August 19, 2022

Bryan Leamons, PE
Senior Operation Manager
Office of Water Quality
ARKANSAS ENERGY AND ENVIRONMENT
DIVISION OF ENVIRONMENTAL QUALITY
5301 Northshore Drive
North Little Rock, AR 72118-5328

RE: Paradise Valley Subdivision WWTP
NPDES Draft Permit: AR0053210; AFIN: 60-05010
Response to Comments

Dear Mr. Leamons:

This letter is in response to your letter dated July 14, 2022, and to questions that you asked during the site visit to observe the WWTP equipment.

1. The Nonmunicipal Domestic Sewage Treatment Works (NDSTW) Construction Cost Estimate has been revised to include replacement cost of the operation components and the assembly and commissioning of the treatment plant. The revised Construction Cost Estimate includes a new standby electric generator. The revised Construction Cost Estimate has increased from $100,000 to $245,000; therefore, Paradise Valley will agree to submit an additional $14,500 to the trust fund. See attached revised cost estimate for assembly and commissioning of the wastewater treatment plant.

   The NDSTW forms and attachments have been updated to reflect the revisions, see attachment 1.

2. The calculations title has been revised to Paradise Valley Subdivision, see attachment 2.

   The technical specifications have been revised per your comments. The sludge holding capacity is 7,500 gallons in the specifications and calculations, see attachments 2 and 3.

3. The grit chamber is part of the flow equalization chamber, and there is not separate specification for the grit chamber.

Bar screen solids will be removed manually (raked) and placed in a dumpster or plastic bags for disposal off-site. Grit will be removed by a septic tank pump truck and disposed of at a municipal treatment plant as part of sludge removal.

4. A revised, signed Disclosure Statement indicates the names of the commissioners listed in the Pulaski County Multipurpose Improvement District 2021-02, attachment 4.

5. Attached are the most current drawings and specifications.

6. The standby electric generator will be tested midday in the middle of the week, but the test time can be varied if the neighbors prefer a different schedule.

Please let me know if you have questions or need additional information.

Respectfully,

Wm. Doug Ford, PE
Principal

WDF:cfn
Enclosures
cc: Rick Ferguson, Paradise Valley

FERG-11791

**PARADISE VALLEY WWTP**
**ASSEMBLY AND COMMISSIONING**

Paradise Valley WWTP is already owned by Pulaski County Property Owners Multipurpose Improvement District No. 2021-2.

The structure of the WWTP is in good condition but will require assembly and some new components. Below is an estimate of the assembly cost and necessary components for commissioning and operation.

| | | | | |
|---|---|---|---|---|
| 1. | Assembly: | | | |
| | Welding Structure - labor and materials | | | $25,800 |
| | Electrical - labor and materials | | | $22,500 |
| | Piping - labor and materials | | | $33,000 |
| | | | **SUBTOTAL:** | **$81,300** |
| 2. | Operation Component Replacement: | | | |
| | Blower | 1 @ | $8,500.00 = | $8,500 |
| | Mudwell & Clearwell Backwash Pumps | 2 @ | $3,500.00 = | $7,000 |
| | Aerators | 8 @ | $300.00 = | $2,400 |
| | Flow Equalization Pumps | 2 @ | $4,800.00 = | $9,600 |
| | Secondary Treatment Blower | 1 @ | $8,500.00 = | $8,500 |
| | Anoxic Mixer | 1 @ | $2,500.00 = | $2,500 |
| | Tertiary Blower | 1 @ | $8,500.00 = | $8,500 |
| | Electric Panel Components | 1 @ | $1,200.00 = | $1,200 |
| | | | **SUBTOTAL:** | **$48,200** |
| 3. | Standby Generator: | | | $40,800 |
| 4. | Miscellaneous Construction: | | | $25,700 |
| | | | **TOTAL:** | **$196,000** |
| | Contingency - 25% | | | $49,000 |
| | | | **TOTAL:** | **$245,000** |

# ATTACHMENT 1

# NDSTW Forms and Attachments

# Nonmunicipal Domestic Sewage Treatment Works Trust Fund Certification Form

Permittee (Legal) Name: Pulaski County Property Owners Multipurpose Improvement District 2021-02
Facility Name: Paradise Valley Subdivision
Permit No. AR0053210

***Section A – Information Requiring Engineering Certification***

## Part I – Operating and Maintenance Expenses

| | Units/Year | Unit Cost | Annual Cost | 5-Year Cost[1] |
|---|---|---|---|---|
| **Operating Expenses** | | | | |
| Operating Labor[2] | 12 | $1,400 | $16,800 | $89,040 |
| Electricity[3] | 12 | 400 | 4,800 | 25,440 |
| Supplies & Chemicals | 12 | 1,400 | 16,800 | 89,040 |
| Analytical Testing | 12 | 250 | 3,000 | 15,900 |
| Generator Fuel | 12 | 20 | 240 | 1,272 |
| Other | 12 | 50 | 600 | 3,180 |
| **Maintenance Expenses** | | | | |
| Maintenance Labor[2] | 12 | 500 | 6,000 | 31,800 |
| Parts & Supplies | 12 | 200 | 2,400 | 12,720 |
| Other | 12 | 50 | 600 | 3,180 |
| **Administrative Expenses** | | | | |
| Administrative Labor[2] | 12 | 200 | 2,400 | 12,720 |
| Customer Fee Collection | 12 | 750 | 9,000 | 47,700 |
| Insurance & Bonding | 12 | 300 | 3,600 | 19,080 |
| Consulting and Legal Fees | 12 | 100 | 1,200 | 6,360 |
| Interest Expenses | N/A | N/A | N/A | N/A |
| Property Taxes | 1 | 400 | 400 | 2,120 |
| Permit Fees | 1 | 200 | 200 | 1,060 |
| **Other Miscellaneous Expenses** | 12 | 50 | 600 | 3,180 |
| **TOTAL** | | | **$68,640** | **$363,792** |

[1] Assuming no inflation data are available, assume an inflation rate of 3% in years two through five and multiply the annual cost by 5.3 to estimate the five-year cost.

[2] Labor costs must include fringe benefits and payroll taxes.

[3] For existing facilities, include historical data if they are representative of future operations. For new facilities, show the electricity consumption calculations in kilowatt hours (kWh).

## Part II – Capital Expenditures

- The wastewater treatment plant (WWTP) must be examined by a Professional Engineer registered in the State of Arkansas to determine all necessary capital expenditures, system upgrades, or significant repairs which may be needed within the following five (5) years. ***A list of all of these items must be attached to this document.***
- A milestone schedule for completion of the capital expenditures, system upgrades, or significant repairs ***must be attached to this document***.

## Nonmunicipal Domestic Sewage Treatment Works Trust Fund Certification Form

### Part III – Financial Plan

A financial plan that demonstrates to the Department's satisfaction the permittee's ability to operate and maintain the WWTP for five (5) years must be prepared. This plan should also include a comprehensive connection summary listing the number of connections and types of connections based on Appendix B of the Arkansas Department of Health Rules and Regulations Pertaining to Onsite Wastewater Systems. The summary should include the number of existing connections and an estimated number of new connections for the next five (5) years. ***The financial plan must be attached to this document.***

### Part IV – Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Printed Name of AR Professional Engineer: William D. Ford

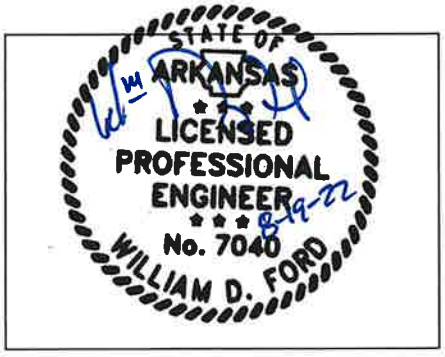
Registration License Number: 7040

Signature of AR Professional Engineer: W D Ford

Date: 8-19-22 Telephone Number: 501-221-7122

E-mail: dford@pmico.com Fax Number: 501-221-7775

Stamp of AR Professional Engineer



# Nonmunicipal Domestic Sewage Treatment Works Trust Fund Certification Form

***Section B – Service Area Information and Certification of Compliance***

**Part I – Legal Description**

A legal description of the service area ***must be attached to this document***. This requirement may be satisfied by providing a plat for the area served by the non-municipal domestic sewage treatment works.

**Part II – Potable Water Sources**

A list of the sources of the potable water for the service area ***must be attached to this document.***

**Part III – Certification of Compliance**

Has the permit applicant complied with all local zoning ordinances, local planning authority regulations, local permitting requirements, and any other applicable local regulations necessary for the construction and operation of this facility?

Yes ✓ No_____

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Printed Name of Permittee Responsible Official: Rick Ferguson

Signature of Permittee Responsible Official: _____

Date: 8-19-22 Telephone Number: 501-912-8800

E-mail: rickferguson777@gmail.com Fax Number: _____

## Paradise Valley WWTP Capital Expenditures and Schedule

Paradise Valley will replace most of the operation equipment during the assembly and commissioning of the plant. Paradise Valley does not expect to need replacement of equipment but has listed below capital expenses that may arise.

Paradise Valley WWTP anticipates that the items listed below can be expected to be replaced within the next five years.

| | Unit Cost | | Total Cost | Tentative Schedule |
|---|---|---|---|---|
| Clearwell backwash pumps | $3,500 | x 2 | $7,000 | 3–4 years |
| Electric panels—rehab | $2,000 | | $2,000 | 2–3 years |
| Aerators | $300 | X8 | $2,400 | 1 year |
| Blower | $8,500 | | $8,500 | 3–4 years |

Table 1 below provides a projected cost of major expenses and a projected schedule.

**Table 1**
**Paradise Valley WWTP**
**Permit #AR0053210**
**Projected Expenses 2022–2026**

| Expense | 2022 | 2023 | 2024 | 2025 | 2026 |
|---|---|---|---|---|---|
| Clearwell Pumps | | | $3,500 | | $3,500 |
| Electric Panel Rehab | $500 | $500 | $500 | $500 | |
| Aerators | $1,200 | $600 | $600 | | |
| Blowers | | | $8,500 | | |
| **SUBTOTAL:** | **$1,700** | **$1,100** | **$13,100** | **$500** | **$3,500** |
| Annual O&M Expenses | $68,640 | $70,699 | $72,820 | $75,005 | $77,255 |
| **TOTAL:** | **$70,340** | **$71,799** | **$85,920** | **$75,505** | **$80,755** |

## Paradise Valley Financial Plan

The Paradise Valley has a Special Improvement District (SID) that will collect fees for the operation and maintenance of the WWTP. Table 2 below indicates the financial plan for collection of revenue from the subdivision. Pulaski County Multipurpose Improvement District No. 2021-02

(Permittee) will subsidize the difference between the expenses and revenue until enough lots can be sold to exceed the expenses.

**Table 2**
**Paradise Valley WWTP**
**Permit #AR0053210**
**Projected Revenues 2022–2026**

| Revenue | 2022 | 2023 | 2024 | 2025 | 2026 |
|---|---|---|---|---|---|
| Paradise Valley SID | $35,040 | $63,480 | $92,640 | $121,440 | $150,240 |

## Paradise Valley Connection Summary

Paradise Valley has 73 lots platted in Phase I of the development and plans to add 60 lots per year for the next four years. Paradise Valley plans to sell all 73 lots in year 2022 and from market levels see no problem with selling 60 lots per year for the following four years. After selling 300 to 316 lots, Paradise Valley plans to add an additional WWTP for the development.

## Potable Water Source

Maumelle Water Corporation has agreed to provide water service to Paradise Valley Subdivision, see attached letter.

## Local Jurisdiction Approval

The Paradise Valley WWTP site is located on a separate parcel of land (approximately 30 acres) in Pulaski County. There is no zoning on this parcel of land and Pulaski County indicated the only County permits needed are a road bore permit for crossing Roland Cutoff Road and a floodplain development permit. Joe White, Joe White and Associates, is making application for both permits.

# ATTACHMENT 2

# Design Calculation Sheet

# DESIGN CALCULATION SHEET
# Wastewater Treatment System

50,000GPD Paradise Valley Subdivision
Roland, AR

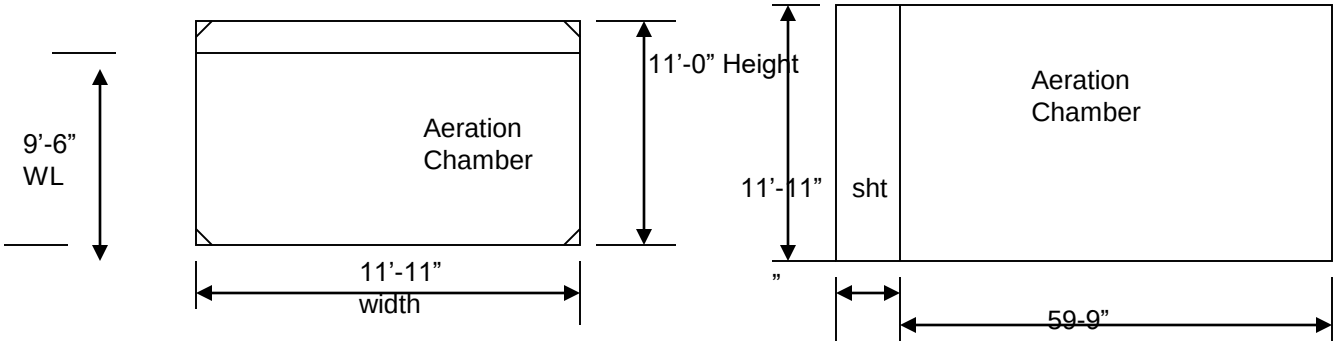
New Wastewater Treatment System

The wastewater treatment system consist of a 50,000 gallons per day extended aeration system complete with and extended aeration period of 24 hours because of the high strength of the BOD 5. The strength of the influent BOD 5 is based on a value of 250 PPM BOD5. The following is the design data for the new system:

Design Flow Rate = 50,000 Gallons Per Day
BOD 5 = 250 PPM
TSS = 250 PPM

AERATION CHAMBER DESIGN

Aeration chamber Volume = 24 hours retention
Required Volume = 50,000 GPD/ 24 hours x 24 hours = 50,000 Gallons

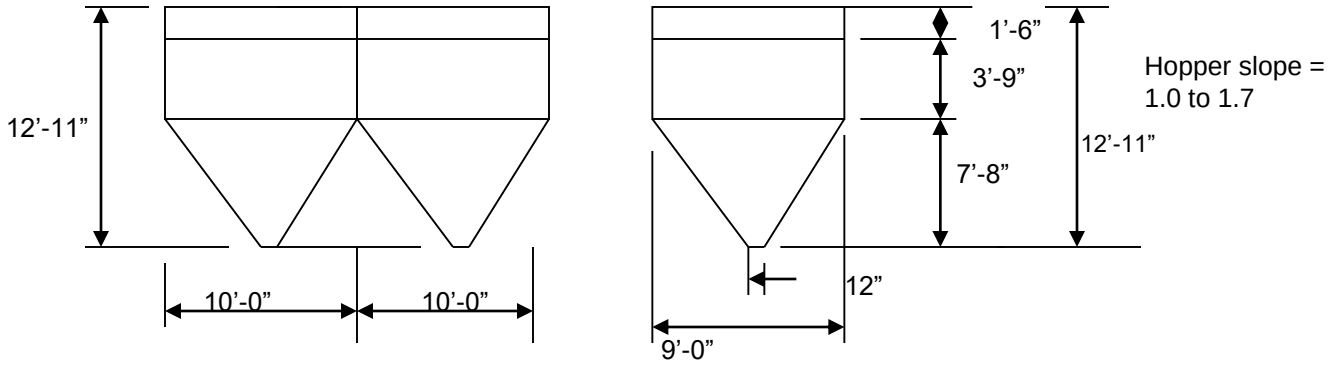



Cross section volume = 11.91' x 9.5 ' x 7.48 gallons per cubic foot = 846.32 gallons
Less Fillet Area = 1 ' x 1 ' x 7.48 gallons per foot = 7.48gallons
Gallons per foot of tank length = 838.84 gallons

Supplied Volume = Length of Tank = 59- 9" ' x 8838 = 50,070.5 gallons OK

CLARIFIER DESIGN

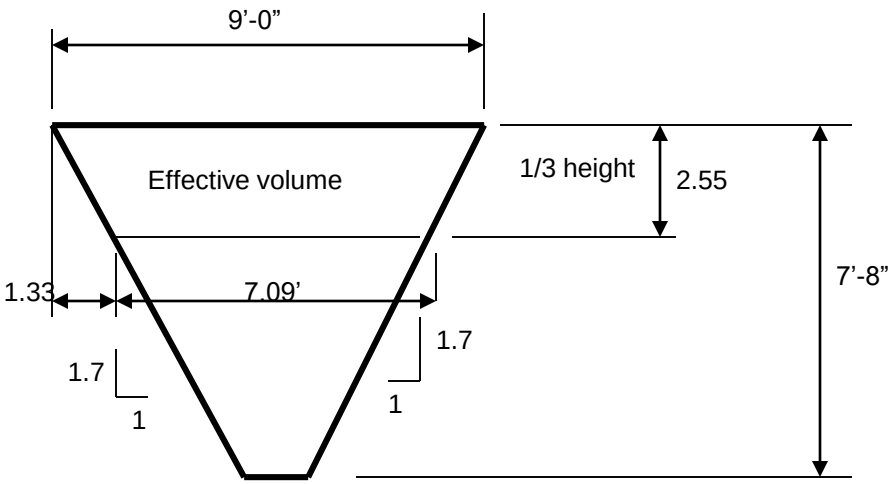
Clarifier Chamber Volume = 4 hours retention
Required Volume = 50,000 GPD/ 24 hours x 4 hours = 8,333 Gallons



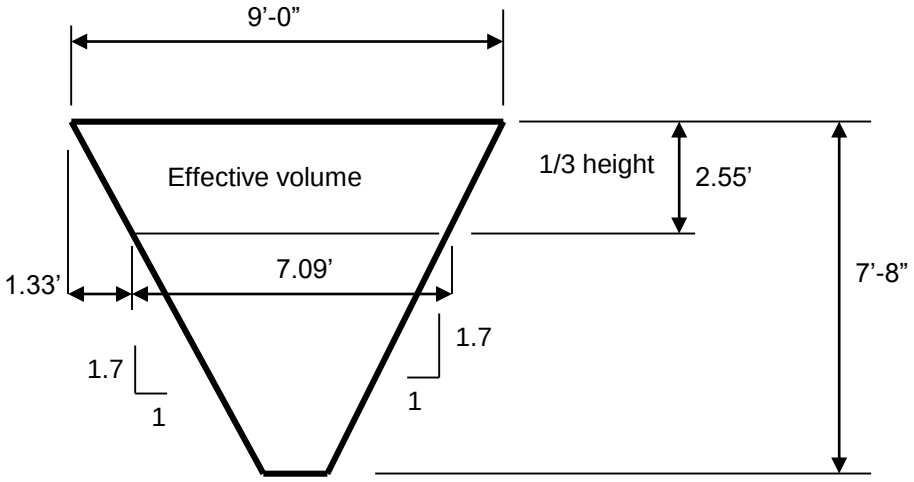
# DESIGN CALCULATION SHEET
# Wastewater Treatment System

50,000GPD Paradise Valley Subdivision
Roland, AR

Calculate the clarifier effective 1/3 clarifer hopper volume




SIDE VIEW




END VIEW

Volume of upper 1/3 clarifier chamber = $\frac{AA + BB + \sqrt{AA \times BB}}{3}$ X height =

$$= \frac{(9.0 \times 9.0) + (7.09 \times 7.09) + (9.0 \times 9.0) + (7.09 \times 7.09) \quad \sqrt{4072}}{3}$$

$\frac{81 + 50.26 + 63.8}{}$ x 2.55 / 3 = 195/ 3 = 65 cubic feet

or 65 cubic feet x 7.48 gallons per cubic feet = 486 gallons

Volume of upper 1/3 clarifier hopper = 486 gallons
For two hopper volume = 486 gallons x 2 = 972 gallons

# DESIGN CALCULATION SHEET
# Wastewater Treatment System

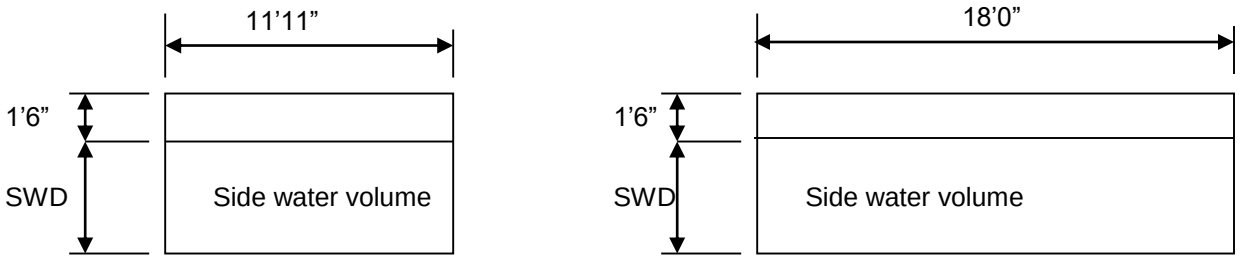
50,000GPD Paradise Valley Subdivision
Roland, AR

Calculate the clarifier side water volume required

Required clarifier volume = 50000 gallons / 24 hour x 4 hour retention
= 8,333 gallons

Volume of 1/3 hoppers volume of the two hoppers = 972 gallons

Side water volume required = 8,333 gallons - 972 gallons
= 7361 gallons required




Side View End View

SWD Volume = D' x 9.0' x 18.0' x 7.48 gallons per foot

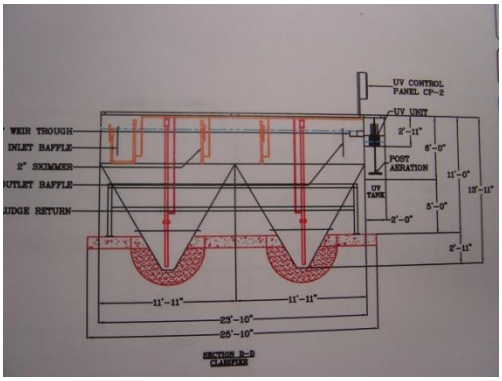
= 1211 gallons per foot
D = 4948 gallons/ 1211 gal per foot = 4.08 or 4 '-1"

Calculate the clarifier surface settling rate required

Surface area = 9'-0' x 18' = 162 square feet

Surface settling Rate = 50,000 GPD/ 162 square feet

= 308 gallons per day per square foot



# DESIGN CALCULATION SHEET
# Wastewater Treatment System

50,000GPD Paradise Valley Subdivision
Roland, AR

SECONDARY WASTEWATER TREATMENT

The objective of this SECONDARY wastewater treatment system is to remove a high % of BOD5 and TSS from the wastewater stream. Secondary wastewater treatment proposed to accomplished this is the TIPTON WWTS by utilizing a the extended aeration process a form of the activated sludge process, The extended aeration process combines biological and physical treatment methods with the objectives of oxidizing the BOD and solids, therefore removing the solids and stabilizing the organic matter contained in the raw sewage. In general, organic matter (typically measured as Biochemical Oxygen Demand and referred to as substrate or food), and nutrients in the raw sewage are utilized by microorganisms (e.g. bacteria) to grow and reproduce into a settleable cellular mass. The extended aeration process involves the removal of organic matter using suspended biological growth under aerobic conditions (accomplished in an aeration zone). The term "activated" refers to the microbial mass formed by the process, which serves to stabilize ( or consume) the waste.

The proposed wastewater treatment system shall be designed and manufactured at the Tipton Environmental International, Inc factory located in Batavia, Ohio and shipped to the project site for re-assembly and installation. Once the tank structure has been set into position and made water tight the blowers and controls are set as shown below.

# DESIGN CALCULATION SHEET
# Wastewater Treatment System

50,000GPD Paradise Valley Subdivision
Roland, AR

DESIGN STAGES

The reduction of total BOD by this system shall be in stages which are:

Primary Screening by the Coarse Bar Screen
Grit Removal
Flow Control
Aeration Zone
Clarifier Zone
Sludge Holding Zone
Post Aeration
Disinfection Zone Using UV

BIOLOGICAL PROCESS DESIGN

The following organic loading:

Determine pound of BOD5

Pound Of BOD5 = 50000 Gallon/day x 250 #/ 1,000,000 # x 8.33 #/ gallon
= pound of BOD55
= 104 pounds of BOD5

Volume Required= 1500 cubic feet per pound of BOD5
= 156,000 cubic feet

or
= 156,000cubic feet / 7.48 gallons per cubic feet
= 20855 gallons

Supplied = 50,000 gallons OK

Determine Air Required for BOD5

Air Required = 2500 scfm per pound of BOD5
= 2500 scfm x 104 # = 260000 scfm per day to oxide BOD5
Operating Continuously
or = 180 SCFM per minute

Determine Air Required for airlifts

Each airlift Requires 10 scfm
Five Airlift supplied = 10 scfm x 5 = 50 scfm

Total Air Required = 180 + 50 scfm = 230 SCFM

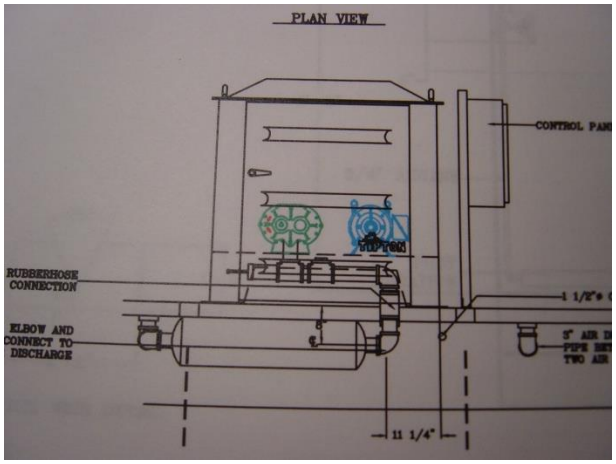
Supplied = 250 SCFM (each blower)

# DESIGN CALCULATION SHEET
# Wastewater Treatment System

50,000GPD Paradise Valley Subdivision
Roland, AR

AIR SUPPLY AND ELECTRICAL CONTROLS

For supplying the air to the extended aeration system dual blower motor units shall be supplied, each with the capacity of 250 SCFM @ 5 PSI. Each provided with a sound reduction enclosure. Time clock controls shall be provided.



SLUDGE HOLDING FACILITIES

For solids control, a sludge holding chamber shall be provided. The sludge holding chamber shall be of the aerated type. The volume of the sludge holding chamber shall be 7500 gallons. A supernatant shall be supplied to concentrate the solids in the chamber with the overflow back to the aeration chamber.

ELECTRICAL CONTROL CONSOLE

An electrical control console shall be provided to operate the dual blower units, the ultraviolet disinfection system and the flow meter. The main blowers shall be programmed by timers and shall operate by an alternator. The main power to the unit shall be 230 volt, three phase, 60 Hz.

# DESIGN CALCULATION SHEET
# Wastewater Treatment System

50,000GPD Paradise Valley Subdivision
Roland, AR

Tertiary Treatment System

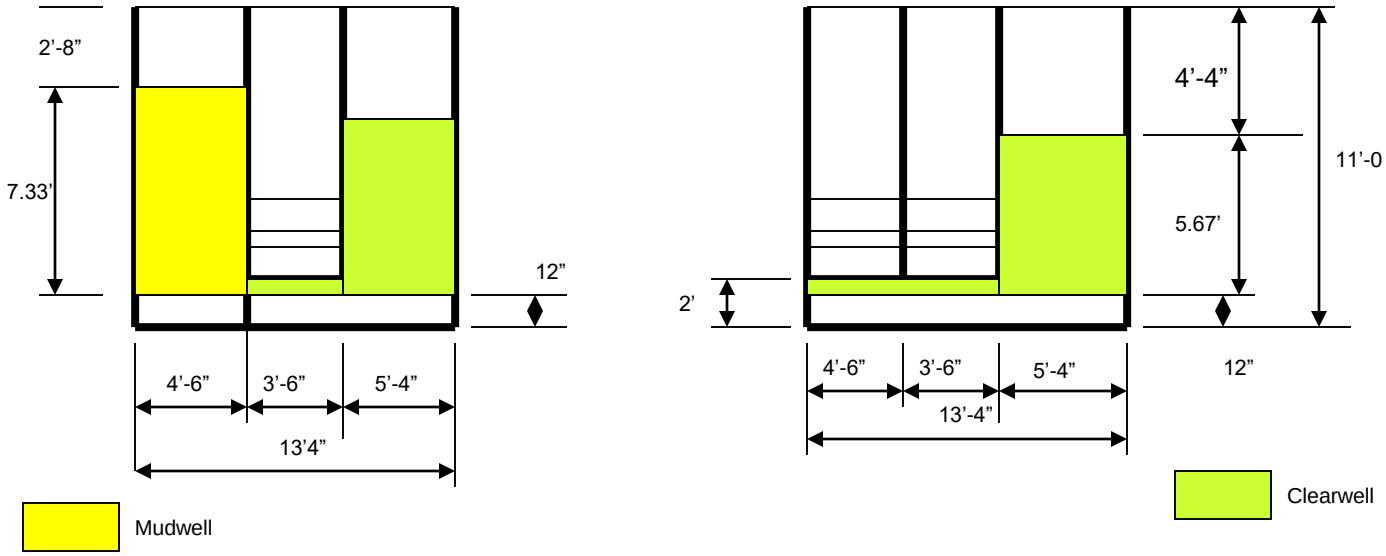
Design Flow = 50,000 gallons per day or 50000 gpd/ 1440 minute per day = 34.7 gallons per minute

The Tertiary Filter to have two cells with the capacity of passing the design flow rate of 1 gallon per minute for the two cells.

Area required = 34.7 gallons per minute / 2 cells = 17.35 gallon per minute per cell or

17.35 square feet per cell.

Supplied two cells equal to 4'-6 " wide x 4'-0" long or 18.0 square feet




Clear well Volume

Total Area = 13.33 x 5.67 ' x 7.0 ' = 529.07 cu ft

Less filter area = 7' x 4.5 ' x 4.67 = 147.10 cu ft

Volume of area less filter area = 529.07 - 147.1 = 381.97 cu ft or 381.97 x 7.48 = 2857 gallons

Required Volume = 15 gpm x 17.35 x 5 x 2 = 2602.5 gallons OK

Mudwell Volume

Total Area = 13.33 x 7.33 ' x 3.5 ' = 341.98 cu ft

Volume of area less filter area = 341.98 x 7.48 = 2558 gallons

Required Volume = 15 gpm x 13.125 x 5 x 2 x 1.1 = 2166 gallons OK

# ATTACHMENT 3

# TEII Systems Specifications Sheet

**TIPTON ENVIRONMENTAL INTERNATIONAL, INC.**
**PACKAGED BIOLOGICAL WASTEWATER TREATMENT**
**SYSTEM EQUIPMENT SPECIFICATIONS**

**Wastewater Treatment System**
**Prefabricated Steel Construction**

## 1.0 GENERAL

1.1 The contractor shall furnish and install one package biological wastewater treatment system, complete and ready for operation in accordance with the plans and specifications stated herein. The treatment system shall include one (1) Model TEII500-FETC prefabricated steel Tipton Environmental International, Inc. using "ASCO2RT" Process, oxygen-controlled reactor system in conjunction with extended aeration process wastewater treatment system complete with secondary treatment as manufactured by Tipton Environmental International, Inc. Batavia, Ohio, U.S.A. The wastewater treatment system will have a total design flow of 50,000 gallons per day. The aeration chamber shall be over-sized for a volume of 50,000 gallons of volume complete with a dual hopper clarifier for an oversized settling area. The proposed equipment package shall include the necessary tank vessels, internal piping, valving, weirs, baffles and all items of equipment as listed below. The secondary treatment system shall be complete with a flow proportioning, flow equalization system, aeration chamber, dual hopper type clarifier, sludge holding tank. For the secondary treatment process. For tertiary treatment a dual cell rapid sand tertiary filter system shall be provided, complete with clearwell chamber, mudwell chamber, disinfection system complete with chlorination, contact tanks and all necessary tank vessels and component equipment necessary for efficient and proper plant operation.

1.2 The package system shall be factory prefabricated and assembled, so far as possible, taking into consideration shipping and erection limitations. Because of the total system length, the tankage shall be shipped to the project site in three major tanks pieces. In addition, all internal tank piping and wiring shall be supplied and ended at the appropriate joints whereas the field contractor shall reconnect. All vessel surfaces shall be factory painted as described below.

1.3 The basic equipment furnished by the manufacturer shall include, but not be limited to tanks vessels, those vessels being factory painted, all tank internal piping and valving, blower motor unit assemblies, service walkways, and electrical equipment including all internal system wiring and/or controls.

## 1.5 THE GENERAL CONTRACTORS FIELD SERVICES

The General Contractor shall perform the actual installation of the TEII wastewater water treatment system. The following is a brief description of the general contractor's responsibilities regarding the installation:

A. Provide a crane and other equipment for off-loading and setting of the wastewater treatment system, which come in several major sections and for setting it onto its foundation pad. Attach the anchoring facilities to be positioned in the foundation pad as defined by the contract drawings.

B. Once the system has been set into position, it shall be reconnected including field welding and or re-assembly the sections which has been disconnected for shipping such as the piping, valving, grating, handrails and wiring which may have been disconnected at the factory for shipping purposes.

C. The general contractor's electrical field crew shall install at the location shown on the drawings the electrical consoles such as; Model CP-1 (Main Control Panel), CP-2A & CP-2B (flow equalization control panels for blowers and surge pumps), CP-3 tertiary control panel. In addition, they shall run the electrical wiring and conduit to the appropriate ancillary components within the wastewater treatment structure.

D. All areas requiring touch up painting shall be painted by the Contractors field crew. The areas which will require field welding, shall be not painted, but shall have a taped area over the metal so that field welding can be performed without burning through the paint.

E. An adequate access road to the plant site shall be provided to enable the lowboy trucks into the project site and for off-loading.

F. The freight for shipping the unit from Manchester, Tennessee to the project site shall be provided by the equipment manufacture.

G Provide facilities and crane for off-loading and setting of the wastewater treatment system onto its concrete foundation pad. It is recommended that the crane size should be a minimum of 100 ton. Access into the site and exit from the site shall be the responsibility of the owner. A two-hour time window schedule to off load each tank has been included. It will be necessary to hold to this time schedule so that the owner is not charged detention time by the freight hauler.

H. All site utilities to the system shall be tied-in to the system. The electrical power requirements shall be provided at each power block of each control console. The main power to the wastewater treatment system shall be supplied through an electrical power meter, main disconnect, and disconnect for each of the sub-panels — CP-1, CP-2A & B, and CP-3. These disconnects shall be supplied by the owner's field electrical contractor. Each of the sub-panels shall be supplied with a power block to receive the electrical power from these disconnects. The power shall be 480 volts, 3 phase, 60 Hz. A total of four sub-panels, CP-1, CP-2A & CP-2B, CP-3. The necessary control voltage of 120 volt, 1 phase for the ancillary equipment shall be obtained through transformers.

I. The foundation pad for setting the system in to position within is to be furnished by the field contractor.

J. Finish grade and placement of gravel and concrete grout around the hopper caps of the clarifier.

K. Field welding the tank structure to a watertight structure shall be by the field contractor. The tank structure shall be shipped in three (3) major tank sections and field welded together per the contract drawings.

**2.0 SYSTEM DESIGN CRITERIA AND PARAMETERS**

2.1 The wastewater treatment system will have a total design flow of 50000 gallons per day of domestic wastewater. The aeration chamber shall be sized for a volume of 50,000 gallons of volume. The peak hourly flow rates shall be controlled by the flow equalization system to reduce and maintain the influent flow rate to the average daily flow rate:

2.2 Flow Equalization Criteria

A) Holding Volume = 7,500 gallons
B) Air line connection to main air header for emergency air supply
C) Air Supplied = One (1) blowers at 75 SCFM at 5 psi each
D) Dimensions = 11'-11"" wide x 11'-0" high x 9'-6" long
E) Airline connection to main air headed with shut off valve.
F) Invert location at side wall of chamber (Invert 1'-4"from top tank)
G) Sub merged bar screen

2.3 Aeration Chamber Criteria

A) Holding Volume = 50,000 gallons
B) Air Supplied = two (2) blowers at 250 SCFM @ 5 psi each
C) Dimensions = 11'-11" wide x 11'-0" high x 59'-9" long
D) Controlled by time clock

2.4 Sludge Holding Criteria

A) Holding Volume = 4,000 gallons
B) Air Supplied = from main blower units
C) Dimensions = 11'-11" wide x 11-0" high x 4'-10" long

2.6 Clarifier Criteria

A) Holding Volume = 8,833 gallons
B) Air Supplied = from main blower units
C) Dimensions = 9'-0" wide x 14-0" high x 18'-0" long

2.7 Tertiary Treatment Criteria

A) Rapid sand type with dual filter cells
B) Each Filter Cell Area = 17.35 square feet
C) Backwash Rate = 15 GPM per square feet = 260 GPM
D) Clear Well Volume = 2600 Gallons
E) Mudwell Volume = 2700 Gallons

2.8 Disinfection Criteria

A) Disinfection by tablet type chlorinator disinfection unit
B) Chlorine contact tank Volume = 30 minute detention = 1042 gallons

## 3.0 VESSEL TANK CONSTRUCTION

3.1 All tank vessels shall be fabricated of one-fourth inch structural grade steel plated; joined by arc welding with fillets of adequate section for the joint involved. All walls shall be continuous and watertight and shall be supported by structural reinforcing members where required. Fabrication and erection shall conform to the standard fabrication procedures of Tipton Environmental International, Inc in the manufacturing of this tankage and its ancillary equipment. All tankage will have reinforcing members as required. All other areas such as the floor, end walls, and internal bulkheads to be adequately reinforced.

3.2 All piping and valving shall be provided constructed of a minimum of schedule 40 steel pipe. The painting of this pipe and valving to be as defined in section below:

3.3 The package wastewater treatment system shall be transported to the project site on low boy truck in three major sections plus the hopper caps of the clarifier, which shall be shipped inside the aeration zone. The contractor shall be responsible for field assembly, including field welding and bolting where required.

## 4.0 PAINTING AND CORROSION CONTROL

4.1 All tank vessel surfaces to be painted shall be properly prepared in a workmanlike manner to obtain a smooth, clean, and dry surface. All rust, metals fragments, dust, weld slag, and mill scale as well as extraneous matter, and shall be removed by means of cleaning by general methods.

4.2 All interior tank vessel surfaces below the main box beam shall be painted with Tnemec 46-465 coal tar paint, or equal to a minimum total dry film thickness of 8-10 mils.

4.3 All exterior tank vessel surfaces including the box beam shall be painted with Tnemec 46-465 coal tar paint, or equal to a minimum total dry film thickness of 8 -10 mils.

4.4 All steel piping & valving shall be painted with Tnemec 46-465 coal tar paint, or equal to a minimum total dry film thickness of 8 - 10 mils.

## 5.0 FOUNDATION

5.1 A concrete foundation pad shall be constructed conforming to the project specifications for level and flatness as specified by the manufacturer on the foundation drawing. The clarifier hopper cap shall penetrate the foundation pad. The concrete contractor shall be responsible for placing these cutouts in the concrete pad. Once the tankages have been set into position the owner's contractor shall be responsible for placing the concrete grout into the cutouts in the foundation pad where the clarifier hopper cap penetrates the pad.

## EQUIPMENT SECTION

## FLOW EQUALIZATION EQUIPMENT SECTION

### DIVISION 6 - FLOW EQUALIZATION SYSTEM

6.1 To control the peak hourly flow rates of 7,500 gallons per day of domestic wastewater from homes in subdivision. A flow equalization system shall be provided at the influent end of the wastewater treatment system. The influent peak flow rates shall enter into the flow equalization system where it is held and aerated until the secondary treatment system is ready to process it. Once the influent has been received by the flow equalization chamber it shall be processed by dual flow equalization pumps, pumping it to the flow-proportioning chamber. This chamber shall be so designed that it will allow the average daily flow to be processed and pass through the chamber into the aeration chamber. To control the flow rate from the flow equalization pumps a series of a v-notch weir and a flat weir, which is adjustable, to be provided. The flow equalization control system shall be complete with bar screen, dual flow equalization pumps, liquid level control system, flow proportioning chamber, electrical controls, air blower, course air diffuser with air manifold.

Tipton Environmental International, Inc shall provide the following equipment for the flow equalization basin:

(A) One Flow Equalization Air Blower Unit, 75 SCFM @ 5 psi. The voltage shall be 480 volts, 3 phase, 60 Hz.
(B) One Flow Equalization Electrical Control Panel Model CP-2B for the surge pumps. The voltage shall be 480 volts, 3 phase, 60 Hz.
(C) One Flow Equalization Control Panel Model CP-2A for the surge blower unit. The voltage shall be 480 volts, 3 phase, 60 Hz.
(D) Four Liquid Level Sensors, narrow angle type controlling the surge pumps.
(D) One Liquid Level Sensor, wide angle type for controlling the surge blower.
(E) Three Course Air Diffusers with drop assemblies complete with air diffusers each with eight diffuser nozzles
(F) Two Flow equalization pumps P-1, P-2. The voltage 480 volts, 3 phase, 60 Hz.
(G) One7,500 gallon flow equalization tank
(H) One Bar screen mounted in the flow equalization chamber
(I) One Flow Proportioning Chamber

### 6.12 INLET CONNECTION

6.121 An influent connection to the wastewater system shall be provided. It shall consist of one 6" inlet entering into the flow equalization chamber. The influent shall be discharged into the bar screen.

### 6.13 Bar Screen

6.131 Bar screen shall be provided as shown on the contract drawings located in the flow equalization chamber. Its purpose is to remove any unusually large solids from the incoming crude sewage flow rate. The bar screen shall be fabricated from one-half inch diameter bars spaced one-inch apart and arranged as shown on the drawings. The bars shall be sloped to permit easy cleaning of accumulating debris. A large drying area shall be provided. In addition, a long handle rake shall be provided so that the plant operator can be used to remove the screenings from the bar screen.

6.14 **AIR SUPPLY FOR FLOW EQUALIZATION TANK**

6.141 For supplying the air requirements of the Flow Equalization System control system, one (1) Model BF-75-R33 Blower Motor Units shall be provided as shown on the drawings. The voltage shall be 480 volts, 3 phase, 60 Hz. The unit shall have the capacity of providing 100% of the air requirements for the system. The blower unit shall be installed at the location shown on the drawings. The unit shall be completely factory built and tested before shipping. The blower unit shall be installed within one Fiberglass Enclosure TEII-2 complete with fiberglass hood. The inlet filter silencer, pressure relief valve, pressure gauge, with only the blower discharge rubber hose connection being provided as a single line hook up for the blower. The necessary electrical connection from the blower to CP-2A shall be provided and pre-wired. The enclosure shall have ivory finish. The blower motor enclosure unit shall be mounted on four (4) vibration pad dampers tagged VP-1. This will help reduce blower vibration and noise transmission. The Blower system shall be equipped with one 2" blower discharge pipe with a 2" marine rubber hose with 2 stainless steel clamps.

6.142 The blower unit shall be supplied with each blower unit shall be a Model BF-75-R33- shall be furnished for supplying all the air requirements needed for the flow equalization Basin. The unit shall be capable of delivering 75 SCFM at an operating pressure of 4 psi.

6.143 The blower shall be of the positive displacement type and shall manufactured by Roots Division of Dresser Industries, Inc., Connersville, Indiana or approval equal. The Model number of the blower will be URAI-33 and equipped with a 2" discharge.

6.144 The motor shall be 3 Hp for operation on 480 volt, 3 Phase, 60 Cycle Service, and 1800 RPM. The motor shall be ODP type Model 182 T, E930 7.8 FLA. The wiring to this motor from the control panel shall be provided and installed by the field contractor.

6.145 For determining the blower performance, and/or diffuser condition, a pressure relief valve and pressure gauge. These items shall be pre-mounted and piped within the blower enclosure.

**6.15 ELECTRICAL CONTROL CONSOLE CP-2A & CP-2B**

An electrical control center, for the flow equalization system shall be the Model CP2A & CP-2B. Each of these control panels shall both be installed within a NEMA 4 electrical weatherproof enclosure complete with floor mounting facilities installation in the electrical control room as shown on the drawings. The voltage shall be 480 volts, 3 phase, 60 Hz. shall be supplied to each panel at the power block.

A step down transformer shall be supplied to step the electrical power down from 480 volt to 120-volt power for control voltages.

The electrical control center Model CP-2A shall control the operation of the following equipment:

A) Blower Motor Unit BM-3, 3 HP, the voltage shall be 480 volts, 3 phase, 60 Hz. ODP type Model 182 T, E930 7.8 FLA
B) Anoxic Mixer MX-1 2, hp, 480 volt, 3 phase, 60 Hz.
C) Liquid level sensors -1 level sensors wide angle

Flow Equalization Blower Motor Unit - The Flow Equalization blower unit operation shall be controlled by the wide-angle liquid level condition of the flow equalization basin. The blower shall turn on when the on liquid level sensor side is activated on when the water level reach the on level and de-activates when the water level is lowered to the off level.

The electrical control center Model CP-2B shall control the operation of the following equipment:

A) Flow Equalization Pump No. 1 P-1, 1 1/2 HP, The voltage shall be 480 volts, 3 phase, 60 Hz. 10 FLA
D) Flow Equalization Pump No. 2 P-2, 1 1/2 HP. The voltage shall be 480 volts, 3 phase, 60 Hz., 10 FLA
E) Liquid level sensors -4 level sensors narrow angle

Flow Equalization Tank Pumps Control - The Flow Equalization pumps shall operate on a duplex pump alternator operation I mode, where pump one will operate alternately with pump no 1 and 2 on cycles. The pump operation shall be controlled by four (4) encapsulated mercury float Switches (narrow angle) each individually adjustable for the following:

A) All Pumps off
B) Lead Pump on
C) Lag Pump on
D) High Level Alarm

The Flow Equalization pumps shall operate on a lead-lag with the two pumps alternating. If the liquid level reaches lag pump on level, both pumps shall operate. If the liquid level reaches the high water level, the alarm will be activated.

All wiring, terminal blocks, supports and accessories required for the operations of the control panel shall be provided in compliance with the National Electric Code.

D1.3 Flow Equalization Pumps Tagged P-1, P-2, The voltage shall be 480 volts, 3 phase, 60 Hz. The Flow Equalization pumps shall be of the Goulds submersible type. Each pump shall be a 3888D3 Model WS1534D3 as manufactured by Goulds Pump Company. The pump shall have a capacity of 25 GPM @ 15 feet of TDH. The pump shall have a 1 1/2 horsepower motor which will operate on 480 volt, 3 phase, 60 Hz. 10 FLA. Each Flow Equalization pump shall be supplied with a 3-inch discharge.

For easy removal of the flow equalization pumps, a hoist shall be provided adjacent to the pump location.

## 7.0 AERATION CHAMBER

7.1 There shall be supplied, an aeration chamber to work in conjunction with the clarifier chambers. The aeration chamber shall conform to the following specifications:

7.2 The aeration chamber shall be of sufficient capacity to provide a total volume of the chamber of 50,000 gallons. The vessel shall be so shaped on each side to prevent sludge accumulation, to enhance the rotation of the vessel contents, and to scum and froth accumulation. To insure maximum retention and eliminate short circuiting of minuscule sewage particles, the aeration chamber shall be constructed with air diffusers, placed longitudinally along one side of the chamber so as to, in conjunction with flow control baffles, enhance the spiral rotation of the chamber contents. To ensure adequate circulation velocity, the proportion of the chamber width to depth, in the direction of rotation, shall not exceed 1.33 to 1. The velocity of rotation shall be sufficient to scour the bottom and prevent sludge filleting as well as to prevent the escape to the surface of minuscule air diffusion bubbles and by so causing their entrapment to provide maximum oxygenation efficiency.

7.3 An air distribution manifold shall be installed longitudinally on one side of the tank with diffuser drop assemblies 'connected thereto. This manifold shall be designed to create a bank of air to supply the air needs of the system, and other ancillary equipment such as the air diffusers, airlift pumps, and scum skimmer to draw from this bank of air.

7.4 Each diffuser drop assembly shall be equipped with an air regulating and/or shutoff valve, a disconnecting union and a diffuser bar with non-clog air diffuser nozzles mounted on the tee bar. The airflow per diffuser shall range from 1 to 5 CFM. This minimum air velocity shall be maintained to insure sufficient velocity for self-cleaning. The diffusers shall be parallel to and near the base of the vessel sidewall and at an elevation, which will provide the optimum diffusion and mixing of the vessel contents. The oxygen transfer capacity of each diffuser shall be such that an adequate supply of oxygen will be maintained in the aeration chamber to meet treatment requirements of the design sewage load. The air diffuser shall be on the air check diaphragm type constructed with a diaphragm mounted on top of the diffuser body. The diffuser body consists of twenty, 3/16" diameter air discharge holes evenly distributed around the diffuser disk. The diffuser will be supplied with standard male pipe thread connections.

**8.0 Clarifier Chamber**

8.1 There shall be furnished a dual hopper type clarifier chamber to work in conjunction with the aeration chamber of the system. The clarifier chamber shall be of the following dimension:

10'-0" Wide x 20'-0 Long x 11'-7" High
The water level from top of tank to water level = 18"
The clarifier hopper slope to be on a 1 to 1.7 slope

8.2 The clarifier chamber shall be of such size as to provide a minimum of four (4) hours retention, equal to 8,833 gallons, based upon the same design flow rate governing the aeration chamber (50,000 GPD), and shall have proper baffling to prevent short circuiting and to provide maximum uniform solids settling area. The clarifier shall be of the two-hopper clarifier type. Settled sludge shall be returned from the clarifier hopper cap floor (sludge well) to the aeration chamber by two positive displacement sludge return systems, consisting of an airlift pump type.

8.3 The inlet of the clarifier chamber shall be provided with an influent baffle. Its purpose is to slow the velocity of the flow from the aeration chamber to start the settling process. It shall prevent the floatables from entering the clarifier settling area. A skimmer assembly shall be provided in this zone to remove the floatables and return them back to the aeration zone for additional processing.

8.4 The clarifier effluent shall pass over the edge of the baffled adjustable effluent weir plate into the effluent trough and then, out the chamber into the tertiary filter system. The weir plate will be constructed of 1/8" galvanized steel and will be gasketed with 1/8" x 1" neoprene strips.

**9.0 Airlift Sludge Recirculation System**

9.1 Installed within the clarifier chamber for returning the settled sludge consisting of two positive sludge re-circulation pump systems. Each clarifier hopper shall be equipped with one, 4" diameter airlift sludge return assembly, meeting the following specifications: The airlift pump system shall have the re-circulation capacity ranging from 0% to 150% of the design flow. The airline supplying air to the pump shall be equipped with an air control valve, which shall vary the capacity of the pump. The airlift pump shall be firmly supported and shall be equipped with a clean-out plug to allow for easy cleaning and maintenance.

**10.0 Airlift Scum Recirculation System**

Installed within the clarifier chamber for controlling and returning to floatables and scum, is a positive scum and skimming re-circulation system. The clarifier shall be equipped with three, 2" diameter airlift skimming device meeting the following specifications: The skimming device shall be of the positive airlift pump type, located in a position to skim and return floating material to the aeration chamber. The air line supplying air to the skimming device shall be equipped with a needle valve to regulate the rate of return. The scum intake shall be equipped with an adjustable assembly, which will enable exact positioning of the skimmer at water level without

placing a hand under the water. The discharge port shall be sloped to enable the operator to determine the flow rate.

**11.0 Air Supply System Secondary Treatment System**

11.1 For supplying the air requirements of the secondary wastewater treatment system, are two (2), model TEII-250-R47. Each unit shall have the capacity of providing 100% of the air requirements for the system. The two blower units shall be installed within one sound enclosure at the location shown on the drawings. Each blower unit shall be completely factory built and tested before shipping. The blower speed and horsepower has been corrected for this elevation levels at the project site. The main blower units shall be installed within a fiberglass Blower housing TEII-2SN Sound enclosure completes with base and enclosure. The discharge piping of the blowers shall be positioned both within the enclosure and exterior of the enclosure. To help reduce the vibration and the noise being created by the air discharge. The check valve shall all be located at the discharge of the blower. Each blower shall discharge into the air plantum with a discharge rubber hose connection being provide for each blower. The necessary electrical connection from the blower to CP-1 for unit. The enclosure shall have ivory finish. The blower motor enclosure unit shall be mounted on four (4) vibration pad dampers tagged VP-1. This will help reduce blower vibration and noise transmission. The Fiberglass housing shall be equipped with a blower discharge pipe with a marine rubber hose with 2 stainless steel clamps. Each unit shall be completely factory built and tested before shipping.

11.2 The blower motor units Model URAI-47 J shall be furnished for supplying all the air requirements needed for the wastewater treatment system. The units shall be capable of delivering 250 SCFM at an operating pressure of 5 psi.

11.3 The blower shall be of the positive displacement type and shall be manufactured by Roots Division of Dresser Industries, Inc., Connersville, Indiana or equal Sutorbilt Blower Division Company, Compton, California; or approved equal. The model number of the blower will be URAI-47 J.

11.4 The motor shall be 10 HP for operation on 480 Volt, 3 Phase, 60 Cycle Service, and 1800 RPM. The motor shall be explosion proof rated for ODP. The wiring to this motor from the control panel shall be provided and installed by the field contractor.

11.5 For determining the blower performance, and/or diffuser condition, a pressure relief valve and pressure gauge. These items shall be premounted and piped at the air plantum.

**12.0 SECONDARY TREATMENT BLOWER ELECTRICAL CONTROL CONSOLE CP-1**

12.1 An electrical control center, Model CP-1, shall be installed within a NEMA 4 steel weatherproof enclosure complete with legs installation in the electrical control room as shown on the drawings.

A step down transformer shall be supplied to step the electrical power down fro 480 volt to 110-volt control voltage.

The electrical control center shall control the operation of the following equipment:

A) Blower Motor Unit BM-1, 10 HP. The voltage shall be 480 volts, 3 phase, 60 Hz., ODP, 215 T frame , U 765, 25.6 FLA
B) Blower Motor Unit BM-2, 10 HP. The voltage shall be 480 volts, 3 phase, 60 Hz., ODP, 215 T frame , U 765, 25.6 FLA

12.2 The electrical control center shall control the operation of all the auxiliary component equipment requiring electrical power. The blower motor unit operation time will be intermittent and as controlled by the blower timer. The plant operator shall control the operation time. The necessary selector switches shall be provided to allow either automatic or manual operation of the auxiliary equipment.

12.3 The enclosure shall be equal to a NEMA type 4. The electrical controls shall consist of IEC starters, timers, and selector switches necessary. Properly sized circuit breakers or fuses shall protect all electrical equipment and circuitry.

12.4 All wire and conduit required between the control panel and the electrical power service should be furnished by and installed by the field controller. The main power supply shall be 480 Volt, 3 Phase, 60 Cycle. Power to the control panel shall be 110 volt, 1 phase. A power block in the control panel shall be supplied for the electrical connection.

12.5 The control console shall be a Model CP-1 and shall be completely factory assembled and tested prior to shipment.

12.6 Controls shall be mounted to a removable sub-panel within the enclosure and shall be wired and spaced in accordance with the latest National Electric Code.

12.7 Blower Operation Controls Method: Each blower for the aeration chamber shall be able to be controlled by the program timer. A selector switch within the control panel shall be used to select the program for automatic operation. The two main blowers for the secondary treatment system shall be controlled by two 24-hour, 7-day time clock and an alternator and shall be capable of being programmed to control the blower run cycle and to adjust both the start set point every 15 minutes on the 24 hour cycle. The clock shall be by Paragon, Model #1015. A selector switch shall be provided with hand off auto for operation selection.

## 13.0 SERVICE WALKWAY

13.1 A service walkway shall be provided for service area only to service the plant equipment. Grating panels shall consist of one-piece skid resistant steel plate. All grating panels shall be constructed of 18 gauge, galvanized sheet steel with maximum yield strength of 37,000 psi. Each grating panel has a standard 9-inch surface width, and a 2 1/2-inch rib depth. Furthermore, each panel shall be so supported as to have a safe uniform load carrying capacity of 50 pounds per square foot.

13.2 A service handrail shall be provided around the perimeter of the service walkway system. The handrail system shall consist of a top rail 1 W aluminum pipe with a center cable guard.

## 14.0 SLUDGE HOLDING CHAMBER

14.1 There shall be supplied an aerated sludge holding chamber to work in conjunction with the aeration chamber and clarifier chamber. The aerated sludge holding chamber shall be an integral section of the main system and shall be common to each of the clarifier chambers and shall conform to the following specifications:

14.2 The sludge holding chamber shall be of sufficient capacity to provide a total volume minimum chamber volume of 4000 gallons. The vessel shall be so shaped on each side to prevent sludge accumulation, to enhance the rotation of the vessel contents, and to scum. To insure maximum retention and eliminate short circuiting of minuscule sewage particles, the aeration chamber shall be constructed with air diffusers, placed longitudinally along one side of the chamber so as to, in conjunction with flow control baffles, enhance the spiral rotation of the chamber contents. To ensure adequate circulation velocity, the proportion of the chamber width to depth, in the direction of rotation, shall not exceed 1.33 to 1. The velocity of rotation shall be sufficient to scour the bottom and prevent sludge filleting as well as to prevent the escape to the surface of minuscule air diffusion bubbles and by so causing their entrapment to provide maximum oxygenation efficiency.

14.3 An air distribution manifold shall be installed longitudinally on one side of the tank with diffuser drop assemblies connected thereto. This manifold shall be designed to create a bank of air to supply the air needs of the system, and other ancillary equipment such as the air diffusers, airlift pumps, and scum skimmer to draw from this bank of air.

14.4 Each diffuser drop assembly shall be equipped with an air regulating and/or shutoff valve, a disconnecting union and a diffuser bar with non-clog air diffuser nozzles mounted on the tee bar. The airflow per diffuser shall range from 1 to 5 CFM. This minimum air velocity shall be maintained to insure sufficient velocity for self-cleaning. The diffusers shall be parallel to and near the base of the vessel sidewall and at an elevation, which will provide the optimum diffusion and mixing of the vessel contents. The oxygen transfer capacity of each diffuser shall be such that an adequate supply of oxygen will be maintained in the aeration chamber to meet treatment requirements of the design sewage load. The air diffuser shall be on the air check diaphragm type constructed with a diaphragm mounted on top of the diffuser body. The diffuser body consists of twenty, 3/16" diameter air discharge holes evenly distributed around the diffuser disc. The diffuser will be supplied with standard male pipe thread connections.

14.5 The flows into the sludge holding tank shall be direct from the sludge return pump. The necessary piping and valving shall be supplied to allow the flow to occur manually at the plant operators' requirements.

14.6 The supernatant shall be returned to the flow equalization chamber for re-processing and treatment.

## TERTIARY FILTER SYSTEM

### 15.0 General

15.1 The contractor shall furnish and install one prefabricated steel tertiary filter of the wastewater treatment system, a tertiary filter system. It shall be complete and ready for operation in accordance with the plans and specifications stated herein and furnished and as an integral section of the secondary treatment system. The tertiary treatment system shall be a TEII Model TF-500-C prefabricated steel package unit as manufactured by Tipton Environmental International, Inc. This section of the wastewater treatment system is of the tertiary treatment type, specifically known as rapid sand filter, designed for treating a total of 50,000 gallons per day of 30 PPM-BOD5 domestic sewage based on composite sewage samples of the average daily flow. The complete system includes all necessary equipment for efficient plant operation.

15.2 The tertiary filter will be factory assembled, so far as possible, with piping, valving and controls. All surfaces shall be factory painted.

### 16.0 PROCESS AND OPERATING INSTRUCTIONS

16.1 Influent Characteristics:

The system is capable of treating 50,000 gallons per day of secondary treat domestic sewage, having an organic strength of 30 PPM 5 day BOD, and 30 PPM suspended solids. The tertiary system is subject to the performance of the secondary treatment system. No substances will be introduced in quantities, which are toxic to biological organisms.

### 17.0 INLET CONNECTION

17.1 The influent connection to the tertiary filter system shall consist of a flow trough, receiving flow from the clarifier effluent trough with connections to the feed trough of the filter. In addition, the feed trough shall be equipped with a tertiary by-pass. The filter cells shall be feed to each cell by a splash plate and shut off valve. This connection shall be from the port trough to the tertiary feed trough as shown on the detail drawings. The by-pass shall consist of a pipe plug within the tertiary feed trough.

### 18.0 Filtrate Holding Chamber

18.1 Two (2) filtrate holding chambers, each located above the filter media shall be of sufficient capacity and surface area to entrap and hold floating, suspended and Settable solids until such time these solids are returned to the wastewater treatment system during filter media backwash by means of the mudwell and return pumps. The volume of each chamber shall not be less than 100 gallons. Each chamber

shall have a minimum water depth of 24 inches above filter media to prevent freezing of filter media.

18.2 Means shall be provided in each chamber for manual dumping of the suspended solids into the mudwell. An access and inspection plate shall be provided in the sidewall filtrate holding chamber to allow inspection and maintenance of the filter bed.

**19.0 Filter Cells**

19.1 There shall be furnished two (2) filter cells for filtering the flow of the Tertiary Filter System. Each cell shall have not less than 17.36 square feet of filter surface area based on 1 GPM / sq. ft. for each cell. The filter cells shall be located at the bottom of the filtrate holding chamber. Filtrate shall percolate through the filter bed and filter nozzles to the false bottom. The filter nozzles shall be equipped with an air tail pipe. The filter nozzles shall be of the type, which is equipped with an expansion ring, which will allow the nozzle to be installed in the underdrain plate easily. From the false bottom, filtered water shall flow to the clear well chamber. Each filter shall be accessible for inspection and maintenance of the filter media. The filter media shall be shown on the plans and as herein after specified.

**20.0 Filter Media**

20.1 Filter media shall be furnished in sealed bags not to exceed 100 pounds each. The filter media shall be packed in a pallet and shipped to the plant site with the filter system. The contractor shall position the filter media in the tertiary filter as shown on

20.2 The plans and in the field. The filter media bed shall consist of eight inches (8") of sand, 0.80 to 1.20 MM effective size with a uniform coefficient of 1.4 through 1.7 and twelve inches (12") of anthracite 1.08 MM effective size with a uniform coefficient of

**21.0 Clear Well**

21.1 The clear well shall be located as shown on the plans. It shall be so designed so that the filtrate from each of the filter cells can discharge into the clear well from the false bottom underdrain system which is located below the media; then flow through a riser and through the backwash pumps. The clear well shall not have less than 2500 gallons for sufficient volume for backwashing based on two 5-minute backwash cycles. An overflow weir shall be provided for gravity effluent discharge to the disinfection system chamber.

**22.0 Backwash Pumps**

22.1 Two (2) backwash pumps shall be furnished and installed in the clear well so as to automatically backwash each filter cell through the water distribution manifolds when required maintaining filtration conditions. Each pump shall be designed to provide one 5-minute backwash at a rate of 15 gallons per minute per square feet, and shall be rated at 270 GPM at 15 TDH. The operating horsepower shall be 2 **HP,** 480 volt, 60 Hz, 3 phase. Both pumps shall be a Model WS20D4 series 3888D4 with a 4" discharge and shall be manufactured by Goulds Pump Company pumps or approved

equal. The backwash rate shall be a minimum of 15 GPM per square foot of filter surface area.

### 23.0 Mud Well Chamber

23.1 A mudwell chamber of the tertiary filter system shall be of such size as to handle the total volume of the filtrate backwash. The Volume of this chamber shall not be less than 2800 gallons. A duplex set of pumps shall be provided and installed in the mud well chamber for returning the filtrate backwash liquid to the secondary wastewater treatment. The capacity for each pump shall be 25 GPM at 15' TDH. The operating horsepower shall be 1/2 HP, 480 volt, 60 Cycles, 3 Phase. The pumps shall be a model 3882 and shall be manufactured by or approved equal and have a 2 inch

### 24.0 TERTIARY AIR SUPPLY BLOWER MOTOR UNIT

24.1 One (1) positive displacement blower motor unit shall be provided and shall be a Model BF-30-S24 shall be supplied, capable of providing the required CFM for air scouring. The unit shall have the capacity of providing 100% of the air requirements for the tertiary system. The blower unit shall be installed at the location shown on the drawings. The unit shall be completely factory built and tested before shipping. Therefore, the blower speed and horsepower has been corrected for this elevation level. One blower unit shall **be** installed within a fiberglass Blower housing TEII-2 complete with base and weatherproof hood. The discharge piping of the blower shall be positioned within the housing to help reduce the vibration and the noise being created by the air discharge. The inlet filter silencer, pressure relief valve, pressure gauge, and check valve shall all be located within the housing with only the blower discharge rubber hose connection being provided as a single line hook up for the blower. The necessary electrical connection from the blower to CP-1 shall be provided and pre-wired. The enclosure shall have ivory finish. The blower motor enclosure unit shall be mounted on four (4) vibration pad dampers tagged VP-1. This will help reduce blower vibration and noise transmission. The fiberglass housing shall be equipped with a 2" blower discharge pipe with a 2" marine rubber hose with 2 stainless steel clamps. Each unit shall be completely factory built and tested before shipping.

24.2 The blower shall be capable of delivering 30 CFM when operating at 5 PSI. The blower shall be manufactured by Roots Division Dresser Industries, California; or approved equal. The model number of the Sutorbilt blower will be URAI-24.

24.3 Each motor shall be 2 Horsepower for operation on 480 volt, 3 Phase, 60 Cycle service 1750 RPM. It shall be of the ODP type. Motor E-929 , 5.6 FLA

24.4 Facilities for air scouring the filter media prior to backwash shall be provided. An air distribution system shall be provided under the filter media.

### 25.0 ELECTRICAL CONTROL CONSOLE CP-3

25.1 An electrical control center shall be installed within a Nema 4 electrical weatherproof enclosure and shall be provided for mounting as indicated on the plans.

25.2 Each filter cell shall be supplied with an AAWS-2 control System. This system shall automatically air scouring and water wash the filter cell. When the resistance of the flow through that filter cell which is caused by the filter media makes the water level in the filtrate collection chamber to rise to a predetermined liquid level, a liquid level control switch shall initiate the automatic air scour cycle. This automatic air and water wash cycle is controlled by a series of adjustable control timers which will allow easy adjustment of each phase of the air and water wash cycles. The AAWS-2 shall include system light which will indicate the operating position of the control system. This light shall be installed within the control panel.

25.3 The enclosure shall be NEMA type 4. The electrical controls shall consist of IEC starters, timers, and switches necessary to automatically control all electrical devices and/or motors on the tertiary treatment system. The blower motor shall be controlled by a H-O-A selector switches and IEC starters. This will be in conjunction with the AAWS-2 control system. Properly sized circuit breakers or fuses shall protect all electrical equipment and circuitry.

25.4 All wire and conduit required between the control panels and the electrical power service shall be furnished and installed by the purchaser

25.5 Wiring and conduit between the control panel CP-3 and the tertiary ancillary equipment as listed below shall be pre-wired and tested at the factory:

Solenoid Valve For Air Scourer Cell # 1
Solenoid Valve For Air Scourer Cell # 2
Solenoid Valve For Clear well aeration

All necessary valving and piping shall also be provided

The main power supply shall be 480 volt, 3 Phase, 60 Cycle, with a control circuit of 120 Volt, 1 Phase, 60 Cycle.

25.6 The electrical equipment, which shall be operated from this control center, are:

Tertiary Blower Unit BM-4 — 5.6FLA, 480 volt, 3 Phase, 60 Cycle, 145 T,E929
Backwash Pump P-3 —FLA, 480 volt, 3 Phase, 60 Cycle
Backwash Pump P-4 —FLA, 480 volt, 3 Phase, 60 Cycle
Mudwell Pump P-5 — 3.6 FLA, 480 volt, 3 Phase, 60 Cycle
Mudwell Pump P-6 — 3.6 FLA, 480 volt, 3 Phase, 60 Cycle
Solenoid Valve For Air Scour Cell # 1
Solenoid Valve For Air Scour Cell # 2
Solenoid Valve For Clear well aeration and post aeration

## 26.0 FILTER BY-PASS

26.1 A by-pass shall be supplied to allow manual by-pass of the filter cells. The by-pass shall consist of the necessary flow troughs, flow vanes, etc., to direct either to the filter cells or to the tertiary outlet port.

26.2 The flow distribution trough shall be so designed as to divert the incoming flow proportionally to each filtrate collection chamber. This shall be done by means of diversion vanes.

## 27.0 CLEARWELL AERATION

27.1 An air distribution manifold shall be installed on one side of the tertiary system with diffuser drop assemblies connected thereto. This manifold shall be designed to create a bank of air to supply the air needs of the post aeration system

27.2 The diffuser drop assembly shall be equipped with an air regulating valve, a disconnecting union and a diffuser bar with non-clog air diffuser nozzles mounted on the tee bar. This minimum air velocity shall be maintained to insure sufficient velocity for self-cleaning. The diffusers shall be placed as shown on the drawings. The air diffuser shall be on the air check diaphragm type constructed with a diaphragm mounted on top of the diffuser body. The diffuser body consists of twenty, 3/16" diameter air discharge holes evenly distributed around the diffuser disk. The diffuser will be supplied with standard male pipe thread connections.

## 28.0 DISINFECTION CHAMBER

28.1 A chlorine contact chamber shall be provided having a volume of 1042 gallons base and configured as shown on the drawings.

28.2 A tablet type chlorination system shall be provided. It shall be a Model 1000 Sanuril

28.3 A 90 degree v-notch weir shall be provided for flow measurement within the chlorination contact tank.

## 29 EFFLUENT CONNECTION

29.1 The effluent connection of the tertiary treatment system shall be located as shown on the plans and shall consist of one 6" diameter standard flanged pipe at the location shown.

# ATTACHMENT 4

# Disclosure Statement

# ARKANSAS DEPARTMENT OF ENVIRONMENTAL QUALITY
# DISCLOSURE STATEMENT

**Instructions for the Completion of this Document:**

**A. Individuals, firms or other legal entities with no changes to an ADEQ Disclosure Statement, complete items 1 through 5 and 18.**

**B. Individuals who never submitted an ADEQ Disclosure Statement, complete items 1 through 4, 6, 7, and 16 through 18.**

**C. Firms or other legal entities who never submitted an ADEQ Disclosure Statement, complete 1 through 4, and 6 through 18.**

**If Not Submitting by ePortal, Mail Original to:**
**ADEQ**
**DISCLOSURE STATEMENT**
**[*List Proper Division(s)*]**
**5301 Northshore Drive**
**North Little Rock, AR 72118-5317**

**1. APPLICANT: (Full Name)**
Pulaski County Property Owners Multipurpose Improvement District 2021-2

**2. MAILING ADDRESS: (Number and Street, P.O.Box Or Rural Route)**
P. O. Box 23670

**3. CITY, STATE, AND ZIPCODE:**
Little Rock, AR 72221

**4a. Applicant Type:**

○ Individual ◉ Corporate or Other Entity

**4b. Reason for Submission:**

☑ Permit ☐ License ☐ Certification ☐ Operational Authority

☐ New Application ☐ Modification ☐ Renewal Application (If no changes from previous disclosure statement, complete number 5 and 18.)

**4c. Programs:**

☐ Air ☑ Water ☐ Hazardous Waste ☐ Regulated Storage Tank ☐ Mining ☐ Solid Waste ☐ Used Tire Program

**5. Declaration of No Changes:**
**The violation history, experience and credentials, involvement in current or pending environmental lawsuits, civil and criminal, have not changed since the last Disclosure Statement that was filed with ADEQ on** _____

**6. Describe the experience and credentials of the Applicant, including the receipt of any past or present permits, licenses, certifications or operational authorization relating to environmental regulation. (Attach additional pages, if necessary.)**

Pulaski Co. Property Owners Multipurpose Improvement District 2021-2 will be chaired by Rick Ferguson who is also chairman of the Waterview Estates wastewater treatment plant. The Multipurpose Improvement District 2021-2 will use a licensed wastewater operator (Arlo Jason Cyz) that is experienced in the operation of residential treatment plants.

**7. List and explain all civil or criminal legal actions by government agencies involving environmental protection laws or regulations against the Applicant * in the last ten (10) years including:**

1. **Administrative enforcement actions resulting in the imposition of sanctions;**
2. **Permit or license revocations or denials issued by any state or federal authority;**
3. **Actions that have resulted in a finding or a settlement of a violation; and**
4. **Pending actions.**

**(Attach additional pages, if necessary.)**

*** Firms or other legal entities shall also include this information for all persons and legal entities identified in sections 8-16 of this Disclosure Statement.**

**8. List all officers of the Applicant. (add additional pages, if necessary.)**

NAME: Rick Ferguson TITLE: Chairman
STREET: P. O. Box 23670
CITY, STATE, ZIP: Little Rock, AR 72221

NAME: Brock Ferguson TITLE: Commissioner
STREET: PO Box 23670
CITY, STATE, ZIP: Little Rock, AR 72221

NAME: German Jimenez TITLE: Commissioner
STREET: PO Box 23670
CITY, STATE, ZIP: Little Rock, AR 72221

**9. List all directors of the Applicant. (Add additional pages, if necessary.)**

NAME: Rick Ferguson TITLE: Chairman
STREET: PO Box 23670
CITY, STATE, ZIP: Little Rock, AR 72221

NAME: Brock Ferguson TITLE: Commissioner
STREET: PO Box 23670
CITY, STATE, ZIP: Little Rock, AR 72221

NAME: German Jimenez TITLE: Commissioner
STREET: PO Box 23670
CITY, STATE, ZIP: Little Rock, AR 72221

**10. List all partners of the Applicant. (Add additional pages, if necessary.)**

NAME: _____ TITLE: _____
STREET: _____
CITY, STATE, ZIP: _____

NAME: _____ TITLE: _____
STREET: _____
CITY, STATE, ZIP: _____

NAME: _____ TITLE: _____
STREET: _____
CITY, STATE, ZIP: _____

**11. List all persons employed by the Applicant in a supervisory capacity or with authority over operations of the facility subject to this application.**

NAME: Arlo J. Cyz TITLE: Treatment Plant Operator
STREET: 17 Tanglewood Drive
CITY, STATE, ZIP: Bryant, AR 72022

NAME: _____ TITLE: _____
STREET: _____
CITY, STATE, ZIP: _____

NAME: _____ TITLE: _____
STREET: _____
CITY, STATE, ZIP: _____

**12. List all persons or legal entities, who own or control more than five percent (5%) of the Applicant's debt or equity.**

**NAME:** Rick Ferguson **TITLE:** President

**STREET:** PO Box 23670

**CITY, STATE, ZIP:** Little Rock, AR 72221

**NAME:** _____ **TITLE:** _____

**STREET:** _____

**CITY, STATE, ZIP:** _____

**NAME:** _____ **TITLE:** _____

**STREET:** _____

**CITY, STATE, ZIP:** _____

**13. List all legal entities, in which the Applicant holds a debt or equity interest of more than five percent (5%).**

**NAME:** _____ **TITLE:** _____

**STREET:** _____

**CITY, STATE, ZIP:** _____

**NAME:** _____ **TITLE:** _____

**STREET:** _____

**CITY, STATE, ZIP:** _____

**NAME:** _____ **TITLE:** _____

**STREET:** _____

**CITY, STATE, ZIP:** _____

**14. List any parent company of the Applicant. Describe the parent company's ongoing organizational relationship with the Applicant.**

**NAME:** _____

**STREET:** _____

**CITY, STATE, ZIP:** _____

**Organizational Relationship:**

**15. List any subsidiary of the Applicant. Describe the subsidiary's ongoing organizational relationship with the Applicant.**

**NAME:** _____

**STREET:** _____

**CITY, STATE, ZIP:** _____

**Organizational Relationship:**

**16. List any person who is not now in compliance or has a history of noncompliance with the environmental law or regulations of this state or any other jurisdiction and who through relationship by blood or marriage or through any other relationship could be reasonably expected to significantly influence the Applicant in a manner which could adversely affect the environment.**

**NAME:** _____ **TITLE:** _____

**STREET:** _____

**CITY, STATE, ZIP:** _____

**NAME:** _____ **TITLE:** _____

**STREET:** _____

**CITY, STATE, ZIP:** _____

**17. List all federal environmental agencies and any other environmental agencies outside this state that have or have had regulatory responsibility over the Applicant.**

EPA and Arkansas Department of Health

## 18. VERIFICATION AND ACKNOWLEDGEMENT

**The Applicant agrees to provide any other information the director of the Arkansas Department of Environmental Quality may require at any time to comply with the provisions of the Disclosure Law and any regulations promulgated thereto. The Applicant further agrees to provide the Arkansas Department of Environmental Quality with any changes, modifications, deletions, additions or amendments to any part of this Disclosure Statement as they occur by filing an amended Disclosure Statement.**

**DELIBERATE FALSIFICATION OR OMISSION OF RELEVANT INFORMATION FROM DISCLOSURE STATEMENTS SHALL BE GROUNDS FOR CIVIL OR CRIMINAL ENFORCEMENT ACTION OR ADMINISTRATIVE DENIAL OF A PERMIT, LICENSE, CERTIFICATION OR OPERATIONAL AUTHORIZATION.**

**COMPLETE THIS SECTION ONLY IF SUBMITTING OTHER THAN BY EPORTAL:**

**I,** Rick Ferguson **, certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violation.**

**APPLICANT SIGNATURE:** 

**TITLE:** Chairman

**DATE:** 8/5/2022

# DRAWINGS AND SPECIFICATIONS

# Wastewater Treatment System For

# 50,000 GPD SYSTEM

## PARADISE VALLEY SUBDIVISION
## PARADISE VALLEY MULTIPURPOSE IMPROVEMENT DISTRICT NO. 2021-2

Total Design Flow = 50,000 GPD

Date: August 2, 2021

Project Number: WWD-50K

CERTIFICATE OF AUTHORIZATION
POLLUTION MANAGEMENT, INC.
No. 331
ARKANSAS-ENGINEER

ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No.7040
10/8/21

WASTEWATER DEPOT, LLC
4446 STATE ROUTE 132
BATAVIA, OH 45103
USA
WWW.WASTEWATERDEPOT.COM
PHONE: (513) 732-0129
FAX: (513) 735-1485

REVISIONS:
DATE: BY: DESCRIPTION:

PROJECT NAME:
50,000 GPD SYSTEM
WASTEWATER TREATMENT PLANT
TANK VOLUME: 50,000 GPD

DRAWING: TITLE PAGE

PROJECT NO.: WWD-50K

SCALE: NTS

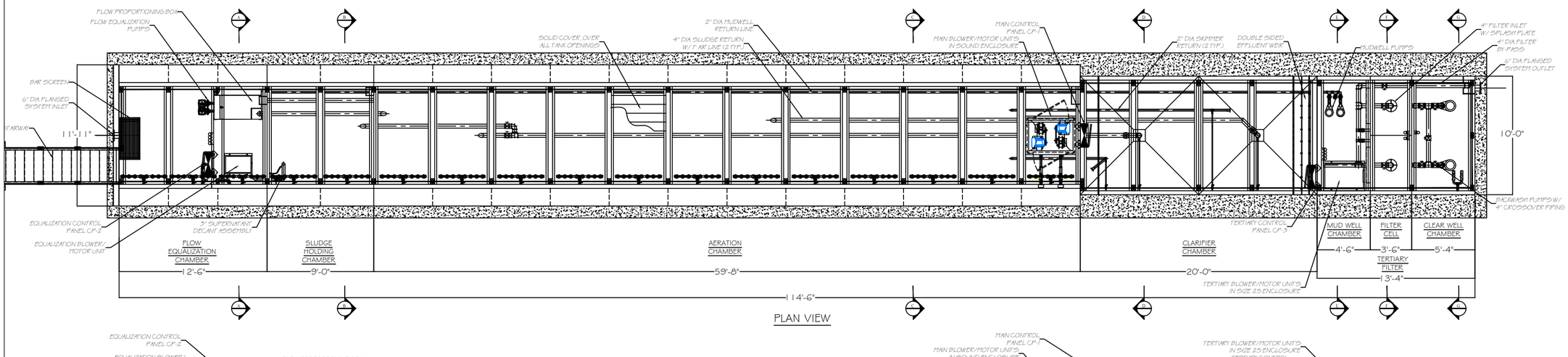
DATE: 8-2-21

DRAWN BY: J.T.

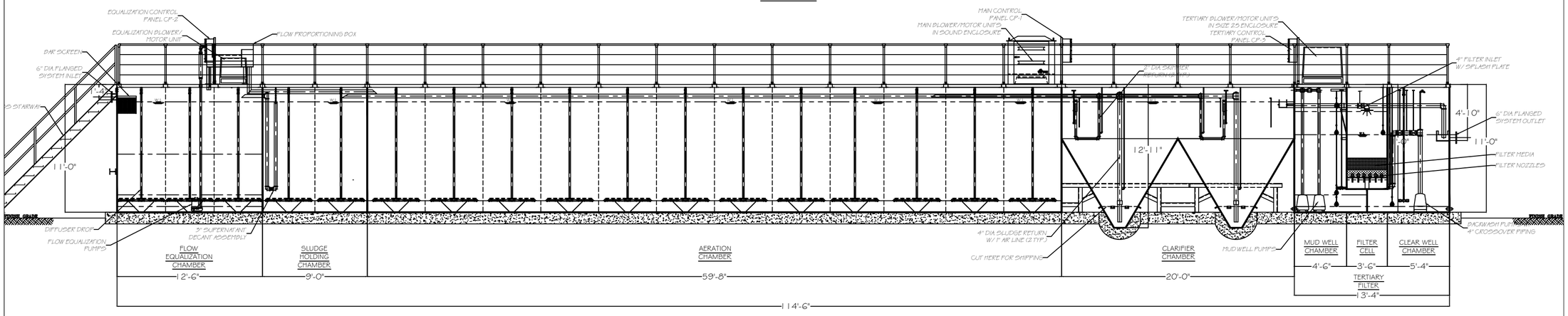
CHECKED BY: BA

APPROVED BY: BA

DWG NO.: 21-50K-01




PLAN VIEW




ELEVATION VIEW

CERTIFICATE OF AUTHORIZATION
POLLUTION MANAGEMENT, INC.
No. 331
ARKANSAS-ENGINEER

ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No.7040
10/8/21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PHONE: (513) 732-0129
FAX: (513) 735-1485


REVISIONS:

| DATE: | BY: | DESCRIPTION: |
|---|---|---|

PROJECT NAME:
50,000 GPD SYSTEM
WASTEWATER TREATMENT PLANT
TANK VOLUME: 50,000 GPD

DRAWING: PLAN & ELEVATION VIEW

PROJECT NO.: WWD-50K

SCALE: NTS

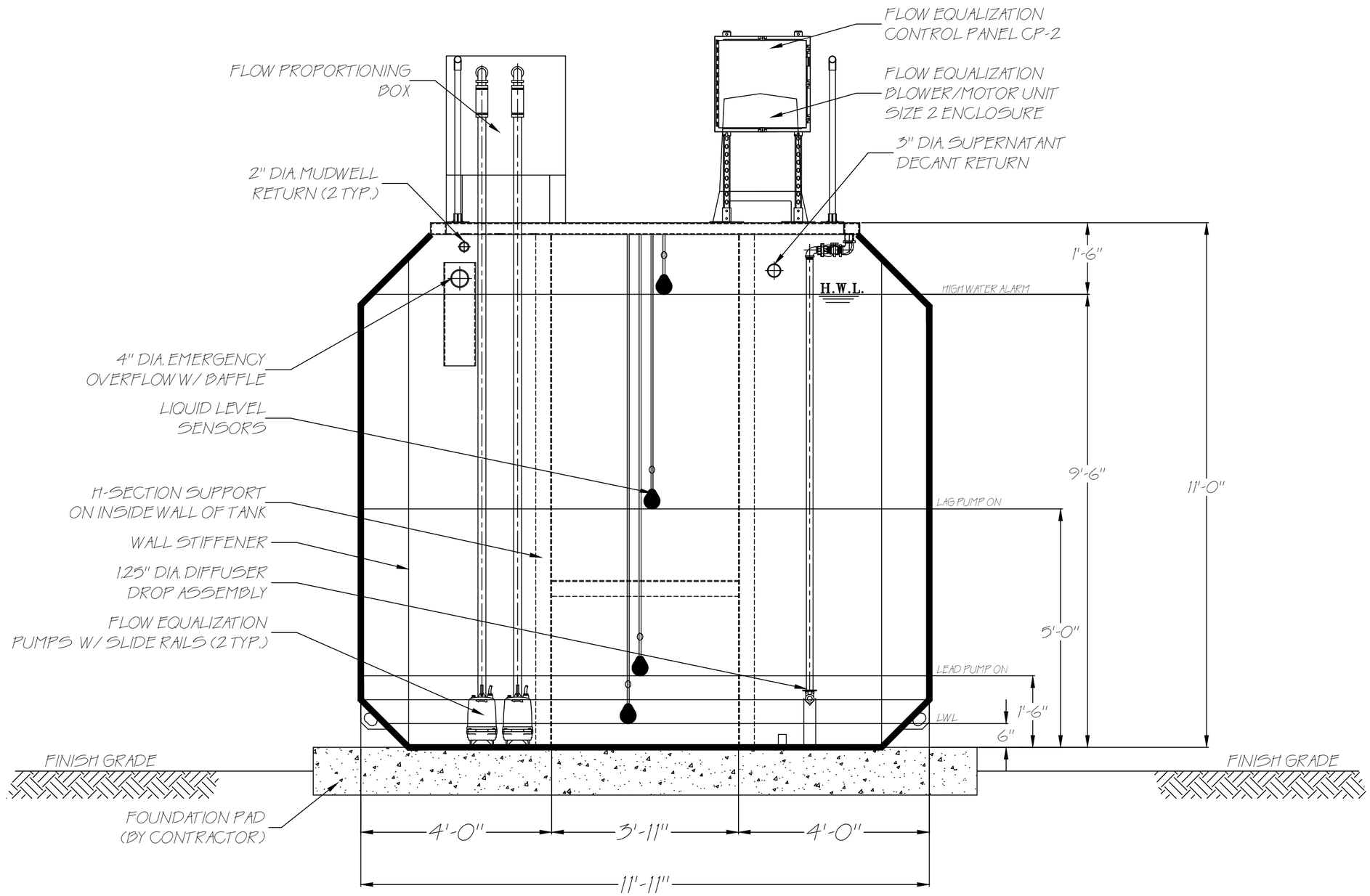
DATE: 8-2-21

DRAWN BY: J.T.

CHECKED BY: BA

APPROVED BY: BA

DWG NO.: 21-50K-02




SECTION VIEW A-A
FLOW EQUALIZATION CHAMBER

CERTIFICATE OF AUTHORIZATION
POLLUTION MANAGEMENT, INC.
No. 331
ARKANSAS-ENGINEER

ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
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10/8/21


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USA
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PHONE: (513) 732-0129
FAX: (513) 735-1485


REVISIONS:

| DATE: | BY: | DESCRIPTION: |
|---|---|---|

PROJECT NAME:
50,000 GPD SYSTEM
WASTEWATER TREATMENT PLANT
TANK VOLUME: 50,000 GPD

DRAWING: SECTION VIEW A-A

PROJECT NO.: WWD-50K

SCALE: NTS

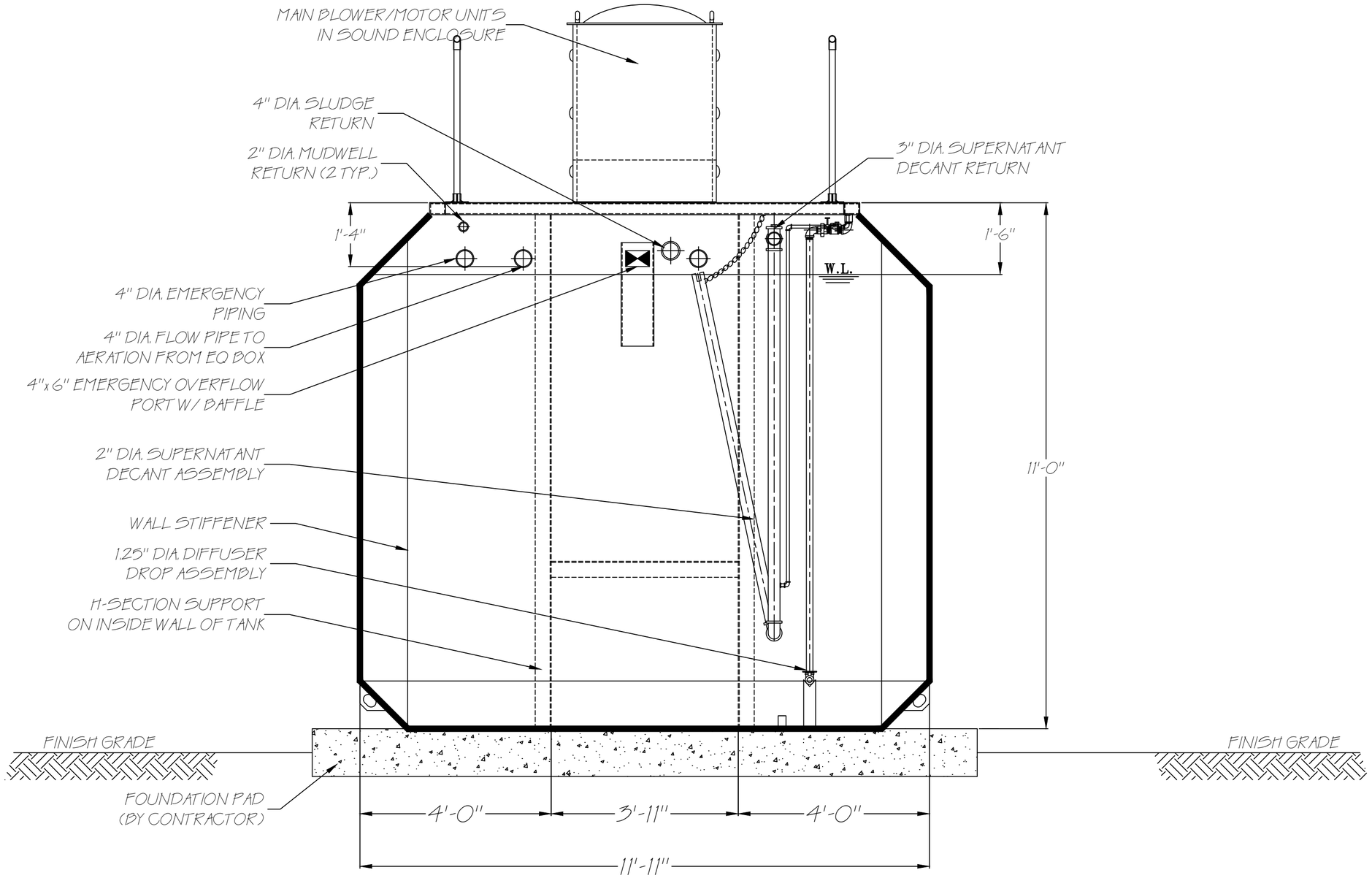
DATE: 8-2-21

DRAWN BY: J.T.

CHECKED BY: BA

APPROVED BY: BA

DWG NO.: 21-50K-03




SECTION VIEW B-B
SLUDGE HOLDING CHAMBER

CERTIFICATE OF AUTHORIZATION
POLLUTION MANAGEMENT, INC.
No. 331
ARKANSAS-ENGINEER

ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
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10/8/21


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PHONE: (513) 732-0129
FAX: (513) 735-1485


REVISIONS:

| DATE: | BY: | DESCRIPTION: |
|---|---|---|

PROJECT NAME:
50,000 GPD SYSTEM
WASTEWATER TREATMENT PLANT
TANK VOLUME: 50,000 GPD

DRAWING: SECTION VIEW B-B

PROJECT NO.: WWD-50K

SCALE: NTS

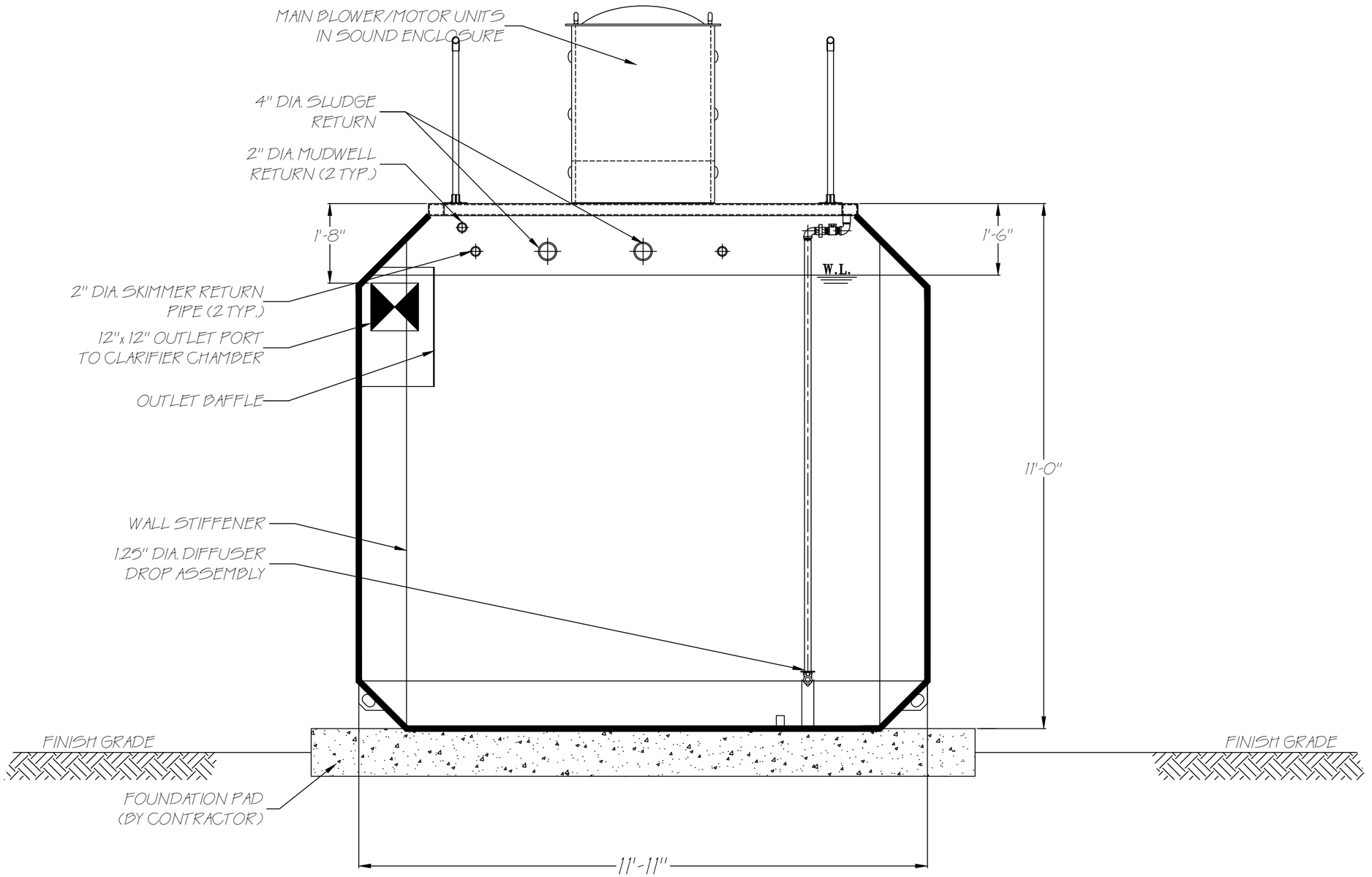
DATE: 8-2-21

DRAWN BY: J.T.

CHECKED BY: BA

APPROVED BY: BA

DWG NO.: 21-50K-04




SECTION VIEW C-C
AERATION CHAMBER

CERTIFICATE OF AUTHORIZATION
POLLUTION MANAGEMENT, INC.
No. 331
ARKANSAS-ENGINEER

ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 7040
10/8/21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BATAVIA, OH 45103
USA
WWW.WASTEWATERDEPOT.COM
PHONE: (513) 732-0129
FAX: (513) 735-1485


REVISIONS:
DATE: BY: DESCRIPTION:

PROJECT NAME:
50,000 GPD SYSTEM
WASTEWATER TREATMENT PLANT
TANK VOLUME: 50,000 GPD

DRAWING: SECTION VIEW C-C

PROJECT NO.: WWD-50K

SCALE: NTS

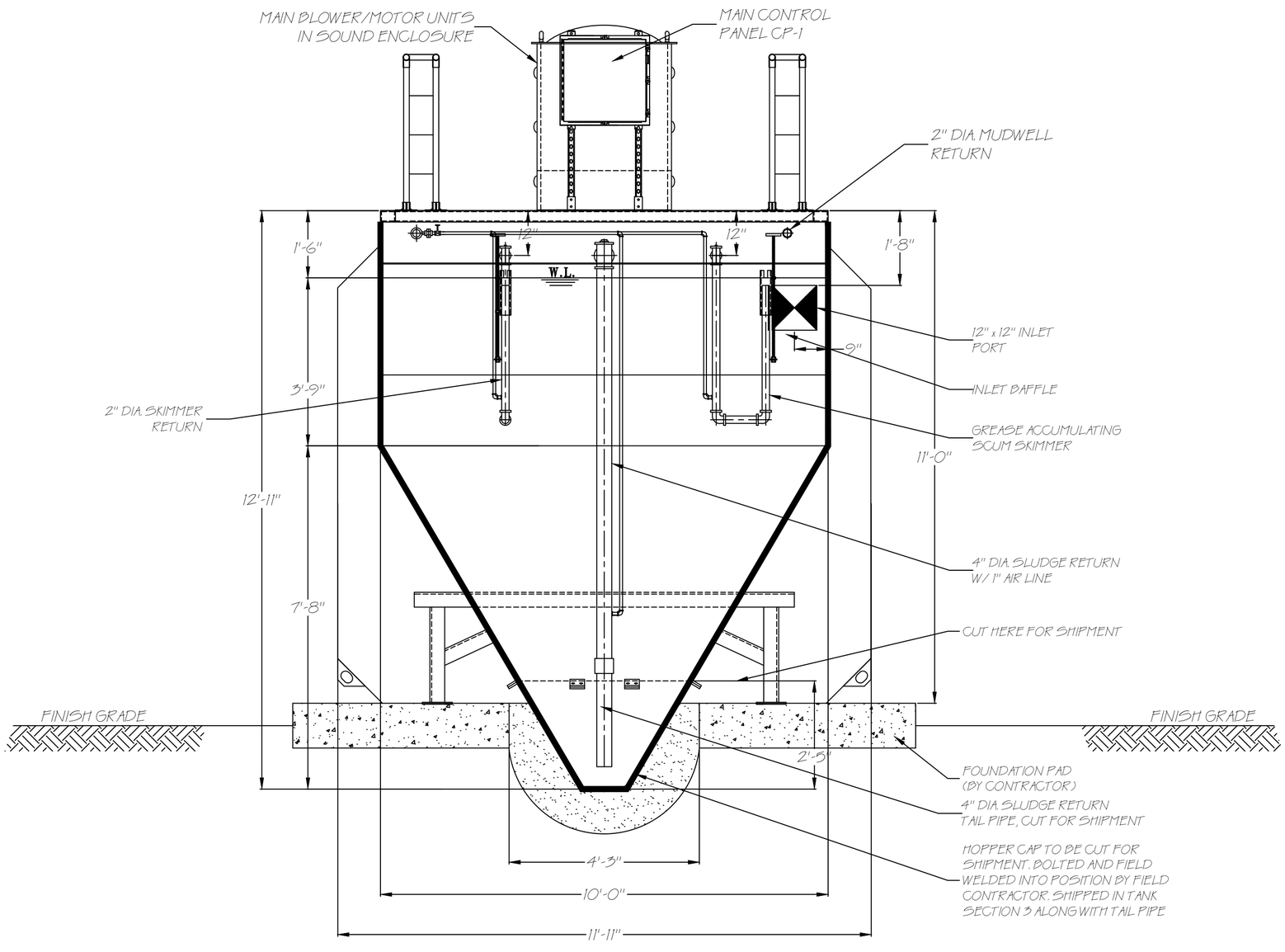
DATE: 8-2-21

DRAWN BY: J.T.

CHECKED BY: BA

APPROVED BY: BA

DWG NO.: 21-50K-05




SECTION VIEW D-D
CLARIFIER
CHAMBER

CERTIFICATE OF AUTHORIZATION
POLLUTION MANAGEMENT, INC.
No. 331
ARKANSAS-ENGINEER

ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 7040
10/8/21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BATAVIA, OH 45103
USA
WWW.WASTEWATERDEPOT.COM
PHONE: (513) 732-0129
FAX: (513) 735-1485


REVISIONS:
DATE: BY: DESCRIPTION:

PROJECT NAME:
50,000 GPD SYSTEM
WASTEWATER TREATMENT PLANT
TANK VOLUME: 50,000 GPD

DRAWING: SECTION VIEW D-D

PROJECT NO.: WWD-50K

SCALE: NTS

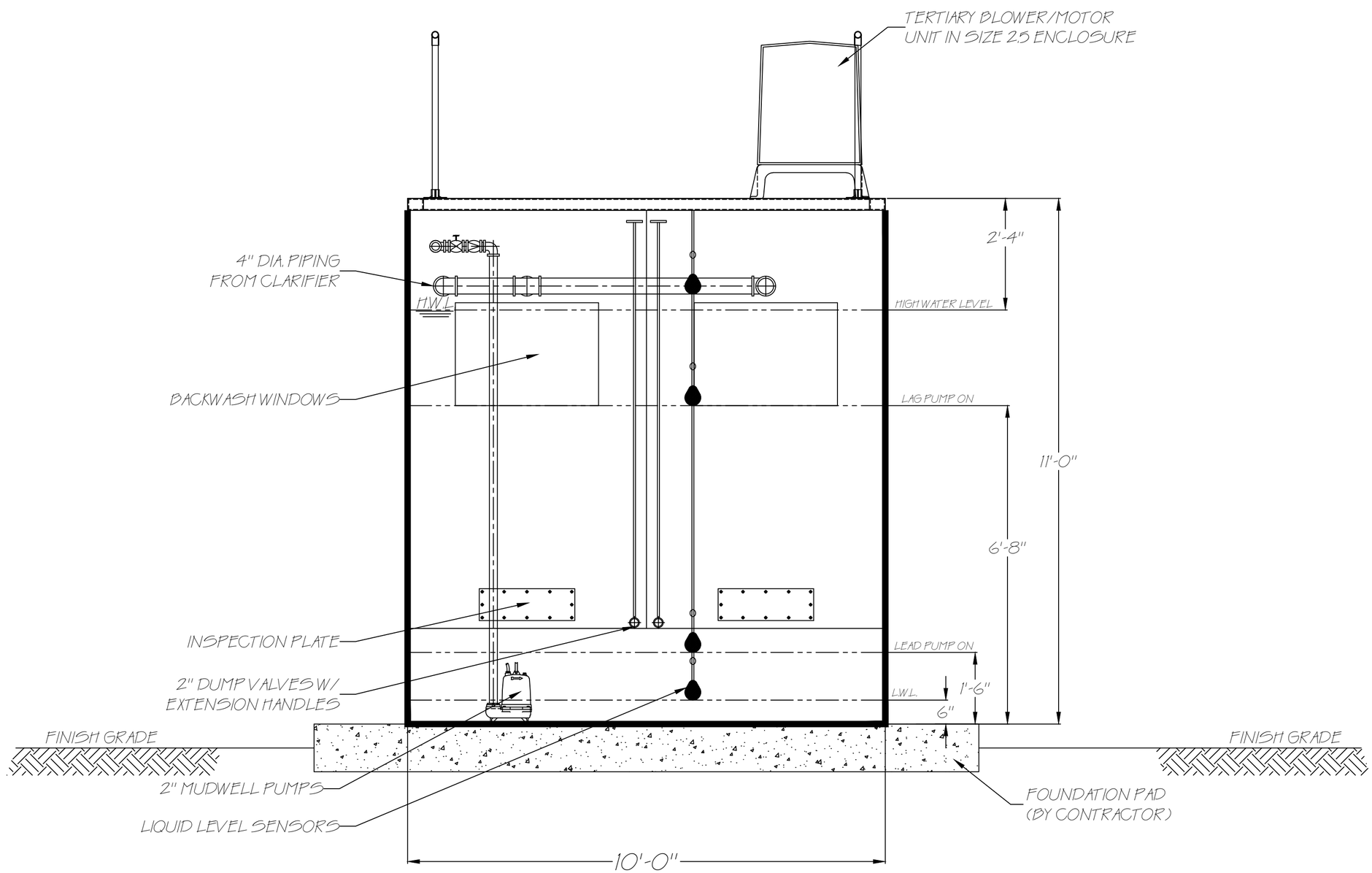
DATE: 8-2-21

DRAWN BY: J.T.

CHECKED BY: BA

APPROVED BY: BA

DWG NO.: 21-50K-06




SECTION VIEW E-E
MUD WELL
CHAMBER

CERTIFICATE OF AUTHORIZATION
POLLUTION MANAGEMENT, INC.
No. 331
ARKANSAS-ENGINEER

ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 7040
10/8/21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USA
WWW.WASTEWATERDEPOT.COM
PHONE: (513) 732-0129
FAX: (513) 735-1485


REVISIONS:

| DATE: | BY: | DESCRIPTION: |
|---|---|---|

PROJECT NAME:
50,000 GPD SYSTEM
WASTEWATER TREATMENT PLANT
TANK VOLUME: 50,000 GPD

DRAWING: SECTION VIEW E-E

PROJECT NO.: WWD-50K

SCALE: NTS

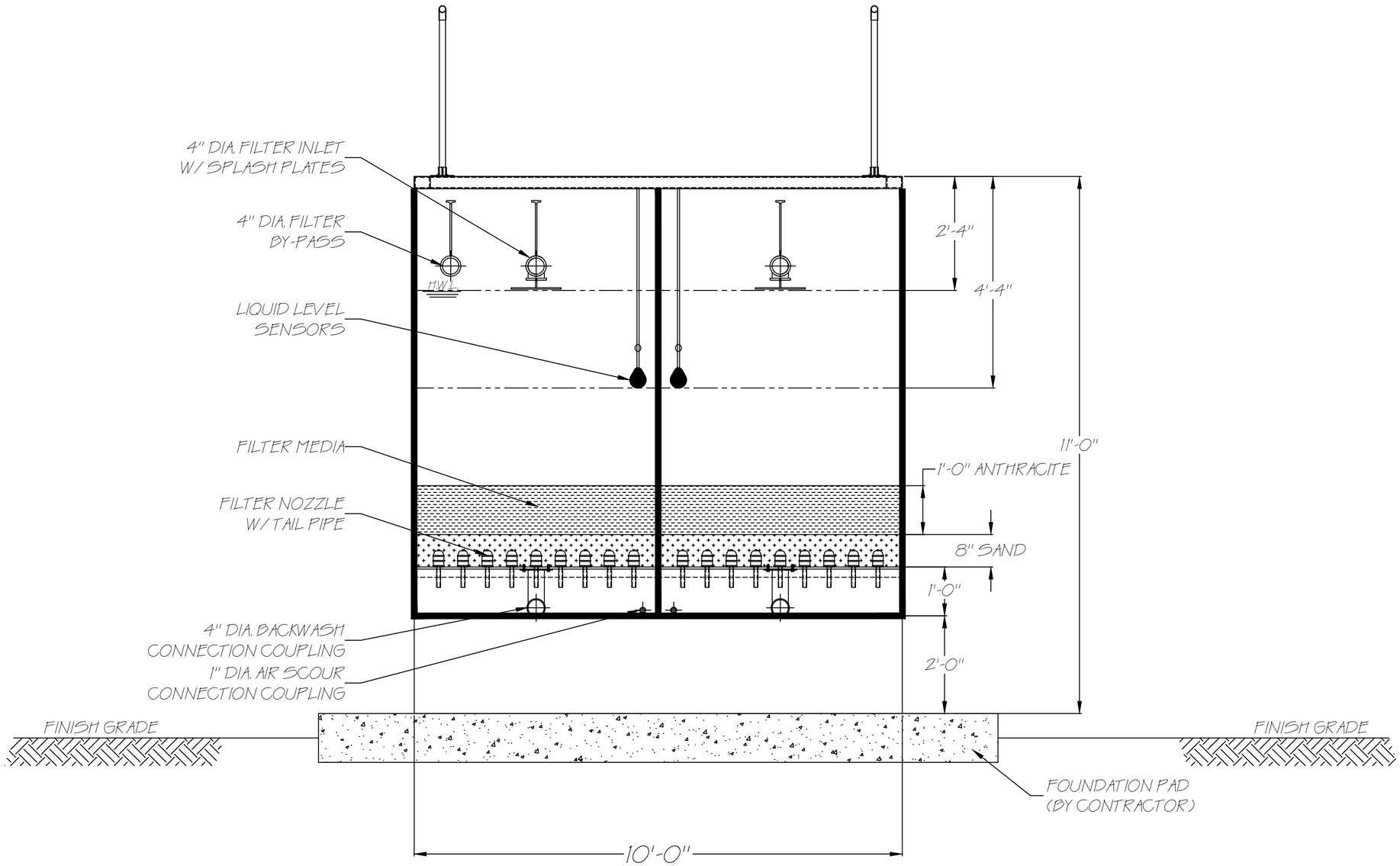
DATE: 8-2-21

DRAWN BY: J.T.

CHECKED BY: BA

APPROVED BY: BA

DWG NO.: 21-50K-07




SECTION VIEW F-F
FILTER CELL
CHAMBER

CERTIFICATE OF AUTHORIZATION
POLLUTION MANAGEMENT, INC.
No. 331
ARKANSAS-ENGINEER

ARKANSAS
REGISTERED
PROFESSIONAL
ENGINEER
No. 7040
10/8/21

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4446 STATE ROUTE 132
BATAVIA, OH 45103
USA
WWW.WASTEWATERDEPOT.COM
PHONE: (513) 732-0129
FAX: (513) 735-1485

REVISIONS:
DATE: BY: DESCRIPTION:

PROJECT NAME:
50,000 GPD SYSTEM
WASTEWATER TREATMENT PLANT
TANK VOLUME: 50,000 GPD

DRAWING: SECTION VIEW F-F

PROJECT NO.: WWD-50K

SCALE: NTS

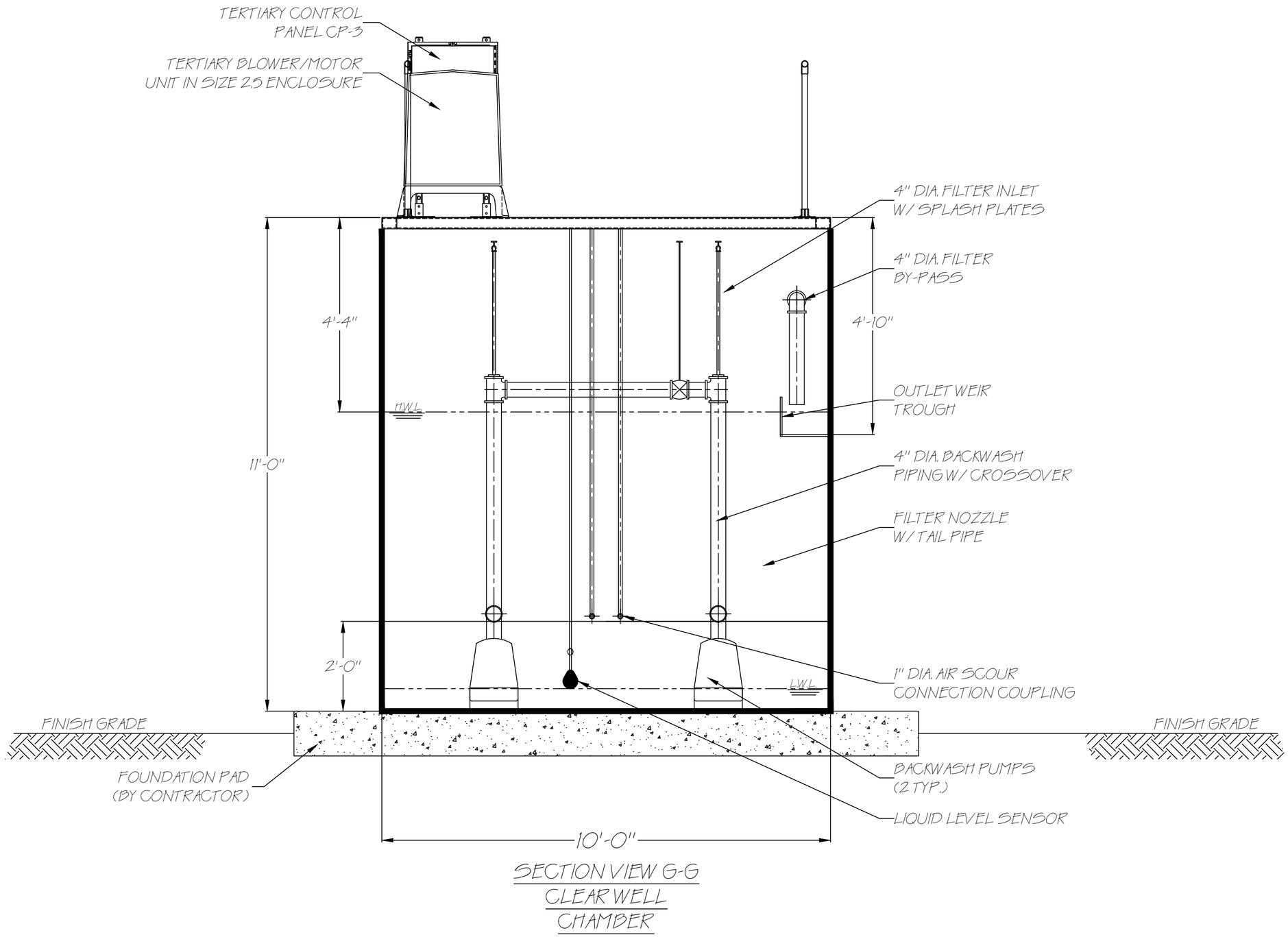
DATE: 8-2-21

DRAWN BY: J.T.

CHECKED BY: BA

APPROVED BY: BA

DWG NO.: 21-50K-08




SECTION VIEW G-G
CLEAR WELL
CHAMBER

CERTIFICATE OF AUTHORIZATION
POLLUTION MANAGEMENT, INC.
No. 331
ARKANSAS-ENGINEER

ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 7040
10/8/21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4446 STATE ROUTE 132
BATAVIA, OH 45103
USA
WWW.WASTEWATERDEPOT.COM
PHONE: (513) 732-0129
FAX: (513) 735-1485


REVISIONS:
DATE: BY: DESCRIPTION:

PROJECT NAME:
50,000 GPD SYSTEM
WASTEWATER TREATMENT PLANT
TANK VOLUME: 50,000 GPD

DRAWING: SECTION VIEW G-G

PROJECT NO.: WWD-50K

SCALE: NTS

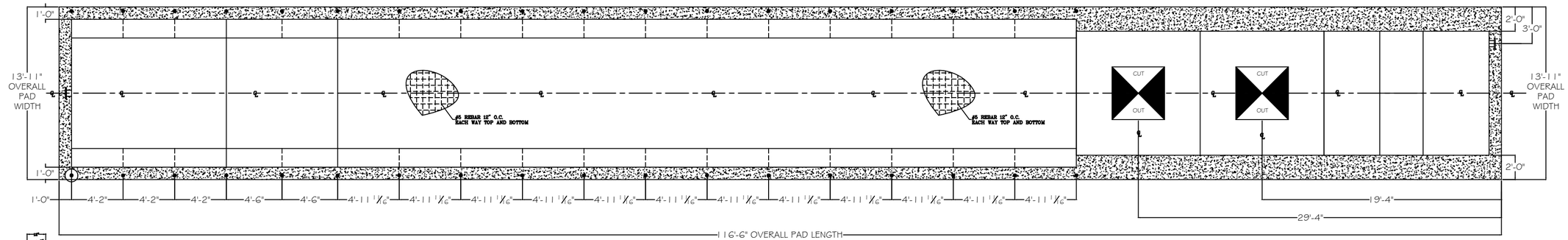
DATE: 8-2-21

DRAWN BY: J.T.

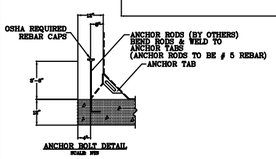
CHECKED BY: BA

APPROVED BY: BA

DWG NO.: 21-50K-09




PLAN VIEW




CERTIFICATE OF AUTHORIZATION
POLLUTION MANAGEMENT, INC.
No. 331
ARKANSAS-ENGINEER

ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 7040
10/8/21

WASTEWATER DEPOT, LLC
4446 STATE ROUTE 132
BATAVIA, OH 45103
USA
WWW.WASTEWATERDEPOT.COM
PHONE: (513) 732-0129
FAX: (513) 735-1485

REVISIONS:

| DATE: | BY: | DESCRIPTION: |
|---|---|---|

PROJECT NAME:
50,000 GPD SYSTEM
WASTEWATER TREATMENT PLANT
TANK VOLUME: 50,000 GPD

DRAWING: FOUNDATION PAD DETAIL

PROJECT NO.: WWD-50K

SCALE: NTS

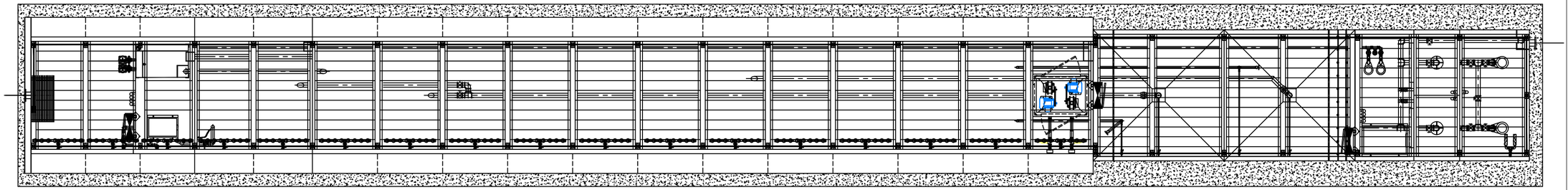
DATE: 8-2-21

DRAWN BY: J.T.

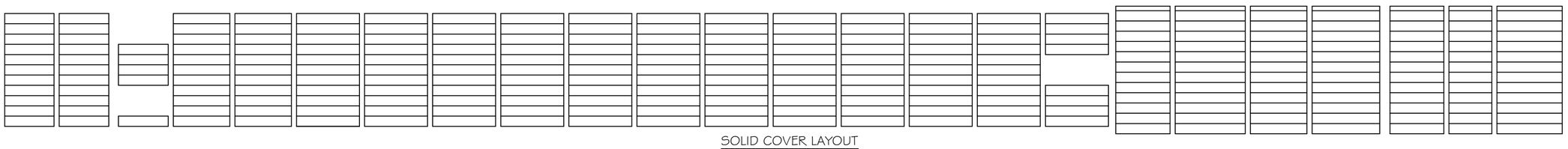
CHECKED BY: BA

APPROVED BY: BA

DWG NO.: 21-50K-10



PLAN VIEW



SOLID COVER LAYOUT

CERTIFICATE OF AUTHORIZATION
POLLUTION MANAGEMENT, INC.
No. 331
ARKANSAS-ENGINEER

ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 7040
10/8/21


WASTEWATER DEPOT, LLC
4446 STATE ROUTE 132
BATAVIA, OH 45103
USA
WWW.WASTEWATERDEPOT.COM
PHONE: (513) 732-0129
FAX: (513) 735-1485


REVISIONS:

| DATE: | BY: | DESCRIPTION: |
|---|---|---|

PROJECT NAME:
50,000 GPD SYSTEM
WASTEWATER TREATMENT PLANT
TANK VOLUME: 50,000 GPD

DRAWING:
GRATING LAYOUT

PROJECT NO.:
WWD-50K

SCALE:
NTS

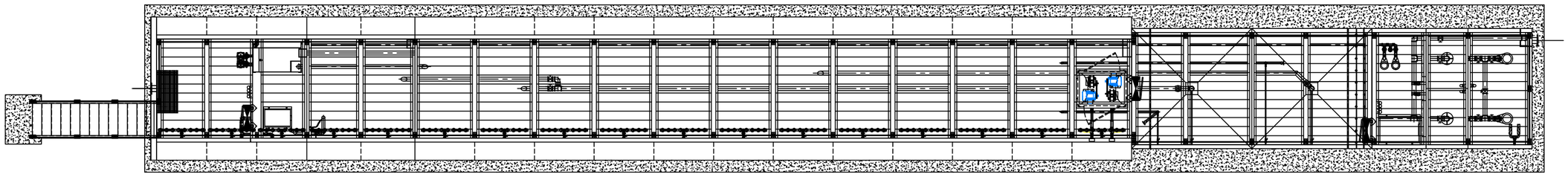
DATE:
8-2-21

DRAWN BY:
J.T.

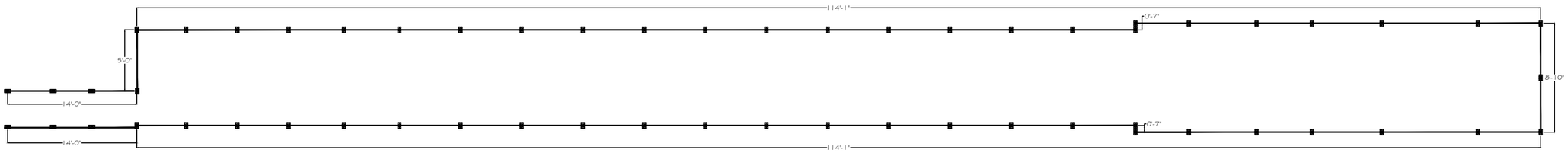
CHECKED BY:
BA

APPROVED BY:
BA

DWG NO.:
21-50K-11



PLAN VIEW




HANDRAIL LAYOUT

CERTIFICATE OF AUTHORIZATION
POLLUTION MANAGEMENT, INC.
No. 331
ARKANSAS-ENGINEER

ARKANSAS
REGISTERED
PROFESSIONAL
ENGINEER
No.7040
10/8/21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REVISIONS:

| DATE: | BY: | DESCRIPTION: |
|---|---|---|

PROJECT NAME:
50,000 GPD SYSTEM
WASTEWATER TREATMENT PLANT
TANK VOLUME: 50,000 GPD

DRAWING: HANDRAIL LAYOUT

PROJECT NO.: WWD-50K

SCALE: NTS

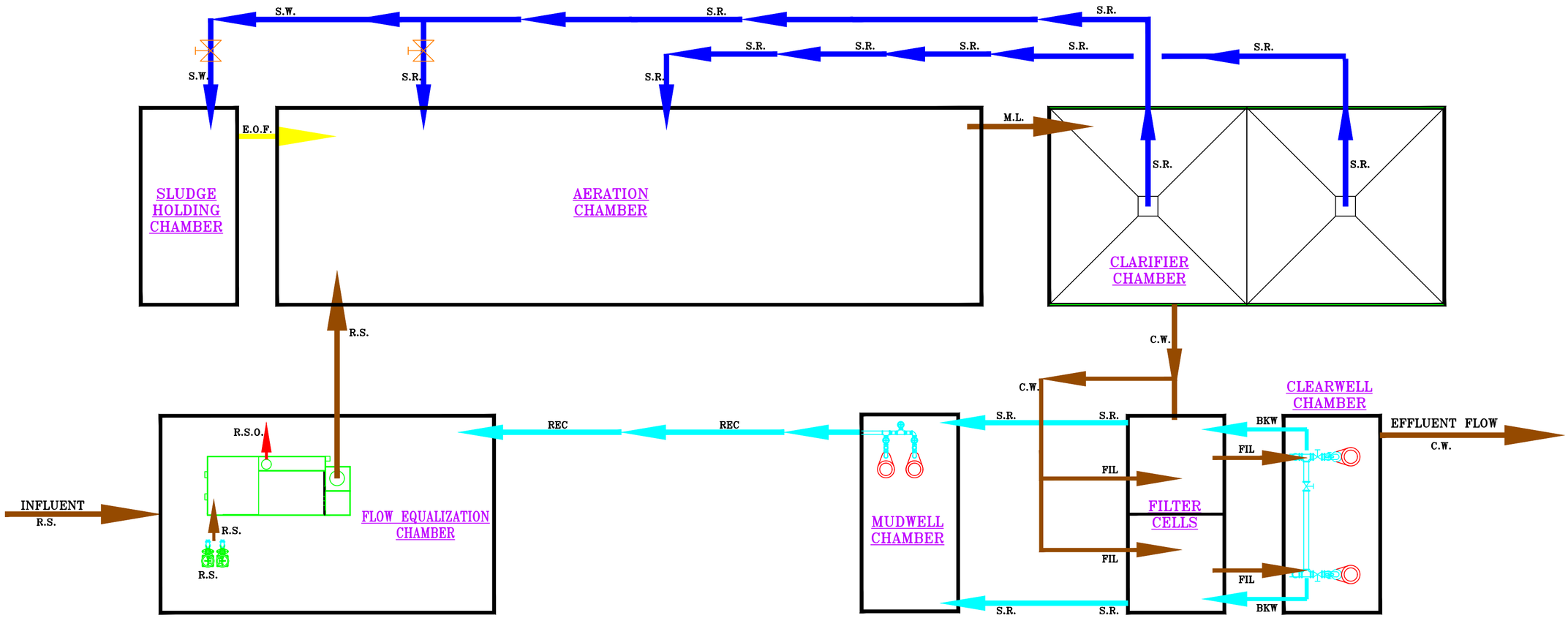
DATE: 8-2-21

DRAWN BY: J.T.

CHECKED BY: BA

APPROVED BY: BA

DWG NO.: 21-50K-12




# PROCESS FLOW DIAGRAM

## LEGEND

- MAIN FLOW THROUGH WASTE WATER TREATMENT SYSTEM
- SURGE FLOW BY-PASS AND RETURN
- SLUDGE RETURN PUMP SYSTEM
- RECYCLE PUMP RETURN LINE
- EMERGENCY OVERFLOW

R.S. = RAW SLUDGE
R.S.O. = RAW SLUDGE OVERFLOW
S.R. = SLUDGE RETURNED
S.W. = SLUDGE WASTED
M.L. = MIXED LIQUOR
C.W. = CLEAR WATER
FIL = FILTRATE
E.O.F. = EMERGENCY OVERFLOW

CERTIFICATE OF AUTHORIZATION
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REVISIONS:
DATE: BY: DESCRIPTION:

PROJECT NAME:
50,000 GPD SYSTEM
WASTEWATER TREATMENT PLANT
TANK VOLUME: 50,000 GPD

DRAWING: PROCESS FLOW DIAGRAM

PROJECT NO.: WWD-50K

SCALE: NTS

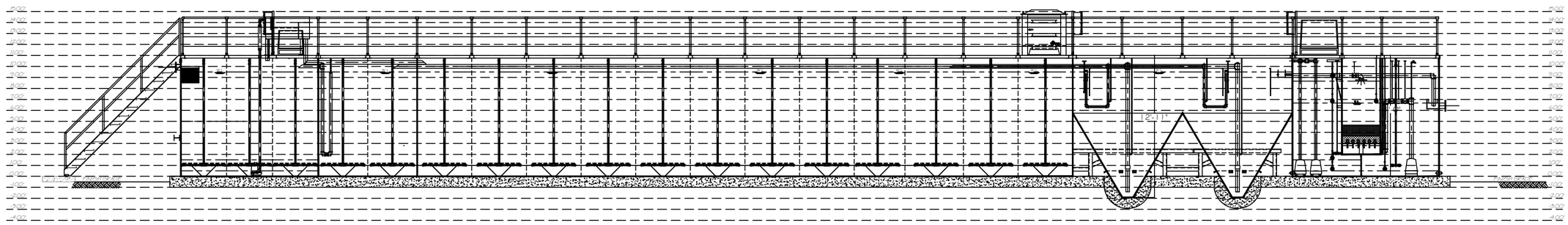
DATE: 8-2-21

DRAWN BY: J.T.

CHECKED BY: BA

APPROVED BY: BA

DWG NO.: 21-50K-13



HYDRAULIC PROFILE

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POLLUTION MANAGEMENT, INC.
No. 331
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REVISIONS:

| DATE: | BY: | DESCRIPTION: |
|---|---|---|

PROJECT NAME:
50,000 GPD SYSTEM
WASTEWATER TREATMENT PLANT
TANK VOLUME: 50,000 GPD

DRAWING:
HYDRAULIC PROFILE

PROJECT NO.:
WWD-50K

SCALE:
NTS

DATE:
8-2-21

DRAWN BY:
J.T.

CHECKED BY:
BA

APPROVED BY:
BA

DWG NO.:
21-50K-14

# TECHNICAL SPECIFICATIONS

# WASTEWATER TREATMENT PLANT

## PARADISE VALLEY SUBDIVISION
## AND PARADISE VALLEY MULTIPURPOSE
## IMPROVEMENT DISTRICT NO. 2021-2
## ROLAND CUTOFF ROAD
## PULASKI COUNTY



PMI

**3512 S SHACKLEFORD ROAD**
**LITTLE ROCK, ARKANSAS 72205**
**Tel: 501-221-7122**
**Fax: 501-221-7775**

# TABLE OF CONTENTS



**END OF SECTION**

# DIVISION 03 – CAST-IN-PLACE CONCRETE

03 30 00 – Cast-in-Place Concrete

**SECTION 03 30 00**
**CAST-IN-PLACE CONCRETE**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Cast-in-place concrete work, complete, unless otherwise specified, including formwork, reinforcing steel, mix design, placement procedures, and finishes. Furnish reinforcing steel bars for masonry work and tie bars after they are in place.

### 1.2 SUBMITTALS:

A. Product Data: Submit manufacturer's product data for reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, and other as requested by Engineer.

B. Shop Drawings: Submit, prior to installation, shop drawings of reinforcing steel, including bar cutting lists, typical bar bend diagrams, construction of forms including jointing, reveals, location and pattern of form tie placement, and construction joint schedule with details.

C. Design Mix: Prior to placement of concrete, submit concrete mix designs proposed by the concrete supplier, for class of concrete, including recent test results substantiating the quality of concrete produced by each mix.

D. Reports: Weekly reports of all compression, slump, and air content tests from the testing laboratory.

E. Samples: Submit samples of concrete stain and sealer in color selected by Engineer for approval.

### 1.3 QUALITY ASSURANCE:

A. Codes And Standards: Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are indicated or specified, and except as accepted or directed by Engineer during unusual climatic conditions.

1. ACI 301 "Specifications for Structural Concrete for Buildings."
2. ACI 318 "Building Code Requirements for Reinforced Concrete."
3. CRSI "Manual of Standard Practice."

B. Local Codes and Ordinances: Wherever provisions of the International Building Code 2006 (IBC) or the local current ordinances are more stringent than the above specifications and standards, the local codes and ordinances shall govern.

C. Concrete Testing Service: Engage a testing laboratory acceptable to Owner and Engineer to perform material evaluation tests and to design concrete mixes.

1. Tests, including retesting of rejected materials for installed work, shall be paid for by the Contractor. Testing requirements are specified in FIELD SAMPLING AND TESTING paragraph.

## PART 2 - PRODUCTS

### 2.1 FORM MATERIALS:

A. Forms For Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.

B. Forms For Unexposed Finish Concrete: Use plywood, lumber, metal, or other acceptable material. If lumber is used, it must be dressed on at least 2 edges and 2 sides for a tight fit.

C. Form Coatings: Commercial formulation form coating compound with maximum VOC of 350 mg/l that will not bond with, stain, nor adversely affect concrete surfaces, will not impair subsequent treatments of concrete surfaces.

D. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units that will leave no metal closer than 1-1/2" to exposed surface.

1. Provide ties that, when removed, will leave holes not larger than 1" diameter in concrete surface.

### 2.2 REINFORCING MATERIALS:

A. Reinforcing Bars: ASTM A 615(S1), Grade 60, deformed billet steel bars of grades indicated on drawings, free from loose rust, scale and other coatings that may reduce bond.

B. Mesh or Fabric Reinforcement: ASTM A 185, welded wire fabric, of sizes and types as indicated on drawings. Use flat sheets.

C. Supports For Reinforcement: Bolsters, chairs, spacers, and other devices necessary for properly spacing, supporting, and fastening reinforcement in place.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
3. For footings, support reinforcing steel with wire, metal chairs, bolsters or other approved device; do not use bricks, rocks or stones.

## 2.3 CONCRETE MATERIALS:

A. Portland Cement: ASTM C 150, Type I.

B. Concrete Aggregates: ASTM C 33, and as specified. Provide aggregates from a single source for exposed concrete.

1. Fine Aggregate: Clean, sharp, natural or manufactured sand, free from loam, clay, lumps, or other deleterious substances.
2. Coarse Aggregate: Clean, uncoated, processed, locally available aggregate, containing no clay, mud, loam or foreign matter; maximum size of 1-1/2" at foundations and 1" at slabs.

C. Water: Clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances that may be deleterious to concrete or reinforcing.

D. Admixtures:

1. Air Entrained Admixture: ASTM C 260; compatible with other required admixtures.
2. Other Admixtures: Do not use other admixtures unless accepted by Engineer; added chlorides will not be accepted.

E. Miscellaneous Materials:

1. Connectors: Provide metal connectors required for placement in cast-in-place concrete, for the attachment of structural and non-structural members.
2. Vapor Barrier: Refer to Specification Section 07 26 16, UNDERSLAB VAPOR RETARDER for information pertaining to the Vapor Barrier.
3. Expansion Joint Filler: ASTM D 1751, non-extruding premoulded material, 1/2" thick, unless otherwise noted, composed of fiberboard impregnated with asphalt, except use ASTM D 1752, Type II, resin-bound cork for walks and other exposed areas.

4. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
5. Moisture-Retaining Cover: One of the following, complying with ASTM C 171; waterproof paper, polyethylene film, polyethylene-coated burlap.
6. Liquid Membrane-Forming Curing Compound: ASTM C 309, Type I, Class A. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal. Conspec "Cure & Seal", L & M "L & M "Dress & Seal", Sonneborn "Kure-N-Seal", Euclid "Eurocure", Master Builders "Masterkure", W.R. Meadows "Sealtight CS-309", or approved equal.
7. Non-Shrink Grout: CRD-C 621, factory pre-mixed grout.

    a. Non-Metallic Shrinkage-Resistant Grout: Conspec "100 Non-Shrink Grout (Non-Metallic)", Euclid "Euco N.S.", L & M "Crystex", Master Builders "Masterflow 713", W. R. Meadows "Sealtight CG-86 Grout", or approved equal.

8. Bonding Agent: Polyvinyl acetate or acrylic base.

    a. Polyvinyl Acetate (Interior Only): Euclid "Euco Weld", L & M "Everweld", or approved equal.
    b. Acrylic or Styrene Butadiene: Euclid "SBR Latex", L & M "Everbond", Conspec "Strongbond", Master Builders "Acryl-Set", Sonneborn "Sonocrete", or approved equal.

9. Epoxy Adhesive: ASTM C 881, two component materials suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit project requirements.

    a. Conspec "Spec-Bond 100", Euclid "Euco Epoxy System #452 or #620", L & M "Epabond", Master Builders "Concresive Standard Liquid", or approved equal.

10. Concrete Sealer: Sonneborn "Son-No-Mar", Euclid "Eucopoxy I", L & M "Super Seal #35", W.R. Meadows "Sealtight Acrylic Concrete Sealer", or approved equal.
11. Concrete Stain: L.M. Scofield is specified. Equivalent products from Southern Color & Chemical are acceptable, or approved equal.

    a. Concrete Stain: Lithochrome Chemstain, in color as selected by Engineer.
    b. Color Sealer: Colorcure Concrete Sealer, color matched to concrete stain color.

12. Waterstop: Cetco (Volclay) Waterstop RX.

## 2.4 PROPORTIONING OF MIXES:

A. Concrete minimum ultimate strength at 28 days; refer to structural drawings.

B. Mix Designs:

1. Prepare design mixes for each type of concrete, in accordance with ACI 301 and ACI 318.
2. Proportion design mixes by weight for class of concrete required, complying with ACI 211.

C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as approved by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and approved by Engineer before using in work.

D. Provide test results from the concrete supplier for proposed design mix, to establish the following:

1. Gross weight and yield per cu. yd of trial mixtures.
2. Measured slump.
3. Measured air content.
4. Compressive strength developed at 7 days and 28 days, from not less than 3 test cylinders cast for each 7- and 28-day test, and for each design mix.

E. Submit written reports to Engineer for design mixes at least 15 calendar days prior to the start of work.

## 2.5 ADMIXTURES

A. Use air-entrained admixtures in strict compliance with manufacturer's directions at all concrete exposed to weather.

## 2.6 SLUMP LIMITS: 4" to +1".

## 2.7 BATCHING AND MIXING

A. Concrete may be ready-mixed or job-mixed at the Contractor's option, in accordance with the governing building code and with the referenced ACI 318. No hand mixing allowed.

B. Job-Site Mixing:

1. Mix materials for concrete in appropriate drum-type batch machine mixer. For mixers of one cu. yd. or smaller capacity, continue mixing at least 1-

1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cu. yd. or fraction thereof.

2. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

C. Ready-Mix Concrete:

1. Comply with requirements of ASTM C 94, and as specified.
2. When air temperature is between 85°F and 90°F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F, reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

3.1 FORM WORK:

A. Coordinate installation of joint materials, vapor barrier/retarder, and other related materials with placement of forms and reinforcing steel.

B. Design, erect, support, brace, and maintain formwork to support vertical and lateral loads, and static and dynamic loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment elevations, and position.

C. Construct forms in accordance with ACI 347, to sizes, shapes, lines and dimensions indicated, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, molding, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.

E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous location.

F. Chamfer exposed corners and edges 3/4" unless otherwise indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Preparation of Form Surfaces: Coat the contact surfaces of forms with a form-coating compound where applicable before reinforcement is placed.

H. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such ties. Accurately place and securely support items built in to form.

I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms after concrete placement, if required, to eliminate mortar leaks.

## 3.2 VAPOR BARRIER INSTALLATION:

A. Following leveling and tamping of granular base for slabs-on-grade, place vapor barrier in position with longest dimension parallel with direction of pour.

B. Lap joints 6" and seal with manufacturers recommended mastic or pressure sensitive tape.

## 3.3 PLACING REINFORCEMENT:

A. Comply with the Concrete Reinforcing Steel Institute (CRSI) recommended practice for "Placing Reinforcing Bars" for details and methods of reinforcement placement and supports, and as herein specified.

1. Avoid cutting or puncturing vapor barriers during reinforcement placement and concreting operations.

B. Clean reinforcement of loose rust, mill scale, dirt, and other materials or coatings which reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers as required.

D. Place reinforcement to obtain minimum coverages indicated, or if not indicated, in compliance with CRSI. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Do not place bars more than 2" beyond the last leg of continuous support. Do not use supports to hold runways for conveying equipment.

F. Install mesh welded wire fabric reinforcement in as long lengths as practicable, lapping pieces at least one mesh plus 2" but in no case less than 8". Lace splices with wire. Offset end laps to prevent continuous laps in either direction. Lift mesh to middle third of slab by use of hooks.

## 3.4 JOINTS AND INSERTS:

A. Joints: Provide construction and expansion joints. Locate and install joints, which are not shown on the drawings, so as not to impair the strength and appearance of structure. Submit joint schedule and details to Engineer.

1. Waterstops: Provide waterstops in construction joints as indicated. Install to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

B. Inserts: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, concrete. Properly locate embedded items in cooperation with other trades, and secure in position before concrete is poured. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

## 3.5 PREPARATION OF FORM SURFACES

A. Coat contact surfaces of forms with an approved nonresidual, low-VOC, form-coating compound before reinforcement is placed. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

## 3.6 CONCRETE PLACEMENT:

A. Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.

B. Pre-Placement Inspection: Before placing concrete, clean and inspect formwork, reinforcing steel, and items to be embedded or cast-in. Notify other crafts in ample time to permit the installation of their work, and cooperate with them in setting such work, as required. Make sure soil treatment for termite control has been applied to cushion fill before vapor barrier and concrete are installed. Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.

C. Notify Engineer 48 hours before placing any concrete.

D. Conveying: Convey concrete from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials. Provide equipment for chuting, pumping, and pneumatically conveying concrete of proper size and design as to insure a practically continuous flow of concrete at the point of delivery and without segregation of the materials. Keep open troughs and chutes clean and free from coatings of hardened concrete. Do not allow concrete to drop freely more than 10 feet. All equipment and methods used for conveying are subject to the approval of Engineer.

E. Depositing: Deposit concrete continuously or in layers of such thickness that no concrete will be placed on hardened concrete so as to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete near or in its final location to avoid segregation due to rehandling or flowing, and displacement of the reinforcement.

F. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

G. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps and hollows. Do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position during concrete placement.

H. Cold Weather Placing: Comply with the requirements of ACI 306 and as follows:

1. Protect concrete work from physical damage and reduced strength that could be caused by frost, freezing actions, and low temperatures.
2. When air temperature has fallen to or is expected to fall below 40`F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50`F and not more than 80`F at point of placement.

    a. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
    b. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted for mix designs.

I. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with the requirements of ACI 305 and as follows:

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90`F. Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
3. When acceptable to Engineer, and when required by high temperatures, low humidity, or other adverse placing conditions, use an approved water-reducing retarding admixture.

## 3.7 FINISH OF FORMED SURFACES:

A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a

minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

## 3.8 SLAB FINISHES:

A. Float Finish:

1. Apply float finish to slab surfaces to receive trowel finish and other finishes specified.
2. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(f) 18 (floor flatness) and F(l) 15 (floor levelness) measured according to ASTM E 1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to uniform, smooth, granular texture.

B. Trowel Finish:

1. Apply where exposed-to-view, and where slab surfaces are to be covered with tile, paint, resilient flooring, carpet, or other thin film finish coating system.
2. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(f) 20 (floor flatness) and F(l) 17 (floor levelness) measured according to ASTM E 1155. Grind smooth surface defects which would telegraph through applied floor covering.

C. Trowel And Fine Broom Finish: Where tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

D. Non-Slip Broom Finish: Apply at exterior concrete steps, ramps, walks, and mowing strips, and as indicated.

E. Concrete Sealer: Comply with manufacturer's instructions.

F. Concrete Stain: Comply with manufacturer's instructions.

## 3.9 CONCRETE CURING AND PROTECTION:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures; maintain concrete above 50°F. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less that 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as specified.

1. Provide moisture curing by keeping concrete surface continuously wet by covering with water, by water-fog spray, or by covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
2. Provide moisture-cover curing by covering concrete surface with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Provide curing and sealing compound on interior slabs left exposed; and to exterior slabs, walks, and curbs, as follows:

    a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
    b. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

C. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in

place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

D. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor toppings, and other flat surfaces by application of appropriate curing compound. Final cure concrete surfaces to receive finish flooring by moisture-retaining cover, unless otherwise directed.

## 3.10 REMOVAL OF FORMS:

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of work, may be removed after cumulatively curing at not less than 50°F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may be removed after 14 days if concrete has attained at least 75% of design minimum compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

## 3.11 REUSE OF FORM:

A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated or otherwise damaged form material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces except as acceptable to Engineer.

## 3.12 MISCELLANEOUS ITEMS:

A. Filling In: Fill in holes and openings left in concrete for the passage of work by other trades after their work is in place. Mix, place, and cure concrete to blend with in-place construction. Provide all other miscellaneous concrete filling required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to hard, dense finish and corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations. Set anchor bolts for machines and equipment to template at correct

elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

## 3.13 CONCRETE SURFACE REPAIRS:

A. Repair and patch defective areas with cement mortar of the same type and class as the original concrete, immediately after removal of forms. Cut out honeycomb, rock pockets, voids over 1/2" diameter, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface, before placing cement mortar in the same manner as adjacent concrete. Proprietary patching compounds may be used when acceptable to Engineer.

1. Smooth, Exposed-To-View Surfaces: Blend cements so that, when dry, patching mortar will match color of surrounding concrete. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
2. Concealed Formed Surfaces: Repair defects that adversely affect the durability of the concrete. If defects cannot be repaired remove and replace the concrete.
3. Other repair methods may be used, subject to acceptance by Engineer.

## 3.14 FIELD SAMPLING AND TESTING:

A. The following samples and tests will be performed by an independent testing laboratory approved by Owner and Engineer. Refer to paragraph 1.4 C. for responsibility for payment of tests.

B. Samples:

1. Field samples shall be made and cured in accordance with ASTM C 31, for each concrete strength, at the rate of 4 test cylinders and one slump test for each 50 cubic yards of concrete from each day's pour. In accordance with ASTM C 173 Volumetric Method, or ASTM C 231 Pressure Method, make air content check for each set of test cylinders. Air content and slump shall be checked and recorded at both truck discharge and point of placement for pumped concrete from the first load each day.
2. Test cylinders as follows: One at 7 days, two at 28 days, and reserve the remaining for testing after a longer period as required by Engineer, if the 28 day tests do not meet the required strength.
3. The taking of samples from small pours of 10 cubic yards or less may be omitted at the discretion of the Engineer.
4. Additionally, test slump every 25 cu. yds, recording location for report.
5. When early form removal is requested, field cure cylinders tested at 7 or less days to determine sufficient strength.

C. Testing:

1. Where average strength of any group of 3 cylinders falls below the minimum compressive strength or if individual cylinder falls more than 500 psi below minimum compressive strength specified, the Engineer shall have the right to require that test specimens be cut from the structure. Specimens shall be selected by Engineer from location in structure represented by test specimen or specimens which failed.
2. Specimens shall be secured, prepared, and tested in accordance with ASTM C 42, within a period of 60 days after placing concrete.
3. Concrete shall be considered to meet the strength requirement of this specification if it meets the strength requirements of paragraph 5.6.4 of ACI 318.
4. Should laboratory analysis indicate that the proper concrete mix has not been used by the Contractor, all such concrete poured using the improper mix shall be subject to rejection.
5. The cost of cutting specimens from the structure, patching the resulting holes, and making the laboratory analysis shall be borne by the Contractor.
6. The holes from which the cored samples are taken shall be packed solid with no slump concrete proportioned in accordance with the ACI 211 "Recommended Practice for Selecting Proportions of No-Slump Concrete". The patching concrete shall have the same design strength as the specified concrete.
7. If any of the specimens cut from the structure fail to meet the requirements outlined in paragraph 5.6.4 of ACI 318, the Engineer shall have the right to require any and all defective concrete to be replaced, and all costs resulting therefrom shall be borne by the Contractor.

D. Contractor Sampling: In addition to the slump tests specified above, the contractor shall keep a cone (mold) and rod apparatus on the job site for random testing of batches. When concrete does not meet the specified slump requirements, and when directed by the Engineer, immediately perform a slump test in accordance with ASTM C 143. Concrete not meeting the slump requirements shall be removed from the job site.

## 3.15 PROTECTION:

A. No wheeling, working, or walking on finished surfaces will be allowed for 16 hours after the concrete is placed.

B. Provide plywood or other acceptable protective cover at all traffic areas throughout the job.

C. Protect exposed concrete floors, steps, and walks from paint and other materials or equipment which may mar or damage these surfaces.

## 3.16 CLEAN-UP

A. Do not allow debris to accumulate. Clean up all concrete and cement materials, equipment and debris upon completion of any portion of the concrete work, and upon completion of entire cast-in-place concrete work.

**END OF SECTION**

# DIVISION 31 – EARTHWORK

31 00 00 – Earthwork

31 11 00 – Clearing & Grubbing

31 23 00 – Excavation and Fill

31 23 33 – Trenching and Backfilling

# SECTION 31 00 00
# EARTHWORK

## PART 1 GENERAL

### 1.01 SUMMARY

A. Section includes general earthwork for grading of the site, access roads, and stormwater facilities.

B. Related Sections:

1. Section 31 23 00 – Excavation and Fill
2. Section 31 23 33 – Trenching and Backfilling

### 1.02 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. ASTM D 422, Standard Method for Particle-Size Analysis of Soils.

2. ASTM D 698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.

3. ASTM D 1140, Standard Test Method for Amounts of Material in Soils Finer than the Number 200 Sieve.

4. ASTM D 1557, Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using Ten-Pound (4.54 kg) Hammer and 18-Inch (457 mm) Drop.

5. ASTM D 2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.

6. ASTM D 2487, Standard Test Method for Classification of Soils for Engineering Purposes.

7. ASTM D 2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

8. ASTM D 3017, Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

9. ASTM D 4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

10. ASTM D 5030 - 04, Standard Test Method for Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.

B. American Association of State Highway and Transportation Officials (AASHTO).

1. AASHTO T 96, Standard Method of Test for Resistance to Degardation of Small-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.

2. AASHTO T 85, Specific Gravity of Coarse Aggregate.

3. AASHTO T 104, Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.

C. Arkansas State Highway and Transportation Department (AHTD)

1. AHTD Standard Specifications for Highway Construction (2003 Edition)

## 1.03 DEFINITIONS

A. Excavation: Consists of the removal of material encountered to subgrade elevations and the reuse and/or disposal of materials removed.

B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base course.

C. Borrow: Soil material obtained from borrow areas when sufficient approved soil material is not available from excavations.

D. Unauthorized Excavation: Consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner's Representative. Unauthorized excavation shall be at the Contractor's expense.

## 1.04 QUALITY ASSURANCE/QUALITY CONTROL

A. Owner will retain the services of an inspection and testing firm to determine conformance of the materials and constructed work with the specifications, in accordance with the General Conditions.

## 1.05 PROJECT CONDITIONS

A. Provide temporary controls as specified in the General Conditions.

B. The Contractor is solely responsible for excavation slope stability. Excavation work shall be in compliance with applicable OSHA regulations and state regulations.

# PART 2 PRODUCTS

## 2.01 GENERAL

A. Provide all labor, materials, and equipment necessary to accomplish the Work specified in this Section.

## 2.02 SOIL MATERIALS

A. General Fill: onsite soil, shale, and sandstone blends with a maximum particle size of 6 inches. Material shall be free of debris, waste, frozen material, vegetation, and other deleterious matter.

B. Prepared Subgrade: In areas to be filled, unless otherwise noted, upper 6 inches of in-situ soil, scarified and recompacted to density of subsequent layer of fill/backfill material.

## 2.03 OTHER MATERIALS

A. Provide other materials, not specifically described herein but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

## 2.04 WATER FOR COMPACTION

A. Furnish as required.

# PART 3 EXECUTION

## 3.01 PREPARATION

A. Protect structures, utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Excavate areas as indicated on the Drawings in a safe manner and in conformance with all local, state, and federal regulations

C. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

D. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties.

## 3.02 DEWATERING

A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding surrounding areas of the project site.

B. Protect subgrade soils from softening and damage by rain or water accumulation.

C. Where surface seeps or springs are encountered, direct seepage to positive discharge at daylight or to a sump system.

## 3.03 EXCAVATION

A. Perform excavation of every type of material encountered within the limits of the Work to the lines, grades, and elevations indicated on the Drawings and specified herein.

B. Satisfactory Excavated Materials

1. Transport to and place in fill or embankment areas within the limits of Work or stockpile per subsection 3.08 of this Section.

C. Unsatisfactory Excavated Materials

1. Unsatisfactory material excavation shall include excavation and disposal of soft or compressible soils, boulders (particles in excess of 12 inches), or any materials judged by the Engineer to be unsuitable for foundations or the placement of compacted soils.

2. Excavate to a distance below grade as directed by the Engineer, and replace with satisfactory materials.

3. The Contractor shall include excavation of unsatisfactory materials, and replacement by satisfactory materials, as part of the Works of this Section.

D. Surplus Materials

1. Coordinate with the Owner or the Engineer to dispose of unsatisfactory excavated materials and surplus excavated satisfactory materials onsite in designated areas.

## 3.04 DITCHES

A. Cut accurately to the cross sections, grades, and elevations shown on the Drawings.

B. Maintain excavation from detrimental quantities of debris until completion of work.

C. Dispose of excavated materials as shown on the Drawings or as directed by the Owner or the Engineer, except do not, in any case, deposit materials less than 3 feet from the edge of a ditch.

## 3.05 UNAUTHORIZED EXCAVATION

A. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific instruction from the Engineer.

## 3.06 STABILITY OF EXCAVATIONS

A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

## 3.07 APPROVAL OF SUBGRADE

A. Notify the Engineer when excavations have reached required subgrade.

B. When the Engineer and/or a representative of the Engineer determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
   1. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Engineer.

## 3.08 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill soil, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust, as necessary.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

## 3.09 GENERAL BACKFILLING

A. Backfill excavations promptly, but not before completing the following:

1. Acceptance of construction below finish grade.

2. Surveying locations of underground utilities for record documents.

3. Testing, inspecting, and approval of underground utilities.

4. Removal of trash and debris from excavation.

5. Removal of temporary shoring and bracing, and sheeting.

## 3.10 GENERAL FILL

A. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills, except when indicated otherwise.

B. Place fill material in not more than 8 to 10-inch loose lifts to required elevations for each location indicated on the Drawings.

## 3.11 MOISTURE CONTROL

A. Unless otherwise noted for general fill, uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within -1 to +3% of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.

a. Stockpile or spread and dry removed wet satisfactory soil material.

## 3.12 COMPACTION

A. Place backfill and general fill materials in layers not more than 8 to 10 inches in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations.

C. Unless otherwise noted, scarify and recompact upper 6 inches of subgrade to density not less than required for the subsequent layer of fill/backfill material.

D. Percentage of Maximum Dry Density Requirements: Unless otherwise noted, compact soil to not less than the following percentages of maximum dry density according to ASTM D 698:

1. The upper 12 inches of fill below access road subgrade shall be compacted to 95% of maximum dry density.

2. All other areas, unless otherwise noted, compact each layer of backfill or fill material to 95% maximum dry density.

## 3.13 GRADING

A. General: Uniformly grade areas to a smooth surface free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and evaluations indicated.

1. Provide a smooth transition between existing adjacent grades and new grades.

2. Over excavate soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

B. Site Grading: Slope grades to prevent surface water from ponding. Finish subgrades to required elevations within plus or minus 0.10-foot tolerances.

## 3.14 FIELD QUALITY CONTROL

A. Allow Owner's Representative to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Perform field in-place density tests by the nuclear method according to ASTM D 2922.

B. When Owner's Representative reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

## 3.15 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Owner's Representative or Engineer; reshape and recompact to optimum moisture content or the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

**END OF SECTION**

# SECTION 31 11 00
# CLEARING AND GRUBBING

## PART 1 – GENERAL

### 1.01 SUMMARY

A. This section includes clearing and grubbing of vegetation, stripping of top soil, and disposal of vegetation.

### 1.02 QUALITY ASSURANCE

A. Site clearing shall be performed in a manner that does not disturb existing structures, utilities, survey control monuments, or other facilities not indicated or directed to be removed or abandoned.

B. Conform to applicable local codes for disposal of cleared and grubbed vegetation.

C. Coordinate clearing work with Owner and utility companies (as applicable)

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.01 CLEARING

A. Remove exposed trees, brush, logs, grass, and other vegetative material resting on or protruding through the ground surface in those areas identified for clearing or where construction will occur as shown on the Drawings.

B. Remove roots of all vegetation (including tree stumps) to a minimum depth of 1-ft below existing grade, or the proposed subgrade elevation, whichever is lower.

C. Limit clearing to areas necessary for construction.

### 3.02 TOPSOIL STRIPPING

A. Excavate topsoil and overburden soils from areas subject to construction of structures, roadways, and ponds. Stripping shall be extended at least 10 feet beyond toes of pond embankments.

B. Stockpile topsoil and overburden soils in an area where approved by the Owner or Engineer for later placement as topsoil on cut and fill slopes designated for vegetation. Implement temporary erosion and sediment control measures specified in Section 01 57 13.

## 3.03 DISPOSAL OF WOOD AND BRUSH

A. All wood and brush shall be disposed within 15 days after cutting or felling unless otherwise approved.

B. Burning of cleared materials will be allowed subject to approval of and coordination with the Owner.

**END OF SECTION**

**SECTION 31 23 00**
**EXCAVATION AND FILL**

## PART 1 GENERAL

### 1.01 SUMMARY

A. Section includes excavation, backfilling and compaction for installation of landfill liner system components.

B. Related Sections:

1. Section 31 00 00 - Earthwork

C. Definitions:

1. Excavation: Consists of the removal of material encountered to the appropriate subgrade elevations shown on the drawings.

2. Unauthorized Excavation: Consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner's Representative or Engineer. Unauthorized excavation shall be at the Contractor's expense.

3. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below a proposed structure, facility, or construction features shown on the drawings.

4. Borrow: Soil material obtained from borrow areas when sufficient approved soil material is not available from excavations.

5. Unsuitable Material: Topsoil, peat, organic soils, lignite, debris, rubble, and soft, loose or saturated soils, as determined by the Owner's Representative or Engineer.

6. Lift: Constructed portion of backfill layer comprised of suitable material placed in specified compacted thicknesses.

### 1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D 422, Standard Method for Particle-Size Analysis of Soils.

2. ASTM D 698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.

3. ASTM D 1140, Standard Test Method for Amounts of Material in Soils Finer than the Number 200 Sieve.

4. ASTM D 1557, Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using Ten-Pound (4.54 kg) Hammer and 18-Inch (457 mm) Drop.

5. ASTM D 2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.

6. ASTM D 2487, Standard Test Method for Classification of Soils for Engineering Purposes.

7. ASTM D 2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

8. ASTM D 3017, Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

9. ASTM D 4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

10. ASTM D 5030 - 04, Standard Test Method for Density of Soil and Rock in Place by Water Replacement Method in a Test Pit.

B. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T 96, Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

2. AASHTO T 85, Specific Gravity of Coarse Aggregate

3. AASHTO T 104, Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.

C. Arkansas State Highway and Transportation Department (AHTD):

1. AHTD Standard Specifications for Highway Construction (2003 Edition)

## 1.03 SUBMITTALS

A. Submit under provisions of the General Conditions.

B. Test Results: The testing laboratory shall submit written reports of all specified tests, showing conformance of the materials and constructed work with the specifications.

C. Contract shall provide for and submit as-built survey maps of each specified fill layer.

## 1.04 QUALITY ASSURANCE/QUALITY CONTROL

A. Testing work to be performed in accordance with the technical specifications, and in accordance with the General Conditions.

B. Use special testing frequency at discretion of Owner's Representative or Engineer when visual observations of construction performance indicate potential problems. Additional testing for suspected areas shall be considered when:

1. Rollers slip during rolling operation.
2. Lift thickness is greater than specified.
3. Fill materials are at improper or variable moisture content.
4. The number of roller passes is less than specified number.
5. Compaction equipment has dirt-clogged rollers.
6. Compaction equipment may not be using optimum ballast.
7. Fill materials differ substantially from those specified.
8. Degree of compaction is doubtful.
9. Directed by the Owner's Representative or the Engineer.

D. During construction, testing frequency may also be increased in following situations:

1. Adverse weather conditions.
2. Breakdown of equipment.
3. At start or finish of grading.
4. Material fails to meet specifications.
5. Work area is reduced.

## 1.05 PROJECT CONDITIONS

A. Work shall be performed in a manner that does not disturb existing survey control monuments or other site facilities not indicated to be removed within the construction limits.

B. Provide temporary controls as specified in the General Conditions.

C. The Contractor is solely responsible for excavation slope stability. Excavation work shall be in compliance with applicable OSHA and state regulations.

# PART 2 PRODUCTS

## 2.01 GENERAL

A. Proposed materials shall be approved for use on this project by the Owner's Representative or the Engineer as specified, prior to use of the material in the construction.

B. Fill material to be reasonably well-graded soils derived from onsite and borrow sources.

C. Soil materials onsite, in-place, and/or in stockpiles are available for use in the construction operations. These materials are to be used subject to acceptance by the Owner's Representative or the Engineer.

## 2.02 GENERAL FILL

A. Material shall meet the standards as defined in Section 31 00 00.

B. Place in areas as shown on Drawings, including but not necessarily limited to geomembrane anchor trenches, pond bottom, and gravel access road subgrade.

# PART 3 EXECUTION

## 3.01 GENERAL

A. Prior to beginning excavation work, Contractor shall review and satisfy himself as the adequacy and accuracy of the control surveys and data established by the Owner's Representative for the purpose of computing payment quantities. Contractor may make such measurements and surveys as it deems necessary to confirm the Owner's Representative control surveys. Any variances or discrepancies will be resolved by the Engineer.

B. Flag and protect all known utilities and other site facilities.

## 3.02 EXCAVATION

A. Excavation consists of open-cut excavation and removal of all types of material encountered when establishing required subgrade and finished grade.

B. Unauthorized excavation consists of removal of materials beyond indicated subgrade or finished elevations without specific direction of the Owner or Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer shall be at the Contractor's expense. Backfill and compact unauthorized excavations with material of subsequent layer and meet specified density of that layer.

C. Excavate areas as indicated on the Drawings in a safe manner and in conformance with all local, state, and federal regulations. Rock excavation shall be in accordance with the Standard Specifications of the Arkansas State Highway and Transportation Department (latest revision).

D. Separate excavated materials into stockpiles as shown on the Drawings and/or as directed by the Engineer. Maintain stockpiles in free-draining condition.

E. Grade final surfaces to the lines and elevations shown on the Drawings with a tolerance of plus or minus 0.1 foot.

F. Final surfaces shall be free of loose material, clods, and other debris including grading stakes and hubs.

G. Grade top perimeter of excavation to prevent surface water from draining into excavation area.

H. Upon completion of excavation, notify Engineer before proceeding with backfilling operations.

## 3.03 REMOVAL OF WATER

A. Provide and operate equipment adequate to keep all excavations free of water as specified in the General Conditions.

## 3.04 PREPARATION

A. Prior to placement of fill materials, examine all surfaces and subgrades to receive fill to identify the existence of soft areas caused by ponding water or unsuitable soils. If possible, proof-roll area with a large rubber-tired vehicle of sufficient weight to reveal unstable areas. Remove all unsuitable soils and backfill with subsequent materials and compact to density as specified for that particular material layer.

B. Scarify top 6 to 8 inches of subgrade, moisture condition, and unless otherwise noted, compact to moisture content and minimum density not less than the subsequent layer of fill/backfill material.

C. Survey Engineer-approved prepared subgrade area for Record Drawings in conformance with the General Conditions. Acceptable tolerances on survey coordinates shall be plus or minus 0.1 foot on elevations and coordinates, unless otherwise specified.

D. Maintain benchmarks and other elevation control points; re-establish, if disturbed or destroyed, at no additional cost to the Owner.

## 3.05 BACKFILLING

A. Notify Engineer at least 48 hours prior to placing any fill material.

B. Place fill material in accordance with procedures required to achieve specified performance standards outlined in each referenced section.

C. Hauling and spreading equipment will not be considered as compaction equipment unless Contractor has demonstrated suitability on test pad.

D. Contractor is responsible for maintaining proper lift thickness to achieve compaction as stated below. Place and compact fill materials in maximum uncompacted lift thickness and to minimum density indicated.

E. Material not meeting specified density shall be additionally compacted to meet specifications, or removed. Material not within specified moisture content range shall be scarified, moisture conditioned, and recompacted to meet the specifications, or removed.

### TABLE 31 23 00-1
### COMPACTION REQUIREMENTS

| Material | Maximum Lift Thickness (inches) | Minimum Compaction (%) | Optimum Moisture Content (%) |
|---|---|---|---|
| General Fill | 10 inches | 95 Standard Proctor, unless otherwise specified | Minus 1 to plus 3% of OMC |

## 3.05 FIELD QUALITY CONTROL

A. Tests specified herein shall be performed by Construction Quality Assurance (CQA) soil testing firm during placement of fill material.

B. Testing of General Fill:

1. Compaction/Density tests, (using ASTM D 2922) and Moisture Content (using ASTM D 3017): Minimum of one test per 10,000-square foot area for each compacted lift, and at every material change.

C. Compacted fill that does not meet density specifications shall be scarified, the moisture content adjusted, and the area recompacted and re-tested at Contractor's expense.

D. Surveying shall be performed to monitor as-built soil layer elevations. Measure on a 50-foot maximum grid pattern and at all break lines at the following locations:

1. Prepared Subgrade (Including pipe trenches).
2. Finished slopes, roads, benches, and channels beyond limits of ponds.

E. Provide topographic survey maps of the as-built surfaces to Engineer for review and approval before proceeding with subsequent construction. Survey maps shall be prepared by a registered Land Surveyor.

## 3.06 STOCKPILING

A. Locate stockpiles as shown on Drawings, or as directed by the Engineer or Owner. Do not exceed 20-foot height of piles unless permitted by the Engineer or Owner. Place, grade, and shape stockpiles for proper drainage. Stockpiles shall have a minimum side slopes of 2 horizontal to 1 vertical.

B. Provide erosion control fences and barriers to prevent loss of material or movement outside the stockpile limits, as necessary.

**END OF SECTION**

**SECTION 31 23 33**
**TRENCHING AND BACKFILLING**

## PART 1. GENERAL

## PART 1.1 SUMMARY

A. Work of this Section also includes:
   1. Replacing topsoil that contains regenerative material.
   2. Disposal of trees, stumps, brush, roots, limbs, and other waste materials from clearing operations.
   3. Imported topsoil.
   4. Crush rock backfill required by over-excavation.
   5. Imported pipe zone material.
   6. Trench settlement repair, including replacing roadway surfacing, sidewalk, or other structures.
   7. Replacing damaged culverts.

B. Trench excavation is classified as common excavation and includes removal of material of whatever types encountered including rock to depths shown or as directed by Engineer.

C. Pipe zone includes full width of excavated trench from bottom of pipe to a point 6 inches above top outside surface of pipe barrel.

D. Conform to federal, state, and local codes governing safe loading of trenches with excavated material.

E. The right is reserved to modify the use, location, and quantities of the various types of backfill during construction as Engineer considers to be in the best interest of Owner.

F. There shall be no extra compensation for dewatering and rock excavation.

## PART 1.2 RELATED SECTIONS

A. Section 32 92 19 – Polyethylene Pipe and Fittings.

## PART 1.3 REFERENCES

A. Arkansas Highway and Transportation Department, P.O. Box 2262, Little Rock, Arkansas 72203, latest edition.
   1. AHTD 303 - Aggregate Base Course.

B. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

1. ASTM D448 - Classifications for Standard Sizes of Aggregate and Bridge Construction.
2. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb. (2.49-kg.) Rammer and 12-inch (304.8-mm) Drop.
3. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 10-lb. (4.54-kg.) Rammer and 18-inch (457-mm) Drop.
4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes.
5. ASTM D2922 - Test Methods for Density of Soils and Soil-Aggregates in Place by Nuclear Method.

C. Occupational Safety and Health Administration (OSHA) Standard for Excavation and Trenches Safety System, 29 CFR 1926, Subpart P = Excavations.

D. The Contractor shall be solely responsible for trench and excavation safety systems in accordance with Act 291 of 1993.

## PART 2. PRODUCTS

### 2.1 FOUNDATION STABILIZATION

A. Crushed gravel or crushed rock, free from dirt, clay balls, or organic material, well graded from coarse to fine, containing sufficient finer material for proper compaction, and meeting ASTM D448 Size No. 67 (Concrete Aggregate).

### 2.2 PIPE ZONE MATERIAL

A. Select material shall consist of fine loose earth or sand free from clods or rocks larger than 3/4 inches in dimension and of proper moisture content for maximum consolidation.

B. Crushed granular material conforming to ASTM D448, Size No. 67.

C. Washed stone bedding size 1/4-inch to 3/4-inch.

D. Class 7 Granular Material.

### 2.3 COMMON FILL MATERIALS

A. Material shall not contain pieces larger than 3 inches, and shall be free of roots, debris, or organic matter.

## 2.4 SELECT FILL MATERIALS

A. Class 7 and Class 4 as established by Section 303 of Arkansas Highway and Transportation Department Standard Specifications for Highway Construction.

B. ASTM Soil Classification GC as set forth in ASTM Designation D2487-92. On site material may be used, provided it is in accordance with ASTM D2487-92.

## 2.5 BEDDING MATERIAL

A. Pea gravel, sand, or other locally available bedding material, as approved.

## 2.6 TRENCH BACKFILL

A. Granular Backfill:
   1. Natural or artificial mixture of gravel and soil mortar uniformly well graded from coarse to fine.
   2. AHTD Section 303 Class 4 or Class 7 as specified in this Section.

## 2.7 PVC WATER AND SEWER PIPE TRENCH

A. See Drawings for trench details.

## 2.8 COMPACTION EQUIPMENT

A. Suitable type and adequate to obtain the amount of compaction specified.

B. Operate in strict accordance with manufacturer's instructions and recommendations and maintain in such condition so that it will deliver manufacturer's rated compactive effort.

## 2.9 IMPORTED TOPSOIL

A. Suitable sandy loam from an approved source.

B. Must possess friability and a high degree of fertility.

C. Free of clods, roots, gravel, and other inert material.
D. Free of quackgrass, horsetail, and other noxious vegetation and seed.

## PART 3. EXECUTION

### 3.1 PREPARATION

A. Where clearing or partial clearing of right-of-way is necessary, complete prior to start of trenching.

B. Cut trees and brush as near to surface of ground as practicable, remove stumps, and pile for disposal.

C. Do not permit excavated materials to cover brush or trees prior to disposal.

### 3.2 PREVENT TRENCH WATER AND ANIMALS FROM ENTERING PIPE

A. When pipe laying is not in progress, including noon hours, open ends of pipe shall be closed; and no trench water, animals, or foreign material shall be permitted to enter the pipe.

### 3.3 DISPOSAL OF CLEARED MATERIAL

A. Dispose of material in such a manner to meet requirements of state, county, and local regulations regarding health, safety, and public welfare.

B. Dispose of nonflammable and flammable material off the construction site in an approved location.

C. Do not leave material on the Project site, shove onto abutting private properties, or bury in embankments or trenches.

### 3.4 REMOVAL OF OBSTRUCTIONS

A. Remove obstructions within trench area or adjacent thereto such as tree roots, stumps, abandoned piling, logs, and debris.

B. Engineer may, if requested, make changes in the trench alignment to avoid major obstructions, if such alignment changes can be made within the easement or right-of-way without adversely affecting the intended function of the facility.

C. Dispose of obstructions in accordance with this Section.

### 3.5 REMOVAL AND REPLACEMENT OF TOPSOIL

A. Where trenches cross lawns, garden areas, pasturelands, cultivated fields, or other areas on which reasonable topsoil conditions exist, remove topsoil for a depth of 6 inches for full width of trench to be excavated.

B. Use equipment capable of removing a uniform depth of material.

C. Stockpile removed topsoil at regular intervals, and do not mix with other excavated material.

D. Locate stockpiles so that material of one ownership is not transported and stockpiled on property of another ownership.

E. Minimum finished depth of topsoil over trenches: 5 inches.

F. Imported topsoil may be substituted for stockpiling and replacing topsoil.

G. Maintain finished grade of topsoil level with area adjacent to trench until final acceptance by Engineer.

H. Repair damage to adjacent topsoil caused by work operations.
   1. Remove rock, gravel, clay, and other foreign materials from the surface.
   2. Regrade.
   3. Add topsoil as required.

## 3.6 TRENCH WIDTH

A. Minimum width of unsheeted trenches where pipe is to be laid shall be 18 inches greater than the outside diameter of the pipe, or as approved.

B. Maximum width at top of trench will not be limited, except where excess width of excavation would cause damage to adjacent structures or property or cause undue stresses on the pipe.

C. Confine trench widths to dedicated rights-of-way or construction easements, unless special written agreements have been made with affected property owner.

## 3.7 EXCAVATION

A. Excavate trench to lines and grades shown or as established by Engineer with proper allowance for pipe thickness and for pipe base or special bedding when required.

B. If trench is excavated below required grade, correct with foundation stabilization material.

C. Place material over full width of trench in compacted layers not exceeding 6 inches deep to established grade with allowance for pipe base or special bedding.

## 3.8 PREPARATION OF TRENCH - LINE AND GRADE

A. Do not deviate more than ½ inch from line or ½ inch from grade. Measure for grade at the pipe invert, not at the top of the pipe, because of permissible variation in pipe wall thickness.

B. Grade the bottom of the trench by hand to the line and grade where the pipe is to be laid, with proper allowance for pipe thickness and for pipe base when specified or indicated.

C. Remove hard spots that would prevent a uniform thickness of bedding.

D. Check the grade with a straightedge and correct irregularities found.

E. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of lifting tackle.

## 3.9 SHORING, SHEETING, AND BRACING OF TRENCHES

A. Sheet and brace trench when necessary to prevent caving during excavation in unstable material or to protect adjacent structures, property, workers, and the public.

B. Increase trench widths accordingly by the thickness of the sheeting.

C. Maintain sheeting in place until pipe has been placed and backfilled at pipe zone.

D. Remove shoring and sheeting as backfilling is done in a manner that will not damage pipe or permit voids in backfill.

E. Conform to safety requirements of federal, state, or local public agency having jurisdiction for sheeting, shoring, and bracing of trenches; the most stringent of these requirements shall apply.

## 3.10 LOCATION OF EXCAVATED MATERIALS

A. Place excavated material only within construction easement, right-of-way, or approved working area.

B. Do not obstruct private or public traveled roadways or streets.

## 3.11 REMOVAL OF WATER

A. Provide and maintain ample means and devices to promptly remove and dispose of water entering trench during time trench is being prepared for pipe laying, during laying of pipe, and until backfill at pipe zone is completed.
   1. These provisions apply during the noon hour as well as overnight.
   2. Provide necessary means and devices, as approved, to positively prevent under water from entering the construction area of another contractor.

B. Dispose of water in a manner to prevent damage to adjacent property.

C. Drainage of trench water through the pipeline under construction is prohibited.

## 3.12 FOUNDATION STABILIZATION

A. When existing material in bottom of trench is unsuitable for supporting pipe, excavate unsuitable material.

B. Backfill trench to subgrade of pipe base with foundation stabilization material specified.

C. Place foundation stabilization material over the full width of trench and compact in layers not exceeding 6 inches deep to required grade by making passes with a vibratory compactor (or equivalent).

D. Material shall be considered unsuitable when it contains more than 5 percent organic material by volumetric sampling or when it will not support a reading of 1.5 on a hand penetrometer.

## 3.13 ROCK IN PIPE TRENCH

A. Where rock is encountered in bottom of trench, support pipe on bedding material.

B. Minimum Bedding Thickness: Minimum of 4 inches or one eighth of the outside diameter of pipe, whichever is greater.

C. Extend bedding up pipe sides one sixth of outside diameter of the pipe, minimum.

D. Backfill over pipe according to pipe zone type.

## 3.14 PIPE ZONE BACKFILL

A. Depth of the pipe zone above pipe barrel varies with pipe material.

B. Particular attention must be given to area of pipe zone from flow line to centerline of pipe to ensure firm support is obtained to prevent lateral movement of pipe during final backfilling of pipe zone.

C. Backfill area of pipe zone from bottom of pipe to horizontal centerline of pipe by hand-placing material around pipe in 4-inch layers.

D. Achieve continuous support beneath pipe haunches by "walking in" and slicing with shovel.

E. Backfill area of pipe zone from horizontal centerline to top of pipe zone with pipe zone material as determined by class of backfill.

F. In lieu of selected material for pipe zone in upper portion of pipe zone, imported pipe zone material approved by Engineer for trench backfill may be substituted.

G. If the Engineer determines that the existing material is insufficient or unsuitable at trench side for selected material for pipe zone in upper portion of pipe zone, provide suitable material from other trench excavation along pipeline or imported pipe zone material.

## 3.15 TRENCH BACKFILL ABOVE PIPE ZONE

A. When backfill is placed mechanically, push backfill material onto slope of backfill previously placed and allow to slide down into trench.

B. Do not push backfill into trench in such a way as to permit free fall of material until at least 2 feet of cover is provided over top of pipe.

C. Under no circumstances allow sharp, heavy pieces of material to drop directly onto pipe or tamped material around pipe.

D. Do not use backfill material of consolidated masses larger than ½ cubic foot.

## 3.16 EXCESS EXCAVATED MATERIAL

A. Dispose of excess excavated material off project site in an approved area.

## 3.17 DRAINAGE CULVERTS

A. Replace drainage culverts which are removed on near right angles to pipe centerline.

B. If pipe cannot be reused or is damaged during removal, dispose of it and provide new pipe.

C. Protect culverts from damage or restore to equivalent condition.

D. Replace culverts to existing lines and grades.

E. Do not replace culverts until proposed pipeline is installed and backfill of trench has been completed to subgrade of culvert.

## 3.18 PIPE COVER

A. Place select material from excavation over pipe to provide minimum coverage, as shown on Drawings or as directed by Engineer.

## 3.19 DRAINAGE DITCH RESTORATION

A. Undercrossings of minor drainage ditches not covered in another Specification Section shall be backfilled so that upper 1 foot of material in ditch between ditch banks is clay.

B. Compact material for full ditch width by 6 passes of vibratory compactor (or equivalent).

C. Where indicated on Drawings, provide concrete arch, and/or riprap on ditch banks.

## 3.20 SETTLEMENT

A. Correct settlement noted in backfill, fill, or in structures built over backfill or fill within warranty period.

## 3.21 IMPORTED TOPSOIL

A. Should regenerative material be present in soil, remove both surface and root which appears in within 1 year following acceptance of Project in a manner satisfactory to Owner.

**END OF SECTION**

# DIVISION 32 – EXTERIOR IMPROVEMENTS

32 11 23 – Aggregate Base Course

32 92 19 – Seeding

**SECTION 32 11 23**
**AGGREGATE BASE COURSE**

## PART 1. GENERAL

### 1.1 SUMMARY

A. This item shall consist of a foundation course for surface course, for other base courses, or for pavements.

B. It shall be constructed on the prepared subgrade, subbase, or other completed base course according to these specifications and in substantial conformity with the lines, grades, compacted thickness, and typical cross section shown on the plans.

## PART 2. PRODUCTS

### 2.1 MATERIALS

A. Aggregate Base Course shall be either gravel and/or crushed stone so proportioned as to meet the requirements for a class of aggregate specified in the following table:

| Sieve,mm | Class 1 | Class 2 | Class 3 | Class 4 | Class 5 | Class 6 | Class 7 | Class 8 |
|---|---|---|---|---|---|---|---|---|
| | | | | **PERCENT PASSING** | | | | |
| 75 (3") | 100 | 100 | 100 | | | | | |
| 50 (2") | 95-100 | 95-100 | 95-100 | | | | | |
| 37.5 (1-1/2") | | | | 85-100 | 100 | 100 | 100 | |
| 25.0 (1") | | | | | | | | 100 |
| 19.0 (3/4") | 60-100 | 60-100 | 60-100 | 60-100 | 60-100 | 50-90 | 50-90 | 65-100 |
| 9.5 (3/8") | 40-8- | 40-80 | 40-80 | 40-80 | 40-80 | | | |
| 4.75 (#4) | 30-60 | 30-60 | 20-60 | 30-60 | 30-60 | 25-55 | 25-55 | 25-55 |
| 2.0 (#10) | 20-50 | 20-50 | 20-45 | 20-45 | 20-45 | | | |
| 0.425 (#40) | 10-35 | 10-35 | 10-35 | 10-35 | 10-35 | 10-30 | 10-30 | 10-30 |
| 0.075 (#200) | 3-15 | 3-15 | 3-12 | 3-12 | 3-12 | 3-10 | 3-10 | 3-10 |
| MAX. PLASTICITY INDEX (MINUS 0.425 MATL.) | 13 | 10 | 6 | 6 | 6 | 6 | 6 | 6 |
| (#40) MINIMUM PERCENT CRUSHED (RETAINED ON 4.75 mm [#4] SIEVE | | | | | 15 | | | |
| MINIMUM PERCENT CRUSHER-RUN MATERIAL | | | | | | 90 | 90 | 90 |

B. Class 7 and 8 shall be any mechanically crushed natural rock or stone of igneous, sedimentary, and/or metamorphic origin produced from a solid geological formation by quarrying method.

C. The Contractor shall have the option of using any higher numbered class Aggregate Base Course than that specified, provided that payment will be for the class specified.

D. Material furnished for Aggregate Base Course, Class 3 through Class 8, shall have a percent of wear by the Los Angeles Test not greater than 45 as determined by AASHTO T 96.

E. When it is necessary to blend two or more materials, each material shall be proportioned separately through mechanical feeders to ensure uniform production. Premixing or blending to avoid separate feedings will not be permitted. Production of material by blending materials on the roadway to obtain a mixture that will comply with the requirements specified herein will not be permitted.

F. For the purpose of this specification, shale and slate are not considered to be gravel or stone. The material furnished shall not obtain more than 5percent by weight of shale, slate, and other objectionable, deleterious, or injurious matter.

G. For Class 1 and 2 materials, the fraction passing the 0.075 mm (#200) sieve shall not be greater than three-fourths of the fraction passing the 0.425 (#40) sieve. For Classes 3 through 8, the fraction passing the 0.075 mm (#200) sieve shall not be greater than two-thirds of the fraction passing the 0.425 mm (#40) sieve. For Classes 3 through 8 the fraction passing the 0.425 mm (#40) sieve shall have a liquid limit not greater than 25.

H. To ensure that gravel is uniformly graded, the difference between the percent passing the various sieves shall be as follows for Classes 3, 4 and 5:

| **Sieve** | | **Percent** |
|---|---|---|
| 19.0 mm - 9.5 mm | (3/4" - 3/8") | 5 min. |
| 9.5 mm - 4.75 mm | (3/8" - #4) | 5 min. |
| 4.75 mm - 2.00 mm | (#4 - #10) | 5 min. |
| 2.0 mm - 0.425 mm | (#10 - #40) | 4 min. |

I. When the material contains aggregate larger than that specified above for the class called for in the Contract, the oversize aggregate shall be removed by screening or by screening and crushing. The removal of large size aggregate by hand methods will not be permitted.

## PART 3. EXECUTION

### 3.1 CONSTRUCTION REQUIREMENTS

A. The base course material shall be placed on a completed and approved subgrade or existing base that has been bladed to substantially conform to the grade and cross section shown on the plans.

B. The subgrade shall be prepared as specified in Section 02300 - Earthwork, and shall be free from an excess or deficiency of moisture at the time of placing base course material.

1. The subgrade shall also comply, where applicable, with the requirements of other items that may be contained in the Contract that provide for the construction, reconstruction, or shaping of the subgrade or the reconstruction of the existing base course.

C. Base course material shall not be placed on a frozen subgrade or subbase.

D. The aggregate shall be placed on the subgrade or other base course material and spread uniformly to such depth and lines that when compacted it will have the thickness, width, and cross section shown on the Drawings.

E. If the required compacted depth of the base course exceeds 150 mm (6 inches), the base shall be constructed in two or more layers of approximate equal thickness. The maximum compacted thickness of any one layer shall not exceed 150 mm (6 inches) except when vibrating or other approved types of special compacting equipment are used, the compacted depth of a single layer of base course may be increased to 200 mm (8 inches) upon approval of the Engineer.

F. The material shall be spread the same day that it is hauled. Spreading shall be performed in such a manner that no segregation of course and fine particles nor nests or hard areas caused by dumping the aggregate on the subgrade will exist. Care shall be taken to prevent mixing of subgrade or unspecified material with the base course material during the blading and spreading operation.

G. Aggregate shall not be dumped or mixed on an existing or newly constructed ACHM course or PCC Pavement that will not be overlaid under the same Contract nor on any open graded base course. Mechanical spreading equipment shall be used, if necessary, to place the base course on the subgrade.

H. If sufficient working space is not available to allow proper aeration or addition of water to the base, the base material shall be mixed by any satisfactory method before placement.

I. Each course shall be thoroughly mixed for the full depth of the course and shall be compacted by any satisfactory method that will produce the density thereinafter specified.

1. The aggregate shall be maintained substantially at optimum moisture during the mixing, spreading, and compacting operations, water being added or the material aerated as may be necessary.
2. The specified grade and cross section shall be maintained by blading throughout the compaction operation.
3. The material in each course shall be compacted to a density, as determined by AASHTO T 238, Method B, of not less than 98 percent of the maximum laboratory density determined in the laboratory by AASHTO T 180, Method D.
4. The aggregate shall be compacted across the full width of application.

J. The compacted base course shall be tested for depth and any deficiencies corrected by scarifying, placing additional material, mixing, reshaping, and recompacting to the specified density, as directed.

K. Where neither prime coat nor surfacing is provided in the same Contract with the base course, the material in the base course shall be uniformly compacted, stable, and free of segregated areas.

L. The Contractor shall maintain the base course in a satisfactory condition until accepted.

## 3.2 QUALITY CONTROL

A. To assure that the material used meets the requirements of the specifications, certain tests for quality control and acceptance will be performed as specified herein. The properties for which quality control and acceptance testing will be performed are gradation, density, moisture content, plasticity index, and thickness as specified in each Section.

B. The maximum laboratory density shall be determined as follows:

| **% Retained - 4.75 mm (#4) Sieve** | **Test Method** |
|---|---|
| 10 Max. | AASHTO T 99, Method A |
| 11 - 30 | AASHTO T 99, Method C |
| 31 Min. | AASHTO T 180, Method D |

**Note:** In lieu of AASHTO T224, correction for coarse particles retained on the 3/4" (19.0 mm) sieve shall be determined by replacing with an equal mass of material passing the 3/4" (19.0 mm) sieve and retained on the #4 (4.75 mm) sieve.

C. The in-place density shall be determined by using AASHTO T 310, Direct Transmission. The moisture content shall be determined by AASHTO T 310 or AHTD Test Method 347 or 348. A new maximum laboratory density and optimum moisture will be determined whenever the Engineer deems necessary or upon evidence provided by the Contractor.

D. Tests for gradation, liquid limit, and plasticity index shall be performed by AASHTO T 11, T 27, T 89, and T 90.

E. The Contractor shall furnish all personnel, equipment, and facilities necessary to perform the required sampling and testing.

F. The Contractor shall provide the Engineer with the opportunity to observe all quality control sampling and testing.

G. All quality control sampling and testing shall be performed by or under the direct supervision of a technician acceptable to the Owner and in accordance with AHTD's Manual of Field Sampling and Testing Procedures. Test reports shall be signed and copies made available to the Engineer if requested.

H. If the results of any test shows that the required minimum density has not been obtained, corrective action shall be taken, followed by a re-test at the same location. The original and re-test reports shall be cross referenced. All corrective actions shall be performed by the Contractor at no cost to the Owner.

## 3.3 ACCEPTANCE

A. Acceptance testing for thickness (when specified on the Drawings), gradation, plasticity index, density, and moisture content will be based on lots. The size of standard lots will be 100 cubic yards. Partial lots, of any size, may be established by the Engineer at any time.

B. Test methods for acceptance shall be the same as specified for quality control testing.

C. The item of work being tested shall not be considered complete or accepted until passing test reports are submitted to the Engineer.

D. The Contractor shall take one test for all properties in each lot or partial lot at a location randomly selected by the Engineer.

E. In addition to the required acceptance tests, the Engineer may require the Contractor to test any location that, by visual observation, appears to be defective.

F. The Contractor's acceptance sampling and testing procedures and results will be subject to independent assurance sampling and testing conducted by the Owner. The Contractor shall be required to make changes to the equipment and/or procedures if the such tests are unable to verify the Contractor's test results.

G. All acceptance testing performed by the Contractor is subject to observation by the Engineer. All test reports shall be signed and submitted to the Engineer the next business day after the tests are performed.

H. If a lot or a partial lot fails to meet the specifications, the Contractor shall remove and replace that lot or partial lot with acceptable material at no cost to the Owner. Tests will be performed on the replacement material as required for the original material. Acceptance of the replacement material will be the same as for the original material.

I. Payment for the quantity in the original lot will be withheld or recovered, and released after the removal and replacement has been acceptably performed.

**END OF SECTION**

# SECTION 32 92 19
# SEEDING AND MULCHING

## PART I GENERAL

### 1.01 SUMMARY

A. Section includes establishing a stand of grass on all areas disturbed by construction.

### 1.02 QUALITY ASSURANCE/QUALITY CONTROL

A. Seeding shall be accomplished according to standard local practice and in compliance with requirements of applicable state and federal regulations.

### 1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver packaged materials in containers showing weight, analysis and name of manufacturer.

B. Protect materials from deterioration during delivery, and while stored at site.

### 1.04 PROJECT CONDITIONS

A. Perform seedbed preparation and seeding as soon as possible after completion of grading and compaction in each area.

B. Seeding shall be performed only during the appropriate growing season for the particular seed mix, as recommended by the local agricultural extension office and approved by the Engineer.

## PART 2 PRODUCTS

### 2.01 FERTILIZER

A. Shall be a standard commercial fertilizer, delivered to the project in bags clearly labeled showing percentages of nitrogen, phosphoric acid, and potash nutrients.

B. The grade of fertilizer shall be the following:

| | |
|---|---|
| Nitrogen | 10 percent |
| Phosphoric Acid | 20 percent |
| Water Soluble Potash | 10 percent |

## 2.02 LIME

A. Shall be ground limestone containing not less than 85% total carbonates and of a fineness so that 90% will pass through a No. 20 mesh sieve and 50% will pass through a No. 100 mesh sieve.

## 2.03 SEED

A. The types and quantities of grass seed to be planted per acre are as follows:

1. Spring Planting (March 15 - June 15):

| | |
|---|---|
| Bermuda Grass (Common) unhulled | 10 lbs. |
| Bermuda Grass (Common) hulled | 5 lbs. |
| Laspedeza (Korean) | 30 lbs. |

2. Summer Planting (June 16 – August 31):

| | |
|---|---|
| Bermuda Grass (Common) unhulled | 10 lbs. |
| Bermuda Grass (Common) hulled | 5 lbs. |
| Weeping Love Grass (Eragrostis Curvula) | 10 lbs. |

3. Fall/Winter Planting (September 1 – March 14)

| | |
|---|---|
| Annual Rye grass or other Cereal Grasses | 30 lbs. |
| Crimson Clover (Dixie) | 20 lbs. |
| Bermuda Grass (Common) unhulled | 20 lbs. |
| Laspedeza (Korean) | 30 lbs. |

## 2.04 WATER

A. Clean, potable.

## 2.05 MULCH AND OTHER EROSION CONTROL

A. Cover material shall be chopped hay mulch generally derived from rice, wheat, oats, barley, or other suitable material.

# PART 3 EXECUTION

## 3.01 SOIL SAMPLING

A. An independent testing firm retained by the Contractor shall obtain samples of the soil to be seeded and send the samples to a local agricultural extension office for recommendations on fertilizer, lime and seed mix to be used.

B. One sample shall be taken at least for approximately every 5 acres of area, or as otherwise determined necessary by the Engineer. Each sample shall be a minimum 10 ounce sample.

## 3.02 PREPARATION

A. Surface shall be scarified to an approximate depth of 3 inches to be seeded.

B. Surface shall be reasonably smooth and free of litter, large clods, roots, sharp protrusions, and large stones.

C. The seed mixtures specified in paragraph 2.03A shall be applied to areas disturbed from construction activities.

## 3.03 APPLICATION METHODS

A. Spread lime (if required) uniformly on soil surface at rate specified in subsection 3.04. Incorporate lime into top 3 inches of soil.

B. Seed, fertilizer, and mulch materials shall be placed by one of the methods described below, as approved by the Owner's Representative.

1. Hydraulic Method

a. The seed and fertilizer, or seed, fertilizer and mulch shall be mixed in the specified amount of water to produce a slurry. Any of the above combinations may be used, provided that the products are added to the water in the following order as applicable: fertilizer, seed, and mulch.

b. The slurry shall then be uniformly applied under pressure to the areas and at the rates indicated in subsection 3.04 below.

c. Areas inadequately covered shall be re-treated as directed by the Engineer.

## 3.04 APPLICATION RATES

A. Lime: 3 tons per acre, or as otherwise determined based on soil test results.

B. Fertilizer:

1. Apply at rate of 1,000 pounds of grade 10-20-10 fertilizer per acre or a sufficient quantity of any other acceptable grades of fertilizer that will provide at least 100 pounds of nitrogen, 200 pounds of available phosphoric acid, and 100 pounds of total potash per acre, as computed from the nominal contents of fertilizing

ingredients.

2. Other rates of application may be allowed by the Owner's Representative based on soil test results.

C. Seed mixtures for permanent vegetation shall be applied at the rate of approximately 60 pounds per acre.

## 3.05 APPLICATION TIMES

A. Seeding for temporary vegetation shall comply with Section 01565.

B. Seeding for permanent vegetation shall be performed during the first optimum planting season following completion of work in an area. Optimum planting seasons are Spring (March through May) and Fall (September through October).

## 3.06 MULCHING

A. Spread mulch uniformly over seeded area in a continuous blanket.

B. Mulch may be spread by hand or by machinery. Mulch shall be spread not later than 48 hours after seeding.

## 3.07 ESTABLISHMENT OF GRASS

A. Begin maintenance immediately after seed placement.

B. Maintain seeded areas not less than 60 days after substantial completion and longer to establish a good stand of grass as per the Engineer.

C. If seeded in Fall, Contractor shall maintain seeded areas throughout Winter and provide a Spring seeding.

D. Carry out watering as needed during the establishment period to maintain moisture in upper 4 inches of soil.

E. Fill, level, and repair washed or eroded areas as necessary.

F. Re-seed mulch areas larger than 1 square foot not having a uniform stand of grass.

END OF SECTION

# DIVISION 33 – UTILITIES

33 11 13.23 – PVC Pipe for Water Distribution

33 12 16 – Valves

33 12 33.10 – Water Meter 1.5” and 2”

33 31 00 – PVC Sewer Pipe

33 32 13.2 – Packaged Utility Duplex Lift Station

33 34 00 – Sewer Force Main

**SECTION 33 11 13.23**
**POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS - WATER**

PART 1. GENERAL

1.1 SUMMARY

A. Provide polyvinyl chloride (PVC) pipe and fittings.

1.2 RELATED SECTIONS

A. Section 31 23 33 - Trench Excavation, Backfill, and Compacting.

B. Section 33 11 00 - Hydrostatic Testing of Water Distribution System.

1.3 REFERENCES

A. Arkansas Department of Health and Human Services.
   1. ADHHS: *"Rules and Regulations Pertaining to Public Water Systems, latest Edition."*

B. ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959.
   1. ASTM D1784 - Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
   2. ASTM D2241 - Specifications for Poly (Vinyl Chloride) (PVC) Pressure - Rated Pipe (SDR Series).
   3. ASTM D3139 - Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
   4. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. American Water Works Association, 6666 West Quincy Avenue, Denver, Colorado 80235.
   1. AWWA C110/A21.10-03 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. For Water and Other Liquids.
   2. AWWA C605-05 - Underground installation of Polyvinyl choride (PVC) Pressure Pipe and Fittings for Water.
   3. AWWA: *"The Ten States Standards for Water, 2007 Edition or latest version."*

PART 2. PRODUCTS

2.1 PIPE

A. PVC pressure pipe, Class 200, SDR-21 in compliance with ASTM D1784 and manufactured from virgin PVC compound with a cell classification of 12454-B with gasket joints and integral bell for buried water piping.

B. Pipe and fittings shall be manufactured in the United States. Foreign made products shall be unacceptable.

C. Pipe shall be permanently marked at 5-foot intervals with the following information:
   1. Nominal size.
   2. Material code designation.
   3. Manufacturer's name or trademark and production record code.
   4. ASTM or AWWA certification.
   5. SDR designation.

D. Warranty:
   1. Manufacturer of the pipe shall warrant product for a period of not less than one (1) year.
   2. Forward copies of warranty to the Owner.
   3. Replace defective materials at no extra cost to the Owner.

2.2 JOINTS

A. Buried Pipe: Gasketed slip joint.

B. Comply with ASTM D3139.

2.3 FITTINGS

A. Fittings 4 Inches and Larger: Ductile iron, 350 psi pressure class, cement-lined and seal-coated. Where taps are shown on fittings, tapping bosses shall be provided.
   1. Flanged Joint: ANSI/AWWA C110/A21.10-03 and ANSI B16.1, faced and drilled
      125-pound ANSI standard.
   2. Mechanical Joint: ANSI/AWWA C110/A21.10-03 and ANSI/AWWA C110/A21.11-07.
   3. Flexible Joint: American Flex-Lox pipe or equal.

B. Cement Linings: In accordance with ANSI A21.4.

C. Fittings shall receive an exterior coating of 1 mil thick bituminous material in accordance with ANSI A21.4.

D. Fittings shall have distinctly cast on them the manufacturer's identification, pressure rating, nominal diameter of openings, and the number of degrees or fraction of the circle on bends.

E. Fittings Smaller Than 4 Inches: PVC.

2.4 GASKETS

A. As recommended by pipe manufacturer to conform to pipe.

B. Comply with ASTM F477.

2.5 MARKING TAPE

A. Install on pressure systems.

B. Terra Tape "Extra Stretch."

C. Or equal.

## PART 3. EXECUTION

3.1 GENERAL

A. Any connection to water main for the purpose of connecting any water line to the water main, shall use a minimum of Schedule 40, Polyvinyl chloride (PVC) pipe.

B. Rigid PVC pipe shall be cut, made up, and installed in accordance with the pipe manufacturer's recommendations.

C. Offset shall be as recommended by the manufacturer for the maximum temperature variation between time of installation and final use.

3.2 TRACE WIRE

A. Furnish and install a 14-gage insulated copper trace wire with PVC pressure pipe.

B. Run wire continuous from valve box to valve box, meter box, air release vault, cleanout, or other access points.

C. Bring wire up inside boxes and vaults in an accessible method.

D. Bring wire around or tape wire to each pipe section.

E. Pipe testing shall include following trace wire.

F. Wire breaks shall be repaired at no additional expense to the Owner.

## 3.3 MARKING TAPE

A. On pressure installations of non-metallic pipe, metallic marking tape, Terra Tape Extra Stretch or equal shall be installed 6 to 12 inches above the top of pipe or service line.
B. The tape shall be in addition to the trace wire specified.

## 3.4 THRUST BLOCKS

A. Install 2,500 psi concrete thrust blocks at bends, wyes, or other thrust points on pressure piping.

B. Block to bear against undisturbed soil and shall be of size and with bearing area as shown on Drawings.

## 3.5 TESTING

A. Pressure lines shall be hydrostatically tested at the pressures listed in Section 02512.

B. Use pipe-locating equipment to test continuity of trace wire.

C. Engineer shall observe and document trace wire test.

**END OF SECTION**

**SECTION 33 12 16**
**VALVES**

PART 1. GENERAL

1.1 SUMMARY

A. Furnish and install valves.

1.2 RELATED SECTIONS

A. Section 33 11 13.23 - Polyvinyl Chloride (PVC) Pipe and Fittings.

1.3 REFERENCES

A. American Water Works Association, 6666 West Quincy Avenue, Denver, Colorado 80235.
   1. AWWA C500-02 - Gate Valves for Water and Sewerage Systems.
   2. AWWA C509-01 - Resilient-Seated Gate Valves for Water and Sewage Systems.

B. ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959.
   1. ASTM A126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   2. ASTM B61 - Specification for Steam of Valve Bronze Castings.

**PART 2. MATERIALS**

2.1 GENERAL

A. Items specified shall be the end products of one manufacturer in order to achieve standardization for operation, maintenance, spare parts, and manufacturer's services.

B. Valves to be complete with necessary operators, valve boxes, extension stems, floor stands, worm and gear operators, operating nuts, etc., required for proper completion of work.

C. Valves of equal quality by other manufacturers will be considered in accordance with the General Conditions.

D. Renewable parts including discs, packing, and seats shall be of types recommended by valve manufacturer for intended service.

E. Units shall have name of manufacturer and size of valve cast on the body or bonnet or shown on a permanently attached plate in raised letters.

## 2.2 DESIGN FEATURES

A. Brass and bronze components of valves and appurtenances which have surfaces in contact with the water shall be alloys containing less than 16 percent zinc and 2 percent aluminum.

B. Stainless steel Alloy 18-8 may be substituted for bronze at the option of the manufacturer and with the approval of the Engineer.

C. All gland bolts on iron body valves shall be bronze and shall be fitted with brass nuts.

## 2.3 VALVE OPERATORS

A. Open by turning counterclockwise.

B. Worm and gear operators to be of totally enclosed design, so proportioned as to permit operation of the valve under full operating head with a maximum pull of 40 pounds on the operator.

C. Self-locking type to prevent the disc or plug from creeping.

D. Self-locking worm gears to be a one-piece design of gear bronze material, accurately machine cut.

E. Worm to be hardened alloy steel with thread ground and polished.

F. Reduction gearing to run in a proper lubricant.

G. Provide gear operators with position indicators, where specified, to show the position of the valve disc or plug.

H. Operators to be galvanized and painted the same color as the valve and associated pipeline.

I. Buried valves to have 2-inch x 2-inch square operating nut.

J. Above-ground valves to have handwheel operators.

## 2.4 EXTENSION STEMS FOR VALVE OPERATORS

A. Where the depth of the valve is such that its centerline is more than 4 feet below grade, provide operating extension stems to bring the operating nut to a point 6 inches below the surface of the ground and/or box cover.

B. Constructed of steel.

C. Complete with 2-inch square operating nut.

D. Bolt to valve stem to prevent separation.

## 2.5 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

A. American AVK Co.; Valves & Fittings Div.
B. American Cast Iron Pipe Co.; American Flow Control Div.
C. East Jordan Iron Works, Inc.
D. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).

2) Nonrising-Stem, Metal-Seated Gate Valves:

A. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.

a. Standard: AWWA C500.
b. Minimum Pressure Rating: 200 psig (1380 kPa).
c. End Connections: Mechanical joint.
d. Interior Coating: Complying with AWWA C550.

3) Nonrising-Stem, Resilient-Seated Gate Valves:

A. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

a. Standard: AWWA C509.
b. Minimum Pressure Rating: 200 psig (1380 kPa).
c. End Connections: Mechanical joint.
d. Interior Coating: Complying with AWWA C550.

4) Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:

A. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

a. Standard: AWWA C509.
b. Minimum Pressure Rating: 250 psig (1725 kPa).
c. End Connections: Push on or mechanical joint.
d. Interior Coating: Complying with AWWA C550.

5) OS&Y, Rising-Stem, Metal-Seated Gate Valves:

A. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.

a. Standard: AWWA C500.
b. Minimum Pressure Rating: 200 psig (1380 kPa).
c. End Connections: Flanged.

6) OS&Y, Rising-Stem, Resilient-Seated Gate Valves:

A. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.

a. Standard: AWWA C509.
b. Minimum Pressure Rating: 200 psig (1380 kPa).
c. End Connections: Flanged.

## 2.6 GATE VALVE ACCESSORIES AND SPECIALTIES

a. Tapping-Sleeve Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a) American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
b) East Jordan Iron Works, Inc.
c) Flowserve.
d) McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
e) McWane, Inc.; Kennedy Valve Div.
f) McWane, Inc.; M & H Valve Company Div.
g) U.S. Pipe and Foundry Company.
h) Watts Regulator; a Watts Water Technologies Company

2. Description: Sleeve and valve compatible with drilling machine.
Standard: MSS SP-60.

a. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.

b. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

c. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

d. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

## 2.7 CHECK VALVES

A. AWWA Check Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a) American AVK Co.; Valves & Fittings Div.
b) American Cast Iron Pipe Co.; American Flow Control Div.
c) APCO Williamette; Valve and Primer Corporation.
d) Mueller Steam Co.; a Watts Water Technologies Company
e) Watts Regulator; a Watts Water Technologies Company

2. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.

a) Standard: AWWA C508.
b) Pressure Rating: 175 psig (1207 kPa).

## 2.8 BUTTERFLY VALVES

A. AWWA Butterfly Valves:

c) Pratt, Henry Company.
d) Val-Matic Valve & Manufacturing Corp.

1. Description: Rubber seated.

a) Standard: AWWA C504.
b) Body: Cast or ductile iron.
c) Body Type: Wafer
d) Pressure Rating: 150 psig (1035 kPa).

## 2.8 PLUG VALVES

A. Plug Valves:

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a) DeZURIK/Copes-Vulcan; a unit of SPX Corporation.
b) McWane, Inc.; M & H Valve Company Div.
c) Val-Matic Valve & Manufacturing Corp.

1. Description: Resilient-seated eccentric.

a) Standard: MSS SP-108.
b) Body: Cast iron.
c) Pressure Rating: 175-psig (1207-kPa) minimum CWP.
d) Seat Material: Suitable for potable-water service.

## 2.9 WATER METERS

A. Water meters will be furnished by utility company.

B. Manufacturers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a) Sensus Metering Systems.

## 2.10 PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a) Honeywell Water Controls.
b) Watts Regulator; a Watts Water Technologies Company.
c) Cla-Val

2. Standard: ASSE 1003.
3. Pressure Rating: Initial pressure of 150 psig (1035 kPa).
4. Size: 4”
5. Design Flow Rate: 200 gpm
6. Design Inlet Pressure: 40 psi
7. Design Outlet Pressure Setting: 20 psi

## 2.11 RELIEF VALVES

A. Combination Air Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a) Crispin-Multiplex Manufacturing Co.
b) GA Industries, Inc.
c) Val-Matic Valve & Manufacturing Corp.
d) ARI

2. Description: Float-operated, hydromechanical device to automatically release accumulated air or to admit air.

a) Standard: AWWA C512.

## 2.12 BACKFLOW PREVENTERS

A. Double-Check, Backflow-Prevention Assemblies:

1) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a) Ames Fire & Waterworks; a Watts Water Technologies Company
b) FEBCO; a Watts Water Technologies Company
c) Flomatic Corporation.
d) Watts Regulator; a Watts Water Technologies Company

2) Standard: AWWA C510
3) Operation: Continuous-pressure applications, unless otherwise indicated.
4) Pressure Loss: 5 psi maximum, through middle 1/3 of flow range.

## 2.12 WATER METER BOXES

A. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping.

1) Option: Base section may be cast-iron, PVC, clay, or other pipe.

B. Description: Cast-iron body and double cover for disc-type water meter, with lettering "WATER METER" in top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.

C. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" in cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches (6800 kg minimum over 254 by 254 mm) square.

2.13 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:

1) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a) Aqua Shield.
b) BF Products, Inc.
c) DekoRRa Products.
d) Dunco Manufacturing, Inc.
e) Watts Regulator; a Watts Water Technologies Company

2) Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F (4 deg C) when external temperatures reach as low as minus 34 deg F (minus 36 deg C).

a) Standard: ASSE 1060.
b) Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
c) Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
aa) Housing: Fiberglass
Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
Drain opening for units with drain connection.
Access doors with locking devices.
Insulation inside housing.
Anchoring devices for attaching housing to concrete base.
aa) Electric heating cable or heater with self-limiting temperature control.

2.14 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:

1) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a) American AVK Co.; Valves & Fittings Div.
b) American Cast Iron Pipe Co.; American Flow Control Div.
c) East Jordan Iron Works, Inc.
d) McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
e) Mueller Co.; Water Products Div.

2) Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.

a) Standard: AWWA C502.
b) Pressure Rating: 250 psi

3) Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.

a) Standards: UL 246, FMG approved.
b) Pressure Rating: 250 psi
c) Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
d) Operating and Cap Nuts: Pentagon, 1-1/2 inches (38 mm) point to flat.
e) Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
f) Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

B. Wet-Barrel Fire Hydrants:

1) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a) American AVK Co.; Valves & Fittings Div.
b) McWane, Inc.; Clow Valve Co. Div. (Corona).
c) McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
d) Mueller Co.; Water Products Div.

2) Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, NPS 6 (DN 150) threaded or flanged inlet, and base section with NPS 6 (DN 150) mechanical-joint inlet. Include interior coating according to AWWA C550.

a) Standard: AWWA C503.
b) Pressure Rating: 150 psig (1035 kPa) minimum.

3) Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, NPS 6 (DN 150) threaded or flanged inlet, and base section with NPS 6 (DN 150) mechanical-joint inlet.

a) Standards: UL 246 and FMG approved.
b) Pressure Rating: 150 psig (1035 kPa) minimum.

c) Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
d) Operating and Cap Nuts: Pentagon, 1-1/2 inches (38 mm) point to flat.
e) Direction of Opening: Open hydrant valves by turning operating nut to left or counterclockwise.
f) Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

2.15 FLUSHING HYDRANTS

A. Post-Type Flushing Hydrants:

1) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a) Mueller Co.; Water Products Div.

2) Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.

a) Pressure Rating: 150 psig (1035 kPa) minimum.
b) Outlet: One, with horizontal discharge.
c) Hose Thread: NPS 2-1/2 (DN 65), with NFPA 1963 external hose thread for use by local fire department, and with cast-iron cap with brass chain.
d) Barrel: Cast-iron or steel pipe with breakaway feature.
e) Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.
f) Security: Locking device for padlock.
g) Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.
h) Inlet: NPS 2 (DN 50) minimum.
i) Operating Wrench: One for each unit.

## PART 3. EXECUTION

3.1 GENERAL

A. Bolt holes of flanged valves shall straddle the vertical centerline of the pipe run.

B. Prior to installing flanged valves, the flange faces shall be thoroughly cleaned.

C. After cleaning, insert gasket and bolts, and tighten the nuts progressively and uniformly.

D. If flanges leak under pressure, loosen or remove the nuts and bolts, reseat or replace the gasket, retighten or reinstall the nuts and bolts, and retest the joints.

E. Joints shall be watertight at test pressures before acceptance.

F. Thoroughly clean threads of screwed joints by wire brushing, swabbing, or other approved methods.

G. Apply approved joint compound to threads prior to making joints.

H. Joints shall be watertight at test pressures before acceptance.

3.2 PLACEMENT OF VALVES

A. Buried valves shall be installed with valve boxes in accordance with the details shown on the Drawings.

B. Buried valves shall have bolts protected by wrapping in polyethylene material.

3.3 ACCESS

A. Location of valves shall be as required to provide accessibility for control and maintenance.

3.4 TESTING

A. Valves: Test at same time adjacent pipeline is tested.

B. Joints shall show no visible leakage under test.

C. Repair joints that show signs of leakage prior to final acceptance.

D. If there are any special parts of control systems or operators that might be damaged by the pipeline test, they shall be properly protected. The Contractor will be held responsible for damage caused by the testing.

E. Valve manufacturer shall furnish an affidavit stating the materials options furnished comply with these and other referenced Specifications.

**END OF SECTION**

**SECTION 33 12 33.10**
**WATER METER – 1 1/2" and 2"**

## PART 1 – GENERAL

### 1.1 SUMMARY

A. This specification covers Badger E-Series Cold Water Ultrasonic Meters in sizes 1-1/2" and 2", or Engineer and Owner approved equal and the materials and workmanship employed in their fabrication. The meter must utilize ultrasonic measurement technology and have no moving parts within the meter.

## PART 2 – PRODUCTS

### 2.1 METER DESCRIPTION

A. The basis for measurement is the use of ultrasonic signals sent consecutively in forward and reverse directions of flow. Velocity is determined by measuring the time difference between the measurement in the forward and reverse direction. Flow totalization can then be calculated from the measured flow velocity using water temperature and pipe diameter. The meter is all electronic with totally potted circuitry, display and battery. There are no moving parts to wear or replace and meter and register are sealed, non-removable and protected from tampering.

### 2.2 AFFIDAVIT OF COMPLIANCE

A. The purchaser may require, in their supplemental specifications, an affidavit from the manufacturer or vendor that the meters furnished under the purchaser's order comply with all applicable requirements of this specification. Failure to meet any part of the specification shall be sufficient cause for rejection.

### 2.3 SIZE, CAPACITY, AND LENGTH

A. Along with the operating and physical characteristics, the nominal size, capacity ratings, related pressure loss limits, and length of the meters are those shown in Table 1 and 2. Meters supplied under this specification shall operate without leakage or damage at a working pressure of 175 psi.

### 2.4 METERING TUBE

A. The housing shall be designed so that at a working pressure of 175 psi, any distortion will not affect the accuracy of the meter. Metering tube shall not be repaired in any manner. The flow direction and meter size shall also be cast in the meter tube and the inlet and outlet shall have a common axis.

### 2.5 METERING INSERT

A. The ultrasonic metering insert shall be self-contained within the meter flow tube, seated, and not removable. The insert shall be secured to the main case, providing a method of minimizing turbulence and cleaning the reflectors, so that the accuracy of the meter will not be affected by any distortions of the case when operating at a pressure of 175 psi. The metering insert shall be made of engineered

thermoplastic and stainless steel and the ultrasonic transducers shall be wetted components that extend through the meter tube and shall have a surface of stainless steel.

## 2.6 ELECTRONIC METER AND REGISTER

A. The electronic circuit shall be micro-processor based and include a non-replaceable battery, and non-volatile memory capable of storing all programmable data and accumulated data. The circuit shall control the ultrasonic transducers. No field programming or calibration shall be necessary. The entire meter circuit and related components shall be fully potted and sealed from water intrusion. No components shall require service or replacement over the life of the meter. For reliability, the use of inductive coil technology shall not be permitted with an electronic residential meter.

## 2.7 REGISTER BOXES

A. The name or logo of the manufacturer shall be permanently molded and the serial number shall be imprinted on the lid of the register box. The lid and shroud components shall overlap to protect the lens. Register box enclosures and lids shall be made of engineering thermoplastic or other suitable synthetic polymer.

## 2.8 REGISTER/DISPLAY

A. The Register shall be encased in an integral non-corrosive plastic housing, with the electronics, display, and battery completely potted within. It must be permanently epoxy sealed to provide moisture resistance to flooded pit or submerged conditions. The permanent seal between the lens and non-corrosive plastic housing shall utilize an adhesive seal without the use of gaskets.

B. The Register shall be an integral part of the meter assembly. The register must be available as either factory pre-wired to an endpoint or factory pre-wired to an inline connector that can be used to connect to an endpoint.

C. The Register shall consist of an electronic local display combined with electronic circuitry to provide a high resolution absolute encoder output. This electronic register assembly shall transmit a signal through properly shielded (grounded) transmission wire for AMR connectivity.

C.1. The High Resolution Absolute Encoder Register option shall use an industry ASCII protocol. Capable of sending a 9-digit encoder output to the endpoint as well as extended status messages. Resolution being sent to the reading software is based on the output of the endpoint.

D. The display shall be a straight reading, permanently sealed electronic LCD with digits 0.28 inches high. The display will contain 9 digits plus a decimal point and display consumption, units of measure, rate of flow and alarm information. The digital display shall provide a totalized consumption resolution to 0.1 gallons, 0.01 cubic feet, or 0.001 cubic meters for 1-1/2” and 2” meters. The maximum indication on the dial and the minimum allowable capacity of the register shall comply with Table 3.

E. The size, model, and direction of flow through the meters shall be permanently visible on the topside of all meter displays. The units of registration, U.S. gallons, cubic feet, or meters cubed

shall also be designated on the Register display. The enhanced resolution of the totalized flow display can be utilized as a flow indicator for leak detection.

F. The Register shall have a lid that covers the display face for added protection and optional identification of serial number.

## 2.9 REGISTRATION ACCURACY

A. Specified in Table 1, at any flow rate within normal test flow limits, the meter shall register not less than 98.5% and not more than 101.5% of the water actually passed through the meter. At the minimum test flow rate, the meter shall register not less than 97.0% and not more than 103.0% of the water actually passed through the meter.

## 2.10 REJECTED METERS

A. The manufacturer shall repair or replace, at its option, without charge, all meters rejected for failure to comply with this specification.

| Meter Size | Required Safe Maximum Operating Capacity | Maximum Pressure Loss At AWWA Safe Maximum Operating Capacity | Recommended Maximum Rate For Continuous Operations | Extended Low Flow | Normal Test Flow Limits |
|---|---|---|---|---|---|
| 1-1/2" Elliptical | 100 gpm | 3.8 psi @ 100 gpm | 100 gpm | 0.40 gpm | 1.25…100 gpm |
| 2" Elliptical | 160 gpm | 4.7 psi @ 160 gpm | 160 gpm | 0.50 gpm | 1.5…160 gpm |
| 1-1/2" Hex NPT | 100 gpm | 3.8 psi @ 100 gpm | 100 gpm | 0.40 gpm | 1.25…100 gpm |
| 2" Hex NPT | 160 gpm | 4.7 psi @ 160 gpm | 160 gpm | 0.50 gpm | 1.5…160 gpm |

*Table 1: Meter Performance Characteristics*

| Meter Size | Lay Length | Minimum Thickness at Bolt Hole | Diameter of Bolt Circle | Number of Bolt Holes | Diameter of Bolt Holes | Nominal Thread Size |
|---|---|---|---|---|---|---|
| 1-1/2" Elliptical | 13" | 9/16" | 4" | 2 | 11/16" | ----- |
| 2" Elliptical | 17" | 5/8" | 4-1/2" | 2 | 13/16" | ----- |
| 1-1/2" Hex NPT | 12-5/8" | ----- | ----- | ----- | ----- | 1-1/2" |
| 2" Hex NPT | 15-1/4" | ----- | ----- | ----- | ----- | 2" |

*Table 2: Dimensional Design Limits for Meters*

| Meter Size | Maximum Allowable Indication of Initial Dial | | | Minimum Allowable Capacity of Register | | |
|---|---|---|---|---|---|---|
| Local Register or Electronic Encoder Register | Cu. Ft | Gallons | $M^3$ | Cu. Ft | Gallons | $M^3$ |
| 1-1/2" | 0.01 | 0.1 | 0.001 | 10,000,000 | 100,000,000 | 1,000,000 |
| 2" | 0.01 | 0.1 | 0.001 | 10,000,000 | 100,000,000 | 1,000,000 |

*Table 3: Maximum Indication on Initial Dial and Minimum Register Capacity*

**SECTION 33 31 00**
**PVC GRAVITY SEWER PIPE**

## PART 1. GENERAL

### PART 1.1 SUMMARY

A. Provide polyvinyl chloride (PVC) pipe and fittings for sewer lines.

### PART 1.2 RELATED SECTIONS

A. Section 31 23 33 - Trench Excavation, Backfill, and Compacting.

B. Section 33 30 00 - Sewage Collection System.

### PART 1.3 REFERENCES

A. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
   1. ASTM D1784 - Specification for Rigid Poly(Vinyl Chloride)(PVC) Compounds and Chlorinated Poly(Vinyl Chloride)(CPVC) Compounds.
   2. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

## PART 2. PRODUCTS

### 2.1 PIPE

A. PVC gravity sewer pipe, SDR-26 in compliance with ASTM D1784 and manufactured from virgin PVC compound with a cell classification of 12454-B with gasket joints and integral bell.

B. Pipe and fittings shall be manufactured in the United States. Foreign made products shall be unacceptable.

C. Pipe shall be permanently marked at 5-foot intervals with the following information:
   1. Nominal size.
   2. Material code designation.
   3. Manufacturer's name or trademark and production record code.
   4. ASTM or AWWA certification.
   5. SDR designation.

D. Warranty:
   1. Manufacturer of the pipe shall warrant product for a period of not less than one (1) year.

2. Forward copies of warranty to the Owner.
3. Replace defective materials at no extra cost to the Owner.

## 2.2 JOINTS

A. Buried Pipe: Gasketed slip joint.

B. Comply with ASTM D3139.

## 2.3 GASKETS

A. As recommended by pipe manufacturer to conform to pipe.

B. Comply with ASTM F477.

# PART 3. EXECUTION

## 3.1 GENERAL

A. Any connection to sewer main for the purpose of connecting any sewer line or field line to the sewer main, shall use a minimum of Schedule 40, Polyvinyl chloride (PVC) pipe.

B. Rigid PVC pipe shall be cut, made up, and installed in accordance with the pipe manufacturer's recommendations.

C. Offset shall be as recommended by the manufacturer for the maximum temperature variation between time of installation and final use.

## 3.2 TESTING

A. Gravity sewer line shall be tested in accordance with Section 33 30 00.

**END OF SECTION**

**SECTION 33 32 13.2**
**PACKAGED UTILITY DUPLEX LIFT STATION**

## PART 1 – GENERAL

### 1.01 SECTION INCLUDES

A. Work under this section includes, but is not limited to, furnishing and installing a factory built duplex pump station as indicated on the project drawings, herein specified, as necessary for proper and complete performance.

### 1.02 REFERENCES

A. Publications listed below form part of this specification to extent referenced in the text by basic designation only. Consult latest edition of publication unless otherwise noted.

1. American National Std. Institute (ANSI) / American Water Works Assoc. (AWWA)

| | | |
|---|---|---|
| a. | ANSI B16.1 | Cast iron pipe flanges and flanged fittings. |
| b. | ANSI/AWWA C115/A21.51 | Cast/ductile iron pipe with threaded flanges. |
| c. | ANSI 253.1 | Safety Color Code for Marking Physical Hazards. |
| d. | ANSI B40.1 | Gages, Pressure and Vacuum. |
| e. | AWWA C508 | Single Swing Check Valves. |

2. American Society for Testing and Materials (ASTM)

| | | |
|---|---|---|
| a. | ASTM A48 | Gray Iron Castings. |
| b. | ASTM A126 | Valves, Flanges, and Pipe Fittings. |
| c. | ASTM A307 | Carbon Steel Bolts and Studs. |
| d. | ASTM A36 | Structural Steel. |

3. Institute of Electrical and Electronics Engineers (IEEE)

| | | |
|---|---|---|
| a. | ANSI/IEEE Std 100 | Standard Dictionary of Electrical Terms. |
| b. | ANSI/IEEE Std 112 | Test Procedure for Polyphase Induction Motors. |
| c. | IEEE Std 242 | Protection of Industrial and Control Power Systems. |

4. National Electric Code (NEC) / National Electrical Manufacturers Assoc. (NEMA)

| | | |
|---|---|---|
| a. | NEC | National Electric Code. |
| b. | NEC 701 | National Electric Code article 701. |
| c. | NEMA Std MG1 | Motors and Generators. |

5. Miscellaneous References

a. Ten-State Standards Recommended Standards for Sewage Works.
b. Hydraulic Institute Std for Centrifugal, Rotary and Reciprocating Pumps.
c. NMTBA and JIC Std. National Machine Tool Builders Association and Joint Industrial Council Standards

d. ISO 9001 International Organization for Standardization.

1.03 SYSTEM DESCRIPTION

A. Contractor shall furnish and install one factory built, automatic pump station with integral. The station shall be complete with all equipment specified herein, factory assembled on a common steel baseplate.

B. The principal items of equipment shall include two self priming, horizontal, centrifugal, v belt motor driven sewage pumps, valves, piping, modular fiberglass enclosure and integral station base. A pump motor control panel with thermal magnetic circuit breakers, motor starters, automatic liquid level control systems for normal and standby operation, and internal wiring.

C. Factory built pump station design, including materials of construction, pump features, valves and piping, and motor controls shall be in accordance with requirements listed under PART 2 - PRODUCTS of this section.

1.04 PERFORMANCE CRITERIA

A. Pumps must be designed to handle raw, unscreened, domestic sanitary sewage. Each pump shall be selected to perform under following operating conditions:

| | |
|---|---|
| 1. Type of Pump | Self-Priming Centrifugal |
| 2. Suction Size | 10” with a 14” bell |
| 3. Discharge Size | 12” customer connection |
| 4. Pumps Required | 2 |
| 5. Liquid Temperature | 68 F |
| 6. Solid Size, Maximum | 3” |
| 7. Design Capacity (GPM) | 2500 |
| 8. Design Total Dynamic Head (FT) | 30 |
| 9. Total Dynamic Suction Lift (FT) | 16.66 |
| 10. Maximum Repriming Lift (FT) | 12 |
| 11. Maximum Static Suction Lift (FT) | 14 |
| 12. Total Static Discharge Head (FT) | 5 |
| 13. Minimum Submergence Depth (FT) | 3 |
| 14. Minimum Pump Efficiency | 71 |
| 15. Maximum Motor Horsepower | 40 |
| 16. Nominal Motor Speed | 1800 |

B. Station Power Requirements

1. Site power furnished to pump station shall be _3_ phase, __60__ hertz, _460_ volts, _4_ wire, maintained within industry standards. The available fault current provided at the pump station control panel is __14__ kA rms symmetrical. Voltage tolerance shall be plus or minus 10 percent. Phase-to-phase unbalance shall not exceed 1% average voltage as set forth in NEMA Standard MG-1. Control voltage shall not exceed 132 volts.

## 1.05 SUBMITTALS

A. Product Data

1. Prior to fabrication, pump station manufacturer shall submit submittal data in portable document format (.pdf) form for review and approval.

B. Shop drawings shall provide layout of mechanical equipment and anchor bolt locations for equipment baseplate. The electrical ladder logic drawings shall illustrate motor branch and liquid level control circuits to extent necessary to validate function and integration of circuits to form a complete working system.

C. Operations Maintenance Manuals

1. Installation shall be in accordance with written instructions provided by the pump station manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.

2. Documentation shall be specific to the pump station supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:

   a. Functional description of each major component, complete with operating instructions.

   b. Instructions for operating pumps, pump controls in all modes of operation.

   c. Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.

   d. Support data for commercially available components not produced by the station manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.

   e. Electrical schematic diagram of the pump station circuits shall be in accordance with NFPA70. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.

   f. Mechanical layout drawing of the pump station and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves and piping.

3. Operation and maintenance instructions which rely on vendor cut-sheets and literature which include general configurations, or require operating personnel to selectively read

portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications.

1.06 QUALITY ASSURANCE

A. The pumps and pump station manufacturer must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

B. The pumps and pump station manufacturer must be registered to the ISO 14001 Environmental Management System standard and as such is committed to minimizing the impact of its activities on the environment and promoting environmental sustainability by the use of best management practices, technological advances, promoting environmental awareness and continual improvement.

C. Upon request from the engineer, the pump station manufacturer shall prove financial stability and ability to produce the station within the specified delivery schedules. Evidence of facilities, equipment and expertise shall demonstrate the manufacturer's commitment to long term customer service and product support.

D. Manufacturer must show proof of original product design and testing. Products violating intellectual property regulations shall not be allowed, as they may violate international law and expose the user or engineer to unintended liabilities. “Reverse-engineered” products fabricated to substantially duplicate the design of original product shall not be allowed, as they may contain substantial differences in tolerances and material applications addressed in the original design, which may contribute to product failure.

E. The term “pump manufacturer” or “pump station manufacturer” shall be defined as the entity which designs, machines, assembles, hydraulically tests and warranties the final product. Any entity that does not meet this definition will not be considered a “pump manufacturer” or “pump station manufacturer” and is not an acceptable supplier. For quality control reasons and future pump and parts availability, all major castings of the pump shall be sourced and machined in North America.

F. Pump Performance Certifications

1. All internal passages, impeller vanes, and recirculation ports shall pass a _3_" spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with priming and pump performance shall not be permitted. Upon request from the engineer, manufacturer’s certified drawings showing size and location of the recirculation port(s) shall be submitted for approval.

    a. Consideration shall be given to the sanitary sewage service anticipated, in which debris is expected to lodge between the suction check valve and its seat, resulting in the loss of the pump suction leg, and siphoning of liquid from the pump casing to the approximate center line of the impeller. Such occurrence shall be considered normal, and the pump must be capable of automatic, unattended operation with an air release line installed.

    b. During unattended operation, the pump shall retain adequate liquid in the casing to insure automatic repriming while operating at its rated speed in a completely open

system. The need for a suction check valve or external priming device shall not be required.

c. Pump must reprime _15_ vertical feet at the specified speed and impeller diameter. Reprime lift is defined as the static height of the pump suction above the liquid, while operating with only one-half of the liquid remaining in the pump casing. The pump must reprime and deliver full capacity within five minutes after the pump is energized in the reprime condition. Reprime performance must be confirmed with the following test set-up:
    1) A check valve to be installed downstream from the pump discharge flange. The check valve size shall be equal (or greater than) the pump discharge diameter.
    2) A length of air release pipe shall be installed between pump and the discharge check valve. This line shall be open to atmosphere at all times duplicating the air displacement rate anticipated at a typical pump station fitted with an air release valve.
    3) The pump suction check valve shall be removed. No restrictions in the pump or suction piping will prevent the siphon drop of the suction leg. Suction pipe configuration for reprime test shall incorporate a 2 feet minimum horizontal run, a 90o elbow and vertical run at the specified lift. Pipe size shall be equal to the pump suction diameter.
    4) Impeller clearances shall be set as recommended in the pump service manual.
    5) Repeatability of performance shall be demonstrated by testing five consecutive reprime cycles. Full pump capacity (flow) shall be achieved within five minutes during each cycle.
    6) Liquid to be used for reprime test shall be water.

d. Upon request from the engineer, certified reprime performance test results, prepared by the manufacturer, and certified by a registered professional engineer, shall be submitted for approval prior to shipment.

G. Factory System Test

1. All components including the pumps, motors, valves, piping and controls will be tested as a complete working system at the manufacturer's facility. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head and capacity per acceptance grade 2B. Factory operational test shall duplicate actual performance anticipated for the complete station.

2. Upon request from the engineer, the operational test may be witnessed by the engineer, and/or representatives of his choice, at the manufacturer's facility.

H. The manufacturer’s technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment as described in Part 3 of this section.

## 1.07 MANUFACTURER’S WARRANTY

A. The pump station manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below.

   1. In addition to defects in material and workmanship, fiberglass reinforced polyester station enclosures (where applicable) are warranted for sixty (60) months to be resistant to rust, corrosion, corrosive soils, effects of airborne contamination or physical failures occurring in normal service for the period of the pump station warranty.

   2. All other equipment, apparatus, and parts furnished shall be warranted for sixty (60) months, excepting only those items that are normally consumed in service, such as light bulbs, oils, grease, packing, gaskets, O rings, etc. The pump station manufacturer shall be solely responsible for warranty of the station and all components.

B. Components failing to perform as specified by the engineer, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer.

C. It is not intended that the station manufacturer assume liability for consequential damages or contingent liabilities arising from failure of any vendor supplied product or part which fails to properly operate, however caused. Consequential damages resulting from defects in design, or delays in delivery are also beyond the manufacturer's scope of liability.

D. Equipment supplied by others and incorporated into a pump station or enclosure is not covered by this limited warranty. Any warranty applicable to equipment selected or supplied by others will be limited solely to the warranty, if any, provided by the manufacturer of the equipment.

E. This limited warranty shall be valid only when installation is made and use and maintenance is performed in accordance with manufacturer recommendations. A start-up report competed by an authorized manufacturer’s representative must be received by manufacturer within thirty (30) days of the initial date the unit is placed into service. The warranty shall become effective on the date of acceptance by the purchaser or the purchaser's authorized agent, or sixty (60) days after installation, or ninety (90) days after shipment from the factory, whichever occurs first.

## PART 2 – PRODUCT

### 2.01 UNITARY RESPONSIBILITY

A. The pump station system integrator must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

B. In order to unify responsibility for proper operation of the complete pumping station, it is the intent of these Specifications that all system components be furnished by a single supplier (unitary source). The pumping station must be of standard catalog design, totally warranted by the manufacturer. Under no circumstances will a system consisting of parts compiled and assembled by a manufacturer's representative or distributor be accepted.

### 2.02 MANUFACTURER

A. The specifications and project drawings depict equipment and materials manufactured by The Gorman-Rupp Company which are deemed most suitable for the service anticipated. It is not intended, however, to eliminate other products of equal quality and performance. The contractor shall prepare his bid based on the specified equipment for purposes of determining low bid. Award of a contract shall constitute an obligation to furnish the specified equipment and materials.

B. After execution of the contract, the contractor may offer substitutions to the specified equipment for consideration. The equipment proposed for substitution must be superior in construction and performance to that specified in the contract, and the higher quality must be demonstrated by a list of current users of the proposed equipment in similar installations.

C. In event the contractor obtains engineer's approval for equipment substitution, the contractor shall, at his own expense, make all resulting changes to the enclosures, buildings, piping or electrical systems as required to accommodate the proposed equipment. Revised detail drawings illustrating the substituted equipment shall be submitted to the engineer prior to acceptance.

D. It will be assumed that if the cost to the contractor is less for the proposed substitution, then the contract price shall be reduced by an amount equal to the savings.

2.03 UNIT BASE

A. The unit base shall be comprised of structural steel with a perimeter flange and reinforcements. Perimeter flange and reinforcements shall be designed to prevent flexing or warping under operating conditions. Perimeter flange shall be drilled for hardware used to secure unit base to concrete pad as shown on the contract drawings. Unit base shall contain provisions for lifting the complete pump station unit during shipping and installation.

2.04 PUMP DESIGN (Super T10)

A. Pumps shall be horizontal, self-priming centrifugal type, designed specifically for handling raw, unscreened, domestic sanitary sewage. Pump solids handling capability and performance criteria shall be in accordance with requirements listed under PART 1 - GENERAL of this section.

B. The pump manufacturer must be ISO 9001:2008 revision certified, with scope of registration including design control and service after sales activities.

C. Materials and Construction Features

1. Pump casing shall be cast iron Class 30 with integral volute scroll. Casing shall incorporate following features:

a. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.

b. Fill port cover plate, 3 1/2" diameter, shall be opened after loosening a hand nut/clamp bar assembly. In consideration for safety, a clamp bar screw must provide slow release of pressure, and the clamp bar shall be retained by detente lugs. A Teflon gasket shall prevent adhesion of the fill port cover to the casing.

c. Casing drain plug shall be at least 1 1/4" NPT to insure complete and rapid draining.

d. Liquid volume and recirculation port design shall be consistent with performance criteria listed under PART 1 - GENERAL of this section.

2. Suction Head shall be Class 30 cast iron. Its design must incorporate following maintenance features:

   a. The suction head will be secured to the pump casing by using hex head cap screws and lock washers. Access to the impeller and mechanical seal shall be accomplished by removing the suction head.

   b. Removal of any blockages in the impeller shall be accomplished by removing the suction head, or through a cleanout cover on the suction head. In consideration of safety, two clamp bar screws must provide slow release of pressure on two clamp bars securing the cleanout cover. A Teflon gasket shall prevent adhesion of the cleanout cover to the suction head casing.

   c. Removal of the suction check valve shall be accomplished through the removable cleanout cover on the suction head.

   d. In consideration for safety, a pressure relief valve shall be supplied in the suction head. The relief valve shall open at 75-200 PSI.

   e. A replaceable ductile iron wear plate shall be secured up against the pump casing by the suction head. Measurement of the clearance between this wear plate and impeller shall be accomplished through the cleanout cover plate.

3. Rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, seal plate and bearing housing, must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate following features:

   a. Seal plate and bearing housing shall be cast iron Class 30. Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Cavities must be cooled by the liquid pumped. Three lip seals will prevent leakage of oil.

      1) The bearing cavity shall have an oil level sight gauge and fill plug check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.
      2) The seal cavity shall have an oil level sight gauge and fill/vent plug. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.
      3) Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.

   b. Impeller shall be ductile iron, two-vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lock screw and conical washer.

   c. Impeller shaft shall be AISI 17-4 pH stainless steel.

   d. Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil

lubricated from a dedicated reservoir. Pump designs which use the same oil to lubricate the bearings and shaft seal shall not be acceptable.

e. Shaft seal shall be cartridge oil lubricated mechanical type. The stationary and rotating seal faces shall be tungsten titanium carbide alloy. Each mating surface shall be lapped to within three light bands flatness (35 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating by virtue of a dual O-ring design; an external O-ring secures the stationary seat to the seal plate, and an internal O-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads which cause shaft deflection, vibration, and axial/radial movement). Elastomers shall be Viton; cage and spring to be stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings. Seal shall be warranted in accordance with requirements listed under PART 1 - GENERAL of this section.

f. Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same cap screws as used for retaining rotating assembly.

4. Adjustment of the impeller face clearance (distance between impeller and wear plate) shall be accomplished by external means.

   a. Clearances shall be maintained by using external shims between the casing ring of the rotation assembly and the pump casing itself. Shims will be of various sizes to allow precise adjustment of this clearance. The clearance can be measured by removing the cleanout cover on the suction head.

   b. Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

5. Suction check valve shall be molded Neoprene with integral steel and nylon reinforcement. A blow-out center shall protect pump casing from hydraulic shock or excessive pressure. Removal or installation of the check valve must be accomplished through the cleanout cover on the suction head without disturbing the suction piping. Sole function of check valve shall be to save energy by eliminating need to reprime after each pumping cycle. Pumps requiring a suction check valve to assist reprime will not be acceptable.

6. Removal of the rotating assembly will be accomplished through the front or the back of the pump casing.

7. Continuous Vane Impeller with Self-Cleaning Wear plate

   a. The nature of the conveyed medium poses significant challenges to the continuous operation of the pump. Of particular concern is the clogging of the impeller by debris in the pumped medium including but not limited to long rags, fibers, and like debris which are able to wrap around the impeller vanes, stick to the center of the vanes or hub, or lodge within the spaces between the impeller and the housing.

   b. The pump impeller shall be a continuous vane extending from one edge of the impeller through the central portion of the impeller to the other edge. The impeller

height shall increase continuously from the outer radius of to the central region of the impeller.

c. The matching wear plate shall have one or more notches and/or recesses provided along a common diameter of the wear plate to disturb and dislodge any solids which might otherwise remain on the impeller in dynamic operation. Clusters of notches and/or recesses may also be provided.

D. Serviceability

1. The pump manufacturer shall demonstrate to the engineer's satisfaction that consideration has been given to reducing maintenance costs.

2. No special tools shall be required for replacement of any components within the pump.

## 2.08 VALVES AND PIPING

A. Check Valve

1. Each pump shall be equipped with a full flow type check valve, capable of passing a 3" spherical solid, with flanged ends and be fitted with an external lever and spring. 316 stainless steel body ring shall be threaded into the valve port. Valve clapper shall be cast iron, rubber face, and shall swing completely clear of waterway when valve is full open. The seating shall be by a resilient field replaceable ring on the valve disc contacting a bronze or stainless seat ring in the valve body. Hinge pin shall be of 18 8 stainless steel construction and shall be utilized with bronze bushings and packing type seal. Valves shall be equipped with removable cover plate to permit entry or for complete removal of internal components without removing the valve from the line. Valve shall be rated at 175 PSI water working pressure, 350 PSI hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3" spherical solid shall not be acceptable.

B. Plug Valve

1. The discharge header shall include a 3 way plug valve to permit either or both pumps to be isolated from the common discharge header. Valves shall have ports designed to pass spherical solids equal to the pumps capability. The plug valve shall be non-lubricated, tapered type. Valve body shall be semi steel with flanged end connections drilled to 125 pound standard. Valve shall be furnished with a drip tight shutoff plug mounted in stainless steel bearings, and shall have a resilient facing bonded to the sealing surface. Valve shall be operated with a single lever actuator providing lift, turn, and reseat action. The lever shall be equipped with a locking device to hold the plug in the desired position.

C. Automatic Air Release Valves

1. An automatic air release valve shall be furnished for each pump designed to permit the escape of air to the atmosphere during initial priming or unattended repriming cycles. Upon completion of the priming cycle or repriming cycle, the valve shall close to prevent recirculation. Valves shall provide visual indication of valve closure, and shall operate solely on discharge pressure. Valves which require connection to the suction line shall not be acceptable.

2. All valve parts exposed to sewage shall be constructed of cast iron, stainless steel, or similar corrosion resistant materials. Diaphragms, if used, shall be of fabric reinforced neoprene or similar inert material.

3. A cleanout port, three inches in diameter, shall be provided for ease of inspection, cleanout, and service.

4. Valves shall be field adjustable for varying discharge heads.

5. Connection of the air release valves to the station piping shall include stainless steel fittings.

D. Gauge Kit

1. Each pump shall be equipped with a glycerin filled compound gauge to monitor suction pressures, and a glycerin filled pressure gauge to monitor discharge pressures. Gauges shall be a minimum of 4 inches in diameter, and shall be graduated in feet water column. Rated accuracy shall be 1 percent of full scale reading. Compound gauges shall be graduated 34 feet to +34 feet water column minimum. Pressure gauges shall be graduated _0_ to __70_ feet water column minimum.

2. Gauges shall be mounted on a resilient panel and frame assembly which shall be firmly secured to pumps or piping. Gauge installations shall be complete with all hoses and stainless steel fittings, and shall include a shutoff valve installed in each gauge inlet at the point of connection to suction and discharge pipes.

E. Piping

1. Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and class 53 thickness.

2. Flanges shall be cast iron class 125 and Comply with ANSI B16.1.

3. Pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe.

4. Bolt holes shall be in angular alignment within 1/2o between flanges. Flanges shall be faced with a gasket finish.

F. Contractor must insure all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps or station piping. Pump station discharge force main piping shall be anchored with thrust blocks where shown on the contract drawings.

## 2.09 VALVES AND PIPING

## 2.10 DRIVE UNIT

A. Motors

1. Pump motors shall be ___ HP, _3_ phase, _60_ hertz, _460__ VAC, horizontal ODP, 1800 RPM, NEMA design B with cast iron frame with copper windings, induction type, with class F insulation and 1.15 SF for normal starting torque and low starting current

characteristics, suitable for continuous service. The motors shall not overload at the design condition or at any head in the operating range as specified.

2. Motors shall be tested in accordance with provisions of ANSI/IEEE Std 112.

## 2.11 FINISH

A. Pumps, piping, and exposed steel framework shall be cleaned prior to coating using an approved solvent wipe or phosphatizing cleaner. The part must thoroughly dry before paint application. Open joints shall be caulked with an approved polyurethane sealant. Exposed surfaces shall be applied with one coat of Tnemec Series 69 Polymide Epoxy Primer and one finish coat of Series 73 Aliphatic Acrylic Polyurethane for a total dry film thickness of 4-6 mils. Finish coat shall be semi-gloss white for optimum illumination and enhancement. The coating shall be corrosion, moisture, oil, and solvent resistant when completely dry. The factory finish shall allow for over-coating and touch-up for 6 months after coating. Thereafter, it will generally require sanding to accept a topcoat or touch-up coating.

## 2.12 ELECTRICAL COMPONENTS

A. The pump station control panel will be tested as an integral unit by the pump station manufacturer. The control panel shall also be tested with the pump station as a complete working system at the pump station manufacturer's facility.

B. The electrical control components shall be provided by the pump station supplier and shall be provided with the following features.

C. Panel enclosure

1. Enclosure shall be constructed in conformance with applicable section of National Electrical Manufacturers Association (NEMA) standards for type 1 electrical enclosures. Enclosure shall be fabricated of steel having a minimum thickness of not less than 0.075 Inch (14 gauge). All seams shall be continuously welded, and shall be free of burrs and voids. Interior and exterior surfaces shall be coated with a paint finish suitable for the NEMA classification of the enclosure. There shall be no holes through the external walls of the enclosure for mounting the enclosure or any components contained within the enclosure. Panel enclosure up to 60" x 36" x 12" shall be mounted on floor stands and secured to the wall.

2. Enclosure shall be equipped with a door mounted on a continuous steel hinge, and sealed around its perimeter. Door shall be held closed with clamps that are quick and easy to operate. The door shall accommodate the mounting of switches and indicators.

3. Enclosure shall be furnished with a removable back panel, fabricated of steel having a thickness of not less than 0.106 Inch (12 gauge), which shall be secured to the enclosure with collar studs. Such panel shall be of adequate size to accommodate all basic components.

4. All control components shall be securely fastened to a removable back panel with screws and lock washers. Switches, indicators and instruments shall be mounted through the control panel door. All control devices and instruments shall be secured to

the sub-plate with machine screws and lock washers. Mounting holes shall be drilled and tapped; Self tapping screws shall not be used to mount any components. All connections from the back panel to door mounted or remote devices shall be made through terminal blocks. All control devices shall be clearly labeled to indicate function.

D. UL Label Requirement

1. Pump station controls shall conform to third party safety certification. The panel shall bear a serialized UL label listed for "Enclosed Industrial Control Panels". The enclosure, and all components mounted on the sub-panel or control cover shall conform to UL descriptions and procedures.

E. 750 VA Control Power Transformer

1. The lift station shall be equipped with a 750 VA step-down transformer to supply 115 volt, AC, single phase for the control equipment.

F. 5 kVA Auxiliary Power Transformer

1. The lift station shall be equipped with a 5 KVA step-down transformer to supply 115 volt, AC, single phase for the control and auxiliary equipment. The primary and secondary side of the transformer to be protected by a thermal magnetic circuit breaker, sized to meet the power requirements of the transformer. An operating mechanism shall penetrate the control panel door and a padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in "OFF" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.

G. Motor Branch Circuit Components

1. Main Connections

a. A main terminal block and ground lug shall be furnished for field connection of the electrical supply. The connections shall be designed to accept copper conductors of sufficient size to serve the pump station loads. The main terminal block shall be mounted to allow incoming wire bending space in accordance with article 373 of the National Electric Code (NEC). A separate terminal strip shall be provided for 115 volt, single phase control power and shall be segregated from the main terminal block. Ten percent of the control terminals shall be furnished as spares.

b. All motor branch and power circuit components shall be of highest industrial quality. The short circuit current rating of all power circuit devices shall be a tested combination or evaluated per the National Electrical Code Article 409. The lowest rated power circuit component shall be the overall control panel short circuit rating and shall not be less than the fault current available. The minimum control panel rating shall not be less than 14kA, rms symmetrical. Control assemblies operating at 120 volts nominal or less may be provided with transformers which limit the fault current and may be rated less than the minimum required short circuit rating.

2. Circuit Breakers and Operating Mechanisms

a. A properly sized heavy duty air circuit breaker shall be furnished for each pump motor. All circuit breakers shall be sealed by the manufacturer after calibration to prevent tampering.

b. A padlocking operating mechanism shall be installed on each motor circuit breaker. Operator handles for the mechanisms shall be located on the exterior of the control compartment door, with interlocks which permit the door to be opened only when circuit breakers are in the "off" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.

3. Motor Starters

4. A reduced voltage, solid state motor starter shall be furnished for each pump motor. The starter construction shall be modular with separately replaceable power and control sections. The power section shall consist of six back-to-back SCR's rated 208 to 480 volts, 50/60 hertz. The SCR's shall have a minimum repetitive peak inverse voltage rating of 1400 volts at 480 volts. The enclosed operating temperature range shall be 0 to 40 degrees C at altitudes up to 2000 meters without derating.

   a. Starting Modes: Starting modes shall be selectable soft start, current limit, or full voltage. Soft starting the pump shall include an adjustable initial torque value of 0 to 90 %. The acceleration ramp shall be adjustable from 0 to 30 seconds. The starter shall include a selectable kick start providing a current pulse at start. Kick start level shall be adjustable from 0 to 90% of locked rotor torque. Kick start time shall be adjustable from 0 to 2 seconds. Current limit mode shall provide means for limiting the starting current to a programmable value between 50 and 600% of full load current. Full voltage start shall provide across the line starting with a ramp time of less than 0.25 seconds.

   b. Pump Control Mode: Ramp time will be dependent on pump torque requirements. The starter shall provide smooth acceleration and deceleration, which approximates the flow rate of a centrifugal pump. The starter's microcomputer shall analyze motor variables and generate control commands, which will minimize surges in the system. Pump stop time shall be adjustable from 0 to 120 seconds. Pump control provides reduced hydraulic shock.

   c. Bypass: When the start ramp time is complete, the starter shall energize an integral bypass contactor. When in the bypass mode, the bypass contactor shall carry the motor load to minimize internal heating in the electrical enclosure.

   d. Protection: The starter shall include protective features: Communication fault, control temperature, excess starts/hour, stall, jam, line fault, open gate, overload, overvoltage, phase reversal, power loss, underload, under voltage, shorted SCR, open bypass and voltage unbalance.

      1) An integral electronic overload relay equipped with thermal memory shall be included and shall utilize three phase current sensing. Adjustments shall include trip current, service factor and 10, 15, 20 or 30 trip class.
      2) Jam trip shall be adjustable 0-1,000% of the nominal motor current with a delay time adjustment of 0-99 seconds.

3) Stall protection senses that the motor is not up-to-speed at end of ramp and will shut down after a user-selected delay time has elapsed. Stall delay shall be adjustable from 0-10 seconds.
4) Fault diagnostics shall be displayed on the starter and shall include temperature fault, line fault, open gate and power loss.

e. Display: The starter shall include a keypad and display on the front of the control module. The display is equipped with a built-in four line, 16 character backlit LCD. The LCD displays metering, faults and parameter settings in English. Faults will display in English and fault code. A fault buffer will store the last five faults. Metering capabilities shall include: Three phase current, three phase voltage, power factor, motor thermal usage, wattmeter, kilowatt hours, and elapsed time meter. Digital parameter adjustments shall be made using the keypad.

f. Door Mounted Display: Each starter shall be furnished with a display and keypad mounted to the door of the control panel. The door mounted display will duplicate the functions of the starter display and allow the operator to monitor or change parameters without opening the control panel door.

H. Three Phase Voltage Monitor

1. The control panel shall be equipped to monitor the incoming power and shut down the pump motors when required to protect the motor(s) from damage caused by phase reversal, phase loss, high voltage, low voltage, and voltage unbalance. An adjustable time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart, following an adjustable time delay, when power conditions return to normal.

I. Transient Voltage Surge Suppressor

1. All Control Panels shall have Surge Protective Devices installed immediately after the main overcurrent device or immediately after the supply conductors to the panel have been terminated. The Surge Protective Device(s) shall follow IEEE C62.41 recommendation for cascading to protect all voltage levels to and including 24 volts AC/DC and shall be as follows:
2. Be UL 1449 3rd Edition Recognized for UL Type 2 applications except at 48 volts AC/DC and below may be UL 1449 3rd Edition for Type 3 applications.
3. Provide suppression for both normal mode (L-N [Wye]) and common mode (L+N-G [Wye] or L-G [Delta]).
4. Have a Surge Current Capacity (Imax) of at least 40kA.
5. Have a Nominal Surge Current Rating (In) of 20kA.
6. Have SCCRs of 200kA, except that 347Y/600V, 240/480V High leg Delta and 347V single-phase SPDs shall have a minimum SCCR of 125kA.
7. Use MOV technology with thermal disconnect.
8. Be RoHS compliant.
9. SPD status monitoring shall be provided by local visual indication and, if needed, by remote contact signaling using an optional Form C contact relay.

10. Hardwired Listed Type 1 or Type 2 Surge Protective Devices Shall:
    a. All Type 1 or Type 2 surge protective devices shall be manufactured by a single ISO-9001 registered company normally engaged in the design, development and manufacture of such devices for electrical distribution system/ equipment protection. Surge protective devices shall be UL Listed with a Short-Circuit Current Rating of 200kA, Nominal Discharge Current (In) of 20kA, and Surge Current Capacity (Imax) of120kA, 200kA, 300kA or 400kA. These SPDs shall be installed in accordance with the NEC® and/or local code requirements. The said manufacturer shall offer a minimum five (5) year warranty for its Type 1 and Type 2 surge protective devices.
    b. The hardwired surge protective device shall have specifications as shown below:
        1) The Maximum Continuous Operating Voltage (MCOV) shall not exceed 25% on Wye and 40% on Delta systems of the nominal voltage (system voltage) in the configuration being used
        2) Prewired NEMA 1 or NEMA 4X factory sealed enclosure suitable for the intended installation location
        3) Shall have a two color LED status indicator per phase
        4) Have an operating temperature range of at least -40˚C to +50˚C
        5) Only use thermally protected MOV technology, such as Bussmann SurgePOD™.
    c. Surge Protective Device Agency Information: SPDs shall be "Listed" by Underwriters Laboratories, Inc. to UL 1449 3rd Edition as a Type 1 or Type 2 device and shall exhibit the UL Listing mark for the UL category VZCA for USA and/or VZCA2 for Canada; and must have CSA certification.
    d. Manufacturers must provide verification of performance data for UL and CSA standards.
    e. All SPDs must be RoHS compliant.
    f. Surge protective devices shall be installed and located in accordance with the all applicable gency, NEC® and local code requirements. The SPDs must be suitable for the particular installation, be it on the upstream side (Type 1) or downstream side (Type 1 or Type 2) of service entrance Overcurrent Protective Device (OCPD).
    g. All SPDs shall match voltage and system specific requirements as provided by the manufacturer.
    h. All SPDs shall provide surge protection for both normal mode (L-N [Wye], L-L [Delta]) and common mode (L+N-G [Wye] or L-G [Delta]).
    i. Surge protective device shall be clearly marked with specifications as required by UL 1449 3rd Edition along with UL holographic label on the SPD.
    j. Each surge protective device should be serial numbered along with barcode for easy identification and traceability.

J. Other Equipment
    1. The manufacturer of the liquid level control system must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

2. The level control system shall start and stop the pump motors in response to changes in wet well level, as set forth herein.

3. The level control system shall be capable of operating as either an air bubbler type level control system, submersible transducer type system, or ultrasonic transmitter type system.

4. The level control system shall utilize alternation to select first one pump, then the second pump, then the third pump (if required), to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle, or in the event of excessive run time.

5. The level control system shall utilize an electronic pressure switch which shall continuously monitor the wet well level, permitting the operator to read wet well level at any time. Upon operator selection of automatic operation, the electronic pressure switch shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "lead pump stop level", the electronic pressure switch shall stop this pump. These actions shall constitute one pumping cycle. Should the wet well level continue to rise, the electronic pressure switch shall start the second and/or third pump (if required) when the liquid reaches the "lag pump start level", or “standby pump start level” so that all pumps are operating. These levels shall be adjustable as described below.

    a. The electronic pressure switch shall include integral components to perform all pressure sensing, signal conditioning, EMI and RFI suppression, DC power supply and 120 volt outputs. Comparators shall be solid state, and shall be integrated with other components to perform as described below.

    b. The electronic pressure switch shall be capable of operating on a supply voltage of 12-24Vdc in an ambient temperature range of 10 degrees C (14 degrees F) through 55 degrees C (131 degrees F). Ingress Protection of IP56 for indoor use with closed cell neoprene blend gasket material. Evaluated by Underwriters Laboratories for Pollution Degree 2 device for U.L. and cU.L. Control range shall be 0 to 33.3 feet of water with an overall repeat accuracy of (plus/minus) 0.1 feet of water. Memory shall be non-volatile. A Battery backed real time clock shall be standard.

    c. Eleven optically isolated, user defined digital inputs for pump and alarm status. Rated at 10mA at 24Vdc. Eight digital output relays (mechanical contacts), configurable for pump start/stop or alarms. Three relays rated at 12 Amp @ 28Vdc and 120Vac, five relays rated at 3 Amp @ 30Vdc and 120Vac. The electronic pressure switch shall consist of the following integral components: pressure sensor, display, electronic comparators, digital inputs and digital output relays.

        1) The internal pressure sensor shall be a strain gauge transducer and shall receive an input pressure from the air bubbler system. The transducer shall convert the input to a proportional electrical signal for distribution to the display and electronic comparators. The transducer output shall be filtered to prevent control response to level pulsations or surges. The transducer range shall be 0 14.5 PSI, temperature compensated from 40 degrees C ( 40 degrees F) through 85 degrees C (185 degrees F), with a repeat accuracy of (plus/minus) 2.5% full

scale about a fixed temperature. Transducer overpressure rating shall be 3 times full scale.

2) The electronic pressure switch shall incorporate a digital back lighted LCD panel display which, upon operator selection, shall indicate liquid level in the wet well, and pump status indication for up to 3 pumps. The display shall include a 128 x 64 bit resolution LCD to read out directly in feet of water, accurate to within one tenth foot (0.1 foot), with a full scale indication of not less than 12 feet. The display shall be easily convertible to indicate English or metric units.
3) Level adjustments shall be electronic comparator set points to control the levels at which the lead, lag and standby pumps start and stop. Each of the level settings shall be easily adjustable with the use of membrane type switches, and accessible to the operator without opening any cover panel on the electronic pressure switch. Controls shall be provided to permit the operator to read the selected levels on the display. Such adjustments shall not require hard wiring, the use of electronic test equipment, artificial level simulation or introduction of pressure to the electronic pressure switch.
4) Each digital input can be programmed as pump run, pump HOA, pump high temp, pump moisture/thermal, starter failure (FVNR, RVSS, VFD), and phase failure. Inputs are used for status and alarm indication.
5) Each output relay in the electronic pressure switch shall be hard contact mechanical style. Each relay input shall be optically isolated from its output and shall incorporate zero crossover switching to provide high immunity to electrical noise. Each output relay shall have an inductive load rating equivalent to one NEMA size 3 contactor. A pilot relay shall be incorporated for loads greater than a size 3 contactor.

6. The electronic pressure switch shall be equipped with alarm banners with time and date history for displaying alarm input notification. Alarm history will retain a 16 of the most recent alarm events.
7. The electronic pressure switch shall be equipped with pump start/stop and alarm input delay(s) that have an adjustable delay set points.
8. An Antiseptic function with a built in timer shall be incorporated in the electronic pressure switch to prevent the well from becoming septic.
9. The electronic pressure switch shall be capable of jumping to next available pump if current pump is out of service due to pump failure or manual selection. Circuit design in which application of power to the lag pump motor starter is contingent upon completion of the lead pump circuit shall not be acceptable.
10. The electronic pressure switch shall be equipped with a simulator system capable of performing system cycle testing functions.
11. The electronic pressure switch shall be capable of calculating and displaying pump elapse run time. The elapse run time is resettable and adjustable.

12. The electronic pressure switch shall have internal capability of providing automatic simplex, duplex, and triplex alternation, manual selection of pump sequence operation, and alternation in the event of 1-24 hours of excessive run time.
13. The electronic pressure switch shall be equipped with a security access code to prevent accidental set up changes and provide liquid level set point lock out. The supervisor access code is adjustable.
14. The electronic pressure switch shall be equipped with one (1) 0 33 ft. W.C. input, one (1) scalable analog input of either 0 5Vdc, or 4 20mA, and one (1) scalable analog output of either 0-5Vdc, 0-10Vdc or 4-20mA. Output is powered by 10-24Vdc supply. Load resistance for 4 20mA output shall be 100 1000 ohms.
15. The electronic pressure switch shall include a DC power supply to convert 120Vac control power to 12 or 24Vdc power. The power supply shall be 500 mA (6W) minimum and be UL listed Class II power limited power supply.
16. The electronic pressure switch shall be equipped with an electronic comparator and mechanical output relay to alert maintenance personnel to a high liquid level in the wet well. An alarm banner, visible on the front of the controller, shall indicate that a high wet well level exists. The alarm signal shall be maintained until the wet well level has been lowered and the circuit has been manually reset. High water alarm shall be furnished with a dry contact wired to terminal blocks.
17. The electronic pressure switch shall be equipped with an electronic comparator and mechanical output relay to alert maintenance personnel to a low liquid level in the wet well. An alarm banner, visible on the front of the controller, shall indicate that a low wet well level exists. The alarm signal shall be maintained until the cause for the low wet well level has been corrected and the circuit has been manually reset. A low liquid level condition shall disable all pump motors. When the wet well rises above the low level point, all pump motors shall be automatically enabled. Low water alarm shall be furnished with a dry contact wired to terminal blocks.
18. Integrinex Standard Analog Output circuit will be furnished with transient voltage surge suppression to protect related equipment from induced voltage spike from lighting.
19. An alarm silence pushbutton and relay shall be provided to permit maintenance personnel to de energize the audible alarm device while corrective actions are under way. After silencing the alarm device, manual reset of the alarm condition shall clear the alarm silence relay automatically. The pushbutton shall be a membrane style button integral to the Integrinex Standard level controller.
20. A high pump temperature protection circuit shall override the level control and shut down the pump motor(s) when required to protect the pump from excessive temperature. A thermostat shall be mounted on each pump casing and connected to the Integrinex™ Standard. If casing temperature rises to a level sufficient to cause damage, the thermostat causes the Integrinex™ Standard to interrupt power to the motor. The Integrinex™ Standard will display an alarm banner indicating the motor stopped due to high pump temperature. The motor shall remain locked out until the pump has cooled and circuit has been manually reset. Automatic reset of this circuit is not acceptable.

21. Indicating Lights

a. Indicating lights shall be provided on the operator Interface terminal to alert the user of the following conditions:

1) Pump Run
2) Pump Fault
3) Wet Well Level Alarm Conditions

b. Physical indicating lights shall be oil tight type and equipped with integral step down transformers for long lamp life. Lamps shall be incandescent type rated 14 volts or less. Lamps shall be replaceable from the front without opening the control panel door and without the use of tools. Physical indicating lights will be provided for the following functions:

1) General Alarm

22. Wiring

a. The pump station components, as furnished by the manufacturer, shall be completely pre-wired. (Note: If control panel is opted to be shipped loose, the pump station as furnished by the manufacturer shall be completely pre-wired except for the power feeder lines and final connections to pump motors, and remote alarm devices. The interconnecting wire, conduit, and other materials required shall be furnished and installed by the electrical contractor.)

b. All wiring, workmanship, and schematic wiring diagrams shall be in compliance with applicable standards and specifications for industrial controls set forth by the Joint Industrial Council (JIC), National Machine Tool Builders Association (NMTBA), and the National Electric Code (NEC).

c. All user serviceable wiring shall be type MTW or THW, 600 volts, and shall be color coded as follows:

1) Line and load circuits, AC or DC power .....black
2) AC control circuit less than line voltage..... red
3) Interlock control circuit, from external source .....yellow
4) Equipment grounding conductor.....green
5) Current carrying ground.....white
6) Hot with circuit breaker open .....orange

23. Wire Identification and Sizing

a. Control circuit wiring inside the panel, with the exception of internal wiring of individual components, shall be 16 gauge minimum, type MTW or THW, 600 volts. Wiring in conduit shall be 14 gauge minimum. Motor branch wiring shall be 10 gauge minimum.

b. Motor branch conductors and other power conductors shall not be loaded above the temperature rating of the connected termination. Wires shall be clearly numbered at each end in conformance with applicable standards. All wire connectors in the control panel shall be of the ring tongue type with nylon insulated shanks. All wires on the sub plate shall be bundled and tied. All wires extending from components mounted on door shall be terminated on a terminal block mounted on the back panel. All wiring outside the panel shall be installed in conduit

24. Control conductors connecting components mounted on the enclosure door shall be bundled and tied in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall be allowed so that the door can swing to its full open position without undue mechanical stress or abrasion on the conductors or insulation. Bundles shall be clamped and held in place with mechanical fastening devices on each side of the hinge.

K. Conduit requirements are as follows:

1. All conduit and fittings shall be UL listed.
2. Liquid tight flexible metal conduit shall be constructed of a smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight, polyvinyl chloride cover.
3. Conduit shall be supported in accordance with articles 346, 347, and 350 of the National Electric Code.
4. Conduit shall be sized according to the National Electric Code.

L. Grounding

1. The pump station manufacturer shall ground all electrical equipment to the enclosure back panel. The mounting surface of all ground connections shall have any paint removed before making final connections.
2. The contractor shall provide an earth driven ground connection to the control panel at the main ground lug in accordance with the National Electric Code (NEC).

M. Equipment Marking

1. Permanent corrosion resistant name plate(s) shall be attached to the control and include following information:
   a. Equipment serial number
   b. Control panel short circuit rating
   c. Supply voltage, phase and frequency
   d. Current rating of the minimum main conductor
   e. Electrical wiring diagram number
   f. Motor horsepower and full load current
   g. Motor overload heater element (if applicable)
   h. Motor circuit breaker trip current rating
   i. Name and location of equipment manufacturer
2. Control components shall be permanently marked using the same identification keys shown on the electrical diagram. Labels shall be mounted adjacent to device being identified.
3. Switches, indicators, and instruments mounted through the control panel door shall be labeled to indicate function, position, etc. Labels shall be mounted adjacent to, or above the device.

## 2.13 LIQUID LEVEL CONTROL SYSTEM

A. The manufacturer of the liquid level control system must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

B. Sequence of Operation with Utility Power

2. The level control system shall start and stop the pump motors in response to changes in wet well level, as set forth herein. The level control system shall utilize the PLC sequencer to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle or if one pump runs as the lead pump for an excessive time.

3. Upon operator selection of automatic operation, the PLC shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "lead pump stop level", the PLC shall stop this pump. These actions shall constitute one pumping cycle. Should the wet well level continue to rise, the PLC shall start the second pump when the liquid reaches the "lag pump start level" so that both pumps are operating.

C. Alarms and shutdown routines shall operate as follows:

1. Condition abnormal: The general alarm pilot light will quick flash until acknowledged, then slow flash until reset, then glow steady until condition returns to normal, then off. The operator interface will display the alarm when acknowledged. The external alarms will be active until silenced, and then off.

2. Condition abnormal then returns to normal: The general alarm pilot light will quick flash until silenced, then slow flash until reset, then off. The operator interface will display the alarm when acknowledged. The external alarms will be active until silenced, and then off.

3. Subsequent alarms will re-alarm when silenced or reset.

E. Submersible Level Transducer Level Sensor

1. The level control system shall utilize a submersible transducer. It shall be a strain gauge transducer with a pressure sensor housed in a 316 SST or Titanium case designed to extend into the wet well. The pressure transducer shall provide a proportional signal for distribution to the display and electronic comparators of the electronic pressure switch, and remainder of the level control system. Sensor range shall be 0 12 ft. W.C. minimum with an over-pressure rating 3 times full scale. The transducer shall have output capability of 0-5Vdc or 4-20mA. The transducer's polyurethane jacketed shielded cable shall be of suitable length for proper installation into the wet well without splicing.

2. An intrinsically safe repeater shall be supplied in the control enclosure. Repeater must be recognized and listed as intrinsically safe by a nationally recognized testing laboratory. Station manufacturer shall make all connections from repeater to feeder lines and motor controls. Installing contractor shall make connections from repeater to transducer.

3. Submersible transducer will be furnished with transient voltage surge suppression to protect related equipment from an induced voltage spike from lighting.

## 2.17 STATION FIBERGLASS ENCLOSURE AND BASE

A. Station Construction and Design:

1. The station shall incorporate a fiberglass enclosure and steel base. The station shall be supplied as a complete, weathertight unit with all pump, piping and controls installed and wired by the pump manufacturer.
2. The enclosure and base is to be rectangular with outside dimensions of __18_' long by _11.5__' wide and having a maximum outside height of 9'-6" at the roof peak. The internal height of the enclosure shall be 8'-6".
3. A minimum of (4) four lifting eyes provided on the station base shall be provided to ease handling and installation onto a concrete pad furnished by the contractor.
4. Enclosure walls and roof shall be seamless, one-piece sprayed fiberglass panels laminated to form a structural composite as follows: 1/8" thick fiberglass outside surface, minimum 2" thick ura foam polyurethane core, 7/16" oriented strand board (OSB), and 3/32" thick fiberglass inside surface. OSB shall replace foam at all cut-out openings and penetration points.
5. Each wall panel shall overlap at the corner and form an internal connection joint using stainless steel hardware. All panel joints shall be thoroughly sealed with silicone caulk. The enclosure shall have a minimum R10 insulation factor and shall be capable of withstanding 150 mph wind loads.
6. All interior surfaces shall be sprayed white isopthalic gel coat finish offering the same characteristics as the exterior surfaces.
7. The roof panel shall be an arched, one-piece design incorporating the same materials of construction as the side walls. The roof shall be removable as a unit, allowing for complete access to the pumping equipment with a crane. The pitch of the roof shall be sufficient for good moisture drainage, and withstand a minimum snow load of 40 pounds per square foot.
8. The station shall be furnished with one (1) 3'0" wide x 6'8" high entrance door(s) shall be constructed of the same laminated fiberglass and foam core materials as the remainder of the station. OSB will replace the insulation in areas where auxiliary equipment will be mounted. Each door shall be hung with (3) three stainless steel ball bearing type hinges incorporating a three point closure system with a lockable door handle. An adjustable door positioner and holder shall be mounted at the top of the door. A gasket consisting of solid rubber and sponge shall seal the door while closed. The door and all hardware shall be mounted to withstand 150 MPH winds. A wall mounted drip molding will be installed above each door.
9. The station enclosure shall be furnished with one (1) extra wide doors. A double hung door design with 3-point locking hardware, door closer, and hinges on each section shall allow complete access to the 6'-0" x 6'-8" full door opening without the need for a center sill.
10. The design shall resist deformation of the structure during shipping, lifting, or handling. Base shall incorporate drainage provisions, and an opening sized to permit installation

of piping and service connections to the wet well. After installation, the opening shall serve as a grout dam to be utilized by the contractor. The base shall incorporate anchor points for securing the complete station to a concrete pad (supplied by the contractor) in accordance with the project plans.

11. Pumps and motor stands shall bolt directly to the station base eliminating the need for a pump skid.
12. Holes through the base shall be provided for suction and discharge lines, air release lines, and level control cabling or air lines. Holes for the suction and discharge lines shall be provided with a grout dam incorporated in a grout retention cavity which the contractor shall fill at installation with suitable grout to seal each pipe to base joint against the entrance of hazardous gases from the wet well.
13. The station base shall be coated with a non-slip surface.
14. The walls of the fiberglass enclosure shall be mounted to the steel base with mechanical fasteners in two foot intervals. The connection between the enclosure walls and the steel base shall be sealed with a neoprene gasket.
15. The station shall be positioned on the concrete mounting pad supplied by others.

B. Enclosure Functional Equipment:

1. The interior of the station shall be illuminated by factory installed 120 volt _florescent__ light fixtures. All lights will be prewired and run to a load center through PVC conduit and a weatherproof switch shall be installed adjacent to each station entrance. The lighting circuit shall be protected by a thermal-magnetic circuit breaker.
2. A thermostatically controlled 120 VAC exhaust fan with screen and weatherproof shutters shall be installed in the wall approximately opposite the fresh air intake vent. The fan shall have a minimum capacity of 1600 CFM at free air and be capable of changing the air in the enclosure a minimum of six times per hour. The exhaust fan shall be protected by a thermal-magnetic circuit breaker.
3. The enclosure will be complete with one (1) set of exhaust louvers. The exhaust louvers will be completely self-contained and shall not require the use of motors, solenoids, or other electrically operated devices. Exhaust louver will consist of four (2) 15" wide and 18-7/8" high shutters that open automatically at 75° F, and close at 60° F. Shutter operation will be the result of the expansion and contraction of wax in an enclosed plunger which shall drive the louver vanes through a mechanical linkage. The exhaust shutter will have the actuator mounted in the flow of the exhaust air and shall maintain the shutter vanes in the open position. Exhaust shutter frame will be constructed of anodized aluminum with zinc plated steel actuator mounting and linkage. The shutter vanes will pivot on plastic bearings. The four (4) intake shutters will be mounted in two aluminum fixed vane louver assemblies to prevent the entrance of rain or snow.
4. A 460V high capacity electric blower type station heater shall be provided for the protection of the pumping equipment. The heater shall maintain an inside/outside differential temperature of 60 degrees F while operating on the primary voltage supplied to the station. The heater shall be provided with an adjustable thermostat, circuit breaker, and contactor.

5. Two wall mounted duplex GFI utility receptacle providing 120 volt AC power shall be installed and prewired through PVC conduit with the station lighting. The receptacle shall be protected by thermal magnetic circuit breaker.

## SECTION 33 34 00

## SEWER FORCE MAIN

GENERAL

1.1 SUMMARY

A. Furnish and install pressure pipe and fittings for sewage force main.

1.2 RELATED SECTIONS

A. Section 31 23 33 – Trenching & Backfilling.

1.3 REFERENCES

A. American Society for Testing and Materials, 1961 Race Street, Philadelphia, Pennsylvania 19103.
   1. ASTM D1784 - Specification for Rigid Poly (Vinyl Chloride)(PVC) Compounds and Chlorinated Poly (Vinyl Chloride)(CPVC) Compounds.
   2. ASTM D2241 - Specification for Rigid Poly (Vinyl Chloride)(PVC) Pressure Rated Pipe (SDR-Series).
   3. ASTM D3139 - Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
   4. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

B. American National Standards Institute, 25 West 43rd Street, 4 floor, New York, NY, 10036.
   1. ANSI/AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
   2. ANSI/AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings, 3 in Through 48 in, for Water and other Liquids.
   3. ANSI/AWWA C111/A21.11 - Rubber Gasket Joints for Ductile-Iron and Gray-Iron Fittings Pressure Pipe and Fittings.
   4. ANSI/AWWA C115/A21.15 - Flanged Ductile-Iron Pipe with Threaded Flanges.
   5. ANSI/AWWA C150/A21.50 - Thickness Design of Ductile-Iron Pipe.

C. ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959.
   1. ASTM A307 - Specifications for Carbon Steel Externally Threaded Standard Fasteners.
   2. ASTM A563 - Specification for Carbon and Alloy Steel Nuts.
   3. ASTM D1248 - Specification for Polyethylene Plastic Molding and Extrusion Materials.

1.4 SUBMITTALS

A. Make submittals in accordance with the General Conditions.

B. Product Data:
1. Pipe materials and manufacturers.
2. Manufacturer's standard installation instructions.

C. Certificate of Compliance: Submit attesting that materials provided are in compliance with referenced standards.

D. Test Records:
1. Date of test.
2. Description and identification of piping tested.
3. Test fluid.
4. Test pressure.
5. Remarks to include such items as:
   a. Leaks (type, location).
   b. Repairs made on leaks.
6. Certification by Contractor and written approval by Engineer.

1.2 QUALITY CONTROL

A. Polyvinyl Chloride (PVC)
1. PVC pipe manufactured from Type 1, Grade 1 PVC, conforming to ASTM D1784.
2. Pipe shall be tested in accordance with ASTM D2241 and product standard PS 22-70.

## PART 2. MATERIALS

2.1 PVC PIPE, FITTINGS, AND JOINTS

A. Pipe: Conform to the following requirements:
1. ASTM D2774 Pressure PVC Pipe rated at 200 psi, SDR 21, or as indicated on plans.
2. ASTM D1784 Class 200, Type I, Grade 1.

B. Permanently mark at 5-foot intervals with the following information:
1. Nominal size.
2. Material code designation.
3. Manufacturer's name or trademark and production record code.
4. ASTM or AWWA certification.
5. SDR designation.

C. Joints:
1. Buried Pipe: Gasketed slip joint with integral bell for buried sewer piping.

2. Comply with ASTM D3139.

D. Fittings:
1. Fittings 4 Inches and Larger: Cast iron or ductile iron mechanical joint.
2. Fittings Smaller Than 4 Inches: PVC.

E. Gaskets:
1. As recommended by pipe manufacturer for outside diameter of pipe.
2. Comply with ASTM F477.

F. Marking Tape:
1. Install on pressure systems.
2. Terra Tape "Extra Stretch."
3. Or equal.

G. Trace Wire: 12 gage, insulated copper.

H. Tee Fittings:
1. Furnish caps or plugs with each tee outlet or stub.
2. Band or otherwise secure plug or cap to withstand test pressures involved without leakage.
3. Furnish tee outlets with gasketed type joint or approved adapter to join service connection pipe used.

## 2.2 DUCTILE IRON PIPE, FITTINGS, AND JOINTS

A. Pipe:
1. Buried Pipe: Pressure Class 250 or 300, as shown on Drawings and in compliance with applicable requirements of ANSI A21.50. Flanged pipe shall meet or exceed ANSI/AWWA C115 /A21.15.
2. Pipe shall be jointed with push-on, mechanical, flanged, restrained, or flexible joints meeting applicable requirements of ANSI A21.11-72 and ANSI 21.15-75.
3. Ductile iron pipe shall receive standard thickness cement lining and bituminous seal coat in conformance with ANSI/AWWA C104 /A21.4.
4. Ductile iron pipe shall be coated on the exterior with either coal tar or asphalt base material approximately 1 mil thick.
5. Flexible Joint (Ball and Socket) Pipe: Class 58.

B. Fittings:
1. Ductile iron, Pressure Class 250 or 300 Class as shown on Drawings, cement-lined and seal-coated. Where taps are shown on fittings, tapping bosses shall be provided.
   a. Flanged Joint: ANSI/AWWA C115/A21.15, faced and drilled. 125-pound ANSI standard.
   b. Mechanical Joint: ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11.

c. Flexible Joint: American Flex-Lox pipe or equal.

2. Cement Linings: In accordance with ANSI/AWWA C104/A21.4

3. Fittings shall receive an exterior coating of 1 mil thick bituminous material in accordance with ANSI/AWWA C104/A21.4.

4. Fittings shall have distinctly cast on them the manufacturer's identification, pressure rating, nominal diameter of openings, and the number of degrees or fraction of the circle on bends.

C. Flanges:

1. ANSI/AWWA C115/A21.15, threaded, 250 psi working pressure, ANSI.

D. Bolts:

1. For Class 125 FF flanges use carbon steel, ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts.

2. For Class 250 RF flanges use carbon steel, ASTM A307, Grade B hex head bolts and ASTM A563, Grade A heavy hex head nuts.

3. For mechanical joint use manufacturer's standard.

E. Gaskets:

1. Gaskets for mechanical joints shall be rubber, conforming to ANSI/AWWA C111/A21.11.

2. Gaskets for flanged joints shall be 1/8-inch thick, cloth-inserted rubber conforming to applicable parts of ANSI/AWWA C115/A21.15 and AWWA C207.

3. Gasket Material: Free from corrosive alkali or acid ingredients and suitable for use in potable waterlines

4. Gaskets shall be full-face type for 125-pound FF flanges.

F. Lubricant:

1. Lubricant for push-on or mechanical joint end piping shall be manufacturer's standard.

G. Marking Tape:

1. Install on pressure systems.
2. Terra Tape “Extra Stretch.”
3. Or equal.

H. Trace Wire:

1. 12 gage, insulated copper.

2.3 CONCRETE FOR THRUST BLOCKING AND ENCASEMENT

A. Compressive Strength: Minimum 2,500 psi at 28 days.

## PART 3. EXECUTION

3.1 PREPARATION OF TRENCH

A. Bell Holes:
   1. Excavate bell holes at each joint to permit proper assembly and inspection of entire joint.
   2. Bell holes shall be of sufficient depth to preclude direct bearing of bell on bottom of trench.

## 3.2 RELATION TO WATER LINE

A. Laying sewer line follow Health Department requirements. Maintain 10-foot horizontal separation and 18-inch vertical separation in crossings.

## 3.3 THRUST BLOCKING

A. Do not over excavate in areas where thrust blocks are to be poured.

B. Construct suitable forms to obtain shapes that will provide full bearing surfaces against undisturbed earth, as indicated.

C. Pour thrust blocking against undisturbed earth.

D. Cure thrust blocks a minimum of 5 days before conducting hydrostatic and air tests.

## 3.4 LAYING AND JOINTING PIPE AND FITTINGS

A. Install in accordance with manufacturer's written instructions.

## 3.5 HYDROSTATIC TESTING OF PRESSURE LINES

A. Conduct test in presence of Engineer or Engineer’s representative.

B. Provide water into pipeline for testing and flushing, including necessary:
   1. Pumps, gages (increment at 10 psi or less), and meters.
   (1) Plugs and caps.
   2. Temporary blowoff piping to discharge water.
   3. Reaction blocking to prevent pipe movement during testing.

## 3.6 HYDROSTATIC AND LEAK TESTING OF PRESSURE LINES

A. Upon completion of installation, thoroughly clean new pipe.
   1. Flush with water to remove dirt, stones, pieces of wood, etc., which may have entered pipe during construction.
   2. Flush pipelines at a minimum rate of 2.5 feet per second for a duration suitable to Engineer.

B. Upon completion of installation, pressure test pipelines:
Minimum Pressure: 100 psig or 50 percent greater than operating pressure

whichever is greater; as measured at the lowest elevation of the line.
Duration: 2 hours.
Repair visible leaks that exceed the leakage rate as determined in paragraph 3.6 L.

A. Water source for the pump suction shall be potable water from the Owner's distribution system; vessel used must be approved by the Engineer.

B. Adequate steps shall be taken to prevent contamination of the Owner's system by the Contractor's actions.

C. After pipelines or isolated sections of pipelines have been filled with water, increase the pressure to test pressure by means of a pump.

D. Test pressure shall be 100 psi or 50 percent above normal operating pressure, whichever is greater.

E. Duration of hydrostatic leakage test shall be 2 hours, or as specified by Engineer.

F. Open interior valves, including fire hydrants and other appurtenances, open during tests.

G. After the specified test pressure has been applied, the entire pipeline shall be checked in the presence of the Engineer giving particular attention to that part of the pipeline and those appurtenances that are exposed.

H. If leaks are apparent, the Contractor shall, at his expense, perform whatever work and/or replace whatever material is required to remedy the defect and stop the leaks.

I. If no leaks were apparent or after corrective work has been completed, the pipelines shall be subjected to a leakage test at the pressure specified with a meter inserted in the test pump discharge line.

J. The maximum leakage per hour for ductile iron, PVC, and concrete pipe shall be as calculated from the following formula from Section 7.3.6 (Test Allowance) of AWWA C605-05.

All rubber gasket or O-ring joints (iron, PVC, and concrete)

$$Q = \frac{LD\sqrt{P}}{148{,}000}$$

Q = Quantity of makeup water (gallons per hour)
L = Length of pipe sections being tested
D = Nominal diameter (inches)
P = Average test pressure during the hydraulic test (psig)

This Formula is based on a Testing Allowance of 10.5 GPD/Mile/inch of nominal pipe diameter at a test pressure of 150 PSI.

K. If any test of pipe laid discloses leakage greater than the allowable leakage as calculated from the above formula, locate the leak or leaks and perform whatever work and/or replace whatever material is required in order to remedy the defect and stop the leak.

L. Corrective work must be approved by Engineer.

EXTERIOR PROTECTION FOR BURIED OR SUBMERGED PIPING ACCESSORIES

Wrap mechanical joints and valves with 8 mil polywrap.

**END OF SECTION**

# DIVISION 41 – MEASUREMENT EQUIPMENT

## 41 36 29.39 – Ultrasonic and Magnetic Flow Measuring Equipment

# SECTION 41 36 29.39
# ULTRASONIC AND MAGNETIC FLOW MEASURING EQUIPMENT

## PART 1 GENERAL

### 1.01 SCOPE OF WORK

A. This specifications section covers the work necessary to furnish complete, operable ultrasonic and magnetic flowmeters in the locations and sizes as shown on the plans.

### 1.02 DELIVERY STORAGE, HANDLING

A. Equipment shall be delivered to the jobsite completely factory assembled. Individual equipment components shall be crated in adequate packing containers to prevent damage, facilitate ease of handling and to provide suitable protection from weather for extended storage at the jobsite prior to installation. Packing containers shall be permanently labeled with appropriate equipment identification, shipping address and return address. Packing list shall be provided with equipment at time of delivery.

B. Electrical equipment shall be kept thoroughly dry at all times and shall be stored indoors. Equipment shall be stored directly on the ground.

### 1.03 QUALITY ASSURANCE

A. The ultrasonic flow meters furnished under this contract shall be as manufactured by Eastech Flow Controls. The magnetic flow meters furnished under this contract shall be as manufactured by ABB.

B. Only manufacturers regularly engaged in the manufacture of the type of equipment specified and that can demonstrate equipment of their manufacture in actual service for a period of not less than 15 years will be considered.

## PART 2 PRODUCTS

### 2.01 ULTRASONIC FLOW METER

A. An ultrasonic flowmeter shall be installed to measure (depth/flow) over the parshall flumes at the locations shown on the plans in accordance with manufacturer recommendations. The flowmeter shall have microprocessor-based electronics, a front panel menu-driven keyboard and shall produce an isolated 4-20 mADC signal proportional to the flow. The flowmeter shall be self-compensating for ambient temperature conditions. The flowmeter shall also have

as standard four relay outputs available for alarm conditions, sampling or pulsing external totalizers. The unit shall be capable of simulating flow/level without any external devices for verifying outputs and calibrations. The units shall be an Eastech Badger Meter Model 2200, Siemens Hydroranger 200 or approved equal.

B. The acoustic sensor shall be permanently mounded at the measuring site and positioned according to the manufacturer's approved method. Sensor mounting adaptor shall be supplied by the manufacturer. The cable from the sensor to the electronics box shall be installed in an exclusive 3/4" or 1" rigid or flexible, continuous, watertight metallic conduit. The sensor shall transmit and receive an acoustic signal to accurately measure fluid depth at the monitoring site. The sensor shall have built-in temperature compensation to maintain accuracy. The sensor shall be capable of an indefinite submergence of 30 feet without degradation. The sensor shall function over an ambient temperature of -20$^{o}$F to 160$^{o}$F.

C. The transmitter shall contain all necessary circuitry to utilize the signal from the acoustic sensor and shall produce an accurate 4-20 mADC (depth/flow) signal. AN RS-232 serial port connection shall be provided for computer interface for real-time communications. The transmitter shall be supplied with a 2-line LCD indicator to display flow rate and flow total and their respective flow units and multipliers. The display shall indicate if there is a fault or an alarm condition. The transmitter shall also produce four relay output connections for external alarms, sampling or pulse output to drive a remote totalizer. The unit shall be enclosed in a NEMA 4X outdoor housing suitable for mounting at the location indicated on the plans. The unit shall function over an ambient temperature range of -20$^{o}$F to 150$^{o}$F. Outdoor application shall incorporate an internal thermostat exhaust fan, intake louver, exhaust louver, and heater to insure cold weather operation all mounted in a fiberglass enclosure. The unit shall function over an ambient temperature range of 32$^{o}$F to 150$^{o}$F outdoors.

D. Accuracy of the unit shall be unaffected by temperature changes within the specified ambient temperature range. Flow sampling shall be a minimum of 15 samples per second and the unit shall be able to operate with as few as 2% of the samples taken successfully. In the event of the prolonged loss of acoustic signaling, the unit shall indicate the condition by a flashing status indication on the front display panel. The flow signal shall be an isolated 4-20 mADC operating into a maximum of 1000 ohms. The output signal indicates (depth/flow) to +/-0.1% of target distance or +/-0.08%, of flow whichever is greater. Repeatability shall be within +/-0.2%. The unit shall operate using (117/230) VAC, (50/60) Hz electrical service with the ability to connect an external battery for uninterrupted operation due to power loss. All user wiring connection shall be made via well-marked terminal blocks.

E. The unit shall be capable of monitoring the status of the meter by a menu-driven

keyboard on the front panel of the transmitter. The unit shall continue to measure and totalize while in the status mode. The unit shall also be capable of recalibration in the field by the menu-driven keyboard. The manufacturer shall provide troubleshooting guides and complete meter instruction, operating and maintenance manuals with each unit.

F. The meter shall be calibrated for the maximum design flowrate.

F. The meter shall out an isolated 4-20 mA DC signal, 800 ohms maximum, to the chart recorder.

G. The electrical signaling cable, supplied by the flowmeter manufacturer, shall be connected from the sensor to the transmitter housing. The cable shall be installed in an exclusive 3/4" or 1" rigid or flexible, continuous, watertight, metallic conduit. The sensor may be located up to 1000' (with splice) from transmitter.

## 2.02 MAGNETIC FLOW METERS

A. The electromagnetic flow meter shall consist of a flow sensor based on Faraday's Law of Electromagnetic Induction and microprocessor-based signal converter.

B. Sensor

1. Operating principle: Utilizing Faraday's Law of Electromagnetic Induction, the flow of liquid through the sensor induces an electrical voltage that is proportional to the velocity of the flow.
2. Construction: The sensor flow tube and liner material shall be constructed of nitrile, which is a hard rubber composite elastomer, surrounded by two integral coils. Measurement and grounding electrodes shall be 316stainless steel. Connecting flanges shall be carbon steel. Wetted materials shall be NSF approved for drinking water service.
3. Installation: A minimum of 5 pipe diameters up stream and 3 pipe diameters down-stream.
4. Operating Temp: -20 to +200 degrees F.

C. Signal converter:

1. Enclosure: NEMA 4X enclosure
2. Display: Background illuminated alphanumeric 3 line, 20 character display to indicate flow rate, totalized values, settings and faults and 6-key keypad. (A blind transmitter version of the 5000 is available)
3. Power supply: 115/230 VAC or 11-24VDC.
4. Operating temp: -5 to 120 degrees F.
5. Output: 0-20mA or 4-20mA into 800 ohms max. 1 relay rated at 42VAC/2A, 24DC/1A.

6. Flowmeter tubes installed in vaults shall be equipped with remote mounted readouts and required cable between the meter tube and readout.

C. Sensor and converter/transmitter performance

1. Flow Range: 1.5 fps to 33 fps for accuracies stated below.
2. Accuracy: 0.50% of actual.
3. Separation: Maximum distance of 900 feet between converter and sensor without the use of any additional equipment.
4. Bi-directional flow capabilities shall be standard.

E. Totalizer

1. Two integral eight digit counters programmable for forward, net or reverse flow.
2. The totalizers may be programmed as non-resettable or resettable.

F. Each flow sensor shall be wet calibrated and all of the calibration information and factory settings matching the sensor shall be stored in an integrally mounted SENSORPROM memory unit. The SENSORPROM shall store sensor calibration data and signal converter settings for the lifetime of the product. At initial commissioning, the flow meter commences measurement without any initial programming. Any customer specified settings are downloaded to the SENSORPROM. Should the signal converter need to be replaced, the new signal converter will upload all previous settings and resume measurement without any need for reprogramming or rewiring. A certificate of calibration shall accompany each flow sensor.

G. The following signal converter functions shall be provided

1. All programming shall be accomplished through an integral keypad and all programming shall be protected by a user-defined password.
2. The signal converter shall be integrally mounted or remotely mounted using a remote-mount kit provided by the manufacturer.
3. The signal converter shall provide a 0/4-20 mA DC signal proportional to flow rate into 800 ohms max. Output selectable as uni-directional or bi-directional.
4. The relay shall be programmable as error indicator, limit alarm or pulsed output.
5. The signal converter system shall be equipped with an error and status log with 4 groups of information.
    a. Information without a functional error involved.
    b. Warnings which may cause malfunction in the application
    c. Permanent errors, which may cause malfunction in the application.

d. Fatal error, which is essential for the operation of the flow meter.

6. A system error shall be indicated by a flashing icon on the display or activation of the relay when set as an error alarm.
7. The first nine standing errors shall be stored in the error pending log. A corrected error is removed from the error pending log. A status log shall be provided to store the last 9 error messages received for 180 days regardless of correction.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. The Owner shall assume full responsibility for coordination of the entire project, including verification that all electronic systems and equipment components are compatible.

B. Equipment and materials utilized for this project must be approved by the Engineer prior to installation. Approval for installation or incorporation in this project will be made only after submittal of manufacturer's shop and installation drawings, test results or other data as required and as specified herein.

C. Installation of equipment shall be in full conformance with the manufacturer shop drawings and requirements as approved by the Engineer.

### 3.02 WARRANTY

A. The manufacturer shall warrant the equipment to be of quality construction, free from defects in materials and workmanship. The warranty shall become effective upon Final Acceptance of the entire project by the Owner.

B. The equipment, apparatus, and parts furnished shall be warranted for a period of one (1) year.

C. Components failing to perform as specified by the Engineer, or as represented by the manufacturer, or proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without any cost to the Owner.

### 3.03 FUNCTION OF MANUFACTURER

A. Provide the services of a qualified representative of the meter manufacturer to assist in adjusting and testing the equipment, to supervise initial operation, and to assist in making final adjustments and the tests specified, or which may be necessary to assure the Engineer that the equipment is in satisfactory operating conditions.

B. Operation and Maintenance Materials

1. The meter and recorder manufacturer shall be responsible for supplying written instruction, which shall be sufficiently comprehensive to enable the operator to service, program, and operate the meter and all equipment supplied by the manufacturer.

2. Operation and maintenance instruction shall be specific to the equipment supplied in accordance with these specifications. Instruction manuals applicable to many different configurations and meters, and which require the operator to selectively read portions of the instructions shall not be acceptable.

C. All costs for the above ultrasonic flow meter manufacturer functions including travel, lodging, meals, and incidentals shall be considered to have been included in the Manufacturer's lump sum bid price and will be at no additional cost to the Owner.

**END OF SECTION**

# APPENDIX A

Tipton Environmental WWTP

**TIPTON ENVIRONMENTAL INTERNATIONAL, INC.**
**PACKAGED BIOLOGICAL WASTEWATER TREATMENT**
**SYSTEM EQUIPMENT SPECIFICATIONS**

**Wastewater Treatment System**
**Prefabricated Steel Construction**

## 1.0 GENERAL

1.1 The contractor shall furnish and install one package biological wastewater treatment system, complete and ready for operation in accordance with the plans and specifications stated herein. The treatment system shall include one (1) Model TEII500-FETC prefabricated steel Tipton Environmental International, Inc. using "ASCO2RT" Process, oxygen-controlled reactor system in conjunction with extended aeration process wastewater treatment system complete with secondary treatment as manufactured by Tipton Environmental International, Inc. Batavia, Ohio, U.S.A. The wastewater treatment system will have a total design flow of 50,000 gallons per day. The aeration chamber shall be over-sized for a volume of 50,000 gallons of volume complete with a dual hopper clarifier for an oversized settling area. The proposed equipment package shall include the necessary tank vessels, internal piping, valving, weirs, baffles and all items of equipment as listed below. The secondary treatment system shall be complete with a flow proportioning, flow equalization system, aeration chamber, dual hopper type clarifier, sludge holding tank. For the secondary treatment process. For tertiary treatment a dual cell rapid sand tertiary filter system shall be provided, complete with clearwell chamber, mudwell chamber, disinfection system complete with chlorination, contact tanks and all necessary tank vessels and component equipment necessary for efficient and proper plant operation.

1.2 The package system shall be factory prefabricated and assembled, so far as possible, taking into consideration shipping and erection limitations. Because of the total system length, the tankage shall be shipped to the project site in three major tanks pieces. In addition, all internal tank piping and wiring shall be supplied and ended at the appropriate joints whereas the field contractor shall reconnect. All vessel surfaces shall be factory painted as described below.

1.3 The basic equipment furnished by the manufacturer shall include, but not be limited to tanks vessels, those vessels being factory painted, all tank internal piping and valving, blower motor unit assemblies, service walkways, and electrical equipment including all internal system wiring and/or controls.

## 1.5 THE GENERAL CONTRACTORS FIELD SERVICES

The General Contractor shall perform the actual installation of the TEII wastewater water treatment system. The following is a brief description of the general contractor's responsibilities regarding the installation:

A. Provide a crane and other equipment for off-loading and setting of the wastewater treatment system, which come in several major sections and for setting it onto its foundation pad. Attach the anchoring facilities to be positioned in the foundation pad as defined by the contract drawings.

B. Once the system has been set into position, it shall be reconnected including field welding and or re-assembly the sections which has been disconnected for shipping such as the piping, valving, grating, handrails and wiring which may have been disconnected at the factory for shipping purposes.

C. The general contractor's electrical field crew shall install at the location shown on the drawings the electrical consoles such as; Model CP-1 (Main Control Panel), CP-2A & CP-2B (flow equalization control panels for blowers and surge pumps), CP-3 tertiary control panel. In addition, they shall run the electrical wiring and conduit to the appropriate ancillary components within the wastewater treatment structure.

D. All areas requiring touch up painting shall be painted by the Contractors field crew. The areas which will require field welding, shall be not painted, but shall have a taped area over the metal so that field welding can be performed without burning through the paint.

E. An adequate access road to the plant site shall be provided to enable the lowboy trucks into the project site and for off-loading.

F. The freight for shipping the unit from Manchester, Tennessee to the project site shall be provided by the equipment manufacture.

G Provide facilities and crane for off-loading and setting of the wastewater treatment system onto its concrete foundation pad. It is recommended that the crane size should be a minimum of 100 ton. Access into the site and exit from the site shall be the responsibility of the owner. A two-hour time window schedule to off load each tank has been included. It will be necessary to hold to this time schedule so that the owner is not charged detention time by the freight hauler.

H. All site utilities to the system shall be tied-in to the system. The electrical power requirements shall be provided at each power block of each control console. The main power to the wastewater treatment system shall be supplied through an electrical power meter, main disconnect, and disconnect for each of the sub-panels — CP-1, CP-2A & B, and CP-3. These disconnects shall be supplied by the owner's field electrical contractor. Each of the sub-panels shall be supplied with a power block to receive the electrical power from these disconnects. The power shall be 480 volts, 3 phase, 60 Hz. A total of four sub-panels, CP-1, CP-2A & CP-2B, CP-3. The necessary control voltage of 120 volt, 1 phase for the ancillary equipment shall be obtained through transformers.

I. The foundation pad for setting the system in to position within is to be furnished by the field contractor.

J. Finish grade and placement of gravel and concrete grout around the hopper caps of the clarifier.

K. Field welding the tank structure to a watertight structure shall be by the field contractor. The tank structure shall be shipped in three (3) major tank sections and field welded together per the contract drawings.

## 2.0 SYSTEM DESIGN CRITERIA AND PARAMETERS

2.1 The wastewater treatment system will have a total design flow of 50000 gallons per day of domestic wastewater. The aeration chamber shall be sized for a volume of 50,000 gallons of volume. The peak hourly flow rates shall be controlled by the flow equalization system to reduce and maintain the influent flow rate to the average daily flow rate:

2.2 Flow Equalization Criteria

A) Holding Volume = 7,500 gallons
B) Air line connection to main air header for emergency air supply
C) Air Supplied = One (1) blowers at 75 SCFM at 5 psi each
D) Dimensions = 11'-11"" wide x 11'-0" high x 9'-6" long
E) Airline connection to main air headed with shut off valve.
F) Invert location at side wall of chamber (Invert 1'-4"from top tank)
G) Sub merged bar screen

2.3 Aeration Chamber Criteria

A) Holding Volume = 50,000 gallons
B) Air Supplied = two (2) blowers at 250 SCFM @ 5 psi each
C) Dimensions = 11'-11" wide x 11'-0" high x 59'-9" long
D) Controlled by time clock

2.4 Sludge Holding Criteria

A) Holding Volume = 4,000 gallons
B) Air Supplied = from main blower units
C) Dimensions = 11'-11" wide x 11-0" high x 4'-10" long

2.6 Clarifier Criteria

A) Holding Volume = 8,833 gallons
B) Air Supplied = from main blower units
C) Dimensions = 9'-0" wide x 14-0" high x 18'-0" long

2.7 Tertiary Treatment Criteria

A) Rapid sand type with dual filter cells
B) Each Filter Cell Area = 17.35 square feet
C) Backwash Rate = 15 GPM per square feet = 260 GPM
D) Clear Well Volume = 2600 Gallons
E) Mudwell Volume = 2700 Gallons

2.8 Disinfection Criteria

A) Disinfection by tablet type chlorinator disinfection unit
B) Chlorine contact tank Volume = 30 minute detention = 1042 gallons

## 3.0 VESSEL TANK CONSTRUCTION

3.1 All tank vessels shall be fabricated of one-fourth inch structural grade steel plated; joined by arc welding with fillets of adequate section for the joint involved. All walls shall be continuous and watertight and shall be supported by structural reinforcing members where required. Fabrication and erection shall conform to the standard fabrication procedures of Tipton Environmental International, Inc in the manufacturing of this tankage and its ancillary equipment. All tankage will have reinforcing members as required. All other areas such as the floor, end walls, and internal bulkheads to be adequately reinforced.

3.2 All piping and valving shall be provided constructed of a minimum of schedule 40 steel pipe. The painting of this pipe and valving to be as defined in section below:

3.3 The package wastewater treatment system shall be transported to the project site on low boy truck in three major sections plus the hopper caps of the clarifier, which shall be shipped inside the aeration zone. The contractor shall be responsible for field assembly, including field welding and bolting where required.

## 4.0 PAINTING AND CORROSION CONTROL

4.1 All tank vessel surfaces to be painted shall be properly prepared in a workmanlike manner to obtain a smooth, clean, and dry surface. All rust, metals fragments, dust, weld slag, and mill scale as well as extraneous matter, and shall be removed by means of cleaning by general methods.

4.2 All interior tank vessel surfaces below the main box beam shall be painted with Tnemec 46-465 coal tar paint, or equal to a minimum total dry film thickness of 8-10 mils.

4.3 All exterior tank vessel surfaces including the box beam shall be painted with Tnemec 46-465 coal tar paint, or equal to a minimum total dry film thickness of 8 -10 mils.

4.4 All steel piping & valving shall be painted with Tnemec 46-465 coal tar paint, or equal to a minimum total dry film thickness of 8 - 10 mils.

## 5.0 FOUNDATION

5.1 A concrete foundation pad shall be constructed conforming to the project specifications for level and flatness as specified by the manufacturer on the foundation drawing. The clarifier hopper cap shall penetrate the foundation pad. The concrete contractor shall be responsible for placing these cutouts in the concrete pad. Once the tankages have been set into position the owner's contractor shall be responsible for placing the concrete grout into the cutouts in the foundation pad where the clarifier hopper cap penetrates the pad.

## EQUIPMENT SECTION

## FLOW EQUALIZATION EQUIPMENT SECTION

### DIVISION 6 - FLOW EQUALIZATION SYSTEM

6.1 To control the peak hourly flow rates of 7,500 gallons per day of domestic wastewater from homes in subdivision. A flow equalization system shall be provided at the influent end of the wastewater treatment system. The influent peak flow rates shall enter into the flow equalization system where it is held and aerated until the secondary treatment system is ready to process it. Once the influent has been received by the flow equalization chamber it shall be processed by dual flow equalization pumps, pumping it to the flow-proportioning chamber. This chamber shall be so designed that it will allow the average daily flow to be processed and pass through the chamber into the aeration chamber. To control the flow rate from the flow equalization pumps a series of a v-notch weir and a flat weir, which is adjustable, to be provided. The flow equalization control system shall be complete with bar screen, dual flow equalization pumps, liquid level control system, flow proportioning chamber, electrical controls, air blower, course air diffuser with air manifold.

Tipton Environmental International, Inc shall provide the following equipment for the flow equalization basin:

(A) One Flow Equalization Air Blower Unit, 75 SCFM @ 5 psi. The voltage shall be 480 volts, 3 phase, 60 Hz.
(B) One Flow Equalization Electrical Control Panel Model CP-2B for the surge pumps. The voltage shall be 480 volts, 3 phase, 60 Hz.
(C) One Flow Equalization Control Panel Model CP-2A for the surge blower unit. The voltage shall be 480 volts, 3 phase, 60 Hz.
(D) Four Liquid Level Sensors, narrow angle type controlling the surge pumps.
(D) One Liquid Level Sensor, wide angle type for controlling the surge blower.
(E) Three Course Air Diffusers with drop assemblies complete with air diffusers each with eight diffuser nozzles
(F) Two Flow equalization pumps P-1, P-2. The voltage 480 volts, 3 phase, 60 Hz.
(G) One7,500 gallon flow equalization tank
(H) One Bar screen mounted in the flow equalization chamber
(I) One Flow Proportioning Chamber

### 6.12 INLET CONNECTION

6.121 An influent connection to the wastewater system shall be provided. It shall consist of one 6" inlet entering into the flow equalization chamber. The influent shall be discharged into the bar screen.

### 6.13 Bar Screen

6.131 Bar screen shall be provided as shown on the contract drawings located in the flow equalization chamber. Its purpose is to remove any unusually large solids from the incoming crude sewage flow rate. The bar screen shall be fabricated from one-half inch diameter bars spaced one-inch apart and arranged as shown on the drawings. The bars shall be sloped to permit easy cleaning of accumulating debris. A large drying area shall be provided. In addition, a long handle rake shall be provided so that the plant operator can be used to remove the screenings from the bar screen.

6.14 **AIR SUPPLY FOR FLOW EQUALIZATION TANK**

6.141 For supplying the air requirements of the Flow Equalization System control system, one (1) Model BF-75-R33 Blower Motor Units shall be provided as shown on the drawings. The voltage shall be 480 volts, 3 phase, 60 Hz. The unit shall have the capacity of providing 100% of the air requirements for the system. The blower unit shall be installed at the location shown on the drawings. The unit shall be completely factory built and tested before shipping. The blower unit shall be installed within one Fiberglass Enclosure TEII-2 complete with fiberglass hood. The inlet filter silencer, pressure relief valve, pressure gauge, with only the blower discharge rubber hose connection being provided as a single line hook up for the blower. The necessary electrical connection from the blower to CP-2A shall be provided and pre-wired. The enclosure shall have ivory finish. The blower motor enclosure unit shall be mounted on four (4) vibration pad dampers tagged VP-1. This will help reduce blower vibration and noise transmission. The Blower system shall be equipped with one 2" blower discharge pipe with a 2" marine rubber hose with 2 stainless steel clamps.

6.142 The blower unit shall be supplied with each blower unit shall be a Model BF-75-R33- shall be furnished for supplying all the air requirements needed for the flow equalization Basin. The unit shall be capable of delivering 75 SCFM at an operating pressure of 4 psi.

6.143 The blower shall be of the positive displacement type and shall manufactured by Roots Division of Dresser Industries, Inc., Connersville, Indiana or approval equal. The Model number of the blower will be URAI-33 and equipped with a 2" discharge.

6.144 The motor shall be 3 Hp for operation on 480 volt, 3 Phase, 60 Cycle Service, and 1800 RPM. The motor shall be ODP type Model 182 T, E930 7.8 FLA. The wiring to this motor from the control panel shall be provided and installed by the field contractor.

6.145 For determining the blower performance, and/or diffuser condition, a pressure relief valve and pressure gauge. These items shall be pre-mounted and piped within the blower enclosure.

**6.15 ELECTRICAL CONTROL CONSOLE CP-2A & CP-2B**

An electrical control center, for the flow equalization system shall be the Model CP2A & CP-2B. Each of these control panels shall both be installed within a NEMA 4 electrical weatherproof enclosure complete with floor mounting facilities installation in the electrical control room as shown on the drawings. The voltage shall be 480 volts, 3 phase, 60 Hz. shall be supplied to each panel at the power block.

A step down transformer shall be supplied to step the electrical power down from 480 volt to 120-volt power for control voltages.

The electrical control center Model CP-2A shall control the operation of the following equipment:

A) Blower Motor Unit BM-3, 3 HP, the voltage shall be 480 volts, 3 phase, 60 Hz. ODP type Model 182 T, E930 7.8 FLA
B) Anoxic Mixer MX-1 2, hp, 480 volt, 3 phase, 60 Hz.
C) Liquid level sensors -1 level sensors wide angle

Flow Equalization Blower Motor Unit - The Flow Equalization blower unit operation shall be controlled by the wide-angle liquid level condition of the flow equalization basin. The blower shall turn on when the on liquid level sensor side is activated on when the water level reach the on level and de-activates when the water level is lowered to the off level.

The electrical control center Model CP-2B shall control the operation of the following equipment:

A) Flow Equalization Pump No. 1 P-1, 1 1/2 HP, The voltage shall be 480 volts, 3 phase, 60 Hz. 10 FLA
D) Flow Equalization Pump No. 2 P-2, 1 1/2 HP. The voltage shall be 480 volts, 3 phase, 60 Hz., 10 FLA
E) Liquid level sensors -4 level sensors narrow angle

Flow Equalization Tank Pumps Control - The Flow Equalization pumps shall operate on a duplex pump alternator operation I mode, where pump one will operate alternately with pump no 1 and 2 on cycles. The pump operation shall be controlled by four (4) encapsulated mercury float Switches (narrow angle) each individually adjustable for the following:

A) All Pumps off
B) Lead Pump on
C) Lag Pump on
D) High Level Alarm

The Flow Equalization pumps shall operate on a lead-lag with the two pumps alternating. If the liquid level reaches lag pump on level, both pumps shall operate. If the liquid level reaches the high water level, the alarm will be activated.

All wiring, terminal blocks, supports and accessories required for the operations of the control panel shall be provided in compliance with the National Electric Code.

D1.3 Flow Equalization Pumps Tagged P-1, P-2, The voltage shall be 480 volts, 3 phase, 60 Hz. The Flow Equalization pumps shall be of the Goulds submersible type. Each pump shall be a 3888D3 Model WS1534D3 as manufactured by Goulds Pump Company. The pump shall have a capacity of 25 GPM @ 15 feet of TDH. The pump shall have a 1 1/2 horsepower motor which will operate on 480 volt, 3 phase, 60 Hz. 10 FLA. Each Flow Equalization pump shall be supplied with a 3-inch discharge.

For easy removal of the flow equalization pumps, a hoist shall be provided adjacent to the pump location.

## 7.0 AERATION CHAMBER

7.1 There shall be supplied, an aeration chamber to work in conjunction with the clarifier chambers. The aeration chamber shall conform to the following specifications:

7.2 The aeration chamber shall be of sufficient capacity to provide a total volume of the chamber of 50,000 gallons. The vessel shall be so shaped on each side to prevent sludge accumulation, to enhance the rotation of the vessel contents, and to scum and froth accumulation. To insure maximum retention and eliminate short circuiting of minuscule sewage particles, the aeration chamber shall be constructed with air diffusers, placed longitudinally along one side of the chamber so as to, in conjunction with flow control baffles, enhance the spiral rotation of the chamber contents. To ensure adequate circulation velocity, the proportion of the chamber width to depth, in the direction of rotation, shall not exceed 1.33 to 1. The velocity of rotation shall be sufficient to scour the bottom and prevent sludge filleting as well as to prevent the escape to the surface of minuscule air diffusion bubbles and by so causing their entrapment to provide maximum oxygenation efficiency.

7.3 An air distribution manifold shall be installed longitudinally on one side of the tank with diffuser drop assemblies 'connected thereto. This manifold shall be designed to create a bank of air to supply the air needs of the system, and other ancillary equipment such as the air diffusers, airlift pumps, and scum skimmer to draw from this bank of air.

7.4 Each diffuser drop assembly shall be equipped with an air regulating and/or shutoff valve, a disconnecting union and a diffuser bar with non-clog air diffuser nozzles mounted on the tee bar. The airflow per diffuser shall range from 1 to 5 CFM. This minimum air velocity shall be maintained to insure sufficient velocity for self-cleaning. The diffusers shall be parallel to and near the base of the vessel sidewall and at an elevation, which will provide the optimum diffusion and mixing of the vessel contents. The oxygen transfer capacity of each diffuser shall be such that an adequate supply of oxygen will be maintained in the aeration chamber to meet treatment requirements of the design sewage load. The air diffuser shall be on the air check diaphragm type constructed with a diaphragm mounted on top of the diffuser body. The diffuser body consists of twenty, 3/16" diameter air discharge holes evenly distributed around the diffuser disk. The diffuser will be supplied with standard male pipe thread connections.

**8.0 Clarifier Chamber**

8.1 There shall be furnished a dual hopper type clarifier chamber to work in conjunction with the aeration chamber of the system. The clarifier chamber shall be of the following dimension:

10'-0" Wide x 20'-0 Long x 11'-7" High
The water level from top of tank to water level = 18"
The clarifier hopper slope to be on a 1 to 1.7 slope

8.2 The clarifier chamber shall be of such size as to provide a minimum of four (4) hours retention, equal to 8,833 gallons, based upon the same design flow rate governing the aeration chamber (50,000 GPD), and shall have proper baffling to prevent short circuiting and to provide maximum uniform solids settling area. The clarifier shall be of the two-hopper clarifier type. Settled sludge shall be returned from the clarifier hopper cap floor (sludge well) to the aeration chamber by two positive displacement sludge return systems, consisting of an airlift pump type.

8.3 The inlet of the clarifier chamber shall be provided with an influent baffle. Its purpose is to slow the velocity of the flow from the aeration chamber to start the settling process. It shall prevent the floatables from entering the clarifier settling area. A skimmer assembly shall be provided in this zone to remove the floatables and return them back to the aeration zone for additional processing.

8.4 The clarifier effluent shall pass over the edge of the baffled adjustable effluent weir plate into the effluent trough and then, out the chamber into the tertiary filter system. The weir plate will be constructed of 1/8" galvanized steel and will be gasketed with 1/8" x 1" neoprene strips.

**9.0 Airlift Sludge Recirculation System**

9.1 Installed within the clarifier chamber for returning the settled sludge consisting of two positive sludge re-circulation pump systems. Each clarifier hopper shall be equipped with one, 4" diameter airlift sludge return assembly, meeting the following specifications: The airlift pump system shall have the re-circulation capacity ranging from 0% to 150% of the design flow. The airline supplying air to the pump shall be equipped with an air control valve, which shall vary the capacity of the pump. The airlift pump shall be firmly supported and shall be equipped with a clean-out plug to allow for easy cleaning and maintenance.

**10.0 Airlift Scum Recirculation System**

Installed within the clarifier chamber for controlling and returning to floatables and scum, is a positive scum and skimming re-circulation system. The clarifier shall be equipped with three, 2" diameter airlift skimming device meeting the following specifications: The skimming device shall be of the positive airlift pump type, located in a position to skim and return floating material to the aeration chamber. The air line supplying air to the skimming device shall be equipped with a needle valve to regulate the rate of return. The scum intake shall be equipped with an adjustable assembly, which will enable exact positioning of the skimmer at water level without

placing a hand under the water. The discharge port shall be sloped to enable the operator to determine the flow rate.

**11.0 Air Supply System Secondary Treatment System**

11.1 For supplying the air requirements of the secondary wastewater treatment system, are two (2), model TEII-250-R47. Each unit shall have the capacity of providing 100% of the air requirements for the system. The two blower units shall be installed within one sound enclosure at the location shown on the drawings. Each blower unit shall be completely factory built and tested before shipping. The blower speed and horsepower has been corrected for this elevation levels at the project site. The main blower units shall be installed within a fiberglass Blower housing TEII-2SN Sound enclosure completes with base and enclosure. The discharge piping of the blowers shall be positioned both within the enclosure and exterior of the enclosure. To help reduce the vibration and the noise being created by the air discharge. The check valve shall all be located at the discharge of the blower. Each blower shall discharge into the air plantum with a discharge rubber hose connection being provide for each blower. The necessary electrical connection from the blower to CP-1 for unit. The enclosure shall have ivory finish. The blower motor enclosure unit shall be mounted on four (4) vibration pad dampers tagged VP-1. This will help reduce blower vibration and noise transmission. The Fiberglass housing shall be equipped with a blower discharge pipe with a marine rubber hose with 2 stainless steel clamps. Each unit shall be completely factory built and tested before shipping.

11.2 The blower motor units Model URAI-47 J shall be furnished for supplying all the air requirements needed for the wastewater treatment system. The units shall be capable of delivering 250 SCFM at an operating pressure of 5 psi.

11.3 The blower shall be of the positive displacement type and shall be manufactured by Roots Division of Dresser Industries, Inc., Connersville, Indiana or equal Sutorbilt Blower Division Company, Compton, California; or approved equal. The model number of the blower will be URAI-47 J.

11.4 The motor shall be 10 HP for operation on 480 Volt, 3 Phase, 60 Cycle Service, and 1800 RPM. The motor shall be explosion proof rated for ODP. The wiring to this motor from the control panel shall be provided and installed by the field contractor.

11.5 For determining the blower performance, and/or diffuser condition, a pressure relief valve and pressure gauge. These items shall be premounted and piped at the air plantum.

**12.0 SECONDARY TREATMENT BLOWER ELECTRICAL CONTROL CONSOLE CP-1**

12.1 An electrical control center, Model CP-1, shall be installed within a NEMA 4 steel weatherproof enclosure complete with legs installation in the electrical control room as shown on the drawings.

A step down transformer shall be supplied to step the electrical power down fro 480 volt to 110-volt control voltage.

The electrical control center shall control the operation of the following equipment:

A) Blower Motor Unit BM-1, 10 HP. The voltage shall be 480 volts, 3 phase, 60 Hz., ODP, 215 T frame , U 765, 25.6 FLA
B) Blower Motor Unit BM-2, 10 HP. The voltage shall be 480 volts, 3 phase, 60 Hz., ODP, 215 T frame , U 765, 25.6 FLA

12.2 The electrical control center shall control the operation of all the auxiliary component equipment requiring electrical power. The blower motor unit operation time will be intermittent and as controlled by the blower timer. The plant operator shall control the operation time. The necessary selector switches shall be provided to allow either automatic or manual operation of the auxiliary equipment.

12.3 The enclosure shall be equal to a NEMA type 4. The electrical controls shall consist of IEC starters, timers, and selector switches necessary. Properly sized circuit breakers or fuses shall protect all electrical equipment and circuitry.

12.4 All wire and conduit required between the control panel and the electrical power service should be furnished by and installed by the field controller. The main power supply shall be 480 Volt, 3 Phase, 60 Cycle. Power to the control panel shall be 110 volt, 1 phase. A power block in the control panel shall be supplied for the electrical connection.

12.5 The control console shall be a Model CP-1 and shall be completely factory assembled and tested prior to shipment.

12.6 Controls shall be mounted to a removable sub-panel within the enclosure and shall be wired and spaced in accordance with the latest National Electric Code.

12.7 Blower Operation Controls Method: Each blower for the aeration chamber shall be able to be controlled by the program timer. A selector switch within the control panel shall be used to select the program for automatic operation. The two main blowers for the secondary treatment system shall be controlled by two 24-hour, 7-day time clock and an alternator and shall be capable of being programmed to control the blower run cycle and to adjust both the start set point every 15 minutes on the 24 hour cycle. The clock shall be by Paragon, Model #1015. A selector switch shall be provided with hand off auto for operation selection.

## 13.0 SERVICE WALKWAY

13.1 A service walkway shall be provided for service area only to service the plant equipment. Grating panels shall consist of one-piece skid resistant steel plate. All grating panels shall be constructed of 18 gauge, galvanized sheet steel with maximum yield strength of 37,000 psi. Each grating panel has a standard 9-inch surface width, and a 2 1/2-inch rib depth. Furthermore, each panel shall be so supported as to have a safe uniform load carrying capacity of 50 pounds per square foot.

13.2 A service handrail shall be provided around the perimeter of the service walkway system. The handrail system shall consist of a top rail 1 W aluminum pipe with a center cable guard.

## 14.0 SLUDGE HOLDING CHAMBER

14.1 There shall be supplied an aerated sludge holding chamber to work in conjunction with the aeration chamber and clarifier chamber. The aerated sludge holding chamber shall be an integral section of the main system and shall be common to each of the clarifier chambers and shall conform to the following specifications:

14.2 The sludge holding chamber shall be of sufficient capacity to provide a total volume minimum chamber volume of 4000 gallons. The vessel shall be so shaped on each side to prevent sludge accumulation, to enhance the rotation of the vessel contents, and to scum. To insure maximum retention and eliminate short circuiting of minuscule sewage particles, the aeration chamber shall be constructed with air diffusers, placed longitudinally along one side of the chamber so as to, in conjunction with flow control baffles, enhance the spiral rotation of the chamber contents. To ensure adequate circulation velocity, the proportion of the chamber width to depth, in the direction of rotation, shall not exceed 1.33 to 1. The velocity of rotation shall be sufficient to scour the bottom and prevent sludge filleting as well as to prevent the escape to the surface of minuscule air diffusion bubbles and by so causing their entrapment to provide maximum oxygenation efficiency.

14.3 An air distribution manifold shall be installed longitudinally on one side of the tank with diffuser drop assemblies connected thereto. This manifold shall be designed to create a bank of air to supply the air needs of the system, and other ancillary equipment such as the air diffusers, airlift pumps, and scum skimmer to draw from this bank of air.

14.4 Each diffuser drop assembly shall be equipped with an air regulating and/or shutoff valve, a disconnecting union and a diffuser bar with non-clog air diffuser nozzles mounted on the tee bar. The airflow per diffuser shall range from 1 to 5 CFM. This minimum air velocity shall be maintained to insure sufficient velocity for self-cleaning. The diffusers shall be parallel to and near the base of the vessel sidewall and at an elevation, which will provide the optimum diffusion and mixing of the vessel contents. The oxygen transfer capacity of each diffuser shall be such that an adequate supply of oxygen will be maintained in the aeration chamber to meet treatment requirements of the design sewage load. The air diffuser shall be on the air check diaphragm type constructed with a diaphragm mounted on top of the diffuser body. The diffuser body consists of twenty, 3/16" diameter air discharge holes evenly distributed around the diffuser disc. The diffuser will be supplied with standard male pipe thread connections.

14.5 The flows into the sludge holding tank shall be direct from the sludge return pump. The necessary piping and valving shall be supplied to allow the flow to occur manually at the plant operators' requirements.

14.6 The supernatant shall be returned to the flow equalization chamber for re-processing and treatment.

## TERTIARY FILTER SYSTEM

### 15.0 General

15.1 The contractor shall furnish and install one prefabricated steel tertiary filter of the wastewater treatment system, a tertiary filter system. It shall be complete and ready for operation in accordance with the plans and specifications stated herein and furnished and as an integral section of the secondary treatment system. The tertiary treatment system shall be a TEII Model TF-500-C prefabricated steel package unit as manufactured by Tipton Environmental International, Inc. This section of the wastewater treatment system is of the tertiary treatment type, specifically known as rapid sand filter, designed for treating a total of 50,000 gallons per day of 30 PPM-BOD5 domestic sewage based on composite sewage samples of the average daily flow. The complete system includes all necessary equipment for efficient plant operation.

15.2 The tertiary filter will be factory assembled, so far as possible, with piping, valving and controls. All surfaces shall be factory painted.

### 16.0 PROCESS AND OPERATING INSTRUCTIONS

16.1 Influent Characteristics:

The system is capable of treating 50,000 gallons per day of secondary treat domestic sewage, having an organic strength of 30 PPM 5 day BOD, and 30 PPM suspended solids. The tertiary system is subject to the performance of the secondary treatment system. No substances will be introduced in quantities, which are toxic to biological organisms.

### 17.0 INLET CONNECTION

17.1 The influent connection to the tertiary filter system shall consist of a flow trough, receiving flow from the clarifier effluent trough with connections to the feed trough of the filter. In addition, the feed trough shall be equipped with a tertiary by-pass. The filter cells shall be feed to each cell by a splash plate and shut off valve. This connection shall be from the port trough to the tertiary feed trough as shown on the detail drawings. The by-pass shall consist of a pipe plug within the tertiary feed trough.

### 18.0 Filtrate Holding Chamber

18.1 Two (2) filtrate holding chambers, each located above the filter media shall be of sufficient capacity and surface area to entrap and hold floating, suspended and Settable solids until such time these solids are returned to the wastewater treatment system during filter media backwash by means of the mudwell and return pumps. The volume of each chamber shall not be less than 100 gallons. Each chamber

shall have a minimum water depth of 24 inches above filter media to prevent freezing of filter media.

18.2 Means shall be provided in each chamber for manual dumping of the suspended solids into the mudwell. An access and inspection plate shall be provided in the sidewall filtrate holding chamber to allow inspection and maintenance of the filter bed.

**19.0 Filter Cells**

19.1 There shall be furnished two (2) filter cells for filtering the flow of the Tertiary Filter System. Each cell shall have not less than 17.36 square feet of filter surface area based on 1 GPM / sq. ft. for each cell. The filter cells shall be located at the bottom of the filtrate holding chamber. Filtrate shall percolate through the filter bed and filter nozzles to the false bottom. The filter nozzles shall be equipped with an air tail pipe. The filter nozzles shall be of the type, which is equipped with an expansion ring, which will allow the nozzle to be installed in the underdrain plate easily. From the false bottom, filtered water shall flow to the clear well chamber. Each filter shall be accessible for inspection and maintenance of the filter media. The filter media shall be shown on the plans and as herein after specified.

**20.0 Filter Media**

20.1 Filter media shall be furnished in sealed bags not to exceed 100 pounds each. The filter media shall be packed in a pallet and shipped to the plant site with the filter system. The contractor shall position the filter media in the tertiary filter as shown on

20.2 The plans and in the field. The filter media bed shall consist of eight inches (8") of sand, 0.80 to 1.20 MM effective size with a uniform coefficient of 1.4 through 1.7 and twelve inches (12") of anthracite 1.08 MM effective size with a uniform coefficient of

**21.0 Clear Well**

21.1 The clear well shall be located as shown on the plans. It shall be so designed so that the filtrate from each of the filter cells can discharge into the clear well from the false bottom underdrain system which is located below the media; then flow through a riser and through the backwash pumps. The clear well shall not have less than 2500 gallons for sufficient volume for backwashing based on two 5-minute backwash cycles. An overflow weir shall be provided for gravity effluent discharge to the disinfection system chamber.

**22.0 Backwash Pumps**

22.1 Two (2) backwash pumps shall be furnished and installed in the clear well so as to automatically backwash each filter cell through the water distribution manifolds when required maintaining filtration conditions. Each pump shall be designed to provide one 5-minute backwash at a rate of 15 gallons per minute per square feet, and shall be rated at 270 GPM at 15 TDH. The operating horsepower shall be 2 **HP,** 480 volt, 60 Hz, 3 phase. Both pumps shall be a Model WS20D4 series 3888D4 with a 4" discharge and shall be manufactured by Goulds Pump Company pumps or approved

equal. The backwash rate shall be a minimum of 15 GPM per square foot of filter surface area.

### 23.0 Mud Well Chamber

23.1 A mudwell chamber of the tertiary filter system shall be of such size as to handle the total volume of the filtrate backwash. The Volume of this chamber shall not be less than 2800 gallons. A duplex set of pumps shall be provided and installed in the mud well chamber for returning the filtrate backwash liquid to the secondary wastewater treatment. The capacity for each pump shall be 25 GPM at 15' TDH. The operating horsepower shall be 1/2 HP, 480 volt, 60 Cycles, 3 Phase. The pumps shall be a model 3882 and shall be manufactured by or approved equal and have a 2 inch

### 24.0 TERTIARY AIR SUPPLY BLOWER MOTOR UNIT

24.1 One (1) positive displacement blower motor unit shall be provided and shall be a Model BF-30-S24 shall be supplied, capable of providing the required CFM for air scouring. The unit shall have the capacity of providing 100% of the air requirements for the tertiary system. The blower unit shall be installed at the location shown on the drawings. The unit shall be completely factory built and tested before shipping. Therefore, the blower speed and horsepower has been corrected for this elevation level. One blower unit shall **be** installed within a fiberglass Blower housing TEII-2 complete with base and weatherproof hood. The discharge piping of the blower shall be positioned within the housing to help reduce the vibration and the noise being created by the air discharge. The inlet filter silencer, pressure relief valve, pressure gauge, and check valve shall all be located within the housing with only the blower discharge rubber hose connection being provided as a single line hook up for the blower. The necessary electrical connection from the blower to CP-1 shall be provided and pre-wired. The enclosure shall have ivory finish. The blower motor enclosure unit shall be mounted on four (4) vibration pad dampers tagged VP-1. This will help reduce blower vibration and noise transmission. The fiberglass housing shall be equipped with a 2" blower discharge pipe with a 2" marine rubber hose with 2 stainless steel clamps. Each unit shall be completely factory built and tested before shipping.

24.2 The blower shall be capable of delivering 30 CFM when operating at 5 PSI. The blower shall be manufactured by Roots Division Dresser Industries, California; or approved equal. The model number of the Sutorbilt blower will be URAI-24.

24.3 Each motor shall be 2 Horsepower for operation on 480 volt, 3 Phase, 60 Cycle service 1750 RPM. It shall be of the ODP type. Motor E-929 , 5.6 FLA

24.4 Facilities for air scouring the filter media prior to backwash shall be provided. An air distribution system shall be provided under the filter media.

### 25.0 ELECTRICAL CONTROL CONSOLE CP-3

25.1 An electrical control center shall be installed within a Nema 4 electrical weatherproof enclosure and shall be provided for mounting as indicated on the plans.

25.2 Each filter cell shall be supplied with an AAWS-2 control System. This system shall automatically air scouring and water wash the filter cell. When the resistance of the flow through that filter cell which is caused by the filter media makes the water level in the filtrate collection chamber to rise to a predetermined liquid level, a liquid level control switch shall initiate the automatic air scour cycle. This automatic air and water wash cycle is controlled by a series of adjustable control timers which will allow easy adjustment of each phase of the air and water wash cycles. The AAWS-2 shall include system light which will indicate the operating position of the control system. This light shall be installed within the control panel.

25.3 The enclosure shall be NEMA type 4. The electrical controls shall consist of IEC starters, timers, and switches necessary to automatically control all electrical devices and/or motors on the tertiary treatment system. The blower motor shall be controlled by a H-O-A selector switches and IEC starters. This will be in conjunction with the AAWS-2 control system. Properly sized circuit breakers or fuses shall protect all electrical equipment and circuitry.

25.4 All wire and conduit required between the control panels and the electrical power service shall be furnished and installed by the purchaser

25.5 Wiring and conduit between the control panel CP-3 and the tertiary ancillary equipment as listed below shall be pre-wired and tested at the factory:

Solenoid Valve For Air Scourer Cell # 1
Solenoid Valve For Air Scourer Cell # 2
Solenoid Valve For Clear well aeration

All necessary valving and piping shall also be provided

The main power supply shall be 480 volt, 3 Phase, 60 Cycle, with a control circuit of 120 Volt, 1 Phase, 60 Cycle.

25.6 The electrical equipment, which shall be operated from this control center, are:

Tertiary Blower Unit BM-4 — 5.6FLA, 480 volt, 3 Phase, 60 Cycle, 145 T,E929
Backwash Pump P-3 —FLA, 480 volt, 3 Phase, 60 Cycle
Backwash Pump P-4 —FLA, 480 volt, 3 Phase, 60 Cycle
Mudwell Pump P-5 — 3.6 FLA, 480 volt, 3 Phase, 60 Cycle
Mudwell Pump P-6 — 3.6 FLA, 480 volt, 3 Phase, 60 Cycle
Solenoid Valve For Air Scour Cell # 1
Solenoid Valve For Air Scour Cell # 2
Solenoid Valve For Clear well aeration and post aeration

## 26.0 FILTER BY-PASS

26.1 A by-pass shall be supplied to allow manual by-pass of the filter cells. The by-pass shall consist of the necessary flow troughs, flow vanes, etc., to direct either to the filter cells or to the tertiary outlet port.

26.2 The flow distribution trough shall be so designed as to divert the incoming flow proportionally to each filtrate collection chamber. This shall be done by means of diversion vanes.

## 27.0 CLEARWELL AERATION

27.1 An air distribution manifold shall be installed on one side of the tertiary system with diffuser drop assemblies connected thereto. This manifold shall be designed to create a bank of air to supply the air needs of the post aeration system

27.2 The diffuser drop assembly shall be equipped with an air regulating valve, a disconnecting union and a diffuser bar with non-clog air diffuser nozzles mounted on the tee bar. This minimum air velocity shall be maintained to insure sufficient velocity for self-cleaning. The diffusers shall be placed as shown on the drawings. The air diffuser shall be on the air check diaphragm type constructed with a diaphragm mounted on top of the diffuser body. The diffuser body consists of twenty, 3/16" diameter air discharge holes evenly distributed around the diffuser disk. The diffuser will be supplied with standard male pipe thread connections.

## 28.0 DISINFECTION CHAMBER

28.1 A chlorine contact chamber shall be provided having a volume of 1042 gallons base and configured as shown on the drawings.

28.2 A tablet type chlorination system shall be provided. It shall be a Model 1000 Sanuril

28.3 A 90 degree v-notch weir shall be provided for flow measurement within the chlorination contact tank.

## 29 EFFLUENT CONNECTION

29.1 The effluent connection of the tertiary treatment system shall be located as shown on the plans and shall consist of one 6" diameter standard flanged pipe at the location shown.