchem March Manufacturing
Chemical Pumps (Progressive Cavity)	Moyno Netzsch
Chemical Pump (Peristatic/Hose Pump)	Watson Marlow Blue White Verder
Chemical Pumps (Hyd & Mech Diaphragm)	Milton Roy -LMI Wallace & Tiernan Pulsafeeder
Chemical Pumps (Solenoid Diaphragm)	LMI Prominent
Sludge Pumps (Water & Waste Water)	Flyght Hydromatic Yeomans ABS Weil KSB

3. MOTORS

Equipment Description	Manufacturers
Vertical Turbine	NIDEC/US Motors Toshiba General Electric Reliance Siemens
Horizontal	NIDEC/US Motors Toshiba General Electric Reliance Baldor Siemens
Submersible	Franklin Plueger Grundfos
C-Frame	NIDEC/US Motors Toshiba General Electric Baldor Siemens

4. CHEMICAL STORAGE & FEED EQUIPMENT

Equipment Description	Manufacturers
Volumetric Feeders	Merrick Acrison Chemco
Lime Slakers	Wallace & Tiernan RDP Technologies
Gaseous Chemical Feed Equipment	Wallace & Tiernan Capital Control
Chlorine Scrubber	Purafil Severn Trent
XLHDPE Chemical Storage Tanks	Poly Processing Assman Nalgene Snyder Tanks
Liquid Polymer Feed Equipment	Fluid Dynamics USGI
Batch Tank Scales	Force Flow Equipment Eaton Scales
Chemical Ball Valves	Chemtrol Hayward
Chlorination Equipment	Evoqua Capitol Controls
Bulk Bag Unloading Equipment	Flexicon Spiroflow Vibrascrew Norit

5. WATER TREATMENT PROCESSES

Equipment Description	Manufacturers
Flocculation Equipment	Philadelphia Mixer Lightnin Chemineer
UV Disinfection Systems	Wedeco Trojan Technologies Calgon Carbon
Hypochlorite Generation Systems	Process Solutions Severn Trent
Settled Solids Sludge Collection	Meurer Research (MRI)
Plate Settlers	Lamella Ecoflow Meurer Research (MRI)
Aerators	Bastin Logan Westech
Filtering Equipment – gravity filters	Roberts Filter Leopold (Xylem)
Filtering Equipment – pressure filters	Roberts Filter Hungerford & Terry Bastin Logan

6. SCADA & INSTRUMENTATION

Equipment Description	Manufacturers
Pressure Transmitters	Rosemont Honeywell
Turbidimeters	Hach Sigma
pH Analyzers	Hach Wallace & Tiernan
Chlorine Residual Analyzer	Hach (CL17) Evoqua Capitol
Fiber Optic Modems	Phoenix Hirschmann
Radio	Microwave Data Systems Free Wave EPROM
Antenna (Radio)	Clearwave Samco Andrew Decibel Pctel
Remote Telemetry Unit	Bristol (Control Wave & Control Wave Micro)
Programmable Logic Controller	Allen Bradley (Control Logix, Compact Logix, & Micro Logix)
Fluoride Ion Monitors	ABB ATI Orion
Particle Counters/Monitors	Chemtrac Systems, Hach
Streaming Current Detectors	Chemtrac Systems
Temperature/OPR Analyzers	Leeds & Northrup Wallace & Tiernan.
Flow Switches	Dwyer Instruments Flo-Tec Kobold
Venturi Flowmeters	Henry Pratt Primary Flow Signal Badger BIF
Magnetic Flowmeters	Endress Hauser ABB Emerson
Displacement & Turbine Flowmeters	Sensus Technologies Schlumberger Industries McCrometer
Ultrasonic Meters	Sensus Nusonics Division – Mesa Laboratories Polysonics Panametrics

Ultrasonic Level Probes	Endress Hauser Inventron Milltronics Flowline
Radar Level Probes	Endress Hauser Ohmart-Vega Siemens Magnetrol
Capacitance Probes	Drexelbrook Siemens
Level Instruments – RF Admittance Probe	Miltronics Drexelbrook
Auto Dialers	Raco Verbatim Win911

7. HVAC

Equipment Description	Manufacturers
Electric Heaters	Trane Indeeco
Air Conditioners	Trane Carrier
Make-up Air Units	Reznor
Exhaust Fans	Greenheck Penn Barry Loren Cook
Dehumidifiers	Dectron
Louvers and Dampers	C/S Louver System Airstream

8. ELECTRICAL

The following listing is intended to identify those manufacturers that are generally acceptable and capable of meeting American Water's Recommended Design Standards, and provides a unified approach in design, maintenance and operation across the entire Company.

Unless specifically indicated, the naming of the manufacturers outlined below is not intended to provide the specified "order" for equipment selections. The list should be reviewed with the Water Company during the initial design phase to add or eliminate any manufacturers that are preferred or rejected by the local Operations team. The Consultant may propose other suppliers/manufacturers for Owner review and acceptance based on the specific nature of the Work and site location and/or conditions. The Consultant shall include a listing of proposed major electrical equipment manufacturers with the Design Memorandum for consideration by the Owner. The Basis of Design shall be established based on the Owner's preferences.

Note: These manufacturers and descriptions below are intended to outline the basis for the equipment design and criteria for development in the project; not exclusive approval.

Equipment Description	Manufacturers
MV Switchgear – Vacuum Breaker, Draw-Out	Cutler-Hammer Square D ABB Siemens General Electric
Medium Voltage Automatic Transfer Switchgear (Circuit Breaker Transfer Equipment – Manual or Automatic)	Cutler-Hammer Square D ABB Siemens General Electric Or Acceptable Manufacturer from above provided by Generator Equipment Manufacturer (subject to Owner approval)
MV Fusible Switchgear	Cutler-Hammer Square D *(Note - HVLcc Type Equip Not Accepted)* ABB Siemens General Electric S&C
MV Switchgear – SF6 Type	*Not Preferred Equipment*
MV Motor Control Equipment, MC Lineups (FVNR, RVSS Equipment)	Cutler-Hammer ABB Siemens General Electric
MV Variable Frequency Drives	Toshiba Allen Bradley – Voltage Source Equipment (not Current Source Drive) Cutler-Hammer Siemens/Robicon

Equipment Description	Manufacturers
LV Power Distribution Equipment – (Swgr, Swbds, Panelboards, Circuit Breakers, etc)	Cutler-Hammer Square D ABB Siemens General Electric
Transformers – Dry Type, VPI, VPE Insulation	Cutler-Hammer Square D/Sorgel Siemens ABB
Transformers – Cast-Coil	Square D/Sorgel ABB
Transformers – Liquid-Filled	*Not Preferred Equipment*
Protection Relays & Monitoring Relays for Voltage, Current, Phase Loss, Etc.	SEL (Schweitzer Engineering Laboratories) *Other acceptable manufacturers may include the following (subject to prior approval by AW Engr / Owner)* All to be provded with Fiber-Optic Communications over Ethernet / Modbus TCP/IP
Power Quality Metering, Motor Monitoring & Feeder Protection Relays	SEL 735, SEL 710, SEL 751A, SEL-489 Other SEL devices as applicable for the design of the power distribution system. *Communications to utlilize fiber-optic interface; dual-port for loop configuration where available. Copper communications to be utilized only where specifically indicated. All to be provded with Fiber-Optic Communications capability Ethernet / Modbus TCP/IP and DNP3*
Low Voltage Motor Control Centers	Cutler-Hammer Square D ABB Siemens General Electric
Full Voltage Motor Starters	Cutler-Hammer Square D ABB Siemens General Electric
Reduced Voltage (Solid-State, Soft Start) Motor Starters	Cutler-Hammer Square D ABB Siemens General Electric Danfoss Benshaw

Equipment Description	Manufacturers
Low Voltage Variable Frequency Drives – Stand Alone Applications (Free-Standing or Wall Mounted Units) *NOTE: Basic Criteria - All VFD equipment to be "Heavy Duty" / "Industrial Duty", rated for 50 C. and suitable for full load rating with 3% voltage unbalance. Cooling fans shall be accessible without requiring total dismantling of the drive assembly; top outlet discharge preferred.* *"HVAC Rated" Drives are Not Permitted* *** NEMA4X Note: Drive assembly to be rated NEMA 4x by manufacturer; use of open chassis or NEMA 1 drives installed in NEMA 4x enclosure is not suitable in meeting this criteria.*	Free-Standing – Wall or Floor Mounted Square D Cutler-Hammer Allen Bradley Toshiba ABB Siemens/Robicon Danfoss Benshaw Yaskawa NEMA 4X Type (where required)** Allen Bradley Yaskawa T B Woods Others as determined suitable for the application Harmonic Filters (where required) TCI Mirrus MTE
Low Voltage Variable Frequency Drives – Part of MCC Lineup/Equipment *(Not an AW preferred method)*	Cutler-Hammer Square D ABB Seimens General Electric
Low Voltage Automatic or Manual Transfer "Switches" – Contactor Type assembly	ASCO 4000 Series (unless otherwise suitable) Other potential Suppliers include: Cutler-Hammer GE/Zenith Russelectric
Low Voltage (*Service Entrance Rated where applicable*) Automatic Transfer Equipment (Circuit Breaker Transfer Equipment – Manual or Automatic) *NOTE: Circuit Breaker – Main and Circuit Breaker – Standby (where identified) REQUIRED unless specifically accepted otherwise*	Cutler-Hammer/Eaton Square D ASCO 4000 Series Russelectic Switchgear General Electric
Uninterrupted Power Supplies	APC Eaton Powerware General Electric Mesta Liebert MCG

Equipment Description	Manufacturers
Surge Protective Devices (UL-1449, Rev 4 Compliant and **Listed/Labeled**) *Note: use of integral SPD with panelboards and equipment not permitted; provide stand-alone external devices only unless otherwise specifically approved*	APT – Advanced Protection Technologies "XDS" Series MCG Cutler-Hammer "SPD" Series
NOTE: The following descriptions provide general guidelines for lighting fixtures and applications. As LED technology continues to be available at lower costs, American Water recommends evaluation between LED and Fluorescent lamps/fixtures. Where fluorescent fixtures are used (T-5 and T-8 fluorescent lamps), provide Programmed / Rapid-Start Ballasts. (*note- the use of Instant-Start ballasts is prohibited*) The use of LED technology is recommended for all exterior applications unless special aesthetic and/or other site-specific criteria is established by the Owner or Regulatory Authority	
Lighting Fixtures – Fluorescent T-8 lamps, Program-Start Ballasts, Indoor Enclosed and Gasketed Fluorescent for Damp and Wet Locations (Process and Chemical Rooms)	EPCO GFF Series w/SS Latches, Simkar EN 2 or 3 w/SS Latches, Holophane ERS Series, Lithonia FSW or FHE Series, ILS Others as accepted by Owner *(Note – the use of fixtures similar to Lithonia DMR Series, Columbia LUN Series, Simkar OV450, etc are generally prohibited due to on-going physical / performance issues associated with this type of design (limited latches retaining sealed integrity of the assembly)). Fixture selection is to take into consideration lamp output, lumen maintenance, and environmental factors associated maintainability of the overall system.*
Lighting Fixtures – Fluorescent T-8 lamps, Program-Start Ballasts, Indoor dry applications	Benjamin, Philips, Keene, Lithonia and Others as accepted by Owner
Lighting Fixtures – Fluorescent T-8 lamps, Program-Start Ballasts, Indoor Hazardous Locations	Appleton Crouse-Hinds Killark Others as accepted by Owner
Lighting Fixtures – LED Indoor	Lithonia Philips Cree Others as accepted by Owner
All LED luminaires must be UL Listed (e.g. UL8753 / UL8750) and tested to IESNA LM-79 and LM-80 standards and that the results of those tests must be submitted to the Owner as part of the submittal review process. LED fixtures to be provided with a minimum 5 year warranty covering the driver, the LED components and the luminaire.	

Equipment Description	Manufacturers
Lighting Fixtures – LED Outdoor	RAB Cree Philips Dialight Lithonia Others as accepted by Owner
Lighting Fixtures – HPS Outdoor	Holophane, Infranor Devine, Philips Others as accepted by Owner
Lighting Control - Occupancy Sensors	Sensor Switch (High Humidity / Low Temperature Type) – process & chem. Areas Leviton, Hubbell, P&S along with others mfgrs and products to be provided as determined suitable for the location and environment where installed. *NOTE: Technology (passive IR, ultrasonic, or dual) to be based on location where installed*.
Lighting Control – Daylight Harvesting and/or Special Function and Dimming	Lutron Wattstopper Day Light Controls Others as accepted by Owner
Control and Timing Relays (“Ice-cube” relay style)	Diversified Potter Brumfield Syrelec Allen Bradley Square D Cutler-Hammer Seimens Releco Others as accepted by Owner
Push Buttons, Selector Switches & Pilot Lights (30 mm minimum size devices, NEMA 4X style preferred and high-intensity LED pilot lamps)	Cutler-Hammer Square D Seimens Allen Bradley Kraus & Naimer
Definite Purpose Relays and Contactors	Cutler Hammer Square D Siemens Allen Bradley
PVC Coated Rigid Steel Conduit	Ocal Robroy
Fiberglass Conduit	Champion FRE
Power Generation Equipment – (Diesel engine driven units)	Onan/Cummins Caterpillar Kohler Others only as determined accepted by Owner

Equipment Description	Manufacturers
Industrial and Corrosion Resistant Wiring Devices	Cooper Industries Legrand Leviton Hubbell Meltric Woodhead, http://www.woodheadsales.com

Specification sheet

Diesel generator set QSX15 series engine

450 kW – 500 kW Standby

Description

Cummins® commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary standby and prime power applications.

Features

Cummins heavy-duty engine - Rugged 4-cycle, industrial diesel delivers reliable power, low emissions and fast response to load changes.

Alternator - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

Permanent Magnet Generator (PMG) - Offers enhanced motor starting and fault clearing short-circuit capability.

Control system - The PowerCommand® electronic control is standard equipment and provides total genset system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

Cooling system - Standard integral set-mounted radiator system, designed and tested for rated ambient temperatures, simplifies facility design requirements for rejected heat.

Enclosures - Optional weather protective and sound attenuated enclosures are available.

Fuel tanks - Dual wall sub-base fuel tanks are also available.

NFPA - The genset accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor network.

	Standby rating	Prime rating	Continuous rating	Data sheets
Model	60 Hz kW (kVA)	60 Hz kW (kVA)	60 Hz kW (kVA)	60 Hz
DFEJ	450 (563)	410 (513)		D-3400
DFEK	500 (625)	455 (569)		D-3401

Generator set specifications

Governor regulation class	ISO 8528 part 1 Class G3
Voltage regulation, no load to full load	± 0.5%
Random voltage variation	± 0.5%
Frequency regulation	Isochronous
Random frequency variation	± 0.25%
EMS compatibility	IEC 61000-4-2: Level 4 Electrostatic discharge IEC 61000-4-3: Level 3 Radiated susceptibility

Engine specifications

Design	Turbocharged with air-to-air charge air-cooling
Bore	136.9 mm (5.39 in.)
Stroke	168.9 mm (6.65 in.)
Displacement	14.9 L (912.0 in^3)
Cylinder block	Cast iron with replaceable wet liners, in-line 6 cylinder
Battery capacity	1400 Amps minimum at ambient temperature 0 ℃ (32 ℉)
Battery charging alternator	35 Amps
Starting voltage	24 volt, negative ground
Fuel system	Full authority electronic (FAE) Cummins HPI-TP
Fuel filter	
Air cleaner type	
Lube oil filter type(s)	Single spin-on combination full flow and bypass filters
Standard cooling system	40 ºC (104 ºF) ambient radiator

Alternator specifications

Design	Brushless, 4 pole, drip-proof revolving field
Stator	2/3 pitch
Rotor	Single bearing, flexible discs
Insulation system	Class H
Standard temperature rise	125 ℃ standby at 40 ℃ ambient
Exciter type	PMG (Permanent Magnet Generator)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower fan
AC waveform total harmonic distortion (THDV)	< 5% no load to full linear load, < 3% for any single harmonic
Telephone influence factor (TIF)	< 50% per NEMA MG1-22.43
Telephone harmonic factor (THF)	< 3%

Available voltages

60 Hz Line – Neutral/Line - Line

- 110/190
- 110/220
- 115/200
- 115/230
- 120/208
- 127/220
- 139/240
- 220/380
- 230/400
- 240/416
- 255/440
- 277/480
- 347/600

Note: Consult factory for other voltages.

Generator set options

Engine

- 208/240/480 V thermostatically controlled coolant heater for ambient above 4.5 ℃ (40℉)
- 208/240/480 V thermostatically controlled coolant heater for ambient below 4.5 ℃ (40℉)
- 120 V 300 W lube oil heater
- Heavy duty air cleaner with safety element

Alternator

- 80 ℃ rise
- 105 ℃ rise
- 125 ℃ rise
- 120/240 V 200 W anti-condensation heater

Exhaust system

- Critical grade exhaust silencer
- Exhaust packages
- Industrial grade exhaust silencer
- Residential grade exhaust silencer

Fuel system

- 1022 L (270 gal) sub-base tank
- 1136 L (300 gal) sub-base tank
- 1514 L (400 gal) sub-base tank
- 1893 L (500 gal) sub-base tank
- 2271 L (600 gal) sub-base tank
- 2498 L (660 gal) sub-base tank
- 3218 L (850 gal) sub-base tank
- 6435 L (1700 gal) sub-base tank
- 9558 L (2525 gal) sub-base tank

Cooling system

- High ambient 50 ℃ radiator

Control panel

- PC 3.3
- PC 3.3 with MLD
- 120/240 V 100 W control anti-condensation heater
- Ground fault indication
- Remote fault signal package
- Run relay package

Generator set

- AC entrance box
- Battery
- Battery charger
- Export box packaging
- UL 2200 Listed
- Main line circuit breaker
- Paralleling accessories
- Remote annunciator panel
- Spring isolators
- Enclosure: aluminium, steel, weather protective or sound attenuated
- 2 year standby power warranty
- 2 year prime power warranty
- 5 year basic power warranty
- 10 year major components warranty

*Note: Some options may not be available on all models - consult factory for availability.

Control system 2.3

The PowerCommand 2.3 control system - An integrated generator set control system providing voltage regulation, engine protection, generator protection, operator interface and isochronous governing (optional).

Control – Provides battery monitoring and testing features and smart-starting control system.

InPower™ – PC-based service tool available for detailed diagnostics.

PCCNet RS485 – Network interface (standard) to devices such as remote annunciator for NFPA 110 applications.

Control boards – Potted for environmental protection.

Ambient operation – Suitable for operation in ambient temperatures from -40 ℃ to +70 ℃ and altitudes to 13,000 feet (5000 meters). Prototype tested - UL, CSA and CE compliant.

AC protection

- AmpSentry protective relay
- Over current warning and shutdown
- Over and under voltage shutdown
- Over and under frequency shutdown
- Over excitation (loss of sensing) fault
- Field overload
- Overload warning
- Reverse kW shutdown
- Reverse Var shutdown
- Short circuit protection

Engine protection

- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- High, low and weak battery voltage warning
- Fail to start (overcrank) shutdown
- Fail to crank shutdown
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown
- Fuel-in-rupture-basin warning or shutdown

Operator/display panel

- Manual off switch
- 128 x 128 Alpha-numeric display with push button access for viewing engine and alternator data and providing setup, controls and adjustments (English or international symbols)
- LED lamps indicating genset running, not in auto, common warning, common shutdown, manual run mode and remote start
- Suitable for operation in ambient temperatures from -20 ºC to +70 ºC

Alternator data

- Line-to-Neutral AC volts
- Line-to-Line AC volts
- 3-phase AC current
- Frequency
- kVA, kW, power factor

Engine data

- DC voltage
- Lube oil pressure
- Coolant temperature

Control functions

- Time delay start and cool down
- Glow plug control (some models)
- Cycle cranking
- PCCNet interface
- (4) Configurable inputs
- (4) Configurable outputs
- Remote emergency stop
- Battle short mode
- Load shed
- Real time clock with exerciser
- Derate

Digital governing (optional)

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

Digital voltage regulation

- Integrated digital electronic voltage regulator
- 3-phase Line-to-Line sensing
- Configurable torque matching
- Fault current regulation under single or three phase fault conditions

Other data

- Genset model data
- Start attempts, starts, running hours
- Fault history
- RS485 Modbus® interface
- Data logging and fault simulation (requires InPower service tool)
- Total kilowatt hours
- Load profile

Options

- Auxiliary output relays (2)
- 120/240 V, 100 W anti-condensation heater
- Remote annunciator with (3) configurable inputs and (4) configurable outputs
- PMG alternator excitation
- PowerCommand for Windows® remote monitoring software (direct connect)
- AC output analogue meters
- PowerCommand 2.3 and 3.3 control with AmpSentry protection

For further detail on PC 2.3 see document S-1569.

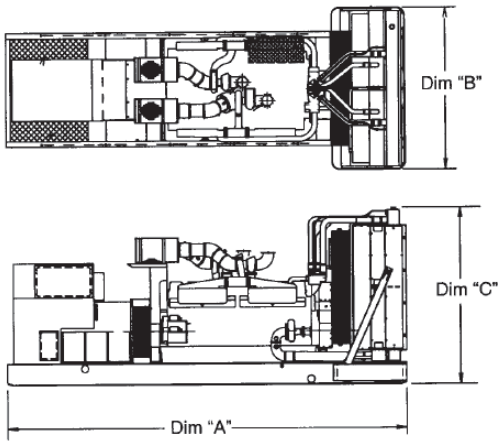
For further detail on PC 3.3 see document S-1570.

Emergency Standby Power (ESP):
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Limited-Time running Power (LTP):
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

Prime Power (PRP):
Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Base Load (Continuous) Power (COP):
Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.



This outline drawing if for reference only. See respective model data sheet for specific model outline drawing number.

Do not use for installation design

Model	Dim 'A' mm (in.)	Dim 'B' mm (in.)	Dim 'C' mm (in.)	Set weight dry* kg (lbs)	Set weight wet* kg (lbs)
DFEJ	3864 (152.1)	1524 (60.0)	1812 (71.3)	4098 (9035)	4234 (9335)
DFEK	3864 (152.1)	1524 (60.0)	1812 (71.3)	4325 (9535)	4461 (9835)

*Weights represent a set with standard features. See outline drawings for weights of other configurations.

see below drawings for overall shipping weight and dimensions

Codes and standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

	This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.		The generator set is available listed to UL 2200, Stationary Engine Generator Assemblies for all 60 Hz low voltage models. The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage. Circuit breaker assemblies are UL 489 Listed for 100% continuous operation and also UL 869A Listed Service Equipment.
	The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.	**U.S EPA**	Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards, 40 CFR 60 subpart IIII Tier 2 exhaust emission levels. U.S. applications must be applied per this EPA regulation.
	All low voltage models are CSA certified to product class 4215-01.	**International Building Code**	The generator set package is available certified for seismic application in accordance with the following International Building Code: IBC2000, IBC2003, IBC2006, IBC2009 and IBC2012.

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

For more information contact your local Cummins distributor or visit power.cummins.com

Our energy working for you.™

S-1582 (08/17)

Generator set data sheet

Model:	**DFEJ**
Frequency:	**60 Hz**
Fuel type:	**Diesel**
kW rating:	**450 Standby** **410 Prime**
Emissions level:	**EPA NSPS Stationary Emergency Tier 2**

Exhaust emission data sheet:	**EDS-184**
Exhaust emission compliance sheet:	**EPA-1025**
Sound performance data sheet:	**MSP-183**
Cooling performance data sheet:	**MCP-106**
Prototype test summary data sheet:	**PTS-145**
Standard set-mounted radiator cooling outline:	**0500-3326**
Optional set-mounted radiator cooling outline:	
Optional heat exchanger cooling outline:	
Optional remote radiator cooling outline:	

Fuel consumption	**Standby**				**Prime**				**Continuous**
	kW (kVA)				**kW (kVA)**				**kW (kVA)**
Ratings	450 (563)				410 (513)				
Load	**1/4**	**1/2**	**3/4**	**Full**	**1/4**	**1/2**	**3/4**	**Full**	**Full**
US gph	10.8	17.4	23.4	30.1	10.2	16.2	21.9	27.7	
L/hr	41	66	89	114	39	61	83	105	

Engine	**Standby rating**	**Prime rating**	**Continuous rating**
Engine manufacturer	Cummins Inc.		
Engine model	QSX15-G9		
Configuration	Cast iron with replaceable wet cylinder liners, In-Line 6 cylinder		
Aspiration	Turbocharged and air-to-air after-cooled		
Gross engine power output, kW_m (bhp)	563.0 (755.0)	507.3 (680.0)	
BMEP at set rated load, kPa (psi)	2192.5 (318.0)	2006.4 (291.0)	
Bore, mm (in.)	136.9 (5.39)		
Stroke, mm (in.)	168.9 (6.65)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	10.1 (1995.0)		
Compression ratio	17.0:1		
Lube oil capacity, L (qt)	83.3 (88.0)		
Overspeed limit, rpm	2150 ± 50		
Regenerative power, kW	52.00		

Fuel flow	Standby rating	Prime rating	Continuous rating
Maximum fuel flow, L/hr (US gph)	423.9 (112.0)		
Maximum fuel inlet restriction, mm Hg (in Hg)	127.0 (5.0)		
Maximum return restriction, mm Hg (in Hg)	165.1 (6.5)		

Air			
Combustion air, m^3/min (scfm)	38.3 (1355.0)	36.8 (1300.0)	
Maximum air cleaner restriction, kPa (in H_2O)	6.2 (25.0)		
Alternator cooling air, m^3/min (cfm)	62.0 (2190.0)		

Exhaust			
Exhaust flow at set rated load, m^3/min (cfm)	87.9 (3105.0)	82.4 (2910.0)	
Exhaust temperature, °C (°F)	462.8 (865.0)	440.6 (825.0)	
Maximum back pressure, kPa (in H_2O)	10.2 (41.0)		

Standard set-mounted radiator cooling			
Ambient design, °C (°F)	40 (104)		
Fan load, kW_m (HP)	19 (25.5)		
Coolant capacity (with radiator), L (US gal)	57.9 (15.3)		
Cooling system air flow, m^3/min (scfm)	707.5 (25000.0)		
Total heat rejection, MJ/min (Btu/min)	19.6 (18485.0)	17.7 (16680.0)	
Maximum cooling air flow static restriction, kPa (in H_2O)	0.12 (0.5)		

Optional set-mounted radiator cooling			
Ambient design, °C (°F)	50 (122)		
Fan load, kW_m (HP)	19 (25.5)		
Coolant capacity (with radiator), L (US gal)	57.9 (15.3)		
Cooling system air flow, m^3/min (scfm)	707.5 (25000.0)		
Total heat rejection, MJ/min (Btu/min)	19.6 (18485.0)	17.7 (16680.0)	
Maximum cooling air flow static restriction, kPa (in H_2O)	0.12 (0.5)		

PINNACLE ENVIRONMENTAL CONSULTANTS, INC.
CORPORATE OFFICE: 486 OLD STATE RT. 74 ■ CINCINNATI ■ OHIO ■ 45244 ■ PHONE: 513-533-1823 ■ FAX: 513-533-1859
2088 ROSS AVENUE ■ CINCINNATI ■ OHIO ■ 45212 ■ PHONE: 513-533-1823 ■ FAX: 513-533-1859
500B PRESTIGE PARK ■ HURRICANE ■ WEST VIRGINIA ■ 25526 ■ PHONE: 304-757-5204 ■ FAX: 304-757-5205

December 29, 2017

Mr. Jerry Byrd
Whitewater Construction
1417 Sheridan Street
Richmond, IN 47374

Re: Pre-Renovation Asbestos Inspection Report of the Structure located at 870 W. State Road 32, Richmond, Indiana 47374
Pinnacle PN: 17-0352

Dear Mr. Byrd:

On November 2, 2017, Mr. Rick Perkins of Pinnacle Environmental Consultants, Inc. (see Attachment 1 for certifications) visited the structure located at 870 Indiana 32 in Richmond, Indiana 47394 per your request. The purpose of this visit was to collect bulk samples of materials suspect for containing asbestos in preparation for the planned renovation of the building, as required for compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAP). Specifically, twenty-two (22) bulk samples were collected from ten (10) homogeneous areas in the planned renovation area. Analysis results show two (2) homogeneous areas were identified with asbestos content greater than one percent (>1). The presence of asbestos was also detected in vermiculite insulation that is located in the attic area of the structure. Please reference the *PLM Bulk Sample Data Summary Table* in Attachment 2 for complete sample location, description and analysis information. The locations of bulk samples collected can be found on the floor plan included in Attachment 3.

Asbestos Bulk Sampling Methods

For friable Surfacing Materials, three (3) bulk samples were collected for each homogeneous area less than or equal to 1,000 square feet. If the homogeneous area was greater than 1,000 square feet but less than 5,000 square feet, five (5) bulk samples were collected. For homogeneous areas that were greater than 5,000 square feet, seven (7) bulk samples were collected. Random sample locations for each homogeneous area of suspect friable surfacing materials were determined by Pinnacle's inspector in the field.

Three (3) samples were randomly collected from homogeneous areas of Thermal System Insulation such as pipe insulation, unless the insulation was known to contain asbestos and a single confirmatory sample was collected. Miscellaneous Material and non-friable suspected ACBM were sampled "in a manner sufficient to determine" whether the material in question contained asbestos.

To avoid disturbing the material more than necessary and potentially cause the release of asbestos fibers, Pinnacle performed bulk sampling of suspect materials in accordance with generally accepted procedures outlined in the Asbestos Hazard Emergency Response Act (AHERA). Each sample was collected and placed in a clean, sealable vial and labeled with a unique sample identification number. This sample number was recorded on a Bulk Sample Log Sheet, the sample vial, and at the sample location to permit easy identification of the sampled materials in the future. Supplemental information was also recorded on the Bulk Sample Log Sheet, including date of inspection, name of Pinnacle's inspector, the building name (or number), a brief description and location of the sample, and type of material sampled (e.g., drywall, ceiling tile, caulk).

Analysis of Bulk Samples

All bulk samples, excluding vermiculite, were submitted to Pinnacle's Analytical Laboratory (see Attachment 4 for a copy of laboratory NVLAP accreditation) and analyzed for asbestos content by PLM and dispersion staining (Method Reference: EPA-600/R-93/116) sample analysis. This analytical method, which the EPA currently recommends for the determination of asbestos in bulk samples of suspect materials, can be used for qualitative identification of six morphologically different types of asbestos fibers: chrysotile, amosite, crocidolite, anthophyllite, tremolite and actinolite asbestos. The method specifies that the asbestos content in a bulk sample will be estimated and reported as a finite percentage (rounded to the nearest percentage) within the range of 0 to 100.

The results of the bulk sample analysis are reported in a standard written laboratory report. This report includes Pinnacle's project number, the laboratory identification number and the field number assigned to the bulk sample upon collection at the site. If a bulk sample contains more than one distinct layer of material, each layer is analyzed separately. The composition of the bulk sample is reported in percentages of asbestos (i.e., chrysotile, amosite or other) and non-asbestos (i.e., cellulose, fiberglass or other) components.

The vermiculite insulation sample was submitted to EMSL Analytical, Inc. and analyzed using Qualitative Analysis by Transmission Electron Microscopy (TEM) and Filtration Technique. The results of the TEM bulk sample analysis are also reported in a laboratory report. The laboratory method for vermiculite only determines if asbestos is present and cannot provide a percentage of asbestos for vermiculite. As a result, if asbestos is found, the vermiculite is considered to be a regulated asbestos-containing material.

To reduce the total number of samples analyzed, the laboratory was instructed to "stop analysis" at the first sample >1% asbestos for each homogeneous area. For example, assume seven bulk samples were collected from a large homogeneous area. If the first or any subsequent sample analyzed by the laboratory identifies >1% asbestos content, there is no need to analyze the remaining samples. As specified in AHERA, one sample of a homogeneous area >1% is enough to designate the entire homogeneous area as asbestos-containing. In addition, EMSL was instructed to stop analysis if asbestos was present for the vermiculite samples collected in the same fashion as described above with exception to the analysis was stopped if asbestos was identified.

If a PLM bulk sample (non-vermiculite) has less than ten percent (<10%) asbestos content, the EPA recommends the sample be analyzed by the point count method reference PLM, EPA 600/R-93/116. This analytical method is a more accurate way of determining the actual asbestos percentage. For this project, there were no samples analyzed using point count methods. A copy of the original laboratory report and sample chain-of-custody for PLM analysis can be found in Attachment 5.

Results and Conclusions

The locations and quantities of materials known or assumed to contain >1% asbestos can be found on the *Inventory of Asbestos-Containing Material Table* in Attachment 6 with this letter.

Vermiculite insulation containing actinolite asbestos was identified in the attic space above the shop, the FL Room, CL Room, Lab, and restrooms. Analysis results indicate that actinolite asbestos was identified in the sample analyzed by EMSL. Asbestos fiber types that are currently regulated in the United States include chrysotile, amosite, crocidolite, anthophyllite, tremolite and ***actinolite*** asbestos. Since the actinolite fibers are present in the vermiculite, this asbestos-contaminated material must be properly removed if it will be disturbed by the planned renovation activities.

Based on the limited access of the bulk sampling survey (i.e., nondestructive inspection), caution should be exercised during the renovation project in the event materials known or suspected to contain asbestos are exposed during the renovation work. In the event additional material suspected to contain asbestos is discovered during this project, work with the potential for disturbance should be stopped until sampling and analysis has been performed. All asbestos bulk sampling should be conducted by a professional consultant utilizing personnel who are licensed as an Asbestos Inspector by the Indiana Department of Environmental Management. Analysis of all bulk samples collected should be performed by laboratories accredited by NVLAP.

Current asbestos laws and regulations require removal of asbestos-containing materials (ACM) prior to renovation activities with the potential to disturb these materials. If removal of ACM is necessary, an Indiana Department of Environmental Management licensed asbestos abatement contractor should be contracted to perform the removal work and submit necessary regulatory notifications. It is also recommended that Whitewater Construction contract with Pinnacle to provide abatement project design and bidding assistance, abatement completion visual inspections, final clearance air sampling and review and organization of the Contractor's project closeout documentation.

Pinnacle greatly appreciates the opportunity to offer our services and expertise to Whitewater Construction for this most important project. Should you have any questions or require additional information, please feel free to contact me at your earliest convenience.

Sincerely,
Pinnacle Environmental Consultants, Inc.
Michael D. Strine

Michael D. Strine
Vice President

Attachments (6)

Attachment 1
PINNACLE'S PERSONNEL CERTIFICATIONS

Indiana Department of Environmental Management
100 N. Senate Avenue
Mail Code 61-52 IGCN 1003
Indianapolis, IN 46204-2251

December 14, 2016

000006

Rick Perkins
Pinnacle Environmental
486 Old State Route 74
Cincinnati OH 45244

Re: Asbestos Inspector # 19A004502

Based upon the review of your license application, the Office of Air Quality has determined that you have fulfilled the requirements of 326 IAC 18 and are eligible for licensing in the following discipline:

Asbestos Inspector

Your Asbestos Inspector license is attached below. The license is waterproof and tear resistant. Please sign your license and do not laminate or alter your license in anyway. Your license must be available for review at all times while implementing an asbestos project. This license may be revoked, pursuant to 326 IAC 18-1-7, if you:

(1) Violate any requirements of these rules (326 IAC 18), 326 IAC 14-10, or any requirement of the Asbestos-Containing Materials in Schools Rule or any other federal, state, or local regulation pertaining to asbestos in buildings or to asbestos projects.
(2) Falsify information on your application for licensing.
(3) Fail to meet any qualifications specified in 326-IAC 18-1-4.
(4) Conduct asbestos project, or related asbestos handling activity, in a manner which is hazardous to the public health.

Your license is valid effective 01/19/2017, and will expire on 01/19/2018, as indicated on your card. We suggest that you attend the required training and submit an application for license renewal early to insure your license does not lapse. NOTE: 326 IAC 18-1-4(h) and 326 IAC 18-1-6(e) require that any individual who has an eighteen (18) month lapse between any two training courses of the same discipline to attend an initial training course for the discipline in which they are seeking a license. In order to avoid re-taking the initial training course you must have attended a refresher in the discipline you are seeking a license within eighteen (18) months from the date of issuance of your last training course certificate.

Office of Air Quality, Asbestos Licensing Section (317) 233-3861

Indiana Dept. of Environmental Management

Rick Perkins

Asbestos Inspector License #: 19A004502

Effective: **01/19/2017**	Expiration: **01/19/2018**
Birth Date: **07/03/1955**	Gender: **M**
Height: **5-10**	Eye Color: **Blue**
Weight: **202**	Hair Color: **Gray**

Attachment 2
PLM BULK SAMPLE DATA SUMMARY TABLE

PLM BULK SAMPLE DATA SUMMARY TABLE
870 STATE ROAD 32
WINCHESTER, INDIANA

Sample Location	Sample Description	Sample ID No.	Lab ID No.	Asbestos Content	* Homo-geneous Area #	Friable/ Nonfriable
The following samples were collected from the Building Interior						
Attic above shop	Rock wool	RPI-320	17WB-28706	None detected	1	Friable
Attic above shop	Rock wool	RPI-321	17WB-28707	None detected	1	Friable
Ceiling above entry to Mens restroom	2'x4' Suspended ceiling tile with fancy face	RPI-322	17WB-28708	None detected	2	Friable
Ceiling above entry to Womens restroom	2'x4' Suspended ceiling tile with fancy face	RPI-323	17WB-28709	None detected	2	Friable
Office 1 ceiling at entry to shop area	2'x4' Suspended ceiling tile with holes	RPI-324	17WB-28710	None detected	3	Friable
Office 2 ceiling at north wall	2'x4' Suspended ceiling tile with holes	RPI-325	17WB-28711	None detected	3	Friable
Office 2 wall above suspended ceiling tile	Drywall joint compound and tape	RPI-333	17WB-28719	None detected	7	Nonfriable
Office 2 wall above suspended ceiling tile	Drywall board	RPI-334	17WB-28720	None detected	8	Nonfriable
Office 2 wall above suspended ceiling tile	Drywall board, joint compound, and tape, composite	RPI-335	17WB-28721	None detected	7 & 8	Nonfriable
Office 3 floor close to center edge	Yellow carpet adhesive	RPI-332	17WB-28718	None detected	6	Nonfriable
North shop wall at entry to garage	Cementitious Wall Panel	RPI-326	17WB-28712	22% chrysotile	4	Nonfriable
West shop wall by window	Cementitious Wall Panel	RPI-327	17WB-28713	Stopped analysis	4	Nonfriable
Office 4 ceiling center of room	Texture on drywall	RPI-328	17WB-28714	None detected	5	Nonfriable
Office 4 ceiling northwest corner	Texture on drywall	RPI-329	17WB-28715	None detected	5	Nonfriable
Office 4 ceiling northeast corner	Texture on drywall	RPI-330	17WB-28716	None detected	5	Nonfriable
Office 4 floor northeast corner	Yellow carpet adhesive	RPI-331	17WB-28717	None detected	6	Nonfriable
Office 4 wall at northwest corner	Drywall joint compound and tape	RPI-336	17WB-28722	None detected	7	Nonfriable
Office 4 wall at northwest corner	Drywall board	RPI-337	17WB-28723	None detected	8	Nonfriable

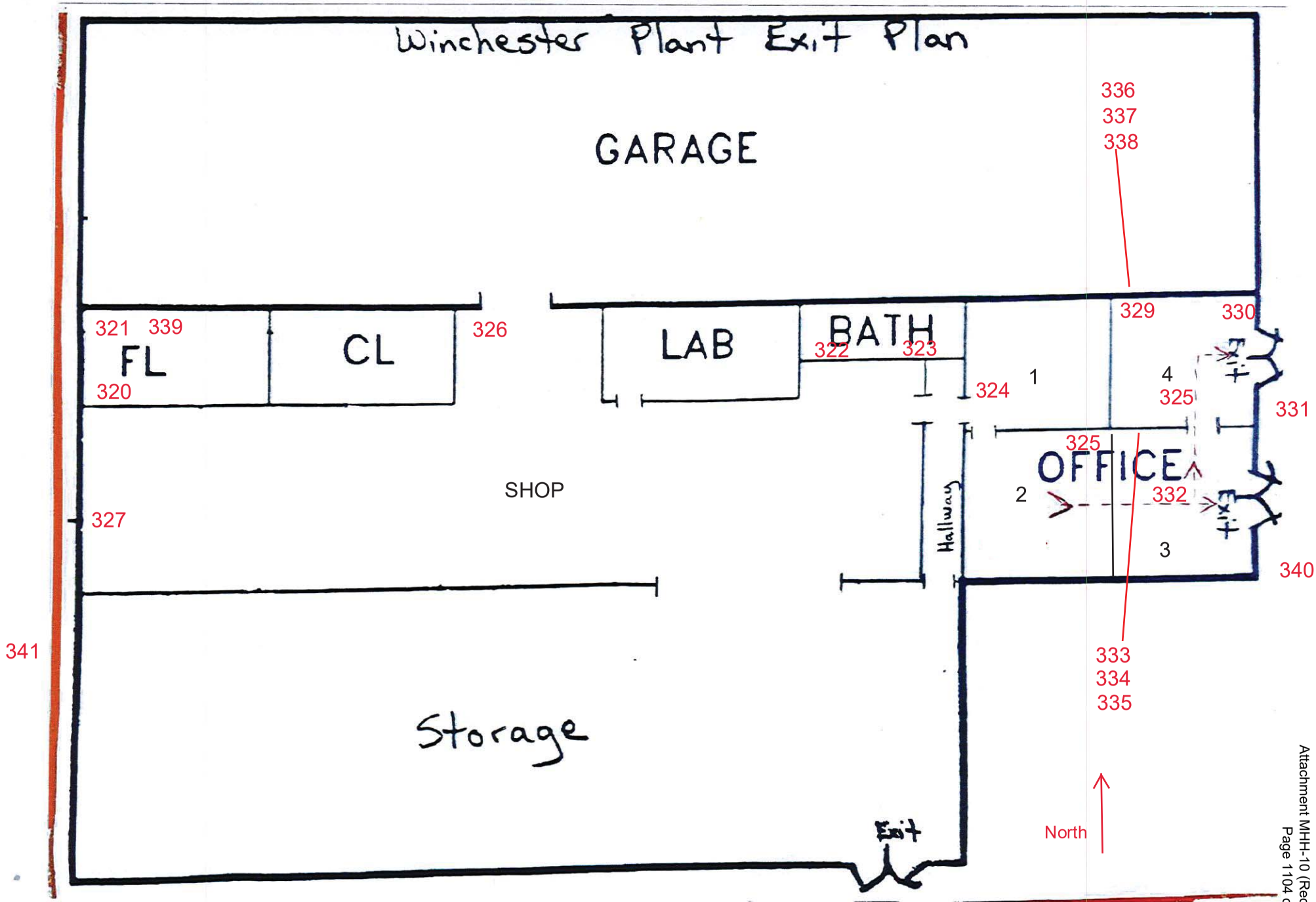
PLM BULK SAMPLE DATA SUMMARY TABLE
870 STATE ROAD 32
WINCHESTER, INDIANA

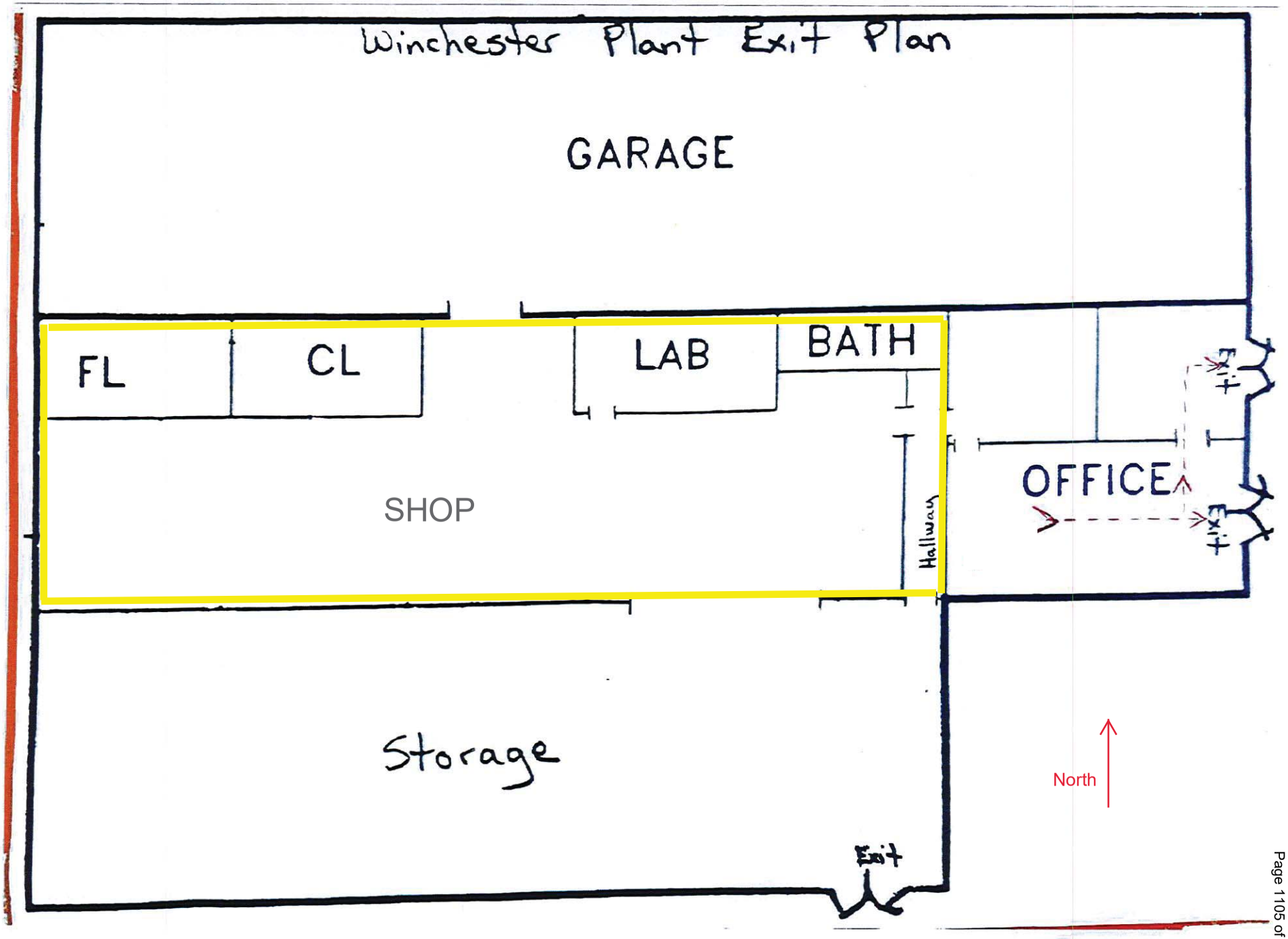
Sample Location	*Sample Description*	*Sample ID No.*	*Lab ID No.*	*Asbestos Content*	** Homo-geneous Area #*	*Friable/ Nonfriable*
Building Interior, Cont.						
Office 4 wall at northwest corner	Drywall board, joint compound, and tape, composite	RPI-338	17WB-28724	None detected	7 & 8	Nonfriable
Above FL room and shop	Vermiculite Insulation	RPI-339	161721596-0001	Actinolite	9	Friable
The following samples were collected from the Building Exterior						
Front of building	White caulk	RPI-340	17WB-28726	None detected	10	Nonfriable
Rear of building	White caulk	RPI-341	17WB-28727	8% chrysotile	10	Nonfriable

**** Homogeneous area number descriptions (bold type indicates asbestos-containing material)***

1 - Rockwool
2 - 2'x4' Suspended ceiling tile with fancy face
3 - 2'x4' Suspended ceiling tile with holes
4 - Cementitious Wall Panel
5 - Texture on drywall
6 - Yellow carpet adhesive
7 - Drywall joint compound and tape
8 - Drywall board
7 & 8 - Drywall board, joint compound, and tape, composite
9 - Vermiculite Insulation
10 - White caulk

Attachment 3
FLOOR PLANS (SAMPLES AND WALL PANELS)


Winchester Plant Exit Plan
GARAGE
336
337
338
329
330
321
339
FL
320
CL
326
LAB
BATH
322
323
324
1
4
325
331
325
OFFICE
SHOP
2
332
Exit
Hallway
327
3
340
341
333
334
335
Storage
Exit
North



Indicates location of asbestos-containing cementitious wall panels

Attachment 4
ANALYTICAL LABORATORY NVLAP ACCREDITATION CERTIFICATE

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200718-0

Pinnacle Environmental Consultants, Inc.

Hurricane, WV

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Asbestos Fiber Analysis

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2017-07-01 through 2018-06-30

Effective Dates

DEPARTMENT OF COMMERCE * UNITED STATES OF AMERICA *

For the National Voluntary Laboratory Accreditation Program

NVLAP® National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Pinnacle Environmental Consultants, Inc.
500B Prestige Park
Hurricane, WV 25526-8420
Ms. Miranda Reedy
Phone: 304-757-5204 Fax: 304-757-5205
Email: mreedy@pinnacleinc.biz
http://www.pinnacleinc.biz

ASBESTOS FIBER ANALYSIS

NVLAP LAB CODE 200718-0

Bulk Asbestos Analysis

Code	*Description*
18/A01	EPA -- Appendix E to Subpart E of Part 763 -- Interim Method of the Determination of Asbestos in Bulk Insulation Samples
18/A03	EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials

For the National Voluntary Laboratory Accreditation Program

Effective 2017-07-01 through 2018-06-30

Attachment 5
LABORATORY REPORTS AND SAMPLE CHAIN-OF-CUSTODIES

Asbestos Identification by Polarized Light Microscopy

Analysis Report

NVLAP LAB CODE: 200718-0

WV License #: LT000552

VA License #: 333 000241

Attn: Chris Belcher
Pinnacle Environmental Consultants, Inc.
486 Old State Route 74
Cincinnati, OH 45244

PINNACLE
500-B Prestige Park
Hurricane, West Virginia 25526
Phone: 304-757-5204
Fax: 304-757-5205

Received Date: 11/6/2017
Analysis Date: 11/8/2017
RE:

PEC Project #: 17-0352
Client Project/PO #:

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28706	RPI-320		Tan

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 2% Fiber Glass: 90% Others: 0% Filler/Binder: 8 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28707	RPI-321		Tan

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 0% Fiber Glass: 90% Others: 0% Filler/Binder: 10 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28708	RPI-322		Brown/White

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 90% Fiber Glass: 0% Others: 0% Filler/Binder: 10 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28709	RPI-323		Brown/White

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 90% Fiber Glass: 0% Others: 0% Filler/Binder: 10 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28710	RPI-324		Beige/White

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 20% Fiber Glass: 4% Others: 0% Filler/Binder: 76 %

RE:

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28711	RPI-325		Beige/White

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 20% Fiber Glass: 4% Others: 0% Filler/Binder: 76 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28712	RPI-326		Gray

Texture/Description: SolidSolid/
TOTAL ASBESTOS: 22 %
Chrysotile: 22% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 0% Fiber Glass: 0% Others: 0% Filler/Binder: 78 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28713	RPI-327	STOP ANALYSIS	

Texture/Description: /
TOTAL ASBESTOS:
Chrysotile: Tremolite: Anthophyllite:
Amosite: Actinolite: Crocidolite:
Cellulose: Fiber Glass: Others: Filler/Binder:

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28714	RPI-328		White

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 3% Fiber Glass: 0% Others: 0% Filler/Binder: 97 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28715	RPI-329		White

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 0% Fiber Glass: 0% Others: 0% Filler/Binder: 100%

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28716	RPI-330		White/Cream

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 2% Fiber Glass: 0% Others: 0% Filler/Binder: 98 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28717	RPI-331		Tan

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 10% Fiber Glass: 0% Others: 10% Filler/Binder: 80 %

RE:

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28718	RPI-332		Tan

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 2% Fiber Glass: 0% Others: 5% Filler/Binder: 93 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28719	RPI-333		White

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 2% Fiber Glass: 0% Others: 0% Filler/Binder: 98 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28720	RPI-334		White

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 3% Fiber Glass: 2% Others: 0% Filler/Binder: 95 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28721	RPI-335		White

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 5% Fiber Glass: 0% Others: 0% Filler/Binder: 95 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28722	RPI-336		White

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 4% Fiber Glass: 8% Others: 0% Filler/Binder: 88 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28723	RPI-337		White

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 3% Fiber Glass: 0% Others: 0% Filler/Binder: 97 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28724	RPI-338		Gray

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 3% Fiber Glass: 2% Others: 0% Filler/Binder: 95 %

RE:

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28725	RPI-339	VOID	

Texture/Description: /
TOTAL ASBESTOS:
Chrysotile: Tremolite: Anthophyllite:
Amosite: Actinolite: Crocidolite:
Cellulose: Fiber Glass: Others: Filler/Binder:

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28726	RPI-340		Cream

Texture/Description: Solid/
TOTAL ASBESTOS: 0 %
Chrysotile: 0% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 2% Fiber Glass: 0% Others: 0% Filler/Binder: 98 %

PEC LAB #:	CLIENT ID #:	LOCATION:	COLOR:
17WB-28727	RPI-341		Cream/Gray

Texture/Description: Solid/
TOTAL ASBESTOS: 8 %
Chrysotile: 8% Tremolite: 0% Anthophyllite: 0%
Amosite: 0% Actinolite: 0% Crocidolite: 0%
Cellulose: 0% Fiber Glass: 0% Others: 0% Filler/Binder: 92 %

Analytical Method: Polarized light microscopy using dispersion staining (EPA-600/M4-82-020). PLM should not be used to demonstrate the absence of asbestos in floor tiles. All samples will be held for sixty (60) days unless otherwise requested. This report relates only to items tested and makes no statement as to the contents of surrounding materials. Multi-layered material which have distinct and separable layers shall be reported separately. This report shall not be reproduced, except in full, without written permission. The results of this report should not be used as an endorsement for NVLAP or any other government agency.

Analyzed by: _____
Jamell Hart

Chain of Custody Form

PINNACLE ENVIRONMENTAL CONSULTANTS, INC.

400D Prestige Park, Hurricane, WV 25526 P: (304) 757-5204 F: (304) 757-5205

486 Old State Rt 74, Cincinnati, OH 45244 P: (513) 533-1823 F: (513) 533-1859

REQUEST FOR ANALYTICAL LABORATORY SERVICES

DATE RESULTS REQUESTED: 11-8-17

RUSH CHARGES AUTHORIZED: ☐ YES ☑ NO

REPORT RESULTS TO	SEND INVOICE TO
NAME: Mike Strine	NAME: Accounts Payable
COMPANY: Pinnacle Environmental Consultants, Inc.	COMPANY: Pinnacle Environmental Consultants, Inc.
ADDRESS: 486 Old State Route 74	ADDRESS: 486 Old State Route 74
CITY, STATE, ZIP: Cincinnati, OH 45244	CITY, STATE, ZIP: Cincinnati, OH 45244
TELEPHONE: (513) 533-1823 FAX: (513) 533-1859	PURCHASE ORDER #:
EMAIL: mstriner@pinnacleinc.biz	CLIENT JOB #: 17-0352

*Point Counts performed per client request

DATE SAMPLED	CLIENT SAMPLE IDENTIFICATION	AIR VOLUME (LITERS) IF APPLICABLE	TIME SAMPLED	PLM*	PCM	TEM	OTHER	LABORATORY USE ONLY
11-2-17	RPI-320 To RPI-341	~~NO Sample #~~	339 Day	✓				17WB-28706
	On Following Samples Stop Analysis on 1st Greater Flow 1%							
	(320 & 321) (322 & 323) (324 & 325)							
	(326 & 327) (328 To 330) (331 & 332)							
	(333 To 338) (340 & 341)							
								17WB-28727

RE:

CHAIN OF CUSTODY		DATE/TIME	
	COLLECTED BY: Rick Perkins (print)	11-3-17	Collector's Signature: Rick Perkins
	RELINQUISHED BY: Rick Perkins		RECEIVED BY:
	RELINQUISHED BY:		RECEIVED BY:
	RECEIVED AT LAB BY: Chelsea Wolf	11-6-17	Sample Condition Upon Reciept: ☑ Accept ☐ Deny

ANALYZE TO THE POSITIVE? ☐ YES ☑ NO

* Samples will be held for thirty (30) days after analysis date, unless otherwise requested by the client*

WVPEC-10/Revision 06

February 27, 2012

EMSL Analytical, Inc.
6340 CastlePlace Dr., Indianapolis, IN 46250
Phone/Fax: (317) 803-2997 / (317) 803-3047
http://www.EMSL.com indianapolislab@emsl.com

EMSL Order: 161721596
CustomerID: PINN52
CustomerPO: OH17-192
ProjectID:

Attn: **Mike Strine**
Pinnacle Environmental
486 Old State Route 74
Cincinnati, OH 45244

Phone: (513) 533-1823
Fax: (513) 533-1859
Received: 11/13/17 10:05 AM
Analysis Date: 11/16/2017
Collected:

Project: **17-0352**

Test Report:Qualitative Asbestos Analysis by Transmission Electron Microscopy (TEM) and Filtration Technique

Sample	Description	TEM Result	Notes
RPI-339 *161721596-0001*	Above ceiling system - granular insulation	**Actinolite**	

Analyst(s)

Melissa Newkirk (1)

Richard Harding, Laboratory Manager
or other approved signatory

Initial report from 11/16/2017 10:50:19

Attachment 6
INVENTORY OF ASBESTOS-CONTAINING MATERIAL TABLE

INVENTORY OF ASBESTOS-CONTAINING MATERIAL TABLE
870 W. STATE ROAD 32
WINCHESTER, INDIANA

Material Location	Material Description	* Homo-geneous Area #	Type ACM	Estimated Quantity*	Category-Friable/ Nonfriable
Shop walls (Shop side only) (North, South,and West walls)	Cementitous Wall Panels	4	Misc.	1,610 sf	II-Nonfriable
Shop walls (Shop side only) (East wall - Top 4' only)	Cementitous Wall Panels	4	Misc.	100 sf	II-Nonfriable
A floor plan is included in Attachment 3 which indicates the locations of the asbestos-containing cementitious wall panels					
Above metal ceilings in the FL room, CL room, Lab, Restrooms and Shop	Vermiculite insulation mixed with Rockwool insulation	9	Misc.	1,400 sf	RACM-Friable
Exterior around perimeter where metal panels meet brick and/or windows	White caulk	10	Misc.	300 lf	I-Nonfriable

NOTES:
lf = linear feet
sf = square feet
Misc. = Miscellaneous

EPA Categories
RACM - Regulated Asbestos-Containing Materials (Friable)
Category I Nonfriable - resilient flooring, roofing products, gaskets, packings
Category II Nonfriable - all other nonfriable asbestos-containing materials

Attachment 7

Asbestos Abatement Plan -

Pinnacle Environmental Consultants

CONTENTS

PART 1

SPECIAL CONDITIONS

I. All references to the Owner in this Work Plan shall be interpreted as Indiana American Water and their designated representatives.

II. The Contractor shall secure, pay for and maintain in full force and effect until no longer necessary, all licenses, regulatory notifications and fees, permits and permissions required by Federal and State law, city ordinance, statute, or regulations and any rules or regulations of any service company that may assert control of any operation under this Contract.

III. Asbestos abatement activities and selected demolition activities shall be in full accord with this Work Plan on file at the office of the Consultant at 486 Old State Route 74, Cincinnati, Ohio 45244, or the office of the Owner, located at 153 north Emerson Avenue, Greenwood, Indiana 46143.

IV. The Contractor shall maintain a temporary office on-site which he or his authorized agent shall man each workday. Copies of permits, specifications and work plan marked up to date with all revisions and required regulations shall be kept in said office ready for use at all times.

V. The Contractor is responsible for security of the abatement project area from the point of initial site mobilization until time of demobilization. The Contractor shall limit entry into regulated work areas to his personnel, the Environmental Project Manager's representatives, authorized Owner's representatives and Governmental regulatory agency personnel legally entitled to inspect the project.

VI. All of the Contractor's employee's shall abide by Federal, State, and local laws while on the premises. All of the Contractor's employees are restricted to those areas of the building and property directly included in the project. Entry to all other areas is prohibited. Any employee whose conduct is judged unfit by the Owner or Environmental Project Manager shall not be permitted to work on this project.

VII. Should the Owner and/or Environmental Project Manager find repeated occurrences of non-conformance with the Work Plan by the Contractor, official reprimands shall be issued. For the first offense, the Contractor shall be warned verbally. The second offense shall result in a written warning to the site supervisor, Contractor's home office and corporate office. A third repeated offense shall result in a written recommendation for dismissal to the Owner. The Owner shall make the final decision as to whether dismissal is warranted.

VIII. Complete waste disposal documentation must be submitted to the Environmental Project Manager after landfill receipt. Documentation must show date/time waste left job site to date/time waste was disposed of at the landfill identified on the EPA notification. Any layovers between leaving the job site (i.e., stored on the Contractor's property, etc.) and disposal date must be documented as well.

IX. If the Contractor uses leased or rented vehicles to transport asbestos-containing waste from the job site, a signed statement from the lease/rental company must be submitted to the Owner and/or Environmental Project Manager stating that the company is aware that their vehicle is being used to transport asbestos-containing waste. All carriers transporting asbestos-containing waste shall be lined with two layers of 6-mil poly. All workers involved in asbestos load-out activities shall wear NIOSH approved half-face air-purifying respirators equipped with P100 filters and protective clothing.

X. Should the Contractor fail to meet the final clearance air sample criteria via PCM and/or TEM in accordance with this Work Plan, all costs resulting from additional testing and inspections shall be borne by the Contractor.

XI. If, in the Contractor's opinion, any work is indicated or is specified in such manner as will make it impossible to produce first-class work, or should discrepancies appear between the Contract Documents and actual field conditions, Contractor shall refer same to the Environmental Project Manager for interpretation before proceeding with work. If Contractor fails to make such reference, no excuse shall be entertained for failure to carry out work in a satisfactory manner. Should conditions arise during the progress of the work which were not foreseen by the Contractor or included in the Contract Documents, the Environmental Project Manager shall be notified at once.

XII. The role of the Environmental Project Manager for this project may include any of the following: 1) inspect the integrity of each work prior removal activities; 2) conduct site inspections and environmental air sampling for verification of regulatory and specification compliance; 3) conduct final visual inspections upon abatement completion to ensure all asbestos-containing materials have been completely removed and the work area adequately decontaminated; and 4) collect final air samples in each work area to determine if final ambient fiber concentrations are equal to or below the specified criteria.

XIII. The Contractor is responsible for submitting a final report to the Consultant, for approval of final payment, within thirty days from the time of final clearance air sampling. The contents of this final report shall contain the following:

- Current fit tests, medicals and training certifications for all workers involved in abatement activities
- Air sampling documentation for duration of project
- Daily competent person and containment logs
- Original waste disposal receipts
- Contractor asbestos hazard abatement license for the State of Indian
- EPA/Indiana Department for Environmental Management (IDEM) Notifications (including all revisions)
- Certificates of Insurance and Worker's Compensation

END OF SPECIAL CONDITIONS

PART 2 - WORK PLAN

SCOPE OF WORK

The Base Bid covers the removal of specified accessible and inaccessible asbestos-containing materials, to include necessary demolition to access any concealed asbestos-containing materials. For bidding purposes, estimated quantities of asbestos-containing materials to be removed and a floor plan with work area locations are provided in Appendix A. All asbestos removal and related work shall be conducted in accordance with all applicable laws, regulations and this Work Plan and drawings. The Contractor shall be responsible all demolition work necessary to access all asbestos-containing materials to be removed from this building.

CONTRACTOR RESPONSIBILITIES

The Contractor is responsible for maintaining and restoring any auxiliary areas used during abatement and demolition activities to a condition equal to or better than original. Any damages to auxiliary and support areas caused during the performance of abatement and demolition activities shall be repaired by the Contractor at no additional expense to the Owner. The Contractor shall be held liable for injuries and/or damages that result from violation of this Work Plan.

INSURANCE REQUIREMENTS

The Contractor shall secure asbestos liability insurance with combined single limit coverage in the minimum amount of two million dollars ($2,000,000). The Contractor shall not commence work until insurance requirements have been obtained with certificates being filed to evidence such coverages. Copies of the actual policy shall be provided to the Owner upon request.

PATENT INDEMNIFICATION

The Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of work or the incorporation in the work of any invention, design, process, product or device which is the subject of patent rights held by others. The Contractor shall indemnify and hold harmless the Owner and Consultant and anyone directly or indirectly employed by them from and against all claims, damages, losses and expenses, including attorneys' fees and court and arbitration costs, arising out of any infringement of patent rights incident to the use in performance of the work of any invention, design, process, product or device specified or not specified in the contract documents, and shall defend all such claims in connection with any alleged infringement of such rights.

SUBMITTALS AND NOTIFICATIONS

The following documents shall be submitted to the Environmental Project Manager prior to the pre-construction meeting.

- Submit to the Environmental Project Manager a detailed construction schedule indicating manpower allocation per phase of Work (i.e., mobilization, demolition, preparation, gross removal, decontamination, tear down and demobilization) to achieve Substantial Completion.

- Submit a detailed work plan specifying means and methods to be used for the abatement project, diagram of the work area, respiratory protection and exposure monitoring methods.

- Submit the name of the supervisor qualified to carry out the functions of competent person per 29 CFR 1926.1101 along with resume showing a minimum of two years experience supervising asbestos hazard abatement projects. Submit documentation demonstrating Indiana Department for Environmental Management certification and satisfactory completion of an EPA approved Contractor/Supervisor Asbestos Abatement Practices training course. The original Contractor/Supervisor training certificate along with a valid refresher certificate shall be required for all competent persons supervising this Project.

- All asbestos abatement workers on this project must have completed an EPA approved Asbestos Worker training course and shall provide the original and valid refresher (if applicable) training certificates and IDEM certification before engaging in any abatement activity (i.e., work area preparation, removal, or decontamination).

- Submit medical examinations and fit test for all workers involved in asbestos abatement activities per 29 CFR 1926.1101 and 29 CFR 1910.134.

- Submit written Compliance program in accordance with OSHA 29 CFR 1926.62.

- Submit MSDS for all encapsulants, amended water solutions, solvents, spray glue or any other material used on this project. MSDS shall be required for all materials delivered on-site by the Contractor.

- Submit written fire protection program for this Project in accordance with 29 CFR 1926.150.

- Submit Certificates of Insurance.

Supply written notification of proposed asbestos work with copies to the Consultant, Indiana Department for Environmental Management at least ten business days prior to commencement of work.

WORK AREA PREPARATION

Prepare all OSHA Class I total containment work areas in the order in which they are presented below:

- Shut down and lock out electric power to the work area where applicable. Provide temporary power and lighting and ensure safe installation of temporary power services and equipment, as specified in applicable electrical code requirements. Provide temporary lighting and ground-fault interrupt circuits as a power source for electrical equipment. All modifications to the building's electrical system shall be performed through coordination with the Owner.

- Shut down and isolate heating, cooling, and ventilating air systems such as, but not limited to, fans, air handlers, and unit ventilators to prevent contamination of the units and fiber disposal to other areas of the structure. Seal all electrical components and equipment tightly to prevent moisture or water damage. During the work, vents within the work area shall be sealed with tape and 6-mil plastic sheeting.

- Sequence of abatement work shall be coordinated with the Owner, in order to assure that the public water supply treatment process is not interrupted.

- The Owner is responsible for removing all movable objects from the work area. The Contractor shall be responsible for the removal and decontamination of any movable equipment that may be contaminated.

- Install HEPA filtered air movement into the work area and vent exhaust ducts through openings to the outside of the building. Seal openings around exhaust ducts. No exhaust from the negative air movement equipment shall be allowed to be released within the buildings.

- Introduce scaffolding, ladders, and other large equipment into the work area and install the worker and equipment decontamination enclosure systems as specified in the following section.

- Seal off all openings (such as, but not limited to, corridors, doorways, windows, skylight, ducts, grilles, diffusers, and any other penetrations of the work area) with 6-mil plastic sheeting sealed with tape

- Construct the worker hygiene facility contiguous to the work area as specified.

- Post warning signs as required per 29 CFR 1926.1101 and 29 CFR 1926.62.

- Pre-clean contaminated movable objects within the work area using HEPA filtered vacuums and wet cleaning methods. Remove the decontaminated furniture from the work area properly dispose.

- Remove carpet from the work areas and dispose of as general construction debris.

- Pre-clean fixed objects within the proposed work area (such as but not limited to shelving, bookcases, hot water heaters, pumps, radiators, unit ventilators, fans, ductwork, and motors) using HEPA filtered vacuums and/or wet cleaning methods as appropriate, and enclose with 4-mil (minimum) plastic sheeting sealed with tape.

- Wet wipe and/or HEPA vacuum off ceiling mounted objects (such as lights, speakers, and other items not previously sealed off) that interfere with asbestos-abatement activities. Items that remain in the work area shall be enclosed with 6-mil plastic sheeting sealed with tape.

- Cover all walls and floor with one layer of 6-mil plastic sheeting and overlap floors sheeting by at least twenty-four (24) inches. Seal all joints with tape and/or spray adhesive.

Prepare all OSHA Class II Regulated work areas in the order in which they are presented below:

- Shut down and lock out electric power to the work area where applicable. Provide temporary power and lighting and ensure safe installation of temporary power services and equipment, as specified in applicable electrical code requirements. Provide temporary lighting and ground-fault interrupt circuits as a power source for electrical equipment. All modifications to the building's electrical system shall be performed through coordination with the Owner.

- Shut down and isolate heating, cooling, and ventilating air systems such as, but not limited to, fans, air handlers, and unit ventilators to prevent contamination of the units and fiber dispersal to other areas of the building.

- The Owner is responsible for removing all movable objects from the work area. The Contractor shall be responsible for the removal and decontamination of any movable equipment that may be contaminated.

- Pre-clean contaminated movable objects within the work area using HEPA filtered vacuums and wet cleaning methods. Remove the decontaminated furniture from the work area and properly dispose.

- Pre-clean fixed objects within the proposed work area (such as but not limited to shelving, bookcases, hot water heaters, pumps, radiators, unit ventilators, fans, ductwork, and motors) using HEPA filtered vacuums and/or wet cleaning methods as appropriate.

- Construct the worker hygiene facility contiguous to the work area as specified in the following section. A remote hygiene facility may be utilized for use during the window treatment and privacy curtain track removal operations.

- Post warning signs as required per 29 CFR 1926.1101 and 29 CFR 1926.62.

- Install one layer of 6-mil plastic on all floors as a drop cloth during all track removal work.

DECONTAMINATION UNIT

Construct a worker decontamination enclosure system contiguous to total and/or regulated work areas that consists of three totally enclosed chambers as follows:

- An equipment room with adequate storage facilities.

- A shower room with one shower head for every ten workers or fraction thereof as required by 29 CFR 1910.141 (d) (3). Careful attention shall be paid to the shower enclosure to ensure against leaking of any kind. Ensure soap is available at all times in the shower room. The shower waste water shall be drained, collected, and filtered through a system with at least five to ten micron particle size collection capability. (**NOTE:** A system containing a series of several filters with progressively smaller pore sizes is recommended to avoid rapid clogging of filtration system by large particles.) All expended filters shall be discarded as contaminated waste. Filtered water may be discharged to a sanitary or storm sewer drain.

- A clean room with one entrance or exit to uncontaminated areas of the building. The clean room shall have sufficient space for storage of workers' street clothes, towels, and other uncontaminated items. **NOTE:** Use black or opaque plastic for the walls of the worker decontamination enclosure system to ensure the privacy of the workers.

PERSONAL PROTECTIVE EQUIPMENT

The Contractor shall provide workers with sufficient sets of disposable full body protective clothing. A new set of disposable clothing must be used daily or as otherwise needed. Eye protection and hard hats shall be furnished as required by applicable safety regulations. Non-disposable type protective clothing, if worn, shall be left in the equipment room until the end of the asbestos abatement work, at which time such items shall be disposed of as asbestos waste or decontaminated and stored in plastic bags for removal from the

project site. Protective clothing shall be furnished for all authorized employees, representatives of the Owner, or regulatory agency personnel as needed.

The Contractor shall provide workers with personally issued and marked respiratory equipment approved by NIOSH and suitable for the asbestos exposure levels in the work area according to OSHA 29 CFR 1926.1101. PAPR and type C, supplied air systems should be used when exposure levels warrant it, as required by the regulations.

At a minimum, all workers shall wear tight fitting powered air-purifying respirators (PAPR) equipped with P100 filters until a negative exposure assessment has been collected for all Class I work. Workers shall be required to be clean shaven when wearing respirators. The Contractor shall provide sufficient filters for replacement as required by the worker or applicable regulations. All workers must be properly trained and fit tested and a written respiratory protection plan established. Compliance with the OSHA asbestos and respiratory protection standards and ANZI Z88.2 is required.

EXPOSURE AIR MONITORING

All exposure monitoring shall be conducted in accordance with 29 CFR 1926.62 and 1926.1101. At a minimum, the Contractor shall monitor one out of four workers involved in asbestos decontamination activities. A short-term thirty minute excursion sample shall also be collected by the Contractor, during peak exposure times, per activity each day. All sampling pumps shall be calibrated between 0.5 to 2.5 liters/minute - calibration shall be checked daily before and after the sampling period to verify proper flow rates. All air samples collected shall be submitted to the on-site Consultant at the end of each work shift for analyses within twenty-four hours.

ASBESTOS REMOVAL METHODS

Prior to removal activities, each work area shall be prepared as specified in this Work Plan.

CEMENTITIOUS PANEL (TRANSITE) REMOVAL

Following preparation of a regulated work area as required for OSHA Class II work, at a minimum, proceed with the following procedures. Wet the cementitious panel with amended water before and during removal. Once the cementitious panel is thoroughly wetted, carefully remove/pull all nails, screws, etc. holding cementitious panel in place and carefully lower cementitious panel to ground, avoiding breakage. Once removed, seal cementitious panels in two layers of 6-mil plastic sheeting. Place the proper labels (DOT, EPA, NESHAPS) on each wrapped section of cementitious panel for disposal. Drop cloths shall be placed under and over any object within fifteen (15) feet of the panels being removed. Materials should be removed with as little breakage as possible to reduce potential fiber release. All wrapped panels

shall be placed into the disposal container (dumpster/truck) prior to the end of abatement activities daily.

VERMICULITE INSULATION

Once the work area has been prepared an OSHA Class I work area proceed with the following procedures. Conduct demolition and removal of existing ceiling systems by cutting and removing small sections the metal ceiling system around the perimeter of the specified work areas. As vermiculite material becomes exposed it shall be sprayed with amended water, using spray equipment capable of providing a mist application.

Saturate the asbestos-containing vermiculite material and continue to spray the material repeatedly during the work process to maintain wet conditions and to minimize airborne asbestos fiber levels. Continue to open and remove the metal ceiling materials and exposed asbestos-containing materials around the perimeter of the work areas and seal and and all penetrations to adjoining areas with 6-mil plastic sheeting as they become exposed and concurrently with removal of the asbestos-containing material. Only after all penetrations have been sealed shall complete removal of the metal ceiling system and asbestos-containing vermiculite be permitted. As the vermiculite material is removed immediately place in appropriate containers for disposal. The material shall not be allowed to dry out prior to insertion into the disposal container. All surfaces within the asbestos abatement work area must be completely clean and free of dust and debris. **NOTES:** 1) The Contractor shall be responsible for the collection and proper disposal of all existing rock wool insultion, vermiculite, and other miscellaneous materials present above the metal ceiling system, as these materials must be considered to be contaminated with asbestos. 2) Pieces of the metal ceiling system may be cleaned and decontaminated for disposal as C&D waste.

ASBESTOS WASTE DISPOSAL

All asbestos-containing waste shall be disposed of at an EPA approved sanitary landfill accepting asbestos waste. All asbestos-containing waste shall be disposed of in double 6-mil poly bags or other suitable impermeable containers (i.e., fiber drums). All bagged waste shall be properly labeled in accordance with OSHA, NESHAP and DOT regulations.

ASBESTOS LOAD-OUT PROCEDURES

All workers involved in load-out procedures shall wear half-face respirators equipped with high efficiency particulate air (HEPA) filters and protective clothing. The container used to haul the hazardous waste shall be lined with two layers of 6-ml poly sheeting. LEASED OR RENTED VEHICLES AND/OR CONTAINERS SHALL NOT BE PERMITTED WITHOUT WRITTEN CONSENT FROM THE OWNER.

ASBESTOS FINAL AIR MONITORING

At the owner's discretion, final air tests may be performed to determine and document air quality upon completion of asbestos hazard abatement activities in each work area. The Environmental Project Manager shall perform the final air tests after the work area has passed the final visual inspection. The samples shall be collected using high-volume electric sampling pumps calibrated at a flow rate up to 10 liters/minute. Final clearance air samples may be collected and analyzed by Phase Contrast Microscopy (PCM) and at the Owner's option, Transmission Electron Microscopy (TEM) as described below:

- Acceptable final clearance concentrations by PCM - PCM samples shall be collected from several locations inside of the work area and in the adjacent equipment and worker decontamination areas. At a minimum, three area samples shall be analyzed by PCM using Method No. 7400. The total airborne fiber concentrations for each sample location collected inside of the work area must not exceed 0.01 fibers per cubic centimeter of air (f/cc). If any air sample concentration in the work area is greater than 0.01 f/cc, the Contractor shall re-clean the work area with HEPA filtered vacuum equipment and damp cloths and mops. A new set of air samples for the entire work area shall be collected and analyzed at the Contractor's expense until the acceptable fiber concentration of 0.01 f/cc for each sample has been achieved.

- Acceptable final clearance structures by TEM - A minimum of five air samples from within the work area shall be collected and analyzed by TEM in accordance with an EPA recommended protocol (40 CFR, Part 763, Appendix A, Mandatory TEM Method). All samples shall be analyzed within 24 hours upon laboratory receipt. The average airborne asbestos concentrations for all samples collected inside of the work area must be less than or equal to 70 structures per square millimeter (70 struct/mm^2). If the average asbestos air sample concentration in the work area is greater than 70 struct/mm^2, the Contractor shall re-clean the work area. A new set of air samples for the entire work area shall be collected and analyzed at the Contractor's expense until the average airborne asbestos concentration of 70 struct/mm^2 for all samples have been achieved.

APPENDIX A

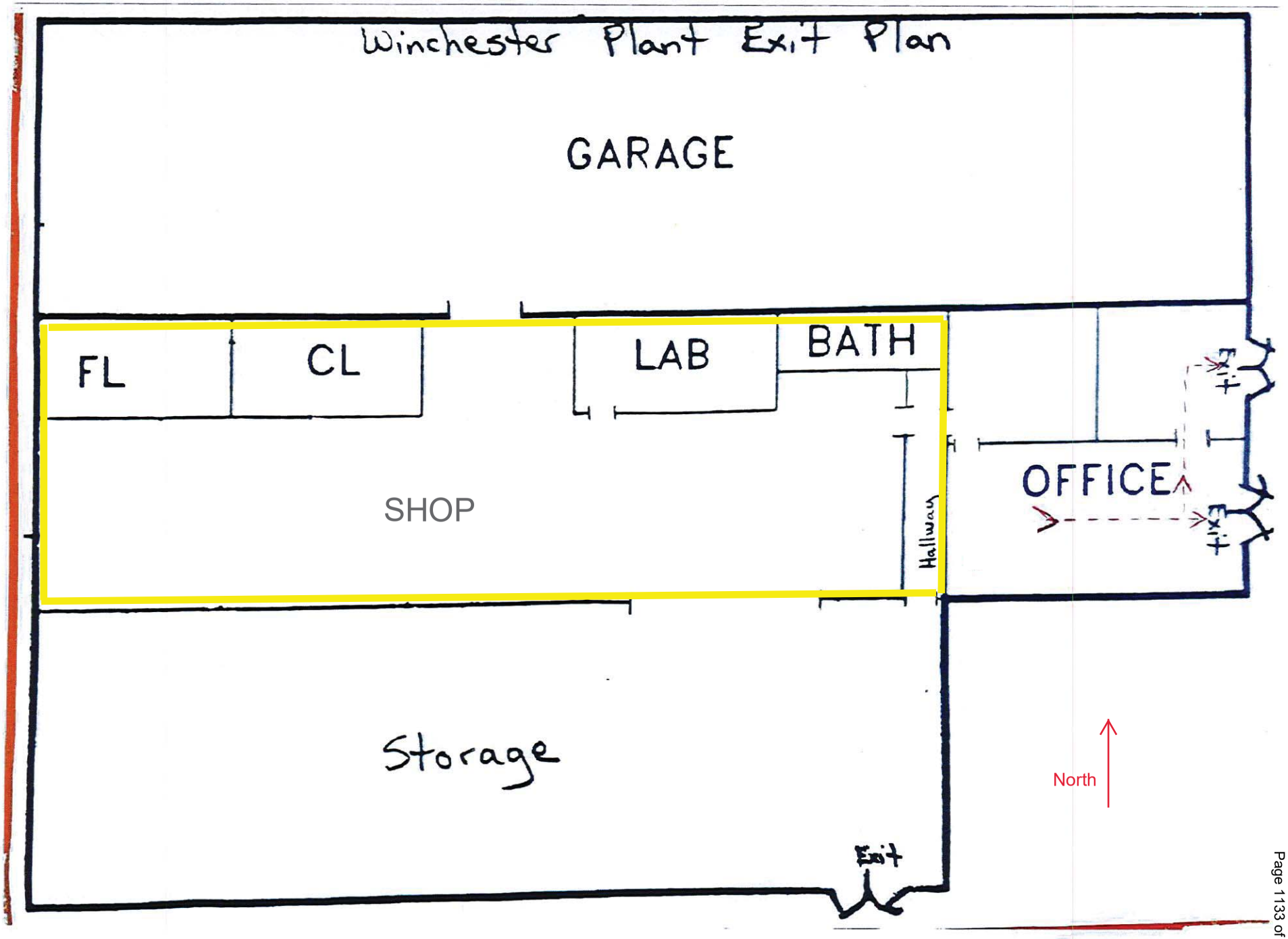
SCOPE OF WORK

ASBESTOS ABATEMENT SCOPE OF WORK TABLE
870 W. STATE ROAD 32
WINCHESTER, INDIANA

Material Location	Material Description	* Homo-geneous Area #	Type ACM	Estimated Quantity*	Category-Friable/ Nonfriable
Shop walls (Shop side only) (North, South,and West walls)	Cementitous Wall Panels	4	Misc.	1,610 sf	II-Nonfriable
Shop walls (Shop side only) (East wall - Top 4' only)	Cementitous Wall Panels	4	Misc.	100 sf	II-Nonfriable
A floor plan is included in Attachment 3 which indicates the locations of the asbestos-containing cementitious wall panels					
Above metal ceilings in the FL room, CL room, Lab, Restrooms and Shop	Vermiculite insulation mixed with Rockwool insulation	9	Misc.	1,400 sf	RACM-Friable

NOTES:
lf = linear feet
sf = square feet
Misc. = Miscellaneous

EPA Categories
RACM - Regulated Asbestos-Containing Materials (Friable)
Category I Nonfriable - resilient flooring, roofing products, gaskets, packings
Category II Nonfriable - all other nonfriable asbestos-containing materials


Winchester Plant Exit Plan
GARAGE
FL
CL
LAB
BATH
SHOP
Hallway
OFFICE
Exit
Exit
Storage
Exit
North
Indicates location of asbestos-containing cementitious wall panels

JPD # 18-48-0314

ASBESTOS WASTE SHIPMENT/DISPOSAL RECORD

instructions on other side

GENERATOR

1. REMOVAL PROJECT LOCATION
Name: *INAW Winchseter Plant*
Mailing Address: *870 West State Road 32*
Winchester, IN 47394
Location:

2. OWNER
Name: *INAW Winchester Plant*
Mailing Address: *870 West State Road 32*
Winchester, IN 47394
Phone: *317-891-1136*

3. OPERATOR/CONTRACTOR
Name: *National Environmental Services Corporation*
Mailing Address: *PO Box 300*
Clear Creek, IN 47426
Phone: *812-339-9000*

4. AUTHORIZED AGENT
Name: *Paul Krick*
Phone: 765-620-8086

WASTE

5. WASTE DISPOSAL SITE (WDS)
Name: *Randolph Farms, Inc.*
Address: *7256 W. CR 600 South*
Location: *Modoc, Indiana 47358 / Randolph County*
Disposal Site Operator: *Danny Tinsman*
Phone: *765-853-5714*

6. ORIGIN OF WASTE
County: Randolph
State: Indiana

7. RESPONSIBLE AGENCY
Name: *Indiana Department Environmental Management, Office of Air Management*
Address: *100 N. Senate Ave. Indianapolis, IN*
Phone: *317-233-3861*

8. DESCRIPTION: R.Q. NA2212, Asbestos

SHIPPING NAME: R.Q. NA2212, Asbestos, 9, PGIII

9. CONTAINERS
Number(s): 1
Type: BAGS

10. TOTAL QUANTITY
Cu ft., Cu Yds., lbs., Tons
38

11. SPECIAL HANDLING INSTRUCTIONS AND ADDITIONAL INFORMATIOI

EMERGENCY RESPONSE PHONE NUMBER: *IDEM - EMERGENCY RESPONSE (317) 233-3656*

12. OPERATOR'S CERTIFICATION

I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked and labeled, and are in all respects in proper condition for transportation by highway according to applicable international and government regulations.

Fausto Lopez | Supervisor | Fausto Lopez | 8-15-18
Name (printed or typed) | Title | Signature | (MM/DD/YY)

13. TRANSPORTERS

(acknowledgement of receipt)

TRANSPORTER #1
Name: *Best Way Disposal*
Mailing Address: *7256 W. CR 600 South*
Modoc, IN 47358
Phone: *765-853-5714*

Chris Haney | Title | Date
Name (printed or typed)

Transporter #1 Signature

TRANSPORTER #2
Name:
Mailing Address:
Phone:

Name (printed or typed) | Title | Date

Transporter #2 Signature

WASTE DISPOSAL SITE

14. DISCREPANCY INDICATION SPACE:

572900
48,600
4.05 32

15. CERTIFICAITON OF RECEIPT

I hereby certify that the above maned material has been accepted and that to the best of my knowledge the foregoing is true except as noted above.

Name (printed or typed) | BOOZE Title | Signature | 16 Aug 18 (MM/DD/YY)

Laboratory Services
304 S. State Avenue ▲ Indianapolis, Indiana 46201
317/756-9320 ▲ FAX: 317/756-9324

August 14, 2018

CLIENT Project: 18-60-0314
Winchester Water
ACT Project No.: 180002

National
PO Box 300
Clear Creek, IN 47426

Air Sample Analysis Report

PHASE CONTRAST MICROSCOPY (PCM)

Performed by NIOSH 7400 Issue 2 Method (1994)

Lab I.D. Number	Client Sample Number	Client Sample Date	Total Time (min)	Sample Volume (liters)	Detection Limit (fibers/cc)	Concentration			
						Fibers/mm2	Fibers/cc	8-Hour TWA	Comments
A184267	03-14-01	8/14/18	120	1200	0.0022	<7	< **0.0022**	< 0.001	**RUSH**
A184268	03-14-02	8/14/18	120	1200	0.0022	<7	< **0.0022**	< 0.001	**RUSH**

Reviewed By: Nikki Brown
Nikki L. Brown
Laboratory Technical Manager

ACT Batch No. **18A0883**
Date Sample(s) Received: 8/14/2018
Date Sample(s) Analyzed: 8/14/2018

Total Number of Pages: 1 of 1

▲ < Denotes: Below Analytical Sensitivity of 7 fibers/sq.mm
▲ ALL ACT performed calculations are based on information provided by the client. Results only relate to samples as received.
▲ If blank samples were identified, they were analyzed in accordance with NIOSH 7400.
▲ Samples and slides are stored 3 months prior to disposal unless notificed by client.
▲ Samples were received in acceptable condition, unless noted in the comments in the above table.
▲ 2017 Inter-laboratory relative standard deviation is 0.406=5-20 f/mm2; 0.546=20-50 f/mm2; 0.297 = 50-100; and 0.280=100+ f/mm2.
▲ 2017 Intra-laboratory relative standard deviation is 0.506 =5-20 f/field 0.450=20-50 f/field; 0.325=50-100 f/field; and 0.310=100+ f/field
▲ This information is for the sole use of the intended recipient(s) and may contain confidential and privileged information. Any unauthorized review, use, disclose, printing, or distribution is prohibited. If you are not the intended recipient, please promptly destroy these documents and notify the sender.

NATIONAL ENVIRONMENTAL SERVICES CORPORATION

AIR SAMPLING DATA

ACT Batch No.: 18A0883

TAT: RUSH

Network: National

ACT Project No.: 180002

CONTRACT NAME: Winchester Water

Comments/Contact Info:

LOCATION OF PROJECT: Winchester Water

CO. JOB NO.: 18-60-0314

DATE: 8/14/18 COLLECTED BY: Fausto Lopez

- INSTRUCTIONS TO LAB -
PLEASE ANALYZE USING NIOSH 7400
METHOD UNLESS SPECIFIED OTHERWISE

OTHER:

SEND WRITTEN REPORT TO NESC

6755 S. Old State Rd 37

Bloomington, IN

ATTN: Fausto Lopez 812-327-3074

1	2	3	4	5	6	7	8	9	10	11	12
Sample I.D. Code	Pump I.D. Nos.	Sample Description Type/Location/Activity If Personal - Need Name	Sampling Period			Pump Flow Rates l/m			Sample Volume	Lab Results	
			Start	Stop	Total Min.	Start	Stop	Avg.	Total X Air Flow		
03-14 01	197573	Final Clearance	AM 11:38	PM 1:38	120	10	10	10	1,200	A 184267	
03-14 02	201305	Final Clearance	AM 11:39	PM 1:39	120	10	10	10	1,200		
										A 184268	

COMMENTS: Average flow rate is sum of start and stop flow rates divided by 2.
"Fibers per field" should be entered by Lab as follows: for 5 fibers per 100 fields - 5/100
for 100 fibers per 50 fields - 100/50
The space below should be used for additional comments and 8 hr. TWA determinations.

RZ 8-14-18

l/m - means liters per minute

WHITE COPY - COMPANY OFFICE
YELLOW COPY - LABORATORY

A: ZP Analyzed By Q1: ZP 1st QC By Q2: CM 2nd QC By

Fausto.lopez@nesccorp.com

NATIONAL
Environmental Services Corporation

FINAL VISUAL CLEARANCE INSPECTION

Project Number: 18-60-0314

Project Name: Winchester Water

Description of project location & amount of ACM removed:

Remove insulation from ATTIC and transite From Walls

Quantity Removed SF: _____

Quantity Removed LF: _____

As an accredited supervisor, I certify that I have conducted the above final visual clearance inspection and no visible debris was noted.

Supervisor Name: Allan Gradiz

Accreditation Number & State: 19A010194 IN

Date: 8-14-2018

INDIANA AMERICAN WATER
Winchester WTF Improvements Design Build Project

PRE-PROPOSAL MEETING MINUTES
February 21, 2023, at 9 a.m.

I. Attendees:

1. Dante Alday – American Water Works Service Co. (AWWSC)
2. Dillon Waterman – AWWSC
3. Brain Van Nortwick – AWWSC (Teams)
4. Jared Burnett – INAW
5. Roy Francis – INAW
6. Richard Miller – INAW (Teams)
7. Ellen Kohl – INAW
8. Kevin Conley – INAW
9. Jim Henderson – INAW
10. Darrin James – INAW
11. Clayton McKee – INAW
12. Darrin Duncan – INAW (Teams)
13. Ezat Nayeri – INAW (Teams)
14. Shawn Cresap – AW (Teams)
15. Pat Sullivan – AW (Teams)
16. Eric Dykema – AW (Teams)
17. Justin Rich – INAW (Teams)
18. Robert Lambert – INAW (Teams)
19. Darren Lowe – Bowen
20. Brian Stater – Bowen
21. Rob Morton – Bowen
22. Devin Baker – Reynolds
23. Adam Ralph – Reynolds
24. Jeff Macomber – Hazen
25. Jamie Shambaugh – Gannett

II. Introductions:

- Owner is Indiana American Water (INAW). Ellen Kohl is the Project Manager.
- Owner's Consultant is American Water Works Service Company (AWWSC) and represented by Dante Alday (Eng Manager), Brian Van Northwick (Const. Engr), and Dillon Waterman (Design Lead)

III. Agenda Items:

- Proposals in PDF format will be submitted via American Water Coupa e-procurement system on March 21, 2023, at 2:00 pm.

- Only questions answered by formal written addenda will be binding. All questions must be submitted in Coupa by March 15. Questions submitted after March 15 may not be answered.

- Technical Proposal shall include all 21 Items in Section ISP with each item getting its own "chapter" in proposal. Must be numbered and or tabbed according to list in ISP.

- Technical Exhibits may include alternatives and/or deviations from the Conceptual Documents provided that such alternatives and/or deviations are in separate written documentation to be submitted with the Proposal.

- Owner does not have easement documents in hand for the pipelines. DB is responsible to perform title search and if needed assist in obtaining necessary easements for the project.

- Proposal Security Bonds are not required.

- Dates for Substantial Completion and Final Completion are April 30, 2025, and June 15, 2025, respectively.

- This project is exempt from Indiana Sales Tax.

- Proposer shall supplement its Statement of Qualification by furnishing the names and relevant information regarding proposed additions or changes to the design-build team.

- Proposers must submit evidence of qualification to do business in Indiana

- Proposals are evaluated according to the following criteria:
  Technical Submission – 30%
  Commercial -25%
  Schedule of Work Plan – 20%
  Qualifications and Experience -15%
  Resources – 10%

- Proposals shall remain subject to acceptance for 60 days. If the contract is awarded, Owner will give Successful Proposer a Notice of Award within 60 days after the day of the Proposal opening.

- Owner does not intend to participate in partnering process.

- Identify design sub-consultants.

- Owner's pre-approved system integrators are:
  - Maxim
  - Langetech
  - G.E. Booth
  - Flexware Innovation

- Identify Electrician to be used. Do not pre-select Electrician. Labor rates shall include hourly rates for electricians.

- Furnish list of suppliers and subcontractors identified and certified as Minority, Woman, Services-Disabled Veteran Business Enterprises must be provided per ISP Paragraph 4.

- Furnish construction cost estimate per Paragraph 8. The construction estimate is for informational purposes and not to determine low bidder for purpose of awarding the contract.

Construction cost estimate shall be broken down by major work item organized by CSI 50-division format.

- Owner does not want Goulds pumps.
- Owner to provide updated List of Approved manufacturers with Addendum.
- Furnish a Cash Flow Schedule estimate per ISP Paragraph 9
- AW will perform design reviews.
- Design-Builder to use current version of AutoCAD and use the AW Drawing Standards.
- Provide one (1) day inspection of the facilities approximately 12 months after they are placed into operation. Provide written report summarizing warranty repairs that are necessary, as well as any operational modifications that are recommended to optimize performance.
- Design-Builder will obtain all required permits. Owner will pay and provide necessary assistance.
- Design-Builder to provide monthly jobsite safety audit during construction.
- Cash allowances in Section 01 29 00 include material testing, RPR equipment and supplies, and background checks.
- Kevin Conley will be the Resident Project Representative (RPR).
- Allowance for material cost escalation will be included in the Target Cost.
- Submittals include the completed Asset Inventory Spreadsheet and Consolidated Summary of Major Component Service Life.
- Design-Builder to use the AW Standard Pipeline Specifications, a copy was provided in the RFP.
- Dillon Waterman reviewed the design concept.
- Owner to clarify required firm capacity of the new water treatment facility.
- Well #4 will be relocated if new treatment building footprint requires.
- Winchester WTF does not recycle. Spent filter backwash will be discharged to the Sanitary Sewer.
- Temporary facilities will include backwash chamber.

IV. The Proposers proceeded and toured the Winchester WTF.

Items discussed during the tour:

- Is SCADA communication via radio or cellular?
  Communication between the Winchester WTF and the Tank in town is via radio.

- Is Well communication wired or via radio antenna?
  Communication is via radio.

- Owner will provide a copy of the Asbestos Inspection Report.

V. The meeting ended at 12:00 p.m.

ATTACHMENT MHH-11 IS CONFIDENTIAL

ATTACHMENT MHH-12 IS CONFIDENTIAL

DETAILED ESTIMATE OF COST

Company: Indiana American Water Company
Winchester District

WIN Plant Improvements
I10-250018

	DATE	Date of Est	Date of Est	Date of Est	Date of Est
	PROJECT STAGE	Project Stage	Project Stage	Project Stage	Project Stage
	TOTAL Project Cost	$25,000,000	$0	$0	$0
	COMPANY FUNDED Project Cost	$25,000,000	$0	$0	$0

Planning Costs		Project Stage	Project Stage	Project Stage	Project Stage
Water Company Labor					
Engineering Planning					
All Other Costs					
Other Costs					
Other Costs					
Planning Costs Sub-Total					

Preliminary Costs		Project Stage	Project Stage	Project Stage	Project Stage
Water Company Labor					
Land and Easement Acquisition					
Preliminary Engineering					
Design, Bidding and Award					
Permit Acquisition					
Other Costs					
Other Costs					
Other Costs					
Water Company Labor Sub-Total					
All Other Costs					
Land and Easement Acquisition					
Preliminary Engineering					
Design Services					
Design-Build Stipend					
Bidding and Award					
Other Costs					
Other Costs					
All Other Costs Sub-Total					
Preliminary Costs Sub-Total					

Implementation Costs		Project Stage	Project Stage	Project Stage	Project Stage
Water Company Labor					
Construction Administration					
Technical Review Services					
Resident Observation					
Other Costs					
Other Costs					
Other Costs					
Water Company Labor Sub-Total					
All Other Costs					
Construction Administration					
Technical Review Services					
Resident Observation					
Design Build Contract					
Construction Estimate					
Other Costs					
Other Costs					
DB Stipend					
JCI - Security					
Other Services (Testing, Permits, etc)					
Small Equipment/Furnishings					
Property Acquisition					
Other Costs					
Other Costs					
Other Costs					
Contingency					
All Other Costs Sub-Total					
Implementation Costs Sub-Total					

Contributions or Advances		Project Stage	Project Stage	Project Stage	Project Stage
Description					
Description					
Description					
Description					
Contributions or Advances Sub-Total					

Cost of Removals		Project Stage	Project Stage	Project Stage	Project Stage
Demo of existing facilities					
Description of Asset or Asset Group					
Description of Asset or Asset Group					
Description of Asset or Asset Group					
Description of Asset or Asset Group					
Cost of Removals Sub-Total					

Overhead and AFUDC Costs (calculated in SAP)		Project Stage	Project Stage	Project Stage	Project Stage
Labor Overhead					
Indirect Capital Overhead					
AFUDC					

INDIANA AMERICAN WATER
SHERIDAN WATER SYSTEM

Project A - 2
Additional Source of Supply

Design and Permitting:	12 months		
Construction:	12-18 months	Project Cost:	$[redacted]

Need for Project:

The existing Sheridan wellfield has a safe yield of 1.15 MGD (Eagon 2008, draft 2021), and a reliable pumping capacity of 1.05 MGD. Base projected maximum day demands for the Sheridan systems is 1.07 MGD, or over 90% of the existing wellfield sustainable yield.

Additionally, well #4 was recommended for replacement due to performance and poor design (Eagon 2008, draft 2021). Well #6 was installed in 2010 (prior to acquisition) approximately 50 feet away, indicating that it may have been intended as a replacement for well #4, and that well #4 was never sealed and abandoned.

Safe yield of the existing wellfield is not reliably achievable with the current well configuration, and additional supply will likely need to be developed away from the existing wellfield in order to meet the projected maximum day demands (Section 3.3.4).

Background:

The Town of Sheridan and surrounding area are anticipated to experience significant residential growth during the planning period, which is expected to more than double the 2021 maximum day demands (**Section 2.6**). Existing supply is provided by three groundwater wells with a combined safe yield of 1.15 MGD that are treated at the Sheridan WTP. The wells are actively treated for iron, but also contain manganese and ammonia. Some manganese is passively removed as a result of the existing treatment process, and the naturally occurring ammonia is used for chloramination. Raw water quality testing conducted in 2018 also indicates total organic carbon levels between 3-4 mg/L.

Recommended Solution:

It is recommended that additional well supply be developed such that the reliable capacity is increased to a minimum of 1.34 MGD[1] in order to meet the projected maximum day demands. New supply is expected to have similar water quality to the existing supply and will need to be treated at the Sheridan WTP. Hydrogeological and geophysical studies from **Project A-1** will be utilized to determine the location and availability of additional source of supply to meet the recommended 1.34 MGD. The development of additional source of supply could be completed simultaneously with **Project A-3**.

Alternate Solutions:

Do Nothing: If nothing is done, there will not be sufficient available supply to meet the projected maximum day demands.

Budget Discussion:

Costs are solely for well drilling and assume that the hydrogeological and geophysical studies are completed as part of **Project A -1**. A breakdown of the cost is provided in **Appendix B**.

Asset and Purpose Codes:

ASSET CODE	PURPOSE CODE
307 - Wells and Springs	Growth/Cap in franchise <3 yrs

[1] At 1.34 MGD, the projected maximum day demands of 1.07 MGD are 80% of the supply reliable capacity.

INDIANA AMERICAN WATER
SHERIDAN WATER SYSTEM

Project A - 3
New Sheridan WTP

Design and Permitting:	12 months		
Construction:	24-36 months	Project Cost:	$ [redacted]

Need for Project:

The Town of Sheridan and surrounding area are anticipated to experience residential growth during the planning period. In 2021, the maximum day demand was 0.41 MGD and is projected to be 1.07 MGD by 2035 under the Base demand scenario. The existing Sheridan Water Treatment Plant has a firm filtration capacity of 0.43 MGD.

Additionally, the WTP requires other improvements to meet American Water (AW) standards and to improve performance. The facility employs chlorine gas for disinfection, which is being removed from all AW facilities for safety reasons. Backwash water for the filters is raw water provided by the High Service pumps, the chemical systems do not meet AW T-2 Standards, and the electrical system is obsolete. The building is also showing significant signs of wear, particularly in and around the chlorine gas room.

Background:

Indiana American Water (INAW) acquired the Sheridan system in January of 2019. The WTP has a rated capacity of 0.65 MGD and employs aeration, chemical oxidation, and filtration for the removal of iron. Supply to the WTP is provided by three wells. Backwash water is discharged into a holding lagoon where iron is settled out, and the supernatant is decanted via an unmetered connection to the wastewater treatment facility, which was acquired by INAW at the same time. Chemical additions include gaseous chlorine for disinfection, zinc orthophosphate for corrosion control, and anionic polymer as a filter aid.

As discussed in **Section 3.3**, the WTP is aging and requires many improvements to continue to provide clean, reliable drinking water. Notably, the WTP uses chlorine gas for disinfection, active treatment for manganese is not provided, the filters use raw water pumped by the high service pumps for backwashing, and the building is showing significant signs of wear. As previously mentioned, the town is also experiencing significant growth, and the WTP does not have enough capacity to meet the forecasted demand. Base scenario projections indicate an average day demand (ADD) of 0.49 MGD and a maximum day demand (MDD) of 1.07 MGD by the end of the planning period.

Recommended Solution:

Capacity for the WTP is based on the Base maximum day demand scenario, which does not include near or long-term demand from the area referred to as "Baker's Corner." Service to the Baker's Corner area would require significant additional supply and a hydrogeological study to determine supply location and feasibility. Details regarding supplying this area are discussed in **Section 2.4** and **Project A-1**. Additional capacity may be required to meet the future needs from Bakers Corner, and sizing of the WTP should be expandable based on the results of **Project A-1**.

The following options are for the WTP and do not include improvements to the distribution system that will be necessary to support the increased demands. Distribution system improvements resulting from projected increased demand are included in **Project A-4**.

Recommended Solution: Construct New Sheridan WTP

A new groundwater treatment plant could be constructed on the existing site with a minimum reliable capacity of 1.34 MGD[2] but is expandable dependent on the additional capacity required by the Sheridan system determined in **Project A-1**. The new building could also provide separate lab and control rooms, or the existing building could be repurposed for office, controls, and lab space.

Construction of a new WTP would provide a newer, more modern facility with greater automation and expandability. The existing WTP would require significant upgrades (see Alternate Solution) and reconfiguration to meet the projected Base demands, which may be less cost effective than new construction.

Iron and Manganese Treatment

[2] At 1.34 MGD, the projected maximum day demands of 1.07 MGD are 80% of the WTP reliable capacity.

The existing process uses aeration for the oxidation of iron. Although it is likely that the raw water iron and manganese concentrations are low enough for effective chemical oxidation, the aerator may be removing undetected dissolved gases such as hydrogen sulfide or carbon dioxide. Pre- and post-aeration pH testing may indicate the presence of dissolved gases. A pilot study should be conducted to determine if the aeration process is necessary, including raw water quality data from individual wells. The study should assess the feasibility of potassium or sodium permanganate and sodium hypochlorite, as well as determine the optimal dosage of the chemicals for adequate iron and manganese oxidation and may need to be conducted at the lab scale due to filter performance issues. Permanganate trials should not be conducted with aerated water as colloidal particles caused by aeration are likely to interfere with the dosage. Trials for both chemicals should also include DBP results due to the presence of TOC in the groundwater. Retiring the aeration process could reduce energy costs and Greenhouse Gas (GHG) emissions associated with the blower and intermediate pumping.

If aeration is found to be necessary after pilot testing, three 700-gpm aerators with two blowers per aerator will be required for sufficient reliable capacity. Each detention basin would be sized to provide a minimum of 30 minutes of detention time at the rated plant capacity (minimum volume of 2,100 gallons each), along with piping and valves to allow the WTP to remain in service while the aerators and detention tanks are out of service for maintenance. Modifications to the influent and effluent piping for the existing aerator may allow the piping to be repurposed for the new WTP, with the addition of two new aerators each rated at 900 gpm with accompanying basins of 2,700 gallons each.

Three 700-gpm pressure filters at a maximum loading rate of 3 gpm/sf with one filter out of service would provide sufficient reliable capacity. Final filter size should be determined during the design phase, and a pilot study should be conducted before final design to ensure the combination of chemical oxidation and filter media can effectively lower the effluent iron and manganese concentrations below the respective SMCLs while minimizing the impact of the formation of disinfection byproducts. Backwash should be adequate to provide a maximum bed expansion of 30% and include surface wash and two backwash pumps.

Several options are presented below for iron and manganese removal.

Option 1: Aeration for iron plus post-aeration sodium hypochlorite for chemical oxidation of manganese. Filter media could be GAC, manganese oxide-coated material, or anthracite.

Option 2: Sodium hypochlorite plus manganese oxide-coated filter material for iron and manganese removal

Option 3: Potassium or sodium permanganate for iron and manganese plus anthracite filters

As previously mentioned, aeration plus potassium or sodium permanganate is not recommended because colloidal particles can make the dosage difficult to optimize and color hard to control. Additionally, the groundwater contains a significant amount of Total Organic Carbon (TOC) and feeding pre-chlorine for iron and manganese may result in an increase in disinfection byproducts (DBPs); therefore, raw water organics and DBP sampling should be conducted as part of any treatment pilot studies.

Chemicals

Sodium hypochlorite, zinc orthophosphate, liquid ammonia sulfate, and anionic polymer should be provided and installed in accordance with American Water T-2 Standards. Raw water ammonia data is limited but indicates that the optimal ratio of 4.5:1 (chlorine to ammonia) for chloramination cannot be met with the raw water ammonia alone. Day and bulk storage should allow for 30 days of stored chemical for ammonia, orthophosphate, and polymer, and 15 days of total storage should be provided for sodium hypochlorite. A raw water ammonia analyzer should be installed to ensure the correct dosage of ammonia to maintain the chloramination ratio to avoid nitrification and other water quality challenges in the distribution system.

Wash Water Storage

Wash water storage should be sufficient to store enough water to provide a backwash rate of 15 gpm/sf for 15 minutes per filter. Total volume of the finished water storage should be determined during the design phase. Standalone storage could be constructed, or wash water can be included in clearwell sizing. Alternatively, wash water can be withdrawn from a plant effluent piping loop.

Clearwell

At a rate of 2.0 MGD and 5 minutes of contact time, approximately 7,000 gallons of effective storage is needed for disinfection. If wash water is to be included, approximately 164,000 gallons of effective clearwell storage is required.

High Service Pumping

A minimum of three pumps with a minimum reliable capacity of 1.34 MGD are needed. If **Project B-1** is met through clearwell storage, an additional 2.7 MGD of rated pump capacity will be required to meet the required fire flow rate.

Waste Discharge

The existing lagoon and waste discharge main are expected to not have enough capacity for the increased plant flow. Additional backwash lagoons or holding tanks will be required and waste from the new WTP will need to enter the lagoon(s) from a new main.

Discharge from the lagoons to the wastewater treatment facility should be metered and the existing pipe to the wastewater plant should also be replaced if necessary.

Electrical and SCADA

[redacted]

Outputs and Benefits:

There is sufficient land to build a new facility on the current property. The new, more modern facility will have enough capacity meet the projected maximum day demands and provide optimized treatment, as well as eliminate risks associated with the existing aging facility and gaseous chlorine.

Alternate Solution: Expand Existing Sheridan WTP

In lieu of constructing a new WTP, the existing facility could be expanded. The following items would need to be completed to bring the WTP to a reliable capacity of 1.34 MGD:

- Conduct a condition-based assessment of the WTP building and make necessary improvements or replace.
- Increase chemical capacity and bring chemical systems to T-2 Standard.

- Replace chlorine gas with sodium hypochlorite and move chlorine injection point to pipe entering detention tank such that mixing is complete before entering the tank. Meter and record chlorine dosage points separately.
- Add a liquid ammonia sulfate system with online raw water ammonia analyzers.
- Replace existing filters (or retrofit) and add filtered water backwash lines with pumps. Add additional filtration capacity and expand building as necessary.
- Install high service pumps after new detention tank. Retain or replace existing pumps as transfer pumps if necessary.
- After filter improvements are complete, pilot chemical oxidation without aeration. If successful, abandon aerator and detention tank. If unsuccessful, add aeration and detention tank capacity.
- Install clearwell with capacity to meet contact time and backwash water. Alternatively, add backwash storage or withdraw wash water from the WTP effluent.
- Actively treat manganese using a stronger oxidation technique such as manganese oxide-coated filter material or potassium or sodium permanganate.
- Replace electrical and install SCADA systems as necessary. Add generator capacity.
- Increase holding lagoon size or construct a wastewater holding tank.
- Increase size of wastewater discharge pipe to WWTP and add a meter.

Expanding the existing facility is likely to cause significant challenges or may not be technically feasible due to space, piping, building deterioration, and an obsolete electrical system. These challenges may also impede the ability to expand quickly enough to meet near-term growth. If this solution is pursued, it is recommended to complete the condition-based assessment first to determine the long-term viability of the building and electrical systems.

Budget Discussion:

The base estimated cost for the recommended solution is $24.5 million, based on the 2020 cost curve for new iron removal treatment facilities with 2.0 MGD of rated capacity and scaled to 2022 dollars using the Handy Whitman index. Costs for demolition or repurposing the existing building are not included. A breakdown of the cost is provided in **Appendix B**.

Asset and Purpose Codes:

ASSET CODE	PURPOSE CODE
320 - Water Treatment Plant Equip	Growth/Cap in franchise <3 yrs

INDIANA AMERICAN WATER
SHERIDAN WATER SYSTEM

Project A - 4
Distribution System Main Upgrade for New WTP

Design and Permitting:	6 months		
Construction:	12 months	Project Cost:	$[redacted] $[redacted]

Need for Project:

The area surrounding the town of Sheridan is experiencing rapid growth, and Base scenario demands are expected to increase significantly throughout the planning period. Maximum day demands are projected to be 1.07 MGD by 2035. Hydraulic modeling results for the pipeline exiting the WTP indicate a velocity of 4.5 feet/second and a headloss of greater than 9 feet/1000 feet, based on the 2035 projected demands. At 4.5 feet/second, the 8-inch main has a capacity of about 1.0 MGD, and a larger main will be necessary to support the increased flow.

Background:

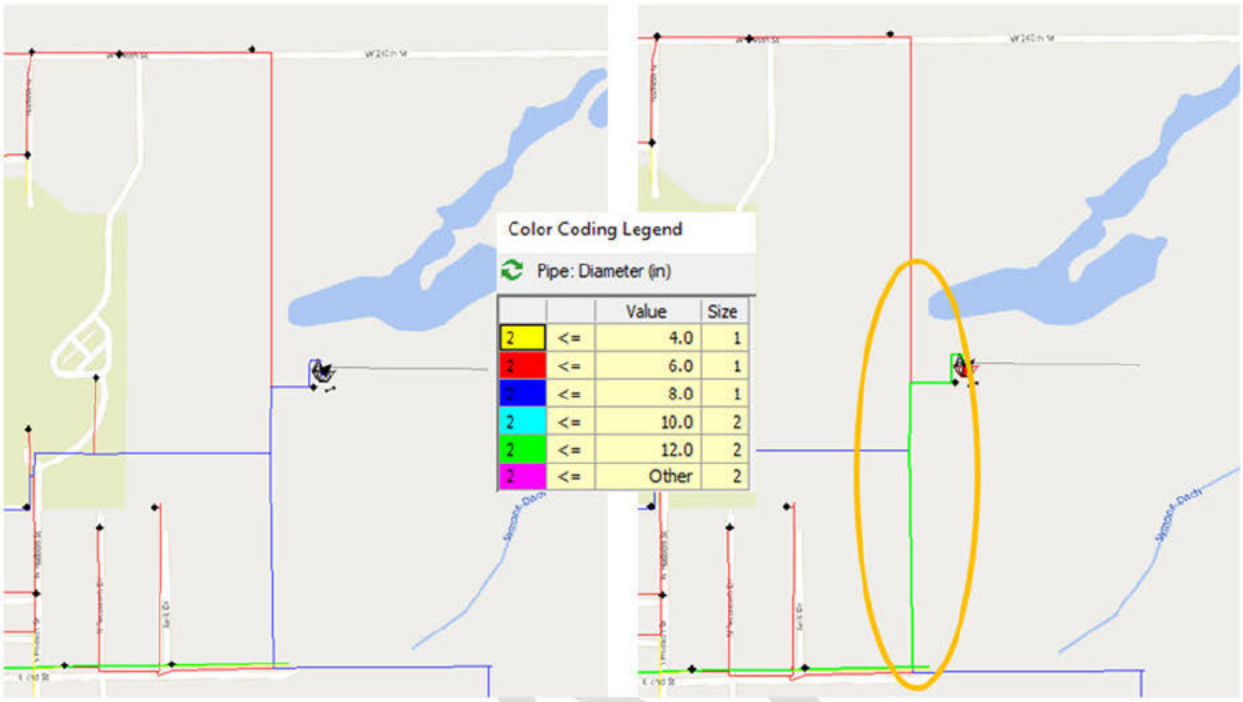
Water from the existing WTP enters the distribution system from a single 8-inch main that extends approximately 320 feet before splitting north and south to provide water to customers. As discussed in **Section 2.4**, there is significant projected growth that is expected to approximately double the current demands. **Project A-2** recommends additional supply and **Project A-3** recommends a new WTP with additional capacity to meet the projected demand.

Recommended Solution:

It is recommended that approximately 1,550 feet of 8-inch main extending from the WTP and south to 2nd Street be replaced with 12-inch main, as shown below. This project could be completed simultaneously with **Project A-3**.

If there is additional growth outside of the Base scenario maximum day demands due to service to Bakers Corner, or **Project B-1** is met through clearwell storage, a 16-inch main may be required for sufficient capacity. Re-evaluation of demands is recommended prior to project implementation.

Exhibit 1-1
Sheridan WTP Effluent Main



Output and Benefits:

A 12-inch main will have enough capacity to meet the projected maximum day demands. Based on hydraulic modeling results, increasing the pipe diameter to 12-inch will reduce the piping velocities below 3 feet/second and the headloss gradient below 3 feet/1,000 feet.

Alternative 1: Do Nothing

If nothing is done, the main will not have enough capacity to meet the projected demand.

Budget Discussion:

The base estimated cost for this project is $1,000,000. A breakdown of the cost is provided in **Appendix B**.

Asset and Purpose Codes:

ASSET CODE	PURPOSE CODE
331 - Trans & Distribution Mains	Growth/Cap in franchise <3 yrs
331 - Trans & Distribution Mains	Cust Svc press flow taste wat qual

INDIANA
AMERICAN WATER

Sheridan Water Treatment Facility
Design Build Project
Sheridan, IN

DESIGN/BUILD
REQUEST FOR PROPOSAL

June 2022

INDIANA-AMERICAN WATER COMPANY, INC.
153 N. Emerson Avenue
Greenwood, Indiana 46143

INDIANA AMERICAN WATER COMPANY
Sheridan, IN
Sheridan Water Treatment Facility

DESIGN/BUILD REQUEST FOR PROPOSAL

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I. GENERAL PROPOSAL INSTRUCTIONS

RFP-1 DEFINED TERMS

1.01 Terms used in this Request for Proposal have meanings assigned to them as defined in the Standard General Conditions of the Contract Between Owner and Design/Builder, EJCDC Document D-700 (2002 Edition). Certain additional terms used in this Request for Proposals have the meanings indicated below.

A. Proposal Documents - The Advertisement or Invitation, Request for Proposal, Proposal Form, and the proposed Contract Documents (including all Addenda issued prior to acceptance of Proposals).

B. Proposer - One who submits a Proposal directly to Owner.

C. Successful Proposer - The Proposer to whom Owner (on the basis of Owner's evaluation as hereinafter provided) makes an award.

D. Technical Exhibits - Documents prepared by Design/Builder that demonstrate the Proposer's plan for meeting the Owner's requirements as set forth in the Conceptual Documents.

E. Target Cost – The Successful Proposer will provide a Target Cost for the Work with the Design Memorandum and upon completion of 60% design. Further definition of Target Cost is provided in the Supplementary Conditions definitions.

RFP-2 COPIES OF PROPOSAL DOCUMENTS

2.01 Obtaining and Use of Proposal Documents

A. Complete sets of the Proposal Documents may be obtained from the Engineer at the following mailing address: **Attention: Roy Francis, Indiana American Water Company, 153 N Emerson Avenue, Greenwood, Indiana 46143. (roy.francis @amwater.com)**

B. Complete sets of Proposal Documents must be used in preparing Proposals. Owner does not assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Proposal Documents.

C. Copies of Proposal Documents available on the above terms are only for the purpose of obtaining Proposals for the Work and do not confer a license or grant to Proposers for any other use.

2.02 Identification of Conceptual Documents

A. Conceptual Documents include Part III, Scope of Design Services and Part IV Attachments

RFP-3 QUALIFICATIONS OF PROPOSERS

3.01 Proposer's Qualifications

A. Each Proposal must contain evidence of Proposer's qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the contract.

3.02 Contractor

A. Furnish the names, titles, their role in the project and qualifications of the key individuals that will be providing Construction Administration and Startup Services.

3.03 Designation of Engineer

A. The individual or entity that will be providing Design Professional Services shall be listed in the Proposal. If more than one entity will be responsible for providing the Design Professional Services list all of these in the Proposal. For each entity furnish the names, titles, their role in the Project and qualifications of the key individuals that will be providing Design Professional Services.

RFP-4 EXAMINATION OF CONTRACT DOCUMENTS AND SITE

4.01 Proposer's Responsibilities

A. It is the responsibility of each Proposer before submitting a Proposal to:

1. Examine and carefully study the Proposal Documents and other related data identified in the Proposal Documents;

2. Visit the Site to become familiar with and satisfy Proposer as to the general, local and Site conditions that may affect cost, progress, performance or furnishing of the Work; See Division 1- General Requirements for limitations on the time and access to the site during construction.

3. Become familiar with and satisfy Proposer as to all federal, state and local Laws and Regulations that may affect cost, progress, performance or furnishing of the Work;

4. Study and carefully correlate Proposer's knowledge and observations with the Contract Documents and such other related data; and

5. Promptly notify Owner of all conflicts, errors, ambiguities, or discrepancies that Proposer has discovered in the Proposal Documents.

4.02 Reports of Subsurface Conditions

A. The Supplementary Conditions identify those reports of explorations and tests of subsurface conditions, existing surface and subsurface structures, or underground facilities at or contiguous to the Site in possession of Owner. Proposer may rely

upon the general accuracy of the "technical data" contained in such reports but not upon other data, interpretations, opinions or information contained in such reports or otherwise relating to the subsurface conditions at the Site, nor upon the completeness thereof for the purposes of preparing Proposals, performing Design Professional Services, or Construction.

B. Copies of any reports and drawings that may be referenced in paragraph 4.02.A will be made available by Owner to any Proposer on written request. Those reports and drawings are not part of the Contract Documents~~, but the "technical data" contained therein has been identified and established in Paragraph SC-4.02 of the Supplementary Conditions.~~ Proposer is responsible for any interpretation or conclusion drawn from any "technical data" or any such data, interpretations, opinions or information.

4.03 Site Conditions

A. Before submitting a Proposal each Proposer will be responsible to obtain such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and underground facilities) at or contiguous to the Site or otherwise, which may affect cost, progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences or procedures of construction to be employed by Proposer and safety precautions and programs incident thereto or which Proposer deems necessary to prepare its Proposal for performing and furnishing the Work in accordance with the time, price and other terms and conditions of the Contract Documents.

4.04 Proposer's Access to the Site

A. On request, Owner will provide each Proposer access to the Site to conduct such examinations, investigations, explorations, tests and studies as each Proposer deems necessary for submission of a Proposal. Proposer must fill all holes and clean up and restore the Site to its former conditions upon completion of such explorations, investigations, tests and studies.

4.05 Work at the Site by Others

A. Reference is made to the Supplementary Conditions for the identification of the general nature of work that is to be performed at the Site by Owner or others (such as utilities) that relates to the Work for which a Proposal is to be submitted. On request, Owner will provide to each Proposer for examination access to or copies of Contract Documents (other than portions thereof related to price) for such work.

4.06 Hazardous Environmental Condition

A. The provisions of Paragraphs 4.01 through 4.05 above do not apply to Hazardous Environmental Conditions covered by Paragraph 4.04 of the General Conditions.

RFP-5 PRE-PROPOSAL CONFERENCE

5.01 A Pre-Proposal Conference will not be held for this project.

RFP-6 SITE AND OTHER AREAS

6.01 The Site is identified in the Proposal Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Design/Builder. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Proposal Documents.

RFP-7 INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Proposal Documents are to be directed to Indiana American Water Company in writing. **Send questions to the attention of Roy Francis at e-mail address roy.francis@amwater.com.** Interpretations or clarifications considered necessary by Owner in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Owner as having received the Proposal Documents. Questions received less than seven (7) days prior to the date for opening of Proposals may not be answered. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, or change the Proposal Documents as deemed advisable by Owner.

RFP-8 PROPOSAL SECURITY

Not Required.

RFP-9 CONTRACT TIMES

9.01 The OWNER desires to achieve substantial completion and readiness for final payment by **August 31, 2024 and December 30, 2024**, respectively. The actual times for Substantial Completion and readiness for final payment shall be those times offered by the Proposer and entered into the Agreement upon award of the contract. These times will be taken into consideration by Owner during the evaluation of Proposals, and it will be necessary for the apparent Successful Proposer to satisfy Owner that they will be able to achieve Substantial Completion and be ready for final payment within the times specified or provide substantive reasoning why the times cannot be met.

RFP-10 LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, are set forth in the Agreement.

RFP-11 TECHNICAL EXHIBITS REQUIRED WITH PROPOSAL

11.01 Proposers shall submit with their Proposals the following Technical Exhibits: See Part II, Information to be Submitted with the Proposal.

11.02 Unsuccessful Proposer shall retain an ownership and property interest in the Technical Exhibits. Owner may retain a record copy for information purposes; however, such documents are not intended or represented to be suitable for reuse by Owner or others on the Project or on any other project. Any reuse will be at Owner's sole risk and without liability or legal exposure to Proposer and Owner shall indemnify and hold harmless Proposer from all claims, damages, losses and expenses including attorneys' fees arising out of or resulting there from.

11.03 Technical Exhibits may include alternatives and/or deviations from the Conceptual Documents provided that such alternatives and/or deviations are called to the Owner's attention in separate written documentation to be submitted with the Proposal.

RFP-12 PREPARATION OF PROPOSAL

12.01 The Proposal Form is included with the Proposal Documents. Additional copies may be obtained from Owner.

12.02 All blanks on the Proposal Form must be completed by printing in black ink or by typewriter and the Proposal signed. Insert the requested Fees in the Cost of the Work section. Insert the requested days in the Contract Times section. Insert the names of the exhibits attached to the Proposal in the Exhibit section.

12.03 Proposal Signatures

A. A Proposal by a corporation must be executed in the corporate name by a corporate officer accompanied by evidence of authority to sign. The corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown below the signature.

B. A Proposal by partnerships shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.

C. A Proposal by Limited Liability Company shall be executed in the name of the firm by a member accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown below the signature.

D. A Proposal by an individual shall show the Proposer's name and official address.

E. A Proposal by a joint venture shall be executed by each joint venturer in the manner indicated on the Proposal Form. The official address of the joint venture shall be shown below the signatures.

12.04 All names must be typed or printed in black ink below the signature.

12.05 The Proposal shall contain an acknowledgement of receipt of all Addenda, the numbers of which must be filled in on the Proposal Form.

12.06 The address and telephone number for communications regarding the Proposal must be shown.

12.07 The Proposal shall contain evidence of Proposer's authority to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the Contract. Proposer's state contractor license number for the state of the Project and professional engineering registration numbers must also be shown if required.

RFP-13 PROPOSAL PRICE

13.01 Lump Sum

A. Proposers shall submit a Proposal on a lump sum basis as set forth in the Proposal Form Lump sum costs include design fees, Design/Builder's fee, construction superintendence, and bond costs. The cost of construction activities is not included in the RFP phase, however, in Section II Information to be Submitted with the Proposal, Proposer is asked to provide a construction cost estimate of the Work.

B. The Proposal price shall include such amounts as the Proposer deems proper for overhead and profit on account of cash allowances, if any, named in the Contract Documents as provided in paragraph 10.02 of the General Conditions.

RFP-14 SUBMITTAL OF PROPOSALS

14.01 Each prospective Proposer is furnished one copy of the Proposal Documents with one separate unbound copy of the Proposal Form and one electronic copy. The unbound copy of the Proposal Form is to be completed and submitted with the information requested in this RFP and as described in Part II, Information to be Submitted with the Proposal. **The portion of the Proposal covering the Cost of the Work, specifically section P-4, CONTRACT PRICE, shall be submitted with the remainder of the Proposal but in a separate, opaque, sealed envelope that clearly marked "COST PROPOSAL ENCLOSED"**. E-mailed and faxed copies of the Proposal Documents submitted to the Owner will not be considered. Proposal Documents submitted after the designated date and time shown below will not be considered.

14.02 Five (5) paper copies and one electronic (PDF format) copy of the proposal shall be submitted no later than **2 PM (EST), July 20, 2022** to each of the following individuals:

Roy Francis
Indiana American Water Company
153 N. Emerson Avenue
Greenwood, Indiana 46143

14.03 Proposals shall be enclosed in an opaque sealed envelope or box, marked with the Project title and name and address of Proposer and accompanied by other required documents. If the Proposal is sent through the mail or other delivery system the sealed envelope or box shall be enclosed in a separate envelope or box with the notation "PROPOSAL ENCLOSED" on the face of it. The electronic copy may be included as a thumb drive with the paper copy, or it may be submitted via email to jared.burnett@amwater.com if the total file size is less than 10 MB.

RFP-15 MODIFICATION AND WITHDRAWAL OF PROPOSAL

15.01 A Proposal may be modified or withdrawn by an appropriate document duly executed in the manner that a Proposal must be executed and delivered to the place where the Proposals are to be submitted prior to the date and time for the opening of the Proposals.

15.02 If within 24 hours after Proposals are opened any Proposer files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Proposal, that Proposer may withdraw its Proposal, and the Proposal security will be returned. Thereafter, if the Work is rebid, that Proposer will be disqualified from further consideration of being awarded the Contract.

RFP-16 OPENING OF PROPOSALS

Proposals will be opened privately.

RFP-17 PROPOSALS TO REMAIN SUBJECT TO ACCEPTANCE

17.01 All Proposals will remain subject to acceptance for the period of **60 days** from the receipt of the Proposal, but Owner may, in its sole discretion, release any Proposal and return the Proposal security prior to the end of that period.

RFP-18 SELECTION CRITERIA

18.01 In evaluating Proposals, Owner may consider:

A. Whether the Proposals comply with the prescribed documents and other data as may be requested in the Proposal Form or prior to the Notice of Award.

B. The Proposal prices as required in the Proposal Form.

C. The innovative alternatives identified by the Proposers and opportunities the alternatives provide for reduction of capital costs and operating and maintenance costs. Innovative alternatives shall meet Indiana American Water Company standards.

D. The qualifications of Proposers and the qualifications and experience of Subcontractors (including engineer), Suppliers, and other individuals and entities proposed for those portions of the Work as to which the identity of Subcontractors, Suppliers, and other individuals and entities must be submitted as provided in the

Supplementary Conditions and as may be requested in the Proposal Form, Information to Be Submitted with the Proposal, Scope of Design Services, or prior to the Notice of Award.

E. The extent to which the Technical Exhibits demonstrate the Proposer's plan for meeting of the Owner's requirements set forth in the Conceptual Documents and design solutions contained therein.

F. The operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to the Notice of Award.

18.02 The Proposals will be evaluated based upon five criteria as listed below. For the purpose of evaluating Proposals, these evaluation criteria will be given the following weights:

1)	Fees and Innovative Cost Solutions	20%
2)	Technical Merit & Quality	25%
3)	Schedule	20%
4)	Qualifications & Experience	15%
5)	Personnel & Resources	20%

18.03 Owner may conduct such investigations as Owner deems necessary to assist in the evaluation of any Proposal and to establish the responsibility, qualifications and financial ability of Proposers and proposed engineers, Subcontractors, Suppliers, and other individuals and entities to perform and furnish the Work in accordance with the Contract Documents.

RFP-19 REJECTION OF ALL PROPOSALS AND DISCREPANCIES; AWARD OF CONTRACT

19.01 Rejection of All Proposals, Discrepancies

A. Owner reserves the right to reject any or all Proposals, including without limitation nonconforming, non-responsive, unbalanced, or conditional Proposals. Owner further reserves the right to reject the Proposal of any Proposer whom it finds, after reasonable inquiry and evaluation, to be non-responsible. Owner may also reject the Proposal of any Proposer if Owner believes that it would not be in the best interest of the Project to make an award to that Proposer. Owner also reserves the right to waive all informalities not involving price, time or changes in the Work and to negotiate contract terms with the Successful Proposer.

B. More than one Proposal for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any proposer has an interest in more than one Proposal for the Work may be cause for disqualification of that Proposer and the rejection of all Proposals in which that Proposer has an interest.

C. If the Contract is awarded, Owner will award the Contract to the Proposer whose Proposal is in the best interests of the Project.

19.02 Award of Contract

A. If the contract is to be awarded, Owner will give Successful Proposer a Notice of Award within **60 days** after the day of the Proposal opening.

RFP-20 CONTRACT SECURITY

None Required

RFP-21 SIGNING OF AGREEMENT

21.01 When Owner gives a Notice of Award to the Successful Proposer, it will be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents that are identified in the Agreement as attached thereto. Within 15 days thereafter, Successful Proposer shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within 15 days thereafter, Owner shall deliver one fully signed counterpart to Successful Proposer.

RFP-22 PROPOSAL COMPENSATION

None Provided.

RFP-23 SALES AND USE TAXES

23.01 Owner is exempt from Indiana State local privilege (“sales”) and use taxes on certain installation labor, materials and equipment to be incorporated in the Work. Said taxes shall not be included in the Proposal. Successful Proposer agrees to work with Owner or Owner’s legal counsel in order to identify nontaxable labor, materials and equipment. Refer to paragraph 6.10 of the Supplementary Conditions for additional information.

RFP-24 RETAINAGE

24.01 Provisions concerning retainage are set forth in the Agreement.

Indiana American Water Company
Sheridan Water Treatment Facility
Design Build Project
Noblesville, Indiana

PROPOSAL FORM

P-1 PROJECT IDENTIFICATION:

The Allisonville Road Water Treatment Facility Improvements project includes the following scope of work:

- Design, permitting and construction of a new groundwater filtration facility, new well, raw water mains and associated facilities in Sheridan, Indiana.

A detailed description of each of the design elements is included in the Design Concept (Attachment B).

P-2 THIS PROPOSAL IS TO BE SUBMITTED TO:

Mr. Roy Francis, P.E.
Indiana- American Water Company
153 N. Emerson Avenue
Greenwood, Indiana 46143

P-3 PROPOSER'S OBLIGATIONS AND REPRESENTATIONS

3.01 The undersigned Proposer proposes and agrees, if this Proposal is accepted, to enter into an Agreement with Owner in the form included in the Contract Documents to perform all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Times indicated in this Proposal and in accordance with the other terms and conditions of the Contract Documents.

3.02 Proposer accepts all of the terms and conditions of the Proposal documents, including without limitation those dealing with the disposition of the Proposal security. This Proposal will remain subject to acceptance for 60 days after the day of Proposal opening. Proposer will sign and deliver the required number of counterparts of the Agreement with any Bonds and other documents required by the Request for Proposal and Proposal Form within 15 days after the date of Owner's Notice to Proceed.

3.03 In submitting this Proposal Proposer represents and agrees, as more fully set forth in the Agreement, that:

A. Proposer has examined and carefully studied the Proposal Documents and the following Addenda (receipt of all which is hereby acknowledged)

Addendum No.	Addendum Date

B. Proposer has visited the Site and become familiar with the general, local and Site conditions that may affect cost, progress, performance and furnishing of the Work.

C. Proposer is familiar with all applicable federal, state and local Laws and Regulations that may affect cost, progress, performance and furnishing of the Work.

D. Proposer has carefully studied all available reports of explorations and tests of subsurface conditions at or contiguous to the Site and all available drawings of physical conditions relating to existing surface or subsurface structures at or contiguous to the Site which have been identified or made available by Owner.

E. Proposer is aware of the general nature of the work to be performed by Owner and others at the Site that relates to Work for which this Proposal is submitted as indicated in the Contract Documents.

F. Proposer has correlated the information known to Proposer, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies and data with the Contract Documents.

G. Proposer has given Owner written notice of all conflicts, errors, ambiguities or discrepancies that Proposer has discovered in the Contract Documents and the written resolution thereof by Owner is acceptable to Proposer, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work for which this Proposal is submitted.

H. This Proposal is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Proposer has not directly or indirectly induced or solicited any other Proposer to submit a false or sham Proposal; Proposer has not solicited or induced any individual or entity to refrain from submitting a Proposal; and Proposer has not sought by collusion to obtain for itself any advantage over any other Proposer or over Owner.

P-4 CONTRACT PRICE

4.01 Proposer will complete the Work in accordance with the Contract Documents for the following price(s):

A. COST OF THE WORK

1. The Cost of all Work other than Unit Price Work shall be determined as provided in Paragraph 10.01 of the General Conditions, as revised or amended by the Supplementary Conditions and shall include the following amounts subject to increases or decreases for changes in Work as provided for in Article 8 of the Agreement

2. Lump Sum Fees

Base Proposal Concept

a. Design Professional Services - Preliminary Design up to and Including Issuing of the Design Memorandum.

$_____

b. Design Professional Services – Preliminary Design Completion through Final Design Phases.

$_____

c. Design Professional Services – Construction/Operational Phase

$_____

d. Pre-Construction Services during Design Phase

$_____

e. Construction Supervision and Superintendence

$_____

f. Cost of Bond Premiums (Based on construction estimate):

$_____

Premium unit Price $_____/$_____

Range: $_____ to $_____

TOTAL LUMP SUM (a. + b. + c. + d. + e. + f.):

$_____

B. DESIGN/BUILDER's FEE

1. Lump Sum Fee $_____

Mandatory Alternate Proposal Concept #1 – Backwash Equalization

a. Design Professional Services - Preliminary Design up to and Including Issuing of the Design Memorandum.

$_____

b. Design Professional Services – Preliminary Design Completion through Final Design Phases.

$_____

c. Design Professional Services – Construction/Operational Phase

$_____

d. Pre-Construction Services during Design Phase

$_____

e. Construction Supervision and Superintendence

$_____

f. Cost of Bond Premiums (Based on construction estimate):

$_____

Premium unit Price $_____/$_____

Range: $_____ to $_____

TOTAL LUMP SUM (a. + b. + c. + d. + e. + f.):

$_____

B. DESIGN/BUILDER's FEE

1. Lump Sum Fee $_____

P-5 CONTRACT TIMES

5.01 Proposer agrees that the Work will be substantially completed and ready for final payment in accordance with paragraphs 13.05 and 13.08 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

Design Memo Completion: _____ days

(Insert days from Notice of Award to completion of the Design Memorandum)

Final Design Phase Completion: _____days

(Insert days from Notice to Award to completion of the Final Design Phase)

5.02 Proposer accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the times specified in the Agreement.

P-6 EXHIBITS

6.01 The following documents are attached to and made a condition of this Proposal:

A. The individual or entity providing the Design Professional Services will be: (if more then one list all)

_____
_____
_____
_____
_____
_____

B. Listed below are the Exhibits the Design/Builder has attached to this proposal:

_____
_____
_____
_____
_____
_____

P-7 TERMINOLOGY

7.01 The terms used in this Proposal which are defined in the General Conditions of the Contract between Owner and Design/Builder (“General Conditions”) included as part of the Contract Documents have the meanings assigned to them in the General Conditions. Terms defined in the Request for Proposal are used with the same meaning in this Proposal.

P-8 SUBMISSION

SUBMITTED on _____.

State Contractor License No. _____.

State Certificate of Authority for Corporate Engineering Practice (If Applicable):

If Proposer is:

An Individual

By: _____ (SEAL)
(Individual's Name)

doing business as _____
Business address: _____
_____

Phone No.: _____
Facsimile No.: _____

A Partnership

By: _____ (SEAL)
(Firm Name)

_____
(general partner)

Business address: _____
_____

Phone No.: _____
Facsimile No.: _____

A Corporation

By: _____ (SEAL)
(Corporation Name)

_____
(state of incorporation)

By: _____ (SEAL)
(name of person authorized to sign)

_____
(Title)

(Corporate Seal)

Attest _____
(Secretary)

Business address: _____
_____

Phone No.: _____
Facsimile No.: _____
Date of Qualification to do business as a foreign (out-of-state) corporation in state where Project is located (if applicable): _____

A Joint Venture

By: _____ (SEAL)
(Name)

_____
(Address)

By: _____ (SEAL)
(Name)

_____
(Address)

Business address: _____
_____

Phone No.: _____
Facsimile No.: _____
(Each joint venturer must sign. The manner of signing for each individual, partnership and corporation that is a party to the joint venture should be in the manner indicated above.)

II. INFORMATION TO BE SUBMITTED WITH THE PROPOSAL

The following minimum information must be submitted with Design/Builder's proposal for it to be accepted. Owner intends to award contract to the successful proposer.

1. Separate Lump Sum amounts for each of the following components in P-4 of the Proposal Form. **Lump Sum amounts listed below, specifically Section P-4, CONTRACT PRICE, of the Proposal Form, shall be submitted with the Proposal but in a separate, opaque, sealed envelope that is clearly marked "COST PROPOSAL ENCLOSED":**

    a. Design Professional Services for– Engineering through Preliminary Design Phase, up to and including issuance of the Design Memorandum. (See III. Scope of Design Services, Section A).

    b. Design Professional Services for – Completion of Final Design Phases (See III. Scope of Design Services, Section A).

    c. Design Professional Services - Construction/Operations Phase (See III. Scope of Design Services, Section B).

    d. Pre-Construction Services during Design Phase - (See III. Scope of Design Services, Section B).

    e. Supervision and Superintendence of Construction – See SC-10.01 Cost of the Work for a description of the costs to be included in this item.

    f. Performance and Payment Bond premium based on the Design Builders estimated construction cost. Provide a premium unit price that can be used if construction cost differs from the estimated cost. Also, provide the range that unit price is valid.

    g. Design Builders Fixed Fee

2. Provide the following Design/Build Team information relative to the proposed team qualifications:

    a. Firms: Identify the companies in the design build team and any other companies you would be teaming up, partnering or associating with during the project.

    b. Design/Build/Partnering Experience: Identify the team's design/build and partnering experience, including experience on projects similar to the proposed. Include a brief description of the projects, their costs and the current names and telephone numbers of the owner or owner's contact.

    c. Quality Management Plan Outline: Provide an organization chart showing reporting lines and responsibilities for the team. Provide references to company procedures to be used to manage the proposed project. Provide the method of management of the subcontractors. Provide the relationship of the contractor's safety plan to the above.

3. List areas of construction work which Design/Builder desires to perform with its own forces either through negotiation or successful competitive bidding against qualified subcontractors.

4. For self-performed work, provide all the classifications of labor to be employed and associated hourly unit cost inclusive of wages, fringe benefits, payroll taxes, insurance, etc. The hourly unit cost provided shall be the cost included in the Cost of the Work.

5. Provide description of the services and facilities included in the lump sum cost of Supervision and Superintendent of Construction. Provide a Construction Phase organizational chart identifying Design/Builder Construction Supervision organization. Indicate those individuals who will be full or part-time on the project and where they will be located (i.e. on-site, office)

6. Provide a narrative description of the Design/Builder's understanding of the design concept for this facility. If the Design/Builder chooses to modify the proposed site layout included with the RFP, a drawing shall be provided to identify the proposed alternate layout. Additionally, provide specifics of any alternative design concepts, which may be proposed by the Design/Builder. The Design/Builder is encouraged to submit alternative design concepts, however, a proposal based on the defined design concept is mandatory. Should alternative proposals be submitted, preliminary sketches of the proposed facilities shall be included along with relative design and construction cost estimates comparing the alternative designs with that defined in this document.

7. Prepare a construction cost estimate of the Work, which shall be broken down by major work item, organized by Construction Specification Institute (CSI) division and major process components. This estimate will be used by the Owner to evaluate Design/Builder’s understanding of the project, evaluate budget and rate impacts.

8. The anticipated number and depth of all soil borings, if any, required after award of contract.

9. Specifics of any exceptions, which are taken to items requested in this document. If no exceptions are taken, it is not necessary to reiterate the information in the Scope of Services Required.

10. A listing of drawings and specifications required for this project, with titles for each drawing.

11. A listing of all Federal, State, and local permits required for design, construction and operation of the proposed facility. Identify anticipated review time for each permit and any special requirement that may delay the process.

12. A project team organizational chart headed up by the proposed project manager and including all other engineering personnel from all disciplines who are expected to be directly associated with this project and construction supervision personnel.

13. Resumes and a work experience history of each individual identified in the project team organizational chart. The resumes of those individuals to be associated with the instrumentation and controls design must demonstrate their capabilities in those areas identified in the Scope of Services required for design.

14. Specific identification of any design sub-consultants that will be utilized for this project, exclusive of soil boring and survey work. If sub-consultants will be utilized, the resumes of the specific individuals will be required as well as a work experience history of their firms, including three (3) references with specific contacts and phone numbers.

15. A preliminary schedule for design, permitting, construction, testing, startup and commissioning of the project from date of award in Gantt chart form. If the time of completion desired by Owner is not acceptable, it shall be explicitly stated in the proposal. The schedule shall identify long lead time equipment and critical path to completion.

16. The number of project site visits by the design team during the construction phase. Provide the number of visits by each discipline (structural, electrical, mechanical, etc) and the timing of the site visits.

17. Identify a list of major and critical shutdowns anticipated to complete the project.

18. Concurrence that Design/Builder has read the Proposed Design/Builder Contract Documents included in the Attachments and are prepared to enter into this Agreement should Design/Builder's proposal be accepted by Owner.

19. Specific information describing how Design/Builder's firm plans to establish electronic communications with Indiana American Water Company, if these capabilities are not already in place.

20. Evidence of Proposer's qualifications to do business in the State where the Project is located (See GPI-3.01).

III. SCOPE OF DESIGN SERVICES

A. Design Professional Services- Preliminary and Final Design

Design Professional Services shall include the work described in General Conditions 6.01 as amended by the Supplementary Conditions and work described in this Scope of Design Services including all listed Attachments.

Review of the design will be performed by American Water engineering personnel. Any changes in the scope of services during the design phase must be addressed by the Design/Builder before the work is performed. Changes will be made in accordance with Articles 3 and 11 of the General Conditions.

1. Preparation of a brief critique of the design concepts to determine what modifications to the concepts may result in a more cost-effective project, simplified construction, and/or improved operating procedures. This document shall be submitted prior to the initial design meeting.

2. Attendance at periodic meetings with the Owner at their office or the treatment plant site located in Sheridan, Indiana. At least ten (10) working days shall be allotted in the schedule for review of information by Owner prior to any meeting. It is expected that several one-day meetings (unless otherwise noted) will be required during the design phase including:

    1. An initial conference (this will include review of the design critique and alternative concepts),
    2. Two meetings to review the instrumentation requirements (these will be coupled with the 30% and 60% design review meetings),
    3. Meetings to review the progressive completion at (15%, 30%, 60%, 90%, and 100%) of design drawings and specifications and to prepare for permit submittals. The draft Design Memorandum will be submitted for review prior to the 15% meeting. The final Design Memorandum and preliminary drawings will be reviewed at the 30% meeting.

    The Design Builder is responsible for preparing notes summarizing the discussions and the conclusions from the meetings and distributing the notes within 7 days following the meeting.

    The preliminary design phase will be considered complete at the 60% completion of design and upon Owner's approval of the construction cost estimate.

3. All land survey work as necessary to adequately complete the design and file permit applications and provide reference points for construction layouts. As a minimum, property lines, topographic information and location of existing structures are to be included.

4. All geotechnical investigations including soil borings, rock cores, and auger probing as necessary to adequately complete the design and estimate and plan construction earthwork.

5. All environmental activities as necessary to adequately complete the design and file permit applications.

6. Total interaction with all utility companies to design and specify proper service for the proposed improvements and to coordinate the relocation of existing utilities as required. The Design/Builder shall also determine if any additional capital or usage fees will be imposed by any specific utility.

7. Determine which Local, State, and Federal permits are required for the facility, prepare the necessary applications, and provide technical input as required in securing these permits. The Design/Builder shall also provide Owner with information regarding the approximate length of review time for each permit, and any special requirements that could delay this process (e.g., public hearings). When required by the permitting agency, the permit applications will be formally submitted by Owner.

8. Preparation of a preliminary budget construction cost estimate broken down by major work item, and a detailed construction cost estimate breakdown: (labor, materials, equipment, subcontract, temporary construction etc.) organized by Construction Specifications Institute (CSI) division and major process components. The preliminary estimate is to be submitted with the Design Memorandum. The detailed construction estimate is to be submitted in accordance with the Supplementary Conditions SC-6.01 Design Professional Services.

9. Preparation and maintenance of a Design Memorandum. The Design Memorandum is a summary of design data presented in outline format along with other pertinent project information. The primary intent of the memorandum is to allow Owner to review and comment on the design before the Design/Builder proceeds with detailed design and drafting. The memorandum shall be updated throughout the design and submitted to the Owner with each set of updated drawings. A summary of the information to be included in the memorandum is outlined in the Attachments. After completion of the draft Design Memorandum a meeting (15% completion) will be held with all parties. The purpose of the meeting will be to review the Design/Builder's Design Memorandum to determine and evaluate alternative concepts to reduce capital and operating costs and/or to improve operations. The Design Memorandum will be modified with the results of this evaluation by the Design/Builder.

10. Preparation of a narrative description of the operation of the proposed facilities to be used by plant operations personnel to familiarize themselves with the operation, capabilities, and limitations of the proposed improvements. The narrative shall be an extension of the process sections from the Design Memorandum, but in text format. It shall explain the intent and function of each unit process in addition to the system as a whole, and it shall include the detailed written control strategies (functional descriptions), which were prepared for the Design Memorandum submission. Preparation of the narrative shall not begin until the Design Memorandum is finalized and accepted. The narrative shall be submitted as a separate document for review at the final design review meeting. It shall serve as the foundation of the Operations and Maintenance Manual discussed in the Construction/Operation Phase section of this document.

11. Preparation of a complete and coordinated set of design drawings for all engineering disciplines with an adequate level of detail to allow for review/approval by permitting agencies and construction by the Design/Builder. Drawings used for permit applications and bidding require the signature and seal of a licensed professional engineer in the State of Indiana. The drawing sets require segregation by major discipline: site, architectural, structural, mechanical, electrical, instrumentation, etc. Drawings shall not contain extensive notes and written instructions that are more appropriate for the specifications. Standard detail drawings shall exclude items that are not applicable to the current project.

    The Design/Builder shall prepare all drawings using the most current version of AutoCAD for Windows. The Owner will not accept drawings created in an alternative CAD program, such as MicroStation, and "converted" to AutoCAD format. The Design/Builder shall use only AutoCAD and AutoLISP routines and no vendor-furnished or third-party programs. Refer to American Water drawing standards and samples provided with this Request for Proposal.

    It is recommended that the Design/Builder submit an early review (e.g., 15% complete) set of .dwg files for this project. The Owner shall review the .dwg files for conformity with the Owner's AutoCAD standards and advise the Design/Builder of any necessary changes. The Owner then shall assume that the Design/Builder completes the remainder of the design in conformity with the Owner's AutoCAD standards. If it is later found that final documents do not conform, the Design/Builder shall revise the final .dwg files at the Design/Builder's cost. The Design/Builder shall have the opportunity to discuss the Owner's AutoCAD standards with Company staff.

    Standards developed by the Owner, and applicable to this project, and selected drawings of the existing facilities are provided in the Attachments. The information provided in the record drawings may not represent actual field conditions. The Design/Builder has the responsibility to field verify and record the existing conditions as necessary to complete the design phase.

    Electrical drafting symbols shall conform to IEEE Standard 315 and 315A. Specific requirements for the design of instrumentation and controls for water treatment processes or water distribution, where applicable, are:

    a. Conduct on-site investigations, interface with process engineers/designers, and review design materials and drawings to determine the type and location of primary sensors, control devices, panels and related instruments, and control equipment. The locations, elevations, and mounting details for these devices shall be included on the drawings.

    b. Prepare P&ID drawings in accordance with ISA Standard S5.1 and Remote Terminal Unit (RTU) Interconnection drawings (input/output point lists) from the P&IDs. Example RTU Interconnection drawing and an electronic template will be provided to the selected Design/Builder upon request. The RTU interconnection drawings must be sufficiently detailed and accurate such that they can be utilized by the System Integrators and provided back to the Owner as record drawings. The Design/Builder is responsible for allowing each of the prequalified System Integrators identified by the Owner to review the RTU Interconnection drawings

prior to the final design review meeting. The minimum information to be included on the RTU Interconnection drawings is as follows:

- Wiring from field instruments to the appropriate I/O point on the RTU.
- All signal isolation and signal conditioning equipment as required (e.g., a current to current isolator).
- Connections associated with the communications between RTUs (radios, fiber optic modems, etc.).
- Contacts and coils on digital outputs.
- Wiring tags showing the RTU number, I/O type (AI, AO, DI, DO), RTU card number, and I/O point number.
- Connections for DC power supplies.

c. Prepare ladder logic diagrams to show the hard-wired logic in panels and motor control logic in PLCs. Drawings shall be prepared to show the general configuration of all new panels, consoles, and the wiring between interconnected hardware components.

d. Prepare conduit and wiring drawings showing conduit and signal wire routing using scaled base drawings of all facilities. Where appropriate, the conduit and wiring drawings shall be integrated into the electrical drawings.

12. Preparation of technical specifications, Divisions 2 through 16 in the CSI Spec-Text format, and the list of required shop drawings, in final electronic form for printing, copying, and binding by the Design/Builder. Specifications shall reflect only the scope of work for the current project. Standard specifications shall be modified to exclude items not applicable to the current project.

    Specifications shall be prepared using the most current version of the Microsoft Word for Windows word processor. If your standard specifications are in a format other than Microsoft Word, they must first be converted to Microsoft Word format, thoroughly checked to ensure that a complete conversion was accomplished (including all tables, charts, headers, footers, etc.), then edited for this project as appropriate within Microsoft Word. The text shall be 11-point Arial font. An electronic file name for each specification section shall include a descriptive name preceding a 5-digit specification section number followed by the Microsoft Word file extension (e.g., PROJECT 11500.doc).

    The American Water System Construction Contract Documents prohibit a Design/Builder from submitting substitute or "or equal" materials or equipment when a proprietary product, named manufacturer, or supplier has been specified. Provisions exist for bidders to submit alternatives to these items at bid time only. To ensure competitive pricing is being obtained for material and equipment that is not necessary to be a sole source item, it is recommended that at least three (3) acceptable manufacturers or products be listed in the specifications for each of these items. Specifying less than three (3) manufacturers is acceptable only when approved by the Owner in cases where the products of additional manufacturers are not deemed to be comparable or do not meet the project requirements. If design details have been used on the drawings that are based on one of the listed products, this should be noted in the specifications. If design revisions are necessary to

accommodate the other acceptable products, additional details shall be provided for the other products to facilitate complete and accurate bidding. Where an item is to be furnished on a sole source basis, only one (1) acceptable manufacturer or product will be listed in the specifications. If common items are included in multiple specification sections, language is to be included in the specifications that the same manufacturer is to be used for these common products.

In general, one of the two specification methods above shall be used for all process, mechanical, and electrical equipment and other materials that are unique to the design (e.g., certain piping, valve, structural, mechanical, electrical and architectural products). Specifications for other materials or products that can be written prescriptively, by performance, or by reference to applicable standards, do not need to include specific manufacturers or products unless desired by the Design/Builder or the Owner.

The specific items and requirements of the specifications for the electrical control circuits and the instrumentation and controls for water processes or water distribution, where applicable, are listed below. The Design/Builder shall interface closely with the Owner in the development of these items.

a. Specifications for the digital equipment, and field and panel mounted instruments. Communication protocol between control system equipment and other digital equipment shall be specified by the Design/Builder and verified that it is compatible with the DCS. Data to be transferred by serial communications with other digital equipment shall also be identified.

b. An input/output point list.

c. Instrument specification sheets that are in accordance with ISA Standard S20.

d. Detailed written control logic and strategies (functional descriptions). Identification of the initial set points to be used at startup when variable set points are required in the control strategy shall also be identified.

e. Graphic display descriptions. Each specific display shall be identified and a brief description provided. Each I/O point (or calculated value) that should appear on each display must also be identified (preferably by indicating the name or number of the display directly on the I/O list). Sample displays, which will be provided by the Owner, shall be included in the contract documents.

f. Report definitions. All typical reports that the Owner will generate shall be integrated with the control system and be accessible via an electronic spreadsheet (Microsoft Excel) or electronic database (Microsoft Access). The Owner will provide examples of each specific report that shall be provided in the specifications. The I/O point or tag number that corresponds to each entry space in each report shall be identified directly on the example reports with appropriate instructions such as whether the data is an average, taken at a specific time of the day, etc. Entry spaces that the system cannot accommodate and need to be filled in manually shall be identified as such.

g. Alarming strategies for all alarms conditions including both warning alarms and critical alarms. Warning alarms are defined as analog (or calculated) alarms that provide notification that a critical condition is being approached (e.g. high turbidity, low chlorine residual, etc.). Critical alarms initiate automatic action by the system to address a critical condition (e.g. shut down the facility, start a backup piece of equipment, etc.). The specific action associated with each critical alarm shall also be identified. The Design/Builder shall identify all initial alarm set points to be used at startup.

h. Structured Query Language (SQL) database definition. All analog values, integrated values, and other relevant historical data shall be identified by the Design/Builder for inclusion in the SQL database and trending by the Systems Integrator. The Integrator shall store all historical data in a Microsoft SQL Server format.

i. Narrative descriptions of all pump control circuits (pump starters for example). These descriptions shall describe in detail the operation of these circuits in the various operating modes (manual, auto, remote, etc.) and shall provide information relating to the purpose of each device (relays, timers, lights, etc.) included in the circuit.

13. Provide a total of ten (10) sets of design memoranda, drawings, and specifications to be used during the design period for review purposes prior to each meeting. This same distribution of final drawings and specifications along with all final design information shall be made at the completion of design. Where possible, this information shall be submitted in electronic format. The information shall include all design notes and calculations, the design memorandum, drawings, and specifications. Electronic information, submitted at the end of (or during) the project, shall be on CD. Provide one set of full-size plans at the completion of final design phase, along with an electronic PDF format set.

14. Performance of a constructability and Value Engineering review by the Design/Builder with participation of Owner. Review each element of construction work with consideration given to feasible methods of construction, constraints to construction (materials, labor, specialty construction, weather, plant operations, other, etc.), design details, time required to complete each element of work, and possible alternatives which would reduce costs.

B. Pre-Construction Services

Pre-Construction Services shall include but not be limited to the following:

1. Make arrangements, schedule, chair and take minutes for all meetings during the design phase portion of the project.

2. Preparation and maintenance of a progress schedule throughout the duration of the design and construction phases is required. The schedule requirements are described in the General Conditions and Section 1300 of the Specifications. The initial schedule for this project must focus on completing work necessary to file the

necessary permit applications and procurement of necessary equipment and materials to meet the Contract Times.

3. Preparation and agreement of the Target Cost of Construction. The Target Cost is to be mutually agreed between the Owner and Design/Builder on an open book basis (with costs established upon the principles of Cost of Work under paragraphs 10.01 to 10.03 of the General Conditions) during the course of the design development. Upon reaching stated percentage completion of the design, including reconciliation of Owner's comments, the Design/Builder shall prepare and present the Target Cost for Owner's agreement.

   Target Cost Development:

   General: As a minimum, the Target Cost shall be prepared and presented in general conformance with the Sixteen (16) Division Format of the Construction Specifications Institute (CSI) and/or by Area of Work as defined in the Estimated Cost of Construction template form; the final content and format is to be agreed with the Owner. Full description of the Target Cost arrangement is provided in the Supplementary Conditions and the Agreement.

   A minimum of three (3) quotations or proposal from Owner-approved suppliers, vendors, manufacturers, subcontractors, etc. shall be obtained to set the target cost for all equipment, materials, products, and subcontracted labor and services. Receiving less than three (3) quotations or proposals is acceptable when approved by the Owner or in cases where the products or services of additional or other suppliers, vendors, manufacturers, subcontractors, etc. are not deemed to be comparable or do not meet the project requirements. The lowest responsive quotation or proposal shall be used to set the cost unless approved by the Owner. The cost for self performed work shall be agreed upon pursuant to SC 10.01. An amount for the Design/Builder's risk/contingency may be included as set forth in the Agreement.

   The Design/Builder shall submit the Target Cost to Owner and include a cover letter detailing the basis of the Target Cost, CSI and/or Work Area estimates and all supporting documentation that shall be clearly listed, labeled and itemized.

   Target Cost shall be developed as follows:

   A. Preliminary Target Cost shall be developed at the 30% design completion stage. Quotations and proposals shall be based on and reference the 30% design documents and shall be specific to model, size, material, etc. as applicable. "Budgetary" quotations or proposals may be used to develop costs if the design of that item or discipline has not progressed to the point where more specific quotations or proposal can be furnished.

   B. The Target Cost shall be developed upon completion of the 60% design, including incorporation of Owner's comments. Quotations and proposals shall be based on and reference the 60% design documents and shall be specific to model, size, material, etc. as applicable. The quotations and proposals shall be accurate, complete and remain valid for a minimum of 60 days and be ready for execution by the Design/Builder. "Budgetary" quotations or

proposals may not be used to develop the Target Cost unless approved by the Owner. In such instances, the budgetary quotation may be used as a "place-holder" to assist in setting the Target Cost at the discretion of the Owner and will be subject to revision once appropriate quotations or proposal can be obtained.

4. Preparation of a detailed construction sequence and logistics plan describing how the proposed facilities will be constructed and placed in-service while keeping existing facilities in-service as necessary. The plan shall consider seasonal limitations and shall specifically define all partial or full outages (including electrical) with estimated time for each outage as well as details on proposed time of day (i.e. regular working hours or evening/weekend hours), proposed time of year (i.e. during peak or off-peak demand seasons) and any special precautions, actions, temporary facilities, etc, that shall be required to safely complete each outage. The plan must be reviewed and approved by Owner to ensure that operations of any existing facilities will be properly maintained during construction. The plans are to show, at a minimum, the scheduled completion of construction on a calendar quarterly basis. Cost associated with keeping the plant on-line as a result of this plan shall be included in the Cost of Construction. As a consequence, the detailed construction sequence and logistics plan must be completed as part of the 60% design.

5. Provide constructability reviews at the 15%, 30%, 60%, and 90% of the design development phase. Review each element of construction work with consideration given to feasible methods of construction, constraints to construction (materials, labor, specialty construction, weather, plant operations, etc.) design details, time required to complete each element of work, and possible alternatives which would reduce costs, and maintain the level of quality expected by the Owner.

   The reviews shall include the appropriate designers, the Owner, and subcontractors if required as participants.

   Include providing the net cost and or time savings associated with each suggested change or modification to the design. Maintain a log tracking each suggestion with the results pertaining to cost and or time savings and acceptance/partial acceptance/rejection.

6. Performance of a bidability review with participation of Owner. Review the breakdown of the work into bid packages that will yield the most cost-effective construction program with consideration given to the availability of qualified subcontractors and vendors. Develop interest in the project from prequalified subcontractors and vendors.

7. Maintain electronic communication capabilities throughout the design and construction phases of the project.

   The Web browser that you utilize must be capable of handling file attachments, and your e-mail must be MIME (Multipurpose Internet Mail Extensions) compatible in order to send file attachments without the need to encode/decode. Additionally, all electronic data files (word processing documents, spreadsheets, etc.) created by American Water will be prepared using Microsoft Office, and the Consultant must have the ability to read these file formats. It is preferred, but not mandatory, that the

consultant also create all data files that may need to be shared via the Web or e-mail in Microsoft Office format.

8. Identify the permits that are required for construction phase of the project, and prepare the necessary applications, and secure these permits. Provide the Owner with information regarding the approximate length of review time for each permit, and any special requirements that could delay this process. Provide all information required for the permit application and submit the fees required. The Owner will reimburse the Design/Builder for all permit application and permit fees at their direct cost. Include but not limited to the Building Permit, electrical, etc. including wastewater discharge if required.

C. Design Professional Services – Construction/Operation Phase

Design Professional Services-Construction/Operation Phase must include the following services:

1. Attendance at construction progress meetings, resolution of construction problems related to the design, and review and interpretation of the design.

2. Shop drawing review and approvals including review and approval of resubmittals, and maintenance of a shop drawing log indicating dates received, returned, and status.

3. Preparation of supplementary detailed working drawings, specifications, and written instructions or meetings as necessary throughout the construction period to interpret the contract plans and documents and to resolve changes brought about by actual field conditions encountered.

4. Provide the services of the I&C Staff Engineer or Subconsultant to witness the factory acceptance test (FAT) of the assembled I&C system prior to the system's shipment from the factory to the job site. The first goal is to ensure that the system has been assembled properly and is in proper working order. This will include testing of each individual I/O point and should be witnessed by the I&C Staff Engineer. The second goal is to simulate and test the control logic, and this portion of the FAT should be attended by the Design Project Manager/Engineer or someone familiar with the details of the process design and operation of the facility. Additionally, provide the services of the I&C Staff Engineer for site visits to review and inspect the instrumentation and wiring of field mounted instruments, resolution of problems, initial calibration and testing, and system start-up.

5. Provide the services of the Design Project Manager/Engineer who will participate in and observe each process and/or phase of initial operation of the project (start-up) and review operation and performance tests required by the contract specifications. At least five (5) days should be allotted for on-site start-up services and resolution of initial operating problems. Engineers from all of the engineering disciplines shall be made available to resolve start-up issues as required, and also to resolve problems which may arise during the construction period allow ten (10) site visits for these services.

For all steel tank construction, Tank Industry Consultants will be performing the following activities under separate contract:

a. Shop Drawing Review
b. Shop Observations
c. Foundation Observations
d. Erection Observation And Weld Radiographic Testing
e. Resident Painting Observation

6. Preparation and submittal of electronic record drawings within two (2) months after start-up. The record .dwg files shall conform to the Company's AutoCAD standards. If it is found that final documents do not conform to the Company's AutoCAD standards, the Consultant shall revise the final .dwg files at the Consultant's cost. Data, information, sketches and working drawings, to be incorporated with the record drawings, shall be provided by the Design/Builder. The record drawings shall include all above and below grade changes from the original design drawings for all engineering disciplines. Changes made to reflect the as-installed conditions shall be made in the same level of detail and to the same degree of drafting quality as the original design drawings. The I&C engineer must review record drawings prepared by the wiring contractors to verify their accuracy prior to substantial completion. Reference Division 1 of the specifications for additional information.

7. Provide three (3) copies of an operation and maintenance manual containing operating, maintenance, and repair information from manufacturer's submittals. The O&M manual shall also contain the final narrative description of the operation of the proposed facility, and a complete description of start-up and shut-down procedures. The O&M manual shall be bound in 3-ring binders and indexed with tabs according to major process designations in the order of the treatment process. Four (4) complete electronic copies of the final O&M manual shall also be provided on CD. An initial draft of the O&M manual, without manufacturer's data, shall be submitted for review at approximately the 50% point of construction completion. The complete O&M manual containing all manufacturer's data shall be submitted at the 95% point of construction completion but no later than one (1) month before scheduled start-up.

8. Provide the services of the Design Project Manager/Engineer for a one (1) day inspection of the facilities approximately twelve (12) months after they are placed into operation. The Design Project Manager/Engineer shall provide a written report summarizing warranty repairs that are necessary, as well as any operational modifications that are recommended to optimize performance.

INDIANA AMERICAN WATER COMPANY
KOKOMO DISTRICT

SHERIDAN WATER TREATMENT FACILITY

DESIGN CONCEPT

INDIANA-AMERICAN WATER COMPANY
153 N Emerson Avenue
Greenwood, Indiana 46143
June 2022

ATTACHMENT A
PROJECT BACKGROUND

A. INTRODUCTION

Indiana-American Water (INAW) provides water service to approximately 1,400 customers in its Sheridan service area (Kokomo District) in Hamilton County, Indiana. The service area includes the Town of Sheridan. The total demand averaged 0.21 million gallons per day (mgd) in 2021. The historic maximum day usage of 0.46 mgd occurred in November 2020.

The District obtains its water supply from three groundwater wells at the existing water treatment facility which is located on the east side of Sheridan.

The total production capacity of the three wells is 1.85 mgd based on operating experience. The firm capacity of these wells is 1.12 mgd with the largest well out of service. The groundwater is treated by aeration, chemical oxidation, and filtration. Gaseous chlorine is used for chemical oxidation and disinfection, polymer is used as a filter aid, and blended ortho/polyphosphate is used for corrosion control. Due to naturally occurring ammonia in the groundwater, the system currently utilizes chloramines as the means of distribution system disinfection.

The Sheridan system produces high quality water that meets or surpasses all applicable US Environmental Protection Agency (EPA) and Indiana Department of Environmental Management (IDEM) standards.

To satisfy the treatment requirements, filtration, chemical treatment and pumping are required. INAW owns property for the proposed Water Treatment Facility (WTF) at 801 East Second St, Sheridan, Indiana. The WTF shall provide an immediate firm capacity of 1.5 mgd/rated capacity of 2.0 mgd, expandable to a rated capacity of 4.0 mgd.

B. EXISTING SYSTEM CONFIGURATION

The existing facility has remote operation and monitoring capability through a SCADA system. The SCADA system consists of an Allen Bradley remote telemetry unit (RTU) linked via radio telemetry to a human-machine interface (HMI) computer at the District office located in Kokomo.

Company personnel perform daily laboratory analyses on grab samples to assess raw and finished water iron and manganese, pH, phosphate, as well as finished water chlorine residuals and fluoride concentrations. Weekly samples are performed for alkalinity and hardness. The analyses are performed at the laboratory located at the District office.

C. WATER QUALITY

The source water has consistent levels of iron, manganese and ammonia as shown below.

	Average	Maximum
Iron, mg/l	2.5	3.3
Manganese, mg/l	0.08	0.15
Ammonia, mg/l	1.2	1.5

There are indications of natural organic matter being present in the existing groundwater. In the past, testing for trihalomethanes and haloacetic acids has found levels close to 50% of the MCL for these disinfection byproducts (DPBs), Management of tank turnover and use of naturally occurring ammonia to form chloramines has resulted in a substantial decrease of these DBPs, but it is uncertain whether or not this is an ongoing water quality concern, and further evaluation is necessary.

Additional water quality sampling and analysis are required for design considerations of the proposed water treatment plant processes. The Design/Builder shall be responsible for all additional water quality sampling and analysis. This may be completed during the Design Memorandum preparation phase after issuance of the Notice To Proceed.

D. TREATMENT FACILITY SITE

The proposed WTF will be located at 801 East Second St on approximately 10 acres of property where the existing water treatment facility is also located.

The following utilities are available for the proposed site:

- Electric – Duke Energy
- Gas – Center Point
- Telephone – Swayzee/Fiberhawk
- Digital Data (T-1) Service – Swayzee/Fiberhawk
- Sanitary Sewer –American Water Kokomo Operations

E. EXISTING TREATMENT FACILITY

The existing water treatment facility has a firm capacity of 0.40 mgd and a rated capacity of 0.65 mgd, and employs aeration, chemical oxidation, and filtration for the removal of iron. The existing facility must remain in-service throughout construction of the proposed facility. The water treatment facility site plan drawing is included in Appendix D.

F. DISTRIBUTION SYSTEM

The proposed WTF will connect to the existing distribution system at the existing water treatment facility property.

ATTACHMENT B
DESIGN SCOPE

A. INTRODUCTION

The design and construction of the proposed Sheridan WTF shall be based on the background information outlined above and the following design information. In general, the scope of work shall include the following facilities:

- Raw Water Piping
- Aeration/Detention Tanks
- Horizontal Pressure Filters
- Chemical Storage and Feed Systems
    - Sodium Hypochlorite
    - Polymer
    - Sodium Permanganate (if required)
    - Liquid Ammonium Sulfate (if required)
    - Phosphate for Corrosion Control
    - Truck Unloading Containment
- Treatment Building to House the Chemicals, Electrical Gear, and Maintenance/Parts Storage Room
- Space for Future Treatment Processes for Perfluorinated Compounds
- Finished Water Storage
- High Service Pumping Station
- Backwash Residuals/Recycle Facilities
- Residuals Management
- Office and Administrative Space
- Parking Space for Employees and Visitors
- Electrical Power Distribution Equipment
- Emergency Power Generator
- Instrumentation and Control (I&C) Systems
- Associated Site Work

A listing of acceptable equipment manufacturers is included in Appendix A. Appendix C includes American Water's Engineering Standard for Liquid Chemical Feed Systems (T-2).

B. PERFORMANCE REQUIREMENTS

The proposed WTF shall achieve a high level of finished water quality that complies with all applicable state and federal water quality and treatment requirements. In addition to these requirements, the plant should also achieve compliance with the following:

1. Finished water free chlorine residual of between 0.8 mg/L and 1.5 mg/L suitable for the distribution system.

2. Production of a stable, non-corrosive water. Finished water must allow INAW to comply with the Lead and Copper Rule, and minimize corrosion, precipitation, and deposition within the distribution system.

3. Total finished water iron and manganese levels that are below the respective secondary maximum contaminant levels, as well as the treatment goals of ≤0.10 mg/l for iron and ≤0.02 mg/l for manganese.

4. Fully automated treatment facility capable of unattended operation.

5. Exterior architectural design that is aesthetically pleasing.

6. Minimization of total project lifecycle costs, factoring in both capital and operating costs.

C. GENERAL

Process Summary

1. It is anticipated that treatment will include aeration, detention and pressure filtration with the addition of chemicals as outlined below. Raw water will be pumped to aerators to oxidize iron, as well as strip any supersaturated gases, from the well water supply. To ensure the oxidation process is complete prior to filtration, the water will be retained in detention tanks directly below the aerators. Following aeration, the water will flow by gravity to the pressure filters. Chlorine will be added to the detention tank effluent to further promote manganese oxidation and removal with the manganese dioxide coated filter media. Effluent from the filters will then flow by gravity to a treated water storage tank prior to the distributive pumps. The distributive pumps will pump finished water from the treated water storage tank to the distribution system.

2. As noted, there is naturally occurring ammonia in the source water which could impact the ability to regenerate manganese dioxide coated filter media, and natural organic material in the source water that could require continued use of chloramines to manage DBP formation in the distribution system. The Design-Builder is to evaluate the source water and recommended a design solution to provide the required treatment. As part of their review, the Design-Builder shall contemplate the possibility that future system demands may be met by connection from a system that does not currently use chloramines.

3. Dedicated pumps will provide wash water from the finished water storage tank for filter backwashing. Spent backwash water will be sent to onsite backwash detention basins, from which supernatant will be discharged to the adjacent Little Cicero Creek.

4. Space shall be allocated in the Treatment Building for the following Chemical Feed Systems: sodium hypochlorite for disinfection, sodium permanganate for oxidation (if required), polymer for aid in filtration, liquid ammonium sulfate for chloramine disinfection (if required), and phosphoric acid for corrosion protection in the distribution system and customer plumbing.

5. The Treatment Building will be constructed to house the filter face piping, chemical systems, distributive pumps, and ancillary electrical and I&C systems. The building will also include a small laboratory and a utility/storage room.

6. The Treatment Building will include an electrical room and new electric service. The remote telemetry unit and touch-screen interface control panel will be provided in the building.

7. Space shall be allocated for a future treatment process for perfluorinated compounds.

8. The Design/Builder should evaluate alternatives for providing the most cost-effective solution for the proposed WTF.

General Design Criteria

1. *Plant Staffing*: The WTF shall be designed for fully automatic, unattended operation. A supervisory/maintenance staff will make daily visits Monday through Friday. The plant will be unattended on Saturday and Sunday. The plant shall operate 24 hours per day and the control system shall be capable of remote access via INAW's wide area network.

2. *Input/Output Lists*: The Design/Builder is required to develop a complete I/O list based on the final design details.

3. *Acceptable Equipment Manufacturers*: Those provided in Appendix A of the Design Concept and Attachment B to the Recommended Electrical Design Criteria and Standards are manufacturers that are acceptable to INAW. This does not preclude the Design/Builder from suggesting other manufacturers of comparable or higher quality. It is also the Design/Builder's responsibility to recommend other manufacturers to facilitate competition for the specific application.

4. *Critical Equipment Procurement:* Design/Builder shall identify critical equipment with long lead times in the Proposal, and will complete sufficient level of design by the 30% Design Phase to enable release for early procurement.

Common Equipment and Materials

1. *General*: Information regarding specific equipment or materials that are common to many areas of the facility is provided in this section.

2. *Process Piping*: Cement-lined ductile iron pipe unless otherwise noted. Appropriate pressure class pipe shall be provided for all above and below ground piping at the plant. Thickness class CL54 as a minimum shall be provided for all pressurized yard piping on the treatment plant site.

3. *Process Piping Joints*: All onsite below ground pressure-rated process piping shall have properly restrained joints. All onsite above ground (plant) pressure-rated process piping shall have flanged joints. Grooved or Victaulic joints are permissible for above ground piping where substantial cost savings may be achieved. Friction type restrained joints (e.g. Megalugs) are only permitted where required to accommodate buried valves or fittings. Set-screw flanges and retainer glands are not acceptable.

4. *Process Valves*: AWWA butterfly valves. Rubber seats shall be applied to the body. Rubber seats applied to the disc are not acceptable. Use plug valves for waste lines.

5. *Operators for Automatic Process Valves*: Electric operators.

6. *Yard Piping*: Piping to backwash residuals management system and other non-pressure pipe may be PVC or ductile iron.

7. *Motors*: All small (fractional) and medium (integral) squirrel-cage induction motors shall be premium efficiency, "NEMA Premium" rated, and shall be designed, constructed, and tested in accordance with NEMA MG-1 and IEEE 112, Test Method B. All motors, ½ horsepower and larger, shall be rated at 480 volts, three-phase. All motors less than ½ horsepower will be rated 120 volts, single phase.

8. *In-plant Water Supply Piping*: Copper inside filter room, and Schedule 80 PVC at all other locations.

9. *In-plant Plant Water Supply Valves*: Bronze ball valves unless otherwise noted.

10. *Backflow Preventers*: Reduced pressure zone type required on all individual connections to in-plant potable water. A common backflow preventer may be provided on the plant water supply. A full-size by-pass line shall be provided, also equipped with a backflow preventer.

11. *Metering*: Magnetic meters with electronic, smart-type type transmitters are preferred. Insert type and strap on type flow meters of any type are not acceptable. The manufacturer's recommendations for minimum straight runs of pipe upstream and downstream of the meter will be strictly adhered to. Locate meters in above ground accessible building locations wherever possible. Below ground meter vaults, if required, shall provide adequate space for meter maintenance and adequate ventilation for confined space requirements.

12. *Level Monitoring*: Ultrasonic level probes for liquid level monitoring.

13. *Sampling Locations*: Specifics defined in each section below. On-line analytical instruments should be located as close as possible to the sample point. Manual taps shall be provided at all sample points to allow for a grab sample. Velocities in sample lines where pumping is required should be approximately 5 ft/sec. Provide insertion-type paddle-wheel flow sensors on the discharge of all sample pumps. Use PVC pipe for all sample lines.

14. *Painting*: All exposed metal piping to be color coded per Ten State Standard requirements. All mechanical equipment and other potentially corrosive surfaces shall be coated. PVC or other flexible piping shall either be purchased in the appropriate color (if available) or wrapped or striped with appropriate colored tape. Any and all PVC piping exposed to sunlight shall be painted to protect from UV degradation. Stainless steel is not acceptable in chlorinous atmospheres.

D. SYSTEM DEMANDS / PLANT CAPACITY

General Design Criteria

1. *Maximum Day*: 1.5 MGD Firm Plant Capacity / 2.0 MGD Rated Plant Capacity

2. *Average Day*: 1.02 MGD

3. *Minimum Day*: 0.72 MGD

4. *Hydraulic Capacity*: 4.0 MGD for all piping and facilities based on all present and future pressure filters simultaneously operating at design capacity.

5. *Operating Capability*: All components of the plant shall be fully capable of operating over the specified range of flows per manufacturer's recommendations.

6. *Redundancy*: Provide for all major process mechanical equipment such that the plant could continue to operate at firm capacity if a single largest process unit were out of service.

7. *Optimum Efficiency of Mechanical/Electrical Equipment*: Based on average day demand.

8. *Expandability:* The plant shall be designed for future capacity expansion up to a rated capacity of 4.0 MGD.

E. WATER TREATMENT FACILITY SITE

General Design Criteria

1. *Roadways*: Concrete paving. The existing gravel drive from the Sheridan Wastewater Treatment Facility to the new water treatment facility is to be paved.

2. *Entrances*: Automated sliding gate with proximity card access. Provide space for one semi-trailer to park in driveway before automated sliding gate.

3. *Parking*: Provide parking area for minimum of seven (7) passenger vehicles and four (4) utility trucks.

4. *Landscaping*: Provide landscaping plan for approval by INAW and conforming to local ordinances and standards. Landscaping shall be minimal to provide aesthetically pleasing view from frontage street.

5. *Signage*: Indiana American Water name and logo at entrance. Signage shall comply with local ordinances.

6. *Exterior Lighting*: Provide where required for security and safety purposes.

7. *Security*: See Section N – Building Requirements for additional design criteria related to site and plant security.

F. SOURCE OF SUPPLY

General Design Criteria

1. *Summary*: One new production well will be constructed and one existing production well will be retired.

2. *Location*: The new well will be centered between Wells #5 & #6.

3. *Type of Pumping Units*: Vertical Turbine Well pumps.

4. *Capacity of Pumping Units*: 400 gpm

5. *Drivers for Pumping Units*: Full voltage motor starter.

6. *Pumping Unit Appurtenances*: Pump discharge flow meters, air and vacuum valves, and a pressure gauge on the discharge of each individual pump. Butterfly isolation valves on the discharge of each pump.

7. *Motor Voltage Monitoring*: Motors for all major equipment shall have microprocessor based motor voltage monitors. The monitors shall protect against phase loss, phase reversal, voltage unbalance, and under voltage on any one or more phases. The monitors shall reactivate after the power line conditions return to an acceptable level. Trip and reset delays shall prevent nuisance tripping due to rapidly fluctuating power line conditions.

8. *Well Head Enclosure*: Well heads shall be elevated to be above the 500 yr flood elevation. Well head and enclosure shall be designed to allow access for well pump removal and well maintenance activities.

Raw Water Transmission Mains

1. *General*: A raw water transmission main shall be installed to convey on-site source of supply to the new treatment facility. Provision shall be made to extend the raw water transmission main to the east and west edges of the water treatment facility property for development of future off-site source of supply.

2. *Pipeline Size:* The transmission main shall have a carrying capacity of not less than 3.5 MGD at a maximum velocity of 6 ft/s.

3. *Material of Construction:* The pipeline shall be constructed of cement-lined ductile iron. Buried steel lugs, rods, brackets, and flanged joints are not permitted. The DESIGN/BUILDER shall also evaluate if the use of high-density polyethylene (HDPE) piping in lieu of ductile iron would result in significantly lower cost and/or superior performance/longevity. However, base proposal pricing shall be based on ductile iron piping.

4. *Thrust Restraint:* Provide all plugs, caps, tees, valves and bends with mechanical restrained joint pipe; proprietary to the pipe manufacturer. Concrete thrust blocks shall be used at connections to existing piping. Thrust blocks shall be appropriately positioned so that the resultant thrust force is contained while keeping the pipe and fitting joints accessible for repair. Restrained joints shall be used within pumping station and treatment plant battery limits.

5. *Corrosion Prevention:* Wrap the pipeline with polyethylene bagging installed in accordance with the pipe manufacturer's instructions. As part of the design effort, DESIGN/BUILDER shall sample soils along the selected route and analyze the potential for corrosion to ductile iron pipe in accordance with AWWA C105.

Chemical Application

1. *Location*: Provide chemical application prior to filtration.

2. *Water Quality Sampling*: True raw water sample taps at each wellhead.

3. *Online Monitoring*: Online sample points, which will be directed to a sample sink, shall be provided in the following locations:

   a. upstream of the filters, into the common raw water main

G. AERATION

General Design Criteria

1. *Type of Aerator:* Forced draft, tray type. Wood slats in the aerators are not acceptable.

2. *Minimum No. of Aerator Units:* One; at least one future

3. *Location/Orientation:* Mount aerator(s) on top of a suitable sized detention tank. Detention tank shall have sufficient side water depth to allow gravity flow through the pressure filters at the maximum water level in the finished water reservoir.

4. *No. of Blowers:* 2 per aerator

5. *Drivers for Blower Unit:* Constant speed electric motors.

6. *Detention Tank Number:* TBD

7. *Detention Tank Sizing:* 30 minutes at 4.0 mgd at full capacity buildout.

8. *Detention Tank Material:* Steel or concrete.

9. *Aeration System By-Pass:* Provide a by-pass system to allow the plant to remain in-service with chemical oxidation while the aerator and/or detention tank are out of service for maintenance/repairs.

10. *Expandability:* Provide space and buried piping connections to allow for future construction of additional aeration/detention tank systems.

Chemical Application

1. *Location*: An application point for sodium hypochlorite shall be provided at the

top of the detention tank.

2. *Water Quality Sampling*: Provide a common raw water sample tap immediately upstream of the aerator. If Backwash Equalization facilities are provided, a separate sample tap shall be provided for the recycle water.

3. *Online Monitoring*: Online sample points, which will be directed to a sample sink, shall be provided in the following locations:

    a. Upstream of the finished water storage tank, downstream of the sodium hypochlorite, phosphoric acid and fluoride feed points with adequate distance for complete mixing.
    b. Filter effluent

H. FILTRATION

General Design Criteria

1. *Type of Filters*: Two-cell, horizontal pressure filters.

2. *No. of Units*: Three (3) minimum with a total of five (5) at total facility expansion.

3. *Capacity of Each Unit*: 700-1050 gpm. Individual unit capacities and sizing of the proposed filters shall be equal to provide for economies of scale.

4. *Maximum Loading Rate of Units*: In accordance with Ten States Standards, 3.0-4.0 gpm/sf with one filter cell out of service.

5. *Vessel Diameter*: 10 foot, minimum.

6. *Vessel Materials of Construction*: SA516 Grade 70 carbon steel with suitable NSF-certified epoxy lining system

7. *Pressure Rating*: 100 psi minimum. The Design/Builder shall evaluate well pump shut-off head capacities and distribution system operating pressures to determine final pressure rating requirements. Suitable pressure/air relief devices shall also be provided.

8. *Type of Underdrain*: Concrete-encased header/lateral system with nozzles.

9. *Media*:

    a. Manganese oxide coated sand – 18 inches (to be confirmed during design phase)

    b. Anthracite – 18 inches (to be confirmed during design phase)

    Effective media size to be selected in accordance with AWWA standards to minimize head loss and ensure adequate bed expansion during filter backwashing. Pilot testing of the filter media shall be performed by the Design-

Builder to determine type of manganese oxide coated filter media for optimum iron and manganese removal.

10. *Media Removal/Installation*: Provide 24" access manway for each filter section to assist in the change out of media.

11. *Location*: The pressure filters should be located outdoors, with the dished head containing the connection nozzles, valves, and vessel face-piping inside the proposed Treatment Building.

12. *Method of Operation*: Rate of flow control to match combined well production rate.

13. *Influent Metering*: Magnetic meters with electronic, smart-type type transmitters with adequate upstream and downstream straight runs of pipe.

14. *Loss of Head*: Loss of head measurement shall be provided by electronic, smart-type type differential pressure transmitters.

15. *Backwash Control Schedule*:
    - Time
    - Differential pressure (head loss)
    - Effluent turbidity
    - Filter Run Hours

16. *Water Quality Sampling*: Individual and common filter effluent sample taps.

17. *On-Line Monitoring*: One common filter effluent turbidimeter.

18. *Humidity Control in Filter Room/Gallery*: Provide air conditioning or dehumidification in the filter room.

<u>Backwash Capabilities</u>

1. *Method*: Means to operate in filter-to-waste mode shall also be provided.

2. *Means of Supplying Wash Water*: Supply is from wash water supply pumps drawing water from the onsite storage reservoir. The wash water supply pumps shall be co-located with and similar in style as the distributive pumps. Two wash water pumps (one duty and one stand-by) shall be provided.

3. *Capacity of Wash Water Supply System*: Adequate to provide a maximum bed expansion of at least 30% (approximately 17 gpm/ft^2 - verify with filter media supplier).

4. *Method of Backwash Rate Control*: Magnetic meter with electronic, smart-type type transmitters and globe-style rate of flow control valve.

Chemical Application

1. *Location*: Application points shall be provided in the following locations:

    a. On the common piping between the detention tank and the filter influent for sodium hypochlorite, filter aid polymer, and sodium permanganate (if required).

    b. On the common piping between the filter effluent and the finished water storage tank for sodium hypochlorite, liquid ammonium sulfate (if required), and phosphate for corrosion control.

2. *Water Quality Sampling*: Filter effluent prior to chemical feed points.

3. *On-Line Chemical Monitoring*: On-line sample points, which will be directed to analyzers and/or a sample sink, shall be provided in the following locations:

    a. Upstream of the filters after the sodium hypochlorite application point, upstream of the finished water storage tank, downstream of the sodium hypochlorite, phosphoric acid and fluoride feed points

I. FINISHED WATER STORAGE

General Design Criteria

1. *Summary:* Finished water storage will be provided for plant flow equalization and wash water storage.
2. *Configuration and sizing criteria*: The finished water storage tank shall be an at-grade structure sized to provide approximately 500,000 gallons of storage. Considerations for backwash must be included in clearwell sizing. Design/Builder will be responsible for final sizing of the finished water storage tank.

3. *Materials of Construction:* To be determined by the Design/Builder during design. Design/Builder shall provide costs for both welded steel and post-tensioned concrete finished water storage tanks.

4. *Expandability:* Provide space and buried piping connections to allow for future construction of additional finished water storage tank systems.

Chemical Application

1. *Location*: A application point for sodium hypochlorite shall be provided downstream of the finished water storage tank.

2. *Water Quality Sampling*: Effluent from the finished water storage tank just after the sodium hypochlorite feed point.

3. *On-Line Chemical Monitoring*: On-line sample points, which will be directed to analyzers and/or a sample sink, shall be provided in the following locations:

- Downstream of the finished water storage tank.

J. DISTRIBUTIVE PUMPING FACILITIES

General Design Criteria

1. *Type of Pumping Units*: Either can-style vertical turbine pumps or horizontal split-case pumps. Design/Builder shall evaluate different type of pumps suitable for use in the proposed system, including recommendations for impeller materials of construction to ensure long life.

2. *Minimum No. of Pumping Units*: Three (3).

3. *Capacity of Pumping Units*: Provide a minimum firm capacity of 1.5 mgd with one pump out of service. Provide space for additional distributive pump(s) for a future total pump capacity of 4.0 mgd. Capacity and arrangement to be determined by Design/Builder with input from INAW during design phase. All pumps shall utilize variable frequency drives for flow adjustments.

4. *Drivers for Pumping Units*: Premium efficiency inverter duty electric motors and adjustable frequency drives.

5. *Pumping Unit Appurtenances*: Suction and discharge butterfly isolation valves, check valve, air release valve, and differential pressure transmitters between the suction and discharge of each individual pump as appropriate. A common pressure transmitter shall be provided on the discharge header. Design shall provide access to pump for maintenance and removal or a means of removal for maintenance purposes.

6. *Motor Monitoring Equipment*: Motors controlled by adjustable frequency drives shall be furnished with at least one automatic reset winding temperature switch per phase. Temperature switch contacts shall be normally closed and rated 5 amps at 120 volts ac. The contacts shall be wired in series with the ends leads brought out to the motor terminal box.

7. *Finite Element Analysis*: The Design/Builder shall perform a finite element analysis for all pumping units to ensure that the design addresses potential vibration and natural frequency concerns. Since more than one pump manufacturer will be specified, the development of the finite element model shall begin during the design phase based on assumed pump and motor manufacturers and be completed after the specific pump and motor manufacturers have been selected. The analysis shall encompass one of each sized pump that is selected in the final design.

8. *Location*: The distributive pumps and backwash pumps shall be located within the Treatment Building. The building shall be configured to permit interior access to distributive pump room from the administrative portion of the building.

9. *Finished Water Pipeline*: Design of the on-site portion of the finished water

transmission mains shall be included in the Design/Builder's scope of work. The Design/Builder's responsibility will end at the property line. Finished water transmission mains from the property line to the distribution system will be provided by others. Design/Builder shall coordinate the termination point with INAW. At minimum, finished water transmission mains will be upsized between the new treatment facility and the point of connection to the Sheridan distribution system (at the entrance to the Wastewater Treatment Facility on Second Street). It is anticipated that an additional water transmission main will be extended to the east edge of the treatment facility property line.

10. *Finished Water Metering*: Provide a common magnetic flowmeter, with electronic, smart-type type transmitters.

11. *Surge Control*: Design/Builder shall perform a complete surge analysis of the distribution pumping system. Normal start/stop surge control shall be by means of pump discharge control valves while power outage transients shall be controlled by a surge anticipator valve discharging to the pump suction piping or by other means as indicated in the surge analysis. INAW will provide all information pertaining to the distribution system piping to the Design/Builder for the analysis.

K. CHEMICAL FEED FACILITIES

General Design Criteria

1. *Applicable American Water Engineering Standard*: T-2 (Liquid Chemical Storage, Feed, and Containment). The intent of the standard (i.e. spill containment, overfeed prevention, etc.) must be met for all designs. A copy of this standard is included in Appendix J.

2. *Dosages*: Dosage requirement shall be provided during the design phase by INAW.

3. *Location*: Chemicals will be stored in the proposed treatment building. The chemical feed facilities shall be located as close to the points of application as possible, and totally isolated (separated by walls) from the rest of the treatment plant. Design enclosures to provide fire rated protection if required by code.

4. *Orientation of Chemical Feed Equipment*: All rooms shall be laid out such that the need to step over piping or conduit is eliminated or minimized. All rooms shall also be oriented similarly such that safety devices (eyewashes) are located in a common place (such as near the door) in each room.

5. *Access*: All enclosed rooms with non-bulk storage shall include secure double doors for loading drums or bags into and out of the room. Access into chemical containment areas shall be by stairs with railings (no ladders) up and over the wall or down into a recessed containment area. Consideration for removal and replacement of bulk storage tanks should be provided in the design. For non-bulk storage rooms, hand truck access ramp systems shall be designed with a maximum 1:12 slope if possible. Safe access to equipment mounted to the top of any tanks shall be provided via platforms and ladders.

6. *Operating Range of Equipment*: All chemical feed equipment shall be fully capable of operating over a feed range corresponding to max day/max dosage down to min day/min dosage. If necessary, a second set of pumps shall be provided.

7. *Operation of Equipment*: All chemical feed equipment shall be flow paced. Cascade loop capabilities shall be provided as specified below. The sample supply for all analytical devices used for cascade loop control shall be minimized to prevent loop delays.

8. *Redundancy*: All chemical feed equipment shall have 100% redundancy such that one system can be isolated while the chemical continues to be fed from the redundant system under all possible flow rates and dosages. This redundancy applies to all components of the feed system including appurtenances such as pumps, anti-siphon valves, etc. but does not apply to bulk and day tanks, drums, scales, and calibration columns.

9. *Tank Sizing*: The required day tank sizes per Engineering Standard T-2 shall consider that the bottom and top of the tanks are typically not useful storage.

10. *Chemical Bulk Storage*: Except for bulk sodium hypochlorite, shall be based on 30 days of storage at the total plant capacity of 6.0 MGD, plus a factor of safety as set forth in Engineering Standard T-2. Bulk sodium hypochlorite shall be based on 15 days of storage at the total plant capacity of 6.0 MGD, plus a factor of safety as set forth in Engineering Standard T-2. Consideration shall be given to tank volumes that will accept full load chemical deliveries.

11. *Drum Feed Systems*: Provide a single scale for mounting a suitably sized day tank.

12. *Transfer Pumps*: Sized to limit manual transfer time to no more than two minutes, where practical. The use of automatic shutoff shall be provided for large day tanks where operator fatigue could be an issue. A drum pump should be provided for transferring chemicals from portable delivery drums to a day tank.

13. *Bulk Tank Fill Connections*: Lockable with shutoff valves and appropriately labeled. Chemical spill containment during the unloading of bulk chemicals should be based on the entire tank truck volume. The largest tank truck volume is 5,000 gallons for hydrofluosilicic acid. Containment system shall be designed to allow isolation from storm water drainage during tank truck unloading operations.

14. *Priming*: All metering pumps shall be oriented so that they have flooded suction. Sodium hypochlorite metering systems shall have liquid conditioning valve off-gas relief systems.

15. *Flushing Systems*: Provide flushing tap at the point of entry into the chemical piping system (downstream of all special valves) for each feed system. Provide means for flushing suction piping.

Chlorination System

1. *General*: A bulk sodium hypochlorite system shall be provided in the Treatment Building. The Design-Builder shall design the sodium hypochlorite system to provide breakpoint chlorination for neutralization of the naturally occurring ammonia in the source water. For the current project, owner may elect to utilize bulk storage tanks sized for continued chloramine operation, and replace with larger bulk storage tanks in the future. The Basis of Design Memorandum shall discuss the required storage and dosage rates for both operating modes.

2. *Specific Chemical*: Sodium hypochlorite

3. *Product Form*: Liquid

4. *Product Density*: 12.5%

5. *Type of Storage Required*: 15 days of bulk storage

6. *Points of Application*:

    a. Detention tank influent, dual application points with manual flush/relief

    b. Combined filter influent, dual application points with manual flush/relief

    c. Combined filter effluent, dual application points with manual flush/relief

    d. Downstream of the finished water storage tank, prior to the distributive pumps, dual application points with manual flush/relief

7. *Feed Method*: Peristaltic metering pump(s)

8. *Chemical Dose*: 1.0 mg/L minimum and 3.5 mg/L maximum. To be confirmed during the design phase.

9. *Cascade Loop Control*: Free chlorine residual analyzers (pre, intermediate, and post)

10. *Isolation*: Located in an isolated room with adequate ventilation and no windows. All piping and equipment in room to be suitable corrosion resistant material.

11. *HVAC:* HVAC system shall maintain room temperature between 55°F and 65°F year-round.

Filter Aid Polymer

1. *General*: This chemical feed system will be utilized to feed filter aid polymer.

2. *Specific Chemical*: To be selected during design phase

3. *Product Form*: Liquid

4. *Product Density*: To be determined during design phase

5. *Type of Storage Required*: Day tank and delivery drum storage.

6. *Points of Application*:

    a. Combined filter influent

7. *Feed Form:* Liquid
8. *Feed Method*: Polyblend dilution system with batch mixing tank and peristaltic metering pump(s)

9. *Chemical Dose*: 0.005 mg/L minimum and 0.050 mg/L maximum. To be confirmed during the design phase.

10. *Isolation*: Located in an isolated room with adequate ventilation and no windows. All piping and equipment in room to be suitable corrosion resistant material.

Sodium Permanganate Feed System (if required)

1. *General:* This chemical feed system will be utilized primarily for oxidation of manganese. Pilot testing shall be performed by the Design-Builder to evaluate the benefit of sodium permanganate for the treatment process.

2. *Specific Chemical:* Sodium permanganate

3. *Product Form:* Liquid

4. *Product Density*: 100%

5. *Type of Storage Required*: 30 days of bulk storage.

6. *Point of Application*:

    a. To be determined

7. *Feed Form*: Liquid

8. *Feed Method*: Peristaltic metering pump(s)

9. *Chemical Dose*: 0.5 mg/L minimum and 1.5 mg/L maximum. To be confirmed during the design phase.

10. *Isolation*: Located in an isolated room with adequate ventilation.

Liquid Ammonium Sulfate Feed System (if required)

1. *General:* This chemical feed system will be utilized to stabilize the chloramine output of the facility to the optimal ratio of 4.5:1 (ammonia to chlorine) for

chloramination.

2. *Specific Chemical:* Liquid ammonium sulfate

3. *Product Form:* Liquid

4. *Product Density*: To be determined during the design phase and verified with product supplier.

5. *Type of Storage Required*: 30 days of bulk storage.

6. *Point of Application*:

    a. Combined filter effluent

7. *Feed Form*: Liquid

8. *Feed Method*: Peristaltic metering pump(s)

9. *Chemical Dose*: To be confirmed during the design phase.

10. *Isolation*: Located in an isolated room with adequate ventilation.

Corrosion Inhibitor Feed System

1. *General:* This chemical feed system will be utilized to feed phosphoric acid.

2. *Specific Chemical:* Phosphoric Acid

3. *Product Form:* Powder or liquid

4. *Product Density*: To be determined during the design phase and verified with product supplier.

5. *Type of Storage Required*: Day tank and dry product or delivery drum storage. If powder form is selected, a mixer is to be provided on day tank.

6. *Point of Application*: Combined filter effluent

7. *Feed Form*: Liquid

8. *Feed Method*: Peristaltic metering pump

9. *Chemical Dose*: 0.5 mg/L minimum to 1.5 mg/L maximum. To be confirmed during the design phase.

10. *Chemical Dose*: To be confirmed during the design phase.

11. *Isolation*: Located in an isolated room with adequate ventilation.

L. TREATMENT RESIDUALS MANAGEMENT

PROPOSAL BASE CONCEPT

Backwash Detention Basins

1. *General*: Spent filter backwash will be sent to onsite backwash detention basins from which supernatant will be discharged to the adjacent Little Cicero Creek. A new NPDES permit will be required for this discharge.

2. *Number of Detention Basins*: To be determined during the design phase.

3. *Size of Detention Basins*: Detention basins shall be sized to contain a volume of ten times the total quantity of wash water discharged during any 24-hour period at rated facility capacity of 4 MGD. Assume 48 hour filter runs.

PROPOSAL MANDATORY ALTERNATE #1 CONCEPT

Backwash Equalization

1. *General*: Spent filter backwash will be treated onsite. Backwash equalization/settling tanks will operate in batch fill, settle, draw mode. The clarified supernatant will be recycled to the common raw water line downstream of the aerator, but prior to the chemical feed points. The remaining settled residuals will be disposed of to the sanitary sewer. The backwash equalization basins must be covered, watertight and have a vent.

2. *Number of Equalization Tanks*: Two (2)

3. *Size of New Equalization Tank*: Size each tank to provide equalization of one complete backwash from three filter vessels, plus a minimum 25% factor of safety.

4. *Decant Mechanism*: Floating.

5. *Backwash Recycle Pump Station*: Provide a separate pump station to recycle clarified backwash wastewater to the head of the plant.

6. *Recycle Pump Type*: Provide redundant pumps.

7. *Recycle Pump Capacity:* 10% max of influent flow

8. *Plant Expansion*: Provide master plan for modifying and/or replacing recycle pumps as additional filters and other treatment units are added.

9. *Recycle PS Appurtenances*: Provide variable speed drives for the backwash recycle pumps. Also provide a recycle flow meter to allow automatic flow adjustment based on a percentage of the raw water flow to the WTP.

10. *Sludge Pump Station*: Provide a separate pump station and force main to route

settled residuals to the Sheridan Wastewater Treatment Facility.

11. *Sludge Pump Type*: Provide redundant submersible pumps.

12. *Sludge Pump Capacity*: To be determined by Designer based on Sanitary Sewer Owner requirements.

13. *Sludge PS Appurtenances*: Provide a magnetic flow meter to measure the wastewater rates and volumes being discharged to the sanitary sewer. Designer shall coordinate pumping system design to satisfy Sanitary Sewer Owner requirements.

M. ELECTRICAL

General

1. *Electrical Design Criteria and Standard:* Refer to Appendix G for detailed electrical design requirements.

2. *Electric Service to the Site:* The existing electrical service to this site may need to be removed and totally replaced under the scope of this project due to the upgrades outlined in the RFP. A new (larger capacity) service or a conversion from 230V 3-phase power to 480V 3-phase power may be required. The Design/Builder shall provide all coordination and construction activities associated with this effort and provide the new installations as outlined.

3. *Number of Services*: 1

4. *Type of Feed*: Duke is the local energy provider. Design/Builder shall coordinate directly with utility supplier but shall keep INAW informed of any design decisions that may have a financial impact on INAW's electric bills. Design/Builder shall account for lightning protection for buildings and other structures as appropriate.

5. *Electric Meter*: Primary electric meter shall be designed in accordance with electric utility requirements. Sub-metering shall be provided to allow INAW to measure and record power usage and demand from major equipment components.

6. *Surge Suppression*: Design using the appropriate level of transient threat as defined in ANSI/I.E.E.E. Standard C62.41. All transient voltage surge suppression equipment shall be tested in accordance with the appropriate parts of ANSI/I.E.E.E. Standard C62.45 and UL Standard 1449. The Design/Builder shall review the following issues and summarize their findings to INAW: length and amplitude of spikes caused by capacitor switching, recloser switching, or other pieces of equipment that can cause problems on a customer's power system and provide the appropriate protective equipment on INAW's side of the power system.

7. *Voltage Drops*: Develop a protection scheme to ensure that the transfer switch

and other items (such as induction motors) are adequately protected from under voltage, voltage unbalance, contact chatter, etc.

8. *Harmonic Evaluation*: Perform harmonic analysis in accordance with IEEE 519 at each site where variable frequency drives are used.

9. *Grounding*: The electrical system and equipment will be grounded in compliance with the National Electrical Code. Conductors shall be No. 4/0 AWG copper, minimum, for interconnecting ground rods and for connection to transformers and MCC's and other major electrical equipment. A grounding ring will be required for the proposed building and major structures. Electrical equipment, devices, panelboards, and metallic raceways will be connected to the ground conductors.

Motor Control Centers

1. *Type of Equipment*: 600V, 3-phase, 4-wire plus ground operating at 60Hz. All components are U.L. listed. MCC equipment shall consist of standardized, freestanding structures bolted together for form a single dead-front panel assembly containing combination motor control units; feeder units; metering, relaying, and interlocking and miscellaneous control devices and will be of the per definitions in the latest edition of NEMA ICS 3 and UL 845.

2. *Factory Testing of Equipment*: Witnessed by INAW or by certified test report. This will be determined during detailed design.

3. *Enclosure Type*: NEMA 1. Design/Builder shall provide HVAC equipment designed with air filtration to ensure that particulate matter cannot track on to pieces of electrical equipment.

4. *Heat Dissipation*: Design/Builder shall provide for adequate heat dissipation based on guidelines listed in I.E.E.E. Standard 141, Typical Efficiencies of Electrical equipment. Calculations shall be submitted to INAW prior to final design specification review.

5. *Main Bus Capacity*: Design for 1.1 times present connected and identified future loads for other potential future loads.

6. *Momentary and Interrupting Ratings*: Determined by the Design/Builder during detailed design. Calculations must be supplied to INAW before final specifications are approved. Calculations can be computer or other INAW approved method per the guidelines listed in I.E.E.E. 141 (latest edition). The Design/Builder shall provide documentation of all assumptions for machine impedances, cable impedances (both resistance and inductance), and transformer impedances to complete the computations. Since INAW prefers a grounded secondary service, both balanced and unbalanced fault computations will be prepared and presented to INAW for review and approval. The equipment vendor will make detailed final calculations during construction and shop drawing approval. The Design/Builder shall develop fault conditions under minimum, maximum, and average power consumption scenarios based on the way the plant is to be operated. The Design/Builder shall also develop fault scenarios with local generators used instead of the electric utility.

7. *Circuit Breaker Compartments and Circuit Breakers*: Control center disconnects shall be three-pole, single-throw, 600-volt, molded-case air circuit breakers. Circuit breakers of combination starters shall be magnetic motor circuit protector type. Feeder circuit breakers shall be thermal-magnetic type and shall be manually operated with quick-make, quick-break, trip-free toggle mechanism.

8. *Power Monitoring*: Provide microprocessor-based GE Multi-Lin unit on main incoming feed. Unit shall compute voltage, amperes, power factor, kilowatt-hour, etc. Communications will be ethernet communication back to a port on a plant remote terminal unit (RTU). Provide individual power transducers on all rotating loads larger than 25 horsepower using Load Controls Inc. PH-3A or equal. Transducers shall be wired to plant RTU for monitoring, trending and archiving.

9. *Surge Suppression*: Transient voltage surge suppressors shall be provided integral to each MCC assembly. Design using the appropriate level of transient threat as defined in ANSI/I.E.E.E. Standard C62.41. All transient voltage surge suppression equipment shall be tested in accordance with the appropriate parts of ANSI/I.E.E.E. Standard C62.45 and UL Standard 1449. The Design/Builder shall review the following issues and summarize their findings to INAW: length and amplitude of spikes caused by capacitor switching, recloser switching, or other pieces of equipment that can cause problems on a customer's power system and provide the appropriate protective equipment on INAW's side of the power system.

10. *Main Circuit Breaker*: Microprocessor based with adjustable trip and delay settings for long-time and short time tripping characteristics in addition to instantaneous and I^2t (for ground fault).

11. *Starters*: Full-Voltage combination magnetic starters shall be utilized as required. Solid-state reduced voltage motor starters may be utilized where required due to power utility requirements and/or engine-generator sizing considerations.

12. *Power Factor Correction*: Power factor correction capacitors will be applied to correct motor power factor to within 90 to 95 percent for all motor starters rated 50 hp and larger. Capacitors will be installed at the motor. Capacitors will not be applied where the motor is served by a VFD.

13. *Variable Frequency Drives:* VFD's shall be remotely mounted and be fed from a dedicated 480 volt, three-phase MCC feeder breaker. The drives shall be 6 pulse, 18 pulse or Active Front End (AFE), fully digital, microprocessor controlled and shall incorporate a diode bridge rectifier and a transistorized inverter section. IGBT type power transistor modules shall be utilized in the inverter section to invert a fixed DC bus voltage to a symmetrical three-phase pulse-width modulated (PWM) output voltage. VFD's for motors smaller than 50 hp shall be 6 Pulse. VFD's for motors 50 hp and larger shall be 18 Pulse or Active Front End.

14. *Compartment*: Equipped with the ability to lock out the starter for testing during

maintenance.

15. *Pilot Lights*: Oil, dust, and water resistant with push to test type operation.

16. *Bus*: Tin plated copper.

17. *Control Power Transformers*: Sized for at least 110% of the required load to allow for future expansion.

18. *Wiring Configuration*: NEMA Class 2B

19. *Gasketing*: Required

20. *Lightning Arrestors*: Provide on the incoming lines based on the isokeraunic number (number of thunderstorms per year).

21. *Surge Capacitors*: To be provided for steep wave transient capacitors.

22. *Basic Impulse Level (BIL) Requirements*: Design/Builder to coordinate to establish a protective margin based on the perceived transient threat caused by switching of capacitor banks.

23. *Thermostats*: Design/Builder shall evaluate the need for the use of condensation control inside each starter to prevent moisture build-up on components and install if required.

24. *Arc Flash*: Provide arc flash protection in accordance with American Water Health & Safety Procedures Manual. Refer to Appendix G for the power system & arc flash study requirements.

Miscellaneous Power Distribution

1. *Circuit Panel*: Circuit breakers will be of the bolt-on type. Push-on type circuit breakers are not allowed. Use copper type bus and ensure U.L. labeling of entire system. Provide a transient voltage surge suppresser on the main of each power distribution panel. For more specific requirements for the protection of sensitive electronic instrumentation, see Instrumentation section. All distribution panels will have hinged doors.

2. *Cables*: Those rated for 480V and below shall be dual listed as XHHW-2 type insulation listed for at least 90 degrees centigrade. In order to maintain a 90 degrees centigrade rating, all of the connectors and lugs at each end of the cable shall be U.L. listed for 90 degrees centigrade per the U.L. Green and White Books.

3. *Lighting and Power Transformers*: Dry type to limit maintenance items. A minimum of (2) taps will be provided above rated voltage (in 2.5% increments) and a minimum of (2) taps will be provided below rated voltage (in 2.5% increments). Open type transformer cases are not allowed. All units will be of sealed type construction. The Design/Builder shall examine the need to install transformers with a higher than average Basic Impulse Level (BIL) that

is not normally required in the 480V class.

Lighting Fixtures

1. *LED Type Fixtures*: Units shall be sealed and water resistant, and of the highest efficiency available. In order to facilitate conformance with NFPA 101 (the Life Safety Code), the facilities shall include separate emergency lighting fixtures to ensure that all passages and exits remain illuminated in the event of a power failure. Design shall achieve adequate lighting at lowest possible energy demand.

2. *Exit Signs*: LED type and placed inside the facility per the latest requirements of NFPA 101 (the Life Safety Code). Ensure exit lights are connected to backup power with bug eye lighting.

3. *Exterior Lighting*: LED with light pollution shielding, photocell type, wall mounted, and vandal proof. Pole lighting is acceptable but must not compromise surveillance video camera effectiveness.

Automatic Transfer Switch

1. *General*: Furnish and tested by the generator set manufacturer to function as one standby power system. The transfer switch shall be UL listed per Standard 1009 and rated for total system load. The Design/Builder shall be expected to specify the close and withstand ratings of the switch components based on the available fault current at the point of installation (based on length of feeder cable run, presence of local generation, etc.). The switch shall be of the contactor type and shall be designed to carry 100% of rated current continuously based on ambient temperature of 120-degree Fahrenheit. Transfer switches using interlocked circuit breakers or molded case switches are not acceptable. The transfer switch shall be performance tested per the requirements of IEEE-587 (latest edition) for voltage surge and withstand capability.

2. *Type of Construction*: Over center double throw. This construction allows for positive electrical and mechanical interlocking via a mechanical beam to prevent simultaneous closing (break-before make-operation).

3. *Lugs*: Double set to allow connection of a load bank to the unit for generator testing. The lugs shall be rated for normal, standby, and neutral load conductors inside the cabinet.

4. *Main Switch Contacts*: High pressure silver alloy to resist burning and pitting for long life operation.

5. *Transition*: Closed transition with storm mode.

Automatic Transfer Switch Controls

1. *General*: Solid state and accessible from the front of the lockable enclosure. The voltage rating of the transfer switch depends upon the selection of the in-plant voltage.

2. *Voltage Sensors*: Solid state and simultaneously monitoring all phases of the normal source and all phases of the standby source. The sensor pick-up settings shall be adjustable from a minimum of 85% to a maximum of 98% of nameplate voltage. Dropout settings shall be adjustable from a minimum of 75% to a maximum of 98% of the pick-up settings with a fixed dropout time delay of .5 seconds. Voltage sensors shall be temperature compensated. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase of the normal or emergency source. A reverse voltage sequence relay shall be interlocked to the operation of the transfer switch.

3. *Frequency Sensors*: Solid state and monitoring normal and emergency power sources. Sensors shall be adjustable for a pick-up of minimum of +4/-4% to a maximum of +/-20% of nominal frequency. Drop out and time delay settings shall be adjustable.

4. *Operation*: The engine-generator set shall start upon signal from normal source voltage sensors. Solid-state time delay start shall be adjustable and shall avoid nuisance start-ups on momentary voltage dips or interruptions. The switch shall transfer the load to the standby power system when the voltage and frequency are within the limits after a specified time delay. The transfer switch shall retransfer the load to the normal source after normal power restoration. An adjustable solid-state time delay retransfer and controls shall be provided to match phases and achieve seamless transfer back to normal service. The retransfer shall be interlocked with the generator to stop after the retransfer of the load to the normal source. Generator run times shall be recorded and tracked through SCADA.

5. *Built-In LED Status Indicator*: Functions to include shall consist of source 1 OK, start genset, source 2 OK, transfer timing, transfer complete, retransfer timing, retransfer complete.

6. *Auxiliary Switch*: Include a Form C 10 Amp 250 VAC auxiliary switch on both the normal and emergency side of the switch. These contacts shall be factory wired to a terminal block to allow interface to the remote telemetry unit digital inputs for transfer switch status.

7. *Test Switch*: Simulates loss of power to the control unit. Controls shall allow for a system test with or without load transfer.

8. *Normal Operating Position Switch*: Restores the load to the normal source after test and time delays.

9. *Retransfer Switch*: Momentary type to allow for a bypass of the retransfer time delays and cause immediate return to normal source after outage.

10. *Pilot Lights*: Provided on the front of the switch to indicate the switch is on normal power, the switch is on standby power, normal source available, and emergency source available.

Generator Set

1. *General*: The Design/Builder shall be responsible for providing the ratings of continuous capacity and select the appropriate operation under a specified voltage dip. The generator set shall 480V. State allowable voltage dip.

2. *Number of Units*: 1.

3. *Type*: Composite outdoor water cooled 4 cycle unit rated for standby duty with integral subbase fuel storage tank and secondary containment. The engine shall run on #2 diesel fuel and shall be equipped with a water separator type oil filter, water pump, and air filter. The fuel tank shall be sized for 24 hours of continuous operation. Although it is not expected that a natural gas generator in this size will be cost effective, the Design/Builder shall evaluate this alternative with consideration of air permitting issues and load curtailment.

4. *Sizing*: The unit shall be capable of keeping the plant operating and treating and pumping water at a flow rate equal to 4 MGD. As an alternative, design shall include provisions for a temporary connection of a portable generator for powering the following plant equipment: 1 high-service pump, chemical feed systems, SCADA system, and general lighting and electrical items. The DCS, lighting and other miscellaneous loads should be included when calculating the generator loadings.

5. *Fuel Tank:* The fuel tank shall be double wall, and be furnished with an interstitial space leak detector, a digital low fuel indicator and an analog fuel gauge.

6. *Noise Attenuation*: Soundproofing, consisting of sound walls, berms, prefabricated enclosures or a building shall ensure that all local sound ordinances are met. Adjoining properties are zoned residential and should be considered in the design.

7. *Batteries*: Lead acid type

8. *Battery Charger*: Trickle type

9. *Engine Block Heater*: Resistance heater

10. *Engine Controls*: The generator shall be equipped with a complete start-stop control that automatically starts the engine on closing contacts and stops the engine on opening contacts. The engine shall run for an adjustable period under the test function described in the transfer switch.

11. *Engine Instruments Required*: Lubricating oil pressure gauge, engine temperature gauge, and battery charge rate ammeter.

12. *Insulation*: Class F as defined in NEMA MG1-1.65

13. *Minimum Acceptable Performance Standards*: Frequency regulation shall be

+/- 0.25% of its mean value for constant loads from no load to full load. Voltage regulation shall be +/- 2% of its mean value for varying loads and +/- 1% of its mean value for constant load.

14. *Control Panel*: Include main circuit breaker, frequency meter, elapsed run time meter, voltage adjusting rheostat, AC voltmeter (dual range indicating all voltages), AC ammeter (dual range indicating all currents), engine controls and instruments, and heater for control of condensation. Provide a common dry contact alarm for the control panel to the DCS. Individual common faults do not need to be annunciated at the DCS. Provide KW or KVA meter.

15. *Communication*: The generator shall be equipped with a ModBus Controls Interface typed to SCADA, and provided with ethernet connection to SCADA.

N. INSTRUMENTATION

General

1. *Operation of the Treatment Plant*: Designed to operate in an unattended, totally automated mode. A supervisory/maintenance staff will be on site periodically; however, the plant will be unattended most of the time.

2. *Remote Control/Monitoring*: The ability to monitor/control the proposed facility, including the well pumps, from a remote site or sites by means of a wide area network (WAN) will be required as part of this project. Only designated, authorized operators and supervisors shall have remote access to control systems via laptops or otherwise. This facility will have a dedicated HMI system. An interface to Kokomo will remain for management oversight and assistance from Kokomo staff, as necessary. This does not preclude remote "monitoring only" access by others. Routers, firewalls, and other security functions shall be furnished to prevent unauthorized access to the plant control network.

3. *System Architecture:* The communication link between RTUs within the WTF shall be via fiber optic cable. Provide a certified fiber optic cable test report which details the wavelength that is used to test the cable as well as the fiber optic testing equipment used. The master RTU shall communicate with the remote sites via cellular modem operating on the AW VPN. The SCADA system shall consist of a process control local area network (LAN) controlled from redundant HMI computers. The HMI software used will be Ignition Software. Ignition Software will be used to dial out alarms to local operations. System architecture shall provide for remote access from the office and business network.

4. *Conventional/Redundant Instrumentation*: Not required.

Modes of Operation

1. *Local/Remote Capabilities*: Each piece of process equipment will be equipped with a Hand-Off-Auto selector switch (at the piece of equipment) to allow the location of control to be changed. In order to ensure that the RTU in the Remote Manual or Remote Automatic Mode has control, an additional contact blocks

will be added to the selector switch to monitor the Hand and Auto positions. The output of the contact block will drive a digital input that will serve as a permissive in the DCS. If the DCS attempts to control a device from the RTU when it is not in the Auto mode, a failure condition will be delineated at the operator's interface. Package systems with a local control panel may not be used.

2. *Local-Manual*: An operator at a piece of process equipment will turn the device on and off and make adjustments. Required for all equipment.

3. *Local-Automatic*: Controls are hardwired into pieces of equipment by a vendor (such as prepackaged process equipment).

4. *Remote-Manual*: An operator turns items on and off via the operator interface terminal (OIT) connected to the DCS. Required for all equipment.

5. *Remote-Automatic*: The DCS turns items on and off and performs all control. Required for equipment as necessary for overall plant coordinated control.

Remote Telemetry Units

1. *Processors*: For the treatment facility and the well pumps, two Allen Bradley Control Logix Controllers in a redundant configuration..

2. *Cabinets*: Include compact lighting fixture activated by a door switch. Each RTU shall have battery backup/DC UPS Units. RTU's shall be located indoors in a controlled environment with fans and heaters. RTU's for the well pumps shall be outdoor rated enclosures (NEMA 4X, SS) with sunshades, thermostatically controlled heaters and coolers.

3. *Terminal Blocks*: Multilevel terminal blocks are not permitted.

4. *Spare Wired Terminals*: Provide in each cabinet to facilitate future expansion (10% minimum).

5. *Convenience Receptacles*: Use ground-fault interrupter type only.

6. *Separation of Power Cable and Signal Wires*: 120 VAC control cable shall be physically separated from 4-20 mA signals and DC wiring as much as practicable inside control cabinets.

7. *I/O Slots*: As required.

8. *Remote Input/Output (RIO) Boards*: Remote I/O, Flex I/O or Remote Racks will be permitted. 20% spare equipment, rounded to the higher quantity should be provided for all components.
9. *3 Wire Control*: Required for all pieces of equipment (one normally closed contact for stop and one normally open for start, etc.) except for metering pumps (which only require 1 contact for the start and the stop functions).

10. *Modulating Valves*: Analog control with full open and full closed feedback or open closed control with position feedback and full open and full closed

feedback.

11. *Signal Configuration:* Analog inputs and outputs shall be 4-20 mA DC: Interrogation voltage for discrete inputs shall be 24 VDC. Isolated dry relay contacts shall be furnished for all discrete outputs – relays may be integral to the I/O module. Interposing relays shall be furnished in cases where the I/O module relay contacts do not have adequate electrical ratings.

12. *Uninterruptible Power Supply:* A smart type, ethernet connected 24VDC UPS shall be furnished to power the control room personal computers, printers, data concentrators, and other network equipment. The control room UPS shall be a floor mounted type with static bypass switch and alarms for overload, equipment over temperature, low battery and load on bypass. All RTU's and analyzers containing programming shall be powered from a battery backup. Battery backups for RTU's and field analyzers shall be mounted in the RTU panels. The UPS or battery backup shall provide a minimum of 30 minutes of backup power.

Server Configuration

1. Software will be a redundant Ignition package with three Stratus 4910 servers, two designated as redundant control servers and one as a database server.

2. Ignition Gateways will be configured with 4 CPUs, 16GB of RAM, and a minimum of 200 GB of Disk Space.

3. The Database Server will be configured with 4 CPUs, 32GB of RAM, a minimum of 200 GB of OS Disk Space and an additional 2 TB of Data Storage for Historical Data.

4. Synology NAS Backup Server DS1821+ with 4 TB RAID one configuration.

5. Ignition Software Modules will be configured with the following:

    - Alarm Notification
    - Voice Notification
    - SMS Notifications
    - TTS Voice_en_us_Katherine
    - SQL Bridge
    - Tag Historian
    - Enterprise Administration Agent
    - Ignition Platform
    - OPC-UA / OpcCom
    - Modbus Driver
    - Allen-Bradley Driver
    - Perspective (Unlimited)
    - Symbol Factory
    - Reporting
    - Cirrus Link MQTT Transmission
    - **Redundancy (for redundant systems)**
    - **Totalcare Support (includes upgrades)**

6. The Database Server will be configured with Microsoft Sequel 2019 with a 5 CAL configuration.

Operator Interface Hardware and Software

1. *General*: Since computer technology rapidly changes, the DESIGN/ BUILDER will specify all items listed under this section at the time of purchase.

2. *Personal Computers*: Two computers and monitors at the proposed facility to allow monitoring and control of the treatment facility and well field while an operator is on site. Users shall employ cryptic passwords complying with the American Water SCADA Acceptable Use Practice and related Company policies. INAW will purchase the computers.

    - Workstations will be Dell 7090 with two 24 inch monitors each.
    - Workstations to be configured for a total of 4 video outputs.

3. *Software*: The software shall be Ignition Software human-machine interface software. INAW will provide the software.

4. *Local Area Network*: The personal computers and printers shall be placed on a process control local area network (LAN). The LAN shall be implemented using Ethernet type cards in each operator interface personal computer. The LAN shall be interconnected to various computers using a 100-base T stackable hub. The cable between devices on the LAN shall be Category 6 type cable or fiber optic. LAN cables between devices in different buildings shall be fiber optic.

5. *LAN Connection*: Shall be provided in the filter gallery (and other strategic locations in the plant) to allow for connection of a laptop computer should an operator desire to watch a filter while it is backwashing.

Operator Interface Functions

1. *Screens*: The Design/Builder shall include paragraph descriptions of the OIT and HMI screens (including a listing of each specific I/O point required on each screen) to give the system integrators an understanding of the level of detail required. Each screen shall utilize INAW's standard color conventions for stop, run, open, closed, and intermediate conditions. Text- based screens shall be considered in the design. An operator (or supervisor only) shall have the capability to manually enter data onto the screen that is not generated by the system but is appropriate to be displayed on a screen, such as a manual valve change for a chemical feed point of application. Control programs shall include limiting parameters for operator inputs, such as chemical feed dosages, to prevent excursions. Only supervisors shall have access to modify those parameters. Provide a list of all screens to be created by the system integrator. Provide sample screens to establish the minimum acceptable level of graphic detail.

    - Screen designs and configuration to be per AW standards related to the

utilization of High Performance Graphic designs designated by the company.

2. *Reports*: Reporting shall be from one Ignition Reporting System. At a minimum, the reports shall consist of Form 100, System Hydraulic, Plant Data and Well Withdrawal. Provisions shall be made for the data to be edited. The original data shall not be changed; however, additional fields shall allow a manual value to be entered into reports. User entering manual data and a comment shall be maintained to explain the reason for the change. The person logged in shall be recorded as a field. Reporting data not provided by the SCADA PLCs will have the ability to be manually entered on the Data Entry Screen. This screen shall allow operators to enter lab data and other data for use in the Form 100 and other reports as needed.

3. *Alarms*: An alarm summary table shall be developed by the Design/Builder and reviewed with INAW during design. The table shall include specific initial values for all high and low alarm set points. Analog set points are also to be configurable on the graphic displays. The specific software package that is ultimately selected must have auto dialing capabilities such that alarms conditions can notify On-Call personnel without the need for a separate auto dialer. Operators shall not have access to modify alarm set points without special authorization.

4. *Database*: Provide Ignition Database package to store process data and act as a server to database users outside the process control system. This shall be installed on an existing server and fully integrated into the existing control system. INAW will provide the software.

System Factory Test

1. INAW and Design/Builder shall witness a complete factory acceptance test (FAT) of the entire control system prior to its shipment to the job site. The Design/Builder shall provide written approval for shipment following acceptance of the factory test.

2. The factory test shall be conducted by the Systems Integrator using simulated inputs to assure all I/O are provided and all inputs, outputs and application software is functioning according to the intent of the plans and specifications. Additional distributed control units shall be provided, if necessary, to accommodate the project phasing requirements. The test procedure shall include simulated system faults and failures. The factory tests shall be staged in two parts: the first to review all I/O and hardware and the second to assure functionality of the system.

3. The factory test shall demonstrate all graphics, report generation and alarm functions of the system.

4. Provide at least a four-week written notification to INAW prior to the start of the witnessed factory test. Provide a written factory acceptance test procedure for INAW review prior to the start of the factory acceptance test.

Training

1. *General*: INAW shall advise the Design/Builder as to the amount of training to be performed relative to the distributed control system. It is expected that the DCS system supplier will furnish videotapes of the training. These videotapes will be turned over to INAW at the end of training program. All training received during the startup and calibration of equipment is considered incidental training and does not count for the requirements listed below.

2. *Operator Training:* Operating training has the following goals:

    a. Use workstations, touch screens, and keyboards

    b. Retrieve and interpret all standards displays including graphics, overview displays, group displays, trends, point summaries, and alarm summaries.

    c. Enter data manually

    d. Change control parameters and set points

    e. Assume manual control of equipment and control it from the HMI

    f. Print Reports

    g. Acknowledge Alarms

    h. Respond to software and hardware errors

    i. Historical Data Collection, archival and retrieval

    j. Capabilities and configurability: reports, alarm reporting, setting passwords, and system hardware configuration.

    k. Database backup and recovery

3. *Maintenance Training*: This training equips INAW personnel with the skills required to diagnose, trouble shoot, and repair the components of the system. As a minimum, maintenance training shall provide technicians with the ability to:

    a. Power-up, boot strap, and shut down all of the hardware devices

    b. Perform scheduled maintenance functions on all components

    c. Describe the theory of operation for all circuit boards.

    d. Setup and use off-line diagnostics to determine hardware failures to the fault board or module.

    e. Use workstations, keypads, or keyboards to retrieve and interpret displays which shall provide on-line diagnostic information

f. Remove and replace all removable boards/modules.

g. Maintenance training shall be at least 75% hands-on instruction and shall be designed for personnel that do not have any familiarity with the equipment furnished.

4. *Supervisor Training*: This training is for personnel who will need to make access changes to the DCS. This training consists of the following basic tasks:

   a. Log-on and log-off to the HMI and OIT

   b. Setting and clearing passwords

   c. Configuring access levels for various process parameters and set points

   d. Printing and configuring reports

5. *Calibration*: It is expected that a detailed calibration plan will be developed during the construction phase of the project. The Design/Builder will review the instrumentation installed and provide guidance to INAW as to the number of follow-up visits for calibration, the type of calibration documentation to be furnished, and the calibration equipment to be furnished to allow INAW personnel to maintain the equipment after project completion.

Protection of Sensitive Electronic Equipment

1. *General*: The Design/Builder shall follow guidelines for the powering and grounding of sensitive electronic equipment listed in I.E.E.E. Standard 1100-1999. Controls and power voltage are not permitted to be mixed.

2. *Transient Voltage Surge Suppression (TVSS)*: Provide TVSS at point of use for all instrumentation loads. Required for all 4 wire instruments (such as a chlorine residual analyzer) and placed on the 120 VAC branch circuit and on the 4-20 mA portion of the circuit. The transient voltage surge suppression on the 4-20 mA wiring shall be located on the RTU end. For all two wire 4-20 mA instruments that have signal cable running from outdoor to indoor locations (or signal wire run between buildings), transient voltage surge suppression on the field side of the 4-20 mA signal is required.

3. *Grounding*: Each RTU cabinet shall be provided with a direct connection to the ground grid via a driven rod in addition to the equipment safety ground required by the National Electrical Code. Daisy chaining of grounds is not acceptable. A grounding detail showing the interface between the RTU cabinet and the proposed grounding system is required. Instrumentation shields shall be grounded at the DCS end only. The electrical grounding specifications must be cross referenced to the instrumentation and control specifications so that it is understood that the system integrator monitors the quality of system grounding. In order to facilitate an electrically conductive ground mass, provide connections to structural steel and interface them to the grounding system that results in a ground impedance of 1 ohm or less.

4. *Power Supplies*: Separate power supplies shall be provided for analog inputs and PLC's, and digital outputs.

5. *Conduit Spacing*: Required between power and signal/control cables as listed in I.E.E.E Standard 518-1982.

Communications Equipment

1. *Data Highway*: Fiber optic cable is required between RTU's. Cable runs should be installed in metal conduit.

2. *Spare Parts*: The Design/Builder shall confer with INAW for the required spare parts associated with communication cables.

    - 20% Minimum, rounding to the higher quantity, for PLC equipment.

Signal/Control Wiring for Corrosive Areas

1. Use Schedule 80 PVC conduit in all chemical storage areas. Where possible, enclosures for control and electrical components should be located outside of the chemical storage rooms. Where this is not possible, the enclosures shall be fiberglass NEMA 4X type enclosures.

O. BUILDING REQUIREMENTS

General

1. The proposed treatment building shall be as specified herein, and as determined by the Design/Builder during the design phase.

Administrative Area

1. *Office Space:* Provide two offices, a lobby with space for an operation support representative, a conference room for 12 people, a break room and restrooms. Approximately 1600 square feet. The conference and break room shall have at least one large screen monitor per room and shall be connected to the SCADA system.
2. *Operator/lab Area*: Approximately 200 ft^2. Provide operator worktable/desk and UPS. Provide lab cabinet, counter space with sink and a service sink for samples and analyzer waste. Provide countertop space to perform routine wet chemistry. Other details to be provided by INAW during design phase.

3. *Maintenance Storage Area*: Approximately 100 ft^2. Provide space for INAW provided wall shelving units.

4. *Restroom:* One women's restroom and one men's restroom, which shall be ADA compliant

5. Furniture: Will be purchased by the Design/Builder with the exception of the maintenance shelving, which will be provided by INAW.

6. Local Area Network: The office space is to be equipped for a business services local area network (LAN2). This network will be completely separate from the process control local area network (LAN1). The LAN shall be interconnected to various devices using a 100-base T stackable hub. The cable between devices on the LAN shall be Category 6 type cable. At least two LAN connections are to be provided in each office and in the break room, and at least six LAN connections are to be provided in the conference room.

7. LAN Room: Approximately 100 ft^2.

Utilities and HVAC

1. *Water Service*: In plant water service to be metered and individual backflow preventers provided where necessary. Provide redundant booster pumps if distribution system pressure is not adequate for plant service needs when plant is not running. The Design/Builder shall review this requirement with the OWNER during preparation of the Design Memorandum to determine if booster pumps will be required.

2. *Sanitary Waste*: Coordinate design of sanitary sewer line with backwash waste disposal and design and construct an onsite sanitary lift station if required.

3. *Heating*: Electric heat or natural gas, if available and cost effective, for heat and hot water.

4. *Air Conditioning*: Provide air conditioning in the administrative areas. Provide dehumidification equipment for all necessary spaces.

5. *Telephone Service*: Design/Builder shall coordinate with the local telephone utility to provide this connection.

6. *Broadband Internet:* Broadband internet service will be required to support the business service local area network (LAN 2), security communications and the fire alarm system.

Architecture

1. *Treatment Plant Layout*: A common structure is preferred.

2. *Exterior*: Exterior appearance to meet local building ordinance. Anticipate brick or color-tinted split face block; color selections by Owner.

3. *Roof*: Precast concrete panels with built up insulation and single ply membrane system. Metal deck and standing seam metal roof is acceptable provided it is cost effective and not exposed to chemical areas.

4. *Interior Walls*: The chemical areas shall have painted block. Drywall with metal frame and/or painted block in remainder areas of the plant as required.

5. *Floors*: Sealed concrete in process areas. Provide chemical resistant concrete coatings in all chemical rooms per T-2 Standard. Provide epoxy coated flooring or commercial tile in operator/lab area and restroom.

Control Room / Operator's Office

1. *Construction*: Totally enclosed room (no outside doors).

2. *Configuration*: Area dedicated to operator control workstations.

3. *Fire Suppression Equipment*: Include equipment such as a fire extinguisher that will not damage computer equipment in the event of a fire. Equipment to comply with the latest requirements of the National Fire Protection Association Codes and standards.

4. *Control Room Furniture*: Will be purchased by Design/Builder.

Safety/Security

1. *Smoke and Fire Alarms*: Provided in areas where fire potential is high. Suppression system(s) shall be designed only if required by code or local ordinance.

2. *Security System*: Designed by Others. Security requirements will be determined by the Owner based on the 60 percent complete design drawings. The Owner will provide the Design/Builder with details of the security system design to incorporate into the final design documents. The Design/Builder will be required to furnish and install basic electrical components, such as conduit, conductors, switches, support poles, wire, etc., to support the final installation of the security system, which shall be completed by others.

   Security system is to provide badge access and gate operator to main gate adjoining the wastewater treatment facility.

3. *Lighting:* Lighting will be placed on structures such that CCTV cameras are not blinded by perimeter lights.

4. *Fencing:* Fence surrounding property will be set back from property line as required by local codes. Design/Builder to verify during design. Area outside of fence will be kept clear so as to provide indication of intrusion. Fencing concept will be further developed during design phase.

5. *Site Design:* Site grading and access drives shall be sloped to facilitate drainage away from the buildings and structures.

DESIGN CONCEPT

APPENDIX A

PREFERRED EQUIPMENT MANUFACTURERS

1. GENERAL (Applies to More Than One Area of the Plant)

Equipment Description	Manufacturers
Ductile Iron Pipe	American Ductile Iron Pipe Griffin Pipe Products United States Pipe and Foundry
PVC Pipe 6” and larger	HD Supply (AW supplier)
PVC Pipe 4” and smaller	Certainteed
Butterfly Valves w/Electric Operators	DeZurik Valve Henry Pratt
Butterfly Valves w/Manual Operators	Henry Pratt DeZurik Clow Valve
Resilient Seat Gate Valves	Mueller Clow Valve United States Pipe and Foundry American Flow Control
Plug Valves	DeZurik Valve Keystone Valve Pratt
Check and Air Valves	Golden Anderson Cla-Val APCO Val-Matic
Pump Control Valves	Cla-Val Rodney Hunt Golden Anderson Bermad Ross Valve Henry Pratt
Sluice Gates	Mueller Rodney Hunt
Slide Gates	Golden Harvest
Pipe Expansion Joints	Red Valve Mercer
Backflow Preventers	Ames Watts Wilkins
Pressure Gauges	Ashcroft Trerice
Electric Valve Actuators	Auma Beck EIM Rotork
Pneumatic Valve Actuators	Auma Aro Pratt
Pneumatic Valve Actuators – Rotary Vane	Kinetrol K-tork

Rotary Lobe Blowers	Ingersoll Rand-Dresser Roots Blowers Gardner Denver Sutorbilt Duroflow MD
Centrifugal Blowers	Continental Lamson Hoffman HSI
Air Compressor	Ingersoll-Rand Champion
Static Mixers	Komax Chemineer Koch
Welded Steel Tanks D100	Advance Tanks Caldwall Chicago Bridge & Iron Hungerford & Terry
Hot Water Heaters	A O Smith
Floor Drains	Zurn
Hoist/Cranes	Harrington Yale Shaw-Box ACCO
Paint & Coatings	Tnemec Carboline Sherwin Williams MAB
Laboratory Furnishing	Celtech Duralab Equipment Fischer Hamilton Scientific Kewaunee Scientific
WW Sludge Presses	Bell Filter Press KCSF Screw Press
Gear Drives	Philadelphia Koellman

2. PUMPING

Equipment Description	Manufacturers
Vertical Turbine Pumps	Layne Western Flowserve Goulds Peerless/Grundfos Fairbanks Morse
Well Pumps	Gould Bryon Jackson Grundfos Fairbanks Morse American Marsh
Horizontal Split-Case Centrifugal Pumps	Fairbanks Morse Flowserve Goulds Aurora Peerless
End Suction Pumps	Goulds Peerless Flowserve Gorman-Rupp Aurora
Sample Pumps	Goulds March Moyno Berks Netzsch
Sump Pumps	Hydromatic KSB Weil ABS
Chemical Pumps (Magnet Drive)	Iwaki Walchem March Manufacturing
Chemical Pumps (Progressive Cavity)	Moyno Netzsch
Chemical Pump (Peristatic/Hose Pump)	Watson Marlow Blue White Verder
Chemical Pumps (Hyd & Mech Diaphragm)	Milton Roy -LMI Wallace & Tiernan Pulsafeeder
Chemical Pumps (Solenoid Diaphragm)	LMI Prominent
Sludge Pumps (Water & Waste Water)	Flyght Hydromatic Yeomans ABS Weil KSB

3. MOTORS

Equipment Description	Manufacturers
Vertical Turbine	NIDEC/US Motors Toshiba General Electric Reliance Siemens
Horizontal	NIDEC/US Motors Toshiba General Electric Reliance Baldor Siemens
Submersible	Franklin Plueger Grundfos
C-Frame	NIDEC/US Motors Toshiba General Electric Baldor Siemens

4. CHEMICAL STORAGE & FEED EQUIPMENT

Equipment Description	Manufacturers
Volumetric Feeders	Merrick Acrison Chemco
Lime Slakers	Wallace & Tiernan RDP Technologies
Gaseous Chemical Feed Equipment	Wallace & Tiernan Capital Control
Chlorine Scrubber	Purafil Severn Trent
XLHDPE Chemical Storage Tanks	Poly Processing Assman Nalgene Snyder Tanks
Liquid Polymer Feed Equipment	Fluid Dynamics USGI
Batch Tank Scales	Force Flow Equipment Eaton Scales
Chemical Ball Valves	Chemtrol Hayward
Chlorination Equipment	Evoqua Capitol Controls
Bulk Bag Unloading Equipment	Flexicon Spiroflow Vibrascrew Norit

5. WATER TREATMENT PROCESSES

Equipment Description	Manufacturers
Flocculation Equipment	Philadelphia Mixer Lightnin Chemineer
UV Disinfection Systems	Wedeco Trojan Technologies Calgon Carbon
Hypochlorite Generation Systems	Process Solutions Severn Trent
Settled Solids Sludge Collection	Meurer Research (MRI)
Plate Settlers	Lamella Ecoflow Meurer Research (MRI)
Filtering Equipment – gravity filters	Roberts Filter Leopold (Xylem)
Filtering Equipment – pressure filters	Roberts Filter Hungerford & Terry Bastin Logan

6. SCADA & INSTRUMENTATION

Equipment Description	Manufacturers
Pressure Transmitters	Rosemont Honeywell
Turbidimeters	Hach Sigma
pH Analyzers	Hach Wallace & Tiernan
Chlorine Residual Analyzer	Hach (CL17) Evoqua Capitol
Fiber Optic Modems	Phoenix Hirschmann
Radio	Microwave Data Systems Free Wave EPROM
Antenna (Radio)	Clearwave Samco Andrew Decibel Pctel
Remote Telemetry Unit	Bristol (Control Wave & Control Wave Micro)
Programmable Logic Controller	Allen Bradley (Control Logix, Compact Logix, & Micro Logix)
Fluoride Ion Monitors	ABB ATI Orion
Particle Counters/Monitors	Chemtrac Systems, Hach
Streaming Current Detectors	Chemtrac Systems
Temperature/OPR Analyzers	Leeds & Northrup Wallace & Tiernan.
Flow Switches	Dwyer Instruments Flo-Tec Kobold
Venturi Flowmeters	Henry Pratt Primary Flow Signal Badger BIF
Magnetic Flowmeters	Endress Hauser ABB Emerson
Displacement & Turbine Flowmeters	Sensus Technologies Schlumberger Industries McCrometer
Ultrasonic Meters	Sensus Nusonics Division – Mesa Laboratories Polysonics Panametrics

Ultrasonic Level Probes	Endress Hauser Inventron Milltronics Flowline
Radar Level Probes	Endress Hauser Ohmart-Vega Siemens Magnetrol
Capacitance Probes	Drexelbrook Siemens
Level Instruments – RF Admittance Probe	Miltronics Drexelbrook
Auto Dialers	Raco Verbatim Win911

7. HVAC

Equipment Description	Manufacturers
Electric Heaters	Trane Indeeco
Air Conditioners	Trane Carrier
Make-up Air Units	Reznor
Exhaust Fans	Greenheck Penn Barry Loren Cook
Dehumidifiers	Dectron
Louvers and Dampers	C/S Louver System Airstream

8. ELECTRICAL

See American Water Recommended Electrical Design Criteria and Standards, Attachment B, March 2018

DESIGN CONCEPT

APPENDIX B

DESIGN MEMO REQUIREMENTS

APPENDIX H

Indiana American Water Company
Sheridan Water Treatment Facility

DESIGN MEMORANDUM REQUIREMENTS

The outline provided below identifies the minimum information that must be included in the Design Memorandum. The Design/Builder shall add additional information to the memorandum where appropriate to sufficiently define all critical design parameters so the Owner can understand the Design/Builder's design concept and visualize the final product.

The main section of the Design Memorandum must include project design data which was utilized in the development of drawings and specifications. This would include quantities, capacities, rates, and all other pertinent design criteria for each specific section specified in the Design Scope. A comparison of the required equipment (as calculated or as specified in the Design Scope) to the equipment selected by the Design/Builder is critical such that the Owner can understand the Design/Builder's logic in sizing facilities and selecting equipment. This information must be presented in an organized, easy to read tabular or outline format.

Provide a brief description of the water treatment approach to include

- Influent and effluent parameters
- Tankage capacities
- Equipment sizing, quantities, and capacities
- Specific process information and specific design criteria
- Operational approach to meeting effluent capacities
- Treatment residuals management

Provide a brief description of the following items for site development

- Layout of the facilities
- Site security
- Site roadways and parking
- Landscaping
- Storm water collection and drainage
- Site utilities

Provide a brief description of the following architectural items

- Structure and Arrangement
- Interior construction – to include room finishes
- Exterior construction

Provide a brief description of the following structural items

- Building structure basis for design
- Design stresses and loading criteria
- Specific geotechnical requirements

Provide a brief description of the following mechanical building systems

- Design criteria
- Plumbing system design
- Sanitary drainage, collection, and treatment systems
- Potable water systems
- Fire Protection
- Heating, ventilation and air conditioning systems

Provide a brief description of the following electrical systems

- General design criteria
- Power distribution functional requirements
- Standby Power
- Lighting requirements
- Telephone communication systems
- Fire Alarm systems
- Lightning protection

Provide a brief description of the following instrumentation and controls systems

- Control system architecture.
- Control philosophy

Along with the above information, the following shall also be included in the Design Memorandum as a minimum.

a. A hydraulic profile
b. A process schematic showing all unit processes, points of chemical application, and points of on-line analytical sampling as a minimum.
c. Chemical feed system schematics
d. Preliminary drawings showing site and building layouts, sections, and architectural treatment.
e. Any additional drawings that may further define the facility proposed by the Design/Builder.
f. An I/O list, functional descriptions, graphic displays, reports, alarm, and historical database definition.
g. A listing of major equipment required for the project including the manufacturer and model number which will be used as a basis of design. If possible, at least two other alternative manufacturers shall be identified for all major equipment for inclusion in the specifications.
h. A summary of all permits required for the project and a brief description of the requirements of each. Any permit requirements that need to be completed by the Owner should be identified.
i. A summary of any significant issues resulting from discussions with utility companies.
j. A detailed project schedule.

DESIGN CONCEPT

APPENDIX C

AMERICAN WATER ENGINEERING STANDARD T-2, CHEMICAL STORAGE, FEED AND CONTAINMENT

AMERICAN WATER
ENGINEERING STANDARD T-2

LIQUID CHEMICAL STORAGE, FEED, AND CONTAINMENT

Prepared by:
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Version Date: April 2017

AMERICAN WATER
ENGINEERING STANDARD T-2
LIQUID CHEMICAL STORAGE, FEED, AND CONTAINMENT

BACKGROUND

Most drinking water and wastewater treatment facilities require chemical addition to help meet water quality or discharge requirements or objectives. These chemicals are typically stored and fed in a concentrated form, with many being strong acids, bases, or oxidizers. Careful attention to detail in selecting materials of construction, providing prudent safety features, and following proper operating procedures is critical to preventing injurious consequences to the water consumer, company personnel, the environment, and company facilities.

The purpose of this standard is to identify the recommended features for safe and reliable liquid chemical systems. The standard provides a basic uniform approach to preventing accidental chemical releases, and should be used by consultants and water company staff involved in designing, modifying, installing, and maintaining such systems.

Some of the most explicit design requirements for liquid chemical systems for water treatment facilities can be found in the “Recommended Standards for Water Works”, which is often referred to as the “Ten States Standards”. Some states have their own unique requirements, while others rely on the professional engineer to design a safe system. New Jersey and Pennsylvania are examples of states that have explicit secondary containment and spill prevention requirements for chemical storage. Some examples of references for design and operating requirements for chemical storage facilities are listed below.

- Recommended Standards for Water Works (2012) and Recommended Standards for Wastewater Facilities (2014); also known as Ten States Standards.

- A Guide to the Preparation of Discharge Prevention, Containment and Countermeasure (DPCC) and Discharge, Cleanup, and Removal (DCR) Plans and Plan Renewals; New Jersey Department of Environmental Protection – Bureau of Release Prevention (2015)

- Pennsylvania Department of Environmental Protection Regulations: CHAPTER 245. ADMINISTRATION OF THE STORAGE TANK AND SPILL PREVENTION PROGRAM

The contents of American Water’s standard may go beyond the minimum requirements of some state regulatory agencies in order to provide consistent protection to consumers, company personnel, water company facilities, and the environment. American Water’s standard does not take precedence over applicable State requirements.

SCOPE

This standard covers the design of liquid chemical storage, feed, and containment facilities for chemicals used in treating water and wastewater. The standard is meant to be used by engineers and other experienced personnel for the basic design and modification of liquid chemical systems. Selecting proper and cost-effective materials of construction, sizing components to address the range of chemical storage and feed requirements, and providing appropriate design features to prevent siphoning are examples where technical expertise is required. Guidelines for prioritizing improvements to existing chemical storage and feed systems are also presented in this document, along with a checklist for evaluating the completeness of proposed designs.

This document is primarily targeted toward the engineering design of facilities, although operational guidance is provided on a number of topics. The safety objectives in this standard are to be addressed in the design and installation of liquid chemical systems. Alternative designs must be carefully evaluated against the standard before implementation, and must not increase the risk of accidental chemical release nor the likelihood of human or environmental exposure to the chemical.

Finally, designers must evaluate site-specific conditions when developing design criteria for a project. Large treatment plants (e.g., greater than 50 million gallons per day (mgd)) and small treatment plants (less than 1 mgd) may have unique chemical storage and feed requirements. The design of the system must fit the application. Consideration should also be given to using safer forms or types of chemicals when possible, after evaluating the potential safety benefits in light of other operational and cost impacts.

HISTORY

This standard replaces the older version of American Water's Liquid Chemical Storage, Feed and Containment (T2) Standard, which was originally published in 1993 and updated in 1996. Numerous American Water personnel contributed to this document, including from both the Operations and Engineering functions, and their contributions are very much appreciated.

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AMERICAN WATER
ENGINEERING STANDARD T-2
LIQUID CHEMICAL STORAGE, FEED, AND CONTAINMENT

PART 1 - SAFETY REQUIREMENTS AND FACILITY LAYOUT

1.1 SAFETY INFORMATION

A. In accordance with OSHA's Hazard Communication Standard, effective June 2015, Safety Data Sheets (SDS) with a standardized 16-section format are to be provided for each chemical. The safety data sheets are to be available to all personnel at each facility.

B. It is recommended that appropriate safety, regulatory, and emergency response information be prominently displayed near each chemical system.

1.2 LABELING

A. Tanks, piping, valves, chemical unloading connections, and other equipment are to be labeled to make operators, maintenance personnel, and other workers aware of the chemicals being handled, and to allow for unambiguous communication for operation and maintenance procedures.

1. Pumps are to be labeled.

2. Piping should be color coded according to Ten States Standards and identified with labels indicating the chemical with arrows pointing in the normal direction of flow. Ten State Standards color coding for water treatment plants is included in Appendix D.

3. Chemical system valves must be provided with a plastic or metal identification tag. In addition to the valve number, the valve tag should include the valve size, material of construction (PVC, CPVC, 304SS, etc.), and chemical service. Valves in sodium hypochlorite service should indicate if the ball is vented. The pressure settings for relief valves and backpressure valves are to be identified.

B. Bulk and day tanks must be clearly labeled with the following:

1. Unique Tank Identification Number

2. Chemical name

3. Chemical Abstract Service (CAS) number

4. Tank capacity (in gallons)

5. Manufacturer name

6. Tank material

7. Date of manufacture

8. Fiberglass tank manufacturer's design information including resins used and applicable operating environment. If the tank is specifically designed for a particular chemical that also needs to be on the name plate

C. As of July 9, 2015, OSHA has begun enforcing the change to Globally Harmonized System (GHS) of Classification and Labeling of Chemicals as the Hazard Communication Standard (HCS). The major changes to the HCS include specific criteria for classification of health and physical hazards, labels with signal word, pictogram, and hazard statement for each hazard class and category. This information must be posted within the chemical storage area.

D. Entry doors should be labeled with room contents and should be equipped with NFPA diamond labels identifying the type of hazard and degree (numeric value).

1.3 PRECAUTIONS FOR CHEMICAL UNLOADING

A. The mixing of incompatible chemicals can result in an exothermic reaction with production of gases such as chlorine or hydrogen. Access to the fill connection for bulk tanks must be restricted to prevent unintentional filling or mixing of chemicals with catastrophic consequences. For example, fill connections can be placed in locked enclosures.

B. Each bulk tank must be equipped with an individual fill line.

C. If tank fill connections are not located within individual locked enclosures, then each fill line must have an individual lockable quick connect cap, with independently keyed and color coded lock to minimize the possibility of connecting to an incorrect fill port.

D. A proven housekeeping approach is to permanently or temporarily locate drip pans below fill connections to capture small volumes of chemical during unloading operations. Permanent drip pans can be provided with latching lids to avoid filling with rainwater.

E. Fill connections are to be labeled clearly. The use of the CAS number is recommended in addition to the official CAS chemical name. Common alias names, such as "caustic" or "bleach", may also be used as long as the official CAS chemical name is also prominently displayed.

1.4 EYEWASHES AND EMERGENCY SHOWERS

A. The provision of appropriate eyewashes and emergency showers to provide first aid to workers in light of the hazards of chemicals is a federal requirement found in 29 CFR, Subpart K, Standard 1910.151 Medical and First Aid. Eyewashes and/or emergency showers must be provided for all liquid chemicals where workers will routinely be exposed to the chemical. The decision whether to use eyewash or eyewash and shower depends on the hazard of the chemical and the location. It is common to provide both devices as a combination unit.

B. Eyewashes and/or emergency showers are to be located adjacent to the chemical equipment and unloading areas. Showers and eyewash stations must be clearly identified, well lit, free from obstruction, in line of sight and no further than 10 seconds travel time of the potential hazard. Emergency showers are not required at chemical injection locations. Eyewash stations should be provided near chemical injection points that require routine maintenance.

C. Operation of eyewashes and emergency showers should trigger an audible alarm with a strobe light located in a visible area. Flow switch alarm from emergency showers and eyewashes should be provided and tied to SCADA. Operations staff at some locations may want to consider sending the alarm to the security monitoring control room also.

D. Eyewashes and/or emergency showers must meet American National Standard for Emergency Eyewash and Shower Equipment (ANSI Z358.1-2014 or latest version). Appendix F includes specific requirements and recommendations for emergency eyewash and shower equipment.

E. Tempered water is to be provided for emergency eyewashes and showers per ANZI Z358.1 – 2014 and OSHA guidance with a temperature between 60 ^{o}F and 100 ^{o}F. Note that 85 ^{o}F water is considered optimum for flushing of eyes.

F. It is recommended that flushing of the water supply piping to plumbed emergency showers and eyewashes be performed weekly in accordance with ANSI Z358.1-2014. Otherwise, the chlorine residual that provides disinfection will dissipate over time, and the water can become unsanitary and unsuitable for flushing of eyes and skin. Automated flushing of piping systems, with solenoid valves discharging to waste, is one way to perform flushing of supply piping on a regular basis. Individual eyewashes and showers must be flushed manually.

1.5 LAYOUT OF CHEMICAL STORAGE AND FEED ROOMS

A. It is preferred to install bulk chemical storage tanks and related equipment indoors. Indoor locations protect tanks, piping and valves, instrumentation, and pumps from weather extremes. Indoor tank locations also eliminate the challenges associated with collection of stormwater within secondary containment. Each chemical should be located within its own secondary containment area, and should be walled off from other chemicals, especially those that are highly corrosive (e.g., bleach, fluoride) or reactive/incompatible (e.g., acids, caustics, etc.).

B. Liquid chemical feeders must be located inside of secondary containment.

C. Chemical feeders should be mounted at least 30 inches above floor level so they will not be immediately inundated should a chemical or water leak occur and to promote ease of maintenance. Day tanks may need to be elevated accordingly, to provide positive head on the metering pump suction.

D. All rooms must be laid out such that tripping hazards are avoided. Any piping within the containment area that could be a tripping hazard must be provided with guards and/or step over platforms.

E. A common strategy should be employed for rooms such that safety devices (eyewashes) are located in a similar location (such as near the door) in each room.

F. Storage tanks have a finite life expectancy. Provisions should be included in the design of the building to allow for removal/replacement of bulk chemical storage tanks. Provisions may include removable skylights, roof or wall panels, or coiling doors. Knockout masonry walls are the least desirable method of replacing tanks.

G. Worker entry into tanks should be addressed through the confined space program. Entry to a tank from a top hatch is problematic and should be avoided when possible. Where entry into the tank is necessary, all safety requirements and provisions such as confined space retrieval devices should be employed. Proper clearances are required to employ retrieval equipment.

H. It is helpful to have double doors or coiling/roll-up doors for loading drums, pallets, or bags into and out of the rooms.

I. For non-bulk storage rooms, hand truck access ramp systems are discouraged. A shallow recessed area in the floor, supplied with grating to achieve a flush surface, allows for unimpeded access by drums on dollies while providing full containment for the largest container, and avoids the need to go over curbs (See Detail H2, Appendix H). Door sweeps should be used in lieu of thresholds that could interfere with hand truck/dolly operation. If access ramps are used, they should be designed with a maximum 1:12 slope.

J. For drum handling, consider an overhead beam lifting mechanism to move drums into the building.

K. Access into chemical containment areas should be by stairs with handrails up and over the wall or down into a recessed containment area. The use of ladders presents an increased safety hazard compared to stairs. Where ladders are provided, they are to comply with OSHA regulations found in 29 CFR Part 1910, Subpart D, 1910.27 Fixed Ladders.

L. Where tanks are installed outdoors, it is recommended that roofs be provided to shield the tanks from direct sunlight, and to reduce the amount of stormwater entering the secondary containment area.

PART 2 - MATERIALS OF CONSTRUCTION

2.1 GENERAL REQUIREMENTS

A. Materials used in chemical systems for tanks, piping, fittings, gaskets, hoses, protective coatings, in-situ instrumentation, etc. must be appropriately selected for highest practical level of compatibility with each specific chemical. Life cycle cost should be considered when selecting materials of construction. For example, titanium is highly resistant to sodium hypochlorite, but is not an economical material of construction for bulk storage. Recommended materials of construction for common treatment chemicals are included in Appendix C of this document and AWWA "Water Treatment Design", 5th Edition. Materials of construction should also be based on American Water engineering and operation staff experience and feedback. Chemical resistance information can sometimes be ascertained from material selection charts provided by various vendors, although the validity of the data is sometimes uncertain.

B. Special precautions must be taken when selecting materials of construction for hydrogen peroxide and sulfuric acid (90 percent concentrated and greater) as incompatible materials can result in immediate violent reactions.

C. Other materials of construction may be acceptable based on operational experience.

D. Authority to regulate products for use in, or in contact with, drinking water rests with individual states. Local agencies may choose to impose requirements more stringent than those required by the State. A standard developed under the direction of NSF, NSF/ANSI61 Drinking Water System Components-Health Effects is referenced by some states or local agencies for liquid chemical system components. The designer should check with the regulator on their policies for using NSF 61 listed components in chemical service.

PART 3 – BULK STORAGE TANKS

3.1 GENERAL REQUIREMENTS

A. Bulk storage tanks are typically used where the chemical consumption and economics justifies bulk storage over drum storage, or where the chemical being handled is particularly corrosive and handling of drums may be a safety hazard.

B. See Section 10 regarding secondary containment. Double wall tanks do not meet the intent of this standard, although they may meet the minimum regulatory requirement.

C. Storage tanks must be equipped with the following fittings:

1. Fill
2. Vent
3. Overflow

4. Discharge/outlet (also serves as drain)
5. Continuous level measuring instrument mount
6. High level switch mount
7. Gasketed hatch (top) for tank inspection
8. Fiberglass reinforced plastic (FRP) and steel storage tanks with volumes greater than 2,000 gallons (or the state/local regulatory limit) should be provided with a side manway to allow for internal inspections

D. Sight glasses with connections to the bottom of tanks are discouraged because of the potential for leaks and breakage. FRP tanks can be formed with a translucent vertical strip so the liquid level can be seen, but the liquid level can be difficult to see without artificial lighting. To make translucent strips effective, it is recommended that two (2) strips be provided, located 180 degrees apart. In addition, a nozzle located above the translucent strip can allow for artificial illumination. The liquid level can sometimes be seen through the sidewall in rotomolded tanks, but it may not be a reliable method especially for larger tanks with thicker sidewalls.

E. Connections to rotomolded high density cross-linked polyethylene (HDXLPE) storage tanks in the bottom third of the tank must be made through flexible connections to increase tank longevity and safety and comply with manufacturer warranty requirements. The flexible connections are to compensate for misalignment, absorb expansion and contraction, and isolate vibration and shock that could damage a tank. Higher level piping connections should also provide for flexibility by avoiding rigid pipe clamps/restraints/supports in close proximity to the tank. Inadequate connections can shorten the life of the tank due to stress concentration at the nozzle.

F. FRP tanks may also require care with connections to prevent adding stress to the nozzles.

G. Bulk tank's outlet should allow full drainage, or near full drainage. Some FRP tank manufacturers recommend against incorporating a false floor (encapsulated balsa wood) to pitch toward the drain. A siphon connection to the outlet allows for draining below the outlet fitting.

H. Bulk tank outlets should be sized according to the maximum transfer pump flow. Excessive velocities in the tank outlet can result in vortexing that reduces the useful volume of the tank. Internal fittings (siphon outlet) that approach the floor of the tank also help maximize the useful volume of the tank, and allow for nearly full drainage.

I. When a day tank is installed, a remotely actuated valve (normally closed) should be installed near the bulk tank outlet to keep the tank isolated except during transfer (see schematic in Appendix B). A manual butterfly valve should be mounted directly on the tank outlet followed by a flexible connector as required in Paragraph 3.1D. The actuated valve must be located immediately downstream of the flexible connection and supported separately to avoid placing excessive stresses on the tank outlet nozzle.

J. A means of access, such as a fixed ladder, should be provided to the top hatch and adjacent instrumentation. Steel and FRP tanks can be designed for staff access to the entire top of the tank by providing a safety rail around the perimeter of the tank top.

3.2 SELECTING BULK TANK CAPACITY

A. Bulk tank capacity is typically reviewed when a facility is being designed, or to evaluate the adequacy of an existing facility. Federal, state, and local regulations governing chemical storage should be considered when determining bulk storage tank capacities. It is common to have a regulatory requirement for 30 days storage, but without specific conditions of dose and flow. There may be some water quality benefit to reducing on-site chemical storage.

B. Sodium hypochlorite degrades while in storage. It is recommended that 12.5% concentration sodium hypochlorite storage be designed for 15 days of average plant flow and maximum dose, or maximum plant flow and average dose, (whichever is considered most reasonable), if allowed by regulators. The amount of storage should be balanced with the reliability of procurement and delivery, and the variability of consumption, and other factors such as other sources of supply. In addition, storage tank capacities for onsite hypochlorite generator systems typically range between two and four days, and should be based on the level of redundancy and ability to obtain and use concentrated sodium hypochlorite in the event of an equipment outage.

C. For new facilities, review at least five (5) years of historical data when available and determine the maximum month consumption. The historical data should be compared to near term growth projections (5-10 years) to determine a future maximum month of storage.

D. If historical data is not available, the designer should identify the volume of storage required for 30 days of storage at a maximum dose and average treated water flow, and also the volume required for average dose and maximum treated water flow. The 30-day total of average dose and average flow should also be computed.

E. To receive a full bulk delivery, tanks must be sized to accommodate 150 % of a bulk shipment of chemical so a facility does not have to run their tank to empty before receiving a full truckload of chemical, or risk overfilling their storage tank.

F. Review tank re-fill strategy with operations staff, as there may be a way to split a bulk load among multiple (small) facilities. Large facilities with good transportation infrastructure may be able to operate with reduced bulk storage volumes.

G. When evaluating bulk storage volume, all data in this section should be taken into account, along with the reliability of supply (supply distance, weather, road conditions), and potential for unexpected high dosages (e.g. coagulant). Final tank size should be made in consultation with operations staff, taking into account site-specific needs and factors. The designer should document the final criteria used for tank volume selection.

3.3 INVENTORY AND TANK LEVEL MONITORING

A. See Part 15 for a summary of instrumentation and controls.

B. High quality level monitoring devices and level switches, suitable for the application, are desired because of their important role in preventing a chemical overflow/spill or feed interruption.

C. A reliable and accurate means of monitoring inventory is required for bulk tanks. Ultrasonic or radar level devices are recommended for liquid level monitoring. High and low level alarms are to be provided based on the continuous level monitor. If using an ultrasonic device, the fitting installed to mount the device must be located in such a way as to prevent extraneous reflections to cause erroneous readings.

D. To prevent chemical overflow resulting from the mis-calibration of the continuous level system, an independent high-level switch indicating imminent tank overflow is also required with local audible alarms that can be heard at the filling station. The level switch must be installed/placed to facilitate ease of periodic testing and maintenance.

E. Due to the high frequency of leaks observed with the bottom fittings on storage tanks, sight glasses are not recommended on bulk storage tanks. Connections below the liquid level should be limited to a single normal outlet. Tank drain should be integrated as a tee fitting on the outlet.

3.4 OVERFLOW AND VENT REQUIREMENTS

A. Tank overflow should be provided and directed to secondary containment. In cases where the chemical has suspected corrosive or injurious vapors or mists such as hydrofluosilicic acid, ammonium hydroxide, and sodium hypochlorite, the end of the overflow pipe should be provided with a water seal (trap) (see Detail H3, Appendix H2). Rubber duckbill type valves have been shown to not be vapor tight.

B. All chemicals with the potential for corrosive or injurious vapors or mists are to be vented to the exterior. The vent line must not function as the overflow.

C. Special precautions must be taken with design of tank vents for onsite hypochlorite generation systems since blowers are used to positively ventilate the tank. Consult the system manufacturer for ventilation pressure requirements and inform the tank manufacturer of the anticipated pressure conditions.

D. The design of bulk storage tank venting is critical with pneumatic transfer of the chemical from the delivery truck. Without adequate venting, the storage tank can be overstressed with release of the air charge in the tank truck at the end of a delivery. This is a concern for both FRP and rotomolded polyethylene tanks. Specific guidelines for venting polyethylene storage tanks are included in Appendix G. It is recommended that the venting guidelines in Appendix G be used to size vents for all bulk storage tanks to avoid over-pressurization. Hinged top manway hatches can supplement properly designed venting to prevent over-pressurization during the unloading process, but should not be used on chemicals with harmful vapors, such as aqueous ammonia.

3.5 TANK HOLD-DOWNS

A. Tank restraints are needed to resist seismic forces in seismically active areas. The system should be designed by the tank vendor when site-specific seismic conditions are presented in an engineering specification. The actual anchor to the concrete slab is typically designed by the design engineer. To keep the tank from moving laterally, restraints may take the form of metal clips anchored to the tank pad, but not attached to the tank.

B. Hold-downs may be needed to prevent tanks from becoming buoyant in the case of secondary containment being filled with liquid.

C. Hold-downs are needed for tanks located outdoors due to wind loadings.

D. Design specifications for chemical tanks should call for tank restraints to be designed by a professional engineer.

3.6 SODIUM HYPOCHLORITE BULK TANKS

A. American Water has had inconsistent results using polyethylene storage tanks when storing dilute and concentrated sodium hypochlorite. Linear polyethylene and cross-linked polyethylene tanks equipped with a linear polyethylene liner are acceptable for storage of sodium hypochlorite where the volume does not exceed 1,000 gallons.

B. Storage tanks for sodium hypochlorite storage greater than 1,000 gallons in size should be constructed of fiberglass reinforced plastic (FRP). The tanks must be specifically designed and constructed for sodium hypochlorite due to the aggressive nature of the chemical.

C. For the longest tank life, and protection of the contents, bulk storage tanks should be located in a cool area away from direct sunlight.

D. Sodium hypochlorite storage tanks have a shorter service life than other chemical tanks and provisions for tank replacement are essential.

E. Cleaning and flushing of sodium hypochlorite tanks annually is recommended to protect the quality of the chemical, and to minimize tank degradation.

F. Some references suggest diluting sodium hypochlorite to slow the degradation process. Experience has shown that in-tank dilution is difficult to accomplish and is not recommended for medium to large tanks at American Water facilities. Where high temperatures may promote rapid degradation, it is recommended that air conditioning of storage rooms be provided.

3.7 TANK INSPECTION RECOMMENDATIONS

A. State regulations typically govern tank inspection requirements over the life of the tank. External tank inspections, looking for obvious signs of leakage or corrosion, may be required as often as weekly or monthly. More detailed formal inspections may be required on a schedule such as every five (5) years.

B. In states without inspection requirements, it is recommended that cursory external inspections be performed monthly for all tanks larger than 100 gallons, looking for leaks at fittings, or leaks at the bottom of tanks. For tanks 2000 gallons and larger, formal inspections should be performed at intervals no more than every 5 years. The formal inspection would include draining of the tank. The details of the formal inspections should mirror industry practice, and consider the type of chemical and the type of tank construction. Records of tank inspections should be maintained.

C. Some states require inspection of chemical storage tanks when either site volumes or individual tank volumes exceed a certain threshold volume. Regulatory compliance for steel tanks is often based on following an industry standard such as Steel Tank Institute STI-SP001 for inspection requirements. For FRP tanks greater than 2,000-gallon capacity, NJDEP requires acoustic emission testing in addition to internal and external inspections. Acoustic emission testing is a non-destructive test method that is addressed in ASTM 1067 “Standard Practice for Acoustic Emission Examination of Fiberglass Reinforced Plastic Resin (FRP) Tanks/Vessels”. Acoustic emission testing can be performed with the tank in-service. Inspection of rotomolded tanks, above a certain capacity, may be required by regulation, but there is no industry consensus standard for inspection. Entry to the rotomolded tanks for inspection is usually not required.

D. Most state regulations do not require tank entry for inspections. If the state requires internal inspection, a side entry port should must be provided. While the side entry port provides better access, it can also be difficult to seal and can be a source of leakage so is only recommended if internal inspections are required. Side entry access hatches are generally not available on rotomolded tanks.

E. Tank testing requirements should be clearly identified in a spill prevention plan, and also recorded in the asset management module of SAP so they can be incorporated into the facility’s preventive maintenance plan.

F. Entry to chemical storage tanks through the top hatch is discouraged. If access is required through the top hatch, all safety aspects must be addressed in advance of the inspection. For example, a top hatch must designed with anchor points for safety/retrieval devices to facilitate fall prevention and confined space retrieval/rescue.

PART 4 – TRANSFER PUMPS

4.1 GENERAL REQUIREMENTS

A. Transfer pumps are to be provided to deliver chemical from bulk tanks to day tanks or batch tanks. Gravity flow from bulk tank to day tank is not allowed because of the high risk for overflowing of the day tank due to not achieving 100% shutoff, or from extended transfer durations at low bulk tank levels.

B. Redundant transfer pumps must be provided for disinfectants and primary coagulants, and are recommended for other chemicals. Where there is a desire to minimize the number of installed transfer pumps, a single installed transfer pump

is allowed for disinfection and primary coagulants if the production facility can be taken off line for repairs or replacement. Where only one transfer pump is installed, a second pump is recommended to be held in inventory as a spare.

C. A bypass around the transfer pump is not allowed.

D. Discharge piping from the transfer pumps must be configured to prevent gravity flow or siphonage from the bulk tank. The fill piping downstream of the siphon break should be sized for gravity flow. The exception is for viscous materials like polymers where siphoning is not a concern.

E. Direct piping from the bulk tank, through the transfer pumps, to the day tank, without an air break is permitted only for viscous chemicals such as polymers.

F. For most liquid chemicals, American Water has had good success using magnetic drive sealless centrifugal pumps. Often, the impeller must be trimmed according to the specific gravity and viscosity of the chemical.

4.2 OPERATION OF TRANSFER PUMP

A. Continuous local operator supervision of the transfer process is preferred. This is usually accomplished with a hold-to-run (momentary contact) push button switch. Transfer pumps should be sized to fill the day tank within two minutes to prevent operator fatigue.

1. Note that there have been instances where hold-to-run switches were purposely defeated and spills occurred. In most of these cases, the timeframe for filling the tank was longer than two minutes due to a design or operational problem with the pump. The pump problem should be corrected as soon as possible as this condition cannot be successfully addressed with an “undefeatable” switch.

B. For day tanks larger than 100 gallons, automatic shutoff of the transfer pumps may be employed if the following conditions are met:

1. Secondary containment is provided.

2. A high level switch, a continuous level measuring device, ***and*** a spill switch in a sump are ***all*** provided and interlocked with the transfer pump to provide at least three levels of overfill protection.

C. When automatic shutoff is used, transfer pumps should be sized to complete the transfer operation within 30 minutes. Automatic shutoff of the transfer pumps should be done through SCADA based on the continuous level (or weight) full tank set point. Shutoff with the high-level switch is an abnormal condition and should not be the basis for normal operation. The provision of a second switch for pump shutoff, in addition to high level, is acceptable.

D. **Transfer pump operation must *never* be initiated automatically without operator involvement.** Also, it is strongly recommended that transfer pump operation be only initiated locally and not remotely through SCADA. This approach

assures that an operator visually inspects the chemical storage facility for leaks or other malfunctions prior to transferring chemicals. However, it is recognized that remote filling of day tanks may be desirable at some remote, un-manned locations. To minimize risks associated with remote refill, the following requirements must be met:

1. Three independent overfill protection devices must be provided. Devices must include 1) a sump level alarm and 2) an independent tank high-level probe directly interlocked with the transfer pumps. The third interlock would normally be a software alarm from the continuous level or weight monitoring device or SCADA system.

2. Monthly in-person observation of chemical transfer operation must be performed and documented.

3. Quarterly testing of all overfill protection devices must be performed and documented.

4. Remote refill must be limited to facilities not required to be attended on a daily basis.

5. Monthly and quarterly testing documentation shall be audited on a regular basis.

6. Video surveillance is a useful tool to assist in monitoring the transfer process and should be considered.

PART 5 – DAY TANKS

5.1 GENERAL REQUIREMENTS

A. Day tanks are used to allow accurate determinations of chemical use, and minimize the volume of chemicals which can be accidentally discharged into the treated water. Many regulatory agencies require day tanks where bulk liquid chemical storage is provided.

B. Day tanks are required when bulk storage is provided. An exception is in large treatment plants when chemical feed can be measured with a reliable flow meter and the chemical is used in pre-treatment. Direct feeding of chemicals from bulk tanks to finished water is not allowed.

C. Day tanks must be equipped with the following fittings:

1. Fill
2. Vent
3. Overflow
4. Discharge/outlet/drain
5. Continuous level measuring instrument mount (not required if weigh scale is provided)
6. High level switch mount

7. Gasketed hatch (top) or removable top for tank inspection

D. Day tanks may be elevated on a concrete pad to enable a positive suction head to the metering pumps at all levels in the day tank.

5.2 SIZING

A. A useful tool in sizing of day tanks is to calculate 125% of the daily volumetric requirements of the maximum dose for the average daily treated water volume, and the average dose for the maximum treated water volume. Where chemical doses have a wide range, resulting in large day tanks, day tanks may be downsized and refilled more than once per day when high chemical demands occur. An overly large day tank does not allow for accurate determination of feed rate and can compromise the safety goal of day tanks. The useful storage volume of the tank should be identified, not just the nominal tank volume.

B. For remote facilities that are not visited on a daily basis, it is acceptable to size a day tank for up to 3 days of projected maximum daily usage.

C. For new facilities, the basis of design for sizing the day tank should be documented in the Engineer's Report.

5.3 INVENTORY AND TANK LEVEL MONITORING

A. Continuous level or weight monitoring is recommended, with alarms for high and low level in the day tank. Ultrasonic or radar type non-contact devices work well for measuring level, although there is a certain dead zone near the device that must be considered.

B. An independent high level switch indicating imminent tank overflow with local audible alarm must be used. The high level switch must be interlocked with the transfer pump as described in Section 4.

C. The continuous level or weight monitoring provides a basis for inventory control. It is possible to use loss in weight, or loss in level calculations to calculate chemical consumption as a control strategy.

D. Sight glasses with connections to the bottom of tanks are discouraged because of the potential for leaks and breakage. FRP tanks can be formed with a translucent vertical strip so the liquid level can be seen, but the liquid level can be difficult to see without artificial lighting. To make translucent strips effective, it is recommended that two (2) strips be provided, located 180 degrees apart. Also a nozzle located above the translucent strip can allow for artificial illumination. The liquid level can sometimes be seen through the sidewall in rotomolded tanks, but it may not be a reliable method especially for larger tanks with thicker sidewalls.

5.4 OVERFLOW AND VENT REQUIREMENTS

A. The day tank fill line must be piped and vented to prevent the possibility of gravity flow or siphonage from the bulk tank to the day tank. Direct piping is allowed only for viscous chemicals such as polymer.

B. When sizing and installing the day tank overflow, the liquid level must not be allowed to rise such that the hydrostatic head exceeds the tank's design rating. This can typically be accomplished by making the overflow pipe at least two (2) inches larger than the fill line, i.e., 4" overflow for a 2" fill. Most tanks are atmospheric; meaning no amount of surcharge is acceptable.

C. Tank overflow must be provided and directed to secondary containment. In cases where the chemical has suspected corrosive or injurious vapors or mists, such as hydrofluosilicic acid, ammonium hydroxide, and sodium hypochlorite, the end of the overflow pipe should be provided with a water seal (trap) (see Detail H3, Appendix H). Rubber duckbill type valves have been shown to not be vapor tight.

D. All chemicals with the potential for corrosive or injurious vapors or mists must be vented to the exterior.

PART 6 – METERING PUMPS

6.1 GENERAL REQUIREMENTS

A. Where facilities cannot be taken off line, redundant installed metering pumps are required for disinfectants and primary coagulants, and recommended for all other chemicals. Where only one pump is installed, a second pump is recommended to be held in inventory as a spare.

B. Metering pumps should be located near the day tanks. Diaphragm metering pumps have the ability to operate with a suction lift, but are more reliable with a flooded suction. While pumps could be installed at or near floor level, metering pumps should be elevated at least 30-inches off the floor to facilitate operation and maintenance, as well as reduce the chance of submergence if a leak occurs. Pumps are to be installed so that adequate suction conditions are maintained. It may be necessary to elevate day tanks to maintain adequate pump suction conditions.

C. Diaphragm metering pumps can have a wide flow range, with both stroking frequency (speed) and stroke length being adjustable. Pumps that only have variable speed, such as peristaltic pumps, have limited flow range (turndown).

D. A calibration cylinder must be provided on the suction side of the metering pumps to permit rapid and accurate determination of the pump's delivery rate. The top of the calibration cylinder must be piped back to the day tank to prevent a chemical spill should overfilling occur.

E. Note that diaphragm metering pump output is typically accurate and linear with respect to stroke length and stroking speed. However, the output typically goes to zero at 1-2% speed, so this must be accounted for when operating at low pump outputs.

F. Some regulators require splashguards adjacent to metering pumps. If not required by the regulator, this feature should be discussed as part of the facility design process.

G. Peristaltic type metering pumps are gaining acceptance for low pressure (< 30 psi) chemical feed applications, typically in the treatment plants. They inherently prevent siphoning because the tubing is always compressed. They also can pump the gas bubbles that are present in sodium hypochlorite systems without losing prime.

H. Some American Water facilities have had good success with gear pumps for sodium hypochlorite, or as transfer pumps for polymer. Gear pumps can operate at elevated pressures, but cannot tolerate grit or suspended solids.

6.2 SIZING

A. Metering pumps must be fully capable of operating over a feed range corresponding to max day/max dosage down to min day/min dosage. If necessary, a second set of pumps must be provided to feed chemicals accurately at low flow ranges.

6.3 PUMP CONTROL

A. Metering pump control includes start/stop and feed rate adjustment. Start/stop control must have safeguards to prevent feeding of chemicals without water flow (such as at a well station). Due to the frequency of overfeed, some regulatory agencies require two or three levels of protection.

B. The use of a single parameter to indicate flow to start/stop metering pumps is not allowed at partially attended or remotely operated facilities. Auxiliary relay contact outputs from a motor starter can be one of the multiple safety interlocks, when coupled with another positive means of flow detection. Treated water flowmeters can be used as one method to stop and start chemical systems. When there is no flow indicated by the flow meter, metering pumps must stop and remain in the off mode position. “Paddle-type” flow switches can report flow, but may be unreliable in some applications. A position switch on a check valve with external lever is a reliable indicator of flow. Continuous analyzers used for water quality monitoring downstream of chemical addition points, or detecting excessive loss of weight/level in the day tank can also be used as secondary “stops” for metering pumps for some chemicals. When excessive chemical feed is detected, an alarm is to be sent to the operator. If the alarm is not addressed within a prescribed time limit, the system may require a shut-down. Each system should be capable of stopping the pump even if there is a total failure of the other system.

C. Provisions should be included to allow manual operation/control of the metering pumps for equipment maintenance and troubleshooting. However, special care must be taken to ensure that only automatic mode with properly functioning safety interlocks is used during unattended operation.

D. Diaphragm metering pumps typically have capacity adjustment by varying speed, and stroke length (volume per stroke). For chemicals that are fed at a relatively consistent dose, remote control of speed alone is typically sufficient. Some installations may require remote control of both speed and stroke length.

PART 7 – PIPING AND TUBING

7.1 GENERAL REQUIREMENTS

A. Piping and tubing are needed to convey treatment chemicals from the point of delivery to the bulk storage tanks, to the feed equipment, and to the point of application.

B. The chemical piping system must provide adequate carrying capacity, and comply with the desired pressure and temperature ratings of the system.

C. It is good design practice to minimize the length of chemical feed piping, but it is not always possible. Underground chemical piping is costly and typically has higher maintenance requirements due to leaks and blockages. Providing spare feed lines to primary application points is good design practice.

D. In most cases, chemical piping and tubing will require replacement numerous times in the life of a facility, and should be installed in such a manner as to allow for replacement.

E. Bulk tank fill piping must be properly braced and supported because it is subject to shaking near the end of each bulk tank delivery (pneumatic transfer method). Typically the piping is at a high elevation, above the top of the bulk tanks. The piping should be pressure tested at time of installation. It is recommended that personnel stay away from overhead the fill piping during unloading as a pipe break could expose them to large quantities of chemical.

F. See Part 10 for secondary containment requirements.

7.2 PVC AND CPVC PIPING

A. Schedule 80 PVC piping is acceptable in many, but not all, rigid liquid chemical piping systems. Ammonium hydroxide (aqua ammonia), hydrogen peroxide, and sulfuric acid (above 94%) are not compatible with PVC and CPVC. Refer to Appendix C for recommended materials of construction.

B. CPVC should be considered for applications where temperatures exceed 90^{o}F.

C. PVC and CPVC pipe should be joined by solvent welding. Large PVC/CPVC unions are difficult to seal so flanged connections should be used instead of union connections for pipe diameters of three inches (3 in) and greater.

D. Threaded joints are not as strong as solvent welded joints and there is a tendency for some chemicals to weep through the joints. The tendency for weeping is increased with higher operating pressures. Threaded joints are to be minimized, especially for caustic soda, sodium chloride brine, sodium hypochlorite, and sodium permanganate.

7.3 TUBING AND HOSES

A. Flexible plastic tubing can be used where continuous runs are required. The plastic tubing should be accessible and be easily replaced (see Detail H4, Appendix H).

B. Chemical hoses can be used when transitioning from rigid piping to equipment and diffusers. They can also serve as primary piping inside a rigid casing pipe.

C. When changing piping direction, gradual radius sweeps or concrete vaults are needed to allow for installation and removal of tubing and hoses. Sharp bends have proven to cause failure of tubing and hoses during installation.

D. Hoses may need support for strain relief at injection points.

PART 8 – VALVES

8.1 GENERAL REQUIREMENTS

A. Diaphragm metering pumps require at least 15 psi backpressure to function properly. If sufficient backpressure is not continuously available, then backpressure valves should be used to maintain a minimum of 15 psi backpressure to ensure accurate delivery. The valves also prevent siphonage or gravity flow of chemicals from the day tank through the metering pumps. Backpressure valves contain a diaphragm and spring, and are reliable; however, preventive maintenance and periodic testing are needed.

B. In situations where siphoning, or gravity flow, is possible, such as pumping chemical to a below grade clearwell, two backpressure valves should be placed in series to provide increased level of anti-siphon protection. The backpressure valve closest to the pump should be set at a higher pressure than the second backpressure valve. A vacuum breaker that opens to atmosphere is often used in plumbing systems (water) to prevent siphoning, but is not recommended in chemical systems due to the potential for leaks.

C. Pressure relief valves must be used where positive displacement metering pumps are capable of producing sufficient pressure to cause damage. The pressure relief valve must be installed upstream of the first valve on the metering pump discharge. Isolation valves are not allowed between the metering pump and the pressure relief valve. The discharge of the pressure relief valve should be directed to the day tank or drum, or to the pump suction line upstream of individual isolation valves if only a single day tank is present. The practice of directing the pressure relief valve discharge to the containment sump allows the discharge to be visually identified, but results in a release that must be addressed, and is not recommended.

D. A “Four-Way Valve” which provides anti-siphon, backpressure, priming, and pressure relief action is commercially available for low capacity applications and can be used to replace separate pressure relief and backpressure valves.

E. Large PVC/CPVC ball valves can be difficult to operate. It is suggested that butterfly valves be used in sizes 3 inch and larger.

F. Valves must be accessible for operation and testing. It is recommended that the piping design and installation not allow valves to be located more than five (5) feet above finished floor.

8.2 BACKPRESSURE VALVE TESTING

A. Backpressure valves contain a spring and diaphragm. If the backpressure valve becomes clogged, it may not perform properly, or the flow through the valve may be blocked. The functioning of the valve cannot be determined by visual inspection since there are no external moving parts. Valve testing procedures used to determine the integrity of a particular valve diaphragm and seat are discussed below:

1. The functioning of backpressure valves can be determined by observation of an upstream and downstream pressure gauge. The upstream pressure gauge should read higher than the downstream gauge.

2. When backpressure valves serve to prevent gravity flow (e.g. siphon), then it is possible to test the valve in-situ, or on a test bench, by creating a downstream vacuum condition using a hand vacuum pump (see Figure I-1 in Appendix I). Any leakage through the valve should be trapped in the receiver, as the liquids would damage the vacuum pump. Testing of anti-siphon valves is recommended at least once per year.

8.3 BALL VALVES FOR SODIUM HYPOCHLORITE

A. Ball valves in sodium hypochlorite service are to have vented balls with a 1/8 inch diameter hole located in the ball on the downstream side to relieve internal pressurization caused by degradation of the sodium hypochlorite.

PART 9 – FEEDING FROM DRUMS

9.1 GENERAL REQUIREMENTS

A. Chemicals may be fed directly from non-refillable drums in low capacity systems.

B. Where drums are used, it is recommended that proper drum handling equipment be provided to minimize the risks associated with moving drums. Such equipment includes hoists, pallet trucks, and dollies. Training should be provided on the proper operation of the equipment.

C. As with day tanks, it is prudent to limit the volume of chemical directly connected to the water supply in case of accidental release. A day tank is to be used if the drum represents more than a seven-day average flow-average dose supply.

D. It may be convenient to have a permanent “day” tank, and use an electric drum pump to transfer from drums to the day tank. This approach minimizes the need to move drums around, including on and off the scale.

E. Drum mixing devices must be provided when applicable.

9.2 INVENTORY AND TANK LEVEL MONITORING

A. A weighing scale or reliable level monitoring device should be used to monitor the quantity of material remaining in the drum. The system should also be equipped with a low weight alarm. An independent high level switch is not required.

9.3 VENTILATION REQUIREMENTS

A. Adequate ventilation should be provided for drum feed areas. Separate rooms may be necessary for fuming chemicals such as hydrofluosilicic acid.

PART 10 – SECONDARY CONTAINMENT

10.1 GENERAL REQUIREMENTS

A. Secondary containment must be provided for all bulk tanks, day tanks, batch tanks, metering pumps, transfer pumps, and chemical unloading areas. To the extent possible, bulk tanks and day tanks should be in the same containment.

1. Most chemical leaks occur between the bulk tank and the metering pumps. In some areas, the minimum regulatory requirements may allow double wall tanks in lieu of providing secondary containment for all of the facilities listed above, but double wall tanks, by themselves, do not meet American Water’s requirement for secondary containment.

B. Minimum secondary containment volume is to be determined based on 110 percent of the largest storage tank capacity within the containment area plus allowances for fire sprinkler water, stormwater contribution, or reasonable freeboard as appropriate. State or local regulations may dictate the amount of capacity necessary for secondary containment.

C. All metering pump suction piping should be located in the containment area.

D. The secondary containment structure should be protected with a coating or liner if the chemical is corrosive to the containment structure based on the expected duration of contact. A prime example of a corrosive chemical that would require a coating or liner is hydrofluosilicic acid within a concrete containment area. Appendix C includes a recommendation for when concrete containment areas should be equipped with a chemical resistant coating/liner.

E. Penetrations of conduit and piping through containment walls or floors is not permitted, and notes on the engineering drawings should address this prohibition. Chemical resistant coating systems should be touched up after installation of drilled anchors used for tank restraint systems, pipe supports, etc.

F. Secondary containment must also be provided for all drums/carboys. The containment volume should hold the larger of 1) 110 percent of the contents of the largest drum, or 2) 10 percent of all drums in storage. Portable containment skids are acceptable if they are capable of containing the full contents of the drum, although bladder style skids should be avoided if possible due to long term integrity concerns.

G. Secondary containment should be provided for buried chemical solution lines to minimize the potential for accidental releases to the environment. Secondary containment for reinforced flexible tubing should be provided with schedule 80 solvent welded PVC, CPVC or continuous HDPE piping. Refer to Detail H4, Appendix H for recommended standard.

H. Where chemical feed lines are buried, it is common to have concrete vaults at intermediate locations to allow for changes in direction, or have access for replacement of chemical tubing. Likewise, concrete vaults may be used where the chemical is injected into the water pipeline. While watertight underground vaults are the goal of designers, vaults are rarely water tight in practice. These are important assets and should be inspected on a regular frequency, at least monthly. It is recommended that liquid level switches be provided in chemical piping vaults, with high level indication to SCADA. A local red/green alarm light can provide rapid indication of a vault with high liquid level. Sumps should be provided in the base of the vault to allow for draining of water, or chemical, when required. Refer to Part 14-Provisions for Maintenance for additional guidance on sumps.

I. Secondary containment for exposed chemical feed lines within buildings is not required because the building should provide an adequate level of containment, leaks are readily evident, and chemical feed flow rates are generally low. However, additional protection (e.g., double-walled pipe, flexible tubing inside a larger diameter PVC pipe, or drip tray system) should be provided for chemical lines where the lines are located near doorways. Secondary containment is not required for lime slurry or powdered activated carbon slurry.

J. Floor drains are not allowed in secondary containment areas. As mentioned elsewhere in this document, a sump within the containment area is a useful feature that provides a common point to monitor for leaks, and for maintenance. Refer to Part 14 – Provisions for Maintenance for additional guidance on sumps.

10.2 CHEMICAL UNLOADING AREA CONTAINMENT

A. Minimum secondary containment volume for bulk chemical unloading areas is to be determined based on the volume of the largest chemical delivery tank truck plus freeboard. The designer shall evaluate local and state regulations, and use professional judgement in determining freeboard. USEPA suggests, but does not require, sufficient freeboard to contain 24 hours of precipitation from the 25-year design storm. The designer is to explicitly identify the criteria used in the Design Memorandum.

B. If chemical deliveries are infrequent, then secondary containment volume can be based on an estimated spill rate and duration. The designer shall identify the basis for stormwater contribution.

C. Portable containment systems may be used on an interim basis until permanent containment systems can be completed.

PART 11 – DILUTION WATER

11.1 GENERAL REQUIREMENTS

A. Continuous dilution water, after the metering pump, is sometimes recommended to improve dispersion at the feed point, to dilute the concentrated chemical to a more practical concentration, or where the chemical output is very low. An indicator device such as a residential type positive displacement meter should be provided immediately upstream of the chemical injection point to provide positive flow indication.

B. Any water supply connected to a chemical system must have proper backflow protection. A reduced pressure zone (RPZ) type device is required for the building water supply to chemical systems. Parallel RPZ devices are required where the flow of water cannot be interrupted. RPZ discharge to chemical containment is prohibited because of the potential high rate of discharge of water.

C. At each chemical system connection to water, some form of backflow prevention is needed. For filling of batch tanks, an air gap or a vacuum breaker may be used. At each chemical system, the minimum level of protection should be a check valve.

D. At each chemical system connection to water within secondary containment, a solenoid valve should be provided to allow for remote shutoff in the event of a water leak within a containment area.

E. At each chemical system connection to water, a high pressure switch should be provided to indicate that the line may be clogged and there is potential for the chemical to be pumped backwards through the water line. Activation of the switch is to send an alarm to SCADA.

F. Low concentrations of iron or manganese in the water can cause rotameters or sight flow indicators to become opaque. The use of residential type flow meters can be a cost effective and reliable flow indicator with low maintenance requirements.

11.2 SOFTENED WATER

A. Softened water is highly recommended when diluting high pH chemicals such as ammonium hydroxide, sodium hydroxide, and sodium hypochlorite to minimize scaling (rapid scaling) of chemical feed lines. Total hardness less than 10 mg/l (as $CaCO_3$) is desirable and achievable by ion exchange softening.

PART 12 – LEAK DETECTION

12.1 GENERAL REQUIREMENTS

A. Chemical feed systems should have a sump within the secondary containment area equipped with a level switch to signal the occurrence of a leak. It is important that personnel be alerted of a leak as soon as possible.

B. Further, it is recommended that the sump mounted leak sensor be electrically interlocked with the isolation valve on the bulk storage tank, and the transfer pumps. Upon detection of a leak the valve should close and transfer pumps should stop, until the leak condition is locally acknowledged. Metering pumps can continue to operate.

PART 13 – CONTINUOUS ANALYZERS

13.1 GENERAL REQUIREMENTS

A. Water quality should be monitored downstream of the chemical addition point to protect the consumer from accidental chemical over- or under-feeds. For strong acids and bases, continuous pH monitoring must be employed to provide warning of excessive chemical feed. Chlorine residual must be monitored to ensure that the correct disinfectant concentration is present. Other online analyzers such as phosphate, fluoride, and ammonia may also be desirable.

13.2 WARNING SYSTEMS

A. In a manned station, alarms from these analytical devices should warn the operator through SCADA so appropriate countermeasures can be taken.

B. In an unmanned facility, alarms should be provided to alert the operator via SCADA or autodialer of a potential problem, and consideration should be given to taking facilities offline in response to an overfeed or underfeed alarm.

PART 14 – PROVISIONS FOR MAINTENANCE

14.1 GENERAL REQUIREMENTS

A. Provide means for draining chemical piping to allow for maintenance. Connections should also be available to flush suction and discharge chemical piping. Discharge piping flush connections should be downstream of all special valves. Draining and flushing procedures should be documented in Standard Operating Procedures. Flush water and flushing connections should be provided when the chemical is compatible with water.

B. Facilities must have the capability to drain chemical storage tanks. Temporary hose and pumping equipment may be necessary to transfer the chemical out of the secondary containment area to an intermediate tank.

C. Provisions for disposal of cleaning/wash down and safety shower test water within secondary containment areas should be considered in the design phase of improvements. While an automatic sump pump would defeat the purpose of secondary containment, a manually operated sump pump powered from a SCADA-controlled 120-volt outlet with a short duration timer (e.g., 10 minutes), triggered by a local pushbutton switch, may be provided and connected to the sanitary sewer for this purpose. The pump must only be used when water/liquid in the sump is acceptable for discharge. Testing of the liquid, such as pH, should be performed prior to discharge. A similar procedure can be used for pumping out vaults for buried piping.

D. Where tubing is used, it must be easily accessible and removable for replacement.

E. Valves must not be placed at an elevation of more than 5 feet above finished floor. It is recommended that this note be included on all piping design drawings as an instruction to the contractor.

F. It is common for chemicals to be injected into a water main under pressure. The details of the injection assembly are critical because of the need for proper dispersion of the chemical, avoiding corrosion at the site of injection (internal and external), and allow for safe removal of the injection stab tube for cleaning. It is typical to provide a brass corporation that is threaded to the water pipe, or to a saddle attached to the water pipe. The use of a saddle has many advantages. The corporation acts as a shutoff valve when the stab tube is removed. It is important to restrain the stab tube, using an appropriately sized chain or double chain, as the tube is removed. It is common for PVC and CPVC to be used as the stab tube, and the tube to penetrate one-third of the diameter of the pipe. Metal stab tubes, are preferable to plastic stab tubes when the length exceeds about 8 inches because long plastic tubes can break due to fatigue. Non-removable stab tubes are a simpler device and may be appropriate where the chemical does not tend to form blockages. A leading supplier of injection assemblies is Saf-T-Flo.

G. All instrumentation and valves must be accessible for maintenance and repair. If temporary ladders are to be used to access equipment, then there must be sufficient space for correctly positioning the ladder and accessing the equipment in a safe manner in accordance with OSHA requirements.

PART 15 – INSTRUMENTATION AND CONTROL

15.1 GENERAL REQUIREMENTS

A. Instrumentation and controls are addressed at multiple locations in this document and are summarized in this part.

B. Typical chemical storage and feed process flow diagrams are provided in Appendix B. Designers typically use the process flow diagram as the basis for preparation of Piping and Instrumentation Diagram (P&ID) type drawings. The P&ID drawings should be carefully reviewed early in the design.

C. It is typical to periodically have minor chemical discharges near the metering pumps during routine operation and maintenance. It is recommended that control and electrical panels and devices be purposely kept away from metering pumps, minimum of 36 inches, to avoid exposure to routine chemical leaks.

15.2 LEVEL CONTROLS

A. Continuous level instrumentation is required to monitor bulk tank level. Non-contact ultrasonic or radar devices, mounted on top of the tank, away from the fill connection, have proved to be reliable and accurate. Close attention must be paid to positioning these devices to prevent “ghost” signals from creating nuisance alarms. High level alarm shall sound at the fill station.

B. For day tanks, level is to be monitored directly or indirectly using non-contact ultrasonic or radar devices, electronic weigh scales. In some cases, pressure transmitters may be used.

C. A level switch, independent of the continuous level instrumentation, is to be located in bulk storage tanks and day tanks to identify when the liquid level is near the overflow level. The high-level switch should be interlocked to visual and audible alarms, connected to SCADA. Bulk tank high-level switch shall alarm at the fill station. The high-level switch in day tanks is to be interlocked with transfer pumps.

D. For day tank installations where continuous level instruments may not be reliable during filling (such as small tanks), a dedicated level switch can be used to terminate a fill cycle.

E. Level switches are to be provided to sense a high liquid level in secondary containment sumps and provide alarm indication through SCADA.

F. Level switches should be provided in buried piping vaults that are providing secondary containment. Local alarm lights (red/green) can provide rapid indication of a high level.

15.3 CHEMICAL FLOW METERING

A. Metering the flow of liquid chemicals is difficult and rarely performed because the flows are typically low, the chemicals are corrosive, and flows may occur in a pulse type manner.

B. No specific recommendations for flow meters are made in this document. The day tank often serves as an adequate “flow meter” when changes in level or weight are calculated over a discrete time period.

C. When a chemical flow meter is being considered, a number of checks should be made prior to implementation. For example, the range of the flow meter should be verified against the project requirements, the viscosity of the chemical should be checked against meter capabilities, and the pressure rating of the meter should be verified. The meter components should be resistant to the chemical. Provisions for verifying accuracy over the life of the unit should be included in the design.

15.4 PUMP AND VALVE CONTROLS

A. Metering pump controls are discussed in Section 6.3.

B. Transfer pump controls are discussed in Section 4.2. The high level switch in day tanks and the sump leak alarm must be hard-wired to the starter for the transfer pump to provide certainty of pump shut-off on high level. Stopping the pump on "full" level using the continuous level signal through SCADA is acceptable.

C. Actuated valves on the outlet of bulk storage tanks may use electric motors or pneumatic actuators. Full open and full closed limit switches are to report position back to SCADA and local control panel. Actuated outlet valves on bulk tanks should close automatically if a high level leak alarm is detected.

15.5 CONTROL PANELS

A. A local control panel is to be provided at the bulk fill area (typically outdoors) to provide important information that can minimize the potential for tank overflows during chemical unloading. The control panel is to indicate the percent full status of each bulk storage tank. The control panel should show the position of the spill containment valve, if valve is equipped with a limit switch. The fill control panel is to be equipped with an alarm beacon and audible alarm horn to signal when a bulk tank high level alarm is triggered. A silence pushbutton is to be provided, but an alarm indicator beacon is to continue to show if a high tank level alarm is active. A typical panel is shown in Detail H5, Appendix H.

B. A local control panel is to be provided for each bulk chemical/day tank/transfer system. The control panel is to present tank level or weight, status of transfer pumps and actuated valves, pump selector switch, and pump start/stop pushbuttons. The control panel will also have visual and audible alarms. Typical panels are shown in Details H6 thru H8, Appendix H.

15.5 SCADA CONTROL

A. It is expected that SCADA will continuously monitor chemical inventories. SCADA can also use algorithms to calculate usage by the loss in weight or level in day tanks.

B. SCADA will present status of pumps and valves.

C. SCADA is not to be used to automatically refill day tanks. However, remote operator-initiated refill of day tanks is permitted when all safety alarm interlocks are in place and properly maintained/tested as previously described.

D. All alarms are to be sent to SCADA and logged.

END

Appendix A

Liquid Chemical Feed System Design Standard Conformance Checklist

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		SUB SECTION	YES	NO	N/A	COMMENT
1. SAFETY REQUIREMENTS AND BUILDING LAYOUT						
1.01	Are Safety Data Sheets (SDS) available to all personnel?	1.1				
1.02	Is wall space reserved for display of safety information?	1.1				
1.03	Are pumps labeled?	1.2				
1.04	Is piping color coded according to Ten State Standards ?	1.2				
1.05	Is piping identified with labels indicating the chemical, and arrows pointing in the normal direction of flow? Labels are required.	1.2				
1.06	Are chemical system valves provided with an ID tag?	1.2				
1.07	Are pressure relief and backpressure valves labeled with pressure settings?	1.2				
1.08	Are storage tanks labeled with signage identifying usable capacity of the tank, contents of the tank, and chemical hazards? See Standard.	1.2				
1.09	Are facility entry doors labeled with NFPA diamond labels?	1.2				
1.1	Are separate bulk tank fill pipelines and connections provided?	1.3				
1.11	Are fill connections for bulk tanks provided with independently keyed locked enclosures? Or locked fill caps?	1.3				
1.12	Are fill connections for bulk tanks labeled including CAS number?	1.3				
1.13	Are drip pans provided at fill connections for housekeeping?	1.3				
1.14	Are eyewashes and emergency showers provided for all liquid chemicals?	1.4				
1.15	Are eyewashes and emergency showers located adjacent unloading areas?	1.4				
1.16	Do eyewashes and emergency showers meet American National Standard for Emergency Eyewash and Shower Equipment (ANSI Z358.1-2014 or latest version)?	1.4				

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		SUB SECTION	YES	NO	N/A	COMMENT
1.17	Is an alarm beacon and connection to SCADA provided?	1.4				
1.18	Is tempered water (60 deg to 100 deg F) provided for emergency eyewashes and showers?	1.4				
1.19	Is there a means to flush stagnant piping on a weekly basis?	1.4				
1.20	Are chemicals isolated within separate secondary containment areas?	1.5				
1.21	Are walls provided between chemical areas?	1.5				
1.22	Are chemical feeders within secondary containment?	1.5				
1.23	Are there tripping hazards (such as conduits, piping, etc)?	1.5				
1.24	Is there a means to replace tanks? How?	1.5				
1.25	Will workers be required to enter the top hatch of a tank? If so, are all required confined space equipment provided in compliance with confined space rquirements?	1.5				
1.25	Are properly sized doors provided where drums, pallets, IBC/totes are handled?	1.5				
1.26	Has a recessed containment area been considered where drums or IBC/totes are handled so grating is flush to concrete floor?	1.5				
1.27	Where ramps are provided, are they a maximum slope of 1:12?	1.5				
1.28	Has an overhead beam been considered for drum handling?	1.5				
1.29	Is ingaress and egress for secondary containment areas safe with stairs and handrails? Stairs preferable to ladders.	1.5				
1.3	For outdoor tanks, has a sunshade been considered to prolong tank life, minimize heating of tank contents, control stormwater accumulation?	1.5				
2. MATERIALS OF CONSTRUCTION		**SUB SECTION**	**YES**	**NO**	**N/A**	**COMMENT**
2.01	Do the materials of construction for tanks, piping, pumps, and valves agree with Appendix C?	2.1				
2.02	Does the chemical have unique properties that must be considered (such as hydrogen peroxide or concentrated sulfuric acid)?	2.1				

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		SUB SECTION	YES	NO	N/A	COMMENT
2.03	Is there local operational experience on materials of construction?	2.1				
2.04	Does the Regulator have NSF 61 requirements for selection of chemical equipment? If so, have selections been made accordingly?	2.1				
3. BULK STORAGE TANKS		**SUB SECTION**	**YES**	**NO**	**N/A**	**COMMENT**
3.01	Has bulk storage been considered to minimize handling of drums and IBC containers?	3.1				
3.02	Are double wall tanks proposed in lieu of secondary containment? If so, why? Reconsider the benefits of locating tanks within secondary containment per this Standard.	3.1				
3.03	Is a side manway provided for FRP tanks that require entry for internal inspection?	3.1				
3.04	Are sightglasses provided? Are they protected from damage? Sightglasses are not recommended for bulk tanks.	3.1				
3.05	Are flexible connections provided for pipe connections at the lower 1/3 of the tank wall for polyethylene tanks ?	3.1				
3.06	Does the tank allow for full drainage, or near full drainage with a siphon outlet?	3.1				
3.07	Is the tank outlet sized to minimize vortexing at the maximum transfer pumping rate?	3.1				
3.08	Is a normally closed remotely actuated discharge valve installed on or near the tank outlet?	3.1				
3.09	Is the remotely actuated discharge valve supported independently of the tank?	3.1				
3.10	Is a manual valve provided (butterfly preferred) upstream of the remotely actuated valve?	3.1				
3.11	Is a ladder provided to access the top of the tank?	3.1				
3.12	Has the desired storage capacity been evaluated from different perspectives? (e.g. max dose, avg day demand, etc)	3.2				
3.13	Are bulk tanks sized to accommodate at least 150 % of a bulk shipment of chemical?	3.2				
3.14	Has local Operations been consulted with respect to splitting partial bulk loads with other sites?	3.2				

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		SUB SECTION	YES	NO	N/A	COMMENT
3.15	Are there unique supply factors that may alter storage volumes (limited road access, nearby suppliers, etc)?	3.2				
3.16	Is continuous level monitoring provided?	3.3				
3.17	Is an independent high level switch provided?	3.3				
3.18	Are high level alarms provided at the unloading station and near the tank?	3.3				
3.19	Is tank overflow directed to secondary containment?	3.4				
3.20	Is a rubber duckbill valve, or a water trap, used to seal the overflow?	3.4				
3.21	Are tanks vented to the outdoors (corrosive, fuming, mists/aerosols during filling)?	3.4				
3.22	Is the venting system consistent with the discharge of air at the end of a chemical delivery? Are the vent lines sized in accordance with Appendix G?	3.4				
3.23	Are restraints provided for seismic conditions? Designed by a P.E.?	3.5				
3.24	Are restraints provided for outdoor tanks?	3.5				
3.25	Are sodium hypochlorite tanks constructed of FRP at sizes greater than 1,000 gallons?	3.6				
3.26	Is sodium hypochlorite storage protected from direct sunlight?	3.6				
3.27	Has air conditioning of the storage room for sodium hypochlorite been considered in hot climates?	3.6				
3.28	Are the state and Company requirements for tank inspection documented?	3.7				
3.29	Does the tank have access for inspection?	3.7				
4. TRANSFER PUMPS		**SUB SECTION**	**YES**	**NO**	**N/A**	**COMMENT**
4.01	Where bulk tanks are used, are transfer pumps provided to deliver the chemical from the bulk tanks to day tanks?	4.1				
4.02	For disinfectants and primary coagulants, are redundant transfer pumps provided?	4.1				
4.03	Is the discharge piping from the transfer pumps configured to prevent gravity flow or siphonage from the bulk tank?	4.1				

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		SUB SECTION	YES	NO	N/A	COMMENT
4.04	Is the fill piping downstream of the siphon break sized for gravity flow?	4.1				
4.05	Are magnetic drive, non-metallic, constant speed pumps proposed?	4.1				
4.06	Does the pump impeller require trimming to avoid overload due to viscosity and/or specific gravity?	4.1				
4.07	To prevent operator fatigue, are transfer pumps sized to fill small day tanks within two minutes?	4.2				
4.08	For day tanks larger than 100 gallons, are means provided to automatically shut off the transfer pumps through SCADA and hard wired controls?	4.2				
4.09	For transfer pumps that are configured to shutoff automatically, are the pumps sized to complete the transfer operation within 30 minutes?	4.2				
4.10	For transfer pumps that are configured to shutoff automatically, are the following safe guards provided : secondary containment, high level switch, continuous level measuring device, and a spill switch in a sump, all interlocked with the transfer pump?	4.2				
4.11	Is remote operation of transfer pumps proposed or practiced?	4.2				
4.12	With remote operation of transfer pumps, verify the following features and management processes are present:	4.2				
4.13	a) Sump level sensor and alarm; Independent high level switch interlocked with pumps; software alarm from continuous level or weight.	4.2				
4.14	b) Monthly in-person observation of transfer operation; documented.	4.2				
4.15	c) Quarterly testing of all overfill devices; documented	4.2				
4.16	d) Remote fill limited to facilities not attended on daily basis	4.2				
4.17	e) Process for reviewing monthly and quarterly testing program	4.2				
4.18	f) Has video surveillance during transfer been considered?	4.2				
5. DAY TANKS		**SUB SECTION**	**YES**	**NO**	**N/A**	**COMMENT**
5.01	Are day tanks provided with bulk tanks? If not, why not?	5.1				
5.02	Does the level of the day tank provide positive suction to the metering pumps?	5.1				

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		SUB SECTION	YES	NO	N/A	COMMENT
5.03	How was the day tank volume determined? Was the useful volume of the tank considered?	5.2				
5.04	For a remote site, is the tank sized for more than 3 days of maximum use? Three days is the maximum allowed.	5.2				
5.05	Is continuous level or weight monitoring provided?	5.3				
5.06	Is an independent high level switch provided?	5.3				
5.07	Is programming provided to calculate rate of loss in level or weight ?	5.3				
5.08	Are sightglasses provided? Are they protected from damage? Sightglasses are not recommended.	5.3				
5.09	Is the fill line piped to avoid siphoning or gravity flow from the bulk tank?	5.4				
5.10	How was the overflow pipe sized? Is it larger than the fill line? Was the maximum rate of the transfer pump considered?	5.4				
5.11	Is daytank overflow directed to secondary containment?	5.4				
5.12	How is the overflow sealed to prevent discharge of vapor to the room?	5.4				
5.13	Is the day tank vented to the outdoors?	5.4				
6. METERING PUMPS		**SUB SECTION**	**YES**	**NO**	**N/A**	**COMMENT**
6.01	Are redundant metering pumps provided for disinfectants and primary coagulants?	6.1				
6.02	Are metering pumps located near the day tank?	6.1				
6.03	Are metering pumps installed at least 12-inches off the floor, (30 inches preferred) to facilitate operation and maintenance?	6.1				
6.04	Are metering pumps installed so that adequate suction conditions are maintained?	6.1				
6.05	Is a calibration cylinder provided on the suction side of the metering pumps to permit rapid and accurate determination of the pump's delivery rate?	6.1				
6.06	Are metering pumps capable of operating over a feed range corresponding to max day/max dosage down to min day/min dosage?	6.2				
6.06	For unattended faciliites, are there at least two (2) reliable safety interlocks to assure that metering pumps are not operating without process water flow?	6.3				

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		SUB SECTION	YES	NO	N/A	COMMENT
6.07	At unattended facilities, is there a facility shutdown, or alarms, when the safety interlocks are not met?	6.3				
6.08	Typically metering pump speed is controlled, and stroke length is manually adjusted. Must stroke length be remotely adjusted?	6.3				
7. PIPING AND TUBING		**SUB SECTION**	**YES**	**NO**	**N/A**	**COMMENT**
7.01	Is chemical metering pump (diaphragm type) suction piping sized to accommodate pulsing supply/discharge?	7.1				
7.02	Are spare feed lines provided to primary application points?	7.1				
7.03	Are piping and tubing installed in a manner to allow for replacement? Can a single tube be pulled and replaced?	7.1				
7.04	Is bulk tank fill piping supported and braced for transferring chemical, including the erratic flow at the end of a bulk truck delivery?	7.1				
7.05	Are you sure of the compatiblity of the piping with the chemical? See Appendix C.	7.2				
7.06	Will the chemical be delivered hot? Was CPVC considered for elevated temperatures?	7.2				
7.07	Are flanged connections used at pipe sizes of 3 inch and larger instead of unions?	7.2				
7.08	Have threaded connections been minimized?	7.2				
7.09	For underground tubing or hose installations, are vaults or long radius sweep carrier piping used to allow for installation and replacement of tubing/hose?	7.3				
7.10	Do tubing/hose lengths allow for elimination of joints except in pull boxes?	7.3				
7.11	Is strain relief provided where hoses/tubing connect to rigid pipe connections?	7.3				
8. VALVES		**SUB SECTION**	**YES**	**NO**	**N/A**	**COMMENT**
8.01	Is gravity flow or siphoning possible through a metering pump? Have two backpressure valves, placed in series, been provided?	8.1				
8.02	Is a pressure relief valve located prior to the first isolation valve after a metering pump?	8.1				

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		SUB SECTION	YES	NO	N/A	COMMENT
8.03	Is a multifunction valve provided for low capacity diaphragm metering pump?	8.1				
8.04	Have butterfly valves been considered instead of large (3 inch and larger) ball valves?	8.1				
8.05	Are valves located within reach, no more than five (5) feet above finished floor?	8.1				
8.06	Are backpressure valves cleaned and tested on a regular basis?	8.2				
8.07	Are ball valves in sodium hypochlorite service provided with a vented ball (e.g. 1/8 inch diameter hole)?	8.3				
9. DRUM FEED SYSTEMS		**SUB SECTION**	**YES**	**NO**	**N/A**	**COMMENT**
9.01	Where drums are used, is drum handling equipment (hoists, pallet trucks, and dollies) provided to minimize the hazards associated with the moving of drums?	9.1				
9.02	How many days supply is provided by a drum/carboy? Should a day tank be provided?	9.1				
9.03	Is a weigh scale or a reliable level monitoring device provided to monitor the quantity of material remaining in the drum?	9.2				
9.04	If a weigh scale is provided, must a full drum be lifted onto the scale? Is proper lifting equipment provided?	9.2				
9.05	Is adequate ventilation provided for drum feed areas?	9.3				
10. SECONDARY CONTAINMENT		**SUB SECTION**	**YES**	**NO**	**N/A**	**COMMENT**
10.01	Is secondary containment provided for all bulk tanks, day tanks, batch tanks, metering pumps, transfer pumps, and chemical unloading areas?	10.1				
10.02	Are bulk tanks and day tanks located within the same containment?	10.1				
10.03	Is secondary containment volume determined based on 110 percent of the largest storage tank capacity within the containment area plus allowances for fire sprinkler water etc?	10.1				
10.04	Is metering pump suction piping located in the containment area?	10.1				
10.05	For corrosive chemicals, are secondary containment structures protected with a coating or liner?	10.1				
10.06	Are there piping or conduits penetrating the floor or sidewalls of the containment area?	10.1				

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		SUB SECTION	YES	NO	N/A	COMMENT
10.07	Is secondary containment provided for all drums and carboys?	10.1				
10.08	Is secondary containment provided for buried chemical solution lines to minimize the potential for accidental releases to the environment?	10.1				
10.09	Are there high level switches and alarms in chemical feed pits and piping pull boxes (recommended).	10.1				
10.10	If level alarms are not provided for chemical feed pits and pull boxes, is there an operational monitoring program for chemical feed and chemical piping pull boxes?	10.1				
10.11	Is secondary containment provided for bulk truck unloading area?	10.2				
10.12	For bulk chemical unloading areas, is the minimum secondary containment volume determined based on the volume of the largest chemical delivery tank truck plus freeboard? Is the criteria for spill volume documented?	10.2				
11. DILUTION WATER		**SUB SECTION**	**YES**	**NO**	**N/A**	**COMMENT**
11.01	Is continuous dilution (or chase) water provided?	11.1				
11.02	If continuous dilution water is provided, is there a mans to provide positive indication of flow?	11.1				
11.03	Is backflow protection provided for all water supply connected to a chemical system?	11.1				
11.04	Are RPZ devices provided? Do RPZ devices discharge out of secondary containment?	11.1				
11.05	Is a solenoid valve provided at each chemical area to allow for remote isolation of water supply?	11.1				
11.06	Where continuous dilution water is provided, is there a high pressure switch that would indicate the feed line is clogged?	11.1				
11.07	Will rotameters or sight flow indicators be obscured by manganese?	11.1				
11.08	Is ion exchange softened water provided for diluting high pH chemicals such as ammonium hydroxide, sodium hydroxide, and sodium hypochlorite to minimize scaling of chemical feed lines?	11.2				

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Liquid Chemical Storage, Feed & Containment Systems
T2 Design Standard Conformance Checklist

		SUB SECTION	YES	NO	N/A	COMMENT
11.09	Are drains provided for the softener backwash and regeneration? Is there a good location for salt storage? Are sample taps provided to monitor hardness?	11.2				
12. LEAK DETECTION		**SUB SECTION**	**YES**	**NO**	**N/A**	**COMMENT**
12.01	Is a sump provided within secondary containment?	12.1				
12.02	Is the sump equipped with a high level switch and alarm to SCADA?	12.1				
12.03	Is the sump high level switch and alarm interlocked with the isolation valve on the bulk tank and the transfer pumps?	12.1				
13. CONTINUOUS ANALYZERS		**SUB SECTION**	**YES**	**NO**	**N/A**	**COMMENT**
13.01	For strong acids and bases, is continuous pH monitoring employed to provide warning of excessive chemical feed?	13.1				
13.02	Is chlorine residual monitored to ensure that the correct disinfectant concentration is present?	13.1				
13.03	In attended facilities, do alarms from analytical devices warn operators of chemical over-or under feeds?	13.2				
13.04	In the absence of full time staffing, do alarms go to on-call personnel?	13.2				
13.05	In the absence of full time staffing, has consideration been given to taking facilities off-line in response to an overfeed or underfeed alarm?	13.2				
14. PROVISIONS FOR MAINTENANCE		**SUB SECTION**	**YES**	**NO**	**N/A**	**COMMENT**
14.01	Are means for draining chemical piping provided?	14.1				
14.02	Is there a means to drain chemical storage tanks?	14.1				
14.03	Are there provisions for disposal of wash down water, and safety shower water from secondary containment?	14.1				
14.04	Is there a means to access and replace tubing?	14.1				
14.05	Are valves accessible; not more than 5 feet above finished floor?	14.1				
14.06	Is the chemical injection assembly properly detailed?	14.1				
14.07	Is a metal stab tube used for insertion lengths > 8 inches?	14.1				

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T2 Design Standard Conformance Checklist

		SUB SECTION	YES	NO	N/A	COMMENT
14.08	If a ladder is required, is there space to safely position the ladder?	14.1				
15. INSTRUMENTATION AND CONTROL		**SUB SECTION**	**YES**	**NO**	**N/A**	**COMMENT**
15.01	Are P&ID drawings available for the chemical system?	15.1				
15.02	Are electrical panels and controls located at least 36 inches away from metering pumps to avoid contact from chemical leaks?	15.1				
15.03	Is continuous level monitoring provided for bulk tanks?	15.2				
15.04	Have ultrasonic level monitors been located away from the fill line? Has the deadzone near the transmitters been accounted for?	15.2				
15.05	Do bulk tank high level alarms sound at the fill station?	15.2				
15.06	Is level, or weight, (or pressure/level) monitoring provided for day tanks?	15.2				
15.07	Is an independent high level switch provided for day tanks?	15.2				
15.08	Is a FULL level switch provided where continuous level may not be accurate during filling cycle?	15.2				
15.09	Is a high level switch provided within secondary containment to signal a chemical or water leak?	15.2				
15.10	Are high level switches provided in buried chemical piping vaults?	15.2				
15.11	Is there local indication of high liquid level at chemical piping vaults?	15.2				
15.08	Have options for chemical flow from metering pumps been reviewed?	15.3				
15.09	For transfer pumps: is the high level switch hard-wired to the transfer pump starter to stop the pump on high level?	15.4				
15.10	For bulk tank outlet valves: is status (OPEN/CLOSED) provided to SCADA?	15.4				
15.11	Does the bulk tank outlet valve close on detection of a high level alarm condition in the sump?	15.4				
15.12	Is bulk tank level and high level switch status shown at a bulk tank fill panel, located near the fill connection? Is there an alarm beacon and audible alarm on high level?	15.3				
15.13	Is a local control panel provided for the transfer of chemicals from bulk tank to day tank ?	15.4				

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American Water
Liquid Chemical Storage, Feed & Containment Systems
T2 Design Standard Conformance Checklist

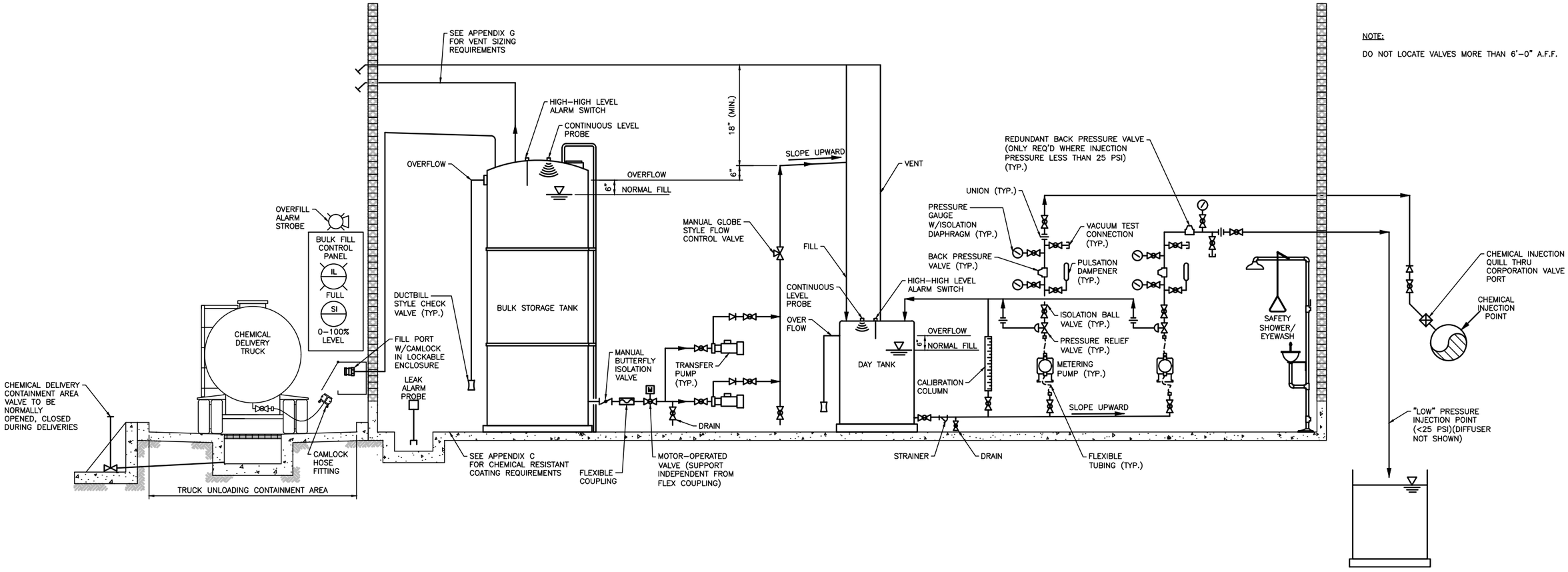
		SUB SECTION	YES	NO	N/A	COMMENT
15.14	Is there an algorithm in SCADA to calculate feed rate from loss in day tank level? (suggested)	15.4				
15.15	Is status of pumps and automated valves shown in SCADA?	15.4				
15.16	Is automatic day tank refill practiced (without Operator initiation)?	15.4				
15.17	Are alarms logged to SCADA ?	15.4				

Comments:

Appendix B

Standard Schematic Diagrams for Liquid Chemical Systems

- **Figure B1 - Bulk Liquid Chemical System**
- **Figure B2 - Drum/Day Tank Feed System**
- **Figure B3 – Direct Drum Feed System**



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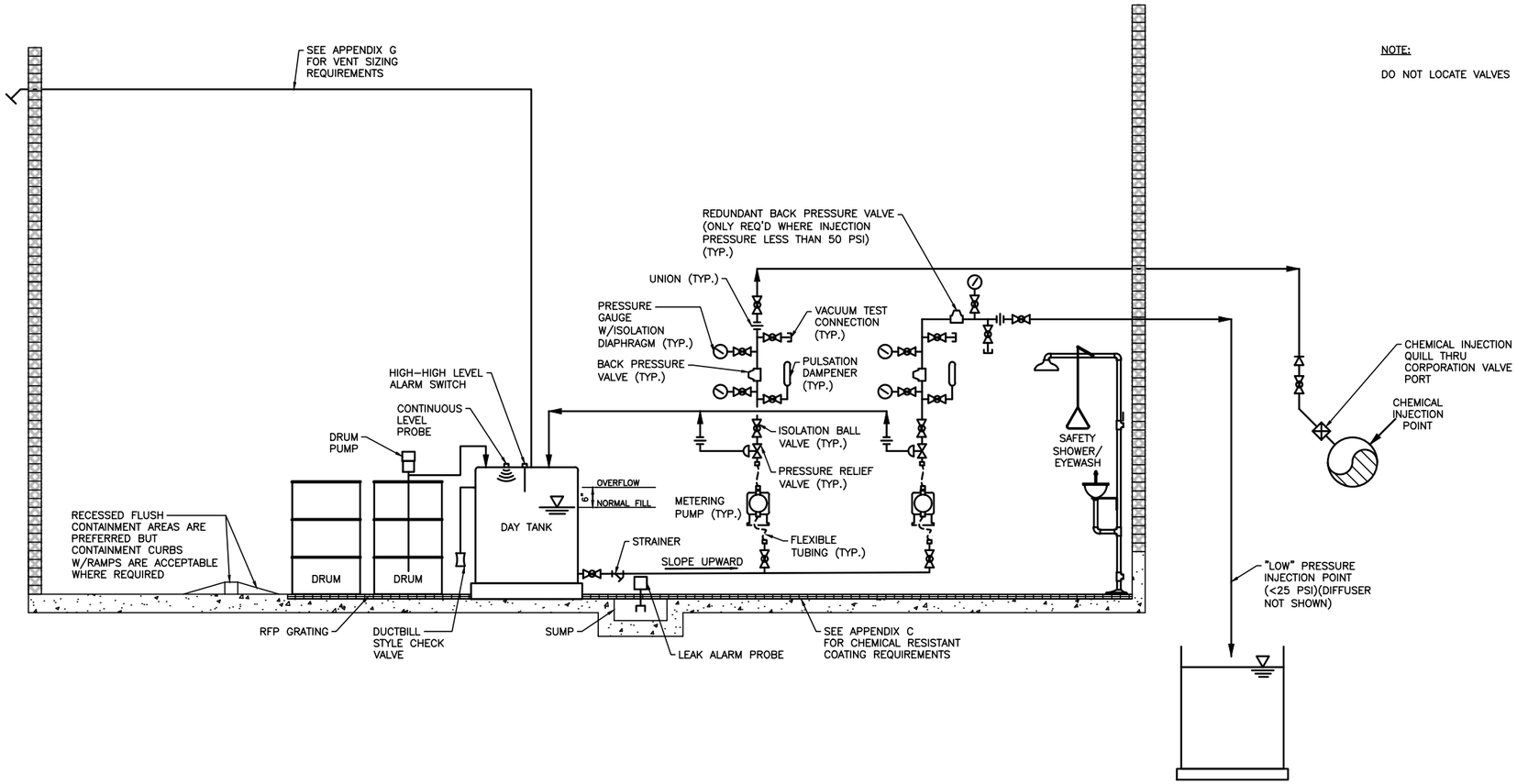
DRAWN BY R. BEATTY
PROJECT ENG'R

DATE 10–28–16

PROJECT

BULK LIQUID CHEMICAL SYSTEM PROCESS SYSTEM SCHEMATIC

AMERICAN WATER	ENGINEERING OPERATIONS CENTER	USE DIMENSIONS ONLY SCALE N.T.S.
USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	STANDARD	APPENDIX B–1



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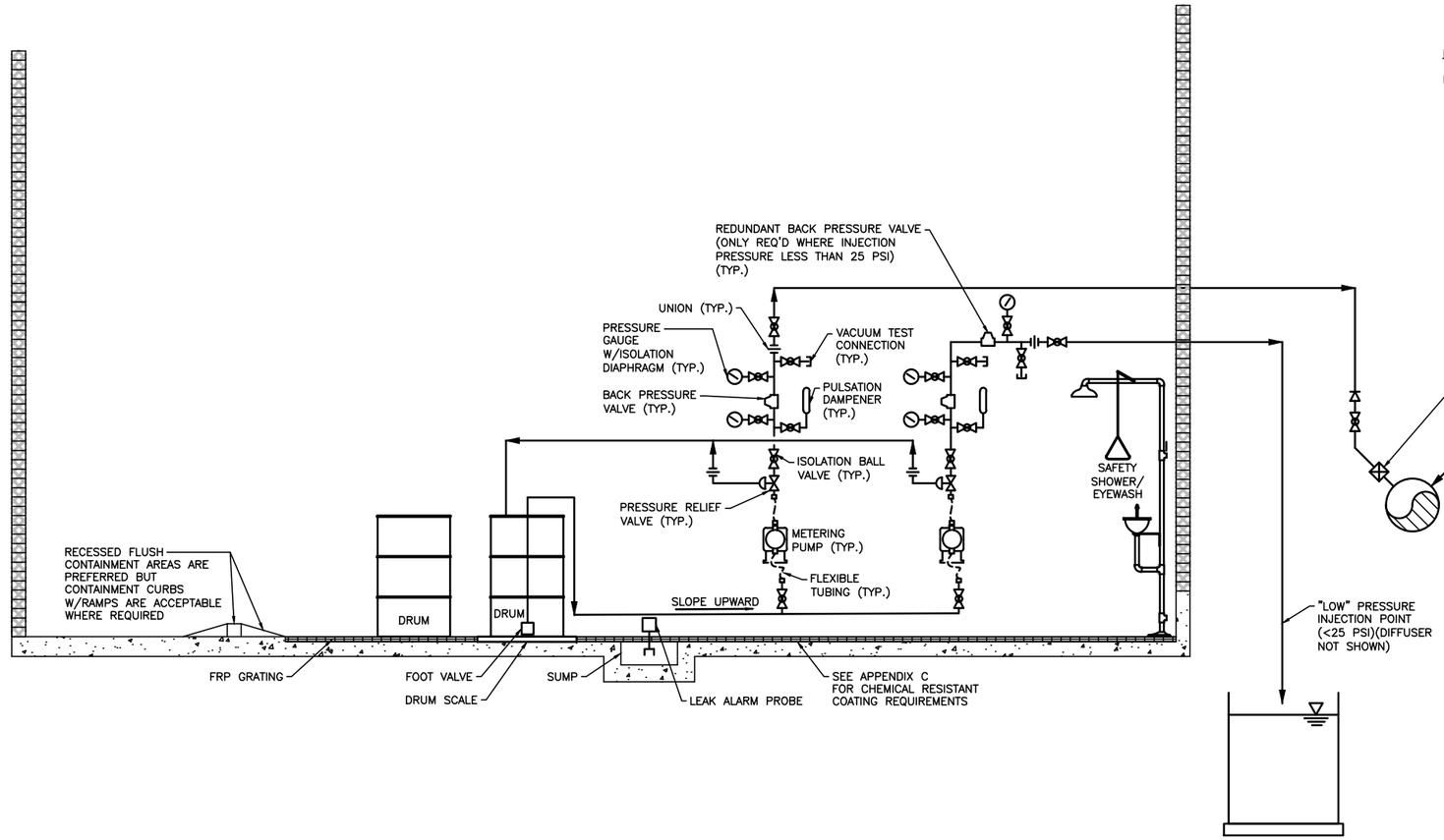
AMERICAN WATER	ENGINEERING OPERATIONS CENTER	USE DIMENSIONS ONLY SCALE N.T.S.
USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	STANDARD	APPENDIX B-2

NOTE:

DO NOT LOCATE VALVES MORE THAN 6'–0" A.F.F.



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BULK LIQUID CHEMICAL SYSTEM PROCESS SYSTEM SCHEMATIC

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Appendix C

Material Selection Guide for Liquid Chemical Systems

AMERICAN WATER

ENGINEERING STANDARD T-2 APPENDIX C

American Water Engineering

Recommended Materials of Construction for Common Water & Wastewater Treatment Chemicals[1,2]

Chemical	Tanks	Piping[3,4]	Valves[3,4]	Flexible[3] Hose and Tubing	Pump Head Elastomers	Secondary Containment Liner
Aluminum Sulfate - Liquid (48%)	XLHDPE	PVC	PVC	HDPE / BrPVC	EPDM	NR
Ammonium Hydroxide (19% - 29%)	CS (no internal coating)	CS	CS	HDPE / BrPVC	EPDM	NR
Ammonium Sulfate (Liquid)	XLHDPE	PVC	PVC	BrPVC	EPDM	NR
Calcium Hydroxide (Lime) Slurry (5%)	CS (no internal coating)	CS	CS / SS	BrPVC	Hypalon / Neoprene	NR
Ferric Chloride	XLHDPE	PVC	PVC	BrPVC	EPDM	NR
Hydrofluosilicic Acid (23%)	LHDPE up to 1000 gal; XLHDPE w/LHDPE liner >1,000 gal	PVC	PVC	BrPVC	FKM	S2P
Phosphoric Acid - Orthophosphate	XLHDPE	PVC	PVC	BrPVC	FKM	S2P
Polyaluminum Chloride	XLHDPE	PVC	PVC	BrPVC	EPDM	NR
Potassium Permanganate (<2%)	XLHDPE	PVC	PVC	BrPVC	EPDM	S2P
Powdered Activated Carbon Slurry	SS / Concrete should be considered for large capacity tanks	PVC	PVC	BrPVC	Hypalon	NR
Sodium Chlorite (18%-31%)	XLHDPE	CPVC	CPVC	BrPVC	EPDM	NR
Sodium Hydroxide (25% - 50%)	CS (no internal coating)	CS/SS[5]	CS/SS[5]	BrPVC	EPDM	S2P[6]
Sodium Hypochlorite (>5%)	LHDPE up to 1000 gal; FRP >1,000 gal	PVC	PVC	HDPE	FKM	NR
Sodium Hypochlorite (0.8%)	LHDPE up to 1000 gal; FRP >1,000 gal	PVC	PVC	HDPE	FKM	NR
Sodium Permanganate (20% - 40%)	XLHDPE	HDPE[7]	PVC	BrPVC	FKM	S2P
Zinc Orthophosphate	XLHDPE	PVC	PVC	BrPVC	FKM / EPDM	NR

Notes:

1) Where two materials are listed, both have been found to be reliable and cost-effective.
2) Contact Corporate Engineering or consult trusted published chemical compatability data for chemicals not listed.
3) Designer should verify selected material has adequate pressure rating for required service.
4) Rigid PVC/CPVC piping shall be a minimum of Schedule 80.
5) Schedule 80 PVC is also compatible but has a life expectancy of less than 15 years in caustic service.
6) Concrete attack due to this chemical is slow, so investing in special epoxy coating should be cost-justified.
7) Oxidant resistant HDPE system (Asahi Chem Proline) with heat welded joints

Legend:

BrPVC	Braided polyvinyl chloride (tubing)
CPVC	Chlorinated polyvinyl chloride
CS	Carbon steel
EPDM	Ethylene propylene diene monomer
FKM	Fluoropolymer (Viton brand name)
FRP	Fiber(glass) reinforced plastic
HDPE	High density polyethylene (tubing)
Hypalon	Chlorosulfonated PE trademarked by Dupont
LHDPE	Linear, high density polyethylene
Neoprene	Chlorprene synthetic rubber
NR	Not required
PVC	Polyvinyl chloride
SS	Stainless Steel (304 or 316L)
S2P	Specialty two-part epoxies, such as: 1) Chemline 784/32 2) Tnemec Series 282 Tneme-Glaze
XLHDPE	Cross-linked, high density polyethylene

Appendix D

Color Codes for Water Treatment Chemicals

APPENDIX D

Water Treatment Plant Color Coding

TYPE OF PIPE	USE OF PIPE	COLOR OF PIPE
Water Lines:	Raw water	Olive Green
	Settled or clarified water	Aqua
	Finished or potable water	Dark Blue
Chemical Lines:	Alum or primary coagulant	Orange
	Ammonia	White
	Carbon slurry	Black
	Caustic	Yellow w/ green band
	Chlorine gas or solution	Yellow
	Fluoride	Light blue w/ red band
	Lime slurry	Light green
	Ozone	Yellow w/ orange band
	Phosphate compounds	Light green w/ red band
	Polymers or coagulant aids	Orange w/ green band
	Potassium permanganate	Violet
	Soda ash	Light green w/ orange band
	Sulfuric Acid	Yellow w/ red band
	Sulfur Dioxide	Light green w/ yellow band
Waste Lines:	Backwash waste	Light Brown
	Sludge	Dark Brown
	Sewer (sanitary or other)	Dark Gray
Other Lines:	Compressed Air	Dark Green
	Natural Gas	Red or Yellow
	Backwash recycle	Beige

Appendix E

Guidelines for Prioritizing Improvements to Existing Chemical Systems

APPENDIX E

American Water

Liquid Chemical Storage, Feed & Containment Systems

Prioritization of Improvements at Existing Facilities

This appendix provides guidance in the evaluation of existing facilities for compliance with the Standard. A checklist is provided with High, Medium, and Low prioritization of the various components of the Standard to assist the evaluator in developing a scope of improvements where deficiencies are found.

PRIORITY	RATIONALE
HIGH	May impact safety of customers or on-site personnel. Failure that could result in a service interruption. Regulatory requirement.
MEDIUM	Spill prevention within secondary containment that could be costly to address.
LOW	Desirable, but not essential features.

PROJECT:

American Water

Liquid Chemical Storage, Feed & Containment Systems

Prioritization of Improvements at Existing Facilities

			PRIORITY			
		SUB SECTION	LOW	MED	HIGH	COMMENT
1. SAFETY REQUIREMENTS AND BUILDING LAYOUT						
1.01	Are Safety Data Sheets (SDS) available to all personnel?	1.1			X	*Regulatory requirement*
1.02	Is wall space reserved for display of safety information?	1.1		X		
1.03	Are pumps labeled?	1.2		X		
1.04	Is piping color coded according to Ten State Standards ?	1.2		X		
1.05	Is piping identified with labels indicating the chemical, and arrows pointing in the normal direction of flow? Labels are required.	1.2			X	*Labeling of piping is required*
1.06	Are chemical system valves provided with an ID tag?	1.2		X		
1.07	Are pressure relief and backpressure valves labeled with pressure settings?	1.2		X		
1.08	Are storage tanks labeled with signage identifying usable capacity of the tank, contents of the tank, and chemical hazards? See Standard.	1.2			X	*Labeling of tanks is required*
1.09	Are facility entry doors labeled with NFPA diamond labels?	1.2		X		
1.1	Are separate bulk tank fill pipelines and connections provided?	1.3			X	
1.11	Are fill connections for bulk tanks provided with independently keyed locked enclosures? Or locked fill caps?	1.3			X	
1.12	Are fill connections for bulk tanks labeled including CAS number?	1.3			X	
1.13	Are drip pans provided at fill connections for housekeeping?	1.3		X		
1.14	Are eyewashes and emergency showers provided for all liquid chemicals?	1.4			X	*A shower may not be required if hazard is low*
1.15	Are eyewashes and emergency showers located adjacent to bulk unloading areas?	1.4			X	

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AMERICAN WATER

American Water
Liquid Chemical Storage, Feed & Containment Systems
Prioritization of Improvements at Existing Facilities

			PRIORITY			
		SUB SECTION	LOW	MED	HIGH	COMMENT
1.16	Do eyewashes and emergency showers meet American National Standard for Emergency Eyewash and Shower Equipment (ANSI Z358.1-2014 or latest version)?	1.4			X	*See Appendix F*
1.17	Is an alarm beacon and connection to SCADA provided?	1.4		X		
1.18	Is tempered water (60 deg to 100 deg F) provided for emergency eyewashes and showers?	1.4			X	
1.19	Is there a means to flush stagnant piping on a weekly basis?	1.4			X	*Routine flushing prevents microbiological contamination*
1.20	Are chemicals isolated within separate secondary containment areas?	1.5		X		*Incompatible chemicals must not be within the same containment area.*
1.21	Are walls provided between chemical areas?	1.5		X		
1.22	Are chemical feeders within secondary containment?	1.5			X	
1.23	Are there tripping hazards (such as conduits, piping, etc)?	1.5			X	
1.24	Is there a means to replace tanks? How?	1.5		X		
1.25	Will workers be required to enter the top hatch of a tank? If so, are all required confined space equipment provided in compliance with confined space rquirements?	1.5			X	
1.25	Are properly sized doors provided where drums, pallets, IBC/totes are handled?	1.5			X	
1.26	Has a recessed containment area been considered where drums or IBC/totes are handled so grating is flush to concrete floor?	1.5		X		
1.27	Where ramps are provided, are they a maximum slope of 1:12?	1.5			X	
1.28	Has an overhead beam been considered for drum handling?	1.5		X		
1.29	Is ingress and egress for secondary containment areas safe with stairs and handrails? Stairs preferable to ladders.	1.5		X		*If ladder is existing, evaluate installation of stairs*

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American Water

Liquid Chemical Storage, Feed & Containment Systems

Prioritization of Improvements at Existing Facilities

			PRIORITY			
		SUB SECTION	LOW	MED	HIGH	COMMENT
1.3	For outdoor tanks, has a sunshade been considered to prolong tank life, minimize heating of tank contents, control stormwater accumulation?	1.5		X		
2. MATERIALS OF CONSTRUCTION		SUB SECTION	LOW	MED	HIGH	COMMENT
2.01	Do the materials of construction for tanks, piping, pumps, and valves agree with Appendix C?	2.1			X	
2.02	Does the chemical have unique properties that must be considered (such as hydrogen peroxide or concentrated sulfuric acid)?	2.1			X	
2.03	Is there local operational experience on materials of construction?	2.1		X		
2.04	Does the Regulator have NSF 61 requirements for selection of chemical equipment? If so, have selections been made accordingly?	2.1			X	
3. BULK STORAGE TANKS		SUB SECTION	LOW	MED	HIGH	COMMENT
3.01	Has bulk storage been considered to minimize handling of drums and IBC containers?	3.1		X		
3.02	Are double wall tanks proposed in lieu of secondary containment? If so, why? Reconsider the benefits of locating tanks within secondary containment per this Standard.	3.1			X	
3.03	Is a side manway provided for FRP tanks that require entry for internal inspection?	3.1			X	
3.04	Are sightglasses provided? Are they protected from damage? Sightglasses are not recommended for bulk tanks.	3.1		X		
3.05	Are flexible connections provided for pipe connections at the lower 1/3 of the tank wall for polyethylene tanks ?	3.1			X	
3.06	Does the tank allow for full drainage, or near full drainage with a siphon outlet?	3.1		X		
3.07	Is the tank outlet sized to minimize vortexing at the maximum transfer pumping rate?	3.1		X		
3.08	Is a normally closed remotely actuated discharge valve installed on or near the tank outlet?	3.1		X		
3.09	Is the remotely actuated discharge valve supported independently of the tank?	3.1			X	

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Liquid Chemical Storage, Feed & Containment Systems

Prioritization of Improvements at Existing Facilities

			PRIORITY			
		SUB SECTION	LOW	MED	HIGH	COMMENT
3.10	Is a manual valve provided (butterfly preferred) upstream of the remotely actuated valve?	3.1		X		
3.11	Is a ladder provided to access the top of the tank?	3.1			X	
3.12	Has the desired storage capacity been evaluated from different perspectives? (e.g. max dose, avg day demand, etc)	3.2			X	
3.13	Are bulk tanks sized to accommodate at least 150 % of a bulk shipment of chemical?	3.2			X	
3.14	Has local Operations been consulted with respect to splitting bulk loads with other sites?	3.2			X	
3.15	Are there unique supply factors that may alter storage volumes (limited road access, nearby suppliers, etc)?	3.2			X	
3.16	Is continuous level monitoring provided?	3.3			X	
3.17	Is an independent high level switch provided?	3.3			X	
3.18	Are high level alarms provided at the unloading station and near the tank?	3.3			X	
3.19	Is tank overflow directed to secondary containment?	3.4			X	
3.20	Is a rubber duckbill valve, or a water trap, used to seal the overflow?	3.4		X		
3.21	Are tanks vented to the outdoors (corrosive, fuming, mists/aerosols during filling)?	3.4			X	
3.22	Is the venting system consistent with the discharge of air at the end of a chemical delivery? Are the vent lines sized in accordance with Appendix G?	3.4			X	*Inadequate venting can shorten the service life of the tank*
3.23	Are restraints provided for seismic conditions? Designed by a P.E.?	3.5		X		
3.24	Are restraints provided for outdoor tanks?	3.5			X	
3.25	Are sodium hypochlorite tanks constructed of FRP at sizes greater than 1,000 gallons?	3.6		X		
3.26	Is sodium hypochlorite storage protected from direct sunlight?	3.6		X		*Direct sunlight will shorten the life of the tank and degrade the chemical*
3.27	Has air conditioning of the storage room for sodium hypochlorite been considered in hot climates?	3.6		X		

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American Water

Liquid Chemical Storage, Feed & Containment Systems

Prioritization of Improvements at Existing Facilities

			PRIORITY			
		SUB SECTION	LOW	MED	HIGH	COMMENT
3.28	Are the state and Company requirements for tank inspection documented?	3.7			X	
3.29	Does the tank have access for inspection?	3.7			X	
4. TRANSFER PUMPS		SUB SECTION	LOW	MED	HIGH	COMMENT
4.01	Where bulk tanks are used, are transfer pumps provided to deliver the chemical from the bulk tanks to day tanks?	4.1			X	
4.02	For disinfectants and primary coagulants, are redundant transfer pumps provided?	4.1			X	
4.03	Is the discharge piping from the transfer pumps configured to prevent gravity flow or siphonage from the bulk tank?	4.1			X	
4.04	Is the fill piping downstream of the siphon break sized for gravity flow?	4.1			X	
4.05	Are magnetic drive, non-metallic, constant speed pumps proposed?	4.1			X	
4.06	Does the pump impeller require trimming to avoid overload due to viscosity and/or specific gravity?	4.1			X	
4.07	To prevent operator fatigue, are transfer pumps sized to fill small day tanks within two minutes?	4.2			X	
4.08	For day tanks larger than 100 gallons, are means provided to automatically stop the transfer pumps through SCADA and hard wired controls?	4.2			X	
4.09	For transfer pumps that are configured to shutoff automatically, are the pumps sized to complete the transfer operation within 30 minutes?	4.2			X	
4.10	For transfer pumps that are configured to shutoff automatically, are the following safe guards provided : secondary containment, high level switch, continuous level measuring device, and a spill switch in a sump, all interlocked with the transfer pump?	4.2			X	
4.11	Is remote operation of transfer pumps proposed or practiced?	4.2			X	
4.12	With remote operation of transfer pumps, verify the following features and management processes are present:	4.2				
4.13	a) Sump level sensor and alarm; Independent high level switch interlocked with pumps; software alarm from continuous level or weight.	4.2			X	

PROJECT:

American Water

Liquid Chemical Storage, Feed & Containment Systems

Prioritization of Improvements at Existing Facilities

			PRIORITY			
		SUB SECTION	LOW	MED	HIGH	COMMENT
4.14	b) Monthly in-person observation of transfer operation; documented.	4.2			X	
4.15	c) Quarterly testing of all overfill devices; documented	4.2			X	
4.16	d) Remote fill limited to facilities not attended on daily basis	4.2			X	
4.17	e) Process for reviewing monthly and quarterly testing program	4.2			X	
4.18	f) Has video surveillance during transfer been considered?	4.2		X		
5. DAY TANKS		SUB SECTION	LOW	MED	HIGH	COMMENT
5.01	Are day tanks provided with bulk tanks? If not, why not?	5.1			X	
5.02	Does the level of the day tank provide positive suction to the metering pumps?	5.1			X	
5.03	How was the day tank volume determined? Was the useful volume of the tank considered?	5.2			X	
5.04	For a remote site, is the tank sized for more than 3 days of maximum use? Three days is the maximum allowed.	5.2		X		
5.05	Is continuous level or weight monitoring provided?	5.3			X	
5.06	Is an independent high level switch provided?	5.3			X	
5.07	Is programming provided to calculate rate of loss in level or weight ?	5.3	X			
5.08	Are sightglasses provided? Are they protected from damage? Sightglasses are not recommended.	5.3		X		
5.09	Is the fill line piped to avoid siphoning or gravity flow from the bulk tank?	5.4			X	
5.10	How was the overflow pipe sized? Is it larger than the fill line? Was the maximum rate of the transfer pump considered?	5.4			X	
5.11	Is daytank overflow directed to secondary containment?	5.4			X	
5.12	How is the overflow sealed to prevent discharge of vapor to the room?	5.4			X	

PROJECT:

American Water

Liquid Chemical Storage, Feed & Containment Systems

Prioritization of Improvements at Existing Facilities

			PRIORITY			
		SUB SECTION	LOW	MED	HIGH	COMMENT
5.13	Is the day tank vented to the outdoors?	5.4			X	
6. METERING PUMPS		SUB SECTION	LOW	MED	HIGH	COMMENT
6.01	Are redundant metering pumps provided for disinfectants and primary coagulants?	6.1			X	
6.02	Are metering pumps located near the day tank?	6.1		X		
6.03	Are metering pumps installed at least 12-inches off the floor, (30 inches preferred) to facilitate operation and maintenance?	6.1		X		
6.04	Are metering pumps installed so that adequate suction conditions are maintained?	6.1		X		
6.05	Is a calibration cylinder provided on the suction side of the metering pumps to permit rapid and accurate determination of the pump's delivery rate?	6.1		X		
6.06	Are metering pumps capable of operating over a feed range corresponding to max day/max dosage down to min day/min dosage?	6.2			X	
6.06	For unattended faciliites, are there at least two (2) reliable safety interlocks to assure that metering pumps are not operating without process water flow?	6.3			X	
6.07	At unattended facilities, is there a facility shutdown, or alarms, when the safety interlocks are not met?	6.3			X	
6.08	Typically metering pump speed is controlled, and stroke length is manually adjusted. Must stroke length be remotely adjusted?	6.3			X	
7. PIPING AND TUBING		SUB SECTION	LOW	MED	HIGH	COMMENT
7.01	Is chemical metering pump (diaphragm type) suction piping sized to accommodate pulsing supply/discharge?	7.1			X	
7.02	Are spare feed lines provided to primary application points?	7.1		X		
7.03	Are piping and tubing installed in a manner to allow for replacement? Can a single tube be pulled and replaced?	7.1		X		
7.04	Is bulk tank fill piping supported and braced for transferring chemical, including the erratic flow at the end of a bulk truck delivery?	7.1			X	

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			PRIORITY			
		SUB SECTION	LOW	MED	HIGH	COMMENT
7.05	Are you sure of the compatiblity of the piping with the chemical? See Appendix C.	7.2			X	
7.06	Will the chemical be delivered hot? Was CPVC considered for elevated temperatures?	7.2			X	
7.07	Are flanged connections used at pipe sizes of 3 inch and larger instead of unions?	7.2		X		
7.08	Have threaded connections been minimized?	7.2		X		
7.09	For underground tubing or hose installations, are vaults or long radius sweep carrier piping used to allow for installation and replacement of tubing/hose?	7.3			X	
7.10	Do tubing/hose lengths allow for elimination of joints except in pull boxes?	7.3			X	
7.11	Is strain relief provided where hoses/tubing connect to rigid pipe connections?	7.3			X	
8. VALVES		SUB SECTION	LOW	MED	HIGH	COMMENT
8.01	Is gravity flow or siphoning possible through a metering pump? Have two backpressure valves, placed in series, been provided?	8.1			X	*Two valves are needed where siphoning or gravity flow can occur.*
8.02	Is a pressure relief valve located prior to the first isolation valve after a metering pump?	8.1			X	
8.03	Is a multifunction valve provided for low capacity diaphragm metering pump?	8.1			X	
8.04	Have butterfly valves been considered instead of large (3 inch and larger) ball valves?	8.1		X		
8.05	Are valves located within reach, no more than five (5) feet above finished floor?	8.1			X	
8.06	Are backpressure valves cleaned and tested on a regular basis?	8.2		X		*High priority for systems susceptible to siphon or flow by gravity.*
8.07	Are ball valves in sodium hypochlorite service provided with a vented ball (e.g. 1/8 inch diameter hole)?	8.3			X	
9. DRUM FEED SYSTEMS		SUB SECTION	LOW	MED	HIGH	COMMENT
9.01	Where drums are used, is drum handling equipment (hoists, pallet trucks, and dollies) provided to minimize the hazards associated with the moving of drums?	9.1			X	

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			PRIORITY			
		SUB SECTION	LOW	MED	HIGH	COMMENT
9.02	How many days supply is provided by a drum/carboy? Should a day tank be provided?	9.1		X		
9.03	Is a weigh scale or a reliable level monitoring device provided to monitor the quantity of material remaining in the drum?	9.2		X		
9.04	If a weigh scale is provided, must a full drum be lifted onto the scale? Is proper lifting equipment provided?	9.2			X	
9.05	Is adequate ventilation provided for drum feed areas?	9.3		X		
10. SECONDARY CONTAINMENT		SUB SECTION	LOW	MED	HIGH	COMMENT
10.01	Is secondary containment provided for all bulk tanks, day tanks, batch tanks, metering pumps, transfer pumps, and chemical unloading areas?	10.1			X	
10.02	Are bulk tanks and day tanks located within the same containment?	10.1			X	
10.03	Is secondary containment volume determined based on 110 percent of the largest storage tank capacity within the containment area plus allowances for fire sprinkler water etc?	10.1			X	
10.04	Is metering pump suction piping located in the containment area?	10.1			X	
10.05	For corrosive chemicals, are secondary containment structures protected with a coating or liner?	10.1			X	
10.06	Are there piping or conduits penetrating the floor or sidewalls of the containment area?	10.1		X		
10.07	Is secondary containment provided for all drums and carboys?	10.1			X	
10.08	Is secondary containment provided for buried chemical solution lines to minimize the potential for accidental releases to the environment?	10.1			X	*Priority related to hazard of chemical and environmental setting.*
10.09	Are there high level switches and alarms in chemical feed pits and piping pull boxes (recommended).	10.1		X		
10.10	If level alarms are not provided for chemical feed pits and pull boxes, is there an operational monitoring program for chemical feed and chemical piping pull boxes?	10.1			X	
10.11	Is secondary containment provided for bulk truck unloading area?	10.2			X	

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			PRIORITY			
		SUB SECTION	LOW	MED	HIGH	COMMENT
10.12	For bulk chemical unloading areas, is the minimum secondary containment volume determined based on the volume of the largest chemical delivery tank truck plus freeboard? Is the criteria for spill volume documented?	10.2			X	
11. DILUTION WATER		SUB SECTION	LOW	MED	HIGH	COMMENT
11.01	Is continuous dilution (or chase) water provided?	11.1				*Provide dilution water only where beneficial*
11.02	If continuous dilution water is provided, is there a means to provide positive indication of flow?	11.1		X		
11.03	Is backflow protection provided for all water supply connected to a chemical system?	11.1			X	
11.04	Are RPZ devices provided? Do RPZ devices discharge out of secondary containment?	11.1			X	
11.05	Is a solenoid valve provided at each chemical area to allow for remote isolation of water supply?	11.1	X			
11.06	Where continuous dilution water is provided, is there a high pressure switch that would indicate the feed line is clogged?	11.1			X	*If feed line is clogged, chemical may be pushed into dilution water plumbing.*
11.07	Will rotameters or sight flow indicators be obscured by manganese?	11.1	X			
11.08	Is ion exchange softened water provided for diluting high pH chemicals such as ammonium hydroxide, sodium hydroxide, and sodium hypochlorite to minimize scaling of chemical feed lines?	11.2			X	
11.09	Are drains provided for the softener backwash and regeneration? Is there a good location for salt storage? Are sample taps provided to monitor hardness?	11.2			X	
12. LEAK DETECTION		SUB SECTION	LOW	MED	HIGH	COMMENT
12.01	Is a sump provided within secondary containment?	12.1		X		
12.02	Is the sump equipped with a high level switch and alarm to SCADA?	12.1			X	

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Prioritization of Improvements at Existing Facilities

			PRIORITY			
		SUB SECTION	LOW	MED	HIGH	COMMENT
12.03	Is the sump high level switch and alarm interlocked with the isolation valve on the bulk tank and the transfer pumps?	12.1			X	
13. CONTINUOUS ANALYZERS		SUB SECTION	LOW	MED	HIGH	COMMENT
13.01	For strong acids and bases, is continuous pH monitoring employed to provide warning of excessive chemical feed?	13.1			X	
13.02	Is chlorine residual monitored to ensure that the correct disinfectant concentration is present?	13.1			X	
13.03	In attended facilities, do alarms from analytical devices warn operators of chemical over-or under feeds?	13.2			X	
13.04	In the absence of full time staffing, do alarms go to on-call personnel?	13.2			X	
13.05	In the absence of full time staffing, has consideration been given to taking facilities off-line in response to an overfeed or underfeed alarm?	13.2			X	
14. PROVISIONS FOR MAINTENANCE		SUB SECTION	LOW	MED	HIGH	COMMENT
14.01	Are means for draining chemical piping provided?	14.1		X		
14.02	Is there a means to drain chemical storage tanks?	14.1			X	
14.03	Are there provisions for disposal of wash down water, and safety shower water from secondary containment?	14.1			X	*See Standard for recommended approach*
14.04	Is there a means to access and replace tubing?	14.1			X	
14.05	Are valves accessible; not more than 5 feet above finished floor?	14.1			X	
14.06	Is the chemical injection assembly properly detailed?	14.1		X		*Details of assembly should be documented in O&M manual*
14.07	Is a metal stab tube used for insertion lengths > 8 inches?	14.1			X	
14.08	If a ladder is required, is there space to safely position the ladder?	14.1			X	*If temporary ladder is unsafe, consider alternatives.*
15. INSTRUMENTATION AND CONTROL		SUB SECTION	LOW	MED	HIGH	COMMENT
15.01	Are P&ID drawings available for the chemical system?	15.1		X		

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			PRIORITY			
		SUB SECTION	LOW	MED	HIGH	COMMENT
15.02	Are electrical panels and controls located at least 36 inches away from metering pumps to avoid contact from chemical leaks?	15.1		X		*Difficult to move panels once they are installed*
15.03	Is continuous level monitoring provided for bulk tanks?	15.2			X	
15.04	Have ultrasonic level monitors been located away from the fill line? Has the deadzone near the transmitters been accounted for?	15.2			X	
15.05	Do bulk tank high level alarms sound at the fill station?	15.2			X	
15.06	Is level, or weight, (or pressure/level) monitoring provided for day tanks?	15.2			X	
15.07	Is an independent high level switch provided for day tanks?	15.2			X	
15.08	Is a FULL level switch provided where continuous level may not be accurate during filling cycle?	15.2			X	
15.09	Is a high level switch provided within secondary containment to signal a chemical or water leak?	15.2			X	
15.10	Are high level switches provided in buried chemical piping vaults?	15.2		X		*Can reduce the need for routine inspections*
15.11	Is there local indication of high liquid level at chemical piping vaults?	15.2	X			*Can reduce the time required for routine inspectons*
15.08	Have options for chemical flow from metering pumps been reviewed?	15.3	X			
15.09	For transfer pumps: is the high level switch hard-wired to the transfer pump starter to stop the pump on high level?	15.4			X	
15.10	For bulk tank outlet valves: is status (OPEN/CLOSED) provided to SCADA?	15.4			X	
15.11	Does the bulk tank outlet valve close on detection of a high level alarm condition in the sump?	15.4			X	
15.12	Is bulk tank level and high level switch status shown at a bulk tank fill panel, located near the fill connection? Is there an alarm beacon and audible alarm on high level?	15.3			X	
15.13	Is a local control panel provided for the transfer of chemicals from bulk tank to day tank ?	15.4			X	
15.14	Is there an algorithm in SCADA to calculate feed rate from loss in day tank level? (suggested)	15.4	X			
15.15	Is status of pumps and automated valves shown in SCADA?	15.4			X	

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Prioritization of Improvements at Existing Facilities

			PRIORITY			
		SUB SECTION	LOW	MED	HIGH	COMMENT
15.16	Is automatic day tank refill practiced (without Operator initiation)?	15.4			X	*Requires careful implementation with operational checks and maintenance procedures*
15.17	Are alarms logged to SCADA ?	15.4			X	

Comments:

Appendix F

Requirements for Emergency Eyewash and Shower Equipment

Guardian ANSI/ISEA Z358.1 Compliance Checklist

Requirements for Emergency Eyewash and Shower Equipment

Background

American Water has numerous chemical storage and feed installations that are necessary for the treatment of water or wastewater. Many of the chemicals are handled in a concentrated form and are a cause for concern if introduced into eyes or exposed to the skin or body parts. Discussions of requirements for emergency eyewashes and emergency showers often arise during design or significant modification of these facilities. The purpose of this document is to identify the regulatory requirements and provide some suggestions for economical and effective methods to provide appropriate equipment/systems.

Regulation

OSHA regulations require first aid for workers under 29 CFR 1910.151. Part (c), shown below, addresses flushing of eyes and body.

§ 1910.151 Medical services and first aid.

(c) Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use.

OSHA Interpretation

OSHA's interpretation of the regulation is explained in a response (2004) from OSHA's Directorate of Enforcement Programs (DEP) (provided below, in part)

> "The OSHA requirements for emergency eyewashes and showers, found at 29 CFR 1910.151(c), specify that "where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use. As the standard states, an eyewash and/or safety shower would be required where an employee's eyes or body could be exposed to injurious corrosive materials. If none of the materials used in this work area is an injurious corrosive [chemical] (as indicated by the Material Safety Data Sheet (MSDS) for each product), then an emergency eyewash or shower would not be required pursuant to 1910.151(c).
>
> While not having the force of a regulation under the OSHA Act, the current ANSI standard addressing emergency eyewash and shower equipment (ANSI [Z]358.1-2004) provides for eyewash and shower equipment in appropriate situations when employees are exposed to hazardous materials. ANSI's definition of "hazardous material" would include caustics, as well as additional substances and compounds that have the capability of producing adverse effects on the health and safety of humans. ANSI's

standard also provides detail with respect to the location, installation, nature, and maintenance of eyewash and shower equipment. You also may wish to consult additional recognized references such as W. Morton Grant's *Toxicology of the Eye* (Charles C Thomas Pub. Ltd., 4th edition, August 1993) when considering potential chemical exposures to the eye and the appropriateness of installing eyewash facilities to protect employees against hazards associated with particular chemicals and substances."

ANSI Standard for Emergency Eyewash and Shower Equipment

The latest ANSI standard on this topic is ANSI Z358.1-2009 (approved by ANSI in 2009). This Standard is widely accepted by OSHA and industry. OSHA uses the Standard in their site audits. The Standard *"establishes minimum performance and use requirements for eyewash and shower equipment for the emergency treatment of the eyes or body of a person who has been exposed to injurious materials*".

The Standard was updated in 1998, 2004, and again in 2009. Providing water of a tepid temperature has been part of the Standard since 1998. Tepid water temperatures, generally defined as 60 to 100 degrees F, are needed to prevent injury, or worsened injury, from cold water temperatures or very warm water temperatures. Untempered cold water is a deterrent to proper flushing, and can quickly lead to numbness, confusion, and disorientation which are the symptoms of hypothermia. Providing flushing fluid at temperatures conducive to use for the recommended irrigation period is considered an integral part of providing suitable facilities.

Equipment manufacturers provide equipment that meets the Standard. Designers and installers must provide sufficient water supply, water temperature, equipment locations, etc. for the system to perform as intended. The Standard requires weekly testing to demonstrate availability. Weekly testing flushes sediment from the lines and minimizes microbial contamination from stagnant water.

Table 1 shows the hydraulic performance required by the Standard. Note that the shower flow rate is much higher than the flow of a residential shower of 2 to 2.5 gpm (or less).

Table 1 - Required Hydraulic Performance

Device	Minimum Flow, gpm	Minimum Duration, minutes
Eyewash	0.4	15
Eye/Face Wash	3	15
Shower	20	15

The Standard states that the flushing device is to be located in an accessible location that requires no more than 10 seconds to reach. The device is to be on the same level as the hazard and the path of travel is to be free of obstructions. The Standard states the flushing device should be immediately adjacent to the hazard for strong acids or strong caustics. Many

water treatment chemicals can be classified as strong acids or strong caustics. Strong oxidizers such as sodium hypochlorite and sodium permanganate, while not mentioned specifically in the Standard, should be addressed similarly.

Portable Flushing Systems

OSHA has stated its policy for providing portable flushing equipment in a response to a specific request for clarification of requirements for lead acid battery service in 1982. Portable systems typically cannot meet the duration of plumbed systems, especially for showers. A portion of OSHA's response is shown below. The reference to electrolyte in OSHA's response could be generalized to all corrosive injurious fluids.

Various forms of eye wash equipment are available today. Many are of the portable or self-contained wall mounted type which are limited in the quantity of water available for eye wash purposes, and usually do not provide for body drenching. This equipment may be used for compliance with 29 CFR 1910.151(c) only when it is not economically feasible to provide plumbed equipment and/or where the potential employee exposure to electrolyte(s) is determined to be slight.

Other Factors

OSHA has identified other factors that should be considered in determining the type of flushing equipment/systems needed in a lead battery maintenance operation. Table 2 identifies the relevance of the lead acid battery example to American Water's chemical systems.

Table 2 - Other Factors that Affect Need for Flushing

Factors Identified by OSHA in Lead Acid Battery Example	Relevance to American Water Chemical Systems
Employee Functions	Worker functions include: Routine operation including inspection, rate adjustment, feeder calibration; Chemical transfer; Chemical unloading; Maintenance and repair of equipment, piping, and valves;
Type of Electrolyte and Concentration	Type of chemical; concentration; specific hazards
Type and Size of Battery	Volume of chemical tanks; operating pressure of chemical piping; rate of chemical delivery from feeder/metering pump; rate of chemical transfer and unloading;
Facility Layout	Layout
Personal Protective Equipment (PPE)	PPE varies, but usually does not include full protection from hazard

Material Safety Data Sheets (MSDS)

MSDS sheets are required to be available to employees for the purpose of communicating the hazards of chemicals used in their workplace. The MSDS sheets contain descriptions of the hazards, and recommendations for first aid in the event of the chemical contacting eyes or skin.

MSDS recommendations are listed in Table 3 for a sampling of chemicals used at American Water.

Table 3 - Examples of MSDS Flushing Guidance

Chemical	Eye Contact Flushing	Skin Contact Flushing	Comments
Liquid Alum (50%)	15 minutes or more	Flush with plenty of water;	
Ferric Chloride (38%)	Rinse for at least 15 minutes	Flush for at least 15 minutes	Remove contaminated clothing and shoes
Sodium Hypochlorite (12.5%)	Rinse for at least 15 minutes	Immediately flush with plenty of water	Remove contaminated clothing and shoes
Fluosilicic Acid (23%)	Flush for at least 15 minutes	Immediately flush with plenty of water	Remove contaminated clothing
Caustic Soda (50%)	Flush 20 to 60 minutes	Flush 20 to 60 minutes	Flush with lukewarm water; repeat if necessary. Remove contaminated clothing and shoes

Summary

1. As part of first aid requirements in the work place, federal regulations require equipment/ systems to be provided to quickly flush/drench eyes and other body parts where anyone may come into contact with corrosive, injurious fluids.
2. Many water treatment chemicals are corrosive, injurious fluids and have the potential to harm eyes, skin, and body parts.
3. ANSI Standard Z358.1 (2009) American National Standard for Emergency Eyewash and Shower Equipment is widely accepted by OSHA and industry for defining the required performance of flushing equipment and systems.
4. The Standard sets minimum flow rates and durations of flow for various flushing equipment/systems.
5. Providing flushing fluid at a temperature conducive to use for the recommended irrigation period is an integral part of providing suitable facilities. The Standard requires the temperature of the water supply to be tepid. Tepid is understood to be approximately 60 to 100 degrees F.
6. The water supply is to be of potable quality.
7. The Standard calls for weekly testing of equipment to verify availability and address stagnant water quality concerns.

8. Portable flushing equipment, with inherent flow and duration limitations, can be used to supplement a system that is compliant with the Standard, or can be used where a compliant system is infeasible, or where the hazard is low. A site with no potable water would be a good candidate for portable flushing equipment.
9. MSDS sheets for water treatment chemicals provide recommendations for first aid in the event of the chemical contacting someone's eyes, or skin. The MSDS sheets frequently identify a minimum period of time for flushing of eyes and skin. Removal of clothing and shoes may be necessary.

Design Recommendations

American Water places a high priority on safety. Identification of alternatives and consideration of their feasibility should be performed and documented by a cross-functional team before proceeding with design and installation of a system that does not meet the latest requirements of ANSI Z358.1. A non-compliant system is usually preferable to not having any flushing system, and may be an interim step preceding installation of a compliant system.

The first aid recommendations contained in MSDS sheets should be reviewed for the chemicals planned to be present for a project. Flushing systems should be designed to provide the first aid measures identified in the MSDS sheets.

General design recommendations are provided below for the two extreme situations of 1) a medium to large treatment plant complex with multiple flushing stations, and 2) a small facility with a single flushing station.

When needed, a tempered water system should be requested in the Design Concept, and addressed in the Design Memorandum/Basis of Design document. A tempered water schematic should be produced as part of the design drawings.

For a large treatment plant, with numerous flushing stations, a central system with hot water or tempered water circulating pump(s) is recommended. Hot water is typically produced from electric or natural gas and stored in a storage tank(s). Hot water is then blended with cold water via a mixing valve to produce tempered water. The mixing valves are located in the vicinity of the flushing stations. Alternatively, tempered water can be circulated through a single mixing valve located near the hot water storage tank.

For a single flush station, hot water can be supplied from either a hot water heater/storage tank, or from an instantaneous heater. In order to meet the hydraulic and temperature requirements for an emergency shower, the hot water heater/storage tank volume may need to be larger than typical residential units. For example, with hot water being stored at 130 degrees F and cold water supplied at 55 degrees F, the hot water storage volume must be at least 53 gallons to meet a 65 degree tepid water target for 15 minutes at 20 gpm. With a 38 degree F supply water temperature, at least 119 gallons of hot water storage is necessary. Note that the recovery rate

for tank type heaters is relatively low compared to the demand for water over a 15 minute period, and therefore not an important design parameter. American Water Engineering has developed a spreadsheet calculator tool that can be used to estimate storage tank volumes and heat input requirements for both tank type heaters and tankless heaters.

Electric tankless hot water heaters are usually impractical due to their high electrical demands. Natural gas tankless heaters can be a practical solution where natural gas is available. Multiple tankless heaters can be installed to operate in parallel, if needed, to provide the necessary heated water supply which is then blended with cold water to the desired temperature by a mixing valve. Propane fuel for tankless heaters may also be a practical alternative for remote locations. Circulation of hot water or tempered water is typically not required for a single flush station as long as the hot water heat source is in relatively close proximity to the eyewash/shower. An example of a natural gas tankless heater and eyewash/shower for a remote site is shown in Figure 1.

Protection from freezing should be included in the design and installation where appropriate.

Someone that has activated a flushing station may benefit from assistance provided by others. It is recommended that activation of a flushing station be alarmed through SCADA resulting in prompt notification of the event to American Water personnel. A flow switch is typically installed on the water supply with an input to SCADA. The activation can be a single input for several flushing stations, or one per each station. In some instances, local alarm indication with audible and visual indication may be desirable. These design preferences should be resolved with local operations staff prior to detailed design (Design Concept if possible).

An emergency eyewash and shower should be provided where liquid chemical deliveries are made that involve temporary hose connections.

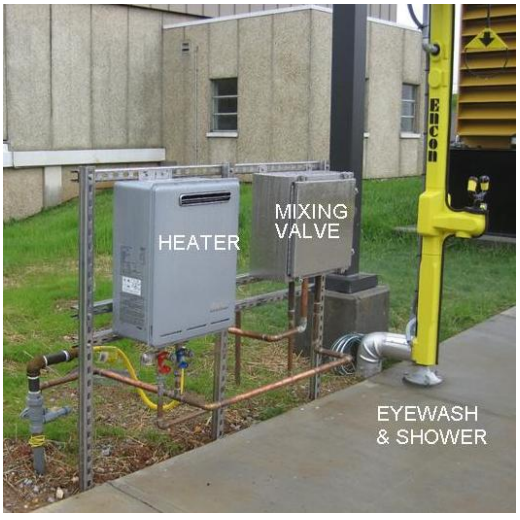


Figure 1 – Natural Gas Tankless Water

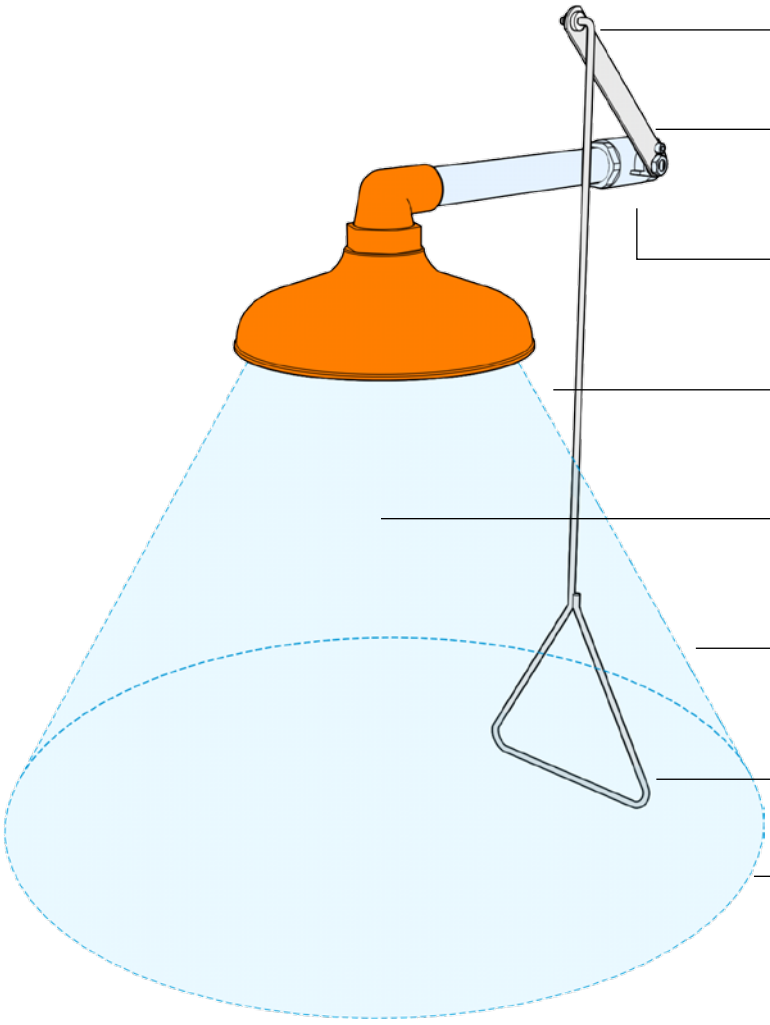
Guardian

ANSI / ISEA Z358.1 Compliance Checklist

Emergency Showers

This checklist is a summary of the provisions of ANSI Z358.1-2014 relating to emergency showers. Please refer to the standard for a complete listing of these provisions.

All Guardian emergency showers are third-party certified to meet or exceed the provisions of ANSI Z358.1-2014.



- "Hands-free" stay-open valve activates in one second or less. (Section 4.2)
- Water supply shall be sufficient to supply at least 20 GPM in the required pattern for 15 minutes. (Sections 4.1.2, 4.5.5)
- Shower shall provide 20 gallons (75.7 liters) of water per minute for 15 minutes. (Section 4.1.2, 4.5.5)
- Height of water column shall be between 82" (208.3 cm) and 96" (243.8 cm) above floor. (Section 4.1.3, 4.5.4)
- Center of the water pattern shall be at least 16" (40.6 cm) from any obstructions. (Section 4.1.4, 4.5.4)
- At 60" (152.4 cm) above floor, the water pattern must be at least 20" (50.8 cm) in diameter. (Section 4.1.4)
- Easily located, accessible actuator no higher than 69" (173.3 cm) above floor. (Section 4.2)
- If provided, shower enclosure shall be a minimum diameter of 34" (86.4 cm). (Section 4.3)

LOCATION	Install shower within 10 seconds (approximately 55 feet) of hazard, on the same level as hazard and with unobstructed travel path. (Section 4.5.2; B5)
IDENTIFICATION	Identify shower location with highly visible sign. Area around the shower shall be well-lit. (Section 4.5.3)
WATER TEMPERATURE	Water delivered by shower shall be tepid (60-100°F). (Section 4.5.6)
TRAINING	Instruct all employees in the location and proper use of emergency showers. (Section 4.6.4)
MAINTENANCE/INSPECTION	Activate shower at least weekly. (Section 4.6.2) Inspect annually for compliance with standard. (Section 4.6.5)

Guardian Equipment
1140 N North Branch St
Chicago, IL 60642

312 447 8100 TELEPHONE
312 447 8101 FACSIMILE
gesafety.com

Listed 8116. Units have been tested to and comply with ANSI Z358.1-2014 and the Uniform Plumbing Code.

ETL Listed 101496. Units have been tested to and comply with ANSI Z358.1-2014.

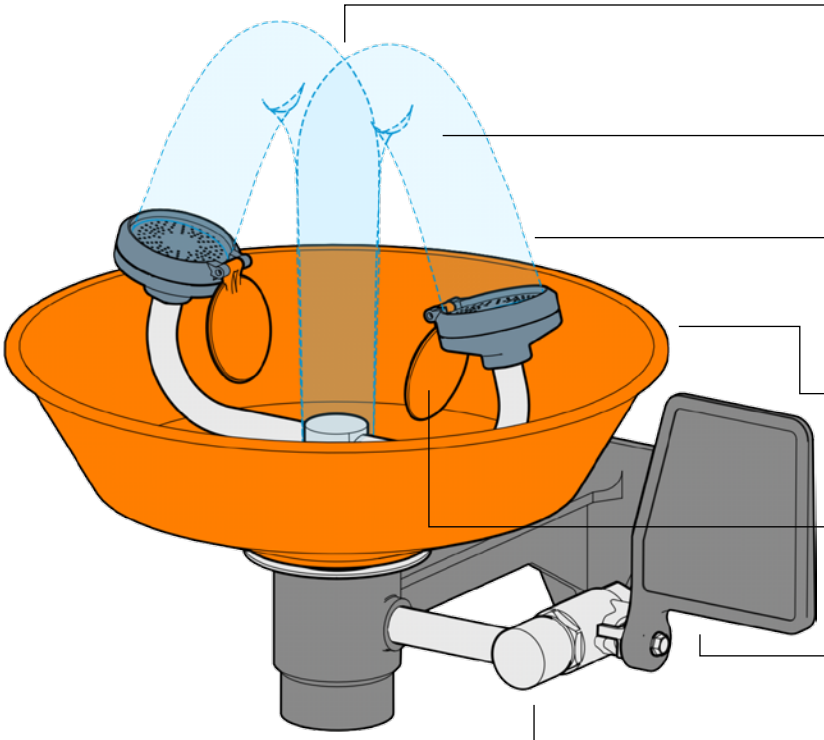
Guardian

ANSI / ISEA Z358.1 Compliance Checklist

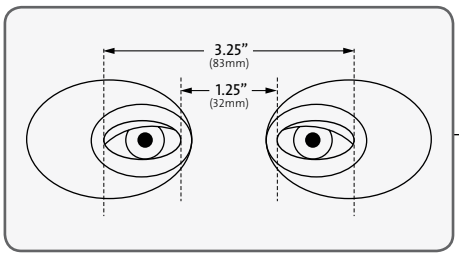
Eye/Face Washes

This checklist is a summary of the provisions of ANSI Z358.1-2014 relating to emergency eye/face washes. Please refer to the standard for a complete listing of these provisions.

All Guardian eye/face wash units are third-party certified to meet or exceed the provisions of ANSI Z358.1-2014.



- Controlled, low velocity flow completely rinses eyes and face and is not injurious to user. (Section 6.1.1)
- Water flow is sufficiently high to allow user to hold eyes open while operating. (Section 6.1.7)
- Flushing fluid flow pattern shall be positioned between 33" (83.8 cm) and 53" (134.6 cm) from the floor and at least 6" (15.3 cm) from the wall or nearest obstruction. (Section 6.4.4)
- Unit must deliver at least 3.0 gallons (11.4 liters) of water per minute for 15 minutes. (Section 6.1.6, 6.4.5)
- Protect spray heads from airborne contaminants. Covers shall be removed by water flow. (Section 6.1.3)
- Valve actuator shall be easy to locate and readily accessible to user. (Section 6.2)
- "Hands-free" stay-open valve shall activate in one second or less. (Section 6.1.4, 6.2)



- Unit washes both eyes simultaneously. Water flow covers area indicated on Guardian test gauge. (Section 6.1.8)

LOCATION	Install eye/face wash unit within 10 seconds (approximately 55 feet) of hazard, on the same level as hazard and with unobstructed travel path. Where strong acids or caustics are being handled, the eye/face wash shall be located immediately adjacent to the hazard. (Section 6.4.2; B5)
IDENTIFICATION	Identify eye/face wash with highly visible sign. Area around eye/face wash shall be well-lit. (Section 6.4.3)
WATER TEMPERATURE	Water delivered by eye/face wash shall be tepid (60-100°F). (Section 6.4.6)
TRAINING	Instruct all employees in the location and proper use of eye/face washes. (Section 6.5.4)
MAINTENANCE/INSPECTION	Activate eye/face wash at least weekly. (Section 6.5.2) Inspect annually for compliance with standard. (Section 6.5.5)

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Listed 8116. Units have been tested to and comply with ANSI Z358.1-2014 and the Uniform Plumbing Code.

ETL Listed 101496. Units have been tested to and comply with ANSI Z358.1-2014.

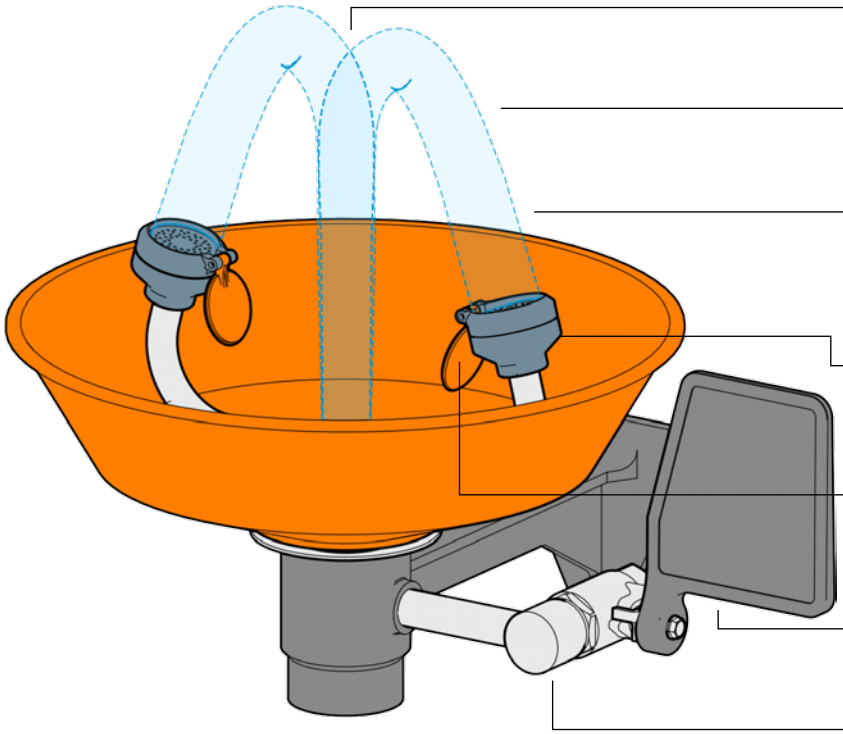
Guardian

ANSI / ISEA Z358.1 Compliance Checklist

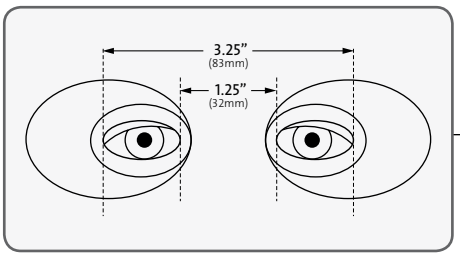
Eyewashes

This checklist is a summary of the provisions of ANSI Z358.1-2014 relating to emergency eyewashes. Please refer to the standard for a complete listing of these provisions.

All Guardian eyewash units are third-party certified to meet or exceed the provisions of ANSI Z358.1-2014.



- Controlled, low velocity flow rinses both eyes and is not injurious to user. (Section 5.1.1)
- Water flow is sufficiently high to allow user to hold eyes open while rinsing. (Section 5.1.7)
- Flushing fluid flow pattern shall be positioned between 33" (83.8 cm) and 53" (134.6 cm) from the floor and at least 6" (15.3 cm) from the wall or nearest obstruction. (Section 5.4.4)
- Unit must deliver at least 0.4 gallons (1.5 liters) of water per minute for 15 minutes. (Section 5.1.6)
- Protect spray heads from airborne contaminants. Covers shall be removed by water flow. (Section 5.1.3)
- Valve actuator shall be easy to locate and readily accessible to user. (Section 5.2)
- "Hands-free" stay-open valve activates in one second or less. (Section 5.1.4, 5.2)
- Unit washes both eyes simultaneously. Water flow covers area indicated on Guardian test gauge. (Section 5.1.8)



LOCATION	Install eyewash wash unit within 10 seconds (approximately 55 feet) of hazard, on the same level as hazard and with unobstructed travel path. Where strong acids or caustics are being handled, the eyewash shall be located immediately adjacent to the hazard. (Section 5.4.2; B5)
IDENTIFICATION	Identify eyewash with highly visible sign. Area around eyewash shall be well-lit. (Section 5.4.3)
WATER TEMPERATURE	Water delivered by eyewash shall be tepid (60-100°F). (Section 5.4.6)
TRAINING	Instruct all employees in the location and proper use of eyewashes. (Section 5.5.4)
MAINTENANCE/INSPECTION	Activate eyewash at least weekly. (Section 5.5.2) Inspect annually for compliance with standard. (Section 5.5.5)

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ANSI / ISEA Z358.1 Compliance Checklist

Eyewash/Drench Hose Units

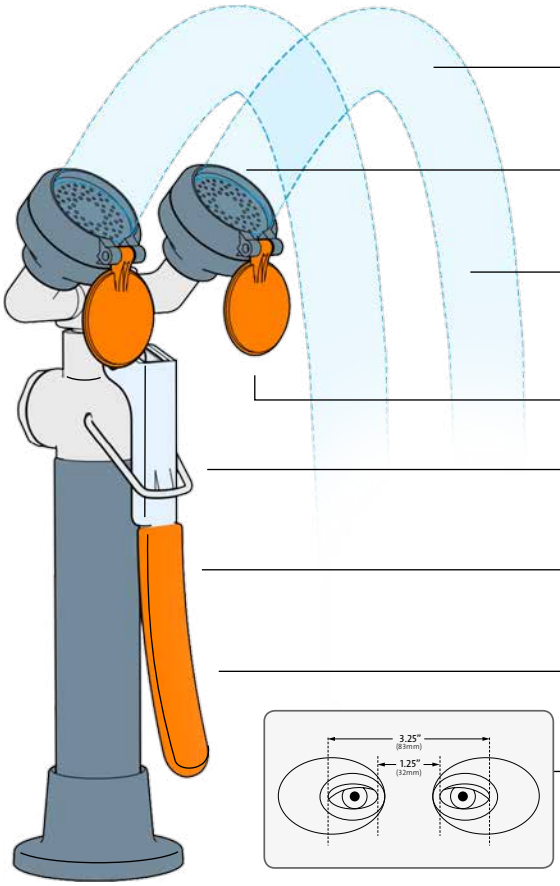
ANSI Standard Z358.1-2014 states that drench hose units may supplement, but may not be used in place of, dedicated eyewash units. Guardian offers a series of units that meet the provisions of the ANSI standard as both an eyewash and a drench hose. These dual purpose units can be used to combine an eyewash and a drench hose into a single versatile, economic unit.

To use the unit as a fixed eyewash, simply leave the unit in the holder. The dual spray heads will deliver water to both eyes simultaneously. To function as a drench hose, remove the unit from the holder and rinse any part of the eyes, face or body.

These units are particularly useful in areas (such as laboratories) where workers are handling relatively small quantities of injurious materials. However, should a spill occur, it might affect any part of the worker's eyes, face or body. Eyewash/drench hose units offer a degree of versatility not found with other types of emergency equipment.

This checklist summarizes the provisions of ANSI Z358.1-2014 for both eyewashes and drench hoses. Please refer to the standard for a complete listing of these provisions.

All Guardian eyewash/drench hose units are third-party certified to meet or exceed the provisions of ANSI Z358.1-2014.



- **Controlled, low velocity flow rinses both eyes and is not injurious to user. (Sections 5.1.1 and 8.2.1)**
- **Water flow is sufficiently high to allow user to hold eyes open while rinsing. (Section 5.1.7)**
- **Flushing fluid flow pattern shall be positioned between 33" (83.8 cm) and 53" (134.6 cm) from the floor and at least 6" (15.3 cm) from the wall or nearest obstruction. (Section 5.4.4)**
- **Protect spray heads from airborne contaminants. (Section 5.1.3)**
- **"Hands-free" stay-open valve shall activate in one second or less. (Sections 5.2 and 8.2.2)**
- **Unit must deliver at least 0.4 gallons (1.5 liters) of water per minute for 15 minutes. (Section 5.1.6)**
- **Valve actuator shall be easy to locate and readily accessible to the user. (Sections 5.2 and 8.2.2)**
- **Unit washes both eyes simultaneously. Water flow covers area indicated on Guardian test gauge. (Section 5.1.8)**

LOCATION	**Install eyewash/drench hose unit within 10 seconds (approximately 55 feet) of hazard, on same level as hazard and with unobstructed travel path. (Section 5.4.2; B5)**
IDENTIFICATION	**Identify eyewash/drench hose unit with highly visible sign. Area around unit shall be well-lit. (Sections 5.4.3 and 8.2.3.2)**
WATER TEMPERATURE	**Water delivered by eyewash/drench hose units shall be tepid (60-100°F). (Sections 5.4.6 and 8.2.3.4)**
TRAINING	**Instruct all employees in the location and proper use of eyewash/drench hose units. (Sections 5.5.4 and 8.2.4.4)**
MAINTENANCE/INSPECTION	**Activate eyewash/drench hose units at least weekly. (Sections 5.5.2 and 8.2.4.2) Inspect annually for compliance with standard. (Section 5.5.5 and 8.2.4.5)**

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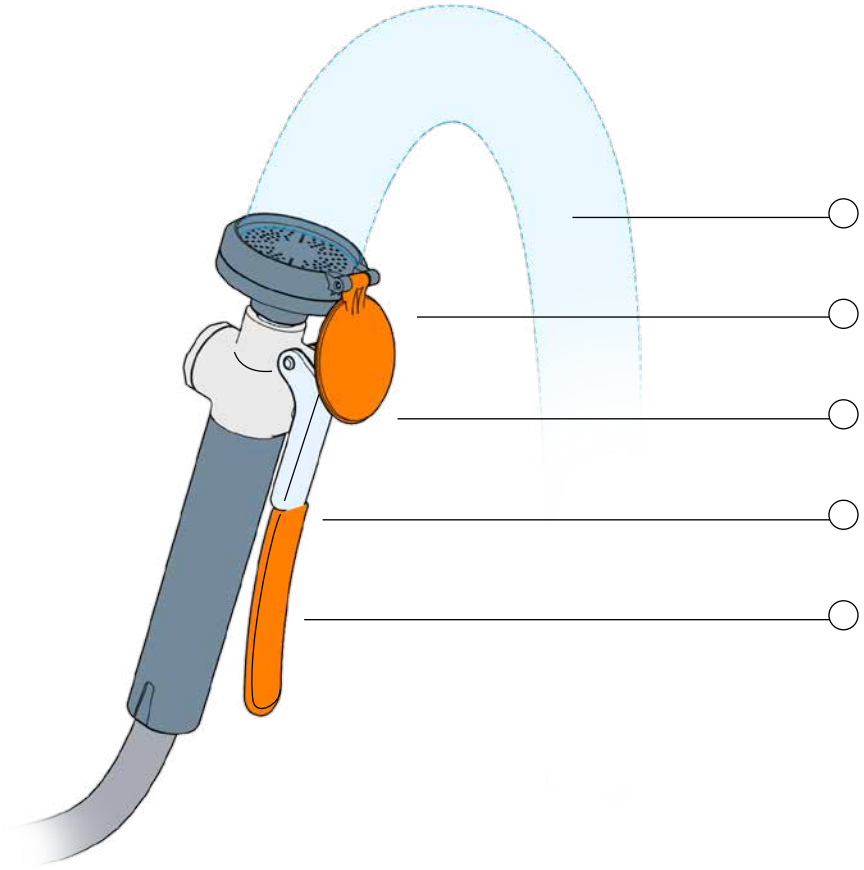
Drench Hose Units

Under ANSI Z358.1-2014, drench hose units support plumbed and self-contained emergency eyewash and shower stations, but cannot replace them. In other words, drench hoses are intended solely as supplemental units providing additional protection to personnel.

Drench hoses are useful in cases where the user is in a prone position or where it is necessary to reach areas of the face and body inaccessible to the fixed stream of a shower or eyewash unit. They are also advantageous in areas (such as laboratories) where they can be installed close to where accidents might occur.

This checklist summarizes the provisions of ANSI Z358.1-2014 relating to drench hoses. Please refer to the standard for a complete listing of these provisions.

All Guardian drench hose units are third-party certified to meet or exceed the provisions of ANSI Z358.1-2014.



- **Controlled, low velocity flow is not injurious to user. (Section 8.2.1)**
- **Drench hose unit supplements shower and eyewash units installed in vicinity. (Section 8)**
- **Valve shall go from “off” to “on” in one second or less. (Section 8.2.2)**
- **Valve actuator shall be easy to locate and readily accessible to the user. (Section 8.2.2)**
- **If providing shutoff valves, allowance shall be made to prevent unauthorized shutoff. (Section 8.2.3.3)**

LOCATION	**Install drench hose unit in area free of debris or obstructions. (Section 8.2.3.2)**
IDENTIFICATION	**Identify drench hose unit with highly visible sign. Area around drench hose shall be well-lit. (Section 8.2.3.2)**
WATER TEMPERATURE	**Water delivered by drench hose shall be tepid (60-100°F). (Section 8.2.3.4)**
TRAINING	**Instruct all employees in the location and proper use of drench hoses. (Section 8.2.4.4)**
MAINTENANCE/INSPECTION	**Activate drench hoses at least weekly. (Section 8.2.4.2) Inspect annually for compliance with standard. (Section 8.2.4.5)**

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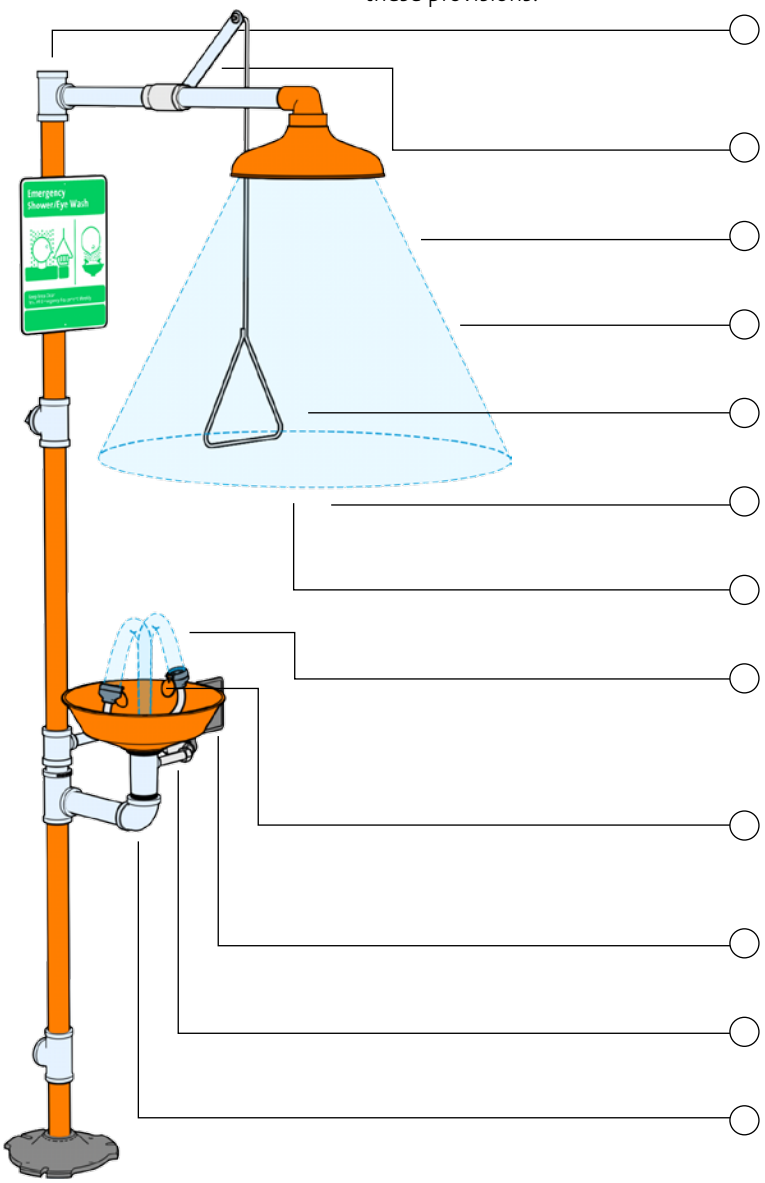
ANSI / ISEA Z358.1 Compliance Checklist

Safety Stations

This checklist is a summary of the provisions of ANSI Z358.1-2014 relating to eye or eye/face wash and shower combination stations. Please refer to the standard for a complete listing of these provisions.

All Guardian safety stations are third-party certified to meet or exceed the provisions of ANSI Z358.1-2014.



- Connect unit to water supply capable of delivering required flow when all components are operated simultaneously. (Section 4.5.5, 7.4.4)
- "Hands-free" stay-open valve activates in one second or less. (Section 4.2)
- Height of water column shall be between 82" (208.3 cm) and 96" (243.8 cm) above floor. (Section 4.1.3, 4.5.4)
- Shower shall provide 20 gallons (75.7 liters) of water per minute for 15 minutes. (Section 4.1.2, 4.5.5)
- Easily located, accessible actuator no higher than 69" (173.3 cm) above floor. (Section 4.2)
- At 60" (152.4 cm) above floor, the water pattern must be at least 20" (50.8 cm) in diameter. (Section 4.1.4)
- Center of water pattern shall be at least 16" from any obstructions. (Section 4.1.4, 4.5.4)
- Flushing fluid flow pattern shall be positioned between 33" (83.8 cm) and 53" (134.6 cm) from the floor and at least 6" (15.3 cm) from the wall or nearest obstruction. (Section 5.4.4, 6.4.4)
- Protect outlet heads from airborne contaminants. Covers shall be removed by water flow. (Section 5.1.3, 6.1.3)
- Valve actuator shall be easy to locate and readily accessible to user. (Section 5.2, 6.2)
- "Hands-free" stay-open valve activates in one second or less. (Section 5.2, 6.1.4, 6.2)
- Unit must deliver at least 3.0 GPM (11.4 liters) (for eye/face wash) or 0.4 GPM (1.5 liters) (for eyewash) for 15 minutes. (Sections 5.1.6, 6.1.6, 6.4.5)

LOCATION	Install safety station within 10 seconds (approximately 55 feet) of hazard, on the same level as hazard and with unobstructed travel path. (Section 7.4.2; B5)
IDENTIFICATION	Identify safety station with highly visible sign. Area around safety station shall be well-lit. (Section 7.4.3)
WATER TEMPERATURE	Water delivered by safety station shall be tepid (60-100°F). (Section 7.4.5)
TRAINING	Instruct all employees in the location and proper use of safety station. (Section 7.5.4)
MAINTENANCE/INSPECTION	Activate safety station at least weekly. (Section 7.5.2) Inspect annually for compliance with standard. (Section 7.5.5)

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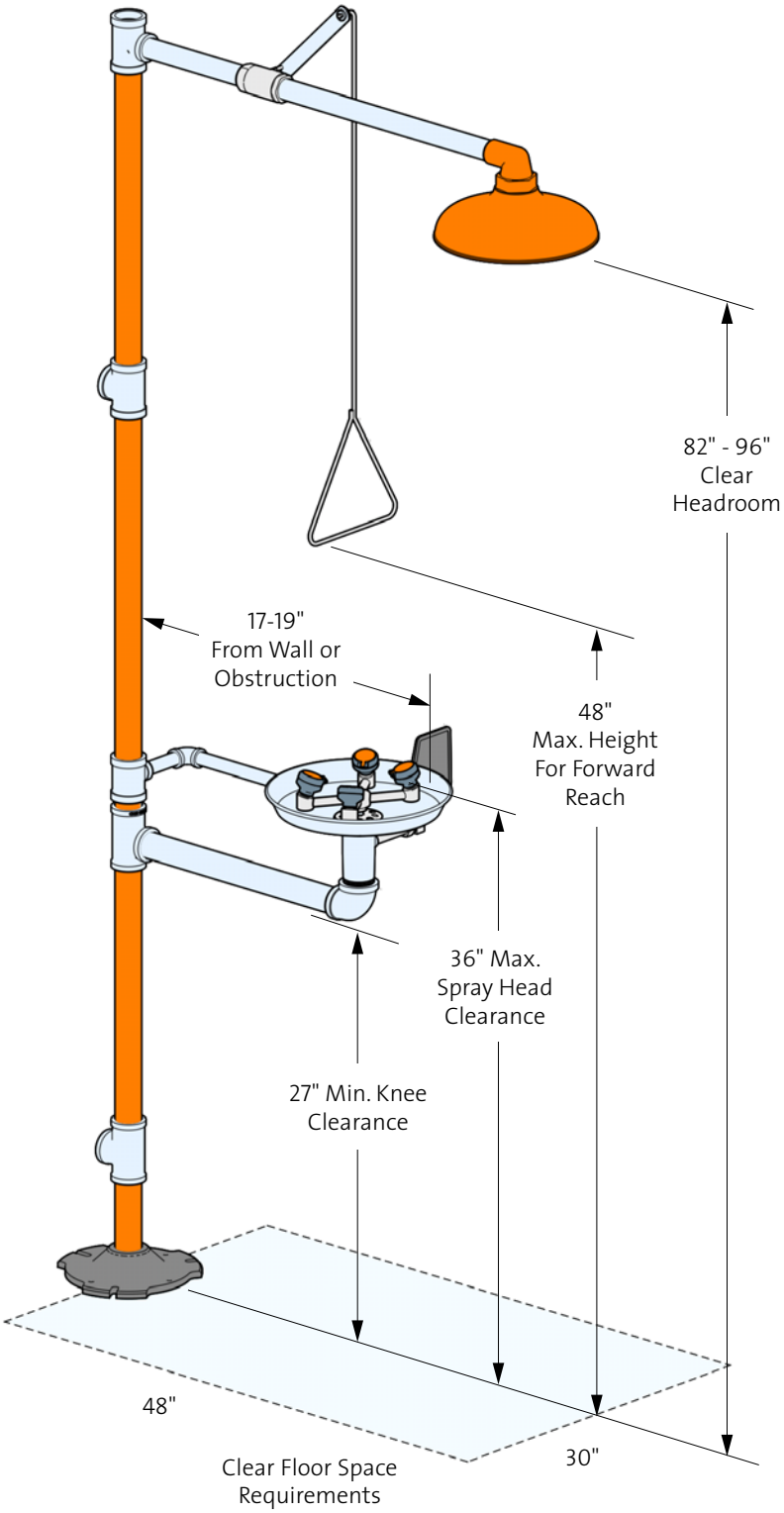
Barrier-Free Equipment



The Americans with Disabilities Act (ADA) requires that employers provide accessible workplaces for all employees. These workplaces may therefore require emergency eyewash and shower equipment that is specially constructed to provide access to handicapped persons.

Barrier-free emergency equipment must comply with the provisions of ANSI 117.1-1998 ("Accessible and Usable Buildings and Facilities"). These provisions include dimensions for minimum knee clearance, maximum height and reach, and minimum distance from obstructions.

Guardian offers an array of eyewash and shower units designed for barrier-free applications. These units meet the provisions of ANSI Z358.1-2014 for emergency equipment and the provisions of ANSI A117.1-1998 for accessibility. The provisions of ANSI Z358.1-2014 are summarized on pages 2-10. The additional provisions of ANSI A117.1-1998 for accessibility are shown here. Please refer to these standards for a complete description of these provisions.

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Appendix G

Guidelines for Venting Polyethylene Storage Tanks

POLYPROCESSING SOLUTIONS, SIMPLIFIED.	**Technical Bulletin**	**Venting – Design for ACFM** (Air Cubic Feet per Minute)
	Date: January 2010 Rev. 1	

Poly Processing Company commissioned an engineering consulting firm to determine the proper venting requirements necessary for polyethylene storage tanks. Two methods of filling were considered, 1) mechanical pumping and 2) compressed air (pneumatic) from tanker trucks.

Filling by Mechanical Pump

Using mechanical pumps to fill your tank is a low impact process and typically does not cause excessive pressure to be placed upon the tank.

- ≤ 1000 gallons – vent size should equal the size of the largest fill or discharge fitting
- > 1000 gallons - vent size should exceed the largest fill or discharge fitting by one-inch.

Pneumatic Filling

The engineering study reviewed the pneumatic filling of a polyethylene storage tank for three common venting scenarios:

1. Short Vent (u-vent)
2. Long Vent (vented through the roof or into a common venting system)
3. Scrubber Vent (used where fume scrubbing is critical)

The following criteria were established for all three venting scenarios:

1. Maximum pressure used to unload tanker trailer was 30 psig.
2. Evaluate tanker hose impact; 1”, 2” & 3”.
3. Evaluate fill-line/fitting size impact; 1”, 2” & 3”.
4. Polyethylene tank internal pressure must not exceed 10” water column per ASTM D1998 section 1.1.3.

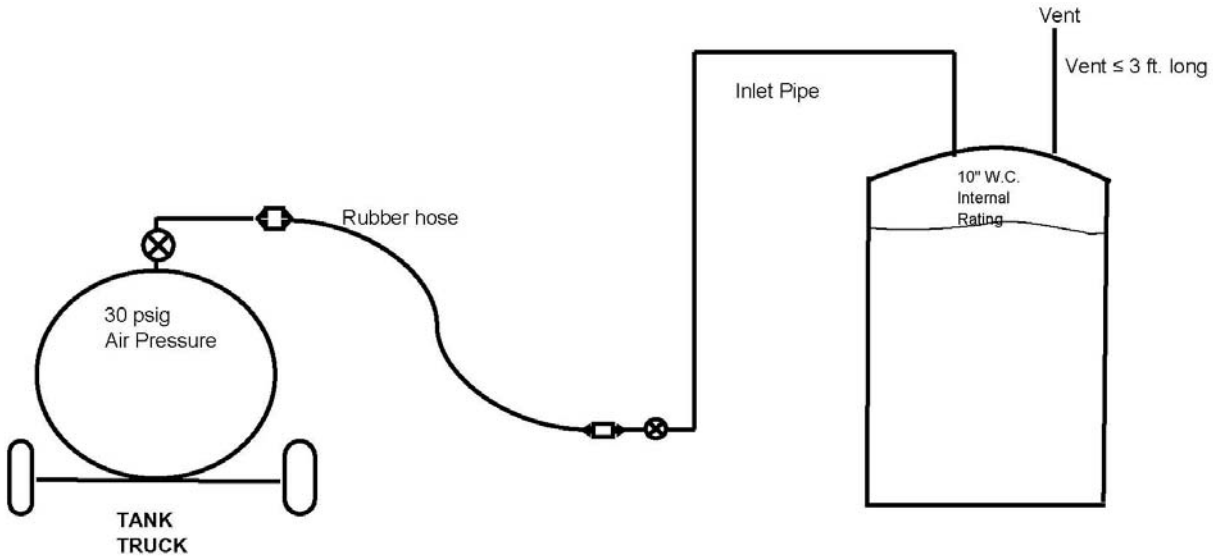
General Conclusions

1. Tanker trailer, once emptied of liquid, becomes large reservoir of compressed air at 30 psig.
2. Size of delivery hose from trailer to tank, 1 to 3 inches in diameter, impacts the volume of air delivered to the tank during line purge.
3. Size of fill line / fitting of the tank, 1 to 3 inches in diameter, impacts the volume of air delivered to the tank during line purge.
4. Vent size 2 inches larger than the fill assembly is sufficient to handle the delivery of the liquid product, but may **not** handle the volume of air released from the tanker trailer based on conclusions #2 and #3.
5. **Venting capacity must equal or exceed Air Cubic Feet per Minute (ACFM) coming from tanker truck for adequate margin of safety and increased tank life!**

POLYPROCESSING SOLUTIONS, SIMPLIFIED.	**Technical Bulletin** **Date: January 2010** **Rev. 1**	**Venting – Design for ACFM** **(Air Cubic Feet per Minute)**

Pneumatic Fill Scenario #1
Short Vent

- Vent length ≤ 3’
- Mesh size on bug screen ≥ ¼” or no screen



Tank Vent Requirements					
	Hose	Inlet Pipe	Inlet Flow / ACFM	**Min. Vent Size**	Vent Flow / ACFM
A)	1"	1"	180	**3"**	600
B)	2"	1"	190	**3"**	600
C)	2"	2"	910	**4"**	1050
D)	3"	2"	1120	**6"**	2500
E)	3"	3"	2250	**6"**	2500

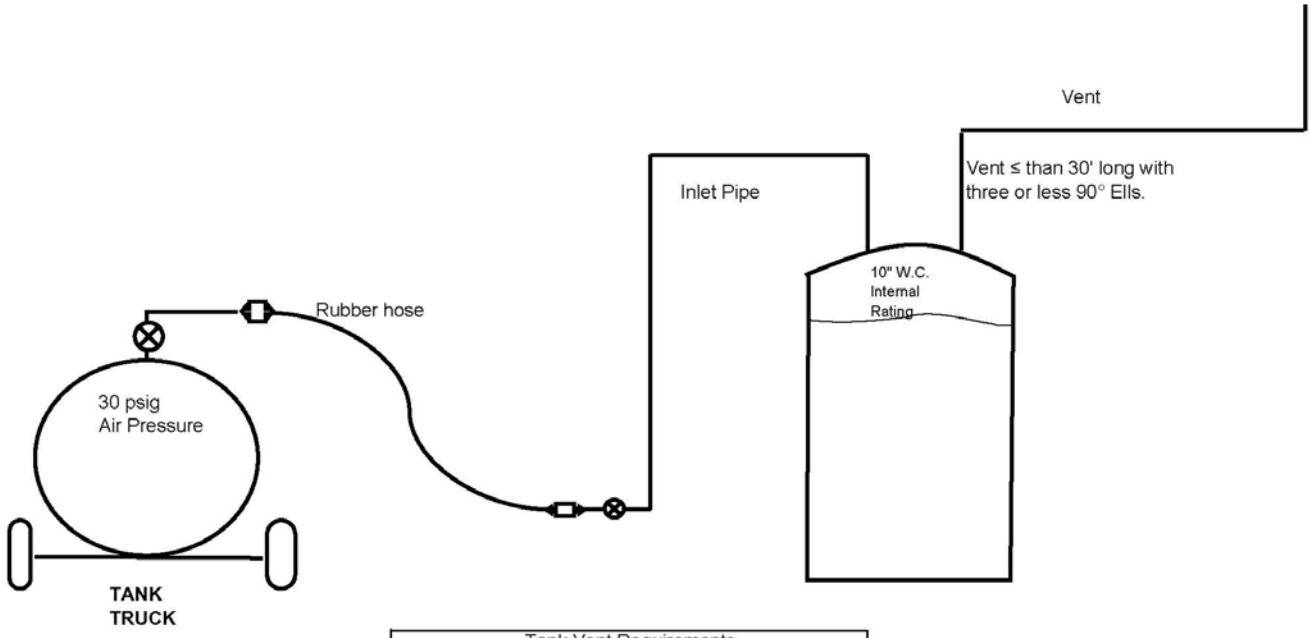
ACFM = air cubic feet per minute

POLYPROCESSING SOLUTIONS, SIMPLIFIED.	**Technical Bulletin**	**Venting – Design for ACFM** (Air Cubic Feet per Minute)
	Date: January 2010 Rev. 1	

Pneumatic Fill Scenario #2

Long Vent

- Vent length > 3’ and ≤ 30’
- Three or less 90° elbows and no other restrictions, i.e. smaller diameter pipe



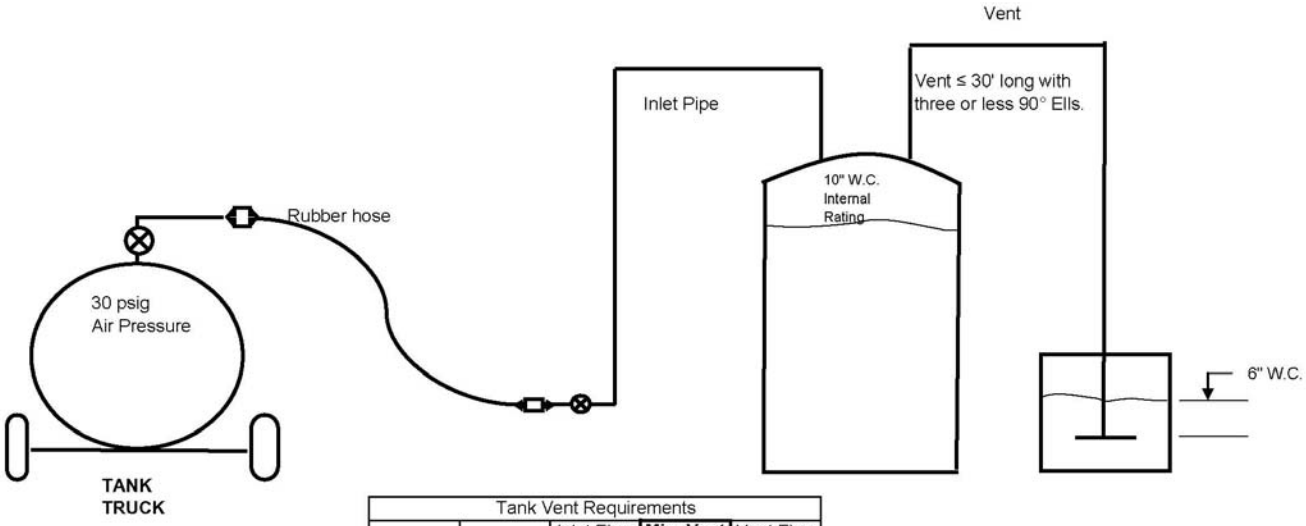
	Tank Vent Requirements				
	Hose	Inlet Pipe	Inlet Flow / ACFM	**Min. Vent Size**	Vent Flow / ACFM
A)	1"	1"	180	**4"**	715
B)	2"	1"	190	**4"**	715
C)	2"	2"	910	**6"**	1870
D)	3"	2"	1120	**6"**	1870
E)	3"	3"	2250	**8"**	3450

ACFM = air cubic feet per minute

PolyProcessing SOLUTIONS, SIMPLIFIED.	**Technical Bulletin** **Date: January 2010** **Rev. 1**	**Venting – Design for ACFM** **(Air Cubic Feet per Minute)**

Pneumatic Fill Scenario #3
Scrubber Vent

- Piping from vent to scrubber cannot be reduced
- Perforated dispersion pipe must be same diameter, or larger, as vent
- Centerline of dispersion pipe not to be submersed > 6 inches
- Sum of perforations ≥ cross sectional area of pipe



Tank Vent Requirements					
	Hose	Inlet Pipe	Inlet Flow / ACFM	**Min. Vent Size**	Vent Flow / ACFM
A)	1"	1"	180	**4"**	380
B)	2"	1"	190	**4"**	380
C)	2"	2"	910	**6"**	970
D)	3"	2"	1120	**8"**	1780
E)	3"	3"	2250	**10"**	2935

ACFM = air cubic feet per minute

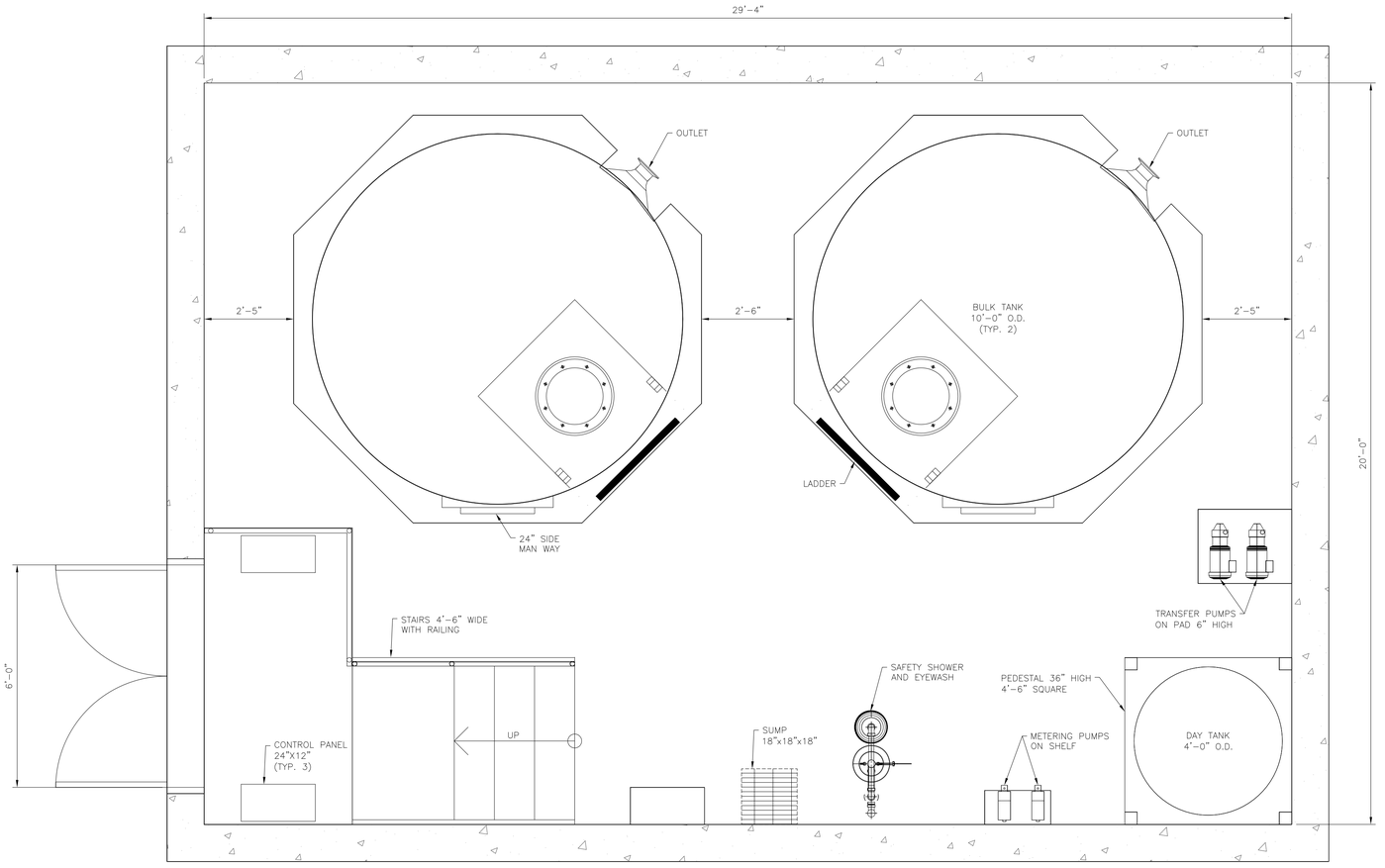
Appendix H

Bulk Chemical System Layout Example

- **H1 - Example of Bulk Chemical System Layout**

Selected Standard Detail Examples

- **H2 - Chemical Area Grating System**
- **H3 - Water Seal Trap**
- **H4 - Example of Flexible Plastic Tubing Application**
- **H5 - Control Panel for Fill Station**
- **H6 - Control Panel for Bulk Chemical Transfer System (Small Day Tank)**
- **H7 - Control Panel for Bulk Chemical Transfer System (Large Day Tank with one Bulk Tank)**
- **H8 - Control Panel for Bulk Chemical Transfer System (Large Day Tank with two Bulk Tanks)**



NOTES:

1. VALVES NOT SHOWN.
2. PIPING NOT SHOWN.

0 1' 2' 4'

SCALE: 1/2" = 1'–0"

AMERICAN WATER

REVISIONS		REVISIONS	
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△		△	
△		△	

LICENSED PROFESSIONAL ENGINEER
NO.

AMERICAN WATER ENGINEERING
3906 CHURCH RD.
MT. LAUREL, NJ 08054

AMERICAN WATER

DRAWN BY D. JOBE
PROJECT ENG'R S. CREEL

DATE 09–14–16

PROJECT

FIGURE H1

BULK STORAGE & FEED PLAN – EXAMPLE
FOR LIQUID CHEMICAL STANDARD

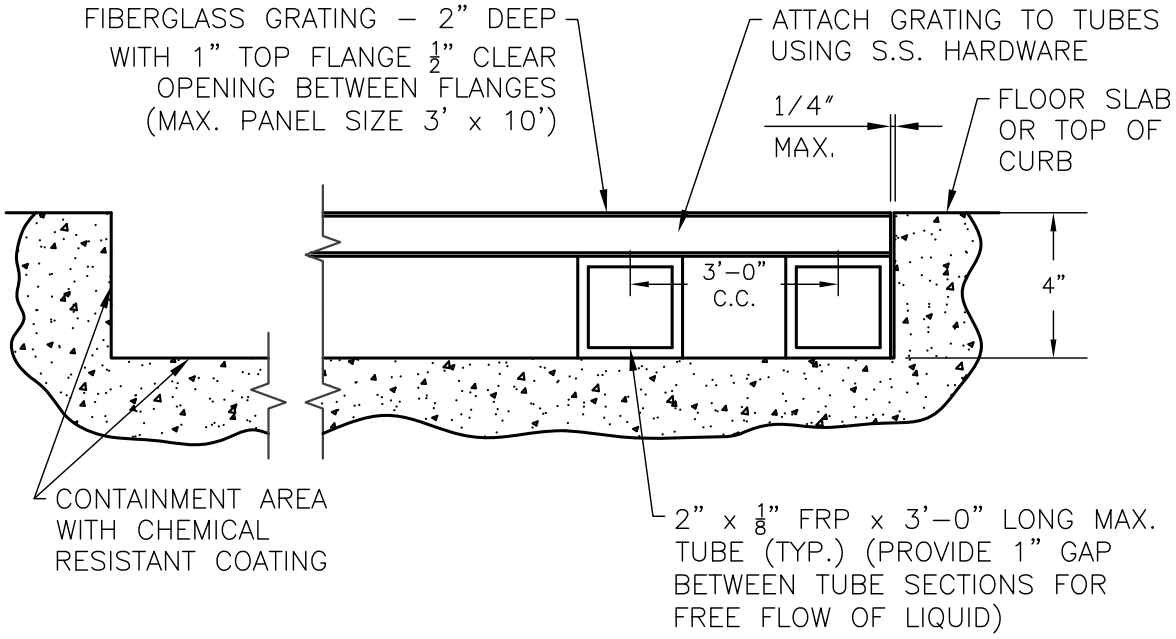
USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES

FOR COMMENTS

USE DIMENSIONS ONLY
SCALE AS SHOWN

0201–0601–SD87

02010601SD87



DETAIL – H2
CHEMICAL AREA GRATING SYSTEM

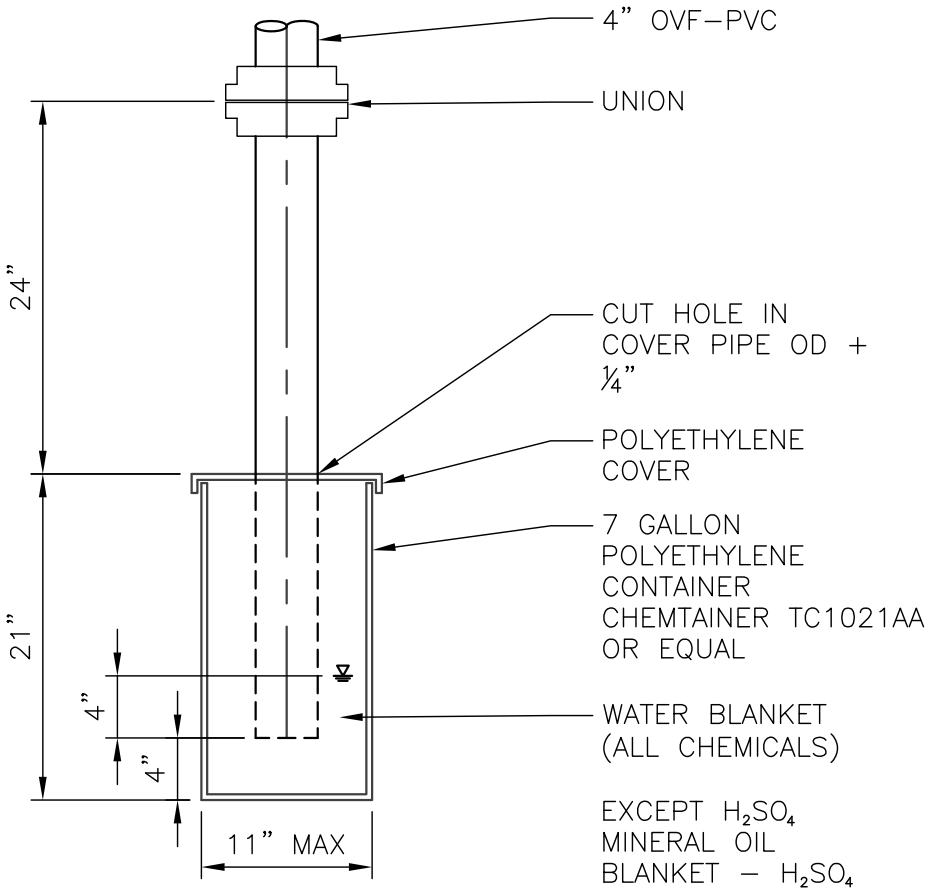
N.T.S.

1/X

REVISIONS	AMERICAN WATER STANDARD CIVIL CHEMICAL AREA GRATING SYSTEM DETAIL H2
	AMERICAN WATER VOORHEES, NJ 08043
	AMERICAN WATER ENG. CENTER 3906 CHURCH ROAD MOUNT LAUREL, NJ 08054
	DRAWN BY DJJ PROJECT ENG'R APPROVED DATE 12-10-13 PROJECT IP USE DIMENSIONS ONLY SCALE N.T.S.
	USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES — 0201-0601-SD81

FOR COMMENTS

02010601SD81



DETAIL – H3
CHEMICAL STORAGE TANK OVERFLOW FUGITIVE EMISSION CONTAINMENT

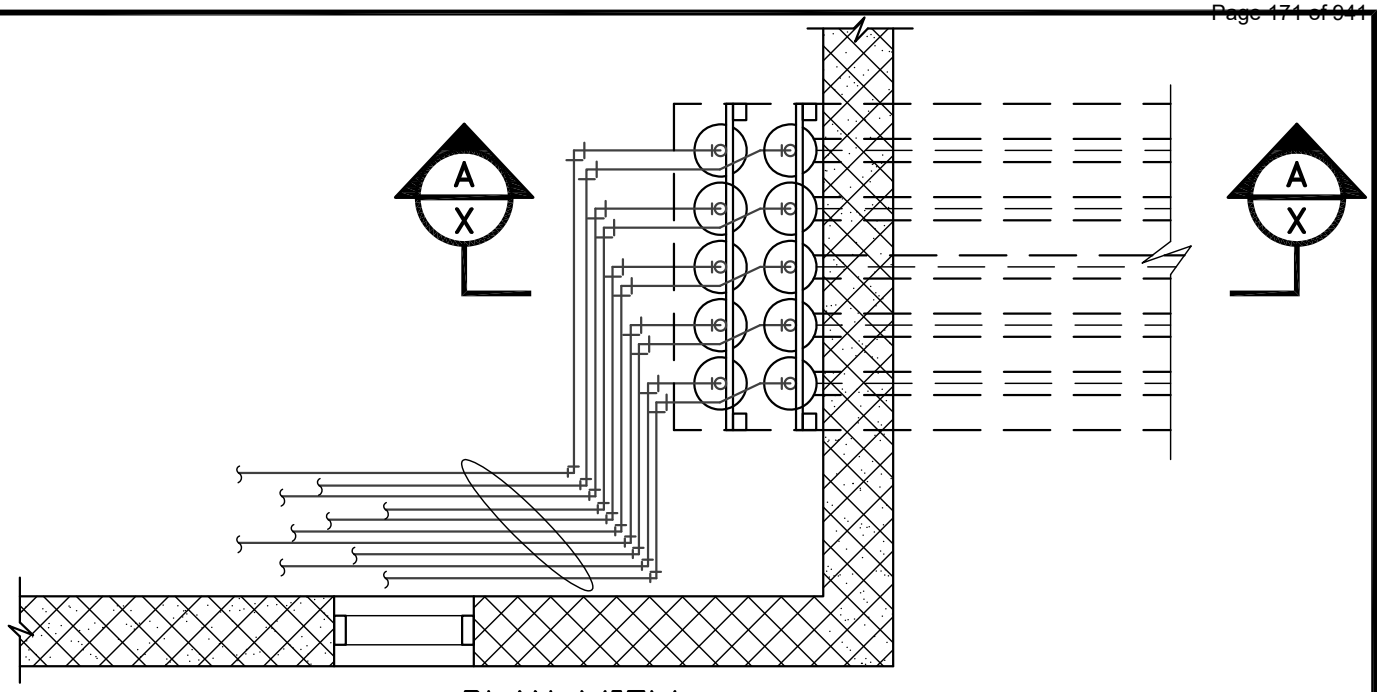
N.T.S.

1
X

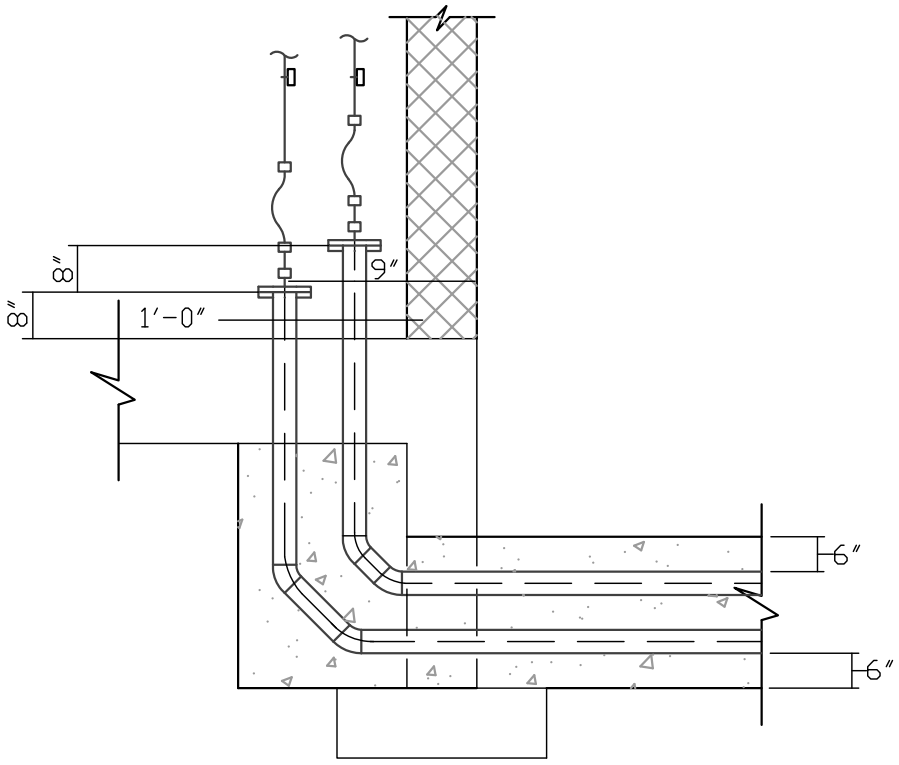
REVISIONS	AMERICAN WATER STANDARD PROCESS WATER SEAL TRAP DETAIL H3
	AMERICAN WATER VOORHEES, NJ 08043
	AMERICAN WATER ENG. CENTER 3906 CHURCH ROAD MOUNT LAUREL, NJ 08054
	DRAWN BY DJJ PROJECT ENG'R APPROVED DATE 11–26–13 PROJECT IP USE DIMENSIONS ONLY SCALE N.T.S.
	USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES — 0201–0601–SD79

FOR COMMENTS

02010601SD79



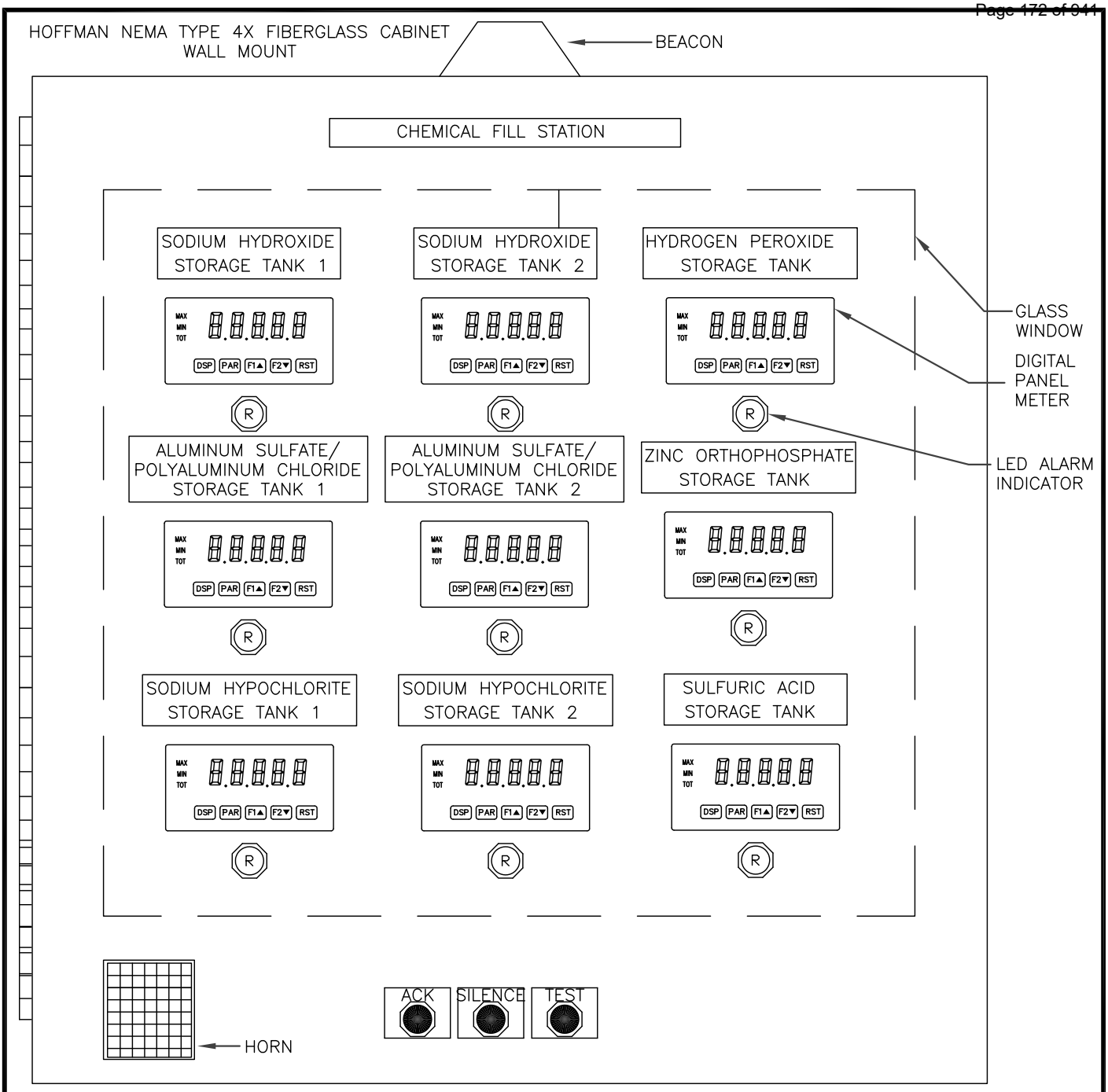
PLAN VIEW



SECTION VIEW

REVISIONS	AMERICAN WATER STANDARD CIVIL FLEXIBLE PLASTIC TUBING APPLICATION DETAIL H4
	AMERICAN WATER VOORHEES, NJ 08043
	AMERICAN WATER ENG. CENTER 3906 CHURCH ROAD MOUNT LAUREL, NJ 08054
	DRAWN BY DJJ PROJECT ENG'R APPROVED DATE 12-10-13 PROJECT IP USE DIMENSIONS ONLY SCALE N.T.S.
	USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES — 0201-0601-SD80

FOR COMMENTS



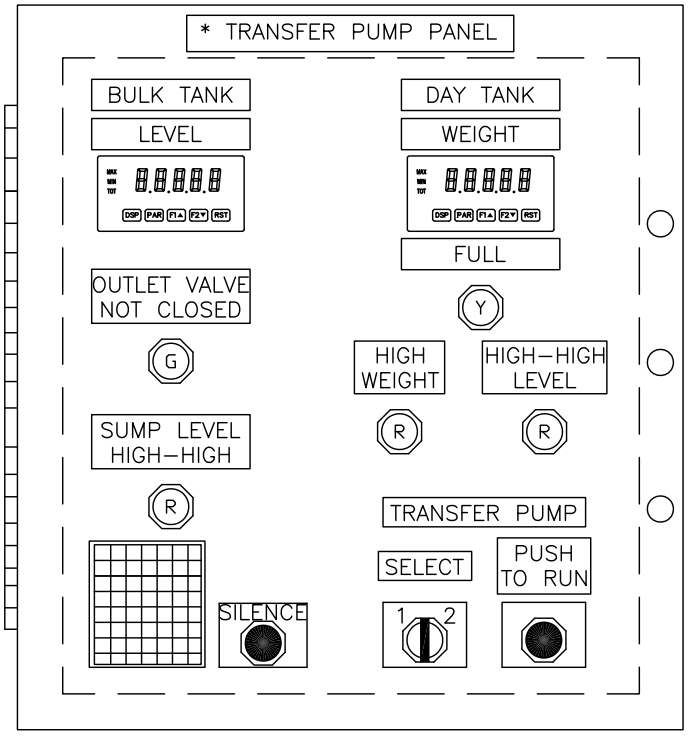
FILL STATION ALARM PANEL (FSAP) FRONT LAYOUT (HOFFMAN NEMA TYPE 4X FIBERGLASS CABINET WALL MOUNT)

REVISIONS	AMERICAN WATER STANDARD PROCESS FILL STATION ALARM PANEL (FSAP) DETAIL H5
	NEW JERSEY AMERICAN WATER
	AMERICAN WATER ENGINEERING 3906 CHURCH ROAD MT. LAUREL, NJ 08054 DRAWN BY D. JOBE PROJECT ENG'R APPROVED DATE 09-10-15 PROJECT IP USE DIMENSIONS ONLY SCALE NOT TO SCALE
	USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES — 0201-0601-SD83

FOR COMMENTS

02010601SD83

HOFFMAN NEMA TYPE 4X FIBERGLASS CABINET
SIZE: 24"X24"X12" (MINIMUM)



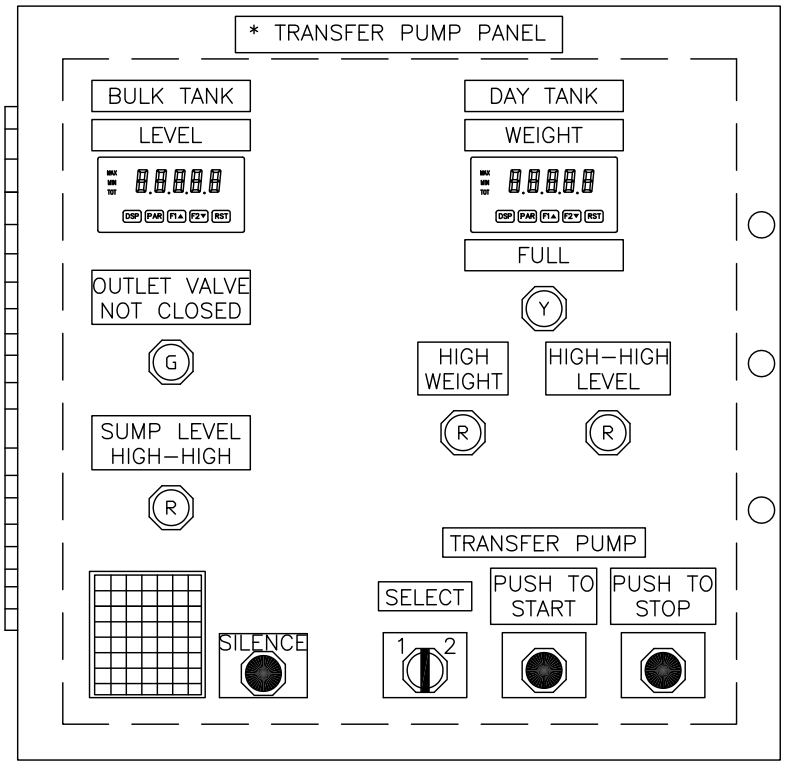
SMALL DAY TANK TRANSFER PUMP CONTROL PANEL

REVISIONS	AMERICAN WATER STANDARD PROCESS SMALL DAY TANK TRANSFER PUMP CONTROL PANEL – DETAIL H6
	NEW JERSEY AMERICAN WATER
	AMERICAN WATER ENGINEERING 3906 CHURCH ROAD MT. LAUREL, NJ 08054 DRAWN BY D. JOBE PROJECT ENG'R APPROVED DATE 09-10-15 PROJECT IP USE DIMENSIONS ONLY SCALE NOT TO SCALE
	USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES 0201-0601-SD84

FOR COMMENTS

02010601SD84

HOFFMAN NEMA TYPE 4X FIBERGLASS CABINET
SIZE: 24"X24"X12" (MINIMUM)



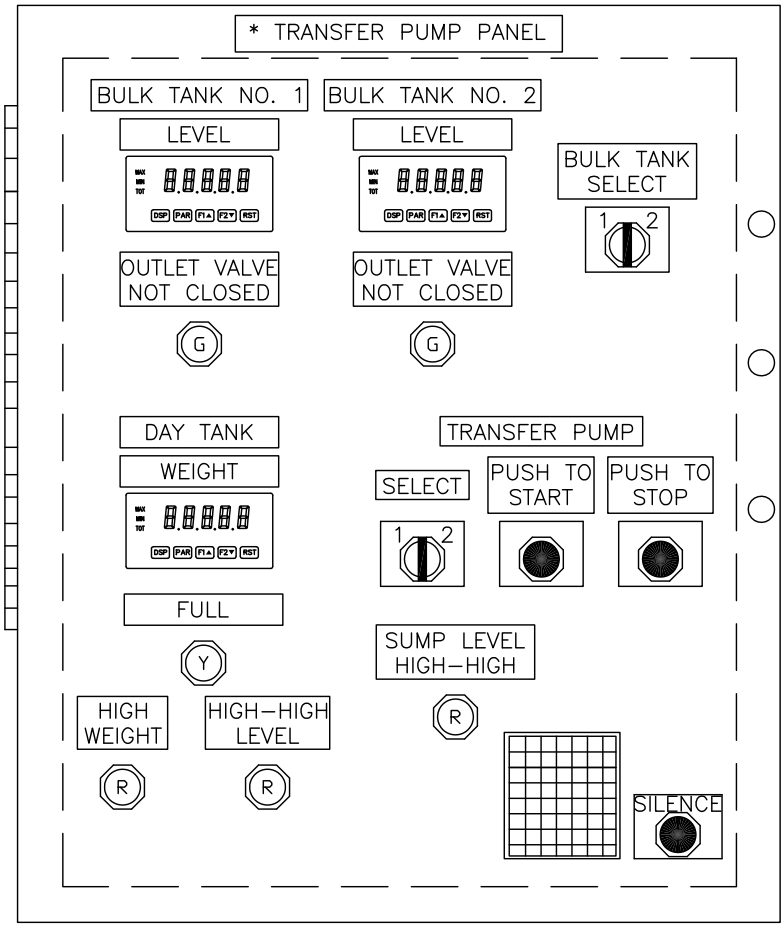
LARGE DAY TANK TRANSFER PUMP CONTROL PANEL

REVISIONS	AMERICAN WATER STANDARD PROCESS LARGE DAY TANK TRANSFER PUMP CONTROL PANEL – DETAIL H7
	NEW JERSEY AMERICAN WATER
	AMERICAN WATER ENGINEERING 3906 CHURCH ROAD MT. LAUREL, NJ 08054 DRAWN BY D. JOBE PROJECT ENG'R APPROVED DATE 09-10-15 PROJECT IP USE DIMENSIONS ONLY SCALE NOT TO SCALE
	USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES 0201-0601-SD85

FOR COMMENTS

02010601SD85

HOFFMAN NEMA TYPE 4X FIBERGLASS CABINET
SIZE: 36"X24"X12" (MINIMUM)



LARGE DAY TANK TRANSFER PUMP CONTROL PANEL

REVISIONS	AMERICAN WATER STANDARD PROCESS LARGE DAY TANK TRANSFER PUMP CONTROL PANEL – DETAIL H8
	NEW JERSEY AMERICAN WATER
	AMERICAN WATER ENGINEERING 3906 CHURCH ROAD MT. LAUREL, NJ 08054 DRAWN BY D. JOBE PROJECT ENG'R APPROVED DATE 09-10-15 PROJECT IP NEW JERSEY AMERICAN WATER USE DIMENSIONS ONLY SCALE NOT TO SCALE
	USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES 0201-0601-SD86

FOR COMMENTS

02010601SD86

Appendix I

Miscellaneous Information

I-1. Hand Vacuum Pump to Test Backpressure Valves

Figure I-1.
Hand Vacuum Pump

Example of pump that can be used to periodically test performance of series backpressure valves and vacuum breakers.

DESIGN CONCEPT

APPENDIX D

EXISTING FACILITY DRAWINGS

SHERIDAN —— INDIANA WATERWORKS IMPROVEMENTS

OWNER

HOOSIER WATER CO, INC.

INDIANAPOLIS, IND.

INDEX

J.B. WILSON & ASSOCIATES
CONSULTING ENGINEERS
INDIANAPOLIS, INDIANA

MAY
1963

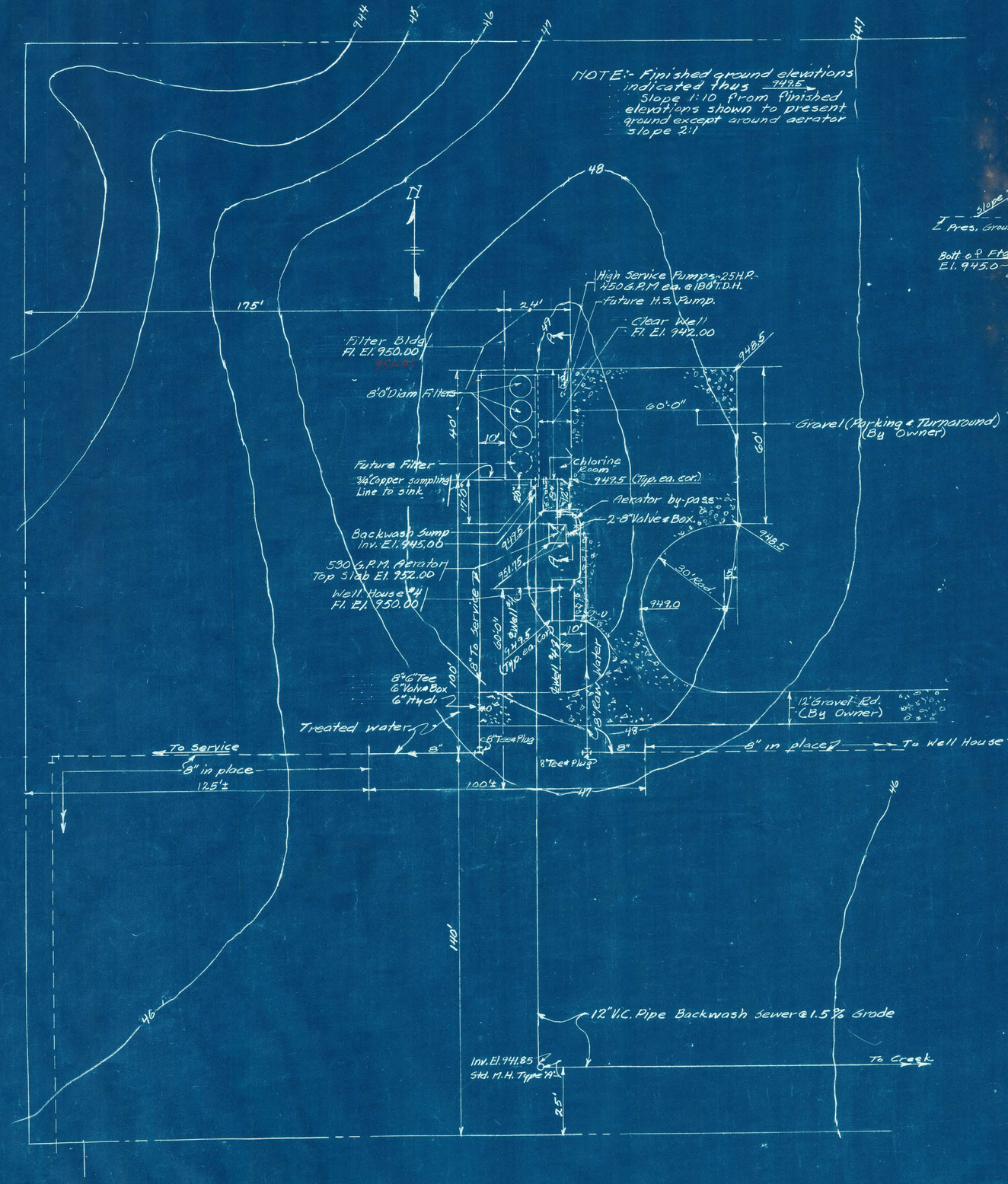
COMMISSION _____

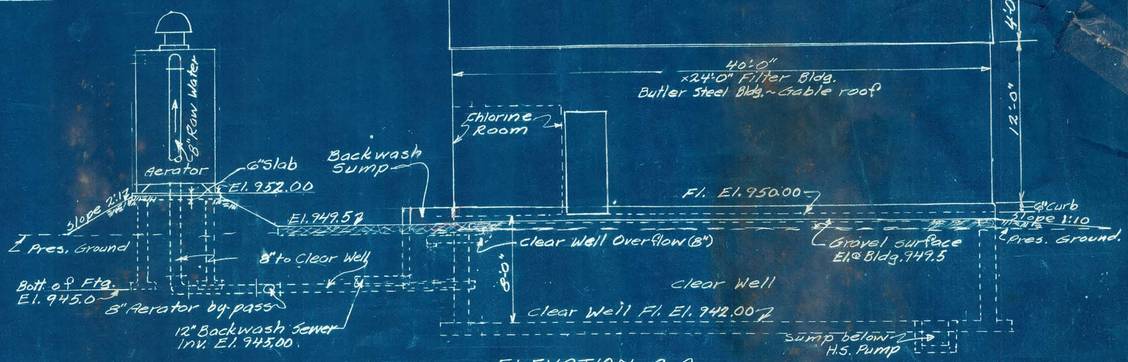
CERTIFIED BY:
J Burlison
REGISTERED PROFESSIONAL ENGINEER, STATE OF INDIANA NO.

SET NO. 1 FILE

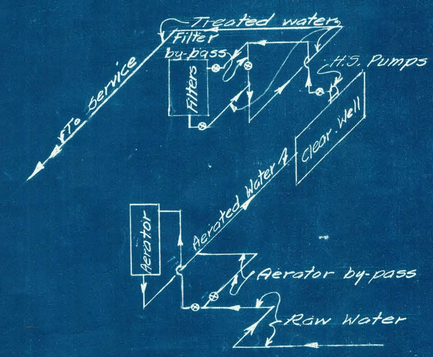

COUNTY ROAD
LEGEND
(A) Filter Bldg. & Clear Well ~ Floor elev's 950.00 & 942.00 respectively
(B) Aerator ~ Top of slab elev. 952.00
(C) Backwash sump ~ Sewer inv. elev. 945.00
*(T) 8" Main ~ Treated water to service
*(R) 8 Main ~ Raw water from Wells to plant
Solid line ~ Proposed
Dashed line ~ In place
(W4) Well House. No. 4 ~ Floor El. 950.00
(W5) Well House No. 5 ~ Floor El. 939.00
* Exception ~ Well House discharge lines (See Well Hse. details)
GRAVEL PIT
Water 917.0
GRAVEL PIT DRIVE
Old Fence
Well No. 5
Well G.I.E. (1" Pilot Point)
WELL #4
WELL #5
Power Pole
12' Gravel Dr. (By Owner)
12" V.C. Pipe Backwash Sewer @ 1.5% Grade
Std. M.H. ~ Type "A" (Typ. for 12" Sewer)
Inv. 941.85
Inv. 935.10
Inv. 928.12
N.W. COR. NE 1/4 SEC. 32 TWP. 20 N. R. 3 E
S.W. COR. NE 1/4 SEC. 32 TWP. 20 N. R. 3 E
Easement #1
Easement #2
Easement #3
Easement #4
Fence
EAST STREET (or Hudson Street)
Wiles South Line
BM Red Cap Nail Elev. 948.82
Backwash Sump Top Wl. El. 950.5
Inv. El. 945.0
12" V.C. Pipe @ 1.5% Grade
Hdwl. (See detail) Sht. #2
Fl. 922.3
Geo. Symons Ditch
SCALE 1" = 50'
PROFILE OF BACKWASH SEWER
Scale: Hor. ~ 1" = 100'
Vert. ~ 1" = 10'
Headwall Inv. 923.62±
Geo Symons Drain
4-11-62 CCF Dimension 652.0 Corrected to 904.0
5-16-63 R.R.G. Backwash sewer, piping, road & bldgs. added.
DATE BY
SUBJECT
HOOSIER WATER CO., INC.
INDIANAPOLIS, INDIANA
SHERIDAN, INDIANA
WATERWORKS
DRAWN BY CCF DATE, Oct. 12. 61
TRACED BY
DATE
APPROVED BY
DATE
SCALE 1" = 50
SHEET #1 OF 11
PLOT PLAN & SEWER PROFILE
Surveyed and Platted by- Roy D. Horney- Land Surveyor Hamilton Co, Indiana
Draftsman C.C. French

NOTE:- Finished ground elevations indicated thus 749.5
Slope 1:10 from finished elevations shown to present ground except ground aerator slope 2:1

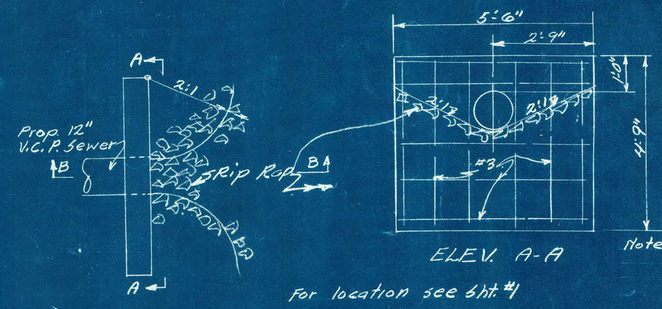




ELEVATION A-A
Scale:- 3/16" = 1'-0"



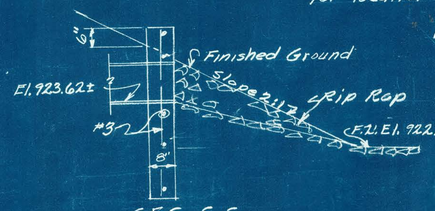
FLOW DIAGRAM
No scale



For location see Sht. #1

Note:- Rip rap to be furnished by owner and placed by contractor.

HEADWALL DETAILS
Scale:- 1/2" = 1'-0"



SEC. 5-5

DATE	BY	REVISION

DRAWN BY: R.R.G. DATE 5-16-63
TRACED BY: DATE
CHECKED BY: DATE

J.B. WILSON & ASSOCIATES
CONSULTING ENGINEERS
INDIANAPOLIS INDIANA

SCALE 1"=20' UNLESS NOTED
SHEET 2 OF 11
JOB NO. OR COMM. NO.

SHERIDAN, INDIANA
FILTER PLANT
HOOSIER WATER CO.

PLANT LAYOUT, GRADING & GENERAL DETAILS