Final Design Summary of Wastewater Treatment System Upgrade

Mountaire Farms of Delaware, Inc.
Millsboro, Delaware

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DNREC Re-Submission

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The Earth is the Lord's...
Reid Engineering
Psalm 24:1

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Table of Contents

Final Design Summary

A. General Design Requirements and Summary

1. Owner Contact Information

   a. Facility Name: Mountaire Farms of Delaware, Inc.
   Wastewater Treatment Plant
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   d. Mailing Address: P.O. Box 1320, 29292 John J. Williams Hwy,
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2. Project Summary

   a. Mountaire Farms of Delaware, Inc. is a poultry processing facility with onsite rendering and feed mill located outside of the Town of Millsboro in Sussex County. The facility is located at 29005 John J. Williams Hwy southeast of the intersection of John J Williams Hwy and Maryland Camp Road (Road 304). The Wastewater Treatment System Upgrade contained in this report will provide onsite wastewater treatment of wastewater generated by the Mountaire Farms Facilities.
   b. Tax Map: 234-32.00-117.00
   c. Hydrologic Unit Code: 020403030203, Swan Creek-Indian River
   d. 100 Year Flood Zone: Zone X, Elevation 18.03 feet ASL
   e. Equivalent Dwelling Units (Flow): 18,200 EDUs (Based on 220 gpd/EDU)
   f. Equivalent Dwelling Units (BOD): 150,000 EDUs (Based on 0.46#BOD/day/EDU)
   g. Design Average Daily Flow: 2.6 MGD, 7 days/week
   h. Design Max Month Daily Flow: 4.0 MGD, 7 days/week

3. Description and Purpose of the Wastewater Treatment System Project

   a. Mountaire Farms must upgrade the efficiency of the existing wastewater treatment system at the Millsboro, Delaware processing complex in order to comply with restrictive discharge permit limitations for disposal of treated wastewater by spray irrigation.

   b. This wastewater treatment system upgrade project is required to provide wastewater treatment capability to comply with the permit TN limit.

c. The proposed wastewater treatment system upgrade project includes the installation of improvements to the activated sludge biological nitrogen removal (BNR) treatment system components. The project also includes the installation of a new tertiary sand filtration system for final effluent polishing. A new screw press sludge dewatering system will be installed to increase waste activated sludge handling capacity.

d. The existing Spray Storage Lagoon will continue to be used for final effluent storage prior to disposal in the existing spray irrigation fields.

e. A new Spray Storage Lagoon will be installed to expand the final effluent storage volume.

4. <u>Summary and Scope of Proposed Wastewater Treatment System Improvements Included in the Project</u>

a. One new 1.50 MG volume Flow Equalization Tank #1 (FET) will provide hydraulic flow equalization of screened raw wastewater upstream of the Primary DAF pretreatment system. DAF sludge is currently processed by a centrifuge system for oil recovery. The DAF sludge centrifuge operation produces "stickwater" or centrate that has high pollutant concentrations. The DAF sludge centrifuge stickwater is currently pretreated by an existing DAF system using DAF Cell #2. Partially pretreated DAF sludge centrifuge stickwater discharged from existing DAF Cell #2 will be pumped with rendering plant floor drainage wastewater into the new FET #1 to be blended with chicken processing plant wastewater normally 5 days/week on processing days prior to first stage DAF pretreatment.

b. One new World Water Works (WWW) DAF Cell rated at a capacity of approximately 3,000 gpm will be installed to operate as DAF Cell #1B independent of or in parallel with the existing 2,400 gpm capacity WWW DAF Cell #1A to provide first stage DAF pretreatment of blended and screened raw wastewater.

c. The first stage DAF Cell effluent will be transferred by the DAF Cell #1A and/or #1B Effluent Pump Station into two new 3.50 MG volume aerated 7 Day Flow Equalization Tanks. Partially pretreated, aerated and equalized wastewater will be pumped out of the 7 Day FETs, normally 24 hours, 7 days/week into the existing P Tec DAF Cell #3, rated at 2,800 gpm capacity, for second stage DAF pretreatment.

d. Pretreated and flow equalized wastewater discharged from the second stage P Tec DAF Cell will be transferred by the DAF Cell #3 Effluent Pump Station into the downstream activated sludge biological nitrogen removal (BNR) system.

e. The existing two stage activated sludge biological nitrogen removal (BNR) treatment system is upgraded into a state of the art four stage biological nitrogen removal (BNR) system to achieve high efficiency total nitrogen removal by biological nitrification and denitrification.

f. One new four stage activated sludge biological nitrogen removal (BNR) final treatment system is provided including new first stage Anoxic Reactor #1; new second stage Nitrification Reactor #2A; retrofitted Nitrification Reactor #2B in the first half of the outer ring of the existing Crom tank; retrofitted Anoxic Reactor #3 in the second half of the outer ring of the existing Crom tank; and, retrofitted Aerobic Reactor #4 in the center section of the Crom tank; and, two existing gravity Final Clarifiers retrofitted with new rapid suction sludge removal mechanisms.

1) One new Anoxic Reactor #1 is provided with jet mixing equipment to operate as first stage anoxic activated sludge reactor in the four stage BNR process to provide BOD removal and removal of nitrate nitrogen by biological denitrification.

2) One new Nitrification Reactor #2A is provided with subsurface jet aeration and mixing equipment to operate as a second stage aerobic activated sludge reactor downstream of new Anoxic Reactor #1 in the four stage BNR process to provide removal of TKN and ammonia nitrogen by biological nitrification.

3) The first half of the outer ring of the existing Crom tank will be retrofitted into new Nitrification Reactor #2B to operate downstream of and in series with new Nitrification Reactor tank #2A. Nitrification Reactor #2B is provided with mixing and subsurface aeration equipment and air supply blowers to provide removal of TKN ammonia nitrogen by biological nitrification.

4) The second half of the outer ring of the existing Crom tank will be retrofitted into new Anoxic Reactor #3. Anoxic Reactor #3 is provided with mixing equipment to function as a third stage anoxic activated sludge reactor in the four stage BNR process to provide final nitrate nitrogen removal by biological denitrification with supplemental carbon source solution dosage if necessary.

5) The center tank section of the existing Crom tank will be retrofitted into new Aerobic Reactor #4. Aerobic Reactor Zone #4 is provided with mixing and diffused aeration equipment and air supply blowers to operate downstream of Anoxic Reactor Zone #3 as a fourth stage aerobic activated sludge reactor in the four stage BNR process to provide final BOD and ammonia nitrogen removal.

g. The Two existing 110 ft. dia. X 12 ft. SWD Final Clarifiers (FC) will continue to operate in parallel; and, new Return Activated Sludge (RAS) Pumps and associated piping, controls and RAS flow meters are installed to provide accurate RAS flow rate and flow rate control from each clarifier back into Anoxic Reactor #1 or Nitrification Reactor #2A. One new rapid suction sludge removal mechanism will be installed in each existing Final Clarifier to improve clarifier TSS removal efficiency and settled biosolids removal capacity.

h. One new Tertiary Filter System (TFS) with deep bed, upflow continuous backwash sand filters is provided for tertiary filtration polishing of clarifier effluent in order to reduce final effluent TSS, BOD, TN and TP concentrations. The TFS is designed with an automatic filter backwash control system and supplemental carbon source (CS) chemical solution dosing system to provide capability to optionally operate the TFS as Denitrification (Denite) Filters to achieve final nitrate nitrogen removal by biological denitrification.

i. New Chemical Storage/Feed Equipment is provided for nitrate nitrogen removal including two new non-flammable carbon source (CS) solution bulk storage tanks and CS solution feed pumps for the new Anoxic Reactor #3 and the new Tertiary Filter System.

j. The existing Oxidation Ditch (OD) basin is retrofitted to function as a first stage aerobic digestion basin for waste activated sludge. The OD aerobic digestion basin will be operated upstream and in series with the two existing waste activated sludge (WAS) storage basins which will be used as second and third stage WAS aerobic digestion basins.

k. A new Screw Press Waste Activated Sludge Dewatering System is provided for mechanical dewatering of aerobically digested and gravity thickened WAS. A minimum of three new BDP Screw Presses or equal will be installed to operate in parallel to provide mechanical dewatering of WAS pumped out of WAS storage-digestion basins.

l. One new DAF Equipment Building #1 is provided for enclosure of the new WWW DAF Cell #1B and the existing P Tech DAF Cell #3 and associated components for the DAF Cells, FET #1 Air Supply Blowers, FET #1 Effluent/DAF Cell #1A and #1B Influent Pumps, DAF Cell #1A and #1B Effluent/FET #2A and #2B Influent Pumps, DAF Cell #3 Effluent Pumps, Chemical Storage and Feed Equipment for DAF Cells and Electrical Motor Controls.

m. New 7 Day FET Equipment Building #2 is provided for enclosure of Jet Pumps, Air Supply Blowers, FET #2A and #2B Effluent/DAF Cell #3 Influent Pumps and Electrical Motor Controls.

n. One new Reactor Equipment Building #3 is provided for enclosure of Jet Pumps, Air Supply Blowers, Nitrate Recycle Pumps, and Electrical Motor Controls for the new Anoxic Reactor #1 and Nitrification Reactor #2.

o. One New RAS/Filter Equipment Building #4 is provided for enclosure of the new RAS pumps, WAS pumps, Filter Influent Pumps, chemical Storage and mix tanks, chemical solution pumps, Tertiary Filters, UV contact channel and Electrical Motor Controls.

p. One new Chemical Equipment Building #5 is provided for enclosure of existing magnesium hydroxide solution bulk storage tanks and solution feed pumps; and, new nonflammable carbon source solution bulk storage tanks and solution feed pumps.

q. One new Sludge Equipment Building #6 is provided for the enclosure of the sludge press dewatering system and Electrical Motor Controls.

r. The existing Oxidation Ditch effluent pump station is retrofitted into a Plant Site Pump Station #2 for collection of drainage flows from the new and existing wastewater Equipment Building(s).

s. One new submersible Plant Site Pump Station #1 is provided for collection of drainage flows from the new Wastewater Equipment Building #2, new Wastewater Equipment Building #3 and new Wastewater Equipment Building #4.

t. One new submersible Plant Site Pump Station #3 is provided for collection of drainage flows from the New DAF Equipment Building.

u. New SCADA Instrumentation and Controls will be provided for the proposed wastewater treatment system improvements.

v. The existing Anaerobic Lagoon is retrofitted into a Stormwater First Flush/Off-Spec Lagoon. Stormwater wastewater is pumped from four Stormwater Pump Stations located on the processing complex site into the lagoon at variable flow rates and volumes. Off-spec wastewater can be pumped by the new Tertiary Filter Influent Pump Station into the lagoon. Stormwater and Off Spec wastewater stored in the lagoon is pumped at a relatively constant flow rate and volume from the lagoon into the new 7 Day Flow Equalization Tanks #2A and #2B.

5. Wastewater Sources

a. Process Wastewater

1) Process wastewater discharged from the Chicken Processing Plant Offal Screening Room and Rendering Plant floor drainage wastewater receives first stage DAF pretreatment before blending with Rendering Plant Condensate Wastewater, stormwater, sanitary wastewater, hatchery and feed mill wastewater, grainary wastewater and boiler room drainage wastewater in two 7 Day Flow Equalization Tanks. Equalized wastewater is pumped out of the 7 Day FETs and receives second stage DAF pretreatment before flowing into an activated sludge biological nitrogen removal (BNR) treatment system. BNR system effluent receives final treatment by tertiary denitrification filters and UV disinfection. The complete multistage wastewater treatment system provides high efficiency removal of BOD, Suspended Solids, Oil & Grease, TKN; Ammonia Nitrogen, Total Nitrogen, Total Phosphorus, Fecal Coliform pollutants to comply with permit limitations before being discharged on existing spray irrigation fields. The existing chlorine disinfection system, located after the existing Spray Irrigation Lagoon, will remain as a backup disinfection system.

b. DAF Sludge Centrifuge Stickwater

1) Stickwater wastewater is discharged from the DAF Sludge centrifuge system. The stickwater receives primary treatment in DAF Cell #2 and is then discharged by gravity flow into the Raw Wastewater Pump Station wet well to mix with other process wastewater. The blended process wastewater is pumped into new FET #1 for flow equalization and aeration prior to first stage DAF pretreatment in DAF Cells #1A and #1B.

c. Sanitary Wastewater

1) Sanitary wastewater generated from the kitchen and bathroom facilities at the Millsboro complex is pumped into the new 7 Day Flow Equalization Tanks #2A and #2B to blend with the process wastewater for final treatment through the on-site biological wastewater treatment system with effluent disinfected and discharged by spray irrigation. Sanitary wastewater is not treated by the first stage DAF pretreatment system.

d. Stormwater Wastewater

1) Stormwater (SW) collected from areas of industrial activity is collected and stored Stormwater First Flush/Off Spec Lagoon (formerly the East Anaerobic Lagoon) with any recycled off spec wastewater and then pumped out of the Lagoon at an equalized flow volume into the 7 Day Flow Equalization Tanks #2A and #2B and BNR system for treatment with process wastewater through the on-site biological wastewater treatment system with effluent disinfected and discharged by spray irrigation. Stormwater is not treated by the first stage DAF pretreatment system.

e. Miscellaneous Wastewater

1) Hatchery Wastewater, Feed Mill Wastewater, Grainary Wastewater and Boiler Room Drainage Wastewater is collected and blended with Sanitary Wastewater before being pumped into the 7 Day Flow Equalization Tanks #2A and #2B to for treatment through the on-site biological wastewater treatment system with effluent disinfected and discharged by spray irrigation. Miscellaneous wastewater is not treated by the first stage DAF pretreatment system.

f. Off Spec Wastewater

1) "Off Spec" wastewater discharged from the existing Final Clarifiers or Final Effluent Spray Storage Pond can be recycled by pumping into the new Stormwater First Flush/Off-Spec Storage Lagoon for blending with stored SW and gradual recycle to the 7 Day FETs and BNR System.

6. Wastewater Flow Volumes and Pollutant Concentrations and Loadings

a. Production Capacities

1) Chicken Processing Plant

a) The chicken processing plant maximum day production capacity = 540,000 chickens/day at 9.25#live weight kill/bird, 5 days/week. Periodically a 6 day kill week may be required.

2) Rendering Plant

a) The rendering plant maximum day production capacity = approximately 2,500,000# raw material/day, 5 days/week.

b. Wastewater Volumes

1) Chicken Processing Plant Wastewater

a) The maximum wastewater flow volume to be discharged from the chicken processing plant @ 6.50 gallons/bird/day = 3,510,000 gallons/day, 5 days/week plus approximately 300,000 gallons/day, 2 days/week on weekend days.

b) The average wastewater flow volume to be discharged from the chicken processing plant @ 6.00 gallons/bird/day = 3,250,000 gallons/day, 5 days/week plus approximately 300,000 gallons/day, 2 days/week on weekend days.

2) Rendering Plant Wastewater

a) The design maximum wastewater flow volumes discharged from the rendering plant are 200,000 gallons/day of condensate wastewater, 6.5 days/week and approximately 150,000 gallons/day of floor drainage wastewater, 7.0 days/week.

3) DAF Centrifuge Stickwater Wastewater

a) The DAF Sludge Centrifuge will generate approximately 100 gpm = 144,000 gallons/day of Stickwater wastewater, 6 days/week. This raw Stickwater will be diluted with approximately 100 gpm of pretreated wastewater discharged from the existing DAF Cell #1A. The total flow volume of diluted stickwater will be approximately 200 gpm = 288,000 gallons/day, 6 days/week.

4) Stormwater Wastewater

a) Stormwater (SW) is collected from areas of industrial activity into SW pump stations and then is pumped as a first flush flow at high flow rates into a Stormwater First Flush/Off Spec Lagoon. Stormwater flow in excess of the first flush flow volumes overflows from the SW pump stations and then is discharged by gravity from the processing plant complex site at permitted Stormwater Outfall Points. Four SW Pump Stations are provided on the processing complex site. SW that is pumped into the SW First Flush Lagoon at high flow rates from these four SW Pump Stations is stored, equalized and pumped out of the SW First Flush Lagoon at relatively constant flow rates and volume into the 7 Day Flow Equalization Tanks #2A and #2B of the on-site WWTS.

b) Four Stormwater Pump Stations are provided on the processing plant complex site as follows:

Table #1
Stormwater (SW) Pump Stations, Pumping Rates and Estimated Stormwater Volumes Pumped into the SW First Flush/Off Spec Lagoon

SW Pump Station	Number of SW Pumps	Maximum Pumping Capacity with All Pumps Operating	First Flush Time	Maximum SW Volume to WWTP
#1	3 – T10s	7,600 gpm	45 min	342,000 gal
#2	2 – T6s	1,200 gpm	Continuous(1)	288,000 gal
#3	2 – T4s	500 gpm	Continuous(2)	126,000 gal
#4	2 – T8s	3,000 gpm	45 min	135,000 gal
Total				**891,000 gal(3)**

(1)for continuous operation, assume an average of 1 pump in operation at 800 gpm for 15 min/hr
(2)for continuous operation, assume an average of 1 pump in operation at 350 gpm for 15 min/hr
(3)Use Total SW Flow Volume = 900,000 gpd

5) Wastewater Flows from Miscellaneous Sources

Table #2
Miscellaneous Wastewater Sources

Wastewater Source	Wastewater Volume
Sanitary Wastewater	40,000 gpd
Hatchery Wastewater	18,000 gpd
Feed Mill Wastewater	20,000 gpd
Grainary Wastewater	12,000 gpd
Boiler Room Drainage	10,000 gpd
Trailer Parking Area	100,000 gpd
Total	**200,000 gpd**

B. Raw Wastewater Pump Station (New)

1. General

   a. One Raw Wastewater Pump Station (RWPS) is provided to pump chicken processing plant wastewater flow and rendering plant drainage wastewater flow from the existing RWPS wet well into the new Flow Equalization Tank #1.

   b. The raw slaughter plant wastewater is screened in the existing Offal Room of the processing plant; and, the rendering plant washdown and floor drainage wastewater is screened in the rendering plant before flowing by gravity into the RWPS wet well.

2. Design Assumptions

   a. The maximum influent wastewater flow rate discharged from the chicken processing plant is calculated as follows assuming a maximum of 80% of the total daily wastewater flow volume is discharged over two 7.5 hour kill shifts:

   $$\frac{3{,}510{,}000 \text{ gpd}(0.80)}{15 \text{ hours x } 60 \text{ min/hr}} \leq 3{,}200 \text{ gpm}$$

   b. The average influent wastewater flow rate discharged from the chicken processing plant is calculated as follows assuming a maximum of 80% of the total daily wastewater flow volume is discharged over two 7.5 hour kill shifts:

   $$\frac{3{,}250{,}000 \text{ gpd}(0.80)}{15 \text{ hours x } 60 \text{ min/hr}} \leq 2{,}900 \text{ gpm}$$

   c. The maximum influent wastewater flow rate discharged from the Rendering Plant (RP) including floor drainage wastewater flow and condensate wastewater flow is calculated as follows assuming the RP is operating approximately 18 hours/day:

   $$\frac{150{,}000 \text{ gpd}}{16 \text{ hours x } 60 \text{ min/hr}} \leq 200 \text{ gpm}$$

   d. Partially pretreated stickwater DAF Cell #2 effluent is discharged into the RWPS for pretreatment with other wastewater through the First Stage DAF Pretreatment System. The maximum stickwater influent wastewater flow rate discharged from existing DAF Cell #2 into the RWPS wet well = 0.2882 MGD = 200 gpm.

e. Influent Flow Rates:

Source	Average	Maximum
Processing Plant	2,900 gpm	3,200 gpm
Rendering Plant	200 gpm	200 gpm
Stickwater DAF #2	200 gpm	200 gpm
Total	3,300 gpm	3,600 gpm

f. Design basis peak influent flow rate = 6.0 MGD = 4,200 gpm

g. Average Pumping Rate Required = 3,300 gpm = 4.80 MGD

h. Maximum Pumping Rate Required = 3,600 gpm = 5.2 MGD

i. Peak Pumping Rate Required = 4,200 gpm = 6.0 MGD

j. Maximum Daily Wastewater Flow Volume = 4.00 MGD, 5 days/week

3. Pump Selection

a. Three new 60 HP sewage pumps are provided to pump screened raw wastewater from the RWPS wet well into new Flow Equalization Tank #1 (FET #1).

b. Each pump is rated at 3.00 MGD = 2,100 gpm @ 60 ft.

c. Operation of two pumps in parallel at reduced speed is required to pump the average flow rate of 4.8 MGD = 3,300 gpm = 1,650 gpm/pump.

d. Operation of two pumps in parallel at reduced speed is required to pump the maximum flow rate = 5.2 MGD = 3,600 gpm = 1,800 gpm/pump.

e. Operation of two pumps in parallel at full speed is required to pump the peak flow rate = 4,200 gpm = 6.0 MGD = 2,100 gpm/pump.

f. The third pump is provided as an installed standby.

4. Variable Speed Drive Controls

a. Each pump is provided with variable speed drive motor controls with automatic pump speed and pumping rate control.

b. The pump speed is normally automatically controlled by liquid level in the RWPS wet well.

5. Liquid Level Controls

   a. The pumps are automatically started and stopped by liquid level controls in the RWPS wet well.

   b. The pump operating speed and pumping rate is automatically controlled by the liquid level in the RWPS wet well.

   c. A high liquid level alarm (HLLA) is provided in the RWPS wet well in order to prevent excessive high liquid level.

6. Flow Meter

   a. One new 14" dia. magnetic flow meter is provided in the RWPS discharge header to accurately measure, indicate, totalize and record the total flow rate pumped into FET #1.

C. Flow Equalization Tank #1 (New)

1. General

   a. Screened raw wastewater discharged from the chicken processing plant, the rendering plant drainage wastewater and, the partially pretreated stickwater discharged from DAF Cell #2 is pumped by the RWPS into new FET #1.

   b. Wastewater is mixed and pumped from FET #1 into the existing World Water Works (WWW) DAF Cell #1A and into new WWW DAF Cell #1B for first stage wastewater pretreatment.

2. Design Assumptions

   a. Wastewater Volumes and Flow Rates

      1) Wastewater Flow Sources and Volumes

         a) Screened Raw Chicken Processing Plant Wastewater = 3.51 MGD, 5 days/week

         b) Screened Raw Rendering Plant Drainage Wastewater = 0.20 MGD, 6.5 days/week

         c) Partially treated stickwater wastewater discharged from DAF Cell #2 = 0.2882 MGD = 200 gpm, 6 days/week

d) Total Maximum Daily Wastewater Flow Volume = 4.00 MGD, 5 days/week

Table #3
Summary of Wastewater Flow Volume into
24 Hour Flow Equalization Tank #1

Flow Source	**Maximum Wastewater Flow Volume**
Process Plant	3.51 MGD
Rendering Plant Drainage	0.15 MGD
DAF Cell #2 Stickwater	0.2882 MGD
Total	**3.95 MGD[(1)]**

[(1)]Assume Total Flow Volume = 4.00 MGD into FET #1 on Processing Weekdays

e) Influent Wastewater Flow Rates

(1) Processing Plant = 3,200 gpm

(2) Rendering Plant = 200 gpm

(3) Stickwater DAF #2 = 200 gpm

(4) Total = 3,600 gpm

2) Effluent Pumping Rates Required

a) Average = 4.0 MGD = 2,800 gpm over 24 hours/day

b) Maximum = 5.2 MGD = 3,600 gpm during processing shifts in dry weather

c) Peak = 6.0 MGD = 4,200 gpm during processing shifts in wet weather

b. Wastewater Pollutant Concentrations and Loadings

Table #4A
FET #1 Influent Wastewater
Pollutant Concentrations and Loadings

Pollutant	Pollutant Concentration[1]		Pollutant Loading[2]	
	Average	Maximum	Average	Maximum
BOD	5,000 mg/L	9,500 mg/L	166,800#/day	316,920#/day
TSS	4,000 mg/L	8,000 mg/L	133,440#/day	224,553#/day
TKN	400 mg/L	500 mg/L	13,440#/day	16,280#/day
Ammonia-N	25 mg/L	35 mg/L	834#/day	1,034#/day
TP	60 mg/L	80 mg/L	2,002#/day	2,668#/day
FOG	1,200 mg/L	1,800 mg/L	40,032#/day	60,382#/day

[1]Based on 2020 composite sample test data provided by Condor including Stickwater in Table #4B
[2]Calculated @ 4.00 MGD

Table #4B
Diluted Centrifuge Stickwater DAF #2 Pretreatment System Effluent Pollutant Concentrations in Partially Pretreated Wastewater Discharged into FET #1 and Pretreated with Process Wastewater in DAF Cell #1A and #1B

Parameter	Pollutant Concentration[1]
BOD	**2,663 mg/L**
TSS	**600 mg/L**
TKN	**340 mg/L**
Ammonia Nitrogen	**130 mg/L**
TP	**50 mg/L[2]**
FOG	**200 mg/L**

[1] Based on DAF pretreatment of stickwater diluted with pretreated wastewater discharged from DAF Cell #1 in a 50/50 ratio and then pretreated by chemical coagulation, flocculation and dissolved air flotation thru DAF Cell #2.
[2] No test data; value is estimated.

3. Flow Equalization Tank #1 (FET #1) Design

   a. Flow Equalization Storage Volume:

      1) Calculate the minimum Flow Equalization Volume Required for 24 hour hydraulic flow equalization.

         Maximum influent flow rate into FET #1 during the 7.5 hour kill shifts from chicken processing plant, rendering plant and sludge centrifuge stickwater = 3,800 gpm.

         Average Effluent Pumping rate out of FET #1 = 4.0 MGD = 2,800 gpm, 24 hours/day.

         Flow Equalization Volume Required =

         (3,800 gpm – 2,800 gpm)(15 hours/day)(60 min/hr) = 900,000 gallons

2) Use FET #1 Design Storage Volume = 1,000,000 gallons

b. Tank Design:

1) One 91 ft. dia. x 31 ft. maximum liquid depth x 33 ft. tall tank is provided with a total liquid volume of approximately 1,500,000 gallons.

2) The low liquid level maintained in the FET #1 is approximately 10.33 ft. with a minimum liquid volume = 500,000 gallons.

3) The high liquid level in the FET #1 is approximately 31 ft. with a maximum liquid volume = 1,500,000 gallons.

4) The maximum storage volume in the FET #1 = 1,000,000 gallons.

4. <u>Aeration and Mixing Equipment Design</u>

a. Mixing Requirements

1) cfm required for mixing 4,000 mg/L to 8,000 mg/L TSS concentration = 20 scfm/1,000 ft^3 in 1,500,000 gallon tank volume = 200.5 x $10^3 ft^3$

cfm = (200.5 x $10^3 ft^3$)(20 cfm) = 4,010 scfm

2) A coarse bubble diffused aeration system is provided in FET #1 for oxygen transfer and complete mixing. The air sparging capacity of the diffuser system is over 6,000 scfm with compressed air supplied by three 200 HP positive displacement blowers each rated at 2,000 scfm @ 14.5 psi

b. Oxygen Transfer Requirements

1) Calculate the average oxygen transfer rate required in FET #1 assuming an average influent BOD concentration = 4,000 mg/L, the maximum daily influent wastewater flow volume = 4.00 MGD; and, an average oxygen demand = 0.10#O_2/#BOD

#BOD/day = (4,000 mg/L)(8.34)(4.00 MGD) = 133,440#/day

$$\text{AOTR} = \frac{133{,}440(0.10)}{24} = 556\#O_2/\text{hr} \leq 600\#O_2/\text{hr}$$

2) Calculate the required corresponding maximum standard oxygen transfer rate required:

$$SOTR = AOTR\left[\frac{Css}{\beta C_{SW}\text{-}DO)\alpha(1.024)^{T-20}}\right]$$

Where DO	=	2.0 mg/L (average DO in FET #1)
ß	=	0.90
α	=	0.80 @ 4,000 to 8,000 mg/L TSS with subsurface coarse bubble aeration diffusers
$1.024^{(T-20)}$	=	1.126 @ maximum T = 25° C
Cw	=	7.92 mg/L @ sea level, 25° C
Cs	=	9.20 mg/L @ sea level, 20° C
Site Altitude	≤	100 feet
Pressure Correction Factor	≥	0.995

$$Csw = 7.92\left[\frac{(0.995)(14.7)+(0.5)(0.433)(31.0)}{14.7}\right]$$

$$= 7.92 \text{ mg/L}(1.452) = 11.50 \text{ mg/L}$$

$$Css = 9.20\left[\frac{14.7+(0.5)(0.433)(31.0)}{14.7}\right]$$

$$= 9.20 \text{ mg/L}(1.456) = 13.40 \text{ mg/L}$$

* 31.0 foot deep storage basin with the airgrid coarse bubble diffusers installed 1.0 above the basin floor.

$$SOTR = AOTR\frac{13.40}{[(0.90)(11.50)\text{-}2.0]0.80(1.126)}$$

$$SOTR = 1.78(AOTR)$$

$$SOTR \leq 1.80(600) \leq 1{,}080\#O_2/hr$$

a) Calculate subsurface aeration equipment air sparging requirements:

(1) The oxygen available per cfm per hour =

x = 0.23 (0.075#/ft^3)(60 min/hr)

= 1.035#O_2/cfm/hr @ 68° inlet air

(2) e = subsurface coarse bubble diffuser oxygen stripping or transfer efficiency at 31.0 ft. maximum air sparge depth = 22%

(3) scfm required = $\frac{SOTR}{(x)(e)}$

scfm (average) = $\frac{1{,}080\#O_2/HR}{(1.035)(0.22)}$ = 4,743 scfm

$\leq$ 5,000 scfm

(4) Max. design blower pressure with 30.0 ft. max. diffuser air sparge submergence including 1.0 ft. of surge depth:

= (30.0 ft.)(0.433) + 1.0 psi = 14. psi $\leq$ 14.50 psi (pressure loss plus pressure drop in air supply lines and in airgrid air diffuser sparges)

b) Oxygen transfer is provided in FET #1 by a new coarse bubble diffused aeration system with a maximum air sparging capacity of 6,000 scfm and maximum oxygen transfer efficiency of over 600#O_2/hr (AOTR).

c) Compressed air is provided to the coarse bubble diffusers by operation of one, two or three 200 HP positive displacement blowers each rated at 2,000 scfm @ 14.5 psi.

D. Flow Equalization Tank #1 (FET) Effluent/DAF Cell #1A and #1B Influent Pump Station

1. General

   a. A new FET #1 Effluent Pump Station is provided to pump mixed wastewater from the FET #1 into the two First Stage DAF Cells #1A and #1B.

   b. Three new FET #1 Effluent Pumps are provided. One pump is dedicated to pump wastewater flow from the FET #1 into existing DAF Cell #1A. One pump is dedicated to pump wastewater flow from the FET #1 into new DAF Cell #1B. The third pump is an installed common standby for pumping from the FET #1 into either DAF Cell #1A or DAF Cell #1B.

2. Design Assumptions

   a. Wastewater Flow Rates and Volumes

      1) Maximum Daily Wastewater Flow Volume = 4.0 MGD = 2,800 gpm, 24 hours/day, 5 to 6 days/week = 2.0 MGD/DAF Cell = 1,400 gpm/DAF Cell

      2) Average Pumping Rate Required = 4.0 MGD = 2,800 gpm over 24 hours/day = 2.0 MGD/DAF Cell = 1,400 gpm/DAF Cell

      3) Maximum Pumping Rate Required = 5.2 MGD = 3,600 gpm = 2.6 MGD/DAF Cell = 1,800 gpm/DAF Cell

      4) Peak Pumping Rate Required = 6.0 MGD = 4,200 gpm split to the two DAF Cells according to the DAF Cell capacities

3. Pump Selection

   a. Three new 40 HP self-priming pumps are provided to pump wastewater from the existing FET #1 into the DAF Cells #1A and #1B.

   b. Each pump is rated at 4.0 MGD = 2,800 gpm @ 25 feet.

   c. One pump is provided to pump wastewater from FET #1 into the existing DAF Cell #1A. Operation of one pump at reduced speed is required to pump the maximum flow rate into DAF Cell #1A = 1,800 gpm = 2.6 MGD.

   d. One pump is provided to pump wastewater from the FET #1 into the new DAF Cell #1B. Operation of one pump at reduced speed is required to pump the maximum flow rate into DAF Cell #1B = 1,800 gpm = 2.6 MGD.

e. To provide the total peak flow pumping rate = 6.0 MGD = 4,200 gpm, one pump is operated at reduced speed to pump 1,800 gpm into existing DAF Cell #1A and one pump is operated at reduced speed to pump 2,400 gpm into new DAF Cell #2A.

f. The third pump is provided as a common standby for pumping from the FET #1 into either existing DAF Cell #1A or new DAF Cell #1B.

4. Variable Speed Drive Controls

a. Each pump is provided with variable speed drive motor controls with automatic pump speed and pumping rate control.

b. The pump operating speed can be automatically controlled by the flow rate into each DAF Cell or by the liquid level in the FET #1.

c. Two pumps will normally be operated in parallel to pump the total wastewater flow volume at a relatively constant flow rate over 24 hours/day into the two DAF Cells #1A and #1B. The operating speeds of the pumps are automatically synchronized to provide approximately the same flow pumping rate into each DAF Cell.

5. Liquid Level Controls

a. The pumps are automatically started and stopped by liquid level in the FET #1.

b. The pump operating speed and pumping rate can be automatically controlled by the liquid level in the FET #1; or, controlled by the flow rate into the DAF Cells

c. A high liquid level alarm (HLLA) is provided in the FET #1 in order to prevent excessive high liquid level.

6. Flow Meters

a. One new magnetic flow meter is provided in the pump station discharge header of the force main to accurately measure, indicate, totalize and record the flow rate and volume pumped from the FET #1 into DAF Cell #1A.

b. One new magnetic flow meter is provided in the pump station discharge header of the force main to accurately measure, indicate, totalize and record the flow rate and volume pumped from the FET #1 into DAF Cell #1B.

E. Dissolved Air Flotation Cells #1A and #1B for First Stage Pretreatment (Modification)

1. General

   a. Screened raw wastewater is pumped from the Raw Wastewater Pump Station wet well into new Flow Equalization Tank #1 operated upstream of the Dissolved Air Flotation (DAF) First Stage Wastewater Pretreatment System.

   b. One new DAF Cell #1B is provided to operate independent of or in parallel with the existing DAF Cell #1A for first stage wastewater pretreatment by chemical coagulation, flocculation and dissolved air flotation.

2. Design Assumptions

   a. Wastewater Volumes and Flow Rates:

      1) Maximum Wastewater Flow Volume = 4.00 MGD = 2,800 gpm = 1,400 gpm/DAF Cell = 2.0 MGD/DAF Cell

      2) Average Wastewater Flow Rate = 4.00 MGD = 2,800 gpm = 1,400 gpm/DAF Cell approximately 24 hours/day

      3) Maximum Wastewater Flow Rate = 5.20 MGD = 3,600 gpm = 1,800 gpm/DAF Cell = 2.60 MGD/DAF Cell during processing shifts in dry weather

b. Wastewater Pollutant Concentrations and Loadings

1) Maximum wastewater pollutant concentrations and loadings in the DAF Cell influent at maximum daily influent flow volume = 4.00 MGD = 2.00 MGD/DAF Cell:

Table #5
DAF Cell Influent Wastewater
Pollutant Concentrations and Loadings

Pollutant	Pollutant Concentration[1]		Pollutant Loading[2]	
	Average	Maximum	Average	Maximum
BOD	5,000 mg/L	9,500 mg/L	166,800#/day	316,920#/day
TSS	4,000 mg/L	8,000 mg/L	133,440#/day	224,553#/day
TKN	400 mg/L	500 mg/L	13,440#/day	16,280#/day
Ammonia-N	25 mg/L	35 mg/L	834#/day	1,034#/day
TP	60 mg/L	80 mg/L	2,002#/day	2,668#/day
FOG	1,200 mg/L	1,800 mg/L	40,032#/day	60,382#/day

[1]Based on raw wastewater composite test data taken from the existing Flow Equalization Tank provided by Condor in March 2020
[2]Calculated @ 4.00 MGD

3. DAF System Design

a. General Description

1) One new World Water Works (WWW) DAF Cell #1B is provided to operate independent of or in parallel with the existing DAF Cell #1A for first stage wastewater pretreatment. The new DAF Cell includes two new recycle flow pressurization pumps, a new air dissolving system and a control panel to provide first stage pretreatment of wastewater by chemical coagulation and flocculation and dissolved air flotation. The minimum Effective Flotation Area of each DAF Cell = 2,625 ft^2 and the minimum Free Surface Area of each DAF Cell = 260 ft^2.

2) One pipeline flocculator or Floc Tube is provided with each DAF Cell for wastewater treatment by chemical coagulation and flocculation upstream of each DAF Cell.

3) Two recycle pressurization pumps are provided with each DAF Cell for compressed air fed into the recycle pressurization pump discharge piping.

4) One existing Air Compressor is provided for air supply to the existing DAF Cell #1A and new Air Compressor is provided for air supply to the new DAF Cell #1B air dissolving system and recycle pressurization pump discharges.

b. Design Calculations

1) Calculate the maximum DAF Cell solids loading rate during processing shifts in dry weather with upstream chemical coagulation-flocculation @ 2.60 MGD/DAF Cell = 1,800 gpm/DAF Cell assuming a TSS removal efficiency of 90%.

a) $\frac{[4{,}000 \text{ mg/L TSS})(0.90)\ 8.34\ (2.60 \text{ MGD})]}{24}$

$= 3{,}276\#/\text{hr} \leq 3{,}300\#/\text{hr/DAF Cell}$

2) Calculate the required air dissolving rate for the maximum solids loading rate of 3,300#/hr, assuming an air to solids ratio = 0.0075#air/#solids in the rectangular DAF cell with polymer coagulation/flocculation.

a) $\frac{3{,}300(0.0075)}{60} < 0.41\#\text{air/min.}$

3) Calculate the required air supply rate @ 90°F inlet air density @ ≤ sea level altitude ≥ 0.0727#/ft^3

a) $\frac{0.41\#/\text{min}}{0.0727} \leq 5.70 \text{ cfm}$

b) Use air supply rate = 3.00 cfm to 6.00 cfm = 80 to 160 liters/min.

4) Calculate the maximum pressurized flow required @ 90 psi air dissolving pressure @ wastewater temperature = 90°F max., assuming an air dissolving capacity =0.90 cfhr/gpm = 0.015 cfm/gpm of recycle flow

a) $QR = \frac{6.00 \text{ cfm}}{0.015 \text{ cfm/gpm}} = 400 \text{ gpm}$

5) Two 40 HP recycle pressure pumps are provided with the DAF Cell each rated @ 450 gpm @ 208 ft. The second uninstalled pump is provided as a standby.

6) The maximum air dissolving capacity of each DAF Cell recycle pressurization system with one recycle pressure pump in operation = 160 liters air/min. = approximately 6.00 cfm.

7) Calculate the maximum DAF Cell Hydraulic Surface Loading Rate

a) Hydraulic Surface Loading Rate = 1,800 gpm/DAF Cell

$$\frac{1{,}800 \text{ gpm} + 450 \text{ gpm}}{2{,}625 \text{ ft}^2} \leq 1.00 \text{ gpm/ft}^2$$

8) Calculate the maximum DAF Solids Loading Rate @ 3,300#/hr/DAF Cell

a) Solids Loading Rate =

$$\frac{3{,}300\#/\text{hr}}{260 \text{ ft}^2} \leq 13\#/\text{ft}^2/\text{hr/DAF Cell}$$

4. DAF Sludge Production Storage and Pumping

a. The calculated average skimmings volume produced per day in the two DAF Cells when operated with chemical coagulation-flocculation = 70,000# to 90,000# dry solids/day = 35,000 to 45,000 gpd after gravity decanting to approximately 25% solids concentration, assuming approximately 82% BOD removal, 90% TSS removal, 90% Oil & Grease removal and 50% TKN removal in the DAF Cells.

b. Solids skimmed from the DAF Cells will flow into two DAF Sludge Holding Tanks (SHT #1A and SHT #1B) for gravity decanting. Thickened solids will be pumped from the SHT into a DAF Sludge Tanker Truck.

c. Three new 10 HP positive displacement DAF sludge pumps are provided each rated at 200 gpm @ 60 ft. to transfer DAF sludge from the DAF Cell #1A and DAF Cell #1B Sludge Holding Tanks to the DAF Sludge Storage Tanker for hauling to an off-site disposal site.

5. Expected DAF Cell First Stage Pretreated System Effluent Quality

a. The following First Stage DAF Cell Pretreatment System effluent quality is expected if the DAF Cells are operating with a high efficiency polymer chemical treatment program for chemical coagulation and flocculation in the Flocculation Tubes upstream of the two DAF Cells. The following DAF Cell effluent quality is expected to be discharged into downstream 7 Day Flow Equalization Tanks at the maximum daily wastewater flow volume = 4.00 MGD, 5 days/week:

Table #6
First Stage DAF Cells #1A and #1B Effluent
Pollutant Concentrations and Loadings

Pollutant	Average		Maximum	
	mg/L	#/day[1]	mg/L	#/day[1]
BOD	5,000(0.18) = 900	30,024	9,500(0.18) = 1,750	58,380
TSS	4,000(0.10) = 4,000	13,344	8,000(0.10) = 800	26,688
TKN	400(0.50) = 200	6,672	500(0.50) = 250	8,340
Ammonia-N	75 mg/L	2,502	100 mg/L	3,336
TP	60(0.50) = 30	1,001	80(0.50) = 40	1,334
FOG	1,200(0.10) = 120	4,004	1,800(0.10) = 180	6,005

[1]Calculated @ 4.00 MGD Maximum Daily Wastewater Flow Volumes

F. DAF Cells #1A and #1B Effluent/FET #2A and #2B Influent Pump Station (New)

1. General Description

a. One new DAF Cell #1A and #1B Effluent Pump Station is provided to pump the first stage DAF Cell #1A and #1B effluent wastewater into the new 7 Day Flow Equalization Tanks #2A and #2B.

b. The new pump station has an above grade wet well tank.

2. Design Assumptions

a. Wastewater Flow Rates and Volumes

1) Maximum Daily Wastewater Flow Volume = 4.0 MGD, 5 to 6 days/week

2) Average Pumping Rate Required = 4.0 MGD = 2,800 gpm over 24 hours/day

3) Maximum Pumping Rate Required = 5.2 MGD = 3,600 gpm

4) Peak Pumping Rate Required = 6.0 MGD = 4,200 gpm

3. Pump Selection

   a. Three new 75 HP Gorman Rupp T10 self-priming sewage pumps are provided to pump wastewater from the DAF Cell #3 effluent wet well into new FETs #2A and #2B.

   b. Each pump is rated at 2,800 gpm @ 50 ft.

4. Variable Speed Drive Controls

   a. Variable speed drive motor controls are provided for each pump.

   b. Pump speed and pumping rate are automatically controlled by the liquid level in the wet well.

   c. Operation of one pump at full speed or two pumps in parallel at reduced speed is required to pump the average flow rate = 2,800 gpm = 4.0 MGD = 1,400 gpm/pump = 2.0 MGD/pump.

   d. Operation of two pumps in parallel at reduced speed is required to pump the maximum flow rate = 3,600 gpm = 5.2 MGD = 1,800 gpm/pump = 2.6 MGD/pump.

   e. Operation of two pumps at full speed is required to pump the peak flow rate = 4,200 gpm = 6.0 MGD = 2,100 gpm/pump = 3.0 MGD/pump.

   f. The third pump is provided as an installed standby.

5. Wet Well Liquid Level Control

   a. One liquid level sensor is provided in the pump station wet well to operate the pump on, pump off and high liquid level alarm controls.

   b. A control system is provided to automatically adjust the pump operating speed and the flow pumping rate to maintain the liquid level in the pump station wet well.

G. Chemical Feed Equipment for First Stage DAF Cells #1A and #1B (Existing and New)

1. The following equipment is provided for mixing, storage and dosing of chemical solutions that are necessary for operation of the First Stage DAF Pretreatment System:

   a. Bulk Polymer Coagulant Solution Storage Tank

      1) One 10' dia. x 12' tall, 6,000 gallon volume, fiberglass double walled tank is provided for bulk storage of coagulant solution.

      2) The bulk coagulant solution storage tank is provided with containment and has an ultrasonic level control with high and low level alarm with continuous level indicator.

   b. Polymer Flocculant Solution Mix Tanks

      1) Two 10'dia. x 7' tall, 4,000 gallon volume fiberglass tanks each with 2 HP mixer are provided for make-up and storage of polymer flocculant solution.

   c. Chemical Solution Pumps

      1) Two polymer coagulant solution pumps are provided each rated at 50 gphr @ 30 psi for dosage of coagulant solution into the wastewater flow into the DAF Cell Flocculation Tubes.

      2) Two polymer flocculant solution pumps are provided each rated at 90 to 900 gphr @ 40 psi for dosage of anionic flocculant solution into the wastewater flow into the DAF Cell Flocculation Tubes.

      3) The polymer coagulant solution and polymer flocculant solution chemical feed pumps have variable speed drives that can be manually controlled; or, automatically controlled by flow pacing from the DAF Cell #1A and #1B influent flow meters and the chemical feed control system.

H. 7 Day Flow Equalization Tanks #2A and #2B (New)

1. General

   a. Two new 7 Day Flow Equalization Tanks #2A and #2B are provided to collect, store, blend and hydraulically equalize wastewater produced by all sources on the processing complex. The process wastewater from the chicken processing plant, the drainage wastewater from the rendering plant and the centrifuge stickwater are blended in FET #1 and receive first stage wastewater pretreatment before discharging into the 7 Day FETs. The Sanitary Wastewater, Miscellaneous Wastewater and Stormwater are pumped directly into the 7 Day FETs. Blended wastewater from all sources is pumped out of the 7 Day FETs at a relatively constant wastewater flow rate and volume 24 hours/day, 7 days/week into DAF Cell #3 for second stage pretreatment of all wastewater by chemical coagulation, flocculation and flotation before flowing into the activated sludge biological nitrogen removal (BNR) system.

   b. Wastewater is generated by the Chicken Processing Plant normally 5 days/week on processing weekdays with a minor wastewater flow produced over the weekend days. The process wastewater receives first stage pretreatment in DAF Cells #1A and #1B before flowing into the 7 Day FETs.

   c. Wastewater is generated by the Rendering Plant as floor drainage wastewater and condensate wastewater on rendering plant operation days normally 6 days/week. The rendering plant floor drainage wastewater receives first stage pretreatment in DAF Cells #1A and #1B before flowing into the 7 Day FETs. The rendering plant raw condensate wastewater is pumped directly into the 7 Day FETs without pretreatment.

   d. DAF Sludge Centrifuge Stickwater Wastewater is generated by the centrifuge system normally 6 days/week. This wastewater receives primary DAF pretreatment in DAF Cell #2 followed by first stage pretreatment with process wastewater in DAF Cells #1A and #1B.

   e. Sanitary and Miscellaneous Wastewater is generated by Processing Complex normally 5 days/week on processing days with some additional sanitary wastewater on the weekends. This wastewater is pumped directly into the 7 Day FETs without pretreatment.

   f. The wastewater discharged by the Chicken Processing Plant and the Rendering Plant contribute over 97% of the pollutant loading produced by the processing complex. The These pollutant loadings are normally generated over 5 days per week of chicken processing plant operation, and, over 6 days per week of rendering plant operation. The pollutant loadings drop off significantly over the weekends. The 7 Day FETs provide sufficient equalization volume to allow the total wastewater volume and pollutant loadings produced over 5 to 6 day period to be blended and discharged out of the 7 Day FETs at a relatively constant flow rate and volume 24 hours/day, 7 days/week.

g. Stormwater Wastewater (SW) is generated at variable flow rates and volumes by rain events on the processing complex site and is collected and stored in the Stormwater First Flush/Off Spec Lagoon (SFFL). SW is pumped from the SFFL at a relatively constant flow rate into FET #2A and #2B.

2. Design Assumptions

a. Wastewater Flow Sources and Volumes

1) Maximum Weekly Flow Volumes

Table #6A
Summary of Design Basis Maximum Weekly Wastewater Flow Volumes Discharged into 7 Day Flow Equalization Tanks #2A and #2B Based on 6 Day Kill

Flow Source	Volume/Day	Days/Week	MG/week
Process Plant[(1)]	3.51 MGD	6	21.06
Process Plant Weekend	0.30 MGD	1	0.30
RPCW	0.20 MGD	6.5	1.30
RPDW	0.15 MGD	7	1.05
Centrifuge Stickwater	0.1441 MGD	6	0.865
Sanitary and Misc.	0.20 MGD	5	1.00
Stormwater[(2)]	0.90 MGD	2	1.80
Total			**27.37**

[(1)]Maximum Process Plant wastewater volume based on 6 day/week operation
[(2)]Maximum MG/week of Stormwater wastewater is based on two SW days/week each at a maximum of 900,000 gpd of stormwater pumped from the SFFL.

2) Average Weekly Flow Volumes

Table #6B
Summary of Design Basis Average Weekly Wastewater Flow Volumes Discharged into 7 Day Flow Equalization Tanks #2A and #2B Based on 5 day Kill

Flow Source	Volume/Day	Days/Week	MG/week
Process Plant[(1)]	3.25 MGD	5	16.25
Process Plant Weekend	0.30 MGD	2	0.60
RPCW	0.20 MGD	6	1.20
RPDW	0.15 MGD	6	0.90
Centrifuge Stickwater	0.1441	6	0.865
Sanitary and Misc.	0.70 MGD	5	1.00
Stormwater[(2)]	0.90 MGD	1	0.90
Total			**21.72**

[(1)]Average Process Plant wastewater volume based on 5 day/week operation
[(2)]Average MG/week of Stormwater wastewater is based on one SW day/week at a maximum of 900,000 gpd of stormwater pumped from the SFFL.

3) The maximum 7 day flow volume pumped out of the 7 Day FETs #2A and #2B = 27.37 MGD/7 days = 3.91 MGD ≤ 4.00 MGD.

4) The average 7 day flow volume pumped out of the 7 Day FETs #2A and #2B = 21.72 MGD/7 days = 3.11 MGD ≤ 3.20 MGD.

b. Wastewater Pollutant Concentrations and Loadings into the 7 Day Flow Equalization Tanks #2A and #2B

1) From First Stage DAF Cells #1A and #1B Effluent

Table #7A
DAF Cell #1A and #1B First Stage Pretreatment System Effluent Pollutant Concentrations in the Pretreated Wastewater Discharged into the 7 Day Flow Equalization Tanks #2A and #2B

Parameter	**Pollutant Concentration [(1)]**
BOD	**1,750 mg/L**
TSS	**800 mg/L**
TKN	**250 mg/L**
Ammonia Nitrogen	**100 mg/L**
TP	**40 mg/L**
FOG	**180 mg/L**

[(1)]The DAF Pretreatment System operation and chemical treatment program used will be selected and automatically controlled to produce pretreated DAF Cell #1A and #1B effluent pollutant concentrations that are within the pretreatment system effluent quality specified in Table #3.

2) From Rendering Plant Condensate Wastewater without Pretreatment

Table #7B
Raw Rendering Plant Condensate Wastewater Pollutant Concentrations Discharged into Flow Equalization Tanks #2A and #2B

Parameter	Pollutant Concentration
BOD	**5,500 mg/L**
TSS	**300 mg/L**
TKN	**1,100 mg/L**
Ammonia Nitrogen	**1,050 mg/L**
TP	**20 mg/L**
FOG	**200 mg/L**

3) From Mixture of Sanitary Wastewater, Hatchery Wastewater and Miscellaneous Wastewater

Table #7C
Sanitary Wastewater and Miscellaneous Wastewater Pollutant Concentrations Discharged into FET Tanks #2A and #2B

Parameter	Pollutant Concentration
BOD	**800 mg/L**
TSS	**350 mg/L**
TKN	**100 mg/L**
Ammonia Nitrogen	**25 mg/L**
TP	**8 mg/L**
FOG	**100 mg/L**

4) From Stormwater Wastewater

Table #7D
Stormwater Wastewater Pollutant Concentrations
Discharged into
Flow Equalization Tanks #2A and #2B

Parameter	**Pollutant Concentration**
BOD	**100 mg/L**
TSS	**300 mg/L**
TKN	**15 mg/L**
Ammonia Nitrogen	**5 mg/L**
TP	**2 mg/L**
FOG	**20 mg/L**

5) Summary of Maximum Wastewater Pollutant Concentrations and Loadings into the 7 Day FETs #2A and #2B

Table #7E
Maximum Pollutant Loadings into the 7 Day FEB Tanks #2A and #2B

Parameter	**DAF Cell #1A & #1B Effluent Wastewater[(1)]**		**Raw Rendering Plant Condensate Wastewater[(2)]**		**Hatchery, Sanitary & Misc[(3)]**		**Stormwater[(4)]**		**∑**	
Flow	4.00 MGD		0.20 MGD		**0.20 MGD**		**0.257 MGD**		**4.66 MGD**	
Pollutant	Concen.	Loading	Concen.	Loading	Concen	Loading	Concen	Loading	Concen.	Loading
	mg/L	#/day	mg/L	#/day	mg/L	#/day	mg/L	#/day	mg/L	#/day
BOD	1,750	58,380	5,500	9,174	800	1,334	100	214	**1,800**	**69,102**
TSS	800	26.688	360	631	350	584	300	643	**735**	**28,546**
TKN	250	8,340	1,100	1,835	100	167	15	32	**267**	**10,374**
Ammonia N	100	3,336	1,050	1,751	25	42	5	10	**132**	**5,139**
TP	40	1,334	20	33	8	13	2	4	**36**	**1,384**
FOG	180	6,005	< 200	334	100	167	20	3	**170**	**6,549**

[(1)]4.00 MGD, 5 to 6 days/week including Centrifuge Stickwater discharged from DAF Cell #2; See Table #3
[(2)]0.20 MGD, 6 days/week
[(3)]0.20 MGD, 5 days/week; See Table #1
[(4)]1.80 MG/7 days = 0.257 MGD, 7 days/week from SW First Flush Lagoon; See Tables #2 and #6A

3. Equalization Volume Calculation

   a. The average and maximum wastewater flow volumes discharged into the 7 Day FETs on processing days are calculated in the following table:

Table #8
Total Daily Wastewater Flow Volume into Flow Equalization Tanks #2A and #2B

Flow Source	Volume/Day	
	Average	Maximum
Process Plant Weekday	3.25 MGD	3.51 MGD
RPCW	0.20 MGD	0.20 MGD
RPDW	0.15 MGD	0.15 MGD
Centrifuge Stickwater	0.1441 MGD	0.1441 MGD
Sanitary and Misc.	0.20 MGD	0.20 MGD
Stormwater	0.13 MGD(2)	0.257 MGD(1)
Total	**4.07 MGD**	**4.46 MGD**

(1)SW = 1.80 MGD/week/7 Days = 0.257 MGD
(2)SW = 0.90 MGD/week/7 Days = 0.130 MGD

   b. The maximum storage volume required to provide 7 Day hydraulic flow equalization based on average daily flow volume and 5 day kill week = (4.07 MGD – 3.11 MGD)5 days = 4.80 MG < 5.00 MG

   a. The maximum storage volume required to provide 7 Day hydraulic flow equalization based on maximum daily flow volume and 6 day kill week = (4.46 MGD – 3.91 MGD)(6 days) ≤ 3.30 MG ≤ 4.00 MG

4. 7 Day FEB Tank Volumes

   a. Two new 141 ft. dia. x 30 ft. maximum liquid depth x 32 ft. tall Flow Equalization Tanks each will be installed and operated downstream of the first stage DAF pretreatment system to provide combined 7-day hydraulic flow equalization followed by second stage DAF pretreatment of wastewater.

   b. Each new 7 Day Flow Equalization Tank has a maximum volume of approximately 3.50 MG and a flow equalization volume of approximately 2.5 MG. The two 7 Day FETs provide a total flow equalization volume = 5.00 MG. The new 7 Day FETs are operated upstream of DAF Cell #3 to provide second stage DAF pretreatment of wastewater.

c. New 7 Day Flow Equalization Tank #2A

Maximum Volume @ Normal HWL	=	3.50 MG
Maximum 7 Day Equalization Volume	=	2.50 MG
Minimum Effective Volume @ Normal LWL	=	1.00 MG
Average Effective Volume	=	2.25 MG

d. New 7 Day Flow Equalization Tank #2B

Maximum Volume @ Normal HWL	=	3.50 MG
Maximum 7 Day Equalization Volume	=	2.50 MG
Minimum Effective Volume @ Normal LWL	=	1.00 MG
Average Effective Volume	=	2.25 MG

5. <u>7 Day FEB Tank Aeration and Mixing Equipment Design</u>

a. Evaluate mixing requirements in FET #1A and #1B:

1) Calculate the BHP required for mixing a 500 to 1,000 mg/L TSS concentration = 50 HP/MG using directional mix jet aeration:

BHP required = 50 HP(3.50 MG) ≤ 175 HP in each FET

2) Two new 100 HP jet recirculation pumps and two directional mix jet aeration headers are provided in each 7 Day FET for mixing and aeration.

b. Evaluate aeration requirements in FET #1A and #1B

1) Calculate the maximum oxygen transfer rate required in FET #1A and #1B:

a) Calculate the oxygen transfer requirement for BOD synthesis assuming 25% BOD removal in the FETs:

$$AOTR_1 = \frac{(0.25\#O_2/\#BOD/day)(69{,}102\#BOD/day)}{24} = 720\#O_2/hr \leq 800\#O_2/hr \text{ (total)}$$

$$\leq 400\#O_2/hr/FET$$

2) Calculate the required corresponding maximum standard oxygen transfer rate required:

$$SOTR = AOTR\left[\frac{Css}{\beta C_{SW}\text{-}DO)\alpha(1.024)^{T-20}}\right]$$

Where DO	$\leq$	2.0 mg/L (average DO in FET)
ß	=	0.95
α	=	0.85 @ 500 to 1,000 mg/L TSS with subsurface jet aeration manifolds
Maximum WW temperatures	=	30°C
$1.024^{(T-20)}$	=	1.2677 @ T = 30°C
Cw	=	7.63 mg/L @ sea level, 30°C
Cs	=	9.20 mg/L @ sea level, 20°C
Site Altitude	$\leq$	100 feet
Pressure Correction Factor	$\geq$	0.995

$$Csw = 7.63\left[\frac{(0.995)(14.7)+(0.5)(0.433)(30.0)}{14.7}\right]$$

$$= 7.63 \text{ mg/L}(1.437) = 10.96 \text{ mg/L}$$

$$Css = 9.20\left[\frac{14.7+(0.5)(0.433)(30.0)}{14.7}\right]$$

$$= 9.20 \text{ mg/L}(1.442) = 13.26 \text{ mg/L}$$

* FET basin maximum liquid depth = 30 ft.

$$SOTR = AOTR\frac{13.26}{[(0.95)(10.96)-2.0]0.85(1.2677)}$$

$$SOTR = 1.46(AOTR)$$

$$SOTR \leq 1.50(800\#O_2/hr) \leq 1{,}200\#O_2/hr$$

c. Calculate subsurface aeration equipment air sparging requirements:

1) The oxygen available per cfm per hour =

$x = 0.23\ (.075\#/ft^3)(60 \text{ min/hr})$

$= 1.035\#0_2/cfm/hr$ @ 68°C inlet air

2) e = subsurface jet nozzle diffuser oxygen stripping or transfer efficiency at 30 ft. liquid depth = 39% in FET #1A and #1B

3) scfm required $= \frac{SOTR}{(x)(e)}$

$$scfm = \frac{1{,}200\#O_2/hr}{(1.035)(0.39)} \leq 3{,}000 \text{ scfm (max)}$$

4) The maximum blower pressure in FET with jet nozzles installed 30" above the basin floor at 30.0 ft. maximum liquid depth – 2.50 ft. = 27.5 ft. jet nozzle air sparge submergence =

= (27.5 ft.)(0.433) + 1.50 psi = 13.4 psi ≤ 13.5 psi including pressure drop in air supply lines and in jet nozzle diffusers

d. Oxygen transfer and mixing is provided in each FET by operation of two directional mix subsurface jet aeration manifolds. Flow recirculation for each jet manifold is provided by one 100 HP end suction sewage pump rated at 9,680 gpm at 23 ft. Each jet pump has a constant speed drive motor. The design air sparging capacity of the two jet aeration manifolds in each FET is approximately 3,000 scfm total providing a maximum total oxygen transfer rate = 850#O_2/hr (AOTR) = 1,275#O_2/hr (SOTR) in each FET with air supplied by two 125 HP positive displacement blowers per FET each rated at approximately 1,500 scfm at 13.3 psi. A fifth 125 HP blower is provided as a common installed standby for either FET.

I. 7 Day Flow Equalization Tank (FET) #2A and #2B Effluent Pump Station (New)

1. General

a. One new 7 Day Flow Equalization Tank Effluent Pump Station is provided to pump aerated, blended and equalized wastewater from the 7 Day FETs #2A and #2B into DAF Cell #3 for second stage pretreatment.

2. Design Assumptions

a. Average Pumping Rate Required = 3.20 MGD = 2,220 gpm, 24 hours/day, 7 days/week

b. Maximum Pumping Rate Required = 4.00 MGD = 2,800 gpm, 24 hours/day, 7 days/week

c. Dry Weather Maximum Pumping Rate Required = 4.00 MGD = 2,800 gpm

d. Wet Weather Peak Pumping Rate Required = 5.00 MGD = 3,500 gpm

3. Pump Selection

   a. Three new 50 HP, 10" self-priming sewage pumps are provided to pump partially pretreated wastewater out of the two 7 Day FETs into the Floc Tube of DAF Cell #3.

   b. Each pump is rated at 4.00 MGD = 2,800 gpm @ 40 feet.

   c. Operation of one pump at full speed or two pumps in parallel at reduced speed is required to pump the maximum day flow rate of 4.00 MGD = 2,800 gpm = 1,400 gpm/pump = 2.0 MGD/pump.

   d. Operation of two pumps in parallel at reduced speed is required to pump the maximum wet weather flow rate of 5.0 MGD = 3,500 gpm = 1,750 gpm/pump.

   e. The third pump is provided as an installed standby.

4. Variable Speed Drive Controls

   a. Each pump is provided with variable speed drive motor controls with automatic pump speed and pumping rate control.

   b. The pumps are automatically controlled to maintain a manually selected constant flow rate and volume pumped out of the 7 Day FETs 24 hours/day, 7 days/week.

5. Liquid Level Controls

   a. The FET Effluent pumps are manually started. A low liquid level (LLL) automatic pump shut off and alarm level control is provided in each FET to prevent excessive ow liquid level. Pumps can also be manually operated to pump below the automatic off liquid level in order to pump down the FETs.

   b. A high liquid level alarm (HLLA) is provided in each FET in order to prevent excessive high liquid level.

6. Flow Meter

   a. One new 14" magnetic flow meter is provided in the 7 Day FET Effluent Pump Station discharge header to accurately measure, indicate, totalize, and record the total flow rate pumped from the 7 Day Flow Equalization Tanks into the downstream activated sludge BNR System.

J. Dissolved Air Flotation Cell #3 for Second Stage Pretreatment (Modification)

1. General

   a. The existing P Tec DAF Cell #3 will be relocated into a new DAF Equipment Building and operated to provide second stage DAF pretreatment of wastewater pumped out of the 7 Day Flow Equalization Tanks #2A and #2B.

   b. New DAF Cell #3 will be operated for second stage DAF pretreatment upstream of the activated sludge BNR system.

2. Design Assumptions

   a. Wastewater Flow Rates and Volumes:

      1) Average Day Flow (ADF) Volume = 3.20 MGD ≤ 2,220 gpm

      2) Maximum Day Flow (MDF) Volume = 4.00 MGD = 2,800 gpm

   b. Maximum wastewater pollutant concentrations and loadings in the DAF Cell #3 influent at maximum daily 7 Day FET influent flow rate = 4.00 MGD assuming no pollutant removals are obtained in the upstream 7 Day FETs:

Table #9
7 Day FET Effluent Wastewater
Pollutant Concentrations and Loadings

Pollutant	Pollutant Concentration		Pollutant Loading	
	Average	Maximum	Average	Maximum
BOD (total)	1,000 mg/L	2,000 mg/L[(1)]	33,360#/day	66,720#/day
TSS	500 mg/L	1,000 mg/L	16,680#/day	33,360#/day
TKN	250 mg/L	300 mg/L[(2)]	8,340#/day	10,000#/day
Ammonia-N	100 mg/L	150 mg/L	3,336#/day	5,004#/day
TP	30 mg/L	45 mg/L	1,000#/day	1,500#/day
FOG	200 mg/L	400 mg/L	1,000#/day	1,500#/day

[(1)]1,880 mg/L BOD from Table #7E rounded up to 2,000 mg/L for conservative design
[(2)]267 mg/L TKN from Table #7E rounded up to 300 mg/L for conservative design

3. DAF System Design

a. General Description

1) One 11 ft. wide x 28 ft. long x 10 ft. liquid depth plate pack DAF Cell is provided with two new recycle flow pressurization pumps, a new air dissolving system and one pipeline flocculator to provide second stage pretreatment of aerated, blended and equalized wastewater pumped out of the 7 Day Flow Equalization Tanks by chemical coagulation and flocculation and dissolved air flotation. The effective flotation area of the DAF Cell = 2,625 ft^2. The free surface area of the DAF Cell = 260 ft^2.

2) One 12" diameter x 220 ft. long, 1,200 gallon volume Flocculation Tube is provided with the DAF Cell for wastewater treatment by chemical coagulation and flocculation upstream of the DAF Cell.

3) Two 40 HP recycle pressurization pumps each rated at 450 gpm at 208 ft. head are provided with compressed air fed into the pump discharge piping.

4) One Air Compressor is provided for air supply to the DAF cell air dissolving system and recycle pressurization pump discharge.

b. Design Calculations

1) Calculate the maximum DAF Cell solids loading rate with upstream chemical coagulation-flocculation @ 2,800 gpm = 4.00 MGD assuming a TSS removal efficiency of 80%.

a) $\frac{[1{,}000 \text{ mg/L TSS})(0.80)\ 8.34\ (4.00 \text{ MGD})]}{24}$

$\leq$ 1,200#/hr

2) Calculate the required air dissolving rate for the maximum solids loading rate of 1,200#/hr, assuming an air to solids ratio = 0.01#air/#solids in the rectangular DAF cell with polymer coagulation/flocculation.

a) $\frac{1{,}200\ (0.01)}{60}$ < 0.20# air/min.

3) Calculate the required air supply rate @ 90°F inlet air density @ ≤ sea level altitude ≥ .071#/ft^3

a) $\frac{0.20\#/\text{min}}{0.071}$ ≤ 3.00 cfm

b) Use air supply rate = 1.0 cfm to 4.0 cfm = 30 to 120 liters/min.

4) The maximum air dissolving capacity of the DAF Cell recycle pressurization system with one 40 HP recycle pressure pump in operation = 140 liters air/min. ≥ 5.0 cfm @ 120 psi.

5) Calculate the pressurized flow required @ 90 psi air dissolving pressure @ wastewater temperature = 90°F max., assuming an air dissolving capacity = 0.864# air/min. @ 90 psi

a) $QR = \frac{0.20\#/min \ (1000)}{0.864\# \text{ air/min}} \leq 240 \text{ gpm}$

Two 40 HP recycle pressure pumps are provided with the DAF Cell each rated @ 450 gpm @ 208 ft. A second uninstalled pump is provided as a standby.

6) Calculate the maximum DAF Cell Hydraulic Surface Loading Rate

a) Hydraulic Surface Loading Rate =

$$\frac{2{,}800 \text{ gpm} + 450 \text{ gpm recycle}}{2{,}625 \text{ ft}^2} \leq 1.25 \text{ gpm/ft}^2$$

7) Calculate the maximum DAF Solids Loading Rate =

a) Solids Loading Rate =

$$\frac{1{,}200\#/hr}{260 \text{ ft}^2} \leq 5.0\#/ft^2/hr$$

4. <u>DAF Sludge Production Storage and Pumping</u>

a. The calculated total skimmings volume produced per day in the DAF Cell #3 when operated with chemical coagulation-flocculation = 14,000# to 28,000# dry solids/day = 17,000 to 34,000 gpd after gravity decanting for approximately 10% solids concentration, assuming approximately 80% TSS removal and 60% Oil & Grease removal in the DAF Cell.

b. Solids skimmed from DAF Cell #3 will flow into a Sludge Holding Tank for gravity decanting. The thickened solids are pumped to WAS Aerobic Digestion Basin #2 to mix and be digested with WAS prior to ultimate disposal; or, the solids are pumped to a tanker truck for disposal by land application.

c. Two 10 HP positive displacement DAF sludge pumps are provided each rated at 200 gpm @ 60 ft. to transfer DAF #3 sludge from the Flotation Cell Sludge Holding Tank to WAS Digestion Basin #1 or to a DAF Sludge Tanker Truck.

5. Expected DAF Cell #3 Effluent Quality

   a. The following DAF Cell #3 effluent quality is expected if the DAF Cell is operating with a high efficiency chemical program using coagulant solution and polymer flocculant solution for chemical coagulation and flocculation in the Flocculation Tube upstream of the DAF Cell #3. The following second stage DAF pretreatment system effluent quality is expected to be discharged into the downstream activated sludge BNR final treatment system:

Table #10
DAF Cell #3 Effluent Pollutant Concentrations and Loadings

Pollutant	Average Concentration	Maximum Concentration
BOD	BOD = 1,000(0.75) ≤ 750 mg/L	BOD = 2,000(0.75) ≤ 1,500 mg/L[(1)]
TSS	TSS = 500(0.20) ≤ 100 mg/L	TSS = 1,000(0.20) ≤ 200 mg/L
TKN	TKN = 250(0.80) ≤ 200 mg/L	TKN = 300(0.80) ≤ 240 mg/L[(2)]
Ammonia N	NH_3-N = 150 mg/L	NH_3-N = 200 mg/L
FOG	FOG = 200(0.40) ≤ 80 mg/L	FOG = 450(0.40) ≤ 160 mg/L
TP[(3)]	TP = 30(0.80) ≤ 24 mg/L	TP = 45(0.80) ≤ 36 mg/L

[(1)]based on 25% BOD removal in DAF Cell #3
[(2)]based on 20% TKN removal in DAF Cell #3
[(3)]if a metal salt coagulant is used in DAF Cell #3, then effluent TP concentration will be much lower

K. DAF Cell #3 Effluent Pump Station (New)

1. General Description

   a. One new DAF Cell #3 Effluent Pump Station is provided to pump DAF Cell #3 effluent wastewater to the activated sludge BNR treatment system.

   b. The new pump station has an above grade wet well tank.

2. Design Assumptions

   a. Wastewater Flow Rates and Volumes

      1) Average wastewater flow (ADF) volume ≤ 3.20 MGD = 2,220 gpm, 7 days/week

      2) Maximum wastewater flow volume ≤ 4.00 MGD = 2,800 gpm, 7 days/week.

      3) Peak wet weather wastewater flow rate ≤ 5.00 MGD = 3,500 gpm

3. Pump Selection

   a. Three new 75 HP Gorman Rupp T10 self-priming sewage pumps are provided to pump wastewater discharged into DAF Cell #3 effluent wet well into the activated sludge BNR treatment system.

   b. Each pump is rated at 2,800 gpm @ 50 ft.

4. Variable Speed Drive Controls

   a. Variable speed drive motor controls are provided for each pump.

   b. Pump speed and pumping rate are automatically controlled by the liquid level in the wet well.

   c. Operation of one pump in parallel at full speed or two pumps in parallel at reduced speed is required to pump the maximum flow rate = 2,800 gpm = 4.00 MGD = 1,400 gpm/pump = 2.0 MGD/pump.

   d. Operation of two pumps in parallel at reduced speed is required to pump the peak flow rate = 3,500 gpm = 5.00 MGD = 1,750 gpm/pump = 2.50 MGD/pump.

   e. The third pump is provided as an installed standby.

5. Wet Well Liquid Level Control

   a. One liquid level sensor is provided in the pump station wet well to operate the pump on, pump off and high liquid level alarm controls.

   b. A control system is provided to automatically adjust the pump operating speed and the flow pumping rate to maintain the liquid level in the pump station wet well.

L. Chemical Feed Equipment for Second Stage DAF Cell #3 Pretreatment System (New)

1. The following equipment is provided for mixing, storage and dosing of chemical solutions that are necessary for operation of the Second Stage DAF Pretreatment System:

   a. Bulk Polymer Coagulant Solution Storage Tank

      1) One 10’ dia. x 12’ tall, 6,000 gallon volume, fiberglass double walled tank is provided for bulk storage of coagulant solution.

2) The bulk coagulant solution storage tank is provided with containment and has an ultrasonic level control with high and low level alarm with continuous level indicator.

b. Polymer Flocculant Solution Mix Tanks

1) Two 10'dia. x 7' tall, 4,000 gallon volume fiberglass tanks each with 2 HP mixer are provided for make-up and storage of polymer flocculant solution.

c. Chemical Solution Pumps

1) Two polymer coagulant solution pumps are provided each rated at 50 gphr @ 30 psi for dosage of coagulant solution into the wastewater flow into the DAF Cell #3 Flocculation Tube.

2) Two polymer flocculant solution pumps are provided each rated at 90 to 900 gphr @ 40 psi for dosage of anionic flocculant solution into the wastewater flow into the DAF Cell #3 Flocculation Tube.

3) The polymer coagulant solution and polymer flocculant solution chemical feed pumps have variable speed drives that can be manually controlled; or, automatically controlled by flow pacing from the DAF Cell #3 influent flow meter and the chemical feed control system.

M. Anoxic Reactor #1 (New)

1. General

a. One new 140 ft. dia. x 28 ft. liquid depth 3.20 MG volume above grade is provided as first stage, activated sludge Anoxic Reactor #1 to provide BOD and nitrate nitrogen removal by biological denitrification.

2. Design Assumptions

a. Wastewater Flows

1) Average wastewater flow (ADF) volume ≤ 3.20 MGD, 7 days/week

2) Maximum month average wastewater flow (MMADF) volume ≤ 4.00 MGD, 7 days/week.

3) Maximum dry weather wastewater flow (MDF) volume ≤ 4.00 MGD

4) Peak wet weather wastewater flow (PF) rate ≤ 5.00 MGD

b. Pollutant Concentrations and Loadings

1) The following maximum influent wastewater pollutant concentrations and loadings are assumed in the DAF Cell #3 effluent for a conservative design of the BNR System at the maximum day influent wastewater flow volume ≤ 4.00 MGD.

Table #11
BNR System Influent
Pollutant Concentrations and Loadings

Pollutant	Pollutant Concentration		Pollutant Loading[1]	
	Average	Maximum	Average	Maximum
BOD	750 mg/L	1,500 mg/L	25,020#/day	50,000#/day
TSS	100 mg/L	200 mg/L	3,336#/day	6,672#/day
TKN	200 mg/L	300 mg/L	6,672#/day	10,008#/day
Ammonia-N	150 mg/L	150 mg/L	5,004#/day	5,004#/day
FOG	80 mg/L	160 mg/L	2,669#/day	4,337#/day
TP	24 mg/L	36 mg/L	801#/day	1,000#/day

[1]@ 4.0 MGD

3. Anoxic Reactor BOD and Nitrate Removal Process Design

a. Anoxic Reactor #1 will be operated in series as first stage anoxic activated sludge reactor for biological nitrate removal and carbonaceous BOD removal in a four stage biological nitrogen removal (BNR) system.

b. Anoxic Reactor #1 will be used as anoxic activated sludge reactor basin for removal of carbonaceous BOD in the pretreated influent wastewater, and, for removal of nitrate nitrogen contained in the mixed liquor flow recycled from downstream Nitrification Reactor #2A.

c. Calculate the maximum loading of influent TKN to be nitrified assuming a nitrogen uptake during BOD removal by synthesis = 3 mg/L N/100 mg/L BOD = 0.03#N/#BOD:

Nitrified Nitrogen = 10,000#TKN/day – 0.03(50,000#BOD/day) = 8,508#NN/day

d. Calculate the expected nitrate nitrogen removal efficiency obtained in Anoxic Reactor #1 based on a Nitrate Recycle Rate = 4Q = 400% of Maximum Daily Flow Volume and RAS Rate = 1Q = 100% of Maximum Daily Flow Volume

$$\% \, NO_3\text{-N removal} = \frac{1Q \text{ RAS} + 4Q \text{ NR}}{1Q \text{ Flow} + 1Q \text{ RAS} + 4Q \text{ NR}}(100)$$

$$= \frac{5}{6}(100) = 83\%$$

e. Calculate the Nitrified Nitrogen denitrified in Anoxic Reactor #1

Nitrate Nitrogen denitrified = 8,508#NO_3-N(0.83) = 7,061#NO_3-N/day

f. Calculate MLVSS concentration required for carbonaceous BOD removal by biological synthesis in Anoxic Reactor #1 at the minimum expected winter season design mixed liquor temperature of 15°C

1) Approximate BOD removal in Anoxic Reactor #1 =

$$= \frac{7{,}061\#NO_3\text{-N}(2.8\#O_2/\#NO_3\text{-N})}{0.60\#O_2/\#\text{BOD}} = 33{,}000\#/\text{BOD removed/day}$$

$$= \frac{33{,}000\#}{50{,}000\#}(100) = 66\% \text{ BOD removal from synthesis using Nitrate Nitrogen}$$

2) For BOD removal assuming a carbonaceous BOD removal rate of 0.40# BOD/#MLVSS at 15°C and a carbonaceous BOD removal efficiency of 66%

$$\frac{33{,}000\#\text{BOD/day}}{0.40} \leq 83{,}000\#\text{MLVSS @ } 15°\text{C}$$

g. Calculate MLVSS concentration required for removal of nitrate nitrogen in the mixed liquor recycled from Nitrification Reactor #2.

1) For NO_3-N removal assuming a denitrification rate ≥ 0.072#NO_3-N/#MLVSS at 15°C

$$\frac{7{,}061\#NO_3\text{-N/day}}{0.072} \leq 100{,}000\#\text{MLVSS @ } 15°\text{C}$$

;therefore, #MLVSS for nitrate nitrogen removal governs the minimum biomass weight required and therefore the design MLVSS = 100,000# and #MLSS = 100,000/0.75 ≤ 134,000# assuming MLVSS/MLSS = 0.75

h. The maximum MLSS concentration required in Anoxic Reactor #1 is calculated as follows:

1) At anoxic basin volume = 3.20 MG

$$\text{MLSS} = \frac{134{,}000\#\text{MLSS}}{(3.2\ \text{MG})(8.34)} = 5{,}020\ \text{mg/L}$$

i. Calculate the hydraulic detention time in Anoxic Reactor #1 assuming the total flow volume into the anoxic reactor = 4.00 MGD inflow volume + 1Q RAS rate + 4Q nitrate mixed liquor recycle flow rate = 4.00 MGD + 4.00 MGD (RAS) + 4.00 MGD(4) = 24.0 MGD = 16,800 gpm

1) $$\text{HDT(min)} = \frac{3{,}200{,}000\ \text{gallons}}{16{,}800\ \text{gpm}} = 190\ \text{min}$$

$$= 3.2\ \text{hrs}$$

4. <u>Anoxic Reactor #1 Mixing and Aeration Equipment Design</u>

a. Evaluate the mixing requirements in Anoxic Reactors #1A & #1B:

1) Calculate the BHP required for mixing 4,000 mg/L to 6,000 mg/L TSS concentration = 50 HP/MG using directional mix jet headers.

2) BHP required for mixing:

a) in Anoxic Reactor #1 = 50 HP(3.20 MG) = 160 HP < 200 HP

b) two 200 HP jet recirculation flow pumps and two directional mix jet aeration headers are provided for tank mixing and mixed liquor solids suspension in Reactor #1.

b. Calculate the oxygen transfer rate required in Anoxic Reactor #1 under normal operating conditions when the downstream Nitrification Reactor #2 is in service

1) Approximate BOD removal in Anoxic Reactor #1 = 33,000#BOD removed/day

2) BOD removal in Reactor #1 =

$$= \frac{33{,}000\#/\text{day}}{50{,}000\#/\text{day}}(100) = 66\% = (1{,}500\ \text{mg/L})(0.66) = 1{,}000\ \text{mg/L BOD removed}$$

3) Calculate the maximum oxygen transfer requirement for BOD synthesis assuming an oxygen demand = 0.60#O_2/#BOD and approximately 66% BOD removal

$$AOTR_1 = \frac{0.60\#O_2/\#BOD(33{,}000\#BOD/day)}{24} = 825\#O_2/hr\ (max)$$

4) Calculate the maximum oxygen available in recycled nitrate for carbonaceous BOD and a removal in Anoxic Reactor #1 assuming a nitrate recycle rate of 4Q = 400%; RAS rate = 1Q = 100%; a recycled nitrate nitrogen fraction = 0.83 or 83%; and an oxygen supply of 2.86#O_2/#NO_3-N.

$AOTR_2$ = #O_2 /hr available from NO_3-N

$$AOTR_2 = \frac{(8{,}508\#TKN/day\ nitrified)2.86(0.83)}{24} = -842\#O_2/hr\ (max)$$

5) Calculate the maximum oxygen transfer requirement for endogenous respiration where the volume in Reactor #1 is approximately 31% of the total activated sludge volume reactor volume calculated as follows:

Reactor	**Volume**	**% of Total Volume**
Anoxic Reactor #1	3.20 MG	31%
Nitrification Reactors #2A	3.50 MG	34%
Nitrification Reactors #2B	1.50 MG	15%
Anoxic Reactor #3	1.50 MG	14.6%
Aerobic Reactor #4	0.55 MG	5.4%
Total Reactor Volume	10.25 MG	100%

$$AOTR_3 = \frac{(50{,}000\#BOD/day)(0.80\#O_2/\#BOD)(0.31)}{24} = 517\#O_2/hr\ (max)$$

6) Calculate the total amount of oxygen required in Anoxic Reactor #1:

$$AOTR_{(total)} = AOTR_1 - AOTR_2 + AOTR_3$$

$$= 825\#O_2/hr - 842\#O_2/hr + 517\#O_2/hr = 500\#O_2/hr\ (max)$$

7) Calculate the required corresponding standard oxygen transfer rate required:

$$SOTR = AOTR\left[\frac{Css}{\beta C_{SW}\text{-}DO)\alpha(1.024)^{T-20}}\right]$$

Where DO	$\leq$	0.30 mg/L (maximum D.O. in Reactor #1)
ß	=	0.90
α	=	0.80 @ 3,000 to 6,000 mg/L MLSS with subsurface jet aeration units
$1.024^{(T-20)}$	=	1.268 @ T = 30°C
Cw	=	7.63 mg/L @ sea level, 30°C @ max. mixed liquor temperature
Cs	=	9.20 mg/L @ sea level, @ 20°C
Site Altitude	$\leq$	100 feet
Pressure Correction Factor	$\geq$	0.995

$$Csw = 7.63\left[\frac{(0.995)(14.7)+(0.5)(0.433)(28.0)}{14.7}\right]$$

$$= 7.63 \text{ mg/L}(1.407) = 10.73 \text{ mg/L}$$

$$Css = 9.20\left[\frac{14.7+(0.5)(0.433)(28.0)}{14.7}\right]$$

$$= 9.20 \text{ mg/L}(1.412) = 12.99 \text{ mg/L}$$

* Reactor basin liquid depth = 28.0 ft.

$$SOTR = AOTR\frac{12.99}{[(0.90)(10.73)\text{-}0.3]0.80(1.268)}$$

$$SOTR = 1.37(AOTR)$$

$$SOTR \leq 1.40(500) \leq 700\#O_2/hr \text{ (max)}$$

8) Calculate subsurface aeration equipment air sparging requirements:

a) The oxygen available per cfm per hour @ 20°C and 1 atm

$x = 0.23\ (0.075\#/ft^3)(60\ min/hr)$

$= 1.035\#O_2/cfm/hr$

b) e = subsurface diffuser oxygen stripping or transfer efficiency at liquid depth = 28.0 ft. = 36%

c) scfm required $= \dfrac{SOTR}{(1.035)(0.36)}$

scfm $= \dfrac{700\#O_2/HR}{(1.035)(0.36)}$ $\leq$ 2,000 scfm (max)

d) The maximum blower pressure with jet nozzles installed 40" = 3.33' above the basin floor at 28.0 ft. maximum liquid depth – 3.33 ft. = 24.67 ft. jet nozzle air sparge submergence

= (25.0 ft.)(0.433) + 1.00 psi = 11.9 psi $\leq$ 12.0 psi including pressure loss in air supply lines and in jet nozzle diffusers

9) Oxygen transfer in Reactor #1 can be provided by the directional jet nozzles if compressed air is supplied from the blowers to the nozzles. The jet aeration headers can be operated to provide mixing only without oxygen transfer, or, with air supply to provide mixing and oxygen transfer. Each jet header unit can be individually operated with or without aeration to supply compressed air to the jet nozzles.

10) Oxygen in Anoxic Reactor #1 will normally be provided by nitrate oxygen contained in the mixed liquor recycle flow pumped from the downstream Nitrification Reactor #2.

11) The total emergency air sparging capacity of the jet aeration mixing system in Reactor #1 is approximately 8,650 scfm providing a maximum oxygen transfer rate $\geq$ 2,000#O_2/hr (AOTR) with air supplied by up to 4 – 200 HP positive displacement blowers each rated at 2,400 scfm at 11.82 psi.

12) If Reactor #2 must be taken out of service, Reactor #1 can be operated in this emergency condition as an aerobic reactor for BOD and TKN removal. In the event of a shutdown of downstream Nitrification Reactor #2A, the air supply blowers normally used for Reactor #2A can be operated to supply compressed air to the jet system in Reactor #1 if Reactor #1 must be operated as an aerobic nitrification reactor.

5. Expected Effluent Quality at the Maximum 7 Day Discharge Flow Volume = 4.00 MGD

   a. To insure a conservative design approach the following maximum Reactor #1 effluent pollutant concentrations and loadings are assumed for the design of downstream Nitrification Reactors #2A and #2B at the maximum day throughput flow volume of 4.00 MGD:

Table #12
Reactor #1 Effluent
Pollutant Concentrations and Loadings

Pollutant	Maximum Concentration	Maximum Loading
BOD	1,500(1 – 0.66) = 510 mg/L	17,000#/day
TKN	255 mg/L[(1)]	8,507#/day
TP	28.5 mg/L[(2)]	767#/day
O&G	150(0.20) = 40 mg/L	1,334#/day

[(1)]TKN = 300 mg/L – 0.03(1,500 mg/L BOD) = 255 mg/L
[(2)]TP = 36 mg/L – 0.005(1,500 mg/L BOD) = 28.5 mg/L

N. Nitrification Reactors #2A (New) and #2B (New and Modification)

1. General Description

   a. One new 152 ft. dia. x 26 ft. liquid depth, 3.50 MG volume above grade concrete tank is provided as second stage, aerobic, activated sludge Nitrification Reactor to provide TKN and ammonia removal by biological nitrification.

   b. The first half of the outer ring of the existing Crom tank can be optionally operated to provide an additional aerobic nitrification reactor volume of 1.50 MG, thereby increasing the total nitrification reactor process volume to approximately 3.50 MG + 1.50 MG = 5.00 MG.

2. Design Assumptions

   a. Wastewater Flow

      1) Average wastewater flow (ADF) volume ≤ 3.20 MGD, 7 days/week

      2) Maximum month average wastewater flow (MMADF) volume ≤ 4.00 MGD, 7 days/week.

      3) Maximum dry weather wastewater flow (MDF) volume ≤ 4.00 MGD

4) Peak wet weather wastewater flow (PF) rate ≤ 5.00 MGD

b. Pollutant Concentrations and Loadings

1) Maximum influent pollutant concentrations and loadings in the Nitrification Reactor #2 influent wastewater flow volume @ 4.00 MGD:

Table #13
Nitrification Reactor #2 Influent
Pollutant Concentrations and Loadings

Pollutant	Concentration	Maximum Loading
BOD	510 mg/L	17,000#/day
TSS (MLSS)	4,000 to 6,000 mg/L	-----
TKN	270 mg/L[(1)]	8,507#/day
TP	28.5 mg/L	951#/day
O&G	40 mg/L	1,334#/day

[(1)]NN = 300 mg/L TKN – 0.03(1,500 mg/L BOD) = 255 mg/L

3. Nitrification Reactor Process Design (Winter Conditions)

a. Calculate MLVSS and MLSS concentrations required for BOD and ammonia removal at the expected minimum winter season design mixed liquor temperature in Reactors #2A and #2B = 15°C

1) For BOD removal assuming a carbonaceous BOD removal rate = 0.40#BOD/# MLVSS @ 15°C:

$$\frac{17{,}000\#\text{BOD/day}}{0.40} \leq 43{,}000\#\text{MLVSS @ 15°C}$$

2) For TKN removal assuming a nitrification rate of 0.08#TKN/# MLVSS at 15°C:

$$\frac{8{,}508\#\text{TKN/day}}{0.08} \leq 107{,}000\#\text{MLVSS @ 15°C}$$

3) The required MLVSS and MLSS concentrations in reactor for BOD removal and nitrification at the 15°C minimum winter season operating temperature assuming MLVSS/MLSS = 0.75 and total Nitrification Reactor Volume = 5.0 MG

$$\frac{43{,}000\#+107{,}000\#}{(8.34)(5.00\ \text{MG})} =$$

$$\frac{150{,}000\#\text{MLVSS}}{(8.34)(5.00\ \text{MG})} = 3{,}600\ \text{mg/L MLVSS}$$

$$\frac{3{,}600\ \text{mg/L}}{0.75} = 4{,}800\ \text{mg/L MLSS}$$

$$\leq 5{,}000\ \text{mg/L} \pm \text{MLSS @ } 15°\text{C}$$

Assume MLSS ≤ 5,000 to 6,000 mg/L in Nitrification Reactors #2A and #2B during **winter season** for conservative design approach.

4) If the MLSS concentration in the Nitrification Reactors is 5,000 to 6,000 mg/L, then the MLSS concentration in Anoxic Reactor #1 will be approximately 5,000 to 6,000 mg/L if return sludge is pumped back into Reactor #1.

4. <u>Nitrification Reactors Process Design (Summer Conditions)</u>

a. Calculate MLVSS and MLSS concentrations required for BOD and ammonia removal at the expected average summer season design mixed liquor temperature in Reactors #2A and #2B = 25ºC

1) For BOD removal assuming a carbonaceous BOD removal rate = 0.45# BOD/# MLVSS @ 25°C:

$$\frac{17{,}000\#\text{BOD/day}}{0.45} \leq 3{,}800\#\text{MLVSS @ } 25°\text{C}$$

2) For TKN removal assuming a nitrification rate of 0.10 #TKN/# MLVSS at 25°C:

$$\frac{8{,}508\#\text{TKN/day}}{0.10} \leq 85{,}070\#\text{MLVSS @ } 25°\text{C}$$

3) The required MLVSS and MLSS concentrations in the total reactor volume for BOD removal and nitrification at the 25°C average summer season operating temperature assuming MLVSS/MLSS = 0.75

$$\frac{38{,}000\# + 85{,}070\#}{(8.34)(5.00\ \text{MG})} =$$

$$\frac{123{,}070\#\text{MLVSS}}{(8.34)(5.00\text{ MG})} = 3{,}000\text{ mg/L MLVSS}$$

$$\frac{3{,}000\text{ mg/L}}{0.75} = 4{,}000\text{ mg/L MLSS}$$

$$\leq 4{,}000\text{ mg/L} \pm \text{MLSS @ } 25°\text{C}$$

Assume MLSS ≤ 4,000 mg/L in Nitrification Reactors #2A and #2B during **summer season** for conservative design approach.

4) If the MLSS concentration in Nitrification Reactors is 4,000 mg/L then the MLSS concentration in Anoxic Reactor #1 will be approximately 4,000 mg/L if return sludge is pumped back into Reactor #1.

5. Calculations indicate that the 5.00 MG total Nitrification Reactor volume will be adequate for accomplishing the required winter season BOD and TKN (ammonia) removal. The use of subsurface jet aeration equipment in Reactor #2A and subsurface diffused aeration in Reactor #2B will insure maximum operating temperatures in the activated sludge treatment process during the winter season. If winter season aeration basin mixed liquor temperatures cannot be maintained at approximately 15°C, then to achieve adequate TKN removal efficiency, the MLSS concentration can be increased up to 6,000 mg/L and/or upstream DAF pretreatment efficiency must be improved by increased chemical dosage in the DAF Cells to reduce the TKN loading on the downstream multi-stage activated sludge treatment system.

6. <u>Nitrification Reactor #2 Mixing Equipment Design</u>

   a. Evaluate mixing requirements in Nitrification Reactor #2:

      1) Calculate the BHP required for mixing a 4,000 to 6,000 mg/L MLSS concentration = 50 HP/MG using directional mix jet aeration manifold in Reactor #2A:

         BHP required = 50 HP(3.50 MG) = 175 HP in Reactor #2

      2) Two new 200 HP jet recirculation pumps and six directional mix jet aeration headers are provided in the Nitrification Reactor #2A tank for suspension and mixing of mixed liquor biomass solids.

7. <u>Nitrification Reactors #2A and #2B Aeration Equipment Design</u>

a. Calculate the maximum oxygen transfer rate required in Nitrification Reactor #2:

1) Calculate the oxygen transfer requirement for BOD synthesis assuming 66% BOD removal in upstream Anoxic Reactor #1:

$$AOTR_1 = \frac{(0.60\#O_2/\#BOD/day)(17{,}000\#BOD/day)}{24} = 425\#O_2/hr\ (max)$$

2) Calculate the oxygen transfer requirement for nitrification:

$$AOTR_2 \leq \frac{(4.57\#O_2/\#TKN)(8{,}507\#TKN/day\ nitrified)}{24} = 1{,}620\#O_2/hr\ (max)$$

3) Calculate the oxygen transfer requirement for endogenous respiration where Nitrification Reactors #2A and #2B are approximately 49% of the total activated sludge volume:

$$AOTR_3 = \frac{(50{,}000\#BOD/day)(0.80\#O_2/\#BOD)(0.49)}{24} = 817\#O_2/hr\ (max)$$

4) Calculate the total maximum oxygen transfer rate required in Nitrification Reactor #2:

$$AOTR(total) \leq AOTR_1 + AOTR_2 + AOTR_3$$

$$= 425\#O_2/hr + 1{,}620\#O_2/hr + 817\#O_2/hr = 2{,}862\#O_2/hr < 3{,}000\#O_2/hr\ (max)$$

5) Calculate the required corresponding maximum standard oxygen transfer rate required:

$$SOTR = AOTR\left[\frac{Css}{\beta C_{SW} - DO)\alpha(1.024)^{T-20}}\right]$$

Where DO	$\leq$	2.0 mg/L (average DO in Reactor #2)
ß	=	0.95
α	=	0.85 @ 4,000 to 6,000 mg/L MLSS with subsurface slot jet aeration manifolds
Maximum MLSS temperatures	=	30°C
$1.024^{(T-20)}$	=	1.2677 @ T = 30°C

Cw	=	7.63 mg/L @ sea level, 30°C
Cs	=	9.20 mg/L @ sea level, 20°C
Site Altitude	≤	100 feet
Pressure Correction Factor	≥	0.995

$$Csw = 7.63\left[\frac{(0.995)(14.7)+(0.5)(0.433)(26.0)}{14.7}\right]$$

$$= 7.63 \text{ mg/L}(1.378) = 10.51 \text{ mg/L}$$

$$Css = 9.20\left[\frac{14.7+(0.5)(0.433)(26.0)}{14.7}\right]$$

$$= 9.20 \text{ mg/L}(1.383) = 12.72 \text{ mg/L}$$

* Reactor basin liquid depth = 26 ft.

$$SOTR = AOTR\frac{12.72}{[(0.95)(10.51)-2.0]0.85(1.2677)}$$

$$SOTR = 1.48(AOTR)$$

SOTR (total)	≤	1.50(3,000#O_2/hr) ≤ 4,500#O_2/hr (maximum total)
AOTR (NR #2A)	≤	0.85(3,000#O_2/hr) ≤ 2,550#O_2/hr
AOTR (NR #2B)	≤	0.15(3,000#O_2/hr) ≤ 450#O_2/hr
SOTR (NR #2A)	≤	1.50(2,550#O_2/hr) ≤ 3,825#O_2/hr
SOTR (NR #2B)	≤	1.50(4,50#O_2/hr) ≤ 675#O_2/hr

b. Calculate subsurface aeration equipment air sparging requirements:

1) The oxygen available per cfm per hour =

$x = 0.23\ (.075\#/ft^3)(60 \text{ min/hr})$

$= 1.035\#0_2/\text{cfm/hr}$ @ 68°C inlet air

2) e = subsurface coarse bubble diffuser oxygen stripping or transfer efficiency at 26 ft. liquid depth = 38% in Reactor #2A

3) scfm required $= \frac{SOTR}{(x)(e)}$

$$\text{scfm \#2A} = \frac{3{,}825\#O_2/hr}{(1.035)(0.38)} \leq 9{,}800 \text{ scfm (max)}$$

4) The maximum blower pressure in Reactor #2A with jet nozzles installed 30" above the basin floor at 26.0 ft. maximum liquid depth – 2.50 ft. = 23.5 ft. jet nozzle air sparge submergence =

= (23.5 ft.)(0.433) + 1.30 psi = 11.50 psi ≤ 12.0 psi including pressure drop in air supply lines and in jet nozzle diffusers

c. Oxygen transfer and mixing is provided in Nitrification Reactor #2A by operation of six directional mix subsurface jet aeration manifolds with three manifolds installed on each of the two jet aeration headers each with 110 slot jet nozzles. Flow recirculation for each jet header is provided by one 200 HP end suction sewage pump rated at 11,000 gpm at 47 ft. Each jet pump has a constant speed drive motor. The design air sparging capacity of the two jet aeration manifolds is approximately 12,000 scfm total providing a maximum total oxygen transfer rate = 3,000#O_2/hr (AOTR) = 4,500#O_2/hr (SOTR) with air supplied by five 200 HP positive displacement blowers each rated at approximately 2,400 scfm at 11.82 psi. A sixth 200 HP blower is provided as an installed standby.

d. Oxygen transfer in Nitrification Reactor #2B of the outer ring of the existing Crom tank is provided by operation of three existing 30 HP submersible pump SAMs aerator units with compressed air supplied from the existing blowers to the units. The SAMs units can be operated to provide mixing only without oxygen transfer, or, with air supply to provide mixing and oxygen transfer. Each SAMs unit can be individually operated with or without aeration whether or not the dedicated blower is operated to supply compressed air to the SAMs unit. The air sparging capacity of each SAMs unit is approximately 1,400 scfm per unit providing an oxygen transfer rate ≥ 150#O_2/hr (AOTR) per unit with air supplied by one dedicated 75 HP positive displacement blower rated at 1,400 sfcm at 9.5 psi. The total oxygen transfer capacity in Reactor #2B with three SAMs units and 3 – 75 HP blowers in operation is approximately (150#O_2/hr/unit) x 3 units = 450#O_2/hr (AOTR).

O. Nitrate Recycle Pump Station (New)

1. General

   a. A new Nitrate Recycle Pump Station is provided to recirculate mixed liquor containing nitrate nitrogen produced in Nitrification Reactor #2A back into Anoxic Reactor #1.

   b. A Nitrate Recycle Flow Volume of up to 400% of the throughput wastewater flow volume is required to achieve efficient nitrate nitrogen removal in Anoxic Reactor #1.

2. Design Assumptions

   a. Maximum 7 Day Wastewater Flow Volume = Q_7 = 4.00 MGD = 2,800 gpm, 24 hours/day, 7 days/week

   b. Maximum Nitrate Recycle Flow Rate = 400% = 4Q = 4.0(4.00 MGD) = 16.0 MGD = 11,200 gpm, 24 hours/day

3. Pump Selection

   a. Two new 30 HP, end suction pumps are provided in the Nitrate Recycle (NR) Pump Station.

   b. Each pump is rated at 5,600 gpm @ 40 ft. total head when operated at full speed.

   c. Operation of two pumps in parallel is required to provide the maximum nitrate recycle total pumping capacity required = 4Q (Nitrate Recycle) = 4Q = 4(4.00 MGD) = 16 MGD = 11,200 gpm = 5,600 gpm/pump.

4. Variable Speed Drive Controls

   a. Each pump is provided with variable speed drive motor controls for control of the pumping rate back into Anoxic Reactor #1.

   b. The operator can manually select and set the desired effluent pumping rate for the flow controller to automatically control and maintain the required pump speed to provide the selected flow pumping rate measured by the downstream magnetic flow meter.

5. Discharge Flow Meter

   a. One new 20" dia. magnetic flow meter is provided in the NR pump station discharge header to accurately measure, indicate, totalize, and allow manual control of the flow rate and volume of mixed liquor nitrate recycle flow pumped from Nitrification Reactor #2A back into Anoxic Reactor #1.

b. The flow meter can be used in combination with downstream flow control valve to maintain a desired set point flow rate from Nitrification Reactor #2A into Anoxic Reactor #1 in the event automatic flow control is out of service, or manual flow control is preferred.

P. Anoxic Reactor #3 (Modification)

1. General Description

   a. The second half of the outer ring of the existing Crom MLE tank will be retrofitted to function as the new third stage Anoxic Reactor #3 in the four stage BNR treatment system.

   b. A minimum of approximately 50% of the outer ring volume will be used for anoxic activated sludge treatment as a post denitrification reactor downstream of new Nitrification Reactor #2B for final nitrate nitrogen removal with optional supplemental carbon source solution dosage.

2. Design Assumptions

   a. Wastewater Flow

      1) Average wastewater flow (ADF) volume ≤ 3.20 MGD, 7 days/week

      2) Maximum month average wastewater flow (MMADF) volume ≤ 4.00 MGD, 7 days/week.

      3) Maximum dry weather wastewater flow (MDF) volume ≤ 4.00 MGD

      4) Peak wet weather wastewater flow (PF) rate = 5.00 MGD

b. Pollutant Concentrations & Loads

1) Influent pollutant loadings of influent wastewater @ 4.00 MGD, 7 days/week from Nitrification Reactor #2

Table #14
Anoxic Reactor #3 Influent
Pollutant Concentrations and Loadings

Pollutant	Concentration	Loading
BOD	≤ 20 mg/L	667#/day
TSS (MLSS)	4,000 to 6,000 mg/L	-
TKN	≤ 4 mg/L	133#/day
NH_3-N	≤ 1 mg/L	33#/day
TP	≤ 25 mg/L	834#/day
NO_3-N	≤ 70 mg/L [(1)(2)]	2,335#/day [(1)(2)]

[(1)]The design mixed liquor recycle flow rate from Nitrification Reactor #2A back to Anoxic Reactor #1 is 400% of the maximum throughput wastewater flow rate = 4Q + 100% sludge Return Rate = 1Q for a Total Recycle Rate = 5Q. This nitrate recycle flow rate will result in removal of approximately 83% of the nitrate produced in Nitrification Reactor #2A assuming that 100% of the nitrate nitrogen is produced in Reactor #2A for a conservative design. The calculated concentration of NO_3-N produced in Nitrification Reactor #2A = 300 mg/L TKN - 0.03 (1,500 mg/L BOD) = 255 mg/L NO_3-N = (4.00 MGD)(8.34)(255 mg/L NO_3-N) = 8,508#NO_3-N produced/day of which 83% is removed by denitrification in Anoxic Reactor #1 leaving 0.17(8,508#NO_3-N) = approx. 1,446#NO_3-N/day = 43 mg/L in the mixed liquor discharged to Anoxic Reactor #3.
[(2)]For conservative design approach assume the maximum NO_3-N concentration and loading discharged into Anoxic Reactor #3 = 43 mg/L(1.5) ≤ 70 mg/L = 2,335#/day (including over 50% safety factor)

c. Nitrate Removal Requirement

1) The final effluent nitrate nitrogen concentration must be under 3.0 mg/L in order for the final effluent total nitrogen concentration to be under 10.0 mg/L including approximately ≤ 1 mg/L ammonia nitrogen and approximately 3.0 mg/L to 6.0 mg/L TKN concentration in the final effluent.

3. <u>Anoxic Reactor #3 Nitrate Removal Process Design</u>

   a. The Anoxic Reactor #3 section of the outer ring of the Crom tank will have a volume of approximately 1.50 MG. The second half of the outer ring of the existing Crom tank will be retrofitted and operated to function as third stage Anoxic Reactor #3 to provide final nitrate nitrogen removal by biological denitrification using supplemental carbon source dosage.

   b. Calculate MLVSS and MLSS concentrations required at the 1.50 MG reactor volume for nitrate removal at the minimum expected winter season design mixed liquor temperature in Reactor #3 of 15°C at the design influent flow rate of 4.0 MGD when treated wastewater is discharged from Nitrification Reactor #2B.

      1) For NO_3-N removal assuming a nitrate removal rate = 0.07#NO_3-N/#MLVSS at 15°C using a methanol or equal organic carbon food source:

      $$\frac{2{,}335\#NO_3\text{-}N}{0.07} \leq 34{,}000\#MLVSS \text{ @ } 15°C$$

      2) The required total MLVSS and MLSS concentrations in the 2.20 MG reactor basin volume for NO_3-N removal at the 15°C winter season operating temperature assuming MLVSS/MLSS = 0.80

      $$\frac{34{,}000\#MLVSS}{(8.34)(1.50\text{ MG})} = 2{,}718 \text{ mg/L MLVSS}$$

      $$\frac{2{,}718 \text{ mg/L}}{0.75} = 3{,}624 \text{ mg/L MLSS @ } 15°C$$

      $$< 4{,}000 \text{ mg/L MLSS}$$

      Assume MLSS = 4,000 mg/L to 6,000 mg/L during winter season to achieve complete nitrification and denitrification using supplemental carbon source dosage into Anoxic Reactor #3.

   c. Calculate the hydraulic detention time in Reactor #3

      $$HDT = \frac{1{,}500{,}000 \text{ gallons}}{(4.00\text{ MGD})(2.0)(694\text{ gpm/MGD})} = 270 \text{ min} = 4.5 \text{ hours}$$

      @ 100% return sludge rate from the Final Clarifier

d. Calculations indicate that the 1.50 MG volume Anoxic Reactor #3 activated sludge basin is adequate for accomplishing the required winter season final stage NO_3-N removal down to an activated sludge basin temperature of 15°C. If winter season aeration basin mixed liquor temperatures cannot be maintained above 15°C, then to achieve adequate Nitrate removal efficiency, the MLSS concentration can be increased up to 6,000 mg/L; and/or upstream pretreatment efficiency must be improved by increased chemical dosage in DAF Cells to reduce the TKN loading on the downstream multi-stage activated sludge treatment system.

4. Anoxic Reactor #3 Mixing Equipment Design

a. Evaluate Mixing and Aeration requirements in Anoxic Reactor #3:

1) Bhp required for mixing 4,000 mg/L to 6,000 mg/L TSS concentration = 40 HP/MG using existing SAMS units

bhp required = 40 HP/MG (1.50 MG) ≤ 60 HP

2) Three existing 50 HP submersible pump SAMs units will be operated without air to provide complete mixing and biomass solids suspension in Reactor #3.

5. Carbon Source Dosage Requirements

a. Calculate the theoretical carbon source dosage requirement in Anoxic Reactor #3 assuming the maximum reactor influent NO_3-N concentration contained in the mixed liquor discharged from upstream Nitrification Reactor #3 ≤ 50 mg/L

1) Methanol requirement =

2.47 (NO_3-N concentration) +
1.53 (NO_2-N concentration) +
0.87 (DO concentration)

where NO_3-N ≤ 50 mg/L
NO_2-N ≤ 1 mg/L
DO ≤ 2.0 mg/L

2) CH_3OH =

= 2.47 (50 mg/L) + 1.53 (1 mg/L) + 0.87 (2.0 mg/L)

= 123.5 + 1.53 + 1.74

= 127 mg/L < 150 mg/L

3) #CH_3OH/day required ≤

(150 mg/L)(8.34)(4.00 MGD) = 5,004#/day

4) @ 6.5#/gal and 770,000 mg/L BOD concentration, the calculated gpd of methanol solution required =

$$\frac{5{,}004\#/\text{day}}{6.5\#/\text{gallon}} = 769 \text{ gpd} \leq 800 \text{ gpd} \leq 35 \text{ gphr } \textit{methanol solution}$$

5) assuming an <u>alternative non-flammable carbon source (CS) solution such as Glycerin or Micro C 2000 with a BOD concentration of approximately ≥ 720,000 mg/L and the CS solution weight = 10.2#/gal will be used instead of methanol</u>, the calculated gpd of CS solution required=

$$\frac{5{,}004\#\text{day}}{10.2\#/\text{gal}}\left(\frac{770{,}000}{720{,}000}\right) = 524 \text{ gpd} \leq 528 \text{ gpd} = 22 \text{ gphr}$$

b. Two new carbon source (CS) solution pumps are provided each rated at 5 to 50 gphr @ 60 psi.

Q. <u>Aerobic Reactor #4 (Modification)</u>

1. <u>General Description</u>

   a. The center section of the outer ring of the existing Crom MLE tank will be retrofitted to function as the new fourth stage Aerobic Reactor #4 in the four stage BNR treatment system.

   b. Aerobic Reactor #4 will be used for aerobic activated sludge treatment as a polishing reactor downstream of Anoxic Reactor #3 for final BOD and ammonia nitrogen removal.

2. <u>Design Assumptions</u>

   a. Wastewater Flow

      1) Average wastewater flow (ADF) volume ≤ 3.20 MGD, 7 days/week

      2) Maximum month average wastewater flow (MMADF) volume ≤ 4.00 MGD, 7 days/week.

      3) Maximum dry weather wastewater flow (MDF) volume ≤ 4.00 MGD

      4) Peak wet weather wastewater flow (PF) rate = 5.00 MGD

b. Pollutant Concentrations & Loads

1) Influent pollutant loadings when influent wastewater @ 4.00 MGD, 7 days/week from Anoxic Reactor #3:

Table #15
Aerobic Reactor #4 Influent
Pollutant Concentrations and Loadings

Pollutant	Pollutant Concentration	Pollutant Loadings
BOD	≤ 10 to 30 mg/L[(1)]	≤ 1,000#/day
TSS (MLSS)	4,000 to 6,000	-
O&G	≤ 2.0 mg/L	67#/day
NH_3-N	≤ 5.0 mg/L[(2)]	167#/day
NO_2-N	≤ 3.0 mg/L	100#/day
TP	≤ 25.0 mg/L	834#/day

[(1)]For conservative design approach assume the maximum BOD concentration and loading discharged into Aerobic Reactor #4 ≤ 30 mg/L = 1,000#/day
[(2)]For conservative design approach assume the maximum NH_3-N concentration and loading discharged into Aerobic Reactor #4 ≤ 5 mg/L = 167#/day

c. Soluble BOD Removal Requirement

1) Soluble BOD concentration should be reduced to approximately 2 mg/L or less.

2) Any ammonia nitrogen produced in upstream Anoxic Reactor #3 by the denitrification process or by cell lysing due to endogenous respiration will be reduced to ≤ 1 mg/L by nitrification in Aerobic Reactor #4.

3. Aerobic Reactor #4 BOD and Ammonia Removal Process Design

a. The center section of the existing Crom tank will be retrofitted and operated to function as a fourth stage aerobic polishing reactor for final removal of any soluble BOD and ammonia nitrogen in the effluent of the Anoxic Reactor #3 zone by simultaneous carbonaceous BOD removal by aerobic synthesis and ammonia removal by nitrification. Aerobic Reactor #4 will have a volume of approximately 0.55 MG.

b. Calculate MLVSS and MLSS concentrations required in the 0.55 MG reactor for BOD and ammonia removal at the minimum expected winter season design mixed liquor temperature in Reactor #4 of 15°C at the design maximum influent flow of 4.00 MGD when treated wastewater flow from Anoxic Reactor #3.

1) For BOD removal assuming a BOD removal rate = 0.40#BOD/#MLVSS @ 15°C:

$$\frac{1{,}000\#\text{BOD/day}}{0.40} \leq 2{,}500\#\text{MLVSS @ 15°C}$$

2) For final ammonia removal assuming a nitrification rate = 0.08#NH_3-N/#MLVSS @ 15°C and assuming a maximum ammonia nitrogen concentration of 10 mg/L and loading in the Anoxic Rector #3 effluent = 334#/day

$$\frac{167\#NH_3\text{-N/day}}{0.08} \leq 2{,}100\#\text{MLVSS @ 15°C}$$

3) The required total MLVSS and MLSS concentrations in the 0.55 MG aeration basin volume for BOD removal and nitrification at the 15°C winter season operating temperature assuming MLVSS/MLSS = 0.75

$$\frac{2{,}500\# + 2{,}100\#}{(8.34)(0.55\text{ MG})}$$

$$\frac{4{,}600\#\text{MLVSS}}{(8.34)(0.55\text{ MG})} \leq 1{,}003\text{ mg/L MLSS}$$

$$\frac{1{,}003\text{ mg/L}}{0.75} \leq 2{,}000\text{ mg/L MLSS @ 15°C}$$

Assume MLSS $\geq$ 2,000 mg/L during winter season for complete carbonaceous soluble BOD removal and ammonia nitrogen removal.

c. Calculate the hydraulic detention time in Reactor #4

$$\text{HDT} = \frac{550{,}000\text{ gallons}}{(4.0\text{ MGD})(2.0)(694\text{ gpm/MGD})} = 99\text{ min} = 1.65\text{ hours}$$

@ 100% return sludge rate from the Final Clarifier

d. Calculations indicate that the 0.55 MG Aerobic Reactor #4 activated sludge basin is adequate volume for accomplishing the required, winter season polishing step of BOD and ammonia removal down to an activated sludge basin temperature of 15°C. The use of subsurface coarse bubble aeration equipment in the aeration basin will insure maximum operating temperatures in the aerobic activated sludge treatment process during the winter season. If winter season aeration basin mixed liquor temperatures cannot be maintained above 15°C, then to achieve adequate Ammonia removal efficiency, the MLSS concentration must be increased and/or upstream pretreatment efficiency must be improved by increased chemical dosage in DAF Cell to reduce the BOD and TKN loading on the downstream Multi-Stage Activated Sludge Treatment System.

4. <u>Aerobic Reactor #4 Aeration and Mixing Equipment Design</u>

a. Evaluate Mixing and Aeration requirements in Aerobic Reactor #4:

1) Mixing Requirements

a) cfm required for mixing 4,000 mg/L to 6,000 mg/L MLSS concentration = 20 scfm/1,000 ft^3 in 550,000 gallon volume tank = 73.5 x $10^3 ft^3$

cfm = (73.5 x $10^3 ft^3$)(20 cfm) = 1,500 scfm

b) a new coarse bubble diffused aeration system is provided in Reactor #4 for oxygen transfer and complete mixing, and, the air sparging capacity of the diffuser system is over 2,000 scfm with compressed air supplied by existing 125 HP positive displacement blowers each rated at 1,400 scfm @ 9.5 psi.

2) Oxygen Transfer Requirements

a) Calculate the maximum oxygen transfer rate required in Aerobic Reactor #4 assuming excess BOD from carbon source dosage ≤ 30 mg/L = 1,000#/day and influent ammonia nitrogen loading = 250#/day

(1) oxygen demand for carbonaceous BOD synthesis @ 0.60#O_2/#BOD

$$AOTR_1 = \frac{0.60\#O_2/\#BOD(1{,}000\#BOD/day)}{24} \leq 25\#O_2/hr$$

(2) oxygen demand for endogenous respiration occurring in Aerobic Reactor #4

(a) % total reactor volume in Aerobic Reactor #4

$$\frac{0.55\ MG}{10.25\ MG}(100) \leq \quad 6\%$$

(b) The calculated endogenous oxygen demand in Aerobic Reactor #4

$$AOTR_2 = \frac{50{,}000\#BOD/day(0.80)(0.06)}{24} \leq 100\#O_2/hr$$

(3) Oxygen demand for nitrification of ammonia @ $4.57\#O_2/hr/\ \#NH_3\text{-}N$

$$AOTR_3 = \frac{(4.57)(167\#NH_3\text{-}N/day)}{24} \leq 32\#O_2/hr$$

(4) Calculate the total oxygen transfer requirement in Aerobic Reactor #5 for excess BOD synthesis plus endogenous respiration plus nitrification = $25\#O_2/hr + 100\#O_2/hr + 32\#O_2/hr = 157\#O_2/hr \leq 160\#O_2/hr$ (AOTR)

b) Calculate the required corresponding maximum standard oxygen transfer rate required:

$$SOTR = AOTR\left[\frac{Css}{\beta C_{SW}\text{-}DO)\alpha(1.024)^{T-20}}\right]$$

Where DO	=	2.0 mg/L (average DO in Aerobic Reactor #4)
ß	=	0.90
α	=	0.80 @ 4,000 to 6,000 mg/L MLSS with subsurface coarse bubble aeration diffusers
$1.024^{(T-20)}$	=	1.126 @ maximum T = 25° C
Cw	=	7.92 mg/L @ sea level, 25° C
Cs	=	9.20 mg/L @ sea level, 20° C
Site Altitude	≤	100 feet
Pressure Correction Factor	≥	0.995

$$Csw = 7.92\left[\frac{(0.995)(14.7)+(0.5)(0.433)(20.0)}{14.7}\right]$$

$$= 7.92 \text{ mg/L}(1.290) = 10.21 \text{ mg/L}$$

$$Css = 9.20\left[\frac{14.7+(0.5)(0.433)(20.0)}{14.7}\right]$$

$$= 9.20 \text{ mg/L}(1.295) = 11.91 \text{ mg/L}$$

* 18.0 foot deep aeration basin with the airgrid coarse bubble diffusers installed 1.0 above the basin floor.

$$SOTR = AOTR\frac{11.91}{[(0.90)(10.21)-2.0]0.80(1.126)}$$

$$SOTR = 1.84(AOTR)$$

$$SOTR \leq 2.00(160) \leq 320\#O_2/hr$$

c) Calculate subsurface aeration equipment air sparging requirements:

(1) The oxygen available per cfm per hour =

$$x = 0.23\ (0.075\#/ft^3)(60 \text{ min/hr})$$

$$= 1.035\#O_2/cfm/hr \text{ @ } 68° \text{ inlet air}$$

(2) e = subsurface coarse bubble diffuser oxygen stripping or transfer efficiency at 20.0 average air sparge depth = 15%

(3) scfm required $= \frac{SOTR}{(x)(e)}$

scfm (average) $= \frac{320\#O_2/HR}{(1.035)(0.15)} = 2{,}061$ scfm

$\leq$ 2,100 scfm

(4) Max. design blower pressure with 19.0 ft. max. diffuser air sparge submergence:

= (19.0 ft.)(0.433) + 1.0 psi = 9.23 psi $\leq$ 9.5 psi (pressure loss plus pressure drop in air supply lines and in airgrid air diffuser sparges)

d) Oxygen transfer is provided in Aerobic Reactor #4 by a new coarse bubble diffused aeration system with a maximum air sparging capacity of 2,800 scfm and maximum oxygen transfer efficiency of over 200#O_2/hr (AOTR).

e) Compressed air is provided to the coarse bubble diffusers by operation of one or two existing 125 HP positive displacement blowers each rated at 1,400 scfm @ 9.5 psi.

R. Clarifier Influent Flow Splitter & Flocculation Tank (New) For Existing Clarifiers #1 & #2

1. Design Assumptions

   a. Wastewater Flow

      1) Average wastewater flow (ADF) volume ≤ 2.60 MGD, 7 days/week

      2) Maximum month average wastewater flow (MMADF) volume ≤ 4.00 MGD, 7 days/week.

      3) Maximum dry weather wastewater flow (MDF) volume ≤ 4.00 MGD

      4) Peak wet weather wastewater flow (PF) rate = 5.00 MGD

      5) Maximum inflow rate with 100% sludge recycle rate = (4.00 MGD)(2) ≤ 8.00 MGD

      6) Maximum inflow rate with 200% sludge recycle rate = (4.00 MGD)(3.0) ≤ 12.00 MGD

   b. Mixed Liquor Suspended Solids Concentrations

      1) Minimum MLSS = 4,000 mg/L

      2) Maximum MLSS = 6,000 mg/L

2. General Description

   a. One new clarifier influent flow splitter tank is provided to split flow into existing Final Clarifier #1 and Final Clarifier #2.

   b. The flow splitter tank will function as a flocculation tank for dosage and mixing of coagulant and flocculant chemical solutions with the clarifier influent mixed liquor flow.

3. Flocculation Tank Design Calculations

   a. Flocculation Tank Sizing

      1) One 15.0 ft. x 15.0 ft. x 14 ft. side water depth Flocculation Tank is provided for mixing of chemical coagulant and flocculant solutions and the mixed liquor influent flow into Final Clarifiers #1 and #2.

      2) Tank volume ≤ 25,000 gallons

      3) Calculated Hydraulic Detention Times:

         a) @ 4.00 MGD maximum design flow through rate plus 100% sludge return flow rate = 8.00 MGD = 5,600 gpm total flow rate = 4.00 MGD/clarifier = 2,800 gpm/clarifier

$$\text{HDT} = \frac{25{,}000 \text{ gallons}}{5{,}600 \text{ gpm}} \geq 4.4 \text{ minutes}$$

         b) @ 4.00 MGD maximum design flow through rate plus 150% sludge return flow rate = 10.00 MGD = 7,000 gpm total flow rate = 5.00 MGD/clarifier = 3,500 gpm/clarifier

$$\text{HDT} = \frac{25{,}000 \text{ gallons}}{7{,}000 \text{ gpm}} \geq 3.5 \text{ minutes}$$

4. Clarifier Influent Flow Splitting and Control

   a. Two 24" outlet lines are provided for discharge of mixed liquor from the Clarifier Influent Flocculation Tank by gravity flow into the two Final Clarifiers.

   b. Each 24" outlet line has a 24" magnetic flow meter and a downstream automatic flow control valve for setting, adjusting and controlling of the wastewater flow volume into each Final Clarifier. Normally, the total clarifier influent flow volume will be equally split into the two Final Clarifiers.

S. Final Clarifiers #1 & #2 (Modification)

1. General Description

   a. The two existing clarifiers will continue to be operated in parallel for final clarification and recycle of biomass mixed liquor suspended solids settled in and removed from the mixed liquor overflow from the activated sludge treatment process.

b. In order to improve TSS removal efficiency within the existing clarifier tanks, a new rapid suction sludge removal mechanism will be installed in each of the two Final Clarifiers.

2. Design Assumptions

a. Wastewater Flow

1) Average wastewater flow (ADF) volume ≤ 2.60 MGD, 7 days/week

2) Maximum month average wastewater flow (MMADF) volume ≤ 4.00 MGD, 7 days/week.

3) Maximum dry weather wastewater flow (MDF) volume ≤ 4.00 MGD

4) Peak wet weather wastewater flow (PF) rate = 5.00 MGD

5) Maximum influent flow rate with 100% sludge recycle rate = (4.00 MGD)(2) ≤ 8.00 MGD

6) Maximum influent flow rate with 150% sludge recycle rate = (4.00 MGD)(2.5) ≤ 10.00 MGD

b. Pollutant Concentrations and Loads

1) Minimum design mixed liquor solids loadings rate at the average design throughput flow rate = 4.00 MGD and with 100% sludge recycle rate @ 6,000 mg/L MLSS concentration =

(4.00 MGD)(6,000 mg/L)(8.34)(2.0)/24 = 16,680#/hr.

2) Average design mixed liquor solids loadings rate at the average design throughput flow rate = 2.60 MGD and with 100% sludge recycle rate @ 5,000 mg/L MLSS concentrations =

(2.60 MGD)(5,000 mg/L)(8.34)(2.0)/24 = 8,688#/hr.

3. Calculate Clarifier Loading Rates

a. The two existing 110 ft. diameter x 12.0 ft. side water depth final clarifier concrete tanks will each be retrofitted with a new rapid hydraulic suction sludge pickup mechanism, surface skimmer and scum box and continue to be operated in parallel and be used for final sedimentation of activated sludge solids.

b. Each 110 ft. dia. circular clarifier has an effective surface overflow diameter = 106 feet, an effective surface overflow area =8,800 ft^3; and an effective clarifier floor area = 9,498 ft^3

c. Clarifier Volume = 850,000 gallons

d. Hydraulic Surface Loading Rates (HSLR)

$$\text{HSLR (average)} = \frac{2{,}600{,}000 \text{ gpd}}{8{,}800 \text{ ft}^2(2)}$$

$$\leq 150 \text{ gpd/ft}^2 \text{ @ average @ 2.60 MGD}$$

$$\text{HSLR (maximum)} = \frac{4{,}000{,}000 \text{ gpd}}{8{,}800 \text{ ft}^2(2)}$$

$$\leq 230 \text{ gpd/ft}^2 \text{ @ maximum @ 4.00 MGD}$$

e. Maximum Solids Loading Rate (SLR) assuming an influent flow rate = 4.00 MGD and a 150% sludge recycle rate with a MLSS concentration < 6,000 mg/L

$$\text{SLR} = \frac{(4.00 \text{ MGD})(2.5)(8.34)(6{,}000 \text{ mg/L})}{9{,}498 \text{ ft}^2(2)}$$

$\leq$ 27.0#/ft^2/day @ maximum throughput flow rate = 4.00 MGD including 150% sludge recycle flow

f. Minimum Hydraulic Detention Time (HDT) assuming a 150% sludge recycle rate

$$\text{HDT} = \frac{(850{,}000 \text{ gallons})(24)(2)}{(4{,}000{,}000)(2.5)}$$

= 4.0 hours @ maximum influent flow rate = 4.00 MGD including 150% sludge recycle flow

T. Return Activated Sludge (RAS) Pump Stations #1 and #2 (New)

1. General

a. A new Return Activated Sludge (RAS) Pump Station is provided for each of the two existing Final Clarifiers.

b. Each RAS Pump Station includes two new self-priming sewage pumps to recycle settled sludge from each Final Clarifier back into Anoxic Reactor #1 of the BNR System.

c. Each pair of RAS pumps will take suction flow from the To Bro rapid suction sludge removal mechanism installed in each of the two existing Final Clarifiers.

2. Wastewater Flow Volume and Rates

a. Average Total Daily Influent Flow Volume (ADF) = 2.60 MGD = 1.30 MGD/clarifer

b. Maximum Total Daily Influent Flow Volume (MDF) = 4.00 MGD = 2.00 MGD/clarifier

c. Average return activated sludge (RAS) = 1Q = 100% of Average Daily Flow Volume = 1.0(1.30 MGD) = 1.30 MGD/clarifier = 900 gpm/clarifier

d. Maximum return activated sludge (RAS) = 1Q = 100% of Maximum Daily Flow Volume = 1.0(2.00 MGD) = 2.0 MGD/clarifier = 1,400 gpm/clarifier

e. Peak return activated sludge (RAS) = 2Q = 200% of Maximum Daily Flow Volume = 2.0(2.00 MGD) = 4.0 MGD/clarifier = 2,800 gpm/clarifer

3. Pump Selection

a. Two new 50 HP 8" self-priming RAS pumps are provided for each of the two Final Clarifiers.

b. The pump is rated at 1,400 gpm @ 57 feet.

c. Operation of one RAS pump at reduced speed is required to pump the design average RAS flow rate = 1Q = 100% of ADF = 1.30 MGD = 900 gpm from each Final Clarifier.

d. Operation of one RAS pump at reduced speed is required to pump the design maximum RAS flow rate = 1Q = 100% of MDF = 2.00 MGD = 1,400 gpm from each Final Clarifier.

e. Operation of two RAS pumps in parallel at full speed is required to pump the design peak RAS flow rate = 2Q = 200% of MDF = 4.00 MGD = 2,800 gpm from each Final Clarifier.

4. Variable Speed Drive Controls

a. Each pump is provided with a 50 HP variable speed drive motor with automatic pump speed and pumping rate control.

b. The pump will be normally operated to maintain a constant flow rate pumped from the Final Clarifier RAS suction line to the Anoxic Reactor #1 tank. The pump is provided with variable speed drive motor control which use the downstream flow meter flow measurement signal and the VFD control panel to automatically control pump operating speed to maintain a manually selected flow rate into Anoxic Reactor #1.

5. Liquid Level Controls

   a. The pumps are manually started

6. Flow Meter and Flow Controls

   a. Two new 12" dia. magnetic flow meters are provided in the two RAS Pump Station discharge header lines to measure, indicate, totalize and control the RAS flow rate and volume pumped from each Final Clarifier into Anoxic Reactor #1.

   b. The flow meter is used with the RAS Pump Station Control Panel for automatic control of pump speed and RAS pumping rate from the Final Clarifier sludge draw off line into the Anoxic Reactor #1.

   c. The flow meter has a flow indicator and totalizer to monitor the RAS flow rate pumped out of the FC into the upstream Anoxic Reactor #1.

U. Sludge Wasting Requirements (Modification)

1. Calculate the activated sludge (AS) process F/M ratio:

   a) #MLSS in AS process = (10.25 MG)(8.34)(5,000 mg/L)

   = 427,425#MLSS

   b) $F/M = \frac{50{,}000\#BOD/day}{427{,}425\#MLSS} \leq 0.12$

2. At the expected F/M ratio of approximately 0.12#BOD/#MLSS, biosolids sludge must be wasted at a rate of approximately 0.60#TSS/#BOD applied from the activated sludge treatment system. At the design maximum 7 day BOD load of 50,000#/day approximately 30,000#/day (dry basis) of activated sludge biosolids must be wasted from the activated sludge process each day to maintain the correct MLSS concentration in the multi-stage Activated Sludge Treatment Process. Activated sludge will be wasted by being pumped from the Final Clarifier sludge return pump station to new mechanical sludge thickeners prior to discharge into existing Waste Activated Sludge Digester Basins #1 and #2 for additional aerobic digestion, gravity thickening and decanting prior to being hauled to land application sites for ultimate disposal.

3. Calculate volume of sludge produced assuming 1.0% solids in return sludge from the final clarifier:

$$\text{Sludge Volume} = \frac{30{,}000\#/\text{day}}{(0.01)8.34}$$

$$\leq 360{,}000 \text{ gpd}$$

The total maximum dry weight and volume of waste sludge to be produced by the treatment system are therefore calculated to be approximately 30,000#ds/day and 250 gpm over 24 hours/day assuming a 1.0% waste sludge solids concentration.

V. Waste Activated Sludge Pump Stations #1 and #2 (New)

1. General

   a. A new Waste Activated Sludge (WAS) Pump Station is provided for each RAS Pump Station for each of the two Final Clarifiers.

   b. Each WAS Pump Station includes one new positive displacement pump to pump WAS into one common WAS force main to the Sludge Digester Tanks.

   c. Each WAS pump will take suction flow from the RAS Pump Station suction line from each Final Clarifier rapid suction sludge removal mechanism installed in the two existing Final Clarifiers.

2. Wastewater Flow Volume and Rates

   a. The maximum volume to be wasted from sludge return flow @ 10,000 mg/L minimum solids concentration = 360,000 gpd = 250 gpm, 24 hours/day.

   b. Average WAS pumping rate = 100 gpm

   c. Maximum WAS pumping rate = 200 gpm

3. Pump Selection

   a. Two new 10 HP positive displacement WAS pumps are provided to pump waste activated sludge from the two Final Clarifier RAS Suction Lines to the Sludge Digester Tanks.

   b. Each RAS Pump is rated at 250 gpm @ 70 feet.

   c. Operation of one WAS pump at reduced speed is required to pump the design average WAS flow rate ≤ 100 gpm.

d. Operation of one WAS pump at full speed is required to pump the design maximum WAS flow rate ≤ 200 gpm.

e. Operation of two WAS pumps in parallel at reduced speed is required to pump the peak WAS flow rate = 350 gpm.

f. The waste sludge pump will normally be manually operated to pump waste sludge flow to the Waste Activated Sludge Digesters from 12 to 24 hours/day at a flow rate ranging from 150 to 250 gpm.

4. Variable Speed Drive Controls

a. Each pump is provided with 10 HP variable speed drive motor controls with automatic pump speed and pumping rate control.

b. The pump will be normally operated to maintain a constant flow rate pumped from the Final Clarifier RAS suction line. Each pump is provided with variable speed drive motor controls which use the downstream flow meter flow measurement signal and the VFD control panel to automatically control pump operating speed to maintain a manually selected WAS flow pumping rate into the Sludge Digester Tanks.

5. Liquid Level Controls

a. The pumps are manually started. There is no liquid level control.

6. Flow Meter and Flow Controls

a. One 4" dia. magnetic flow meter is provided in each WAS Pump Station discharge header line to measure, indicate, totalize and control the WAS flow rate and volume pumped from the Final Clarifier RAS suction line.

b. The flow meter is used with the WAS Pump Station Control Panel for automatic control of pump speed and WAS pumping rate from the Final Clarifier sludge draw off RAS suction line.

c. The flow meter has a flow indicator and totalizer to monitor the WAS flow rate pumped to the Sludge Digester Tanks.

W. Tertiary Filter Influent Pump Station (New)

1. General Description

a. One new pump station is required to transfer Final Clarifier effluent into the new Tertiary Filters.

b. The new Tertiary Filter (TF) Influent Pumps are located in the new TF Enclosure Building.

2. Design Assumptions

a. Average wastewater flow (ADF) volume ≤ 2.60 MGD = 1,800 gpm, 7 days/week

b. Maximum month average wastewater flow (MMADF) volume ≤ 4.00 MGD = 2,100 gpm, 7 days/week.

c. Maximum dry weather wastewater flow (MDF) volume ≤ 4.00 MGD = 2,800 gpm

d. Peak wet weather wastewater flow (PF) rate = 5.00 MGD

3. Pump Selection

a. Three new 40 HP, 8-inch self-priming sewage pumps are provided to pump wastewater discharged from the Final Clarifiers into the Filter Influent wet well into the new Tertiary Filter System.

b. Each pump is rated at 1,750 gpm @ 40 ft.

4. Variable Speed Drive Controls

a. Variable speed drive motor controls are provided for each pump.

b. Pump speed and pumping rate are automatically controlled by the liquid level in the wet well.

c. Operation of two pumps in parallel at reduced speed is required to pump the maximum flow volume = 2,800 gpm = 4.00 MGD. The third pump is provided as an installed standby pump.

d. Operation of two pumps in parallel at maximum speed is required to pump the peak flow rate = 3,500 gpm = 5.00 MGD.

5. Wet Well Liquid Level Control

a. One liquid level sensor is provided in the pump station wet well to operate the pump station pump on, pump off and high liquid level alarm controls.

b. A control system is provided to automatically adjust the pump operating speed and the flow pumping rate to maintain the liquid level in the pump station wet well.

X. Tertiary Filtration System (New)

1. General

   a. New deep sand bed, continuous backwash, upflow sand filters are provided for polishing final clarifier effluent for final removal of TSS, BOD and TKN.

   b. Operation of the tertiary filters will provide capability to achieve overall higher efficiency TSS and total nitrogen removal.

   c. Effluent from the existing Final Clarifiers will be pumped into the new tertiary filters

2. Design Assumptions

   a. Wastewater Flows

      1) Average wastewater flow (ADF) volume ≤ 2.60 MGD = 1,800 gpm, 7 days/week

      2) Maximum month average wastewater flow (MMADF) volume ≤ 4.00 MGD = 2,100 gpm, 7 days/week.

      3) Maximum dry weather wastewater flow (MDF) volume ≤ 4.00 MGD = 2,800 gpm

      4) Peak wet weather wastewater flow (PF) rate = 5.00 MGD

      5) 24 hour, 7 day/week hydraulic flow equalization is provided upstream of the filters

   b. Wastewater Pollutant Concentrations

Table #16
Tertiary Filter Influent
Pollutant Concentrations

Pollutant	Concentration	
	Average	Maximum
TSS	5 – 15 mg/L	20 mg/L
BOD	2 – 10 mg/L	15 mg/L
Total Nitrogen	5 - 8 mg/L	10 mg/L

3. <u>Continuous Backwash, Upflow Deep Sand Bed Filter Design</u>

   a. Number of filters = 9

   b. Number of modules per filter = 2

   c. Total number of filter modules = 9 filters x 2 modules = 18 modules

   d. Filter module size 7.083 ft. square = 50 ft^2 each; total filter bed area = 900 ft^2.

   e. Design filtration rates:

      1) With 18 filter modules in service and total filter area = 900 ft^2;

         a) @ 2.60 MGD = 1,800 gpm, the average filtration rate ≤ 2.00 gpm/ft^2

         b) @ 4.00 MGD = 2,800 gpm, the maximum filtration rate ≤ 3.20 gpm/ft^2

         c) @ 5.00 MGD = 3,500 gpm, the peak filtration rate ≤ 4.00 gpm/ft^2

      2) With 14 filter modules in service and total filter area = 700 ft^2;

         a) @ 2.60 MGD = 1,800 gpm, the average filtration rate ≤ 2.60 gpm/ft^2

         b) @ 4.00 MGD – 2,800 gpm, the maximum filtration rate ≤ 4.00 gpm/ft^2

         c) @ 5.00 MGD = 3,500 gpm, the peak filtration rate ≤ 5.00 gpm/ft^2

   f. Design solids loading rates:

      1) With 18 filter modules in service;

         a) @ 2.60 MGD with TSS_i = 10 mg/L, the solids loading rate = 12.0#/filter module/day = 0.24#/ft^2/day

         b) @ 4.00 MGD with TSS_i = 20 mg/L, the solids loading rate = 37.3#/filter module/day = 0.84#/ft^2/day

      2) With 14 filter modules in service;

         a) @ 2.60 MGD with TSSi = 10 mg/L, the solids loading rate = 12.0/filter module/day = 0.31#/ft_2/day

         b) @ 4.00 MGD with TSSi = 20 mg/L, the solids loading rate = 48#/filter module/day = 0.83#/ft^2/day

g. Filter Bed Specifications

1) 80" deep high grade silica sand bed complying with Standard Specifications for Filtering Material (AWWA Designation B100-89).

2) Grain Shape, Effective Size (ES), and Uniformity Coefficient (UC)

Grain Shape	Effective Size	Uniformity Coefficient
Sub-Angular	1.40 mm	1.30 to 1.60

The sand must conform to the conditions of above. The filter media shall predominantly be siliceous material that will resist degradation during handling and use. Crushed gravel is not acceptable. "Sub-Angular" grains are essentially sub-angular with multifaceted smooth edges. The effective size is the diameter of the tenth percentile grain (D10). The uniformity coefficient is the diameter of the sixtieth percentile grain divided by the diameter of the tenth percentile grain (D60/D10). The effective size and uniformity coefficient are determined by a dry, 10-minute automatic sieve shaker procedure on a 500-800 gram sample with U.S. Sieve Nos. 12, 14, 16, 18, 20, 30, as well as a pan.

3) Fines Content is defined for this size filter media as particles passing through a 30 mesh screen. Fines should not exceed by 1.5% by weight.

4) Specific Gravity – dry specific gravity must be greater than 2.5

5) Hardness – minimum 6.0 on Moh's scale (ref. Testing and Inspection of Engineering materials; McGraw-Hill Cook Co., New York, NY; 3rd Edition; page 209)

6) Acid Solubility – less than 1% total loss in mass after a 30- minute immersion in an approx. 20% by wt. hydrochloric acid (HCl) solution (made by combining equal volumes of water and standard reagent grade 12.1 N (approx.) (HCl)

h. Description of Filter Operation

1) Influent feed is introduced into the bottom of the sand bed through a series of feed radials that are open at the bottom. As the influent flows upward through the downward moving sand bed, organic and inorganic impurities are captured by the sand. The clean, polished filtrate continues to move upward and exists at the top of the filter over the filtrate weir and out through, the effluent pipe.

i. Filter Media Cleaning and Backwashing

1) The filter is an upflow, deep bed, granular media filter with continuous backwash. The filter media is cleaned by a simple internal washing system that does not require backwash pumps or storage tank.

2) The sand bed containing captured impurities is drawn downward into the center of the filter where the airlift pipe is located. A small volume of compressed air is introduced at the bottom of the airlift, drawing the sand into the airlift pipe. The sand is scoured within the airlift pipe. The sand is scoured within the airlift pipe at an intensity of 100-150 SCFM/ft2. The effectiveness of this scouring process is vastly greater than what can be expected in conventional sand filtration backwash. The scouring dislodges any solid particles attached to the sand grains.

3) The dirty slurry is pushed to the top of the airlift and into the reject compartment. From the reject compartment, the sand falls into the sand washer and the lighter reject solids are carried over the reject weir and out the reject pipe. As the sand cascades down through the concentric stages of the washer, it encounters a small amount of polished filtrate moving upward, driven by the difference in water level between the filtrate pool and the reject weir. The heavier, coarser sand grains fall through this small countercurrent flow while the remaining contaminants are carried back up to the reject compartment. The clean, recycled sand is deposited on the top of the sand bed where it once again begins the influent cleaning process and its eventual migration to the bottom of the filter.

j. Filter Backwash Rate

1) Each of the eighteen filter modules will have a continuous backwash wastewater flow rate of approximately 7 gpm to 14 gpm producing a total backwash flow rate = 126 gpm to 252 gpm.

2) Backwash wastewater will flow by gravity into the new Filter Reject Backwash wastewater wet well to flow by gravity to the Plant Site Pump Station #2.

k. Filter Influent Trough Skimmer

1) The filter influent trough is provided with an overflow baffle for manual skimming of the influent trough liquid level surface. Skimmings are discharged by gravity to recycle to the Plant Site Drain Pump Station.

Y. Ultraviolet (UV) Final Effluent Disinfection System (New)

1. General Description

   a. One new UV Contact Channel is provided for installation of an ultraviolet light contact system for final effluent disinfection.

   b. The UV Disinfection System will include three UV Banks installed to operate in series within the concrete contact channel.

   c. Normally two UV Banks will be operated with the third bank provided as an installed standby.

2. Design Assumptions

   a. Wastewater Flows

      1) Average wastewater flow (ADF) volume ≤ 2.60 MGD = 1,800 gpm, 7 days/week

      2) Maximum month average wastewater flow (MMADF) volume ≤ 4.00 MGD = 2,800 gpm, 7 days/week.

      3) Maximum dry weather wastewater flow (MDF) volume ≤ 4.00 MGD = 2,800 gpm

      4) Peak wet weather wastewater flow (PF) rate = 5.00 MGD

   b. Monthly Average Influent Pollutant Concentrations

      TSS ≤ 5.0 mg/L
      O&G ≤ 1.0 mg/L
      NH_3N ≤ 1.0 mg/L

   c. Monthly Average Effluent Limitations

      Fecal Coliform ≤ 200 MPN/100 ml (Monthly Average)

3. In order to comply with the fecal coliform bacteria limitations, final effluent will be disinfected by the new ultraviolet light (UV) system. The existing chlorination system will remain as a backup to the new UV system.

4. The UV contact channel structure is located in the Tertiary Filter building and has the following dimensions and volume:

   a. Concrete Channel Structure

      1) Total Length = 44 ft.
      2) Width = 4 ft.
      3) Depth = 5 ft.

   b. UV Lamp Bank Contact Zone

      1) Number of UV Banks = 3
      2) UV Bank Zone Length/UV Bank = 42 ft.
      3) UV Bank Zone Width = 24 inches
      4) Maximum Liquid Depth = 30 inches
      5) UV Bank Contact Zone Volume = 200 ft^3 = 1,570 gallons

5. <u>UV System Components and Design Features</u>

   a. UV Transmission = 50% minimum

   b. Uniform Lamp Array - 3 Banks each with 7 Modules per Bank and 8 lamps per module providing a total of 168 UV Lamps. Each UV Bank has a flow capacity of 2.50 MGD. Operation of 2 Banks is required to disinfect the peak flow rate = 5.00 MGD = 3,500 gpm.

   c. The UV system will have two Power Distribution Centers and one System Control Center.

   d. The discharge end of the UV Contact Channel will be provided with one automatic level controller

   e. The UV system will be provided with an Automatic Chemical/Mechanical Cleaner.

   f. Automatic Power Dose Pacing System Control will be provided.

Z. <u>Effluent Flow Meter (New)</u>

1. One new 9" throat x 24" max. liquid depth Parshall Flume Flow Meter with a maximum flow capacity = 3,900 gpm = 5.7 MGD is provided to measure the total flow discharging from the new UV contact channel.

2. One flow indicating, recording, totalizing flow meter is provided with the Parshall Flume.

AA. Waste Activated Sludge Aerobic Digestion Tanks (Existing & Modification)

1. General Description

   a. The existing Oxidation Ditch Basin will be retrofitted into a new Waste Activated Sludge (WAS) Aerobic Digestion Tank #1 (ADT #1) for first stage aerobic digestion, gravity thickening, and decanting of WAS solids generated by the BNR treatment process.

   b. The two existing Sludge Storage Tanks will be retrofitted to function as Aerobic Digestion Tanks #2 and #3. These two ADTs will normally be operated as second and third stage aerobic digesters in series with ADT #1. The WAS is normally pumped from the RAS flow into aerated Oxidation Ditch ADT #1 for first stage aerobic digestion and gravity thickening. Partially digested WAS is pumped from ADT #1 into aerated ADT #2 for second stage aerobic digestion, decanting and gravity thickening; and, then pumped into aerated ADT #3 for third stage aerobic digestion, decanting and gravity thickening.

   c. Aerobically digested WAS is pumped from ADT #2 and/or #3 to the new Screw Press System for mechanical dewatering prior to future heat drying.

2. Aerobic Digestion Tank #1 Design

   a. The existing 500 ft. long x 98 ft. wide x 8.0 ft maximum liquid depth, 3.00 MG volume below grade concrete lined oxidation ditch will be retrofitted into ADT #1 for aerobic digestion, thickening and storage of WAS.

   b. Two existing 86 ft. dia. X 9.5 ft. maximum liquid depth, 0.40 MG volume above grade concrete tanks will continue to be used for aerobic digestion, storage and gravity thickening of WAS.

   c. WAS will be pumped from the RAS suction lines of the two existing Final Clarifiers into ADT #1.

   d. Solids removed by the DAF Cell #3 can be collected in a sludge storage tank and pumped to a tanker truck for hauling to off-site disposal; or, optionally pumped at a low flow rate into ADT #2 for mixing and disposal with WAS.

   e. Two new 25 HP self-priming rotary lobe Decant Pumps are provided drawing off clarified decant liquid from the top of ADT #1 at the end of gravity sludge thickening periods. Decant wastewater is pumped from ADT #1 into Anaerobic Lagoons #1 or #2 for recycle and disposal with treated wastewater. The second pump is provided to transfer the partially digested sludge to ADT #2 or #3.

f. One new floating, manual operated, decant pipe is provided in ADT #2 and ADT #3 for drawing off clarified decant liquid from the surface of the ADT at the end of gravity sludge thickening periods. Decant wastewater is drained by gravity from ADT #2 and ADT #3 for recycle into the Plant Site Pump Station #2.

g. Gravity thickened sludge will normally be pumped from the ADT #1 into ADT #2 and then into ADT #3. After aerobic digestion, decanting and gravity thickening, WAS will be pumped to the new Screw Press Sludge Dewatering System.

h. Two new 15 HP self-priming rotary lobe sludge transfer pumps are provided to transfer sludge from ADT #2 to ADT #3 or the new Screw Press Sludge Dewatering System. The pumps can also transfer sludge from ADT #3 to the Screw Press Dewatering System.

3. <u>Sludge Storage Tank Aeration and Mixing Equipment Design</u>

a. Evaluate mixing requirements in the Aerobic Digestion Tanks:

1) ADT #1

a) Six new 60 HP $AerO_2$ floating surface directional mix subsurface aerator units are provided in ADT #1 for biomass mixing and oxygen transfer. The HP/MG = 6 x 60 HP/3.0 MG = 120 HP/MG for mixing.

b) Five existing 75 HP Aqua Aerobics floating surface aerators are also provided in ADT #1 for biomass sludge mixing and aeration. The HP/MG = 5 x 75 HP/3.0 MG = 125 HP/MG.

2) ADT #2 and #3

a) Two new 50 HP $AerO_2$ floating surface directional mix subsurface aerator units are provided in each of ADT #2 and ADT #3 for biomass mixing and oxygen transfer. The HP/MG = 2 x 50 HP/0.40 MG = 250 HP/MG for mixing.

b. Evaluate Oxygen Transfer Requirements in the ADT #1, #2 and #3:

1) Assume 0.25#O_2/#BOD is required in the aerobic sludge digester tanks based on the maximum BNR process BOD loading

$$\text{AOTR} = \frac{(0.25\#O_2/\#\text{BOD})(50{,}000\#\text{BOD/day})}{24} = 520\#O_2/\text{hr} \leq 325\#O_2\text{hr total}$$

2) Assume oxygen transfer capacity required in each ADT is calculated as follows:

$$\text{ADT \#1} = 350\#/\text{hr}\left(\frac{3.0\text{ MG}}{3.0\text{ MG}+2(0.4\text{ MG})}\right) \leq 300\#/\text{hr}$$

$$\text{ADT \#2 and \#3} = 350\#/\text{hr}\left(\frac{0.40\text{ MG}}{3.8\text{ MG}}\right) \leq 50\#/\text{hr}$$

4. Aeration and Mixing Equipment in ADT #1, ADT #2 and ADT #3

   a. ADT #1 (old Oxidation Ditch)

      1) Oxygen transfer capacity is provided in ADT #1 by six (6) new, 60 HP, $AerO_2$ floating directional mix subsurface aerators each with a floating bridge mounted 10 HP air blower rated at 440 scfm. Each $AerO_2$ unit provides an oxygen transfer capacity of approximately 64#O_2/hr (AOTR). The total oxygen transfer capacity provided by operation of six $AerO_2$ units is approximately = 385#O_2/hr (AOTR).

      2) Additional oxygen transfer capacity can be provided by operation of up to five (5) 75 HP floating Aqua Aerobics surface aerators. Each Aqua unit provides an oxygen transfer capacity = 75#O_2/hr (AOTR). The total maximum oxygen transfer capacity provided in ADT #1 is approximately = 385#O_2/hr (6 units) + 75#O_2/hr (5 units) = 760#O_2/hr (AOTR).

   b. ADT #2 and #3

      1) Oxygen transfer capacity is provided in each of ADT #2 and ADT #3 by two new 50 HP, $AerO_2$ floating directional mix subsurface aerators each with a floating bridge mounted 7.5 HP air blower rated at 420 scfm. Each $AerO_2$ unit provides an oxygen transfer capacity of approximately 53#O_2/hr (AOTR).

      2) The total oxygen transfer capacity provided by the operation of two $AerO_2$ units in the ADT is approximately 100#O_2/hr (AOTR).

      3) The total oxygen transfer capacity provided in all three ADTs is equal to approximately 960#O_2/hr vs. the oxygen demand of approximately 525#O_2/hr (AOTR).

5. WAS Aerobic Sludge Digestion Time

   a. The total aerobic sludge digestion basin provided = 3.0 MG + 0.40 MG(2) = 3.80 MG.

b. Calculate the approximate sludge solids detention time in the three digester basins assuming initial MLVSS/MLSS ratio = 0.80, assuming approximately 25% VSS destruction by aerobic digestion and assuming an average thickened digested sludge solids concentration = 2.0%

Net Solids = 30,000#ds/day(0.80)(1 – 0.25) + 30,000#ds/day(0.20)

= 24,000#ds/day

$$\text{Net Digested Sludge Volume} = \frac{24{,}000\#\text{ds/day}}{(8.34)(0.02)} \leq 150{,}000 \text{ gallons/day}$$

c. Sludge Retention Time for Aerobic Digestion = SRT

$$\text{SRT} = \frac{3{,}800{,}000 \text{ gallons}}{150{,}000 \text{ gallons/day}} = 25 \text{ days}$$

d. The Aerobic Sludge Digestion Time will therefore be over 20 days which should provide sufficient VSS destruction for efficient mechanical dewatering of WAS.

BB. Screw Press Sludge Dewatering System (New)

1. Waste Activated Sludge (WAS) Dewatering and Disposal

a. Biosolids waste activated sludge (WAS) is pumped from the Final Clarifier Return Activated Sludge (RAS) Pump Station suction lines through a WAS force main line to the Aerobic Sludge Digestion Tanks (ADT) #1, #2 and #3. Partially aerobically digested, gravity thickened WAS is normally pumped from the ADT #3 to the new Screw Press for mechanical dewatering prior to ultimate disposal by hauling to off-site land application.

b. If the Sludge Digestion Tanks are in service so that WAS can be gravity thickened to a minimum of 2% solids concentration, the average daily liquid volume of biosolids sludge to be pumped to the new Screw Press system under normal operating conditions = approximately 150,000 gpd @ 20,000 mg/L.

c. If the Sludge Digestion Tanks are out of service so that the WAS cannot be gravity thickened, the maximum daily liquid volume of biosolids sludge to be pumped to the Screw Press for dewatering assuming a solids concentration of approximately 1.0% in the WAS sludge pumped from the Final Clarifier RAS flow = approximately 360,000 gallons/day @ 10,000 mg/L.

2. Screw Press Design

a. Three new Screw Presses are provided for sludge dewatering. The sludge inflow capacity rating of each Screw Press = 150 gpm of the WAS sludge @ 1.0% minimum solids concentration and 1,500#ds/hr. Operation of two Screw Presses for two shifts for approximately 12 hours/day is required to dewater the average daily sludge volume of approximately 180,000 gpd assuming a maximum flow rate into each Screw Press of approximately 150 gpm.

b. The calculated screw press operation times and sludge feed rate:

1) @ maximum WAS dry solids production rate = 30,000#ds/day assuming a maximum screw press operation time of 20 hours, the calculated press solids loading rate =

$$\frac{30{,}000\text{\#ds/day}}{20\text{ hrs/day}} = 1{,}500\text{\#ds/hour}$$

The maximum WAS liquid volume at the minimum WAS solids concentration =

$$\frac{30{,}000\text{\#ds/day}}{(8.34)(0.01)} = 360{,}000\text{ gpd}$$

The maximum WAS liquid sludge feed rate to the screw presses if operated 20 hours/day @ 1.0% solids concentration =

$$\frac{360{,}000\text{ gallons/day}}{20\text{ hrs x }60} = 300\text{ gpm total} = 150\text{ gpm/press with 2 presses in operation}$$

2) @ average digested WAS dry solids production rate = 30,000#ds/day assuming an average screw press operation time of 12 hours/day, the calculated press solids loading rate =

$$\frac{30{,}000\text{\#ds/day}}{16\text{ hrs/day(2 presses)}} = 938\text{\#ds/hour}$$

The average digested WAS liquid sludge feed rate to the screw press if operated 12 hours/day @ an average of 2.0% solids concentration =

$$\frac{30{,}000\text{\#ds/day}}{(0.02)(8.34)} \leq 180{,}000\text{ gallons/day}$$

$$\frac{180{,}000\text{ gpd}}{12\text{ hrs/day x }60} \leq 250\text{ gpm total} = 125\text{ gpm/press with 2 presses in operation}$$

3. WAS/Screw Press Sludge Feed Pumps

   a. Three new 15 HP progressive cavity sludge pumps are provided each rated at 150 gpm to pump sludge from the 4,000 gallon Screw Press Influent Tank to the Screw Press for dewatering via influent flocculation piping for polymer mixing and detention time.

   b. Three magnetic flowmeter with flow indicators and totalizers are provided in the screw press sludge feed lines to accurately measure, indicate and totalize the sludge waste flow pumped to the Screw Presses.

4. Dewatered Solids Discharge Conveyor

   a. Dewatered sludge will discharge by gravity from the Screw Press into a new conveyor auger to transfer sludge into an open top dump truck.

5. Screw Press Filtrate Recycle

   a. Filtrate wastewater discharged from the new Screw Press will drain by gravity into the Plant Site Pump Station No. 1 Wet Well to be recycled back into Anoxic Reactor #1 of the activated sludge treatment system.

6. Chemical Storage Feed Equipment for Screw Press Sludge Dewatering System

   a. For polymer flocculation of sludge being pumped into the Screw Press the following chemical feed equipment is provided:

      1) One Polymer Solution Preparation Unit including a Polymer Solution Mixing Chamber, Neat Polymer Metering Pump, Dilution Water Inlet and Solution Outlet Assembly and Control Panel.

      2) One progressive cavity Neat polymer solution metering pump is provided rated at 0.5 to 5 gphr @ 40 psi to pump Neat polymer solution from drums or totes into the Polymer Mixing Chamber of the Screw Press Polymer Feed Solution Preparation Unit for dosing into the screw press sludge feed line.

7. Dewatered Sludge Volume and Water Content

   a. The estimated maximum sludge volume of approximately 360,000 gpd @ 1.0% solids concentration will be dewatered by the Screw Press to 20% or greater solids concentration depending upon sludge temperature, polymer flocculant dosage efficiency, and solids dewatering characteristics.

b. The calculated average sludge volume and weight of dewatered WAS assuming a screw press solids capture efficiency of 97%, a dewatered sludge solids content of over 20% and an average dewatered sludge weight of 9.8#/gal = 73#/ft^3 = approximately 2,000#/Yd^3.

1) Dewatered Sludge Volume:

$$= \frac{(30{,}000\#ds/day)(0.97)}{(0.20)(9.8\#/gal)}$$

$\leq$ 15,000 gpd $\leq$ 2,025 ft^3/day $\leq$ 75 Yd^3/day, 5 days/week

2) Dewatered Sludge Weight = 75 Yd^3/day x 2000#/Yd^3 = 150,000#/day = 75 wet tons/day, 7 days/week @ 20% dewatered solids content.

CC. Plant Site Pump Station #1 (New)

1. General

a. One new submersible pump station and wet well is provided for pumping drainage wastewater into either Anoxic Reactor #1 or Nitrification Reactor #2A.

b. The pump station will receive drainage from the following primary sources:

1) New Equipment Building floor drain

2) New Chemical Building floor drain wastewater

3) Screw press filtrate flow and wastewater flow

4) Screw press building floor drain wastewater flow

5) Miscellaneous intermittent or periodic drainage flows

2. Design Assumptions

a. Screw Press Filtrate Wastewater Flow Volume and Rates

1) Average flow rate $\leq$ 150 gpm

2) Peak flow rate $\leq$ 250 gpm

b. Total Flow Rate

1) Average = 150 gpm ≤ 150 gpm

2) Maximum = 250 gpm + 150 gpm ≤ 400 gpm

3. Wastewater Pumping Requirements

a. Screw Press Filtrate wastewater will be continuously discharged by gravity flow into the pump station wet well to be recycled back to Anoxic Reactor #1.

b. Design average discharge flow rate = 150 gpm with one pump in operation at reduced speed.

c. Design maximum discharge flow rate = 400 gpm with one pump in operation at full speed.

4. Pump Selection

a. Two new 7.5 HP, 4" self-priming wastewater pumps are provided in the existing pump station building.

b. Each pump is rated at 400 gpm @ 40 ft. head when operated at full speed.

5. Variable Speed Drives

a. Each pump is provided with a variable speed drive motor controls with automatic pump speed and pumping rate control.

b. Pump speed and pumping rate will be automatically controlled by the liquid level in the pump station wet well.

c. Automatic Lead, Lag and Standby pump operation and sequencing is provided with high liquid level alarm and automatic pump on/off liquid levels.

DD. Plant Site Pump Station #2 (Modification)

1. General

a. The existing Oxidation Ditch Basin Effluent Pump Station will be retrofitted into the new Plant Site Pump Station #2.

b. The pump station will receive drainage from the following primary sources:

1) Filter reject backwash wastewater

2) Clarifier scum trough flush water flow

3) ADT #2 and #3 Decant

4) Miscellaneous intermittent or periodic drainage flows

2. Design Assumptions

a. Filter Reject Backwash Wastewater Flow Volume and Rates

1) Average flow rate = 18 filter modules x 7 gpm/filter = 126 gpm

2) Peak flow rate = 18 filter modules x 14 gpm/filter = 252 gpm

b. Clarifier Scum Flow Volume and Rates

1) Average Skimmings Flow = 20 gpm/clarifier x 2 units = 40 gpm

2) Maximum Skimmings Flow = 40 gpm/clarifier x 2 units = 80 gpm

c. ADT #2 and #3 Decant Flow Volume and Rates

1) Average flow rate ≤ 150 gpm

2) Peak flow rate ≤ 250 gpm

d. Total Flow Rate

1) Average = 126 gpm + 40 gpm + 150 gpm ≤ 350 gpm

2) Maximum = 252 gpm + 80 gpm + 250 gpm ≤ 600 gpm

3. Wastewater Pumping Requirements

a. Design average discharge flow rate = 350 gpm with one pump in operation at reduced speed.

b. Design maximum discharge flow rate = 600 gpm with one pump in operation at full speed.

4. Pump Selection

   a. Two new 15 HP, 4" self-priming wastewater pumps are provided in the existing pump station building.

   b. Each pump is rated at 600 gpm @ 35 ft. head when operated at full speed.

5. Variable Speed Drives

   a. Each pump is provided with a variable speed drive motor controls with automatic pump speed and pumping rate control.

   b. Pump speed and pumping rate will be automatically controlled by the liquid level in the pump station wet well.

   c. Automatic Lead, Lag and Standby pump operation and sequencing is provided with high liquid level alarm and automatic pump on/off liquid levels.

EE. Chemical Storage-Feed Equipment for Activated Sludge Process and For Nitrogen Removal (Existing and New)

1. The following equipment is provided for mixing, storage and pumping chemical solutions that are necessary for operation of the Activated Sludge Treatment System and Final Clarifiers.

   a. For pH adjustment of mixed liquor contained in Anoxic Reactor #1 and/or Nitrification Reactor #2A to maintain the activated sludge denitrification/nitrification process mixed liquor pH between 7.2 to 8.2 units; or, for adjustment of final effluent pH above 6.0 units:

      1) One existing 6,100 gallon bulk storage tank will continue to be used for storage of commercially purchased 60% strength magnesium hydroxide solution. Magnesium hydroxide solution is dosed into the Reactor #2A tank to maintain mixed liquor pH above 6.8 units in the biological nitrification process.

      2) Magnesium hydroxide (MgOH) liquid solution is dosed for pH control in the activated sludge BNR process.

         a) Calculate the MgOH dosage rate for nitrification of 8,507# of TKN @ 4.0# alk/#TKN when biological denitrification is achieved in the Anoxic Rectors #1A, #1B & #3.

            (1) (8,507#TKN) nitrified/day x 4.0# alk/#TKN

            $\leq$ 34,000#alk/day

(2) estimated alkalinity available combined pretreated Anaerobic Lagoon effluent and DAF Cell effluent wastewater = (600 mg/L)(8.34)(4.00 MGD) = 20,000#/day

(3) desired alkalinity in final effluent = (200 mg/L)(8.34)(4.00 MGD) = 6,672#/day ≤ 7,000#/day

(4) $CaCO_3$ alk required =

34,000# - 20,000 + 7,000 ≤ 21,000#alk/day

(5) Estimated MgOH dosage rate @ 4.00 MGD

$$= \frac{21{,}000\#/\text{day}}{(8.34)(4.00\ \text{MGD})} = 630\ \text{mg/L} \leq 650\ \text{mg/L}$$

(6) @ 60% MgOH solution strength and solution weight of 12.6#/gallon and assuming approximately 12.8#alk/gal MgOH, the MgOH solution volume required per day and solution pumping rate required/hr =

$$= \frac{21{,}000\#/\text{day}}{12.8\#\text{alk/gal})} = 1{,}641\ \text{gpd} \leq 1{,}700\ \text{gpd} = 71\ \text{gal/hour}$$

vs. 150 gal/hr pumping capacity provided by one MgOH solution pump in operation.

b) Two new magnesium hydroxide (MgOH) solution pumps with manual variable speed drives are provided each rated at 15 - 150 gphr @ 60 psi to dose MgOH solution into the 4.00 MGD maximum design flow rate. One pump @ 150 gphr will inject MgOH at a rate of over 46,000#/day = 1,400 mg/L (dry basis) @ 4.00 MGD. The normal MgOH dosage requirement is expected to be between 55 to 75 gphr or 500 to 700 mg/L (dry basis). The second MgOH pump is provided for parallel operation, as an installed standby.

b. The following equipment will be provided for dosage of organic Carbon Source Solution for carbonaceous BOD feed into Anoxic Reactor #3 for denitrification process control and final removal of nitrate nitrogen.

1) Non-Flammable carbon source (CS) solution make up and pumping equipment is provided for dosage of CS into the mixed liquor influent flow into Anoxic Reactor #3.

2) Two new 5,000 gallon fiberglass bulk tanks will be provided for nonflammable organic carbon source (CS) solution storage. The carbon source solution bulk tanks will be installed in the new Chemical Equipment Building adjacent to Anoxic Reactor. Carbon source solution will be pumped into the Anoxic Reactor #3 influent line.

3) Two new carbon source solution pumps with manual variable speed drives are provided each rated at 30 gphr @ 60 psi to dose organic carbon solution into the 4.00 MGD maximum design flow rate. One pump @ 17 gphr can inject 400 gpd of organic carbon source at a rate of over 5,000#CS/day > 150 mg/L @ 4.00 MGD. The normal organic carbon source dosage requirement is expected to be between 5 to 10 gphr. A second organic carbon source pump is provided for parallel operation and as an installed standby.

c. For dosing of flocculant settling aid polymer solution into the Final Clarifier influent mixed liquor:

1) Two new 4,000 gallon flocculant solution mix-storage tanks each with a 2 HP mixer are provided for dosing polymer flocculant aid to the Final Clarifiers. The polymer tanks are located in the new Tertiary Filter Equipment Building located near the existing Final Clarifiers.

2) Two existing polymer flocculant solution pumps with manual variable speed drives are provided for operation of the Final Clarifiers. Each flocculant solution pump is rated at 200 gphr @ 60 psi. One pump @ 167 gphr will inject flocculant solution at a rate of over 5 mg/L (dry basis) into the 4.00 MGD maximum design flow rate assuming a minimum 0.50% by weight flocculant solution strength is made up in the flocculant solution mix tanks; the normal flocculant dosage requirement is expected to be between 2 mg/L to 5 mg/L (dry basis).

FF. Expected Final Effluent Quality in Treated Wastewater Discharged into The Existing Spray Irrigation Lagoon

After complete treatment by a two stage dissolved air flotation pretreatment system with intermediate 7 Day Flow Equalization Tanks, four stage anoxic/aerobic/anoxic/aerobic activated sludge biological treatment, final clarification; tertiary filtration and UV disinfection, the effluent quality is expected to meet Mountaire spray irrigation operations permit requirements in effect as of the date hereof. Please note that the influent and effluent parameters set forth in this report have been developed using assumptions regarding the operation of the system that may not reflect actual operating conditions over time. Moreover, many factors can influence the ability of the wastewater treatment system to achieve target effluent parameters, including the character of production throughput, weather conditions, etc. Accordingly, no parameters can be guaranteed.

Table #17
Expected Final Effluent
Pollutant Concentrations

Pollutant	Expected Average Final Effluent Quality	Spray Irrigation Permit Limits	
		Monthly Average	Daily Maximum
Flow	Average: 2.60 MGD Peak: 4.00 MGD	NL	NL
BOD	≤ 50 mg/L	50 mg/L	NL
TSS	≤ 50 mg/L	50 mg/L	NL
Ammonia	≤ 2 mg/L	NL	NL
Nitrate + Nitrite	≤ 5 mg/L	NL	NL
Total Nitrogen	≤ 10 mg/L	15.6 mg/L	NL
Total Phosphorus	20 mg/L*	NL	NL
Chlorides	≤ 250 mg/L*	NL	NL
Sodium	≤ 250 mg/L*	NL	NL
Copper	<0.0040*	NL	NL
Cadmium	<0.0004*	NL	NL
Nickel	0.0040*	NL	NL
Lead	0.0040*	NL	NL
Zinc	<0.0500*	NL	NL
pH	5.5 - 9	NL	NL
Fecal Coliform	≤ 200 MPN/100 ml	≤ 200 MPN/100 ml	≤ 200 MPN/100 ml

NL = No Limit
*Values provided by Owner

GG. Finish Water Storage Pond (New)

1. General Description

   a. The new Finish Water Pond (FWSP) is provided to store final effluent discharged from the on-site wastewater treatment system. The FWSP is a minimum of 22 MG in volume and is provided with a synthetic liner system.

   b. The new Finish Water Storage Pond is designed to operate in parallel with the existing Effluent Spray Storage Pond and thereby significantly increase the total final effluent wastewater storage volume.

   c. The lagoon is used for storage of final effluent prior to disposal by spray irrigation on the existing spray irrigation sites.

2. Design Assumptions

   a. Wastewater Flow Volume

      1) Average Wastewater Flow Volume = 3.20 MGD, 7 days/week

      2) Maximum Wastewater Flow Volume = 4.00 MGD, 7 days/week

      3) Peak Wastewater Flow Volume = 5.00 MGD in wet weather

   b. Storage Lagoon Location

      1) The Storage Lagoon is located along the east side of the existing circular pivot spray irrigation field that is located adjacent to the WWTS.

3. Storage Pond Design

   a. One irregular shaped lagoon is provided constructed of an excavated, backfilled and bermed earthen structure with a synthetic membrane liner.

   b. The lagoon has a maximum storage volume of approximately 32 MG.

HH. Finish Water Storage Pond Effluent Pump Station (New)

1. General Description

   a. Two pumps are provided to pump stored wastewater from the Finish Water Storage Pond to the following optional discharge locations:

      1) Transfer to the existing Spray Storage Lagoon

2) Directly to the spray irrigation system for disposal

3) Transfer to two of these locations at the same time by operation of two pumps at independent pumping rates.

2. Design Assumptions of Pumping Conditions

   a. Average withdrawal pumping rate if pumped = 3.2 MGD = 2,220 gpm

   b. Maximum withdrawal pumping rate if pumped = 4.0 MGD = 2,800 gpm

   c. Peak withdrawal pumping rate if pumped = 5.0 MGD = 3,500 in wet weather

3. Pump Selection

   a. Two 75 HP sewage pumps are provided to pump wastewater from the Storage Pond.

   b. Each pump is rated at 2,800 gpm at 60 feet.

   c. Operation of one pump at reduced or full speed is required to pump conditions a and b.

   d. Operation of two pumps in parallel at reduced speed is required to pump condition c.

   e. The second pump is provided as an installed standby pump and wet weather peak flow pump.

4. Variable Speed Drive Controls

   a. Each pump is provided with variable speed drive motor controls with automatic pump speed and pumping rate control.

   b. The pump speeds and pumping rates are normally automatically operated to maintain a manually selected constant flow rate out of the Storage Pond to the discharge locations.

5. Liquid Level Controls

   a. The Storage Pond Effluent pumps are manually started.

   b. A low liquid level automatic pump shut off and alarm level control is provided to prevent excessive low liquid level in the Storage Pond. Pumps can also be manually operated to pump below the automatic off liquid level.

   c. A high liquid level alarm is provided in order to prevent excessive high liquid level in the Storage Pond.

6. Flow Meter

   a. Two 12" magnetic flow meters are provided in the pump station in order to allow wastewater flow to be pumped and metered to two different discharge locations at the same time.

   b. Each flow meter is provided to accurately measure, indicate, totalize, record and control the wastewater flow rate and volume pumped from the Storage Pond to a specific discharge location.

   c. The pump station discharge piping has two discharge headers each with one flow meter. The discharge headers can be valves that are manually controlled to direct the pumped flow to the different discharge locations.

II. Stormwater First Flush/Off-Spec Lagoon (Modification)

1. General

   a. Stormwater Wastewater (SW) pumped from the processing complex site is collected and stored in the Stormwater First Flush Lagoon (SWFFL). Existing 7 MG Anaerobic Lagoon #1 is retrofitted into the SWFFL for storage of SW and recycled off spec wastewater. Wastewater is pumped out of the SW Lagoon at a relatively constant flow rate and volume into the 7 Day FETs or directly into the BNR System.

   b. Since stormwater runoff wastewater can have large solids and debris, the wastewater must be screened before discharging into the SWFFL. Four existing SW Pump Stations are provided to pump SW from different locations on the processing plant site into mechanical screens before flowing into the SWFFL.

   c. Screened and equalized SW is then normally pumped from the SWFFL at a relatively constant flow rate and volume into the 7 Day FETs or optionally, directly into the BNR System.

   d. Off spec wastewater can be optionally recycled from the wastewater treatment system by pumping from the Tertiary Filter Influent Pump Station into the SWFFL.

2. Lagoon Design

   a. Old Anaerobic Lagoon #1 is retrofitted to function as the Stormwater First Flush Lagoon (SWFFL). The Lagoon provides a minimum volume at low liquid level of approximately 4.00 MG and a maximum volume at high liquid level of approximately 7.00 MG.

   b. The Lagoon dimensions are approximately 500 ft. long x 255 ft. wide at the high liquid level surface.

3. Lagoon Mixing and Aeration

   a. The SWFFL is provided with partial mixing and oxygen transfer to maintain aerobic conditions in the Lagoon.

   b. Three 40 HP cable mounted, floating surface aerators are provided for oxygen transfer and mixing.

4. SWFFL Aeration and Mixing Equipment Design

   a. Mixing Requirements

      1) bhp required for mixing = 30 HP/MG @ LWL Volume = 4.0 MG; bhp for mixing = (4.0 MG)(30) = 120 HP

   b. Oxygen Transfer Requirements

      1) Calculate the maximum oxygen transfer rate required in the SWFFL assuming the stormwater wastewater blended with any off spec recycled wastewater has a BOD concentration of less than 100 mg/L ≤ 750#BOD/day @ 0.90 MGD average daily influent flow volume; and, assuming an oxygen demand of approximately 0.60#O_2/#BOD:

$$AOTR = \frac{0.60\#O_2/\#BOD(750\#BOD/day)}{24}$$

$$= 19\#O_2/hr \leq 20\#O_2/hr$$

      2) Use maximum AOTR ≤ 50#O_2/hr for the SWFFL aeration system design.

      3) Floating surface aerators will provide an oxygen transfer rate of approximately 1.5#O_2/HP/HR
      4) Three 40 HP floating surface aerators are provided for mixing and aeration. Operation of each surface aerators will provide total oxygen transfer rate of approximately 55#O_2/hr.

JJ. Stormwater First Flush Lagoon Wastewater Influent Mechanical Screens (New)

1. General

   a. Stormwater Wastewater contains large solids, debris, and trash that must be screened out before this wastewater is discharged into the Stormwater First Flush Lagoon (SWFFL).

b. Two mechanical screens are provided to screen out large solids and debris from the SWFFL influent flow.

c. Screened raw miscellaneous wastewater will discharge by gravity flow into the SWFFL.

2. Design Assumptions

a. Average influent flow rate = 700 gpm

b. Maximum influent flow rate = 2,800 gpm

c. Peak influent flow rate = 11,200 gpm under maximum wet weather conditions

3. Screen Selection

a. Two Lyco or equivalent externally fed rotary mechanical screens are provided for automatic screening of the wastewater.

b. Each screen is rated at 6,000 gpm maximum flow capacity.

4. Screenings Collection

a. Screenings are discharged into a dumpster for storage prior to off-site disposal.

5. Screen Enclosure

a. To protect the mechanical screens from freezing during winter season operating conditions, the screens are provided with an Enclosure Structure.

b. The Screen Enclosure is heated and ventilated.

KK. Stormwater First Flush Lagoon Effluent Pump Station (New)

1. General

a. A Stormwater First Flush Lagoon Effluent Pump Station is provided to pump screened and blended lagoon effluent wastewater from SWFFL into the 7 Day FETs or into the BNR System.

b. Two self-priming pumps are provided to transfer stored miscellaneous wastewater at an equalized, relatively constant flow rate and volume into the on-site wastewater treatment system.

2. Design Assumptions

   a. Minimum Pumping Rate Required = 350 gpm = 0.50 MGD

   b. Average Pumping Rate Required = 630 gpm = 0.90 MGD

   c. Maximum Pumping Rate Required = 1,400 gpm = 2.00 MGD

3. Pump Selection

   a. Two 25 HP, 8" self-priming sewage pumps are provided to pump wastewater from the SWFFL to the 7 Day FETs or into the BNR System.

   b. Each pump is rated at 700 gpm @ 60 feet.

   c. Operation of one pump at reduced speed is required to pump the minimum flow rate of 350 gpm or the average flow rate of 630 gpm.

   d. Operation of two pumps at full speed is required to pump the maximum flow rate of 1,400 gpm.

4. Variable Speed Drive Controls

   a. Each pump is provided with variable speed drive motor controls with automatic pump speed and pumping rate control.

   b. The pump speed and pumping rate are automatically controlled by manually selected effluent flow rate and volume.

   c. The pumps are automatically stopped liquid level controls. A pump start and stop level is provided for each pump.

   d. A high liquid alarm is provided or order to prevent excessive high liquid level in the storage lagoon.

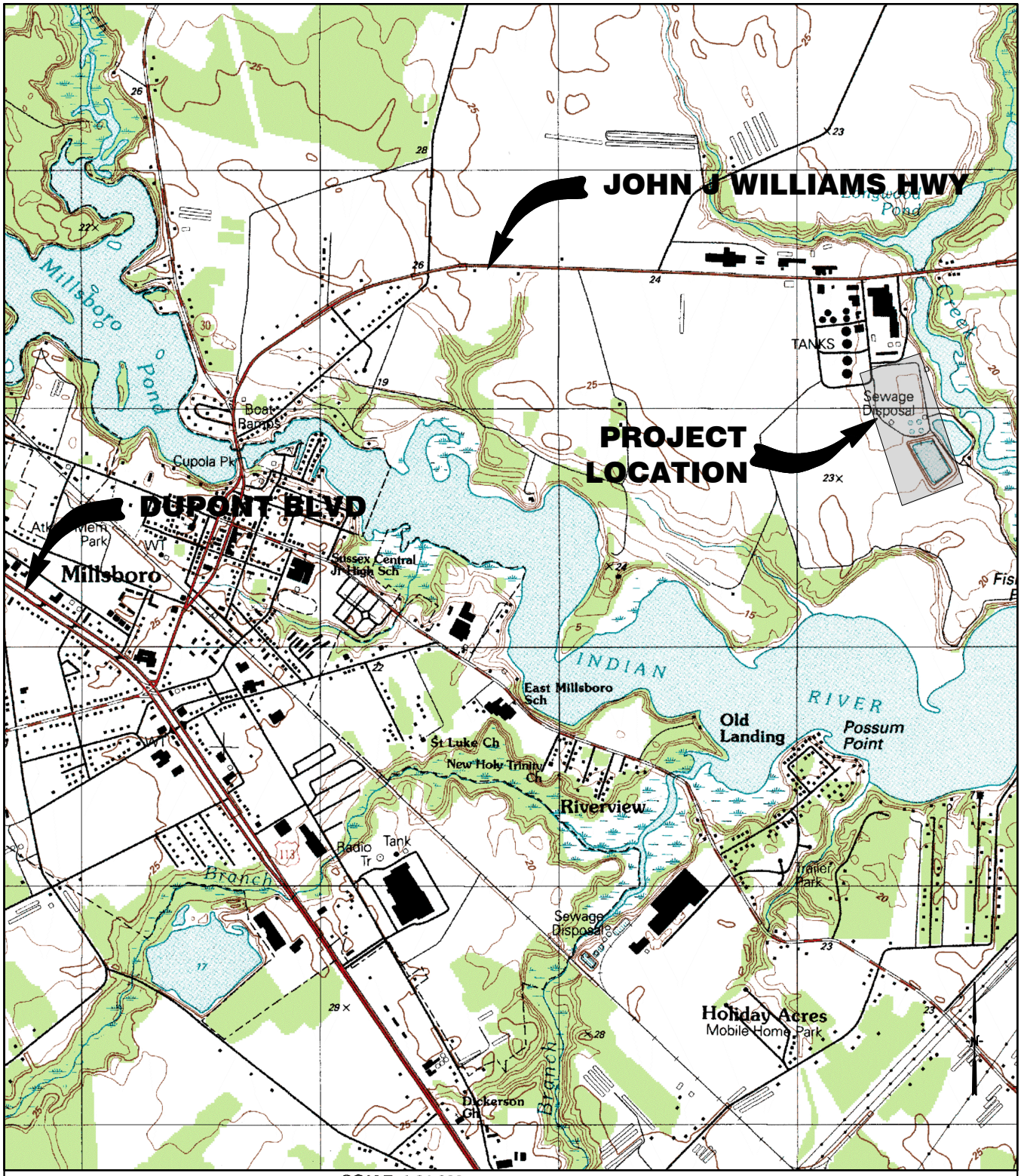
5. Flow Meter

   a. One 8" magnetic flow meter is provided in the pump station discharge header.

   b. The flow meter is provided to accurately measure, totalize, record and control the wastewater flow rate and volume pumped from the SWFFL.

Appendix 1

Location Map



SCALE 1:24 000

KILOMETERS 1 .5 0 1 2
METERS 1000 0 1000 2000
MILES 1 .5 0 1
FEET 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000

MILLSBORO, DEL.
38075-E3-TF-024
1992
DMA 5961 III SE-SERIES V832

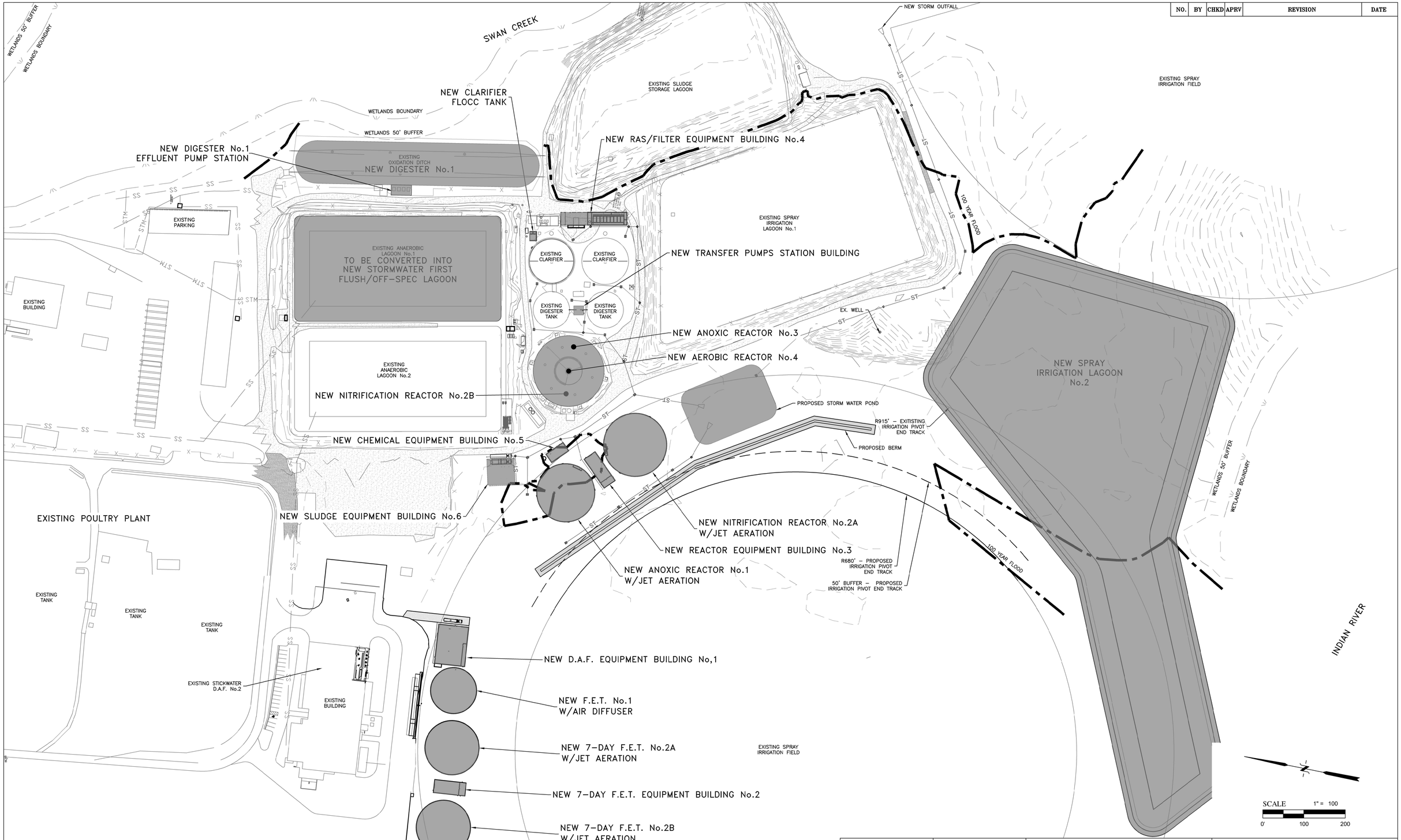
REID ENGINEERING COMPANY, INC.
1210 Princess Anne Street
Fredericksburg, Virginia
Phone: 540-371-8500 Fax: 540-371-8576

Scale: 1"=2000'	LOCATION MAP
Date: 12.18.18	
Drawn by: BWF	MOUNTAIRE FARMS COMPANY
Dwg No: FIG.1	SUSSEX COUNTY, DELAWARE

Appendix 2

Site Map

NO.	BY	CHKD	APRV	REVISION	DATE



John H. Reid P.E.

DRAWN BY: JW
DESIGNED BY: JHR
CHKD BY: JHR

REID ENGINEERING COMPANY, INC.
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SITE MAP

MOUNTAIRE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	1"=100'	DWG NO:	SITE MAP

Appendix 3

Nitrogen Balance and Storage Calculations

Design Engineer Report and Vegetative Management Plan Update for Spray Irrigation of Treated Wastewater

Submitted by:

Mountaire Farms of Delaware Inc.
Millsboro Processing Complex
P.O. Box 1320
Route 24 East
Millsboro, Delaware 19966

Contributing Authors:

Duffield Associates
Dover, Delaware

Keen Consulting
Georgetown, Delaware

Earth Data Incorporated
Centreville, Maryland

February 2020

Table of Contents

Figures and Attachments

1.0 INTRODUCTION

The following presents the 2020 Design Engineer Report and update to the Vegetative Management Plan for Spray Irrigation of Treated Wastewater at the Millsboro Processing Complex of Mountaire Farms of Delaware, Inc. (Mountaire). The original plan was prepared by George, Miles & Buhr in 2003. This plan was updated in 2019 with the assistance of Duffield Associates of Dover, Delaware; Keen Consulting of Georgetown, Delaware; and Earth Data Incorporated of Centreville, Maryland.

Mountaire owns and operates a poultry processing operation near Millsboro, Delaware. As part of this operation wastewater generated at the processing plant and support facilities is treated at an onsite wastewater treatment plant. Mountaire is upgrading the treatment plant to provide improved effluent quality. A separate Design Engineer Report prepared by Reid Engineering Inc., and hereinafter referred to as the Reid Report, describes the wastewater treatment plant upgrade. Some assumptions included herein are based on the Reid Report. Treated wastewater is irrigated on a cropland adjacent to the wastewater plant that is also part of the Millsboro complex. This document includes design and operation data for the effluent disposal system at the Millsboro plant including the effluent pumping, distribution, and irrigation systems. This document also includes crop management information typically referred to as a Vegetative or Nutrient Management Plan.

This is a guidance document intended to document the interrelationships between processing, wastewater treatment and farming operations. It also identifies critical operational concerns and provides guidance as to how processing plant, wastewater and farming operations can be best managed to provide environmentally sound land application of the treated wastewater. It is focused on the management practices for the croplands used to land apply treated wastewater through the facility's spray irrigation system.

2.0 BACKGROUND

2.1 Site History

In May 2000 Mountaire Farms of Delaware, Inc. purchased the Townsends Poultry plant located in Millsboro, Delaware. The Millsboro facility includes a poultry processing plant, a resource recovery facility, hatchery, grain handling, feed mill and associated trucking, transportation garage, farming and administrative facilities. It is located approximately 2.0 miles east of the Town of Millsboro on approximately 2,000 acres along Route 24 (Figure 1). The facility includes approximately 1,566 acres of cropland for production of cash crops using a corn-small grain-soybean-cover crop rotation system. Treated wastewater can be irrigated on 893 acres.

The facility has a long history of using its byproducts for beneficial purposes. There are several permits regulating such activities which center on the wastewater treatment plant. Examples include using the biological solids produced by the wastewater treatment processes as a soil amendment and nutrient sources to sustain crop growth; and the use of treated wastewater to irrigate the well-drained soils, helping to reduce the amount of irrigation water withdrawn from the groundwater aquifers and again supplementing the available nutrients to enhance crop production.

Originally, treated wastewater was discharged to Swan Creek. In an effort to make beneficial use of the treated wastewater and to reduce any possible environmental impacts on the Creek, the facility began to use the treated wastewater for spray irrigating crops on the lands south of Route 24 ("Centerblock" pivots) in 1978 and north of Route 24 ("WHBJ" pivots) in 1984.

Stream discharges became intermittent and as a level of comfort was developed, stream discharges became seasonal, essentially eliminating the stream discharge except during the winter months when regulatory restrictions on the land application system precluded land application.

In the 1990's, the Delaware Department of Natural Resources and Environmental Control (DNREC) worked cooperatively with the facility management to identify wet and cold weather spray fields where spray irrigation is now allowed on a year-round basis with some restrictions. This was due in part to the facility's land rich situation that allowed distribution of the wastewater across more land at relatively small application rates than was actually needed. When Mountaire Farms purchased the Millsboro Complex from Townsend Inc., Mountaire committed to eliminating the stream discharge per DNREC's request and the spray irrigation permit was modified to designate wet weather fields.

2.2 Existing Groundwater Discharge Permit Requirements

The land application of treated wastewater is regulated through the State permit system administered by DNREC's Groundwater Discharges Section. A copy of Mountaire's active spray irrigation permit (359191-04) is included as Attachment A.

Mountaire's permit contains numerous conditions and requirements for irrigation water quality, sampling, record keeping, monitoring of groundwater wells, etc. Some key elements as they relate to vegetative management and routine operational control include:

- 2.6 MGD monthly average limit on influent to the WWTP
- 2.5 inches per week maximum application rate on the spray fields
- 320 total pounds of nitrogen/acre/year maximum from all sources

In addition to these conditions, the permit also contains requirements related to buffer zones. The design and layout of the irrigation system helps ensure Mountaire' s compliance with the mandated buffer requirements. As part of ongoing operation and maintenance (O & M) procedures, not less than annually Mountaire personnel inspect the irrigation facilities to confirm that the buffer zone requirements are being met. As a matter of practice Mountaire also reviews and inspects the buffers any time system stops are modified or updated, or methods of application are changed.

The buffer zone and other requirements are detailed in the State permit and are not specifically restated here. Some requirements in the Special Conditions section of the permit are very specific to the Mountaire operation and spray fields, including some exceptions to the standard requirements. This includes the aforementioned wet weather fields.

3.0 SPRAY SPECIFIC DESIGN DATA

3.1 Effluent Water Quality and Quantity

Please refer to the Reid Report for a summary of Effluent Water Quality and Quantity.

3.2 Water Balance/Determination of Design Wastewater Loading

EarthData Inc. was retained by Mountaire to complete soil infiltration testing in September and October 2019 based on a workplan approved by DNREC. The soils that make up the irrigation fields at the Millsboro complex are mostly well drained loamy sands with high percolation rates and low moisture holding capabilities. Previous soils investigations determined that infiltration rates ranged from 2.25 to 17 inches per hour. The recent testing resulted in measured infiltration rates ranging from 0.13 to 14.49 inches per hour. The overall average infiltration rate measured by EarthData was 4.02 in/hr.

The infiltration test results were used in water balance calculations to determine maximum monthly hydraulic loading rates (Lw) based on current soils conditions as shown on Attachment B. A safety factor of 7% was applied to measured rates due to variability observed during soil testing. Attachment B also includes calculation of allowable hydraulic loading based on maintaining a monthly percolate nitrogen of less than 10 mg/l during years when small grain and soybeans are grown (this condition represents the most conservative crop uptake scenario for nitrogen). As shown on Attachment B allowable loading rates based on percolate N requirements, not soil infiltration rates, are limiting at this facility. Allowable loading rates based on percolate N requirements exceed the regulatory maximum of 2.5 inches per week for every month. Loading rates can also be limited by Phosphorus or metals.

3.2 Phosphorus and Other Constituent Metal Loading Rates

Based on current soil P levels, the site's nutrient management plan recommends that effluent phosphorus be reduced to crop removal amounts. Attachment C includes calculations

of annual phosphorus loading rates based on effluent Total P concentrations ranging from 0.5 to 5.0 mg/l and irrigation rates ranging from 2.0 to 2.6 mgd. The most conservative scenario in regards to crop P uptake is based on a year in which corn is grown. Corn is preceeded by a cover crop which is not harvested and therefore does not contribute to an overall P reduction through crop removal. Annual Corn phosphorus uptake based on DNREC standard values is 26.18 lb/ac/yr (Total P basis) for a yield of 150 bushels/acre. To comply with nutrient management recommendations, effluent Total P should be maintained at concentrations of 3.0 mg/l or less for effluent flows of 2.6 mgd.

Land limiting constituent calculations for metals (Cadmium, Copper, Lead, Nickle, Zinc) is provided on Attachment D. The soils ability to assimilate metals is assumed to be related to Cation Exchange Capacity (CEC), which was measured in 2018 as part of routine soil sampling. Effluent sampling completed in February, 2019 included analysis for metals. The LLC analysis for metals indicates that the site life is 186 years and that the limiting constituent is Cadmium.

3.3 Spray Irrigation Facilities, Wetted Area and Storage

Treated wastewater is discharged using 13 center pivot irrigations systems which are typically operated 24 hours per day, 7 days per week. Weather and farming do affect operations; however, irrigation downtime is mitigated because Mountaire has significant irrigation capabilities beyond the minimum requirements for their design flow. Mountaire operations staff completed an analysis of the previous five (5) years operational and weather data in August 2019. The analysis included as Attachment E, demonstrates that the irrigation systems are operated, on average from 23 to 28 days per month as summarized below.

Month	Average Operating Days per Month
January	26
February	23
March	26
April	26

May	25
June	25
July	24
August	28
September	24
October	26
November	27
December	26

When the wastewater treatment plant upgrade is completed, effluent will be pumped to the spray irrigation storage lagoon after the new UV disinfection process. The capacity of the storage lagoon affords the operators the flexibility to spray at specific times during the day or to skip a limited number of days as needed. A total of 21.3 million gallons operational storage is available between the lagoon high (HWL) and low water levels (LWL). The lagoon has a surface area of 5.36 acres. Mountaire plans to construct an additional storage lagoon in the future that will be at least 22 MG.

Wastewater leaves the storage lagoon via a spray irrigation pumping station that is equipped with four (4) pumps - three (3) operating pumps and one (1) standby pump. Pumping capacity with all three (3) operating pumps on is 3,300 gpm. The pumping station discharges into an irrigation main distribution system that extends throughout the fields. Valves in the pump discharge header, throughout the distribution system and at each pivot are used to select which fields will be irrigated on a daily basis. Irrigation volumes are measured by magnetic type flow meters located at each pivot. The operations staff observe metered volumes and record them daily on digital spreadsheets.

Mountaire has 893 wetted irrigation acres in 13 fields, each with its own center pivot system. The North Spray Fields (Attachment F) include the following seven fields:

Field	Wetted Area (ac)	Design Flow (gpm)
WHBJ #1	54.29	850
WHBJ #2	65.33	850
WHBJ #3	78.00	780
WHBJ #4	76.84	850
WHBJ #5	64.42	850
WHBH #6	72.91	800
WHBJ #7	199.54	1750

The South Spray Fields (Attachment F) include the following six fields:

Field	Wetted Area (ac)	Design Flow (gpm)
Block 3	40.84	850
Block 3A	28.97	850
Block 3B	64.24	850
Block 3C	64.72	800
Block 3D East	41.56	850
Block 3D West	41.97	850

Note: Wetted areas shown on Attachment F for system Block 3 will change to the figures above due to anticipated irrigation pivot changes associated with the treatment plant upgrade.

The following summary of flow related design constraints is based on existing soil conditions observed during recent testing, allowable application rates based on regulatory limits, available wetted irrigation area and capabilities of the irrigation system.

1 Allowable flow based on soil infiltration testing -

3.9 inches per day or 94,409,032 gallons per day on 893 acres.

2. Allowable flow based on regulatory limits -

   2.5 inches per week or 8,645,516 gallons per day on 893 acres

   (WHBJ1, WHBJ3, WHBJ5, CB3 and CB3C have a slightly reduced rate based on recent infiltration testing.)

3. Capacity of irrigations pivots -

   Northern fields (North of Route 24) – 6,730 gpm

   Southern fields (South of Route 24) – 5,050 gpm

4. Pumping capability (Maximum Daily Flow) -

   4,752,000 gpd or 3,300 gpm

5. WWTP average design flow –

   4,000,000 gpd or 2,778 gpm

6. Irrigation average design flow -

   2,600,000 gpd or 1,805 gpm

The soils at the Mountaire site have measured infiltration rates (with a large safety factor applied) much greater than the design flows, the regulatory maximum flow, and capabilities of the irrigation pumping system. The large available wetted area provides operational flexibility. Mountaire has 13 irrigation systems. Up to 3 systems are required to be operated daily to eliminate the average daily flow (irrigation) and up to 5 systems can be operated to eliminate the maximum daily flow.

4.0 Vegetatative Management Plan

A copy of Mountaire's Nutrient Management Plan (NMP), prepared by Keen Consulting, is included as Attachment G. The NMP includes a discussion of crop types; crop planting sequence; anticipated crop yield; timing and application rates of commercial fertilizers; planting and harvesting timelines; cover crops; and nitrogen and phosphorus balances used for nutrient planning purposes.

5.0 Active Spreadsheet

The Active Spreadsheet included as Attachment H was completed using DNREC's standard template and includes all information required in Section 6.5.1.4.1.7.6.9 of the Regulations. The Active Spreadsheet is based on design criteria included in the preceding text or referenced documents, DNREC guidance documents and regulatory standard values. The Active Spreadsheet demonstrates that Mountaire can comply, under normal operating conditions, with a maximum monthly percolate nitrogen concentration of 10 mg/l when irrigating an average of 2.6 mgd treated effluent on 893 acres farmed on the corn-small grain-soybean-cover crop rotation system. Specific variances from normal operating conditions are discussed in Section 6.0.

6.0 Spray Irrigation-Contingency Plans

As discussed in Section 5.0 the active spreadsheet is based on design assumptions that represent average design conditions. Mountaire's operating staff are required to adjust operations as necessary to deal with irregular conditions such as farm or crop related issues, extreme weather events, off specification effluent, and temporary flow variations. For each of these scenarios, an additional active spreadsheet was created using different assumptions that represent irregular operating conditions. Each scenario is described in more detail below.

Attachment I modifies the assumption that 2.6 mgd will be applied monthly year round with no supplemental fertilization and considers an increased effluent flow of up 4.0 mgd every month with supplemental fertilization of 119 lb/ac/yr and 70 lb/ac/yr on corn and soybeans respectively.

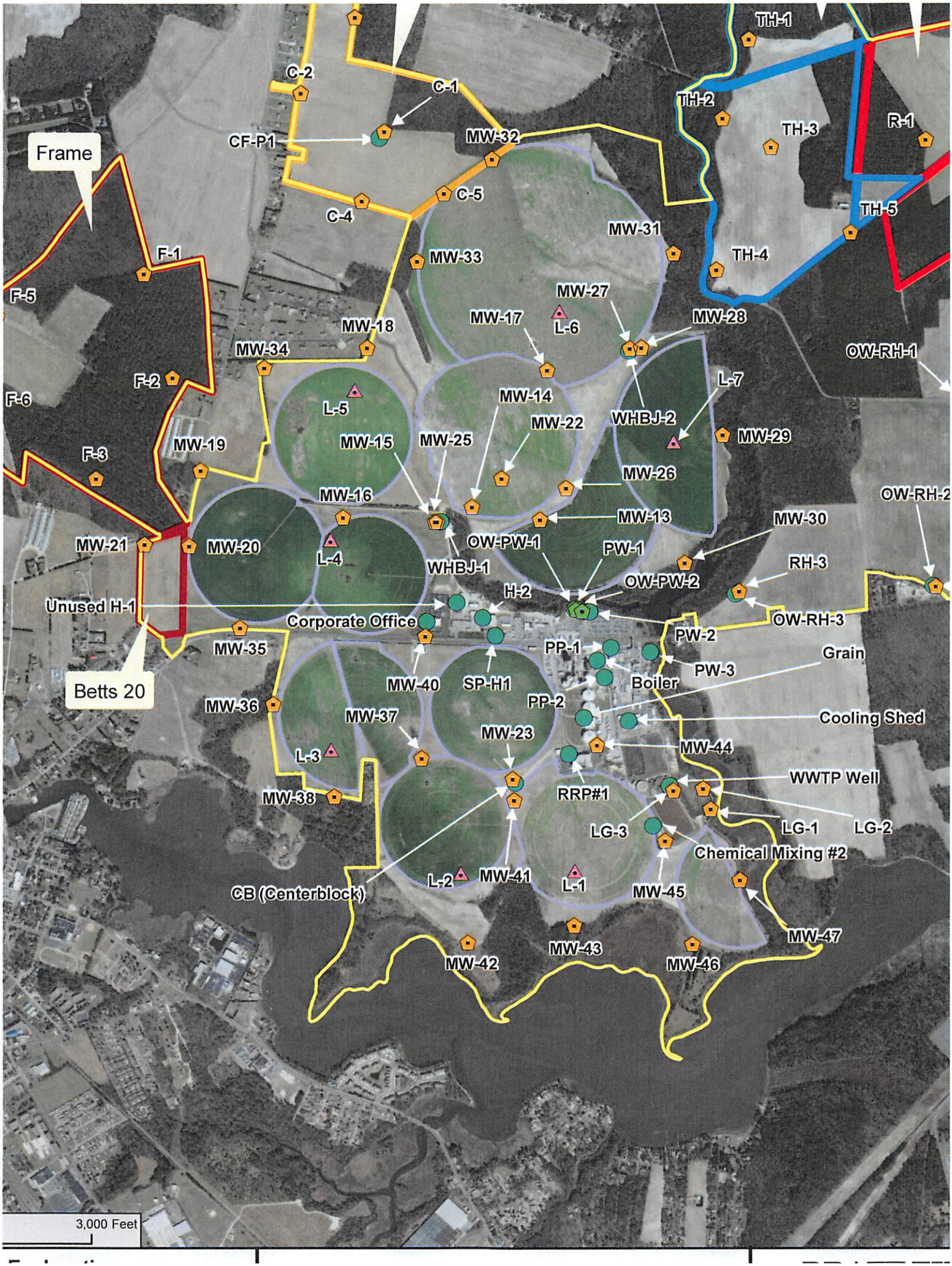
Attachment J modifies the assumption that 2.6 mgd will be applied monthly year round and considers a scenario in which the regulatory maximum 2.5 inches per week is applied every month at rates up to 4.0 mgd. This scenario also assumes that supplemental fertilization occurs at rates included on the previous scenario. As shown on Attachment J this scenario requires only 420 of the total available wetted acres and does not result in percolate nitrogen concentrations exceeding 10 mg/l. Fields WHBJ1, WHBJ3, WHBJ5, CB3 and CB3C, which had a maximum percolation rate of less than 2.5 inches per week when Earth Data performed the infiltration testing are not needed as part of the 420 acres.

Attachment K modifies the assumption that 2.6 mgd will be applied monthly year round and considers a scenario in which the effluent nitrogen concentration is as high as 14.5 mg/l and irrigated at rates up to 4.0 mgd. With abnormally high effluent, no supplemental fertilization is applied. This analysis does not result in percolate nitrogen concentrations exceeding 10 mg/l.

Finally, Attachment L is an active spreadsheet prepared on a four (4) week rather than 12 month basis. This analysis assumes that the entire irrigation system is shut down during a winter period (January) for an entire week. The analysis demonstrates the full storage volume can be eliminated over the next two weeks by irrigating up to the regulatory maximum of 2.5 inches per week without percolate nitrogen issues.

7.0 Monitoring

Part II of the existing permit included in Attachment A depicts the location of monitoring wells and lysimeters and summarizes required effluent, groundwater and soil monitoring required. Only one change to the current plan is proposed, Total Residual Chlorine will no longer be required due to installation of the UV systems.


Frame
Betts 20
TH-1
TH-2
TH-3
TH-4
TH-5
R-1
C-1
C-2
C-4
C-5
CF-P1
MW-32
MW-31
MW-33
F-1
F-2
F-3
F-5
F-6
MW-27
MW-28
MW-17
L-6
MW-18
MW-34
OW-RH-1
L-7
L-5
MW-14
MW-22
WHBJ-2
MW-29
MW-15
MW-25
MW-19
MW-26
MW-16
MW-13
OW-RH-2
MW-30
MW-21
MW-20
L-4
OW-PW-1
PW-1
WHBJ-1
RH-3
OW-PW-2
H-2
Unused H-1
Corporate Office
OW-RH-3
PW-2
MW-35
PP-1
Grain
PW-3
MW-40
SP-H1
Boiler
PP-2
MW-36
MW-37
Cooling Shed
MW-23
MW-44
L-3
WWTP Well
MW-38
RRP#1
LG-1
LG-2
LG-3
Chemical Mixing #2
L-2
MW-41
L-1
MW-45
CB (Centerblock)
MW-47
MW-43
MW-42
MW-46
3,000 Feet

Spray Irrigation Operations Permit

Issued by: Groundwater Discharges Section
Division of Water
Department of Natural Resources
and Environmental Control
89 Kings Highway
Dover Delaware 19901
302-739-9948

DEN Number: 359191-04
Effective Date: July 31, 2017
Expiration Date: July 30, 2022

AUTHORIZATION TO OPERATE AND MAINTAIN
UNDER THE LAWS OF THE
STATE OF DELAWARE

PERMITTEE: Mountaire Farms of Delaware, Inc.
P.O. Box 1320
Millsboro, Delaware 19966

FACILITY: Mountaire Farms of Delaware, Inc.

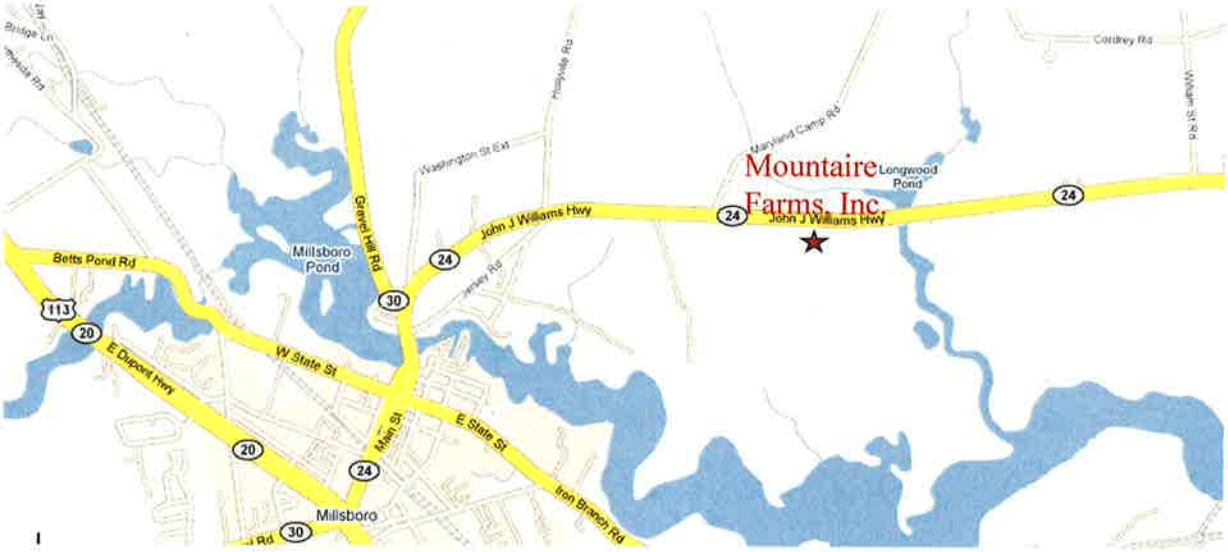
1. Pursuant to the provisions of 7 Del. C. §6003, **Mountaire Farms of Delaware, Inc.** is herein authorized to operate and maintain the facility known as **Mountaire Farms of Delaware, Inc.** located on Route #24, approximately 2.0 miles east of Millsboro, Sussex County, Delaware to spray irrigate treated poultry processing wastewater and treated sanitary waste to an area north of State Route #24 "WHBJ" consisting of 619 acres and to areas south of State Route #24 "Center Block System" consisting of 343 acres.

2. The effluent limitations, monitoring requirements and other permit conditions are set forth herein.

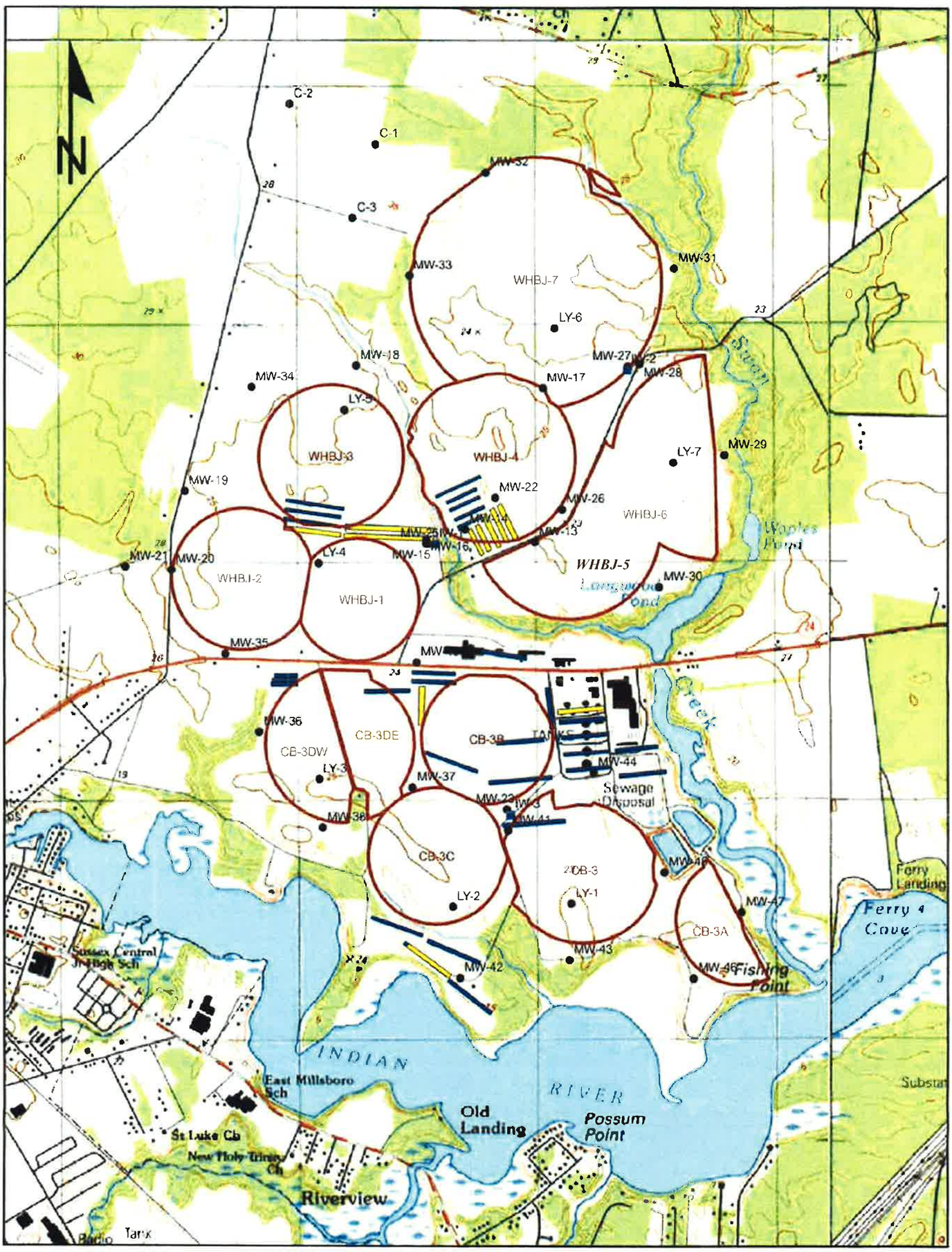
John G. "Jack" Hayes, Jr.
Environmental Program Manager
Groundwater Discharges Section
Division of Water
Delaware Department of Natural Resources
and Environmental Control

7/31/17
Date Signed

LOCATION MAP



SITE MAP -- Labeling of ***WHBJ-5*** superimposed by the GWDS



Note: Chicken houses shown in study area were digitized from 1954 and 1992 USGS 7.5 minute quadrangles for Millsboro, Delaware. All chicken houses shown have been abandoned.

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Explanation

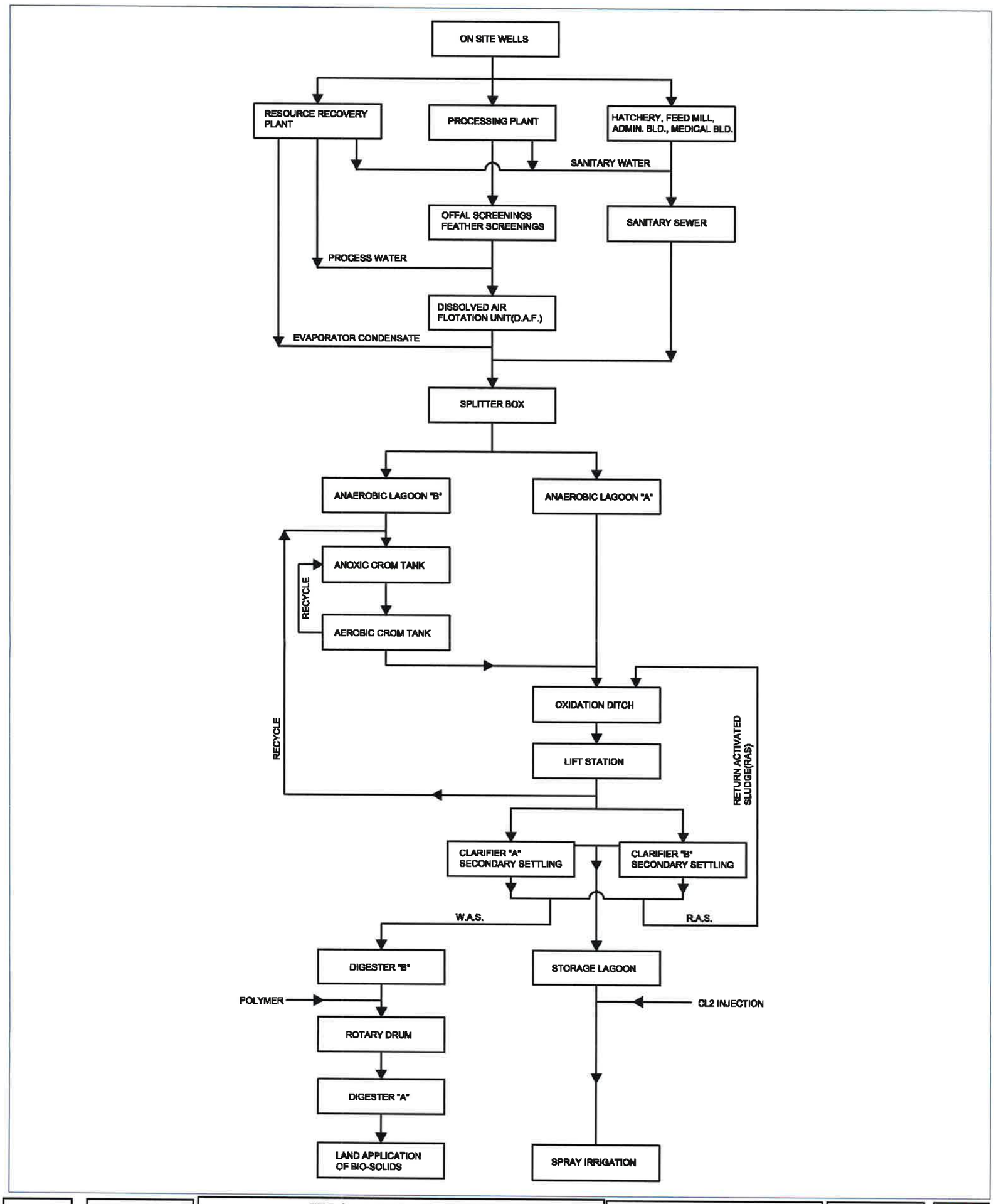
- Irrigation Wells
- Monitoring Points
- Pivot Spray Areas
- Chicken Houses
  - Exisiting 1954
  - Existing 1992

0 1,000 2,000 3,000 4,000 Feet

Document Path: J:_Job_Directories\current\4681 Mountaire CMR\GIS\Figure_1.mxd

Figure 1: USGS 7.5 minute quadrangle map for Millsboro, Delaware showing the location and topography of the site and surrounding area (created 1954, Photorevised 1992)

PROCESS FLOW DIAGRAM



SHEET	SCALE: N/A	WASTEWATER		DATE: 02/05/13
	DRAWING #	TITLE: PROCESS FLOW DIAGRAM		REV: 1
		LOCATION: MILLSBORO, DE		DRAWN BY: SEH REVISED BY:

PART I

A. GENERAL DESCRIPTION OF OPERATION/DISCHARGES

The treatment facility is designed to treat poultry processing wastewater and sanitary waste. The treatment process includes: primary and secondary screening, dissolved air flotation (DAF), anaerobic lagoon biological treatment/equalization (2 lagoons), activated sludge biological treatment with biological nutrient reduction capability – Modified Ludzack-Ettinger (MLE), secondary clarification (2 units), sludge digestion and thickening, disinfection (chlorination) and a post treatment spray irrigation storage lagoon.

The treated effluent is spray irrigated onto approximately 928 acres. Seven center pivot spray irrigation systems are located north of State Route #24 and are designated as WHBJ Systems Nos. 1, 2, 3, 4, 5, 6, 7. And, six center pivot spray irrigation systems are located south of Route #24 and are designated as Center Block Systems Nos. 3, 3A, 3B, 3C, 3DE and 3DW.

The fields are maintained in corn, small grains (barley and wheat), and soybeans.

Approximately 542 acres are permitted for wet and cold weather use.

Spray Field Listing per 2017 Vegetative Management Plan Update Attachment D:

Spray Field Listing

Spray Field	Irrigated Acres	Irrigated Acres by Farming Group	Tilled Acres by Farming Group	% Irrigated Acreage	Wet Weather Approved	Wet Weather Acres	2.5 "/wk {gals}
Centerblock 3 *	75.33	104.30	133.00	78.4%	Yes*	60.00	5,105,294
Centerblock 3A	28.97					-	1,963,366
Centerblock 3B	64.24	170.52	202.00	84.4%	Yes	64.24	4,353,698
Centerblock 3C	64.72				Yes	64.72	4,386,229
Centerblock 3D East	41.56				Yes	41.56	2,816,621
Centerblock 3D West	41.97	41.97	48.00	87.4%	Yes	39.20	2,844,407
WHBJ 1	54.29	119.62	150.00	79.7%	Yes	54.29	3,679,363
WHBJ2	65.33				Yes	65.33	4,427,570
WHBJ 3 *	78.00	78.00	101.00	77.2%	Yes*	59.00	5,286,246
WHBJ 4 *	76.84	76.84	101.00	76.1%	Yes*	74.00	5,207,630
WHBJ 5	64.42	137.33	165.00	83.2%	-		4,365,897
WHBJ6	72.91				-		4,941,285
WHBJ7	199.54	199.54	231.00	86.4%	-		13,523,303
	928.12	**928.12**	**1131.00**	**81.6%**	**542.03**		**62,900,911**

*Portions of fields not allowed during wet/frozen weather. Area reduction estimated.

B. DOCUMENTATION

The slow rate land treatment operation shall be conducted in accordance with the following documents:

1. The State of Delaware, Department of Natural Resources and Environmental Control's Regulations Governing the Design, Installation and Operation of On-Site Wastewater Treatment and Disposal Systems, (Regulations).
2. The Operations and Management Plan submitted by Townsends Inc., during 1988.
3. The letter to Ronald E. Graeber from Metcalf and Eddy dated July 26, 1989 addressing the plan of action for the effluent disinfection system.
4. The letter to Gordon Serman from Bruce B. Bagley dated August 15, 1995 asking Townsends Inc. to address several outstanding issues.
5. The letter to Bruce B. Bagley from Robert A. Palczewski dated October 13, 1995 addressing the decreased buffer zone distance and monitoring plan.
6. A letter to Joseph Mulrooney from Bruce Stephens dated August 5, 1997 identifying wet weather irrigation fields at the Townsends treatment facility.
7. A Detail Soil Investigation for Cordrey and Frame Farms dated February 1999 submitted by Bradley Cates.
8. A report submitted by Bruce Stephens from James E. Havey dated March 23, 1999 addressing the treatment capacity of the Townsend's wastewater treatment capability and future wastewater treatment needs.
9. Plans and Specifications dated June 2, 1999 submitted by Metcalf and Eddy detailing treatment plant upgrades to increase future treatment capacities.
10. A report submitted by Gordon Serman to Doris Hamilton on August 24, 1999 identifying the wet weather spray irrigation fields.
11. A letter dated April 7, 2000 from George C. White notifying DNREC of the sale of the Townsend Facility to Mountaire Corporation.
12. A letter to Bruce B. Bagley from Jeff Smith dated November 8, 2002 providing detailed calculations on the Stormwater Improvement Project and site plan of the facility.
13. A Vegetative Management Plan for Spray Irrigation of Treated Wastewater prepared by George, Miles and Buhr, LLC dated January 31, 2003.
14. A Spray Irrigation Permit Application submitted by Mountaire Farms, Inc. on October 23, 2008.
15. The Design Development Report Addendum 2011 Wastewater Treatment Improvements submitted by CABE Associates, Inc. dated December 7, 2010.
16. Any other correspondence, documentation and/or reports related to the **Mountaire Farms of Delaware, Inc. Wastewater Treatment Facility** received and approved by the Groundwater Discharges Section and/or sent by the Groundwater Discharges Section.

C. INFLUENT LIMITATIONS

1. The monthly average influent to the wastewater treatment facility shall not exceed 2.6 million gallons per day in any calendar month calculated as Total Monthly Volume divided by the number of days in the month.

   The connection of additional units or waste streams other than those indicated in the approved design documents referenced in Part I.B is prohibited without prior written approval from the Groundwater Discharges Section.

   Design Treatment Capacity: 2.6 MGD Monthly Average [calculated as Total Monthly Volume divided by the number of days in the month]

D. SPRAYED EFFLUENT LIMITATIONS

During the period beginning on the effective date and lasting through the expiration date of this permit, the Permittee is authorized to discharge to the spray irrigation field(s) identified on page 1, in Part I.A, and depicted on page 3 of this permit the quantity and quality of effluent specified below and in accordance with the design documents listed in Part I.B of this permit:

1. The monthly average quantity of effluent discharged from the wastewater treatment facility to the spray fields shall not exceed 2.6 million gallons per day (MGD) calculated as Total Monthly Volume divided by the number of days in the month.

2. The average weekly quantity of effluent discharged to any portion of the spray irrigation field shall not exceed 2.5 inch per acre averaged over a 7 day rolling period.

3. The quantity of effluent discharged to any portion of the spray irrigation field shall not exceed 0.25 inch/acre/hour.

4. There shall be a minimum of a three hour rest period between applications of wastewater to the spray fields when the center pivot systems (WHBJ 4, 5, 6, Center Block 3A, 3D east and west) contact any permanent end stop. On all other spray fields, there shall be a sufficient rest period between applications to prevent field saturation and runoff from occurring in any part of the field.

5. The pH of the effluent shall not be less than 5.5 standard units nor greater than 9.0 standard units at any time.

6. The total residual chlorine concentration shall not be less than 1.0 mg/L nor more than 4.0 mg/L at any time.

7. The Chloride concentration of the effluent shall not exceed 250 mg/L on an average annual basis.

8. Design Effluent Nitrogen Concentration:

   The facility has been designed for a monthly effluent Total Nitrogen concentration of 15.6 mg/L.[1]

   If the effluent exceeds a Total Nitrogen concentration of 19.5 mg/L [Design Value + 25%] in any calendar month, the permittee shall resample the wastewater and submit the additional analyses to the Groundwater Discharges Section. If the effluent exceeds 19.5 for over a three month period, the permittee must have the system evaluated to determine the cause and submit a revised Design Engineer Report to the Groundwater Discharges Section. If the effluent exceeds 29.3 [Design Value +50%], the Department may invoke the provisions of Part V.A.1 of this permit. [Also reference Part II.B.1.]

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1 Design Effluent Nitrogen Concentration is in accordance with Page 2 and Attachment B Page 1 and 2 of the Design Development Report Addendum 2011 Wastewater Treatment Improvements submitted by CABE Associates, Inc. dated December 7, 2010.

9. The total amount of nitrogen that may be applied to each spray field acre shall not exceed the following amounts. These amounts include supplemental fertilizers, the nitrogen supplied from the effluent, and any other source.

Spray Field Crop Type	Nitrogen Loading Limit[2]
Corn and Small Grain	320 lbs/acre
Soybeans and Small Grain	320 lbs/acre

Adjustments and reductions for denitrification, ammonia volatilization, evapotranspiration and plant uptake are ***not*** to be factored into the annual reporting of Total Nitrogen Loading for demonstration of compliance with this limit.

If any crops are not removed from the spray irrigation fields, then the total nitrogen application rate for the field must be reduced by the amount of nitrogen that would be removed by harvesting the crop as detailed in the facility's Design Engineer Report.

The limitation of total nitrogen that can be applied to each acre may be adjusted by the Groundwater Discharges Section if it can be shown through subsequent analysis of the crop removed that the total nitrogen removed with the crop is equal to the amount applied from the effluent and additional fertilizer applications. Supplemental additions of commercial fertilizers shall be limited to amounts necessary to meet crop needs in accordance with the written recommendations of the University of Delaware Cooperative Extension Service, or a Delaware Certified Crop Advisor, for the specified crop and anticipated yield.

10. The discharge to the spray irrigation fields shall be free from material such as floating solids, sludge deposits, debris, scum, oil and grease.

11. The facility has been designed for limited public access. The treated wastewater utilized for limited public access sites must meet the following daily permissible average concentrations. The daily average concentration shall be determined by the summation of all the measured daily concentrations obtained from composite samples divided by the number of days during the calendar month when the measurements were made.
    a. The 5-day Biochemical Oxygen Demand (BOD5) of the treated wastewater must not exceed 50 mg/L.
    b. Disinfection of wastewaters containing domestic waste is required to yield a discharge not to exceed 200 col/100 mL Fecal Coliform.
    c. The treated wastewater must not contain more than 50 mg/L of Total Suspended Solids.

Parameter	Daily Permissible Average Concentration
BOD_5	50.0 mg/L
Fecal Coliform	200 colonies/100 mL
Total Suspended Solids	50 mg/L

E. FACILITY CLASSIFICATION

1. A classification was performed on the permitted facility in accordance with Regulations Licensing Operators of Wastewater Facilities. The wastewater treatment system is designated as a Class IV Facility. The facility must be under the direction of a Class IV Licensed Operator in Direct Responsible Charge for the facility who is available at all times. A licensed operator, operating under the direction of the licensed operator in Direct Responsible Charge for the facility, must be available when the spray irrigation system is in operation.

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2 Nitrogen Loading Limit in accordance with Attachment B, Page 3 of the Design Development Report Addendum 2011 Wastewater Treatment Improvements submitted by CABE Associates, Inc. dated December 7, 2010.

F. SCHEDULE OF COMPLIANCE

1. The Permittee shall submit the information necessary and/or complete the following requirements for proper compliant operation of the spray irrigation system:

   a. Effluent Total Nitrogen concentration:
      i. By October 31, 2017, the Permittee must return Mountaire Farms of Delaware, Inc.'s effluent Total Nitrogen concentration to within 25% of the design value of 15.6 mg/L in accordance with the Design Development Report Addendum 2011 Wastewater Treatment Improvements submitted by CABE Associates, Inc. dated December 7, 2010.
      ii. By August 31, 2017, the Permittee must submit to the Groundwater Discharges Section a Plan of Corrective Action. The Plan must include proposed efforts to investigate the cause of the elevated Total Nitrogen concentration in the effluent, proposed modifications to the system, and a timeline for implementing proposed modifications.

2. The Permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance by specified date. In the event of noncompliance, the notice shall include the cause of noncompliance, any remedial action taken, and the probability of meeting the next scheduled requirement.

G. BUFFER REQUIREMENTS

Buffer zones must be maintained in accordance with Section 6.3.2.3.10 of the Regulations unless otherwise specified below.

1. A buffer zone of at least 50 feet shall be maintained between the edge of the wetted field area and all highways, individual lots and property lines.
2. A buffer zone of 50 feet shall be maintained between the wetted edge of the spray field and the edge of any wetlands or any perennial lake or stream provided that the buffer zone is maintained in perennial vegetation, otherwise a buffer zone of 100 feet shall be maintained.
3. Spray irrigation of wastewater in the reduced buffer areas along Route #24 and County Road 304 shall only occur during daylight hours.

H. SLUDGE HANDLING REQUIREMENTS

In accordance with AGU 1402-5-03 and AGU 1403-5-03 issued by DNREC's Surface Water Discharges Section (302) 739-9946.

I. FACILITY SPECIFIC CONDITIONS

1. Spray irrigation is prohibited when saturated or frozen soil conditions exist, except on fields identified by the Department as "wet weather irrigation fields." No runoff of wastewater from the spray fields may enter adjacent properties, tax ditches or other water bodies. Pivot #'s CBS# 3, 3B, 3C, 3D east, 3D west (except for a portion of CBS# 3 which is adjacent to Indian River) and WHBJ 1, 2, 3 and 4 (except for portions of the WHBJ 3 and 4 spray areas along the ditch that runs west to east along these systems) have been designated as "wet weather irrigation fields."

2. If down-gradient water supply wells (public or private) are contaminated by the wastewater spray irrigation process, the permittee shall provide a free, alternative potable water supply to the affected parties.

3. The permittee shall track the wind direction to ensure that no spray drift occurs to roadways during irrigation. If wind conditions are such that spray drift could occur over roadways, then all spray irrigation activities shall cease in those fields.

4. The irrigation pump station shall be kept free from accumulated solids, debris or sludge deposits.

5. Use of the spray irrigation system for the application of pesticide products shall be conducted in accordance with approved standards for sprinkler chemigation.

6. Commercial phosphorus fertilizer applications should be limited to starter fertilizer for corn if soils tests show that it is necessary (per Jan 2015 CMR - Soils Recommendations page 9).

PART II

A. MONITORING REQUIREMENTS

During the period beginning on the effective date and lasting through the expiration date of this permit, the Permittee is authorized to discharge to spray irrigation fields identified on page 1, in Part I.A, and depicted on page 3 of this permit. Such discharge shall be monitored by the Permittee as specified herein.

Requests for monitoring modifications must be submitted to the Department's Groundwater Discharges Section in writing. Such requests must clearly state the reason for and nature of the proposed modification and, where applicable, must contain supporting scientific information, analysis, and justification. Requests will be addressed by the Department on a case by case basis.

Permittee shall initiate periodic reporting required under Part II.B.2 upon initiation of irrigation activities for all of the following monitoring requirements.

1. INFLUENT MONITORING REQUIREMENTS

Permittee shall sample combined flows resulting into the following two influent streams:

a. From anaerobic lagoon #1 going to the oxidation ditch; and
b. From anaerobic lagoon #2 going to the MLE.

Permittee shall submit spreadsheet summarizing combined flows resulting in the two influent streams with the Monthly DMR.

Parameter	**Unit of Measurement**	**Monitoring Frequency**	**Sample Type**
Flow	Gallons/Day	Continuous	Recorded
BOD5	mg/L	Monthly	Grab
TSS	mg/L	Monthly	Grab
Total Nitrogen	mg/L	Monthly	Grab
Ammonia Nitrogen	mg/L	Monthly	Grab
Nitrate/Nitrite as Nitrogen	mg/L	Monthly	Grab
pH	S.U.	Monthly	Grab
Total Phosphorus	mg/L	Monthly	Grab
Chloride	mg/L	Monthly	Grab

2. SPRAYED EFFLUENT MONITORING REQUIREMENTS

Samples taken in compliance with the monitoring requirements for Fecal Coliform, Oil and Grease, Total Dissolved Solids and Total Residual Chlorine shall be collected at the spray irrigation pivot. Samples taken in compliance with the monitoring requirements for pH and all composite sampling shall be at the effluent end of the clarifier.

Parameter	Unit Measurement	Monitoring Frequency	Sample Type
Ammonia Nitrogen	mg/L	Monthly	Composite
BOD_5	mg/L	Twice per month	Composite
Cadmium	mg/L	Annually	Composite
Calcium	mg/L	Annually	Composite
Chloride	mg/L	Quarterly	Composite
Copper	mg/L	Annually	Composite
Effluent Flow	Gal/day	Continuous	Recorded
Fecal Coliform	Col/100 ml	Twice per month	Grab
Lead	mg/L	Annually	Composite
Magnesium	mg/L	Annually	Composite
Nickel	mg/L	Annually	Composite
Nitrate + Nitrite Nitrogen	mg/L	Monthly	Composite
Oil and Grease	mg/L	Monthly	Grab
Organic Nitrogen	mg/L	Monthly	Calculation
pH	S.U.	Daily	Grab
Potassium	mg/L	Quarterly	Composite
Sodium Adsorption Ratio	N/A	Quarterly	Calculation
Sodium	mg/L	Quarterly	Composite
Total Dissolved Solids	mg/L	Quarterly	Grab
Total Nitrogen	mg/L	Monthly	Composite
Total Nitrogen Loading	lbs/acre	Monthly	Calculation
Total Phosphorus	mg/L	Monthly	Composite
Total Phosphorus Loading	lbs/acre	Monthly	Calculation
Total Residual Chlorine	mg/L	Daily	Grab
Total Suspended Solids	mg/L	Twice per month	Composite
Zinc	mg/L	Annually	Composite

3. GROUNDWATER MONITORING REQUIREMENTS

Groundwater samples shall be taken from each monitoring well for the facility. Groundwater monitoring well locations are depicted on the Site Map found on Page 3 of this Permit.

Samples taken in compliance with the monitoring requirements specified shall be taken at each monitoring well in accordance with procedures approved by the Department and listed in the State of Delaware, Field Manual for Groundwater Sampling (Custer, 1988).

Groundwater monitoring results for each monitoring well shall be reported using the State of Delaware Well Identification Tag Number that is required on all wells in accordance with the Delaware Regulations Governing the Construction and Use of Wells, Section 10, A.

All field sampling logs and laboratory results for samples obtained from a well shall be identified by the DNREC ID affixed to the well.

Groundwater samples shall be tested from the following wells for the following parameters:

Local ID	DNREC ID	Field	Local ID	DNREC ID	Field
MW-13	243364	WHBJ-5	MW-31	70662	WHBJ-7
MW-14	243361	WHBJ-4	MW-32	70663	WHBJ-7
MW-15	243359	WHBJ-4/5	MW-33	70664	WHBJ-7
MW-16	243358	WHBJ-1	MW-34	70665	WHBJ-3
MW-17	243357	WHBJ-4/7	MW-35	70666	WHBJ-2
MW-18	243356	WHBJ-3	MW-36	70667	CB-3DW
MW-19	243355	WHBJ-2	MW-37	70668	CB-3B/C/D
MW-20	243354	WHBJ-2	MW-38	192056	CB-3DW
MW-21	243353	WHBJ-2	MW-40	70671	WHBJ-1
MW-22	243362	WHBJ-4	MW-41	70672	CB-3/B/C
MW-23	243365	CB-3/B/C	MW-42	70673	CB-3C
MW-25	243351	Next to 15	MW-43	70674	CB-3
MW-26	243363	WHBJ-4	MW-44	70675	CB-3
MW-27	243352	WHBJ-7	MW-45	70676	CB-3/3A
MW-28	70659	WHBJ-6	MW-46	70677	CB-3A
MW-29	70660	WHBJ-6	MW-47	70678	CB-3A
MW-30	70661	WHBJ-6			

GROUNDWATER MONITORING REQUIREMENTS (con't)

Parameter	Unit Measurement	Measurement Frequency	Sample Type
Ammonia as Nitrogen	mg/L	Quarterly	Grab
Arsenic	mg/L	Quarterly	Grab
Chloride	mg/L	Quarterly	Grab
Depth to Water	hundredths of a foot	Quarterly	Field Test
Dissolved Oxygen	mg/L	Quarterly	Field Test
Fecal Coliform	Col/100mL	Quarterly	Grab
Nitrate + Nitrite as Nitrogen	mg/L	Quarterly	Grab
pH	S.U.	Quarterly	Field Test
Sodium	mg/L	Quarterly	Grab
Specific Conductance	µS/cm	Quarterly	Field Test
Temperature	°C	Quarterly	Field Test
Total Dissolved Solids	mg/L	Quarterly	Grab
Total Nitrogen	mg/L	Quarterly	Grab
Total Phosphorus	mg/L	Quarterly	Grab

4. GROUNDWATER TABLE ELEVATION MONITORING REQUIREMENTS

N/A

5. LYSIMETER MONITORING REQUIREMENTS

Samples shall be taken from each lysimeter for the facility. Lysimeter locations are depicted on the Site Map found on Page 3 of this Permit.

Samples must be tested from the following wells for the following parameters. The constituents are listed below in highest priority first. In the event that sufficient sample volume may not be obtained to test for all parameters listed, the sample shall be tested for as many constituents possible in the following order:

Local ID	DNREC ID	Associated Pivot	Notes
LY-1	257012	CB-3	Replaced well 233818 on 2/7/2017
LY-2	257636	CB-3C	Replaced well 233819 on 3/29/2017
LY-3	257016	CB-3DW	Replaced well 233820 on 2/7/2017
LY-4	233821	WHBJ-1	
LY-5	233822	WHBJ-3	
LY-6	233823	WHBJ-7	
LY-7	233824	WHBJ-6	

Parameter	**Unit Measurement**	**Measurement Frequency**	**Sample Type**
Total Nitrogen	mg/L	Quarterly	Grab
Total Phosphorus	mg/L	Quarterly	Grab
Nitrate + Nitrite as Nitrogen	mg/L	Quarterly	Grab
Ammonia as Nitrogen	mg/L	Quarterly	Grab
Chloride	mg/L	Quarterly	Grab
Sodium	mg/L	Quarterly	Grab
Total Dissolved Solids	mg/L	Quarterly	Grab
pH	S.U.	Quarterly	Field Test
Specific Conductance	µS/cm	Quarterly	Field Test
Temperature	°C	Quarterly	Field Test

6. SOIL MONITORING REQUIREMENTS

Composite soil samples representing each soil series within the wetted spray field shall be taken separately from both soil depths of 0–12 inches and 12–24 inches. A minimum of one composite sample for each of the both aforementioned depths is required for every 20 acres of each soil series. The composite soil sampling must represent the average conditions in the sampled body of material. The discrete samples that are to be composited must be collected from the same soil horizon and depth interval.

Soil sample locations shall be plotted on a scaled drawing and labeled consistent with the sample nomenclature. Each field must also be identified so that sample results may be tracked and properly assessed for field life limiting factors.

Soil chemical testing should be in accordance with Methods of Soil Analysis published by the American Society of Agronomy, Madison, Wisconsin.

If a Compliance Monitoring Report (CMR) is required for the facility, testing for Cadmium, Nickel, Lead, Zinc and Copper should be performed approximately one year prior to permit renewal so results may be utilized by the Permittee in the CMR. Reference Part IV.A.2 of the Permit and Section 6.5.4 of the Regulations regarding CMR requirements.

Parameter	Unit Measurement	Measurement Frequency	Sample Type
pH	S.U.	Annually	Soil Composite
Organic Matter	%	Annually	Soil Composite
Phosphorus (as P_2O_5)	mg/kg	Annually	Soil Composite
Potassium	mg/kg	Annually	Soil Composite
Sodium Adsorption Ratio	meq/100g	Annually	Soil Composite
Arsenic	mg/kg	Once per 5 years	Soil Composite
Cadmium	mg/kg	Once per 5 years	Soil Composite
Nickel	mg/kg	Once per 5 years	Soil Composite
Lead	mg/kg	Once per 5 years	Soil Composite
Zinc	mg/kg	Once per 5 years	Soil Composite
Copper	mg/kg	Once per 5 years	Soil Composite
Cation Exchange Capacity	meq/100g	*Only if soil pH changes significantly	Soil Composite
Phosphorus Adsorption (Mehlich 3 acceptable)	meq/100g	**Only if soil phosphorus levels become excessive for plant growth	Soil Composite
Percent Base Saturation	%	*Only if soil pH changes significantly	Soil Composite

*A significant change in soil pH is defined as a change of one or more standard units from the original value established in the Design Development Report.

** Excessive levels of soil phosphorus are defined by the Delaware Nutrient Management Commission. Soil phosphorus levels must be tested in accordance with the University of Delaware soil testing methods (Gartley, 2002). If the soil phosphorus levels become excessive, the Permittee must perform a Phosphorus Site Index (PSI) study. The results must be submitted to the Groundwater Discharges Section within 30 days of completion. Based on these, the Groundwater Discharges Section may require the Permittee to submit a plan for detailing steps to reduce the phosphorus loading rates at the site.

7. VEGETATION MONITORING

In the year prior to permit expiration, a minimum of one composite sample for each field is required upon each harvest. If a crop rotation is utilized either in alternate years or in the same year, the aforementioned requirement must be duplicated for each crop type. If a Compliance Monitoring Report (CMR) is required for the facility, testing should be performed approximately one year prior to permit renewal so results may be utilized by the Permittee in the CMR. Reference Part IV.A.2 of the Permit and Section 6.5.4 of the Regulations regarding CMR requirements.

Parameter	Unit Measurement	Measurement Frequency	Sample Type
Yield	Bushels/acre and lbs/acre	Per harvest	Vegetation Composite
Nitrogen	% and lbs/acre	Per harvest	Vegetation Composite
Phosphorus	% and lbs/acre	Per harvest	Vegetation Composite
% Moisture	%	Per harvest	Vegetation Composite

8. OPERATIONS MONITORING REQUIREMENTS

a. Spray Field Applications

Parameter	Unit Measurement	Monitoring Frequency	Sample Type
Fertilizer Nitrogen	lbs/acre per field/zone/pivot	Monthly	Reported
Fertilizer Phosphorus	lbs/acre per field/zone/pivot	Monthly	Reported

b. Treatment System

Parameter	Sample Location	Unit Measurement	Monitoring Frequency	Sample Type
Lagoon Levels	Lagoons	Feet of depth of lagoon	Weekly	Field Test

9. SURFACE WATER MONITORING REQUIREMENTS

N/A

B. MONITORING SPECIFICATIONS AND REPORTING REQUIREMENTS

1. Representative Sampling

Samples and measurements taken as required in the operation permit shall be representative of the volume and nature of the monitored discharge. If there has been significant increase (> 25%) in the characterization of any one parameter of the effluent wastewater as established in the Design Engineer Report, the permittee shall resample the wastewater and submit the additional analyses to the Department. The permittee shall re-characterize the wastewater to determine if a change in treatment is required and/or if the land limiting constituent has changed. If a change in treatment is required and/or if the land limiting constituent has changed, a revised Design Engineer Report shall be submitted to the Department. After a review of these results, the Department may invoke the provisions of Part V.A.1 of this permit.

2. Reporting

Monitoring results obtained during the previous one month/quarter shall be summarized and reported on an approved monitoring report form(s) postmarked no later than the 28th day of the month following the completed reporting period. Laboratory analytical results and sampling logs must be submitted with the corresponding month's monitoring report. Signed reports/forms, laboratory analytical results, laboratory sampling logs and field data sheets shall be submitted in one complete package to the Department at the following address:

Groundwater Discharges Section
Division of Water
Department of Natural Resources and Environmental Control
89 Kings Hwy
Dover DE 19901
(302) 739-9948 Office
(302) 542-9735 Cell

3. Monitoring results reported as less than the detectible limit should be reported with the less than symbol "<" before the detection limit. The full detection limit value must be utilized in any necessary calculations. The less than symbol must be carried through the calculation. The resulting value must include any appropriate less than or greater than symbol resulting from the calculation.

4. Additional Monitoring by Permittee

If the permittee monitors any parameter at the location(s) designated herein more frequently than required, using approved analytical methods, the results shall be reported to the Department on an approved monitoring report form. Such increased frequency shall also be indicated.

5. Annual Report

The Permittee shall submit to the Department's Groundwater Discharges an Annual Report summarizing the operations, management, administration and maintenance of the facility for the calendar year. The Annual Report must be submitted to the Department's Groundwater Discharges on or before February 28th of each year. The Annual Report must include all applicable items found in Section 6.8.2.4.1.3 and Section 6.9 of the Regulations.

6. Test Procedures

Test procedures for analysis of pollutants shall conform to the applicable test procedures identified in 40 CFR, Part 136 or the most recently adopted copy of Standard Methods unless otherwise specified in this permit.

7. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the Permittee shall record the following information:

a. The exact place, date and time of sampling and/or measurement;

b. The person(s) who performed the sampling and/or measurement;

c. The date(s) the analyses were performed and the time the analyses were begun;

d. The person(s) who performed the analyses; and

e. The results of each analysis.

8. Records Retention

All records and information resulting from the monitoring activities required by this permit or the Regulations including all records of performed analyses, calibration and maintenance of instrumentation and recording from continuous monitoring instrumentation shall be retained for five years. This period of retention shall be extended automatically during the course of any unresolved litigation regarding the regulated activity or regarding control standards applicable to the permittee or as requested by the Department.

9. Availability of Reports

All reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Department of Natural Resources and Environmental Control. Monitoring data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in 7 Del. C., §6013.

10. Operator Log

An operator log must be kept on site at all times. Each spray system section shall be numbered and referred to by number in the operator log. All records and reports shall also be kept in a bound log book on site at all times and must be made available upon request for review by the Department. This log shall, at a minimum, include the applicable items listed in Section 6.7.3 of the Regulations.

11. Quality Assurance Practices

The Permittee is required to show the validity of all monitoring data by requiring its laboratory to adhere to quality assurance practices in accordance with Section 6.8.2.4 of the Regulations.

PART III

A. OPERATIONAL REQUIREMENTS

1. Groundwater Requirements

   Operation of the wastewater treatment facility and spray irrigation system shall not cause the quality of Delaware's groundwater resources to be in violation of applicable Federal or State Drinking Water Standards on an average annual basis.

2. Facilities Operation

   The Permittee must properly maintain and operate all structures, pipelines, systems and equipment for collection, treatment control and monitoring which are used by the permittee to achieve compliance with the terms and conditions of the permit. Proper operation and maintenance includes, but is not limited to, effective performance based on designed facility removals, adequate funding, effective management, adequate operator staffing and training, and adequate laboratory and process controls including appropriate quality assurance procedures.

3. The spray irrigation fields shall be managed to assure at a minimum that:

   a. Spray irrigation of wastewater shall only occur on fields being prepared for planting or already planted with a crop and shall not occur on fields with crops not actively growing or on voluntary vegetation.

   b. The spray fields shall be maintained in such a manner as to prevent wastewater pooling and/or discharge of wastewater to any surface waters. Should pooled areas become evident, spraying on those areas shall be prohibited until saturated conditions no longer exist.

   c. Aerosols or nuisance odors shall not extend beyond the boundary of the spray irrigation site when treated wastewater is being applied. If odors are produced that are considered to be a public nuisance, the Permittee shall take the necessary steps to eliminate such odors. All action taken shall be reported to the Department in accordance with Part IV.A.4 of this permit.

   d. Erosion controls must be employed to prevent wastewater runoff from the spray irrigation fields. The Permittee must notify the Department immediately if any wastewater runoff occurs.

   e. The spray irrigation field's crops must be maintained in optimal condition, including any necessary weed management, reseeding, or other vegetative management practices.

   f. Effective vegetative management shall be provided such that crops harvested on the spray irrigation sites are removed from the sites.

   g. Forage crops must be harvested and removed from the irrigation field(s) at least twice a year. Crops harvested must be removed from the irrigation site within six (6) months of harvest.

   h. The wastewater must be applied in a manner such that the application is even and uniform over the irrigation area.

4. Spray irrigation is prohibited when saturated or frozen soil conditions exist except on fields identified in Part I.I.1.

5. The groundwater mound created by the added infiltration shall at no time reach within two feet of the ground surface in any section of the spray irrigation fields. Should the groundwater mound exceed this limit, the Permittee shall cease all irrigation of wastewater to the affected fields until the groundwater mound recedes to acceptable levels.

6. Connections or additions to the spray irrigation system other than those indicated on the approved plans are prohibited without prior approval from the Department's Groundwater Discharges Section.

7. Roof downspouts, foundation drains, area drains, storm sewers, combined sewers or appurtenances thereto or any sewer or device carrying storm water shall not be connected to the spray irrigation system.

8. The Permittee shall take appropriate measures to protect the spray irrigation system from damage due to sub-freezing conditions.

9. Any leaks shall be reported to the Department and repaired immediately.

10. Signs

    a. Limited Public Access: Signs must be posted on all limited public access spray fields utilized to irrigate treated wastewater to prohibit public contact. The signs must indicate that the water being irrigated is treated wastewater. The signs must be legible. Limited public access sites must have signs posted on the perimeter every 1,000 feet, at a minimum, and at all entry points. Unlimited public access sites must have signs posted at all entry points.

    b. Unlimited Public Access: Unlimited public access sites must have advisory signs posted at all entry points that indicate the site is spray irrigated with treated wastewater. Verbiage should include the following wording: "RECYCLED WASTEWATER – DO NOT DRINK". Alternate verbiage may be used if approved in writing by the Department.

11. Potable ground or surface water may be used for distribution system testing and irrigation to establish vegetation when sufficient treated effluent is not available.

12. Phased Systems

    a. Once an operation permit has been issued and the wastewater flow reaches 80% of the permitted treatment capacity for the constructed phase based on a period of seven (7) consecutive days, the Permittee must submit written notification to the Department. The written notification must include a work plan for construction of the next permitted phase. The Permittee must submit a construction permit application, plans and specifications and Design Engineer Report with applicable fees if the next phase has not yet been permitted or if there are changes to the previously permitted design.

    b. Any flow above the permitted flow for a phase shall not be allowed to be discharged to the system until construction is completed on the following phase and an operating permit has been issued or amended by the Department for the next phase.

    c. Required documents for connecting subdivisions may be found in Section 6.5.10.3.1 of the Regulations.

13. In the event that the permittee installs new monitoring wells or replaces any existing monitoring wells, the Permittee shall submit to the Department's Groundwater Discharges Section new elevation details relative to the common benchmark previously established. Additionally, the permittee shall conduct a groundwater quality sampling program prior to initiation of wastewater disposal activities on the area incorporating the well. The sampling program shall be sufficient to establish representative groundwater quality at each well prior to initiation of the wastewater disposal activities. A minimum of three samples shall be collected at least one month apart and analyzed. A summary report detailing all analyses shall be submitted to the Department's Groundwater Discharges Section prior to initiation of wastewater disposal activities. Analyses shall include the parameters iterated in Section 6.8.1 of the Regulations.

14. The Permittee shall calibrate all flow meters in accordance with the Manufacturer's recommendations. Calibration shall include, but not be limited to influent, effluent, continuous online turbidity and chlorine residual monitors. The calibration documentation must be submitted with the Annual Report in accordance with Part II.B.5

15. The Permittee shall operate and maintain the land treatment system in accordance with the approved Operation and Maintenance Plan (O&M). A copy of the O&M must be on site at all times. The Permittee must maintain the O&M's accuracy and applicability in accordance with both their Permit and the Regulations. In the event of a discrepancy between the O&M and the Permit or Regulations, the requirements of the Permit and the Regulations would govern.

16. At least two feet of freeboard, measured vertically from the lowest point of the berm, is required for all ponds. The lowest point of the berm must be determined and marked.

    The Permittee must notify the Department's Groundwater Discharges Section in writing prior to utilizing the freeboard in any lagoon or immediately upon unexpected encroachment into freeboard. In the event of encroachment into freeboard, Permittee shall contact the Groundwater Discharges Section to coordinate relief measures. In the event of an emergency, Permittee may contact the Department at the telephone numbers cited in Part II.B.2 of this permit; however, written notification must subsequently be provided within 5 days of encroachment.

17. If the facility does not treat sewage and has a storage tank that requires cleanout, and if the permittee intends to land apply material collected from the cleanout onto the spray irrigation field, the Permittee must analyze the material for nutrients and any other applicable parameters of concern as determined by the Groundwater Discharges Section Prior to tank cleanout being performed. Permittee must submit to the Groundwater Discharges Section a report including the results, the frequency and estimated volume of material to be applied, and how and where it will be applied. The report must include a mathematical analysis determining any nitrogen loading from the tank cleaning combined with nitrogen loading from wastewater application will not exceed the allowable nitrogen load.

18. Fencing is required at treatment facilities, pump stations and storage/treatment ponds. Fencing of spray fields is not required.

19. The collection and channelization of irrigated wastewater for purposes other than retreatment is prohibited.

20. Direct application of treated wastewater to drainage ditches, any water bodies, and wetlands is prohibited.

21. Emergency Repairs

    Emergency repairs or the replacement of critical "like kind" components of the wastewater treatment facility necessary for the continued operation of the facility may be performed without first obtaining a construction permit from the Department.

    A report must be submitted to the Department within five (5) days of completion of the emergency repairs. The report must summarize the nature of the emergency and the repairs performed. All violations must also be reported in accordance with Section 6.5.9.

22. Adverse Impact

    The Permittee shall take all steps to minimize any adverse impact to the Waters of the State resulting from operation under this permit. Such steps shall include, but not be limited to, accelerated or additional monitoring as necessary to determine the nature and impact of the non-complying discharge or mitigation of such impacts.

23. Bypassing

The diversion of flow from any portion of the treatment facility's process flow (including, but not limited to, pretreatment, storage, distribution and land application) necessary to maintain compliance with the terms and conditions of this permit is prohibited unless:

a. The bypass is unavoidable to prevent personal injury, loss of life, severe property damage, or materially adversely affect public health and/or the environment; or

b. There are no alternatives readily available.

The Groundwater Discharges Section must be orally notified within 24 hours after such bypass; and, a written submission regarding the bypass must be submitted within five days of the Permittee's becoming aware of the bypass. Where the need for a bypass is known (or should have been known) in advance, this notification must be submitted to the Groundwater Discharges Section for approval at least ten days prior, or as soon as possible, before the date of bypass.

The treatment facility must be repaired and restored to the permitted design operations process flow.

24. Removed Substances

Solids, sludges, filter backwash or other pollutants removed in the collection, conveyance, or treatment of wastewater shall be disposed of in a manner such as to prevent any pollutant from entering the surface water or groundwater and to comply with applicable federal or state laws and regulations.

25. Power Failures

An alternative power source, which is sufficient to operate the wastewater treatment and disposal facilities, shall be available. If such alternative power source is not available, the Permittee shall halt, reduce or otherwise control production and/or all discharges upon the reduction, loss, or failure of the primary source of power to the wastewater facilities.

PART IV

A. MANAGEMENT REQUIREMENTS AND RESPONSIBILITIES

1. Initiation of Facility Operations Notification

   If this permit is for initial operations following construction, the Permittee shall notify the Department in writing within 24 hours of the initiation of operations.

2. Operation Permit Re-Issuance

   At least 180 days before the expiration date of this permit, the Permittee must submit an application for renewal or notify the Department of the intent to cease discharging by the expiration date. The application package for systems with a design flow ≥ 100,000 gpd, must include a five (5) year Compliance Monitoring Report (CMR). The CMR must be in accordance with Section 6.5.4.3 of Regulations. In the event that a timely and complete application has been submitted as determined by the Department, and the Department is unable, through no fault of the Permittee, to issue a new permit before the expiration date of this permit, the terms and conditions of this permit are automatically continued and remain fully effective and enforceable until a decision is made on the new application.

3. Change in Discharge

   All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit.

   Any anticipated facility expansions, production increases, or process modifications that will result in new, different, or increased discharges of pollutants must be reported in writing to the Department's Groundwater Discharges Section for approval. A new permit may be required.

   Any other activity which would constitute cause for modification or revocation and reissuance of this permit as described in Part V.A.1 of this permit shall be reported to the Groundwater Discharges Section. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

4. Non-compliance Notification

   The Permittee shall report to the Department's Enforcement Section at (800) 662-8802 any unpermitted release or discharge of any contaminant into the air, or a pollutant, including petroleum substances, into surface waters, groundwater, or onto land as soon as the Permittee has knowledge of, or should have had knowledge of, the release or discharge.

   The Permittee shall report to the Groundwater Discharges Section orally within 24 hours from the time the Permittee became aware of any noncompliance that may endanger the public health or the environment by contacting the Groundwater Discharges Section at the telephone numbers cited in Part II.B.2 of this permit.

   If for any reason the Permittee does not comply with, or will be unable to comply with, any effluent limitations or other conditions specified in this permit, the Permittee shall provide the Department with the following information in writing within five days of becoming aware of any actual or potential non-compliance:

   a. A description and cause of the non-compliance with any limitation or condition;

   b. The period of non-compliance including exact dates and times; or, if not yet corrected, the anticipated time the non-compliance is expected to continue; and

c. The steps being taken or planned to reduce, eliminate and/or prevent recurrence of the non-compliant condition.

5. Facility and Construction Changes

The Permittee shall submit a written report to the Department for review and approval, of any changes to the facility or construction of the system within the following time periods:

a. Thirty days before any planned activity, physical alteration to the permitted facility or addition to the permitted facility if that activity, alteration or addition would result in a change in information that was previously submitted to the Department;

b. Thirty days before any anticipated change which would result in noncompliance with any permit condition or the regulations; or

b. Immediately after the Permittee becomes aware of relevant facts omitted from, or incorrect information submitted in, a permit application or report to the Department.

6. Right of Entry

The permittee shall allow the Department entry and access, consistent with 7 Del.C. Ch. 60, to:

a. Enter the permitted facility.

b. Inspect any records that must be kept under the conditions of the permit.

c. Inspect any facility, equipment, practice, or operation permitted or required by the permit.

d. Sample or monitor for the purpose of assuring permit compliance of any substance or any parameter at the facility.

7. Permit Transferability

Permits may be transferred to a new owner or operator. The permittee must notify the Department by requesting a change of ownership of the permit before the date of transfer. The transfer must be consistent with any notarized legal documents and/or CPCN required by the Regulations. The legal documentation must be provided with the application. The application must be received 30 days before the transfer.

a. No person shall transfer a permit from one (1) person to another unless 30 days written notice is given to the Department, indicating the transfer is agreeable to both persons, and approval of such transfer is obtained in writing from the Department, and any conditions of the approval of such transfer is obtained in writing from the Department, and any conditions of the transfer approved by the Department are complied with by the transferor and the transferee.

b. The notice to the Department shall contain a written agreement between the transferor and the transferee, indicating the specific date of proposed transfer of permit coverage and acknowledging responsibilities of current and new permittees for compliance with and liability for the terms and conditions of this permit. The notice shall be signed by both the transferor and the transferee.

PART V

A. PROVISIONS

1. Permit Revocation

The Department may revoke a permit if, among other things, the permittee violates any permit condition, these regulations, fails to pay applicable Departmental fees, obtains the permit by misrepresentation or fails to fully disclose all relevant facts.

Except in cases of emergency, the Department shall issue a written notice of intent to revoke to the permittee prior to final revocation. Revocation shall become final within 20 days of receipt of the notice by the permittee, unless within that time the permittee requests an administrative hearing in writing.

The Department shall notify the permittee in writing of any revocation hearing at least 20 days prior to the date set for such hearing.

If the Department finds the public health, safety or welfare requires emergency action, the Department shall incorporate findings in support of such action in a written notice of emergency revocation issued to the permittee. Emergency revocation shall be effective upon receipt by the permittee. Thereafter, if requested by the permittee in writing, the Department shall provide the permittee a revocation hearing.

2. Permit Modifications/Amendments

In consultation with the permittee, the Department may modify or amend an existing permit provided that the modifications would not result in an increased impact or risk to the environment or to public health.

3. State Laws

This permit shall not be construed to preclude the institution of any legal action or relieve the Permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation.

4. Property Rights

The issuance of this permit does not convey any property rights of either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

5. Severability

The provisions of this permit are severable. If any provision of this permit, or the application of any provision of this permit, to any circumstances is held invalid; the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

6. This permit does not relieve the Permittee of complying with any applicable Federal, State or local regulations.

7. In the event that the Regulations Governing the Design, Installation and Operation of On-Site Wastewater Treatment and Disposal Systems or applicable federal regulations are revised, this permit may be opened and modified accordingly after notice and opportunity for a public hearing.

8. This permit supersedes all previous spray irrigation operation permits issued to the Permittee.

Attachment B

Water Balance/Determination of Design Wastewater Loading (Lw)

1. Allowable hydraulic loading based on limiting to percolate nitrogen concetration to less than 10 mg/l

	Pr (in)	Et (in)	U (lb/mo)	f	Cn (mg/l)	Cp (mg/l)	Lwn (in)	Lw (in)	Design Lw (in)
Jan	3.0	0.1	0.3	0	10	9	27.5	206.4	27.5
Feb	3.2	0.1	2.0	0	10	9	36.5	185.9	36.5
Mar	4.1	0.7	10.4	0	10	9	76.4	205.9	76.4
Apr	3.2	1.8	22.1	0	10	9	109.8	201.1	109.8
May	3.4	3.3	22.8	0	10	9	101.0	209.2	101.0
Jun	3.6	4.8	15.1	0	10	9	55.7	203.7	55.7
Jul	3.9	5.5	30.2	0	10	9	118.7	210.9	118.7
Aug	5.3	4.9	22.7	0	10	9	103.4	208.9	103.4
Sep	3.6	3.6	7.6	0	10	9	33.3	202.5	33.3
Oct	3.5	1.9	0.0	0	10	9	14.4	207.7	14.4
Nov	3.1	0.9	0.0	0	10	9	19.8	200.3	19.8
Dec	3.6	0.2	0.0	0	10	9	30.6	205.9	30.6

2. Allowable hydraulic loading based on soil infiltration testing

Overall average measured infiltration rate[10] 4.02 in/hour

Pw per day using a safety of 7% 6.8 in/day

	Days	Pr (in)	Et (in)	Et-Pr (in)	Pw (in)	Lw (in)
Jan	31	3.0	0.1	2.9	209.25	206.4
Feb	28	3.2	0.1	3.1	189.00	185.9
Mar	31	4.1	0.7	3.4	209.25	205.9
Apr	30	3.2	1.8	1.4	202.50	201.1
May	31	3.4	3.3	0.1	209.25	209.2
Jun	30	3.6	4.8	-1.2	202.50	203.7
Jul	31	3.9	5.5	-1.6	209.25	210.9
Aug	31	5.3	4.9	0.4	209.25	208.9
Sep	30	3.6	3.6	0.0	202.50	202.5
Oct	31	3.5	1.9	1.6	209.25	207.7
Nov	30	3.1	0.9	2.2	202.50	200.3
Dec	31	3.6	0.2	3.4	209.25	205.9

Notes and assumptions

1. Pr = Precipitation (in/mo) - from DNREC table of standard values
2. Et = Evapotranspiration (in/mo) - from DNREC table of standard values
3. U = N Uptake (lb/ac/mo) - form DNREC table based on Small Grain-Soybean year
4. f = fraction of effluent N which is denitrified or volatilized, assumed to be 0, Conservative
5. Cn = effleunt N (mg/l)
6. Cp = Percolate N limit (mg/l), conservative
7. Lwn - Allowable application rate based on percolate N limit (in/mo)
8. Lw - Allowable application rate based soil hydrulic conductivity (in/mo)
9. Pw = Allowable percolation depth with saefy factor applied to hydraulic conductivity measurments, (in/mo)
10. Based on infiltration testing completed by EarthData Inc., 2019

Attachment C

Corn uptake 26.18 lb/ac/yr TP based 150 bu/ac yield

883 acres

	Flow (mgd)>	2	2.1	2.2	2.3	2.4	2.5	2.6
	(mgy)>	730	766.5	803	839.5	876	912.5	949
	TP							
Effluent	0.5	3.45	3.62	3.79	3.96	4.14	4.31	4.48
P Conc	1.0	6.89	7.24	7.58	7.93	8.27	8.62	8.96
(mg/l)	1.5	10.34	10.86	11.38	11.89	12.41	12.93	13.45
	2.0	13.79	14.48	15.17	15.86	16.55	17.24	17.93
	2.5	17.24	18.10	18.96	19.82	20.68	21.55	22.41
	3.0	20.68	21.72	22.75	23.79	24.82	25.86	26.89
	3.5	24.13	25.34	26.55	27.75	28.96	30.17	31.37
	4.0	27.58	28.96	30.34	31.72	33.10	34.47	35.85
	4.5	31.03	32.58	34.13	35.68	37.23	38.78	40.34
	5.0	34.47	36.20	37.92	39.65	41.37	43.09	44.82

Attachment D

Land Limiting Constuent Analysis (Metals)

Wastewater Loading Rate	949	MG/year
Area	893.63	acres
CEC (Based on 2018 data, average of all samples)	4.74	meq/100g

Parameter	Concentration in Soils* (mg/kg)	Metal Content** (lb/acre)	Allowable Loading Level (CEC<5) (lb/acre)	Remaining Capacity (lb/acre)	Assumed Effulent Concentration (mg/L)	Lbs Applied per Acre pre Year (lbs/yr-acre)	Site Life (yrs)
Cadmium	0.4909	0.984	4.4	3.42	0.00207	0.018	186
Copper	2.42	4.849	125.0	120.15	0.00830	0.074	1634
Lead	12.2944	24.635	500.0	475.36	0.00302	0.027	17792
Nickel	1.7070	3.420	125.0	121.58	0.00524	0.046	2618
Zinc	5.97	11.962	250.0	238.04	0.13800	1.222	195

Effleunt Metal Data History

	2017 (mg/l)		2018 (mg/l)		2019 (mg/l)	Average (mg/l)
Cadmium	0.0005	***	0.0005	***	0.00521	0.00207
Copper	0.0057		0.0024		0.0168	0.00830
Lead	0.001	***	0.0014		0.00665	0.00302
Nickel	0.0069		0.0033		0.00553	0.00524
Zinc	0.227		0.017		0.17	0.13800

* Most recent data is used. Copper and Zinc values are from 2018. Cadmium, Lead, and Nickel are from 2017.

** Assumed soil weight per acre > 43,560 sq/ft acre x 0.5 ft x 92 lb/cu ft = 2,003,760 lbs/ac

*** Indicates measured value was below detection limit

DUFFIELD ASSOCIATES
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CHECKED BY:	DESIGNED BY:	CHKD BY DATE
SHL	SCH	
FILE NAME:	DRAWN BY:	
####XX-XXX	DAC	

ENGINEER'S_NAME

STATE:_XXXXXX P.E._#####

NO.	REVISION

PRELIMINARY
NOT FOR
CONSTRUCTION

OWNER:

SPRAY FIELD SITE PLAN
WHBJ FIELDS 1 THRU 7
COMPLIANCE MONITORING REPORT
MOUNTAIRE FARMS, INC.
MILLSBORO~SUSSEX COUNTY~DELAWARE

DATE:	DECEMBER 2016
SCALE:	1" = 400'
PROJECT NO.	10806.BE
SHEET:	EXHIBIT 2

1000 0 1000 2000

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DESIGNED BY:	SCH
DRAWN BY:	DAC
CHECKED BY:	SHL
FILE:	####XX-XXX

SPRAY FIELD SITE PLAN
CENTERBLOCK FIELDS 3 THRU 3D
COMPLIANCE MONITORING REPORT
MOUNTAIRE FARMS, INC.

MILLSBORO ~ SUSSEX COUNTY ~ DELAWARE

DATE: MAY 2016

SCALE: 1" = 1000'

PROJECT NO. 10806.BE

SHEET: EXHIBIT 2

Mountaire Farms
Millsboro, DE Facility
Nutrient Management Planning – Effluent Irrigation

The purpose of this overview is to provide a description of the nutrient management planning and implementation activities associated with the cropland located around the Millsboro Delaware facility of Mountaire Farms. Currently there is approximately 1,566 acres of cropland under Mountaire's control. Approximately 893 acres of this cropland receives treated effluent water from the on-site poultry processing facility. This acreage receives this effluent via various center pivot irrigation systems operated by Mountaire for this specific purpose. Treated effluent is applied on a year round basis. All of these activities are performed in compliance with provisions set forth in a wastewater discharge permit issued through the Delaware Department of Natural Resources and Environmental Control (DNREC).

All of the farming practices are performed by outside entities that lease the associated cropland. Their farming practices are performed in accordance with a Nutrient Management Plan (NMP) that meets Delaware Department of Agriculture's Nutrient Management Program standards. All nutrient management activities are performed under the advice of a Delaware certified nutrient management planner and in conjunction with Mountaire to ensure adherence to permit requirements. Currently there are two enterprises that are responsible for the farming of the lands and all parties involved employ Keen Consulting, Inc. Georgetown, Delaware for the services related to these planning and implementation processes.

General Cropping Information

The cropping sequence employed on the effluent treated land is a corn/small grain/soybean/small grain (cover crop) rotation. All crops are harvested and sold to be utilized as animal feed. Crops are maintained in all of the spray irrigation fields on a year round basis with the exception being during brief transition times between harvesting and establishment of succeeding crops. Generally no-till and minimum-till methods (low soil disturbance) are employed. More intensive tillage is occasionally employed if environmental conditions necessitate. Supplemental fertilization is performed to account for nutrient needs not supplied via effluent applications. Liming of the soils is also performed in order to maintain a pH that is advantageous to proper crop growth. These activities are dictated by the NMP and utilize soil and plant tissue test results as a basis for decision making. Generally speaking a relatively equal split in the cropping mix on an annual basis is desired.

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Corn

Corn is planted after the termination of the winter cover crop (wheat or barley). No-till or minimum-till planting methods are usually employed. Planting occurs in mid-April to mid-May. Supplemental fertilizer (starter, pre-plant, etc.) may be applied at this time to address any additional nutrient needs.

Approximately 4-6 weeks after crop emergence soil nitrate testing may be performed to help gauge nitrogen available for crop growth. Test results along with anticipated effluent contributions are then utilized for the purposes of a supplemental nitrogen fertilization recommendation provided through the certified planner.

Corn is harvested in September to early October. Yields generally range in the 130-175 bu/acre range with a "typical" yield being 150-165 bu/acre. Corn stover is occasionally harvested and a yield of approximately 1.9 tons/acre would be expected when this occurs.

Small Grain

Small grain (barley and wheat) is planted in late September through late October. Both barley and wheat are utilized as cover or harvestable crops dependent upon the cropping rotation in a given field for a given year. Additions of lime and potassium fertilizers as dictated by soil test results are usually performed at this time.

For small grain being taken to grain harvest, a determination of anticipated supplemental crop nitrogen needs is made in early March. This is done in a collaborative fashion between the farmers, certified consultant and Mountaire personnel. This recommendation is based upon many factors which include crop condition, yield expectations, climatic conditions and contributions from both applied and anticipated applications of effluent water.

Small grains are harvested from mid-June through early July. Barley yields range from 60-99 bu/acre with 75 bu/acre being a "typical" expected yield. Wheat yields range from 37-76 bu/acre with 50-60 bu/acre being "typical". On occasion wheat and barley straw may also be harvested. Straw yields range from 1,800-3,600 lbs/acre with 2,400-3,000 lbs/acre being "typical". Soybeans are planted immediately following the small grain harvest utilizing the no-till method of farming practices.

Soybeans

Soybeans are almost exclusively planted as a "double crop" following small grain harvest. Occasionally due to environmental conditions a "full season" crop of soybeans

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may be utilized within the rotation. Full season soybeans would be planted in mid-May to early June. Double crop soybeans are planted in mid-June through early July.

There is generally no supplemental fertilization of soybeans beyond foliar applications of needed nutrients (minor elements) as dictated by soil and plant tissue test results and environmental conditions.

Double crop soybean yields range from 28-48 bu/acre with 40 bu/acre being "typical". There has not been much of a full season soybean history but an anticipated slightly higher "typical" yield of 50 bu/acre would be anticipated.

Nitrogen Overview

The following table is provided as an illustration of expected crop yields and expected nitrogen uptake values.

20012-2016 Average Crop Yields (Treated Water Irrigated Fields) and Estimated Uptake Rates				
Crop	**Yield**	**Units**	**Nitrogen Content per Unit**	**Nitrogen Uptake (lbs/acre @ Yield**
Corn	155	bu/acre	1.0	155
Corn Stover	1.9	tons/acre	18.3	34.8
Barley	75	bu/acre	1.08	81
Barley Straw	1.35	tons/acre	15.0	20.25
Wheat	55	bu/acre	1.16	63.8
Wheat Straw	1.35	tons/acre	18.0	24.3
Cover Crop	Not Harvested			40
Soybeans	40	bu/acre	3.75	150

Phosphorus Overview

On high phosphorus soils (>150 Fertility Index Value) Delaware nutrient management regulations require that a Phosphorus Site Index (PSI) be performed prior to any proposed applications of phosphorus. The purpose of this calculation is to provide a

rating of probability for phosphorus movement given a site's current conditions and the management techniques employed. The current PSI calculations for Mountaire result in ratings ranging from low to medium. A medium PSI rating requires that strategies be employed to reduce the amounts of phosphorus applied to a given site. It is recommended that Mountaire strive to achieve a wastewater phosphorus concentration that results in a reduction of phosphorus application that matches crop removal based on a three year cycle.

Summary

Nutrient management planning is performed on an on-going basis throughout the year. It is done as collaborative effort between the farmers, consultant and Mountaire personnel to ensure permit compliance along with the goal of achieving a successful farming outcome. At a minimum, soils analyses are performed on an annual basis (fall season) along with any needed in-season testing deemed appropriate to the given situation. Historical data along with past and anticipated environmental conditions are also significant to the nutrient management planning and implementation process. A monthly accounting of nutrient additions via effluent water along with any supplemental contributions of nitrogen and phosphorous through commercial fertilizers is kept in a collaborative manner between Keen Consulting (consultant) and Mountaire personnel.

ATTACHMENT H

Facility: Mountaire Farms Inc,
Field: All Fields
Date: 2/5/2020

	Design Criteria		
1	Treatment Capacity	942,065,000	gal/year
2	Treatment Capacity Average Daily Flow	2,581,000	gal/day
3	Disposal Capacity	947,362,911	gal/year
4	Disposal Average Daily Flow	2,595,514.82	gal/day
5	Number of Units	NA	
6	Soil Perc Rate	4.02	inches/hr
7	Maximum Allowed Infiltration Rate from Water Balance Calcs	0.28	inches/hr
8	Total Storage Volume	21,300,000	gallons
9	Treatment Lagoon and Storage Surface Acreage	5.36	acres
10	Total Spray Acreage	893.63	acres
11	Crop Type(s)		Corn

	Parameter	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	SUM
13	**Treatment Capacity**														
14	Influent Flow	gal/mo	80,011,000	72,268,000	80,011,000	77,430,000	80,011,000	77,430,000	80,011,000	80,011,000	77,430,000	80,011,000	77,430,000	80,011,000	942,065,000
15															
16	**Hydraulic Spray Application**														
17	Effluent Flow	gal/mo	80,600,000	72,800,000	80,600,000	78,260,530	80,258,430	77,473,664	80,127,438	80,491,305	77,662,875	80,520,415	77,968,254	80,600,000	947,362,911
18		gal/acre													
19	Calendar days per month	days/mo	31	28	31	30	31	30	31	31	30	31	30	31	365
20	Spray days per month	days/mo	26	23	26	26	25	25	24	28	24	26	27	26	306
	Spray weeks per month	week/mo	4.4	4.0	4.4	4.3	4.4	4.3	4.4	4.4	4.3	4.4	4.3	4.4	52.1
21	Spray hydraulic application rate	in/mo	3.3	3.0	3.3	3.2	3.3	3.2	3.3	3.3	3.2	3.3	3.2	3.3	39.0
22	Spray hydraulic application rate	in/week	0.75	0.75	0.75	0.75	0.75	0.74	0.75	0.75	0.75	0.75	0.75	0.75	9.0
23															
24	**Total Nitrogen Application**														
25	Total nitrogen in spray effluent	mg/L	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	
26	Total nitrogen in spray effluent	lb/acre-mo	7.52	6.79	7.52	7.30	7.49	7.23	7.48	7.51	7.25	7.51	7.28	7.52	88
27	Total nitrogen applied as commercial fertilizer	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
28	Total nitrogen applied as biosolids	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
29	Total nitrogen due to precipitation	lb/acre-mo	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	5.0
30	Total nitrogen due to fixation	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
31	Total nitrogen applied	lb/acre-mo	7.94	7.21	7.94	7.72	7.91	7.65	7.90	7.93	7.67	7.93	7.70	7.94	93
32															
33	**Ammonia Application**														
34	Ammonia in spray effluent	mg/L	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
35	Total ammonia application	lb/acre-mo	0.75	0.68	0.75	0.73	0.75	0.72	0.75	0.75	0.72	0.75	0.73	0.75	8.84
36															
37	**Nitrogen Utilization**														
38	Plant nitrogen uptake (see below)														
39	Summer Crop ****	lb/acre-mo	0.00	0.00	0.00	3.10	23.25	40.30	52.70	32.55	3.10	0.00	0.00	0.00	155.0
40	Winter Cover Crop ***	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	2.28	0.65	4.2
41	Denitrification (15% of line 26)	lb/acre-mo	1.13	1.02	1.13	1.10	1.12	1.08	1.12	1.13	1.09	1.13	1.09	1.13	13.3
42	Ammonia Volitilization (5% of line 35)	lb/acre-mo	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.4
43	Total nitrogen consumed	lb/acre-mo	1.17	1.05	1.17	4.23	24.41	41.42	53.86	33.71	4.22	2.46	3.40	1.82	172.9
44															
45	**Percolate Nitrogen Content**														
46	Total nitrogen in percolate (line 31 minus line 43)	lb/acre-mo	6.78	6.16	6.78	3.49	-16.50	-33.77	-45.96	-25.78	3.44	5.47	4.3	6.1	(79.5)
47	Total nitrogen in percolate	lb/mo	6,055	5,506	6,055	3,120	(14,746)	(30,178)	(41,072)	(23,040)	3,078	4,888	3,837	5,475	(71,021)
48															
49	**Percolate Volume**														
50	Spray Hydraulic Application (line 21)	in/mo	3.3	3.0	3.3	3.2	3.3	3.2	3.3	3.3	3.2	3.3	3.2	3.3	39.0
51	Climatoligical Normal Precipitation (Exhibit K-K)	in/mo	3.3	3.2	4.1	3.2	3.4	3.6	3.9	5.3	3.6	3.5	3.1	3.6	43.8
52	Total Hydraulic Loading	in/mo	6.6	6.2	7.4	6.4	6.7	6.8	7.2	8.6	6.8	6.8	6.3	6.9	82.8
53	Thornwaite Potential Evapotranspiration (Exhibit J-J)	in/mo	0.1	0.1	0.7	1.8	3.3	4.8	5.5	4.9	3.6	1.9	0.9	0.2	27.8
54	Percolate (line 52 minus line 53)	in/mo	6.5	6.1	6.7	4.6	3.4	2.0	1.7	3.7	3.2	4.9	5.4	6.7	55.0
55	Percolate volume	gal/mo	158,250,318	148,023,763	163,103,479	112,232,401	82,684,745	48,354,438	41,301,880	90,197,361	77,662,618	119,345,441	131,352,773	163,103,479	1,335,612,695
56															
57	**Percolate Nitrogen Concentration**														
58	Total nitrogen in percolate (line 47)	lb/mo	6,055	5,506	6,055	3,120	0	0	0	0	3,078	4,888	3,837	5,475	38,015
59	Percolate volume (line 55)	gal/mo	158,250,318	148,023,763	163,103,479	112,232,401	82,684,745	48,354,438	41,301,880	90,197,361	77,662,618	119,345,441	131,352,773	163,103,479	1,335,612,695
60	Total nitrogen concentration in percolate	lb/MG	38.26	37.20	37.13	27.80	-	-	-	-	39.64	40.96	29.21	33.57	28.46
61	**Nitrogen concentration in percolate**	**mg/L**	**4.6**	**4.5**	**4.5**	**3.3**	**0.0**	**0.0**	**0.0**	**0.0**	**4.8**	**4.9**	**3.5**	**4.0**	**2.8**

	STORAGE	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	SUM
63	Volume Generated (line 14)	gal/mo	80,011,000	72,268,000	80,011,000	77,430,000	80,011,000	77,430,000	80,011,000	80,011,000	77,430,000	80,011,000	77,430,000	80,011,000	942,065,000
64	Volume Irrigated (line 17)	gal/mo	80,600,000	72,800,000	80,600,000	78,260,530	80,258,430	77,473,664	80,127,438	80,491,305	77,662,875	80,520,415	77,968,254	80,600,000	947,362,911
65	Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K)")	gal/mo	684,071	640,407	815,063	654,961	727,735	742,290	916,946	1,193,485	756,844	785,954	669,516	756,844	9,344,117

66	Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9)	gal/mo	14,555	14,555	101,883	261,985	480,305	698,626	800,508	713,180	523,969	276,539	130,992	29,109	4,046,206
67	Volume Stored	gal/mo	80,516	93,852	124,180	(437,553)	(0)	0	(0)	0	0	(1)	270	138,735	(0.40)
68	Cumulative Volume Stored	gal/mo	219,521	313,373	437,553	0							270	139,005	
		P5 (in/mo)	4.7	4.4	5.6	4.5	5	5.1	6.3	8.2	5.2	5.4	4.6	5.2	64.2

Facility: Mountaire Farms Inc,
Field: All Fields
Date: 2/5/2020

	Design Criteria		
1	Treatment Capacity	942,065,000	gal/year
2	Treatment Capacity Average Daily Flow	2,581,000	gal/day
3	Disposal Capacity	947,362,911	gal/year
4	Disposal Average Daily Flow	2,595,515	gal/day
5	Number of Units	NA	
6	Soil Perc Rate	Varies	inches/hr
7	Maximum Allowed Infiltration Rate from Water Balance Calcs	0.28	inches/hr
8	Total Storage Volume	21,300,000	gallons
9	Treatment Lagoon and Storage Surface Acreage	5.36	acres
10	Total Spray Acreage	893.63	acres
11	Crop Type(s)		Soybean

12	Parameter	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	SUM
13	**Treatment Capacity**														
14	Influent Flow	gal/mo	80,011,000	72,268,000	80,011,000	77,430,000	80,011,000	77,430,000	80,011,000	80,011,000	77,430,000	80,011,000	77,430,000	80,011,000	942,065,000
15															
16	**Hydraulic Spray Application**														
17	Effluent Flow	gal/mo	80,600,000	72,800,000	80,600,000	78,260,530	80,258,430	77,473,664	80,127,438	80,491,305	77,662,875	80,520,415	77,968,254	80,600,000	947,362,911
18		gal/acre													
19	Calendar days per month	days/mo	31	28	31	30	31	30	31	31	30	31	30	31	365
20	Spray days per month	days/mo	26	23	26	26	25	25	24	28	24	26	27	26	306
	Spray weeks per month	week/mo	4.4	4.0	4.4	4.3	4.4	4.3	4.4	4.4	4.3	4.4	4.3	4.4	52.14
21	Spray hydraulic application rate	in/mo	3.3	3.0	3.3	3.2	3.3	3.2	3.3	3.3	3.2	3.3	3.2	3.3	39.04
22	Spray hydraulic application rate	in/week	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	8.98
23															
24	**Total Nitrogen Application**														
25	Total nitrogen in spray effluent	mg/L	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	
26	Total nitrogen in spray effluent	lb/acre-mo	7.52	6.79	7.52	7.30	7.49	7.23	7.48	7.51	7.25	7.51	7.28	7.52	88.4
27	Total nitrogen applied as commercial fertilizer	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
28	Total nitrogen applied as biosolids	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
29	Total nitrogen due to precipitation	lb/acre-mo	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	5.0
30	Total nitrogen due to fixation	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	12.00	24.00	18.00	6.00	0.00	0.00	0.00	60.0
31	Total nitrogen applied	lb/acre-mo	7.94	7.21	7.94	7.72	7.91	7.65	7.90	7.93	7.67	7.93	7.70	7.94	93.5
32															
33	**Ammonia Application**														
34	Ammonia in spray effluent	mg/L	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
35	Total ammonia application	lb/acre-mo	0.75	0.67	0.75	0.72	0.75	0.72	0.75	0.75	0.72	0.75	0.72	0.75	8.8
36															
37	**Nitrogen Utilization**														
38	Plant nitrogen uptake (see below)														
39	Summer Crop ****	lb/acre-mo	0.0	0.0	0.0	0.0	0.0	30.0	60.0	45.0	15.0	0.0	0.0	0.0	150.0
40	Winter Cover Crop ***	lb/acre-mo	0.3	1.9	10.2	21.7	22.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.5
41	Denitrification (15% of line 26)	lb/acre-mo	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	13.3
42	Ammonia Volitilization (5% of line 35)	lb/acre-mo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
43	Total nitrogen consumed	lb/acre-mo	1.5	3.0	11.4	22.8	23.5	19.1	37.2	28.2	10.1	1.2	1.1	1.2	160.2
44															
45	**Percolate Nitrogen Content**														
46	Total nitrogen in percolate (line 31 minus line 43)	lb/acre-mo	6.46	4.25	-3.43	-15.10	-15.58	-11.47	-29.26	-20.23	-2.46	6.77	6.6	6.8	(66.7)
47	Total nitrogen in percolate	lb/mo	5,771	3,796	(3,066)	(13,494)	(13,923)	(10,250)	(26,148)	(18,080)	(2,194)	6,050	5,870	6,056	(59,614)
48															
49	**Percolate Volume**														
50	Spray Hydraulic Application (line 21)	in/mo	3.3	3.0	3.3	3.2	3.3	3.2	3.3	3.3	3.2	3.3	3.2	3.3	39.0
51	Climatoligical Normal Precipitation (Exhibit K-K)	in/mo	3.3	3.2	4.1	3.2	3.4	3.6	3.9	5.3	3.6	3.5	3.1	3.6	43.8
52	Total Hydraulic Loading	in/mo	6.6	6.2	7.4	6.4	6.7	6.8	7.2	8.6	6.8	6.8	6.3	6.9	82.8
53	Thornwaite Potential Evapotranspiration (Exhibit J-J)	in/mo	0.1	0.1	0.7	1.8	3.3	4.8	5.5	4.9	3.6	1.9	0.9	0.2	27.8
54	Percolate (line 52 minus line 53)	in/mo	6.5	6.1	6.7	4.6	3.4	2.0	1.7	3.7	3.2	4.9	5.4	6.7	55.0
55	Percolate volume	gal/mo	158,250,318	148,023,763	163,103,479	112,232,401	82,684,745	48,354,438	41,301,880	90,197,361	77,662,618	119,345,441	131,352,773	163,103,479	1,335,612,695
56															
57	**Percolate Nitrogen Concentration**														
58	Total nitrogen in percolate (line 47)	lb/mo	5,771	3,796	0	0	0	0	0	0	0	6,050	5,870	6,056	27,542.15
59	Percolate volume (line 55)	gal/mo	158,250,318	148,023,763	163,103,479	112,232,401	82,684,745	48,354,438	41,301,880	90,197,361	77,662,618	119,345,441	131,352,773	163,103,479	1,335,612,695
60	Total nitrogen concentration in percolate	lb/MG	36.47	25.64	-	-	-	-	-	-	-	50.69	44.69	37.13	20.62
61	**Nitrogen concentration in percolate**	**mg/L**	**4.4**	**3.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**6.1**	**5.4**	**4.5**	**1.9**

62	**STORAGE**	**Units**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**SUM**
63	Volume Generated (line 14)	gal/mo	80,011,000	72,268,000	80,011,000	77,430,000	80,011,000	77,430,000	80,011,000	80,011,000	77,430,000	80,011,000	77,430,000	80,011,000	942,065,000
64	Volume Irrigated (line 17)	gal/mo	80,600,000	72,800,000	80,600,000	78,260,530	80,258,430	77,473,664	80,127,438	80,491,305	77,662,875	80,520,415	77,968,254	80,600,000	947,362,911
65	Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K)")	gal/mo	684,071	640,407	815,063	654,961	727,735	742,290	916,946	1,193,485	756,844	785,954	669,516	756,844	9,344,117
66	Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9)	gal/mo	14,555	14,555	101,883	261,985	480,305	698,626	800,508	713,180	523,969	276,539	130,992	29,109	4,046,206
67	Volume Stored	gal/mo	80,516	93,852	124,180	(437,553)	(0)	0	(0)	0	0	(1)	270	138,735	

68	Cumulative Volume Stored	gal/mo	219,521	313,373	437,553	0	0	0	(0)	0	0	(0)	270	139,005	

ATTACHMENT I

Facility: Mountaire Farms Inc,
Field: All Fields
Date: 2/5/2020

	Design Criteria		
1	Treatment Capacity	949,000,000	gal/year
2	Treatment Capacity Average Daily Flow	2,600,000	gal/day
3	Disposal Capacity	1,460,000,000	gal/year
4	Disposal Average Daily Flow	4,000,000	gal/day
5	Number of Units	NA	
6	Soil Perc Rate	4.02	inches/hr
7	Maximum Allowed Infiltration Rate from Water Balance Calcs	0.28	inches/hr
8	Total Storage Volume	21,300,000	gallons
9	Treatment Lagoon and Storage Surface Acreage	5.36	acres
10	Total Spray Acreage	893.63	acres
11	Crop Type(s)		Corn

	Parameter	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	SUM
13	**Treatment Capacity**														
14	Influent Flow	gal/mo	80,600,000	72,800,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	949,000,000
15															
16	**Hydraulic Spray Application**														
17	Effluent Flow	gal/mo	124,000,000	112,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	949,000,000
18		gal/acre													
19	Calendar days per month	days/mo	31	28	31	30	31	30	31	31	30	31	30	31	365
20	Spray days per month	days/mo	26	23	26	26	25	25	24	28	24	26	27	26	306
	Spray weeks per month	week/mo	4.4	4.0	4.4	4.3	4.4	4.3	4.4	4.4	4.3	4.4	4.3	4.4	52.1
21	Spray hydraulic application rate	in/mo	5.1	4.6	5.1	4.9	5.1	4.9	5.1	5.1	4.9	5.1	4.9	5.1	60.2
22	Spray hydraulic application rate	in/week	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	13.8
23															
24	**Total Nitrogen Application**														
25	Total nitrogen in spray effluent	mg/L	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	
26	Total nitrogen in spray effluent	lb/acre-mo	11.57	10.45	11.57	11.20	11.57	11.20	11.57	11.57	11.20	11.57	11.20	11.57	136
27	Total nitrogen applied as commercial fertilizer	lb/acre-mo	0.00	0.00	0.00	7.00	24.00	38.00	50.00	0.00	0.00	0.00	0.00	0.00	119
28	Total nitrogen applied as biosolids	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
29	Total nitrogen due to precipitation	lb/acre-mo	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	5.0
30	Total nitrogen due to fixation	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
31	Total nitrogen applied	lb/acre-mo	11.99	10.87	11.99	18.62	35.99	49.62	61.99	11.99	11.62	11.99	11.62	11.99	260
32															
33	**Ammonia Application**														
34	Ammonia in spray effluent	mg/L	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
35	Total ammonia application	lb/acre-mo	1.16	1.05	1.16	1.12	1.16	1.12	1.16	1.16	1.12	1.16	1.12	1.16	13.63
36															
37	**Nitrogen Utilization**														
38	Plant nitrogen uptake (see below)														
39	Summer Crop ****	lb/acre-mo	0.00	0.00	0.00	3.10	23.25	40.30	52.70	32.55	3.10	0.00	0.00	0.00	155.0
40	Winter Cover Crop ***	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	2.28	0.65	4.2
41	Denitrification (15% of line 26)	lb/acre-mo	1.74	1.57	1.74	1.68	1.74	1.68	1.74	1.74	1.68	1.74	1.68	1.74	20.4
42	Ammonia Volitilization (5% of line 35)	lb/acre-mo	0.06	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.7
43	Total nitrogen consumed	lb/acre-mo	1.79	1.62	1.79	4.84	25.04	42.04	54.49	34.34	4.84	3.09	4.01	2.44	180.3
44															
45	**Percolate Nitrogen Content**														
46	Total nitrogen in percolate (line 31 minus line 43)	lb/acre-mo	10.20	9.25	10.20	13.78	10.95	7.58	7.50	-22.35	6.78	8.90	7.6	9.5	80.0
47	Total nitrogen in percolate	lb/mo	9,114	8,268	9,114	12,317	9,784	6,777	6,701	(19,974)	6,062	7,952	6,799	8,533	71,448
48															
49	**Percolate Volume**														
50	Spray Hydraulic Application (line 21)	in/mo	5.1	4.6	5.1	4.9	5.1	4.9	5.1	5.1	4.9	5.1	4.9	5.1	60.2
51	Climatoligical Normal Precipitation (Exhibit K-K)	in/mo	3.3	3.2	4.1	3.2	3.4	3.6	3.9	5.3	3.6	3.5	3.1	3.6	43.8
52	Total Hydraulic Loading	in/mo	8.4	7.8	9.2	8.1	8.5	8.5	9.0	10.4	8.5	8.6	8.0	8.7	104.0
53	Thornwaite Potential Evapotranspiration (Exhibit J-J)	in/mo	0.1	0.1	0.7	1.8	3.3	4.8	5.5	4.9	3.6	1.9	0.9	0.2	27.8
54	Percolate (line 52 minus line 53)	in/mo	8.3	7.7	8.5	6.3	5.2	3.7	3.5	5.5	4.9	6.7	7.1	8.5	76.2
55	Percolate volume	gal/mo	201,650,174	187,223,633	206,503,335	153,971,733	126,426,170	90,880,633	85,174,297	133,705,912	119,999,602	162,824,881	173,384,379	206,503,335	1,848,248,085
56															
57	**Percolate Nitrogen Concentration**														
58	Total nitrogen in percolate (line 47)	lb/mo	9,114	8,268	9,114	12,317	9784.1991	6,777	6,701	0	6,062	7,952	6,799	8,533	91,422
59	Percolate volume (line 55)	gal/mo	201,650,174	187,223,633	206,503,335	153,971,733	126,426,170	90,880,633	85,174,297	133,705,912	119,999,602	162,824,881	173,384,379	206,503,335	1,848,248,085
60	Total nitrogen concentration in percolate	lb/MG	45.20	44.16	44.13	80.00	77.39	74.57	78.68	-	50.52	48.84	39.21	41.32	49.46
61	**Nitrogen concentration in percolate**	**mg/L**	**5.4**	**5.3**	**5.3**	**9.6**	**9.3**	**8.9**	**9.4**	**0.0**	**6.1**	**5.9**	**4.7**	**5.0**	**6.2**
62	**STORAGE**	**Units**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**SUM**
63	Volume Generated (line 14)	gal/mo	80,600,000	72,800,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	949,000,000
64	Volume Irrigated (line 17)	gal/mo	124,000,000	112,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	1,460,000,000
65	Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K)")	gal/mo	684,071	640,407	815,063	654,961	727,735	742,290	916,946	1,193,485	756,844	785,954	669,516	756,844	9,344,117
66	Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9)	gal/mo	14,555	14,555	101,883	261,985	480,305	698,626	800,508	713,180	523,969	276,539	130,992	29,109	4,046,206
67	Volume Stored	gal/mo	(42,730,484)	(38,574,148)	(42,686,820)	(41,607,023)	(43,152,570)	(41,956,336)	(43,283,562)	(42,919,695)	(41,767,125)	(42,890,586)	(41,461,476)	(42,672,265)	(505,702,089.40)

68	Cumulative Volume Stored	gal/mo													

Facility: Mountaire Farms Inc,
Field: All Fields
Date: 2/5/2020

	Design Criteria		
1	Treatment Capacity	949,000,000	gal/year
2	Treatment Capacity Average Daily Flow	2,600,000	gal/day
3	Disposal Capacity	949,000,000	gal/year
4	Disposal Average Daily Flow	4,000,000	gal/day
5	Number of Units	NA	
6	Soil Perc Rate	4.02	inches/hr
7	Maximum Allowed Infiltration Rate from Water Balance Calcs	0.28	inches/hr
8	Total Storage Volume	21,300,000	gallons
9	Treatment Lagoon and Storage Surface Acreage	5.36	acres
10	Total Spray Acreage	893.63	acres
11	Crop Type(s)		Soybean

	Parameter	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	SUM
13	**Treatment Capacity**														
14	Influent Flow	gal/mo	80,600,000	72,800,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	949,000,000
15															
16	**Hydraulic Spray Application**														
17	Effluent Flow	gal/mo	124,000,000	112,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	1,460,000,000
18		gal/acre													
19	Calendar days per month	days/mo	31	28	31	30	31	30	31	31	30	31	30	31	365
20	Spray days per month	days/mo	26	23	26	26	25	25	24	28	24	26	27	26	306
	Spray weeks per month	week/mo	4.4	4.0	4.4	4.3	4.4	4.3	4.4	4.4	4.3	4.4	4.3	4.4	52.14
21	Spray hydraulic application rate	in/mo	5.1	4.6	5.1	4.9	5.1	4.9	5.1	5.1	4.9	5.1	4.9	5.1	60.17
22	Spray hydraulic application rate	in/week	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	13.85
23															
24	**Total Nitrogen Application**														
25	Total nitrogen in spray effluent	mg/L	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	
26	Total nitrogen in spray effluent	lb/acre-mo	11.57	10.45	11.57	11.20	11.57	11.20	11.57	11.57	11.20	11.57	11.20	11.57	136.3
27	Total nitrogen applied as commercial fertilizer	lb/acre-mo	0.00	0.00	0.00	7.00	23.00	13.00	27.00	0.00	0.00	0.00	0.00	0.00	70.0
28	Total nitrogen applied as biosolids	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
29	Total nitrogen due to precipitation	lb/acre-mo	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	5.0
30	Total nitrogen due to fixation	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	12.00	24.00	18.00	6.00	0.00	0.00	0.00	60.0
31	Total nitrogen applied	lb/acre-mo	11.99	10.87	11.99	18.62	34.99	24.62	38.99	11.99	11.62	11.99	11.62	11.99	211.3
32															
33	**Ammonia Application**														
34	Ammonia in spray effluent	mg/L	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
35	Total ammonia application	lb/acre-mo	0.75	0.68	0.75	0.73	0.75	0.73	0.75	0.75	0.73	0.75	0.73	0.75	8.9
36															
37	**Nitrogen Utilization**														
38	Plant nitrogen uptake (see below)														
39	Summer Crop ****	lb/acre-mo	0.0	0.0	0.0	0.0	0.0	30.0	60.0	45.0	15.0	0.0	0.0	0.0	150.0
40	Winter Cover Crop ***	lb/acre-mo	0.3	1.9	10.2	21.7	22.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.5
41	Denitrification (15% of line 26)	lb/acre-mo	1.7	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	20.4
42	Ammonia Volitilization (5% of line 35)	lb/acre-mo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
43	Total nitrogen consumed	lb/acre-mo	2.1	3.5	12.0	23.4	24.1	19.7	37.8	28.8	10.7	1.8	1.7	1.8	167.3
44															
45	**Percolate Nitrogen Content**														
46	Total nitrogen in percolate (line 31 minus line 43)	lb/acre-mo	9.90	7.36	0.01	-4.79	10.89	4.90	1.22	-16.78	0.90	10.22	9.9	10.2	44.0
47	Total nitrogen in percolate	lb/mo	8,847	6,574	10	(4,280)	9,731	4,381	1,089	(14,996)	807	9,132	8,850	9,132	39,278
48															
49	**Percolate Volume**														
50	Spray Hydraulic Application (line 21)	in/mo	5.1	4.6	5.1	4.9	5.1	4.9	5.1	5.1	4.9	5.1	4.9	5.1	60.2
51	Climatoligical Normal Precipitation (Exhibit K-K)	in/mo	3.3	3.2	4.1	3.2	3.4	3.6	3.9	5.3	3.6	3.5	3.1	3.6	43.8
52	Total Hydraulic Loading	in/mo	8.4	7.8	9.2	8.1	8.5	8.5	9.0	10.4	8.5	8.6	8.0	8.7	104.0
53	Thornwaite Potential Evapotranspiration (Exhibit J-J)	in/mo	0.1	0.1	0.7	1.8	3.3	4.8	5.5	4.9	3.6	1.9	0.9	0.2	27.8
54	Percolate (line 52 minus line 53)	in/mo	8.3	7.7	8.5	6.3	5.2	3.7	3.5	5.5	4.9	6.7	7.1	8.5	76.2
55	Percolate volume	gal/mo	201,650,174	187,223,633	206,503,335	153,971,733	126,426,170	90,880,633	85,174,297	133,705,912	119,999,602	162,824,881	173,384,379	206,503,335	1,848,248,085
56															
57	**Percolate Nitrogen Concentration**														
58	Total nitrogen in percolate (line 47)	lb/mo	8,847	6,574	10	0	9,731	4,381	1,089	0	807	9,132	8,850	9,132	58,553.48
59	Percolate volume (line 55)	gal/mo	201,650,174	187,223,633	206,503,335	153,971,733	126,426,170	90,880,633	85,174,297	133,705,912	119,999,602	162,824,881	173,384,379	206,503,335	1,848,248,085
60	Total nitrogen concentration in percolate	lb/MG	43.87	35.11	0.05	-	76.97	48.21	12.79	-	6.72	56.09	51.04	44.22	31.68
61	**Nitrogen concentration in percolate**	**mg/L**	**5.3**	**4.2**	**0.0**	**0.0**	**9.2**	**5.8**	**1.5**	**0.0**	**0.8**	**6.7**	**6.1**	**5.3**	**3.7**

	STORAGE	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	SUM
62															
63	Volume Generated (line 14)	gal/mo	80,600,000	72,800,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	949,000,000
64	Volume Irrigated (line 17)	gal/mo	124,000,000	112,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	1,460,000,000
65	Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K)")	gal/mo	684,071	640,407	815,063	654,961	727,735	742,290	916,946	1,193,485	756,844	785,954	669,516	756,844	9,344,117
66	Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9)	gal/mo	14,555	14,555	101,883	261,985	480,305	698,626	800,508	713,180	523,969	276,539	130,992	29,109	4,046,206
67	Volume Stored	gal/mo	(42,730,484)	(38,574,148)	(42,686,820)	(41,607,023)	(43,152,570)	(41,956,336)	(43,283,562)	(42,919,695)	(41,767,125)	(42,890,586)	(41,461,476)	(42,672,265)	(505,702,089.40)
68	Cumulative Volume Stored	gal/mo												(42,672,265)	

ATTACHMENT J

Facility: Mountaire Farms Inc,
Field: All Fields
Date: 2/5/2020

	Design Criteria		
1	Treatment Capacity	949,000,000	gal/year
2	Treatment Capacity Average Daily Flow	2,600,000	gal/day
3	Disposal Capacity	1,460,000,000	gal/year
4	Disposal Average Daily Flow	4,000,000	gal/day
5	Number of Units	NA	
6	Soil Perc Rate	4.02	inches/hr
7	Maximum Allowed Infiltration Rate from Water Balance Calcs	0.28	inches/hr
8	Total Storage Volume	21,300,000	gallons
9	Treatment Lagoon and Storage Surface Acreage	5.36	acres
10	Total Spray Acreage	420	acres
11	Crop Type(s)		Corn

Note: fields WHBJ-1, WHBJ-3, WHBJ-5, CB-3, and CB-3C all have maximum percolation rates less than 2.5 in/wk and are not included in this Total Spray Acreage

	Parameter	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	SUM
13	**Treatment Capacity**														
14	Influent Flow	gal/mo	80,600,000	72,800,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	949,000,000
15															
16	**Hydraulic Spray Application**														
17	Effluent Flow	gal/mo	124,000,000	112,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	124,000,000	120,000,000	124,000,000	120,000,000	72,900,000	949,000,000
18		gal/acre													
19	Calendar days per month	days/mo	31	28	31	30	31	30	31	31	30	31	30	31	365
20	Spray days per month	days/mo	26	23	26	26	25	25	24	28	24	26	27	26	306
	Spray weeks per month	week/mo	4.4	4.0	4.4	4.3	4.4	4.3	4.4	4.4	4.3	4.4	4.3	4.4	52.1
21	Spray hydraulic application rate	in/mo	10.9	9.8	10.9	10.5	10.9	10.5	10.9	10.9	10.5	10.9	10.5	6.4	123.5
22	Spray hydraulic application rate	in/week	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	1.4	28.4
23															
24	**Total Nitrogen Application**														
25	Total nitrogen in spray effluent	mg/L	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	
26	Total nitrogen in spray effluent	lb/acre-mo	24.62	22.24	24.62	23.83	24.62	23.83	24.62	24.62	23.83	24.62	23.83	14.48	280
27	Total nitrogen applied as commercial fertilizer	lb/acre-mo	0.00	0.00	0.00	7.00	24.00	38.00	50.00	0.00	0.00	0.00	0.00	0.00	119
28	Total nitrogen applied as biosolids	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
29	Total nitrogen due to precipitation	lb/acre-mo	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	5.0
30	Total nitrogen due to fixation	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
31	Total nitrogen applied	lb/acre-mo	25.04	22.66	25.04	31.25	49.04	62.25	75.04	25.04	24.25	25.04	24.25	14.90	404
32															
33	**Ammonia Application**														
34	Ammonia in spray effluent	mg/L	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
35	Total ammonia application	lb/acre-mo	2.46	2.22	2.46	2.38	2.46	2.38	2.46	2.46	2.38	2.46	2.38	1.45	27.98
36															
37	**Nitrogen Utilization**														
38	Plant nitrogen uptake (see below)														
39	Summer Crop ****	lb/acre-mo	0.00	0.00	0.00	3.10	23.25	40.30	52.70	32.55	3.10	0.00	0.00	0.00	155.0
40	Winter Cover Crop ***	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	2.28	0.65	4.2
41	Denitrification (15% of line 26)	lb/acre-mo	3.69	3.34	3.69	3.57	3.69	3.57	3.69	3.69	3.57	3.69	3.57	2.17	42.0
42	Ammonia Volitilization (5% of line 35)	lb/acre-mo	0.12	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.07	1.4
43	Total nitrogen consumed	lb/acre-mo	3.82	3.45	3.82	6.79	27.07	43.99	56.52	36.37	6.79	5.12	5.97	2.89	202.6
44															
45	**Percolate Nitrogen Content**														
46	Total nitrogen in percolate (line 31 minus line 43)	lb/acre-mo	21.23	19.21	21.23	24.46	21.98	18.26	18.53	-11.32	17.46	19.93	18.3	12.0	201.2
47	Total nitrogen in percolate	lb/mo	8,915	8,069	8,915	10,271	9,230	7,667	7,781	(4,756)	7,331	8,369	7,678	5,041	84,512
48															
49	**Percolate Volume**														
50	Spray Hydraulic Application (line 21)	in/mo	10.9	9.8	10.9	10.5	10.9	10.5	10.9	10.9	10.5	10.9	10.5	6.4	123.5
51	Climatoligical Normal Precipitation (Exhibit K-K)	in/mo	3.3	3.2	4.1	3.2	3.4	3.6	3.9	5.3	3.6	3.5	3.1	3.6	43.8
52	Total Hydraulic Loading	in/mo	14.2	13.0	15.0	13.7	14.3	14.1	14.8	16.2	14.1	14.4	13.6	10.0	167.3
53	Thornwaite Potential Evapotranspiration (Exhibit J-J)	in/mo	0.1	0.1	0.7	1.8	3.3	4.8	5.5	4.9	3.6	1.9	0.9	0.2	27.8
54	Percolate (line 52 minus line 53)	in/mo	14.1	12.9	14.3	11.9	11.0	9.3	9.3	11.3	10.5	12.5	12.7	9.8	139.5
55	Percolate volume	gal/mo	160,494,834	147,354,397	162,775,787	135,966,272	125,140,065	106,313,885	105,751,967	128,561,495	119,999,602	142,247,211	145,090,083	111,675,956	1,591,371,554
56															
57	**Percolate Nitrogen Concentration**														
58	Total nitrogen in percolate (line 47)	lb/mo	8,915	8,069	8,915	10,271	9230.052	7,667	7,781	0	7,331	8,369	7,678	5,041	89,268
59	Percolate volume (line 55)	gal/mo	160,494,834	147,354,397	162,775,787	135,966,272	125,140,065	106,313,885	105,751,967	128,561,495	119,999,602	142,247,211	145,090,083	111,675,956	1,591,371,554
60	Total nitrogen concentration in percolate	lb/MG	55.55	54.76	54.77	75.54	73.76	72.12	73.58	-	61.09	58.83	52.92	45.14	56.09
61	**Nitrogen concentration in percolate**	**mg/L**	**6.7**	**6.6**	**6.6**	**9.1**	**8.8**	**8.6**	**8.8**	**0.0**	**7.3**	**7.1**	**6.3**	**5.4**	**6.8**

62	**STORAGE**	**Units**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**SUM**
63	Volume Generated (line 14)	gal/mo	80,600,000	72,800,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	949,000,000
64	Volume Irrigated (line 17)	gal/mo	124,000,000	112,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	124,000,000	120,000,000	124,000,000	120,000,000	72,900,000	1,408,900,000
65	Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K)")	gal/mo	684,071	640,407	815,063	654,961	727,735	742,290	916,946	1,193,485	756,844	785,954	669,516	756,844	9,344,117
66	Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9)	gal/mo	14,555	14,555	101,883	261,985	480,305	698,626	800,508	713,180	523,969	276,539	130,992	29,109	4,046,206
67	Volume Stored	gal/mo	(42,730,484)	(38,574,148)	(42,686,820)	(41,607,023)	(43,152,570)	(41,956,336)	(43,283,562)	(42,919,695)	(41,767,125)	(42,890,586)	(41,461,476)	8,427,735	(454,602,089.40)

68	Cumulative Volume Stored	gal/mo	(118,654,810)	(157,228,958)	(199,915,778)	(241,522,801)						(42,890,586)	(84,352,062)	(75,924,327)	

Facility: Mountaire Farms Inc,
Field: All Fields
Date: 2/5/2020

	Design Criteria		
1	Treatment Capacity	949,000,000	gal/year
2	Treatment Capacity Average Daily Flow	2,600,000	gal/day
3	Disposal Capacity	949,000,000	gal/year
4	Disposal Average Daily Flow	4,000,000	gal/day
5	Number of Units	NA	
6	Soil Perc Rate	4.02	inches/hr
7	Maximum Allowed Infiltration Rate from Water Balance Calcs	0.28	inches/hr
8	Total Storage Volume	21,300,000	gallons
9	Treatment Lagoon and Storage Surface Acreage	5.36	acres
10	Total Spray Acreage	420	acres
11	Crop Type(s)		Soybean

Note: Fields WHBJ-1, WHBJ-3, WHBJ-5, CB-3, and CB-3C all have maximum percolation rates less than 2.5 in/wk and were not included in this Total Spray Acreage.

	Parameter	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	SUM
13	**Treatment Capacity**														
14	Influent Flow	gal/mo	80,600,000	72,800,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	949,000,000
15															
16	**Hydraulic Spray Application**														
17	Effluent Flow	gal/mo	124,000,000	112,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	124,000,000	120,000,000	124,000,000	120,000,000	72,900,000	1,408,900,000
18		gal/acre													
19	Calendar days per month	days/mo	31	28	31	30	31	30	31	31	30	31	30	31	365
20	Spray days per month	days/mo	26	23	26	26	25	25	24	28	24	26	27	26	306
	Spray weeks per month	week/mo	4.4	4.0	4.4	4.3	4.4	4.3	4.4	4.4	4.3	4.4	4.3	4.4	52.14
21	Spray hydraulic application rate	in/mo	10.9	9.8	10.9	10.5	10.9	10.5	10.9	10.9	10.5	10.9	10.5	6.4	123.54
22	Spray hydraulic application rate	in/week	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	1.4	28.45
23															
24	**Total Nitrogen Application**														
25	Total nitrogen in spray effluent	mg/L	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	
26	Total nitrogen in spray effluent	lb/acre-mo	24.62	22.24	24.62	23.83	24.62	23.83	24.62	24.62	23.83	24.62	23.83	14.48	279.8
27	Total nitrogen applied as commercial fertilizer	lb/acre-mo	0.00	0.00	0.00	7.00	23.00	13.00	27.00	0.00	0.00	0.00	0.00	0.00	70.0
28	Total nitrogen applied as biosolids	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
29	Total nitrogen due to precipitation	lb/acre-mo	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	5.0
30	Total nitrogen due to fixation	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	12.00	24.00	18.00	6.00	0.00	0.00	0.00	60.0
31	Total nitrogen applied	lb/acre-mo	25.04	22.66	25.04	31.25	48.04	37.25	52.04	25.04	24.25	25.04	24.25	14.90	354.8
32															
33	**Ammonia Application**														
34	Ammonia in spray effluent	mg/L	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
35	Total ammonia application	lb/acre-mo	1.60	1.45	1.60	1.55	1.60	1.55	1.60	1.60	1.55	1.60	1.55	1.60	18.8
36															
37	**Nitrogen Utilization**														
38	Plant nitrogen uptake (see below)														
39	Summer Crop ****	lb/acre-mo	0.0	0.0	0.0	0.0	0.0	30.0	60.0	45.0	15.0	0.0	0.0	0.0	150.0
40	Winter Cover Crop ***	lb/acre-mo	0.3	1.9	10.2	21.7	22.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.5
41	Denitrification (15% of line 26)	lb/acre-mo	3.7	3.3	3.7	3.6	3.7	3.6	3.7	3.7	3.6	3.7	3.6	2.2	42.0
42	Ammonia Volitilization (5% of line 35)	lb/acre-mo	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.9
43	Total nitrogen consumed	lb/acre-mo	4.1	5.3	14.0	25.3	26.1	21.7	39.8	30.8	12.7	3.8	3.7	2.3	189.4
44															
45	**Percolate Nitrogen Content**														
46	Total nitrogen in percolate (line 31 minus line 43)	lb/acre-mo	20.95	17.34	11.06	5.90	21.94	15.60	12.27	-5.73	11.60	21.27	20.6	12.6	165.4
47	Total nitrogen in percolate	lb/mo	8,799	7,282	4,646	2,480	9,215	6,551	5,153	(2,407)	4,871	8,933	8,651	5,311	69,484
48															
49	**Percolate Volume**														
50	Spray Hydraulic Application (line 21)	in/mo	10.9	9.8	10.9	10.5	10.9	10.5	10.9	10.9	10.5	10.9	10.5	6.4	123.5
51	Climatoligical Normal Precipitation (Exhibit K-K)	in/mo	3.3	3.2	4.1	3.2	3.4	3.6	3.9	5.3	3.6	3.5	3.1	3.6	43.8
52	Total Hydraulic Loading	in/mo	14.2	13.0	15.0	13.7	14.3	14.1	14.8	16.2	14.1	14.4	13.6	10.0	167.3
53	Thornwaite Potential Evapotranspiration (Exhibit J-J)	in/mo	0.1	0.1	0.7	1.8	3.3	4.8	5.5	4.9	3.6	1.9	0.9	0.2	27.8
54	Percolate (line 52 minus line 53)	in/mo	14.1	12.9	14.3	11.9	11.0	9.3	9.3	11.3	10.5	12.5	12.7	9.8	139.5
55	Percolate volume	gal/mo	160,494,834	147,354,397	162,775,787	135,966,272	125,140,065	106,313,885	105,751,967	128,561,495	119,999,602	142,247,211	145,090,083	111,675,956	1,591,371,554
56															
57	**Percolate Nitrogen Concentration**														
58	Total nitrogen in percolate (line 47)	lb/mo	8,799	7,282	4,646	2,480	9,215	6,551	5,153	0	4,871	8,933	8,651	5,311	71,890.38
59	Percolate volume (line 55)	gal/mo	160,494,834	147,354,397	162,775,787	135,966,272	125,140,065	106,313,885	105,751,967	128,561,495	119,999,602	142,247,211	145,090,083	111,675,956	1,591,371,554
60	Total nitrogen concentration in percolate	lb/MG	54.83	49.42	28.54	18.24	73.63	61.62	48.73	-	40.59	62.80	59.62	47.55	45.18
61	**Nitrogen concentration in percolate**	**mg/L**	**6.6**	**5.9**	**3.4**	**2.2**	**8.8**	**7.4**	**5.8**	**0.0**	**4.9**	**7.5**	**7.1**	**5.7**	**5.5**

	STORAGE	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	SUM
62															
63	Volume Generated (line 14)	gal/mo	80,600,000	72,800,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	949,000,000
64	Volume Irrigated (line 17)	gal/mo	124,000,000	112,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	124,000,000	120,000,000	124,000,000	120,000,000	72,900,000	1,408,900,000
65	Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K)")	gal/mo	684,071	640,407	815,063	654,961	727,735	742,290	916,946	1,193,485	756,844	785,954	669,516	756,844	9,344,117
66	Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9)	gal/mo	14,555	14,555	101,883	261,985	480,305	698,626	800,508	713,180	523,969	276,539	130,992	29,109	4,046,206
67	Volume Stored	gal/mo	(42,730,484)	(38,574,148)	(42,686,820)	(41,607,023)	(43,152,570)	(41,956,336)	(43,283,562)	(42,919,695)	(41,767,125)	(42,890,586)	(41,461,476)	8,427,735	(454,602,089.40)
68	Cumulative Volume Stored	gal/mo	(118,654,810)	(157,228,958)	(199,915,778)	(241,522,801)						(42,890,586)	(84,352,062)	(75,924,327)	

ATTACHMENT K

Facility: Mountaire Farms Inc,
Field: All Fields
Date: 2/5/2020

	Design Criteria		
1	Treatment Capacity	949,000,000	gal/year
2	Treatment Capacity Average Daily Flow	2,600,000	gal/day
3	Disposal Capacity	1,460,000,000	gal/year
4	Disposal Average Daily Flow	4,000,000	gal/day
5	Number of Units	NA	
6	Soil Perc Rate	4.02	inches/hr
7	Maximum Allowed Infiltration Rate from Water Balance Calcs	0.28	inches/hr
8	Total Storage Volume	21,300,000	gallons
9	Treatment Lagoon and Storage Surface Acreage	5.36	acres
10	Total Spray Acreage	893.63	acres
11	Crop Type(s)		Corn

	Parameter	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	SUM
13	**Treatment Capacity**														
14	Influent Flow	gal/mo	80,600,000	72,800,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	949,000,000
15															
16	**Hydraulic Spray Application**														
17	Effluent Flow	gal/mo	124,000,000	112,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	949,000,000
18		gal/acre													
19	Calendar days per month	days/mo	31	28	31	30	31	30	31	31	30	31	30	31	365
20	Spray days per month	days/mo	26	23	26	26	25	25	24	28	24	26	27	26	306
	Spray weeks per month	week/mo	4.4	4.0	4.4	4.3	4.4	4.3	4.4	4.4	4.3	4.4	4.3	4.4	52.1
21	Spray hydraulic application rate	in/mo	5.1	4.6	5.1	4.9	5.1	4.9	5.1	5.1	4.9	5.1	4.9	5.1	60.2
22	Spray hydraulic application rate	in/week	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	13.8
23															
24	**Total Nitrogen Application**														
25	Total nitrogen in spray effluent	mg/L	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	
26	Total nitrogen in spray effluent	lb/acre-mo	16.78	15.16	16.78	16.24	16.78	16.24	16.78	16.78	16.24	16.78	16.24	16.78	198
27	Total nitrogen applied as commercial fertilizer	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
28	Total nitrogen applied as biosolids	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
29	Total nitrogen due to precipitation	lb/acre-mo	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	5.0
30	Total nitrogen due to fixation	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
31	Total nitrogen applied	lb/acre-mo	17.20	15.58	17.20	16.66	17.20	16.66	17.20	17.20	16.66	17.20	16.66	17.20	203
32															
33	**Ammonia Application**														
34	Ammonia in spray effluent	mg/L	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
35	Total ammonia application	lb/acre-mo	1.16	1.05	1.16	1.12	1.16	1.12	1.16	1.16	1.12	1.16	1.12	1.16	13.63
36															
37	**Nitrogen Utilization**														
38	Plant nitrogen uptake (see below)														
39	Summer Crop ****	lb/acre-mo	0.00	0.00	0.00	3.10	23.25	40.30	52.70	32.55	3.10	0.00	0.00	0.00	155.0
40	Winter Cover Crop ***	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	2.28	0.65	4.2
41	Denitrification (15% of line 26)	lb/acre-mo	2.52	2.27	2.52	2.44	2.52	2.44	2.52	2.52	2.44	2.52	2.44	2.52	29.6
42	Ammonia Volitilization (5% of line 35)	lb/acre-mo	0.06	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.7
43	Total nitrogen consumed	lb/acre-mo	2.57	2.33	2.57	5.59	25.82	42.79	55.27	35.12	5.59	3.87	4.77	3.22	189.5
44															
45	**Percolate Nitrogen Content**														
46	Total nitrogen in percolate (line 31 minus line 43)	lb/acre-mo	14.63	13.25	14.63	11.07	-8.62	-26.13	-38.07	-17.92	11.07	13.33	11.9	14.0	13.1
47	Total nitrogen in percolate	lb/mo	13,070	11,841	13,070	9,890	(7,707)	(23,353)	(34,025)	(16,018)	9,890	11,908	10,627	12,489	11,681
48															
49	**Percolate Volume**														
50	Spray Hydraulic Application (line 21)	in/mo	5.1	4.6	5.1	4.9	5.1	4.9	5.1	5.1	4.9	5.1	4.9	5.1	60.2
51	Climatoligical Normal Precipitation (Exhibit K-K)	in/mo	3.3	3.2	4.1	3.2	3.4	3.6	3.9	5.3	3.6	3.5	3.1	3.6	43.8
52	Total Hydraulic Loading	in/mo	8.4	7.8	9.2	8.1	8.5	8.5	9.0	10.4	8.5	8.6	8.0	8.7	104.0
53	Thornwaite Potential Evapotranspiration (Exhibit J-J)	in/mo	0.1	0.1	0.7	1.8	3.3	4.8	5.5	4.9	3.6	1.9	0.9	0.2	27.8
54	Percolate (line 52 minus line 53)	in/mo	8.3	7.7	8.5	6.3	5.2	3.7	3.5	5.5	4.9	6.7	7.1	8.5	76.2
55	Percolate volume	gal/mo	201,650,174	187,223,633	206,503,335	153,971,733	126,426,170	90,880,633	85,174,297	133,705,912	119,999,602	162,824,881	173,384,379	206,503,335	1,848,248,085
56															
57	**Percolate Nitrogen Concentration**														
58	Total nitrogen in percolate (line 47)	lb/mo	13,070	11,841	13,070	9,890	0	0	0	0	9,890	11,908	10,627	12,489	92,784
59	Percolate volume (line 55)	gal/mo	201,650,174	187,223,633	206,503,335	153,971,733	126,426,170	90,880,633	85,174,297	133,705,912	119,999,602	162,824,881	173,384,379	206,503,335	1,848,248,085

60	Total nitrogen concentration in percolate	lb/MG	64.81	63.25	63.29	64.23	-	-	-	-	82.42	73.13	61.29	60.48	50.20
61	**Nitrogen concentration in percolate**	**mg/L**	**7.8**	**7.6**	**7.6**	**7.7**	**0.0**	**0.0**	**0.0**	**0.0**	**9.9**	**8.8**	**7.3**	**7.3**	**5.3**
62	**STORAGE**	**Units**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**SUM**
63	Volume Generated (line 14)	gal/mo	80,600,000	72,800,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	949,000,000
64	Volume Irrigated (line 17)	gal/mo	124,000,000	112,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	1,460,000,000
65	Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K)")	gal/mo	684,071	640,407	815,063	654,961	727,735	742,290	916,946	1,193,485	756,844	785,954	669,516	756,844	9,344,117
66	Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9)	gal/mo	14,555	14,555	101,883	261,985	480,305	698,626	800,508	713,180	523,969	276,539	130,992	29,109	4,046,206
67	Volume Stored	gal/mo	(42,730,484)	(38,574,148)	(42,686,820)	(41,607,023)	(43,152,570)	(41,956,336)	(43,283,562)	(42,919,695)	(41,767,125)	(42,890,586)	(41,461,476)	(42,672,265)	(505,702,089.40)
68	Cumulative Volume Stored	gal/mo													

Facility: Mountaire Farms Inc,
Field: All Fields
Date: 2/5/2020

	Design Criteria		
1	Treatment Capacity	949,000,000	gal/year
2	Treatment Capacity Average Daily Flow	2,600,000	gal/day
3	Disposal Capacity	949,000,000	gal/year
4	Disposal Average Daily Flow	4,000,000	gal/day
5	Number of Units	NA	
6	Soil Perc Rate	4.02	inches/hr
7	Maximum Allowed Infiltration Rate from Water Balance Calcs	0.28	inches/hr
8	Total Storage Volume	21,300,000	gallons
9	Treatment Lagoon and Storage Surface Acreage	5.36	acres
10	Total Spray Acreage	893.63	acres
11	Crop Type(s)		Soybean

12	Parameter	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	SUM
13	**Treatment Capacity**														
14	Influent Flow	gal/mo	80,600,000	72,800,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	949,000,000
15															
16	**Hydraulic Spray Application**														
17	Effluent Flow	gal/mo	124,000,000	112,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	1,460,000,000
18		gal/acre													
19	Calendar days per month	days/mo	31	28	31	30	31	30	31	31	30	31	30	31	365
20	Spray days per month	days/mo	26	23	26	26	25	25	24	28	24	26	27	26	306
	Spray weeks per month	week/mo	4.4	4.0	4.4	4.3	4.4	4.3	4.4	4.4	4.3	4.4	4.3	4.4	52.14
21	Spray hydraulic application rate	in/mo	5.1	4.6	5.1	4.9	5.1	4.9	5.1	5.1	4.9	5.1	4.9	5.1	60.17
22	Spray hydraulic application rate	in/week	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	13.85
23															
24	**Total Nitrogen Application**														
25	Total nitrogen in spray effluent	mg/L	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	
26	Total nitrogen in spray effluent	lb/acre-mo	16.78	15.16	16.78	16.24	16.78	16.24	16.78	16.78	16.24	16.78	16.24	16.78	197.6
27	Total nitrogen applied as commercial fertilizer	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
28	Total nitrogen applied as biosolids	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
29	Total nitrogen due to precipitation	lb/acre-mo	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	5.0
30	Total nitrogen due to fixation	lb/acre-mo	0.00	0.00	0.00	0.00	0.00	12.00	24.00	18.00	6.00	0.00	0.00	0.00	60.0
31	Total nitrogen applied	lb/acre-mo	17.20	15.58	17.20	16.66	17.20	16.66	17.20	17.20	16.66	17.20	16.66	17.20	202.6
32															
33	**Ammonia Application**														
34	Ammonia in spray effluent	mg/L	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
35	Total ammonia application	lb/acre-mo	0.75	0.68	0.75	0.73	0.75	0.73	0.75	0.75	0.73	0.75	0.73	0.75	8.9
36															
37	**Nitrogen Utilization**														
38	Plant nitrogen uptake (see below)														
39	Summer Crop ****	lb/acre-mo	0.0	0.0	0.0	0.0	0.0	30.0	60.0	45.0	15.0	0.0	0.0	0.0	150.0
40	Winter Cover Crop ***	lb/acre-mo	0.3	1.9	10.2	21.7	22.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.5
41	Denitrification (15% of line 26)	lb/acre-mo	2.5	2.3	2.5	2.4	2.5	2.4	2.5	2.5	2.4	2.5	2.4	2.5	29.6
42	Ammonia Volitilization (5% of line 35)	lb/acre-mo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
43	Total nitrogen consumed	lb/acre-mo	2.9	4.2	12.8	24.2	24.9	20.5	38.6	29.6	11.5	2.6	2.5	2.6	176.5
44															
45	**Percolate Nitrogen Content**														
46	Total nitrogen in percolate (line 31 minus line 43)	lb/acre-mo	14.33	11.35	4.44	-7.51	-7.68	-3.81	-21.35	-12.35	5.19	14.65	14.2	14.6	26.1
47	Total nitrogen in percolate	lb/mo	12,803	10,147	3,966	(6,707)	(6,867)	(3,408)	(19,083)	(11,040)	4,635	13,088	12,678	13,088	23,299
48															
49	**Percolate Volume**														
50	Spray Hydraulic Application (line 21)	in/mo	5.1	4.6	5.1	4.9	5.1	4.9	5.1	5.1	4.9	5.1	4.9	5.1	60.2
51	Climatoligical Normal Precipitation (Exhibit K-K)	in/mo	3.3	3.2	4.1	3.2	3.4	3.6	3.9	5.3	3.6	3.5	3.1	3.6	43.8
52	Total Hydraulic Loading	in/mo	8.4	7.8	9.2	8.1	8.5	8.5	9.0	10.4	8.5	8.6	8.0	8.7	104.0
53	Thornwaite Potential Evapotranspiration (Exhibit J-J)	in/mo	0.1	0.1	0.7	1.8	3.3	4.8	5.5	4.9	3.6	1.9	0.9	0.2	27.8
54	Percolate (line 52 minus line 53)	in/mo	8.3	7.7	8.5	6.3	5.2	3.7	3.5	5.5	4.9	6.7	7.1	8.5	76.2
55	Percolate volume	gal/mo	201,650,174	187,223,633	206,503,335	153,971,733	126,426,170	90,880,633	85,174,297	133,705,912	119,999,602	162,824,881	173,384,379	206,503,335	1,848,248,085
56															
57	**Percolate Nitrogen Concentration**														
58	Total nitrogen in percolate (line 47)	lb/mo	12,803	10,147	3,966	0	0	0	0	0	4,635	13,088	12,678	13,088	70,403.44
59	Percolate volume (line 55)	gal/mo	201,650,174	187,223,633	206,503,335	153,971,733	126,426,170	90,880,633	85,174,297	133,705,912	119,999,602	162,824,881	173,384,379	206,503,335	1,848,248,085
60	Total nitrogen concentration in percolate	lb/MG	63.49	54.20	19.20	-	-	-	-	-	38.63	80.38	73.12	63.38	38.09
61	**Nitrogen concentration in percolate**	**mg/L**	**7.6**	**6.5**	**2.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**4.6**	**9.6**	**8.8**	**7.6**	**3.9**
62	**STORAGE**	**Units**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**SUM**
63	Volume Generated (line 14)	gal/mo	80,600,000	72,800,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	80,600,000	78,000,000	80,600,000	78,000,000	80,600,000	949,000,000
64	Volume Irrigated (line 17)	gal/mo	124,000,000	112,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	124,000,000	120,000,000	124,000,000	120,000,000	124,000,000	1,460,000,000

65	Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K)")	gal/mo	684,071	640,407	815,063	654,961	727,735	742,290	916,946	1,193,485	756,844	785,954	669,516	756,844	9,344,117
66	Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9)	gal/mo	14,555	14,555	101,883	261,985	480,305	698,626	800,508	713,180	523,969	276,539	130,992	29,109	4,046,206
67	Volume Stored	gal/mo	(42,730,484)	(38,574,148)	(42,686,820)	(41,607,023)	(43,152,570)	(41,956,336)	(43,283,562)	(42,919,695)	(41,767,125)	(42,890,586)	(41,461,476)	(42,672,265)	(505,702,089.40)
68	Cumulative Volume Stored	gal/mo													

Attachment L

Facility:
Field:
Date: 11/11/2019

	Design Criteria		
1	Treatment Capacity	72,800,000	gal/year
2	Treatment Capacity Average Daily Flow	2,600,000	gal/day
3	Disposal Capacity	72,800,000	gal/year
4	Disposal Average Daily Flow	2,600,000	gal/day
5	Number of Units		
6	Soil Perc Rate		inches/hr
7	Maximum Allowed Infiltration Rate from Water Balance Calcs		inches/hr
8	Total Storage Volume	21300000	gallons
9	Treatment Lagoon and Storage Surface Acreage	5.36	acres
10	Total Spray Acreage	460	acres
11	Crop Type(s)		Corn

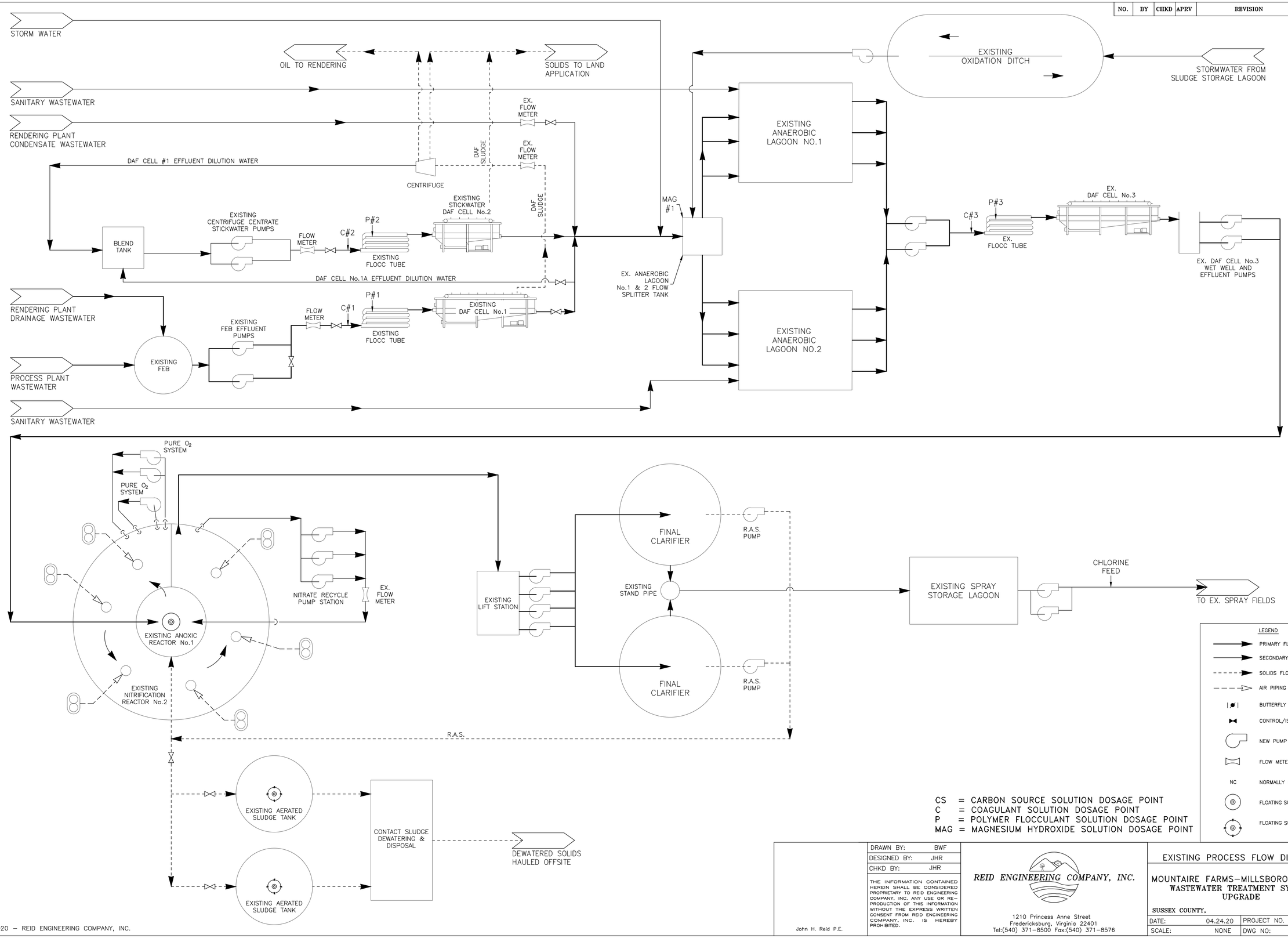
	Parameter	Units	Jan/Week 1	Jan/Week 2	Jan/Week 3	Jan/Week4									SUM
13	**Treatment Capacity**														
14	Influent Flow	gal/wk	20,150,000	20,150,000	20,150,000	20,150,000									80,600,000
15															
16	**Hydraulic Spray Application**														
17	Effluent Flow	gal/wk	20,146,361	-	30,634,580	30,634,580									80,600,000
18		gal/acre													
19	Calendar days per week	days/wk	7	7	7	7									28
20	Spray days per week	days/wk	7	0	7	7									21
	Spray weeks per month	week/mo													0.0
21	Spray hydraulic application rate	in/wk	1.6	0.0	2.5	2.5									6.5
22															0.0
23															
24	**Total Nitrogen Application**														
25	Total nitrogen in spray effluent	mg/L	10.00	10.00	10.00	10.00									
26	Total nitrogen in spray effluent	lb/acre-wk	3.65	0.00	5.55	5.55									15
27	Total nitrogen applied as commercial fertilizer	lb/acre-wk	0.00	0.00	0.00	0.00									-
28	Total nitrogen applied as biosolids	lb/acre-wk	0.00	0.00	0.00	0.00									-
29	Total nitrogen due to precipitation	lb/acre-wk	0.42	0.42	0.42	0.42									1.7
30	Total nitrogen due to fixation	lb/acre-wk	0.00	0.00	0.00	0.00									-
31	Total nitrogen applied	lb/acre-wk	4.07	0.42	5.97	5.97									16
32															
33	**Ammonia Application**														
34	Ammonia in spray effluent	mg/L	1.00	1.00	1.00	1.00									
35	Total ammonia application	lb/acre-wk	0.37	0.00	0.56	0.56									1.48
36															
37	**Nitrogen Utilization**														
38	Plant nitrogen uptake (see below)														
39	Summer Crop ****	lb/acre-wk	0.00	0.00	0.00	0.00									0.0
40	Winter Cover Crop ***	lb/acre-wk	0.00	0.00	0.00	0.00									0.0
41	Denitrification (15% of line 26)	lb/acre-wk	0.55	0.00	0.83	0.83									2.2
42	Ammonia Volitilization (5% of line 35)	lb/acre-wk	0.02	0.00	0.03	0.03									0.1
43	Total nitrogen consumed	lb/acre-wk	0.57	0.00	0.86	0.86									2.3
44															
45	**Percolate Nitrogen Content**														
46	Total nitrogen in percolate (line 31 minus line 43)	lb/acre-wk	3.51	0.42	5.11	5.11									14.2
47	Total nitrogen in percolate	lb/wk	1,613	193	2,352	2,352									6,510
48															
49	**Percolate Volume**														
50	Spray Hydraulic Application (line 21)	in/wk	1.6	0.0	2.5	2.5									6.5
51	Climatoligical Normal Precipitation (Exhibit K-K)	in/wk	0.8250	0.825	0.825	0.825									3.3
52	Total Hydraulic Loading	in/wk	2.4	0.8	3.3	3.3									9.8
53	Thornwaite Potential Evapotranspiration (Exhibit J-J)	in/wk	0.025	0.0250	0.0250	0.0250									0.1
54	Percolate (line 52 minus line 53)	in/wk	2.4	0.8	3.3	3.3									9.7
55	Percolate volume	gal/wk	30,140,739	9,992,746	40,629,808	40,629,808									121,393,100
56															
57	**Percolate Nitrogen Concentration**														
58	Total nitrogen in percolate (line 47)	lb/wk	1,613	193	2,352	2,352									6,510
59	Percolate volume (line 55)	gal/wk	30,140,739	9,992,746	40,629,808	40,629,808									121,393,100
60	Total nitrogen concentration in percolate	lb/MG	53.51	19.33	57.89	57.89									53.63
61	**Nitrogen concentration in percolate**	**mg/L**	**6.4**	**2.3**	**6.9**	**6.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.9**
62	**STORAGE**	**Units**	**Week 1**	**Week 2**	**Week 3**	**Week 4**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**SUM**
63	Volume Generated (line 14)	gal/wk	20,150,000	20,150,000	20,150,000	20,150,000	-	-	-	-	-	-	-	-	80,600,000
64	Volume Irrigated (line 17)	gal/wk	20,146,361	-	30,634,580	30,634,580	-	-	-	-	-	-	-	-	81,415,521
65	Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K)")	gal/wk	-	684,064	-	-									684,064
66	Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9)	gal/wk	3,639	3,639	3,639	3,639	-	-	-	-	-	-	-	-	14,555
67	Volume Stored	gal/wk	(0)	20,830,425	(10,488,219)	(10,488,219)	-	-	-	-	-	-	-	-	(146,012.42)
68	Cumulative Volume Stored	gal/wk	138,735	20,969,160	10,480,941	(7,277)		-	-	-	-	-	-	-	
		P5 (in/wk)		4.7											4.7

Week 1 Cumlative volume represents stored effluent from previous December a shown on Attachment H

Appendix 4

Flow Diagram

NO.	BY	CHKD	APRV	REVISION	DATE



CS = CARBON SOURCE SOLUTION DOSAGE POINT
C = COAGULANT SOLUTION DOSAGE POINT
P = POLYMER FLOCCULANT SOLUTION DOSAGE POINT
MAG = MAGNESIUM HYDROXIDE SOLUTION DOSAGE POINT

John H. Reid P.E.

DRAWN BY: BWF
DESIGNED BY: JHR
CHKD BY: JHR

REID ENGINEERING COMPANY, INC.
1210 Princess Anne Street
Fredericksburg, Virginia 22401
Tel:(540) 371-8500 Fax:(540) 371-8576

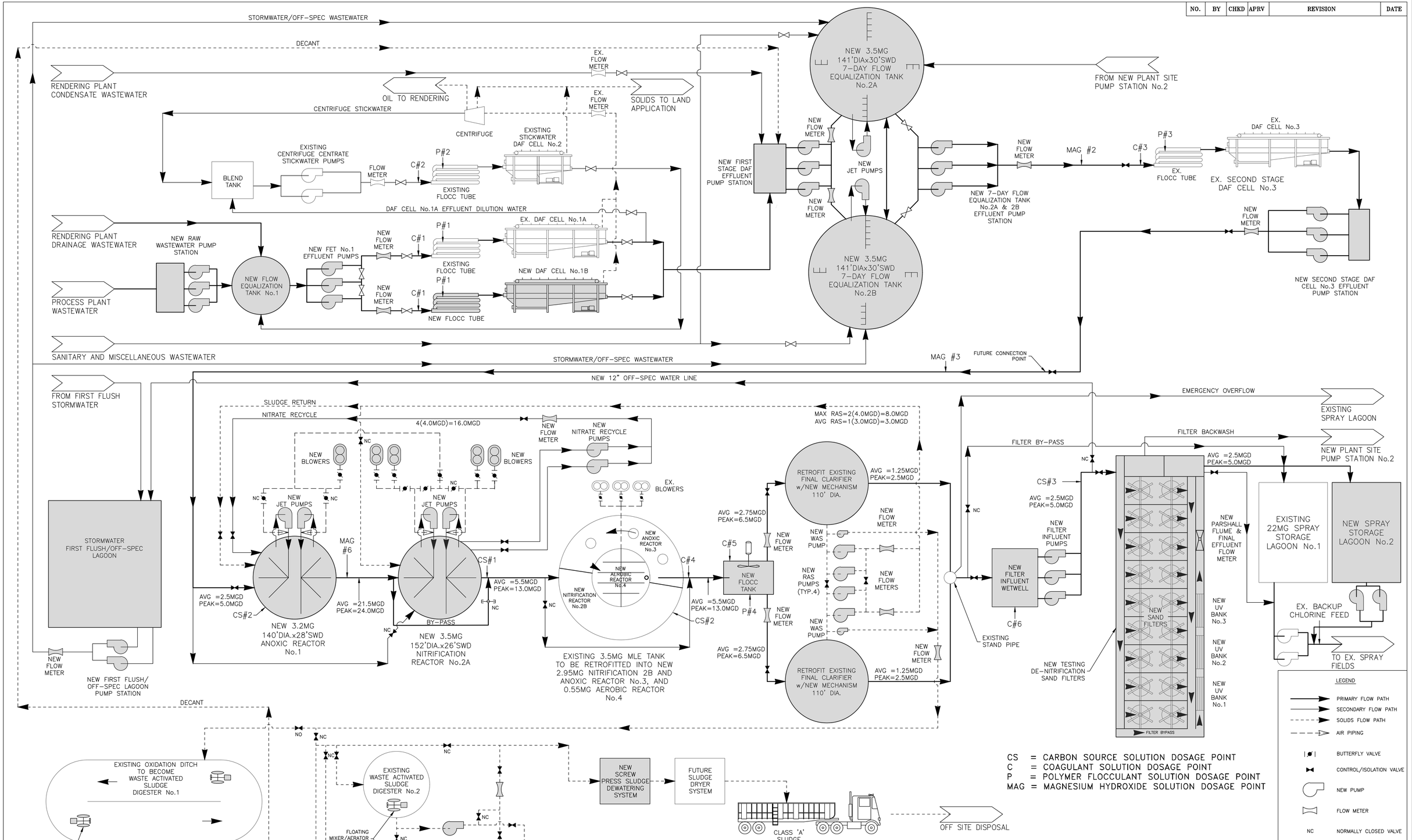
EXISTING PROCESS FLOW DIAGRAM

MOUNTAIRE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F100A

NO.	BY	CHKD	APRV	REVISION	DATE



CS = CARBON SOURCE SOLUTION DOSAGE POINT
C = COAGULANT SOLUTION DOSAGE POINT
P = POLYMER FLOCCULANT SOLUTION DOSAGE POINT
MAG = MAGNESIUM HYDROXIDE SOLUTION DOSAGE POINT

JOHN HAGER REID LICENSED No. 6580 PROFESSIONAL ENGINEER
04 - 24 - 20
John H. Reid P.E.

DRAWN BY:	GDS
DESIGNED BY:	JHR
CHKD BY:	JHR

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REID ENGINEERING COMPANY, INC.
1210 Princess Anne Street
Fredericksburg, Virginia 22401
Tel:(540) 371-8500 Fax:(540) 371-8576

PROCESS FLOW DIAGRAM

MOUNTAIRE FARMS-MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM UPGRADE

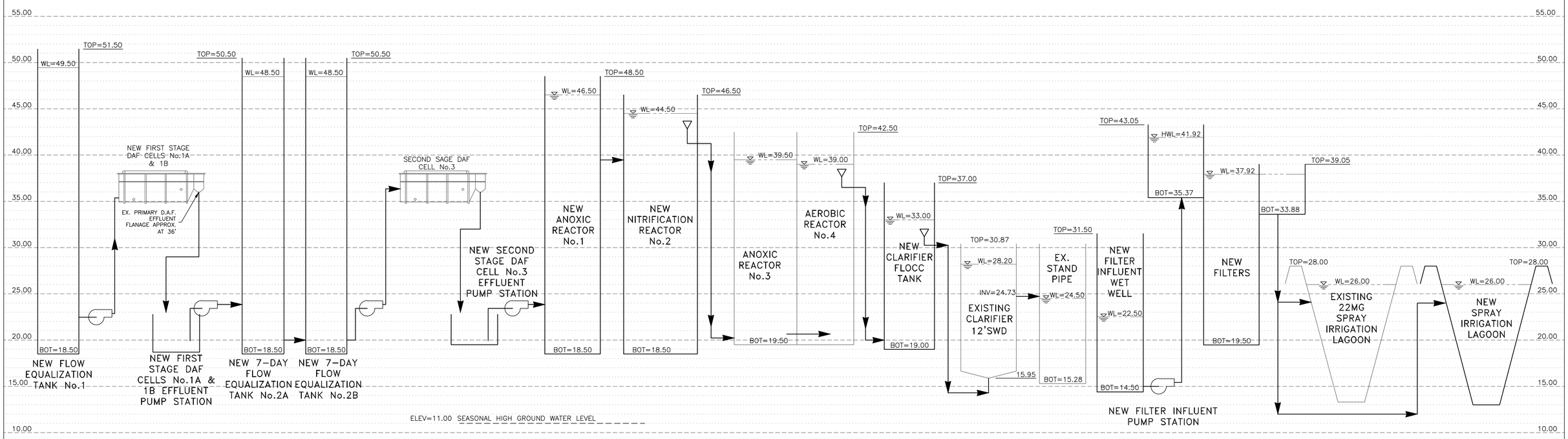
SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F100

Appendix 5

Hydraulic Profile

NO.	BY	CHKD	APRV	REVISION	DATE



John H. Reid P.E.	DRAWN BY: JW DESIGNED BY: JHR CHKD BY: JHR	REID ENGINEERING COMPANY, INC. 1210 Princess Anne Street Fredericksburg, Virginia 22401 Tel:(540) 371-8500 Fax:(540) 371-8576

HYDRAULIC PROFILE

MOUNTAIRE FARMS-MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F101

Appendix 6

P&IDs

NO.	BY	CHKD	APRV	REVISION	DATE

EQUIPMENT SYMBOLS

SYMBOL	TYPE
	CENTRIFUGAL PUMP
	SUBMERSIBLE PUMP (CENTRIFUGAL)
	POSITIVE DISPLACEMENT PUMP
	PROGRESSIVE CAVITY PUMP
	SCREW PUMP
	CHEMICAL METERING PUMP
	CHEMICAL PERISTALTIC PUMP
	BLOWER (CENTRIFUGAL)
	BLOWER (POSITIVE DISPLACEMENT)
	EDUCTOR
	COMPRESSOR
	AIR FILTER
	CARTRIDGE FILTER
	SCREW CONVEYOR
	VERTICAL TURBINE PUMP
	FLOATING SURFACE MIXER
	FLOATING SURFACE AERATOR
	MIXER
	SUBMERSIBLE MIXER
	ELECTRIC MOTOR
	PNEUMATIC OPERATOR
	EXISTING SAM UNITS

EQUIPMENT TYPES

AU	AUGER
B	BLOWER
C	COMPRESSOR
CVR	CONVEYOR
CF	CENTRIFUGAL FAN
D.A.F.	DISSOLVED AIR FLOATATION
D	AERATOR/DIFFUSER
F	FILTER
G	GRIT SEPARATION
H	HOIST
LA	LAGOON
M	MOTOR
MXR	MIXER
P	PUMP
S	MECHANICAL SCREEN
SM	SURFACE MIXER
SA	SURFACE AREATOR
SK	SKIMMER
TK	TANK
T	WET WELL
U	UV DISINFECTION UNIT

VALVE SYMBOLS

DESIGNATION	SYMBOL	TYPE
VA		GATE
VB		BALL
VC		CHECK
VD		DIAPHRAGM
VG		GLOBE
VK		KNIFE GATE
VN		NEEDLE
VO		PINCH
VP		PLUG
VY		BUTTERFLY
TW		3 WAY
VL		ANGLE
VT		TELESCOPING
HB		HOSE BIBS
YH		FREEZE PROOF YARD HYDRANT
MUD		MUD (DRAIN)
PSV		PRESSURE RELIEF OR SAFETY
PSV		VACUUM RELIEF OR SAFETY
PSV		COMBINATION RELIEF OR SAFETY
PCV		SELF CONTAINED PRESSURE CONTROL
PCV		SELF CONTAINED BACK PRESSURE CONTROL
ARV		AIR RELEASE VALVE
SOV	S	SOLENOID VALVE TWO-WAY THREE-WAY SOLENOID VALVE. (ARROW DIRECTION SHOWS DE-ENERGIZED FLOW DIRECTION)
SOV	S	SOLENOID ACTUATOR (W/MANUAL OVERRIDE)

NOTE: VALVES ARE THE SAME SIZE AND SPECIFICATION AS THE LINE THEY ARE IN UNLESS STATED OTHERWISE ON THE DRAWING.

P & ID LINE LEGEND

- PRIMARY PROCESS PIPING/FLOW
- SECONDARY PROCESS PIPING/FLOW
- EXISTING PIPING
- SLUDGE PIPING
- AIR PIPING
- PNEUMATIC LINE
- SKID/VENDOR PACKAGE BOUNDARY

INTERFACE SYMBOLS

DWG No
SOURCE/DESTINATION
DESCRIPTION

PIPING IDENTIFICATION

PIPING SPECIFICATION
PIPE SIZE
FLOW STREAM/SERVICE
6"–DI–WW
PIPE

NOTES:

1. FLOW STREAM AND PIPING SPECIFICATIONS ARE SOMETIMES OMITTED.
2. PIPE SIZE IS IN INCHES.
3. SEE SHEET D100 FOR ADDITIONAL PIPE MATERIAL SPECIFICATION REQUIREMENTS.

PIPE MATERIAL IDENTIFICATION

DI	DUCTILE IRON
CS	CARBON STEEL
PVC	PVC
CPVC	CPVC
SS316	STAINLESS STEEL SCH. 316
SS304	STAINLESS STEEL SCH. 304

FLOW STREAM IDENTIFICATION

BA	BLOWER AIR
CA	COMPRESSED AIR
CD	CONDENSATE
CO	CLEAN OUT
DR	DRAINS
HCL	HYPOCHLORITE
NG	NATURAL GAS
NR	NITRATE RECYCLE
RAS	RETURN ACTIVATED SLUDGE
SC	SCREENINGS
SD	D.A.F. SOLIDS
ST	STORMWATER
STM	STEAM
VT	VENT
WW	PROCESS WASTEWATER
WAS	WASTE ACTIVATED SLUDGE
W	POTABLE WATER

PIPING & PIPING EQUIPMENT SYMBOLS

OPTIONAL DESIGNATION	SYMBOL	TYPE
NONE		CAP/PLUG
NONE		BLIND FLANGE
NONE		FLANGED CONNECTION
NONE		UNION
NONE		CONCENTRIC REDUCER
NONE		ECCENTRIC REDUCER
EJ		EXPANSION JOINT
ST		STRAINER
BFP		BACKFLOW PREVENTER
FLC		FLEXIBLE CONNECTION
NZ		SPRAY NOZZLE
QCH		HOSE COUPLING
QCU		QUICK COUPLING
SM		STATIC MIXER
DF		DIFFUSER (FINE BUBBLE)
DC		DIFFUSER (COARSE BUBBLE)
CAL		CALIBRATION COLUMN

EQUIPMENT IDENTIFICATION

T–101

EQUIPMENT TYPE
EQUIPMENT NUMBER

1 0 1

UNIT PROCESS
EQUIPMENT/ INSTRUMENTATION TYPE
INCREMENTAL EQUIPMENT No.

EQUIPMENT INSTRUMENTATION TYPE

0	TANKS
1	PUMPS
2	BLOWERS
3	MIXERS
4	AERATORS
5	OTHER
6	OTHER
7	OTHER
8	FLOW METER
9	INSTRUMENTATION (DO, PH, ORP, LEVEL, ETC.)

VALVE IDENTIFICATION
(IF DIFFERENT FROM PIPE SPECIFICATION)

VALVE SIZE IN INCHES — 6"
VA–118
VALVE TYPE — VALVE NUMBER

John H. Reid P.E.

DRAWN BY: S.B.A.
DESIGNED BY: J.H.R.
CHKD BY: J.H.R.

REID ENGINEERING COMPANY, INC.
1210 Princess Anne Street
Fredericksburg, Virginia 22401
Tel:(540) 371–8500 Fax:(540) 371–8576

P&ID SYMBOLS

MOUNTAIRE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM UPGRADE

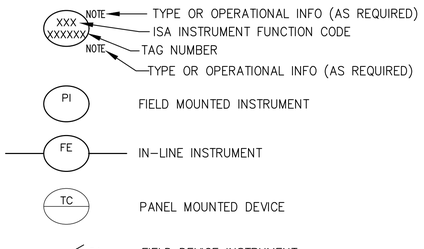
SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F200

NO.	BY	CHKD	APRV	REVISION	DATE

INSTRUMENT IDENTIFICATION

EXAMPLE SYMBOLS



INSTRUMENTATION FUNCTION DESIGNATORS

ACK	ACKNOWLEDGE
AM	AUTO-MANUAL
AUTO	AUTOMATIC
C	CLOSED
DISC	DISCONNECT SWITCH
DIFF	DIFFERENTIAL
ES	EMERGENCY STOP (SAFETY SWITCH)
ETM	ELAPSED TIME METER
F	FAST
FR	FORWARD-REVERSE
FS	FAST-SLOW
FSLOS	FAST-SLOW-LOCKOUT STOP
FTC	FAIL TO CLOSE
FTO	FAIL TO OPEN
HA	HAND-AUTO
HOA	HAND-OFF-AUTO
LCP	LOCATE CONTROL PANEL
L/B/P	LOCAL/BYPASS/AUTO
L/L	LEAD/LAG
L/L/LL	LEAD/LAG/LAG-LAG
LOC	LOCAL
LOR	LOCAL-OFF-REMOTE
LOS	LOCKOUT STOP
LR	LOCAL-REMOTE
LRA	LOCAL-REMOTE-AUTO
MA	MANUAL-AUTO
MAN	MAN
O	OPEN
OC	OPEN-CLOSE
OL	OVERLOAD
OO	ON-OFF
OPER	OPERATE
OSC	OPEN-STOP-CLOSE
RDY	READY
REM	REMOTE
RUN	RUN
S	SLOW
SEQ	SEQUENCER
SIL	SILENCE
SLOS	START-LOCKOUT STOP
SP	STOP
SR	STOP RESET
SS	START-STOP
ST	START
SWF	SEAL WATER FAIL

GENERAL ABBREVIATIONS

AC	ALTERNATING CURRENT
AVE	AVERAGE
BOD	BIOCHEMICAL OXYGEN DEMAND
BOT	BOTTOM
BOP	BOTTOM OF PIPE
CISP	CAST IRON SOIL PIPE
℄	CENTERLINE
Ø	DIAMETER
DC	DIRECT CURRENT
DO	DISSOLVED OXYGEN
DWG	DRAWING
E	EAST
EL	ELEVATION
EX	EXISTING
FLG	FLANGE
FT	FOOT, FEET
GALV	GALVANIZED
IMH	INFLUENT MANHOLE
IN	INCH(S)
IPS	INFLUENT PUMP STATION
INV	INVERT
MAX	MAXIMUM
MCC	MOTOR CONTROL CENTER
MFG	MANUFACTURER
MGD	MILLION GALLONS PER DAY
MG/L	MILLIGRAMS PER LITER
MH	MANHOLE
MIN	MINIMUM
MJ	MECHANICAL JOINT
N	TORQUE, NORTH
NO	NUMBER
NPT	AMERICAN NATIONAL STANDARD TAPER THREAD PIPE
ORP	OXIDATION REDUCTION POTENTIAL
pH	HYDROGEN ION CONCENTRATION
PE	PLAIN END
PLC(S)	PLACE OR PLACES
PS	PIPE SLEEVE
SCH	SCHEDULE
STL	STEEL
T	TURBIDITY
TSS	TOTAL SUSPENDED SOLIDS
TYP	TYPICAL
VFD	VARIABLE FREQUENCY DRIVE
WP	WALL PIPE
Z	SHEAR

AUTOMATIC VALVE SYMBOLS

OPEN-CLOSE VALVES

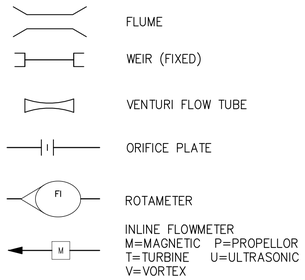
XXX = VALVE TAG NUMBER
SEE DRAWING F200 FOR VALVE SYMBOLS
* = ACTUATOR TYPE
M = ELECTRIC MOTOR
P = PNEUMATIC

MODULATING VALVES

XXX = VALVE TAG NUMBER
SEE ABOVE FOR ACTUATOR TYPE
SEE DRAWING F200 FOR VALVE SYMBOLS

PCV = PRESSURE CONTROL VALVE
FCV = FLOW CONTROL VALVE
LCV = LEVEL CONTROL VALVE
TCV = TEMPERATURE CONTROL VALVE

PRIMARY ELEMENT SYMBOLS

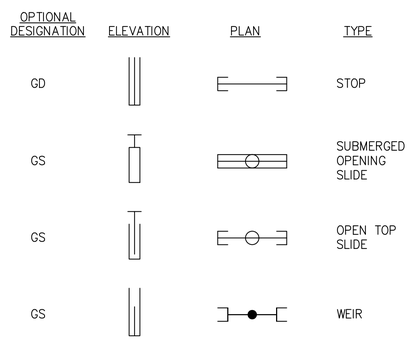


INSTRUMENT IDENTIFICATION TABLE – ISA STANDARDS

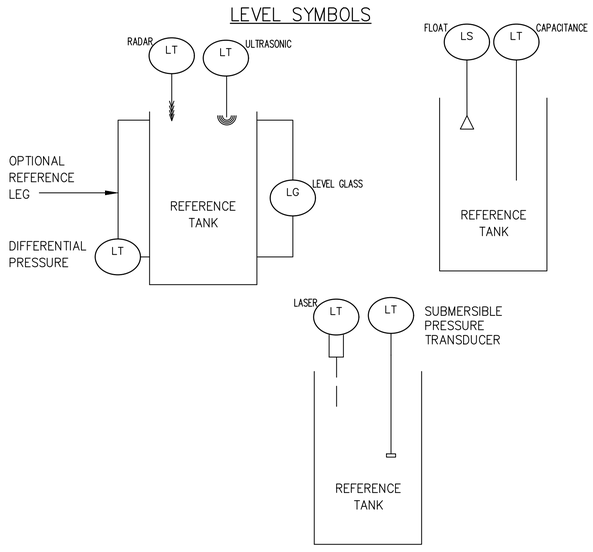
INSTRUMENT IDENTIFICATION TABLE ISA-S5.1-1984

LETTER	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	CONDUCTIVITY			CONTROL	
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			
G	GAGING (DIMENSIONAL)		GLASS, VIEWING DEVICE		
H	HAND (MANUALLY INITIATED)				HIGH (OPENED)
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW (CLOSED)
M	MOISTURE OR HUMIDITY				MIDDLE OR INTERMEDIATE
N	ON/OFF		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE, RESTRICTION		
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY OR EVENT	INTEGRATE, TOTALIZE			
R	RADIOACTIVITY		RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED,		UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	USER'S CHOICE			RELAY, COMPUTE, CONVERT	
Z	POSITION			DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

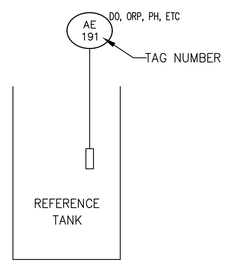
GATE SYMBOLS



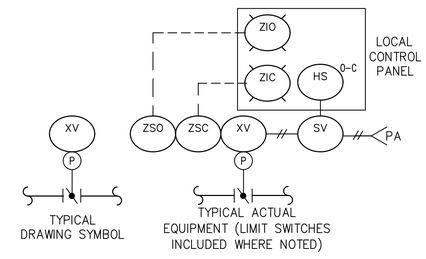
LEVEL SYMBOLS



ANALYSIS INSTRUMENT SYMBOLS



AIR OPERATED OPEN-CLOSE VALVES



John H. Reid P.E.

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DESIGNED BY: J.H.R.
CHKD BY: J.H.R.

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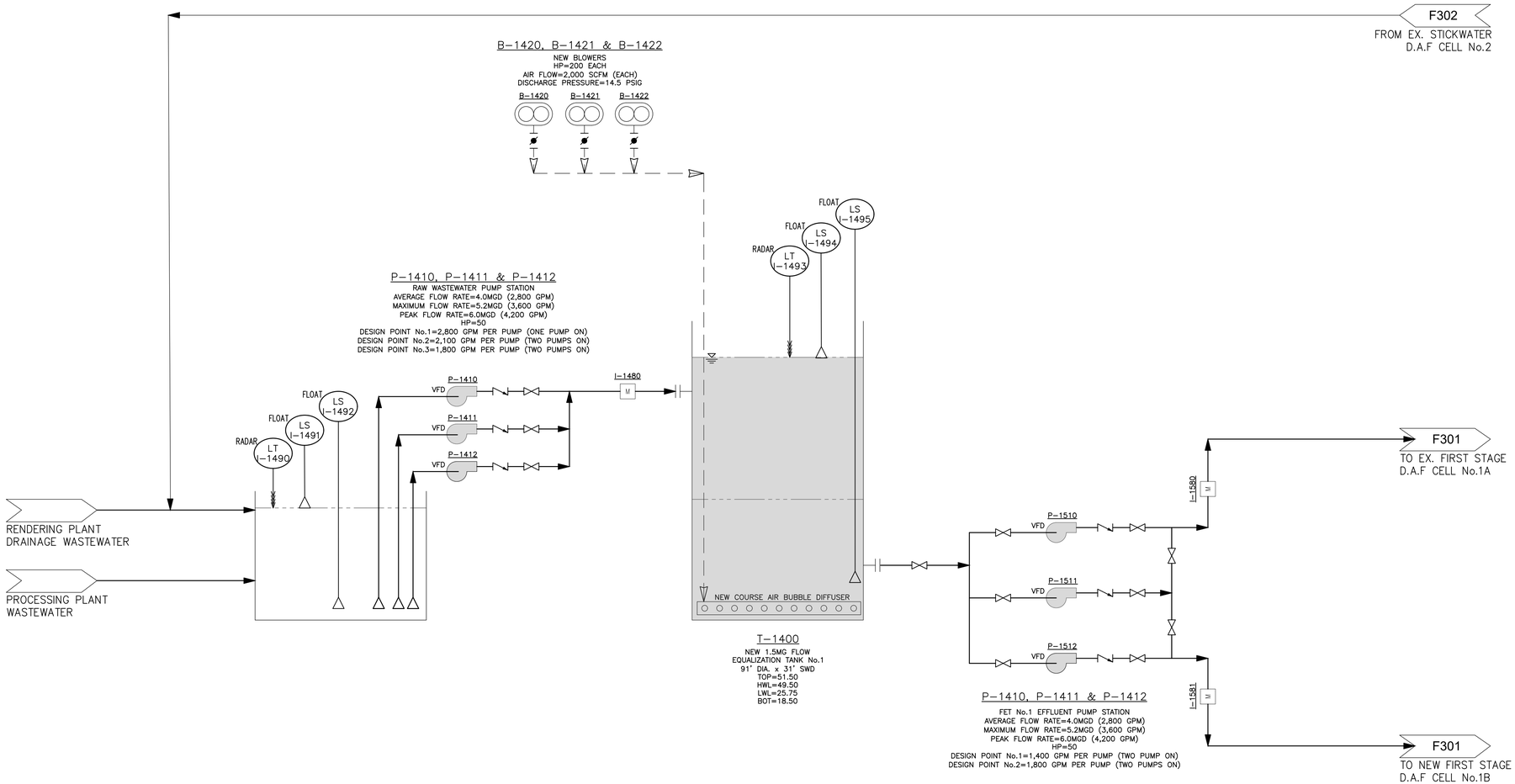
P&ID SYMBOLS

MOUNTAIRE FARMS-MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F201

NO.	BY	CHKD	APRV	REVISION	DATE



John H. Reid P.E.

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DESIGNED BY: JHR
CHKD BY: JHR

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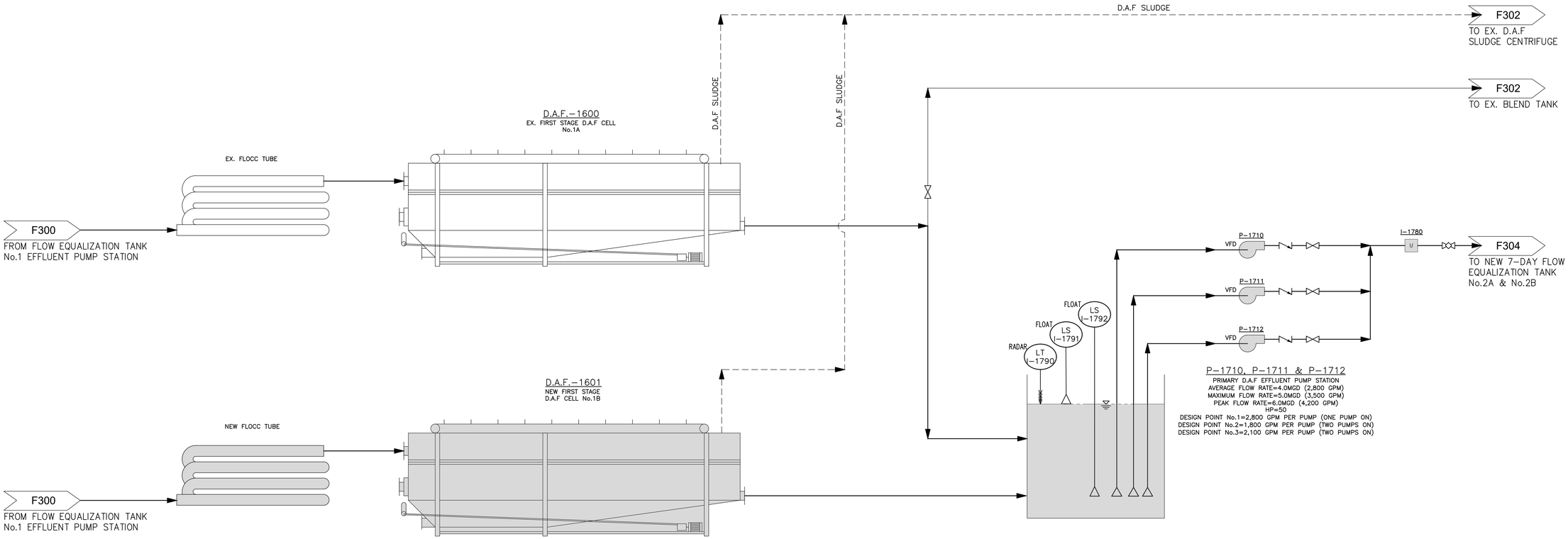
NEW FLOW EQUALIZATION TANK No.1
P&ID

MOUNTAIRE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F300

NO.	BY	CHKD	APRV	REVISION	DATE



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CHKD BY: JHR

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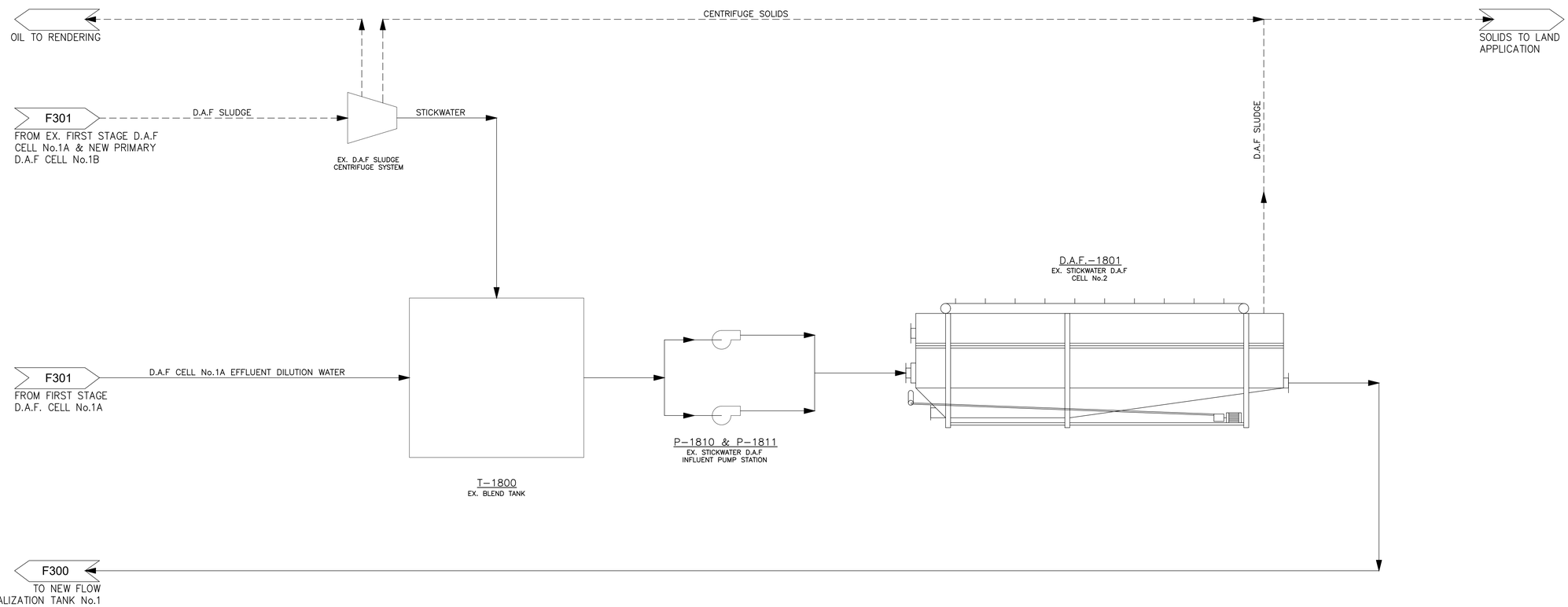
NEW FIRST STAGE D.A.F. & EFFLUENT PUMP STATION – P&ID

MOUNTAIRE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F301

NO.	BY	CHKD	APRV	REVISION	DATE



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CHKD BY: JHR

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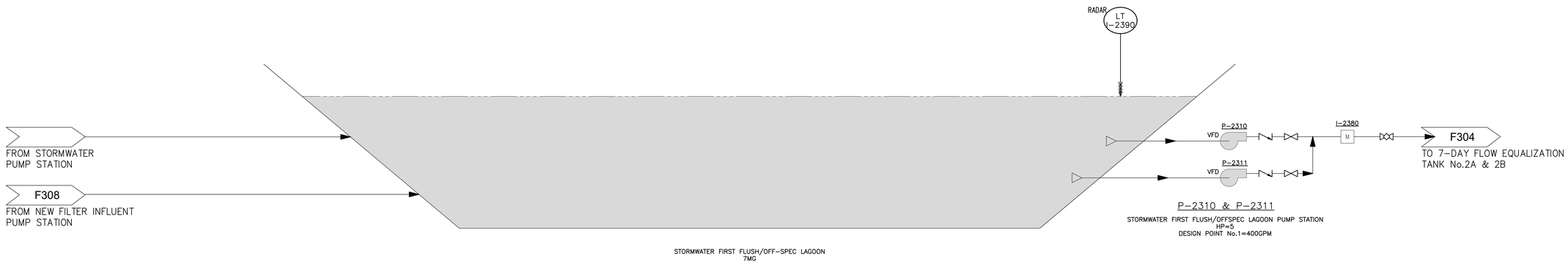
EXISTING BLEND TANK
P&ID

MOUNTAIRE FARMS-MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM
UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F302

NO.	BY	CHKD	APRV	REVISION	DATE



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CHKD BY:	JHR

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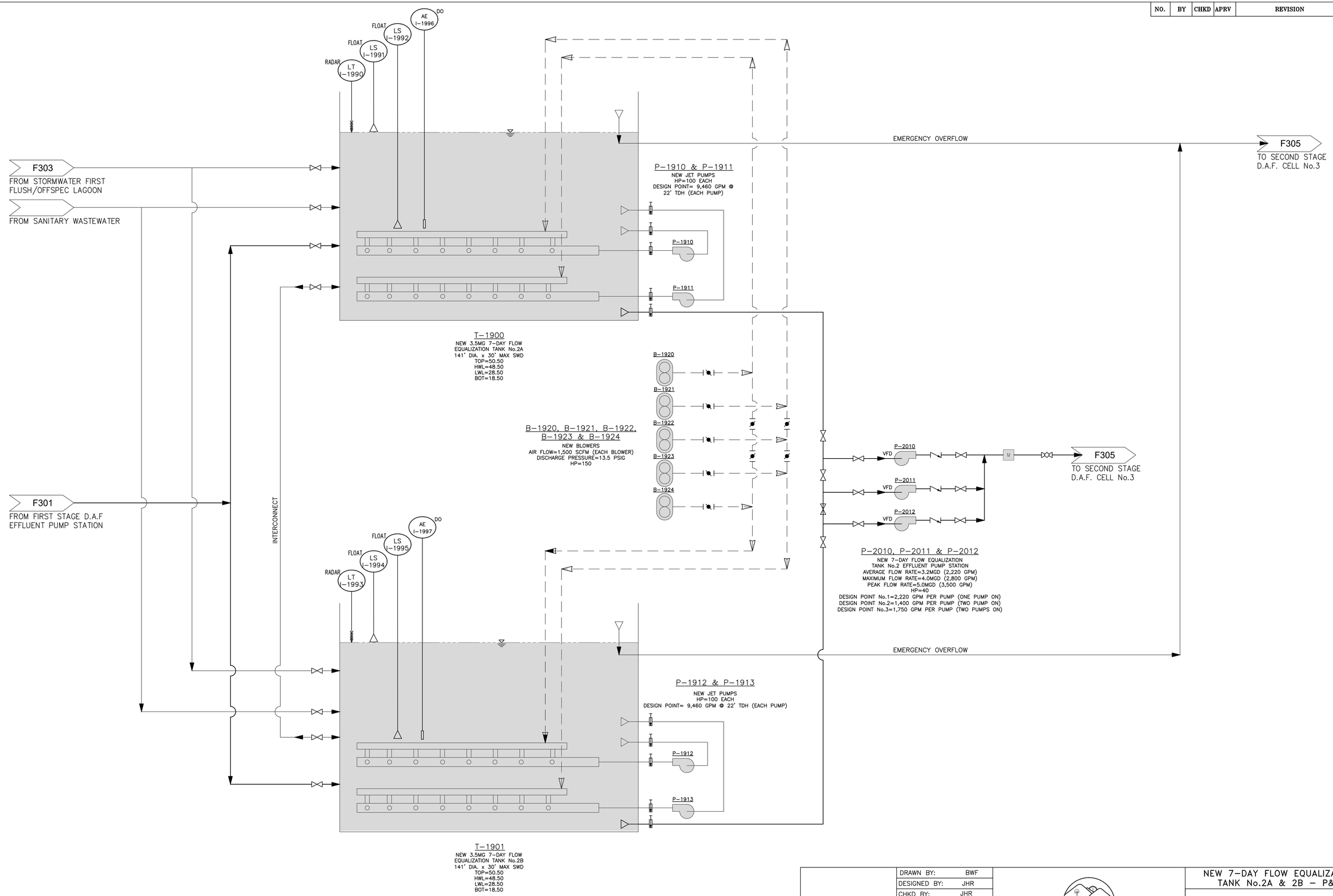
NEW STORMWATER FLUSH
LAGOON – P&ID

MOUNTAIRE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM
UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F303

NO.	BY	CHKD	APRV	REVISION	DATE



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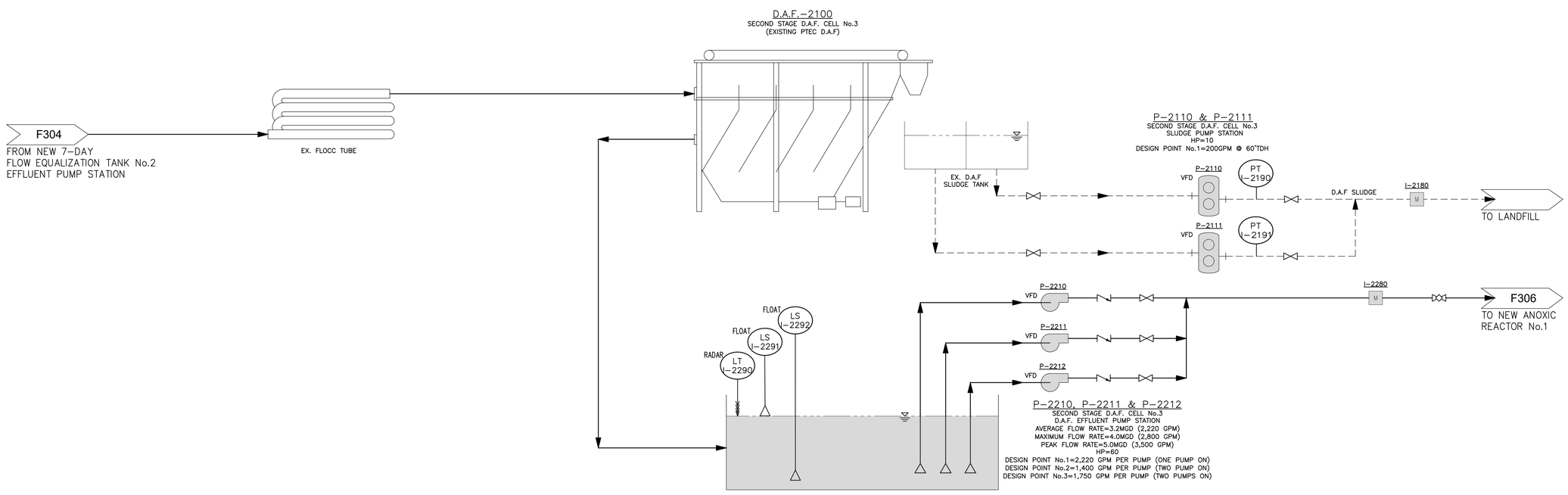
NEW 7-DAY FLOW EQUALIZATION TANK No.2A & 2B – P&ID

MOUNTAIRE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F304

NO.	BY	CHKD	APRV	REVISION	DATE



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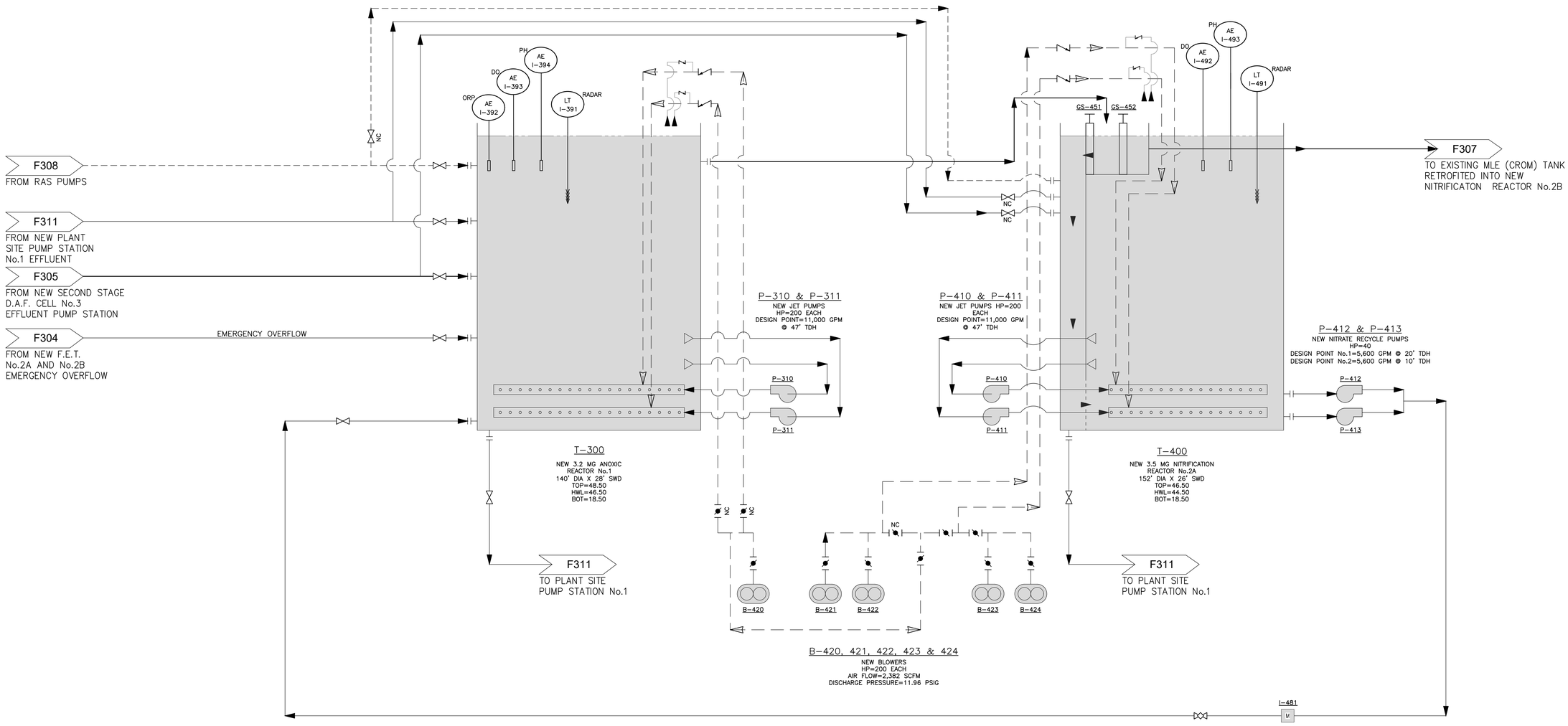
NEW SECOND STAGE D.A.F. No.3
EFFLUENT PUMP STATION – P&ID

MOUNTAIRE FARMS-MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM
UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F305

NO.	BY	CHKD	APRV	REVISION	DATE



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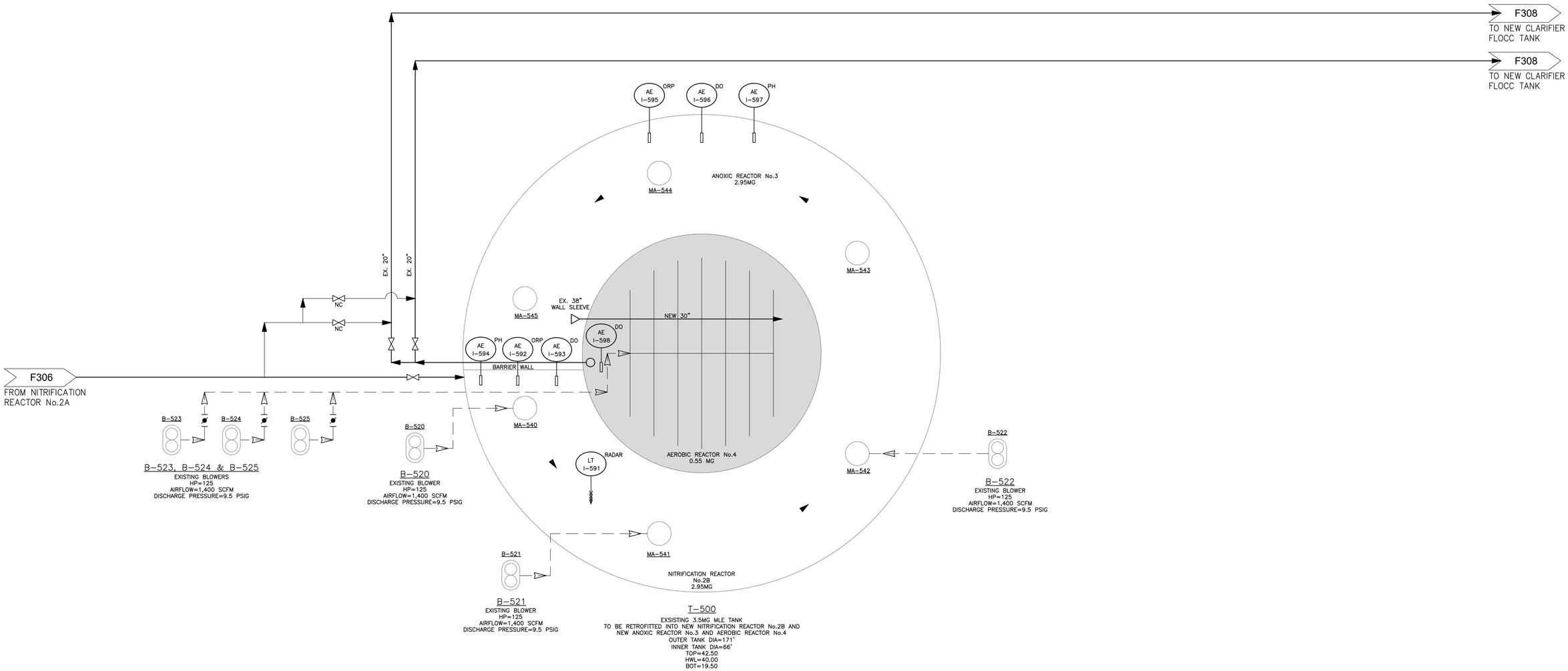
NEW REACTOR No.1 & No.2
P&ID

MOUNTAIRE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM
UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F306

NO.	BY	CHKD	APRV	REVISION	DATE



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DESIGNED BY: JHR
CHKD BY: JHR

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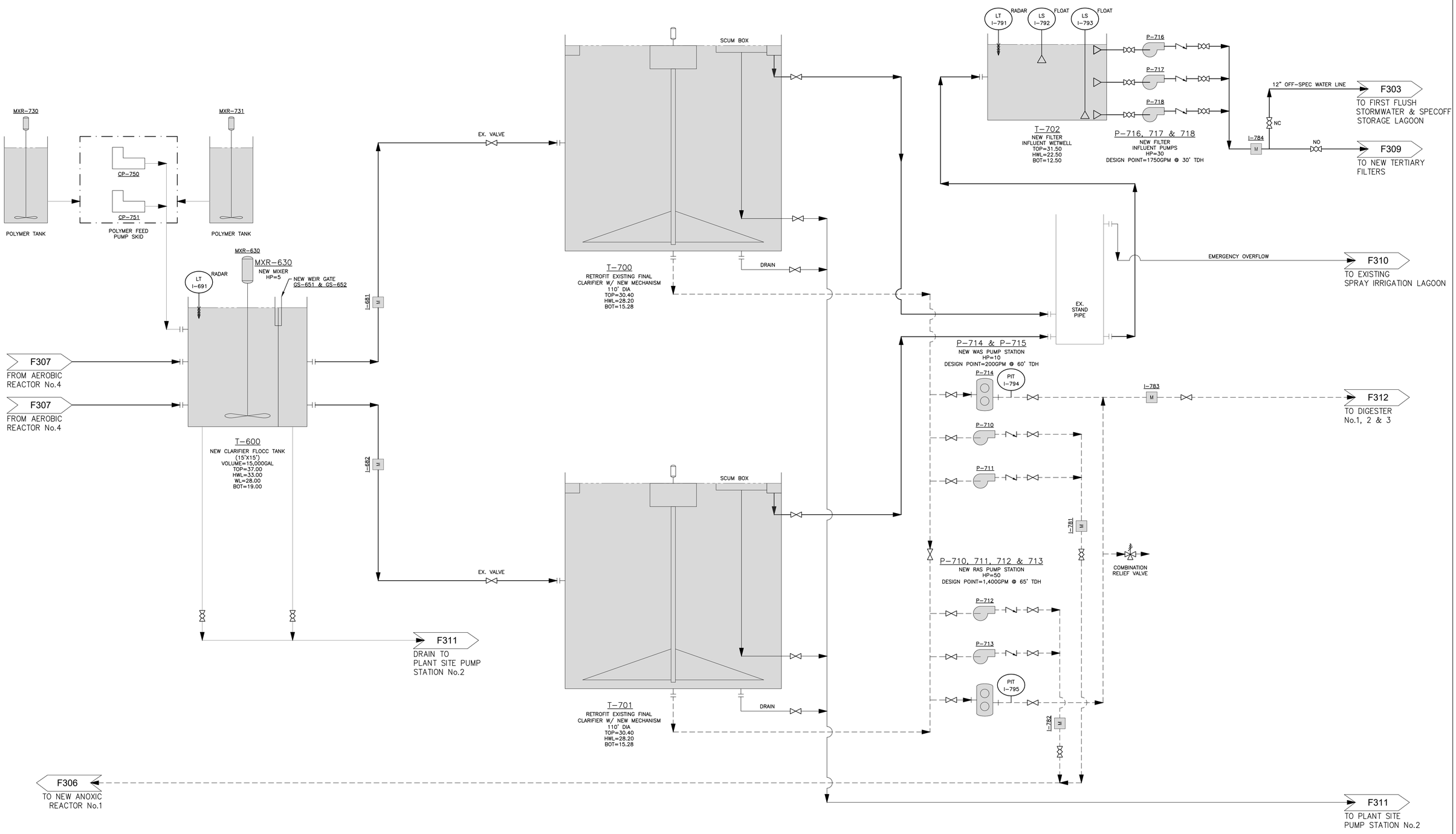
EXISTING MLE TANK
NEW REACTOR No.3 & No.4 – P&ID

MOUNTAIRE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM
UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F307

NO.	BY	CHKD	APRV	REVISION	DATE



DRAWN BY:	BWF	
DESIGNED BY:	JHR	
CHKD BY:	JHR	

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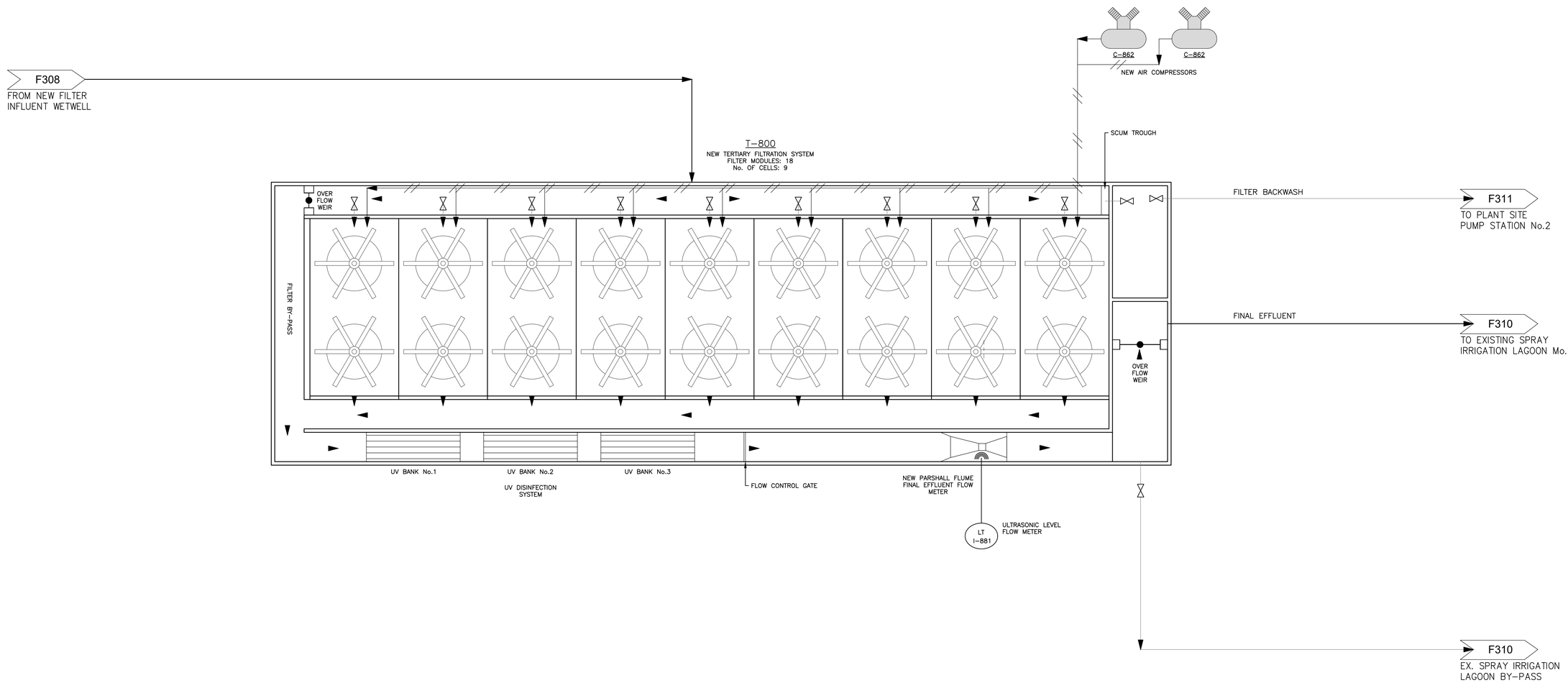
FINAL CLARIFIERS
P&ID

MOUNTAIRE FARMS-MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM
UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F308

NO.	BY	CHKD	APRV	REVISION	DATE



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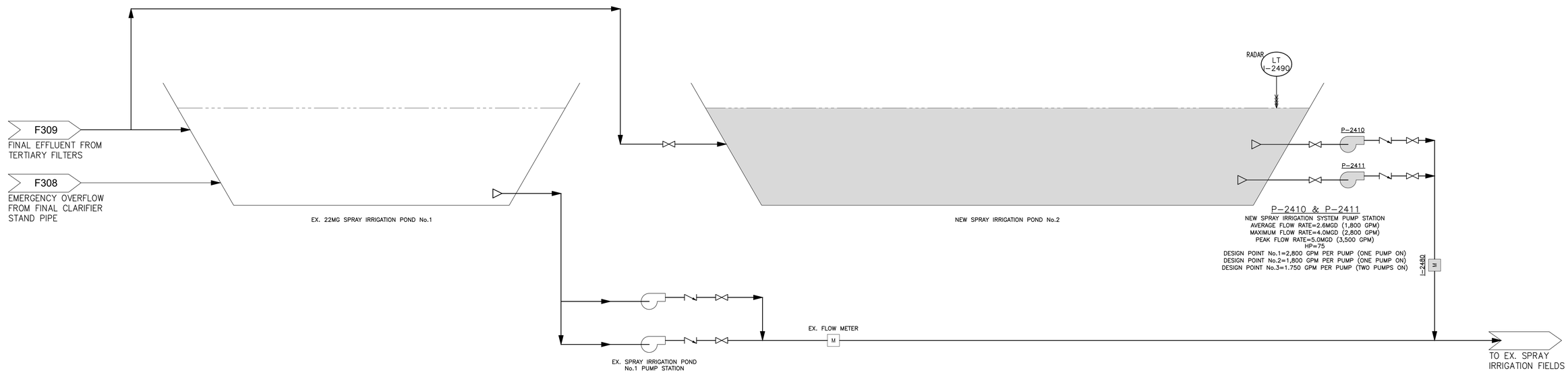
NEW SAND FILTERS
P&ID

MOUNTAIRE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM
UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F309

NO.	BY	CHKD	APRV	REVISION	DATE



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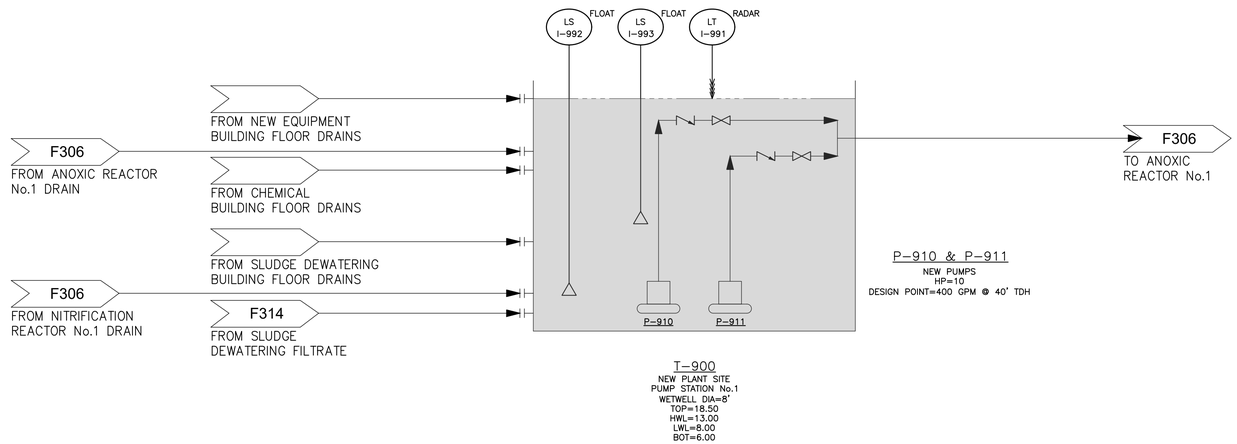
SPRAY IRRIGATION POND No.1 & No.2
P&ID

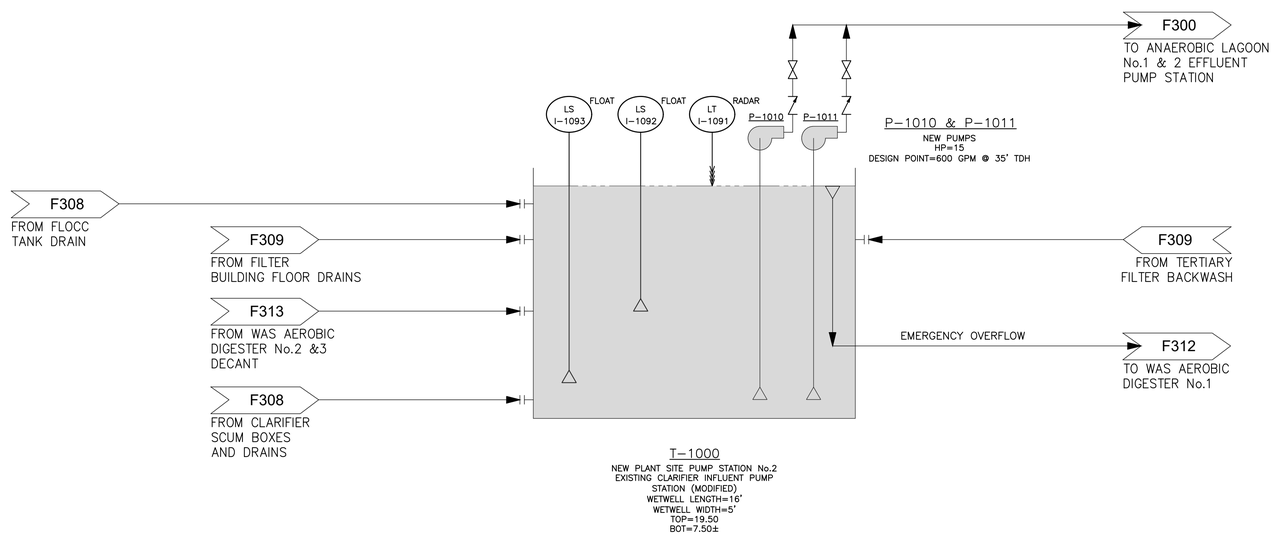
MOUNTAIRE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM
UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F310

NO.	BY	CHKD	APRV	REVISION	DATE





John H. Reid P.E.

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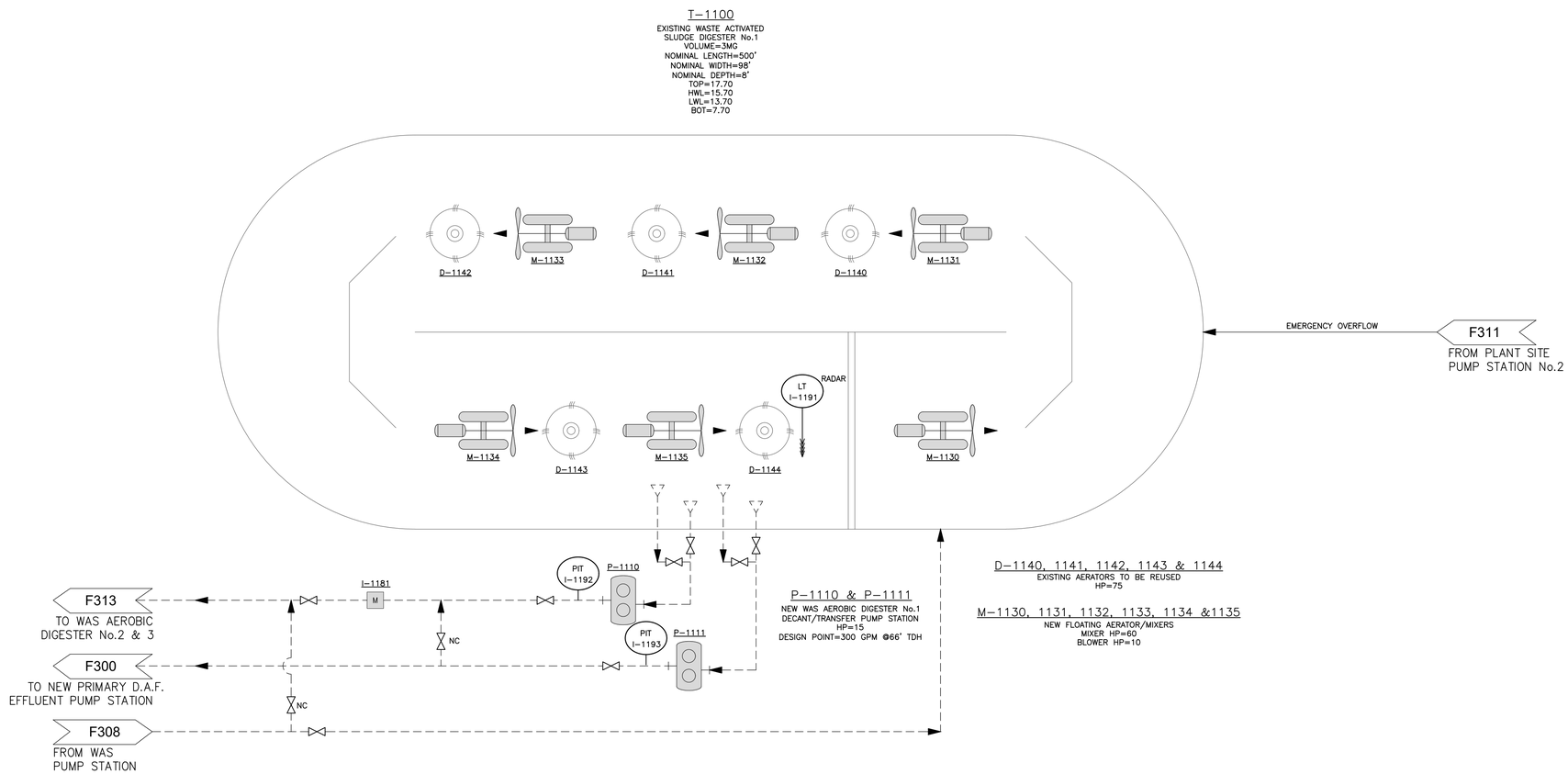
NEW PLANT SITE PUMP STATIONS No.1 & No.2 P&ID

MOUNTAIRE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F311

NO.	BY	CHKD	APRV	REVISION	DATE



John H. Reid P.E.

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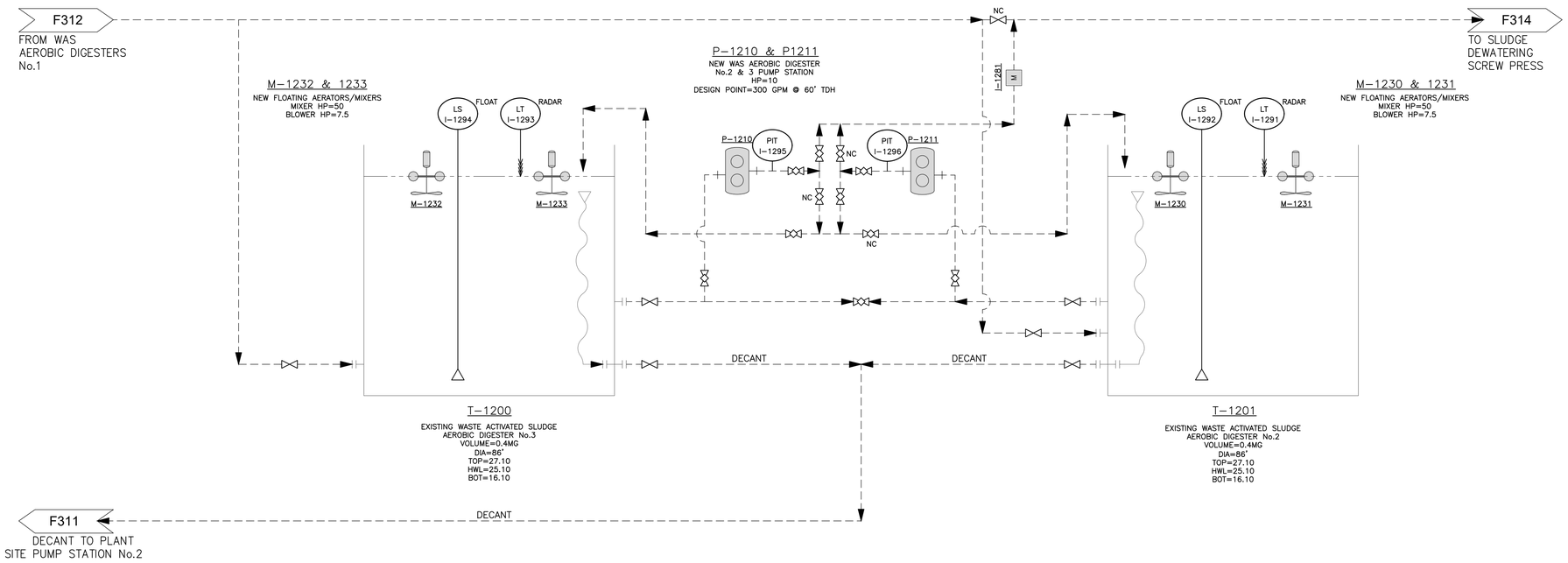
EXISTING WASTE ACTIVATED SLUDGE AEROBIC DIGESTER No.1 – P&ID

MOUNTAIRE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F312

NO.	BY	CHKD	APRV	REVISION	DATE



John H. Reid P.E.

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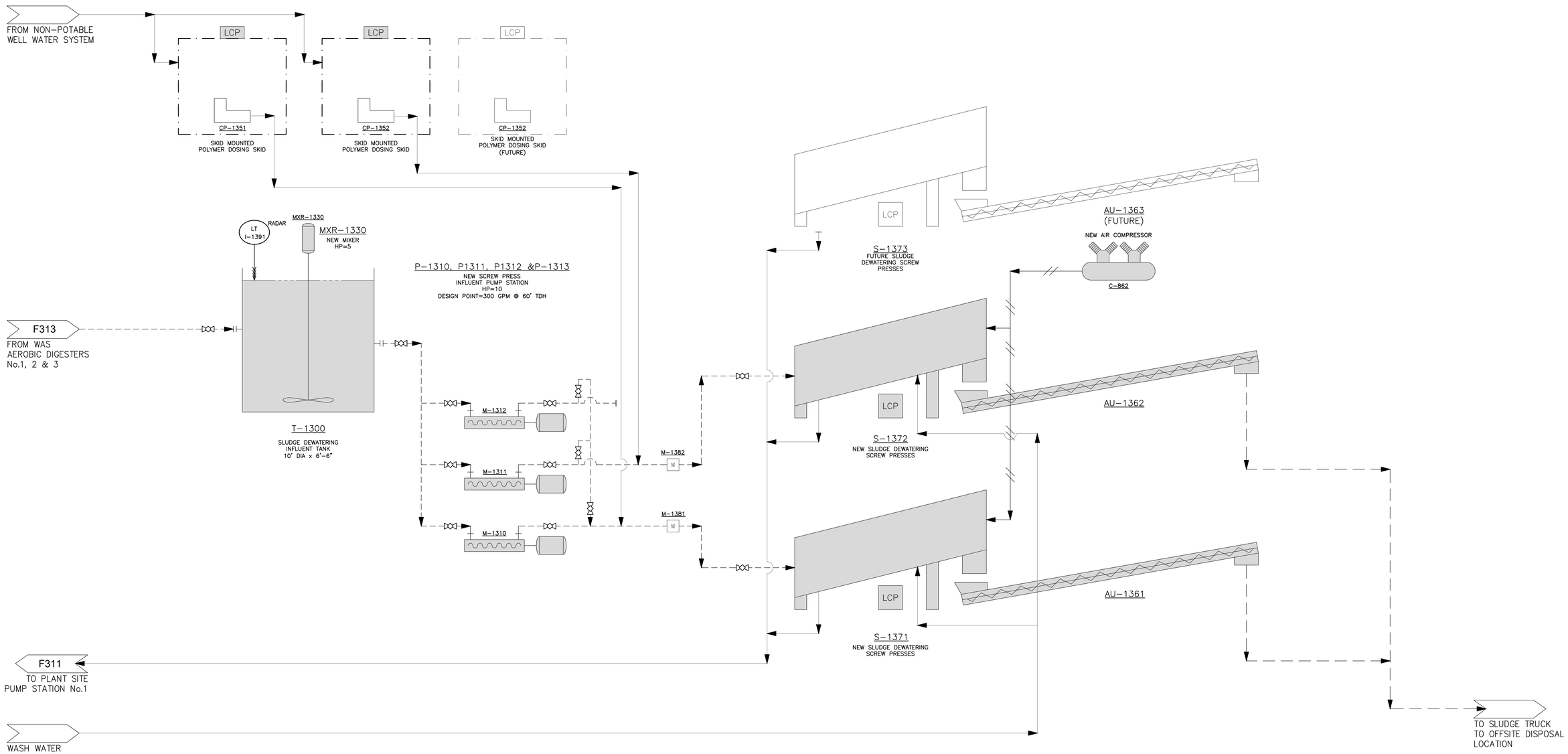
WASTE ACTIVATED SLUDGE
AEROBIC DIGESTER No.2 & 3 – P&ID

MOUNTARE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM
UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F313

NO.	BY	CHKD	APRV	REVISION	DATE



NOTE:
THE LOCALE CONTROL PANEL LCP SHALL BE LOCATED IN THE ELECTRICAL ROOM

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NEW SLUDGE DEWATERING SCREW PRESS – P&ID

MOUNTAIRE FARMS–MILLSBORO FACILITY
WASTEWATER TREATMENT SYSTEM UPGRADE

SUSSEX COUNTY, DELAWARE

DATE:	04.24.20	PROJECT NO.	MN01B
SCALE:	NONE	DWG NO:	F314

Appendix 7

Controls and Integration

Mountaire Farms of Delaware, Inc.

Millsboro Facility

Sussex County, DE

Wastewater Treatment System Upgrade

Control Logic Outline

Notes:

1. The Control Logic Outline is provided as a guide for the General Contractor and the Integrator to serve as a general guide of the design intent for the functionality of the specified equipment.
2. The Control Logic Outline shall be reviewed by each Bidder and any discrepancies between the Drawings, Technical Specifications and the Control Logic Outline shall be brought to the Engineers attention immediately.
3. Equipment specific alarms, warnings, and protections are not included in the following list. The General Contractor (GC)/Integrator shall be responsible for reviewing and coordinating all equipment specific features for inclusion in the system controls. This Control Logic Outline is a general list of the operational control scheme. The Contractor/Integrator shall provide revisions/additions to this outline to be included in the Contractor/Integrator prepared Control Logic Outline.
4. Audio/Visual Alarms are to activate for specified alarms within the PLC control as well as specified alarms outside of the PLC control (i.e. PLC is not functioning, or the equipment is being operated at the MCC)

Control Logic:

1. **Raw Wastewater Pump Station**

   A. Equipment

      1) Pump – P-1410

      2) Pump – P-1411

      3) Pump – P-1412

   B. Associated Equipment

      1) Level Transmitter – I-1490

      2) Level Float – I-1491

      3) Level Float – I-1492

      4) Flow Meter – I-1480

   C. MCC Controls

      1) Manually operate, On/Off, pumps

      2) Control Speed

3) Prevent pump from operating at LWL

4) Auto

D. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

b. Control Speed

c. Pump Auto Off at LWL

2) Automatic Control:

a. Pump on at Pump On Level

b. Adjust pump speed to maintain operator set liquid level in the wet well.

c. Prevent pump from operating at LWL.

d. Engage lag pump at HWL

E. Pump Alternation

1) The alternation of the lead pump shall be capable of being based on operational run time

2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.

F. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Flow rate, gpm

c. Pump operating Hz

d. Liquid Level in wet well

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

b. Flow volume pumped the previous day

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. Select lead pump

b. Disengage the automatic alternation of pumps

c. Adjust pump discharge flow rate.

G. Alarms

1) High Water Alarm

2) Low Water Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

2. FET No. 1 Blowers

A. Equipment

1) Blower – B-1420

2) Blower – B-1421

3) Blower – B-1422

B. MCC Controls

1) Manually operate, On/Off, pumps

2) Control Speed

C. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each Blower

b. Blower operating Hz

D. Alarms

1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

3. FET No. 1 – Process Integration

A. Equipment

1) D.O. Sensor – I-1496

B. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Display D.O. level

2) At a minimum, the following data shall be maintained in the PLC:

a. Record D.O. trend data

4. FET #1 Effluent Pump Station

A. Equipment

1) Pump – P-1510

2) Pump – P-1511

3) Pump – P-1512

B. Associated Equipment

1) Level Transmitter – I-1493

2) Level Float – I-1494

3) Level Float – I-1495

4) Flow Meter – I-1580

5) Flow Meter – I-1581

C. MCC Controls

1) Manually operate, On/Off, pumps

2) Control Speed

3) Prevent pump from operating at LWL

4) Auto

D. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

b. Control Speed

c. Pump Auto Off at LWL

2) Automatic Control:

a. Adjust pump speed to maintain operator set flow rate to Primary DAF No. 1A.

b. Adjust pump speed to maintain operator set flow rate to Primary DAF No. 1B.

c. Prevent pump from operating at LWL.

E. Pump Alternation

1) The alternation of the lead pump shall be capable of being based on operational run time

2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.

F. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Flow rate, gpm

c. Pump operating Hz

d. Liquid Level in FET

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

b. Flow volume pumped the previous day

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. Select lead pump

b. Disengage the automatic alternation of pumps

c. Adjust pump discharge flow rate.

G. Alarms

1) High Water Alarm

2) Low Water Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

5. First Stage DAF Sludge Pump Station

A. Equipment

1) Pump – P-1610

2) Pump – P-1611

B. Associated Equipment

1) Flow Meter – I-1680

2) Pressure Sensor – I-1690

3) Pressure Sensor – I-1691

C. MCC Controls

1) Manually operate, On/Off, pumps

2) Adjust pump speed

3) Auto

D. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

b. Adjust pump speed

c. Prevent pump from operating at high discharge pressure

2) Automatic Control

a. Adjust pump speed to maintain operate set discharge flow rate.

b. Prevent pump from operating at high discharge pressure

E. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Flow rate, gpm

c. Pump operating Hz

d. Pump discharge pressure

e. Digester liquid level

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

b. Flow volume pumped the previous day

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. Adjust pump discharge flow rate.

F. Alarms

1) HWL Alarm

2) LWL Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

6. First Stage DAF Effluent Pump Station

A. Equipment

1) Pump – P-1710

2) Pump – P-1711

3) Pump – P-1712

B. Associated Equipment

1) Level Transmitter – I-1790

2) Level Float – I-1791

3) Level Float – I-1792

4) Flow Meter – I-1780

C. MCC Controls

1) Manually operate, On/Off, pumps

2) Control Speed

3) Prevent pump from operating at LWL

4) Auto

D. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

b. Control Speed

c. Pump Auto Off at LWL

2) Automatic Control:

a. Pump on at Pump On Level

b. Adjust pump speed to maintain operator set liquid level in the wet well.

c. Prevent pump from operating at LWL.

d. Engage lag pump at HWL

E. Pump Alternation

1) The alternation of the lead pump shall be capable of being based on operational run time

2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.

F. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Flow rate, gpm

c. Pump operating Hz

d. Liquid Level in wet well

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

b. Flow volume pumped the previous day

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. Select lead pump

b. Disengage the automatic alternation of pumps

c. Adjust pump discharge flow rate.

G. Alarms

1) High Water Alarm

2) Low Water Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic

Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

7. FET #2A & #2B – Jet System Pumps

A. Equipment

1) Pump – P-1910 (FET #2A)
2) Pump – P-1911 (FET #2A)
3) Pump – P-1912 (FET #2B)
4) Pump – P-1913 (FET #2B)

B. Associated Equipment

1) Level Transmitter Radar – I-1990 (FET #2A)
2) Level Float – I-1991 (FET #2A)
3) Level Float – I-1992 (FET #2A)
4) Level Transmitter Radar – I-1993 (FET #2B)
5) Level Float – I-1994 (FET #2B)
6) Level Float – I-1995 (FET #2B)

C. MCC Controls

1) Manually operate, On/Off, pumps
2) Prevent pump from operating at LWL
3) Auto

D. PLC Controls

1) Manual Control
   a. Manually operate, On/Off, pumps
   b. Pump Off at LWL

E. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:
   a. Operational status of each pump
   b. Pump operating Hz
   c. Liquid Level in the FET #2A & #2B
2) At a minimum, the following data shall be maintained in the PLC:
   a. Run time data for each pump

F. Alarms

1) High Water Alarm

2) Low Water Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

8. FET #2A & #2B – Jet System Blowers

A. Equipment

1) Blower – B-1920

2) Blower – B-1921

3) Blower – B-1922

4) Blower – B-1923

5) Blower – B-1924

B. Associated Equipment

1) D.O. Sensor – I-1996

2) D.O. Sensor – I-1997

3) Pump – P-1910

4) Pump – P-1911

5) Pump – P-1912

6) Pump – P-1913

C. MCC Controls

1) Manually operate, On/Off, blowers

2) Control blower speed

3) Auto

D. PLC Controls

1) Manual Controls

a. Manually operate, On/Off, blowers

b. Adjust blower speed

c. Prevent Blowers from operating when the corresponding jet pump is not operating. Must be able to override the lock out in order to perform backflush and to operate if one of the jet pumps or reactors is out of service

2) Automatic Controls

a. Automatically adjust speed to maintain operate specified D.O.

b. Prevent Blowers from operating when the corresponding jet pump is not operating. Must be able to override the lock out in order to perform backflush and to operate if one of the jet pumps or reactors is out of service

c. Turn additional blowers (non-lead blower) On/Off to maintain set D.O. Level

i. The GC/Integrator/Equipment Manufacturer shall propose a blower control sequencing that prevents blowers from frequently cycling on and off.

3) Blower Alternation

a. The alternation of the lead blower shall be capable of being based on operational run time

b. All blowers shall alternate as lead blower. All blowers to maintain approximately equivalent run times.

c. The alternation of the lead blower shall be capable of being based on a set time and day of the week.

E. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each blower

b. D.O.

c. Blower operating Hz

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each blower

b. D.O. trend data for both tanks

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. D.O. set point in each reactor

b. Manually select lead blower

c. Disengage the automatic alternation of pumps

d. Override the blower lockout in order to operate the blowers without the jet system pumps operating in order to backflush the system.

F. Alarms

1) The Contractor/Integrator shall be responsible for identifying all available alarms on the existing equipment and the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

9. FET #2 Effluent Pump Station

A. Equipment

1) Pump – P-2010

2) Pump – P-2011

3) Pump – P-2012

B. Associated Equipment

1) Level Transmitter – I-1990 (FET #2A)

2) Level Transmitter – I-1993 (FET #2B)

3) Level Float – I-1991 (FET #2A)

4) Level Float – I-1992 (FET #2A)

5) Level Float – I-1994 (FET #2B)

6) Level Float – I-1995 (FET #2B)

7) Flow Meter – I-2080

C. MCC Controls

1) Manually operate, On/Off, pumps

2) Control Speed

3) Prevent pump from operating at LWL

4) Auto

D. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

b. Control Speed

c. Pump Auto Off at LWL

2) Automatic Control:

a. Adjust pump speed to maintain operator set flow rate to Secondary DAF

b. Prevent pump from operating at LWL.

i. Operate shall be able to link the appropriate level device signals to the corresponding pump to prevent LWL operation.

E. Pump Alternation

1) The alternation of the lead pump shall be capable of being based on operational run time

2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.

F. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Flow rate, gpm

c. Pump operating Hz

d. Liquid Level in FETs

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

b. Flow volume pumped the previous day

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. Select lead pump

b. Disengage the automatic alternation of pumps

c. Adjust pump discharge flow rate.

G. Alarms

1) High Water Alarm

2) Low Water Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

10. Second Stage DAF Sludge Pump Station

A. Equipment

1) Pump – P-2110

2) Pump – P-2111

B. Associated Equipment

1) Flow Meter – I-2180

2) Pressure Sensor – I-2190

3) Pressure Sensor – I-2191

C. MCC Controls

1) Manually operate, On/Off, pumps

2) Adjust pump speed

3) Auto

D. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

b. Adjust pump speed

c. Prevent pump from operating at high discharge pressure

2) Automatic Control

a. Adjust pump speed to maintain operate set discharge flow rate.

b. Prevent pump from operating at high discharge pressure

E. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Flow rate, gpm

c. Pump operating Hz

d. Pump discharge pressure

e. Digester liquid level

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

b. Flow volume pumped the previous day

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. Adjust pump discharge flow rate.

F. Alarms

1) HWL Alarm

2) LWL Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

11. Second Stage DAF Effluent Pump Station

A. Equipment

1) Pump – P-2210

2) Pump – P-2211

3) Pump – P-2212

B. Associated Equipment

1) Level Transmitter – I-2290

2) Level Float – I-2291

3) Level Float – I-2292

4) Flow Meter – I-2280

C. MCC Controls

1) Manually operate, On/Off, pumps
2) Control Speed
3) Prevent pump from operating at LWL
4) Auto

D. PLC Controls
1) Manual Control
a. Manually operate, On/Off, pumps
b. Control Speed
c. Pump Auto Off at LWL
2) Automatic Control:
a. Pump on at Pump On Level
b. Adjust pump speed to maintain operator set liquid level in the wet well.
c. Prevent pump from operating at LWL.
d. Engage lag pump at HWL

E. Pump Alternation
1) The alternation of the lead pump shall be capable of being based on operational run time
2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.

F. HMI
1) At a minimum, the following shall be displayed on the HMI Screen:
a. Operational status of each pump
b. Flow rate, gpm
c. Pump operating Hz
d. Liquid Level in wet well
2) At a minimum, the following data shall be maintained in the PLC:
a. Run time data for each pump
b. Flow volume pumped the previous day
3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
a. Select lead pump
b. Disengage the automatic alternation of pumps
c. Adjust pump discharge flow rate.

G. Alarms
1) High Water Alarm

2) Low Water Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

12. Stormwater First Flush / Offspec Lagoon Pump Station

A. Equipment

1) Pump – P-2310

2) Pump – P-2311

B. Associated Equipment

1) Level Transmitter – I-2390

2) Flow Meter – I-2380

C. MCC Controls

1) Manually operate, On/Off, pumps

2) Control Speed

3) Prevent pump from operating at LWL

4) Auto

D. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

b. Control Speed

c. Pump Auto Off at LWL

2) Automatic Control:

a. Adjust pump speed to maintain operator set flow rate.

b. Prevent pump from operating at LWL.

E. Pump Alternation

1) The alternation of the lead pump shall be capable of being based on operational run time

2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.

F. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Flow rate, gpm

c. Pump operating Hz

d. Liquid Level in Lagoon

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

b. Flow volume pumped the previous day

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. Select lead pump

b. Disengage the automatic alternation of pumps

c. Adjust pump discharge flow rate.

G. Alarms

1) High Water Alarm

2) Low Water Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

13. Spray Irrigation Pond Pump Station

A. Equipment

1) Pump – P-2410

2) Pump – P-2411

B. Associated Equipment

1) Level Transmitter – I-2490

2) Flow Meter – I-2480

C. MCC Controls

1) Manually operate, On/Off, pumps

2) Control Speed

3) Prevent pump from operating at LWL

4) Auto

D. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

b. Control Speed

c. Pump Auto Off at LWL

2) Automatic Control:

a. Adjust pump speed to maintain operator set flow rate.

b. Prevent pump from operating at LWL.

E. Pump Alternation

1) The alternation of the lead pump shall be capable of being based on operational run time

2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.

F. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Flow rate, gpm

c. Pump operating Hz

d. Liquid Level in Lagoon

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

b. Flow volume pumped the previous day

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. Select lead pump

b. Disengage the automatic alternation of pumps

c. Adjust pump discharge flow rate.

G. Alarms

1) High Water Alarm

2) Low Water Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

14. Anoxic Reactor No. 1 Jet System Pumps

A. Equipment

1) Pump – P-310

2) Pump – P-311

B. Associated Equipment

1) Level Sensor – I-391

C. MCC Controls

1) Manually operate, On/Off, pumps

2) Prevent pump from operating at LWL (I-391)

3) Auto

D. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

b. Pump Off at LWL (I-391)

E. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Pump operating Hz

c. Liquid Level in the Anoxic Reactor No. 1 (I-391)

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

F. Alarms

1) High Water Alarm

2) Low Water Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

15. Anoxic Reactor No. 1 – Process Instrumentation

A. Equipment

1) Level Sensor – I-391

2) ORP Sensor – I-392

3) D.O. Sensor – I-393

4) pH Sensor – I-394

B. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Anoxic Reactor No. 1 liquid level

b. Display ORP level

c. Display D.O. level

d. Display pH level

2) At a minimum, the following data shall be maintained in the PLC:

a. Record ORP trend data

b. Record D.O. trend data

c. Record pH trend data

C. Alarms

1) High Water Level (HWL) Alarm

2) Low Water Level (LWL) Alarm

16. Nitrification Reactor No. 2 Influent Slide Gates

A. Equipment

1) Weir Gate – GS-451

2) Weir Gate – GS-452

B. MCC Controls

1) Adjust weir gate position

C. PLC

1) Manual Controls

a. Adjust weir gate position

D. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Position of each weir gate

E. Alarms

1) Alarm if both weir gates are simultaneously closed

17. Nitrification Reactor No. 2 – Jet System Pumps

A. Equipment

1) Pump – P-410

2) Pump – P-411

B. Associated Equipment

1) Level Sensor – I-491

C. MCC Controls

1) Manually operate, On/Off, pumps

2) Adjust pump operating speed

3) Prevent pump from operating at LWL (I-491)

4) Auto

D. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

b. Adjust pump operating speed

c. Pump Off at LWL (I-491)

E. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Pump operating Hz

c. Liquid Level in the Nitrification Reactor No. 2 (I-491)

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

F. Alarms

1) High Water Alarm

2) Low Water Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

18. Nitrification Reactor No. 2 – Jet System Blowers

A. Normal operation is for the Nitrification Reactor No. 2 to be operated as a completely mixed aerobic reactor (jet mixing with aeration) and the Anoxic Reactor No. 1 to be operated at a completely mixed anoxic condition (jet mixing without aeration). Alternate Operation: The Anoxic Reactor will act as the single aerobic reactor and the Nitrification Reactor No. 2 will be offline; therefore, the blowers will provide air flow to the Anoxic Reactor No. 1 jet system

B. Equipment

1) Blower – B-420

2) Blower – B-421

3) Blower – B-422

4) Blower – B-423

5) Blower – B-424

C. Associated Equipment

1) D.O. Sensor – I-492
2) D.O. Sensor – I-393
3) Pump – P-310
4) Pump – P-311
5) Pump – P-410
6) Pump – P-411

D. MCC Controls
1) Manually operate, On/Off, blowers
2) Control blower speed
3) Auto

E. PLC Controls
1) Manual Controls
a. Manually operate, On/Off, blowers
b. Adjust blower speed
c. Select Normal or Alternate Operation Mode
i. During Normal Operation Mode of using the Nitrification Reactor No. 2 as the aerobic reactor: Prevent Blower B-420, B-421, B-422, B-423, and B-424 from operating when the Nitrification Reactor No. 2 jet pumps are not operating. Must be able to override the lock out in order to perform backflush and to operate if one of the jet pumps or reactors is out of service
ii. During Alternate Operation Mode of using the Anoxic Reactor No. 1 as an aerobic reactor: Prevent Blower B-420, B-421, B-422, B-523, and B-524 from operating when the Anoxic Reactor No. 1 jet pumps are not operating. Must be able to override the lock out in order to perform backflush.

2) Automatic Controls
a. Select Normal or Alternate Operation Mode
i. Normal Operation: Automatically adjust speed to maintain operate specified D.O. in the Nitrification Reactor #2 (Normal Operation). During Normal Operation the D.O. in the Anoxic Reactor No. 1 will not have any control of the blower's operation.
ii. Alternate Operation: Automatically adjust speed to maintain operator specified D.O. in the Anoxic Reactor #1 (Alternative Operation when Anoxic Reactor is being operated as the aerobic reactor)
iii. During Normal Operation Mode of using the Nitrification Reactor No. 2 as the aerobic reactor: Prevent Blower B-420, B-421, B-422, B-423, and B-424 from operating when the Nitrification Reactor No. 2 jet pumps are not operating. Must be able to override the lock out in order to perform backflush and to operate if one of the jet pumps or reactors is out of service

iv. During Alternate Operation Mode of using the Anoxic Reactor No. 1 as an aerobic reactor: Prevent Blower B-420, B-421, B-422, B-523, and B-524 from operating when the Anoxic Reactor No. 1 jet pumps are not operating. Must be able to override the lock out in order to perform backflush.

b. Turn additional blowers (non-lead blower) On/Off to maintain set D.O. Level

i. The GC/Integrator/Equipment Manufacturer shall propose a blower control sequencing that prevents blowers from frequently cycling on and off.

3) Blower Alternation

a. The alternation of the lead blower shall be capable of being based on operational run time

b. All blowers shall alternate as lead blower. All blowers to maintain approximately equivalent run times.

c. The alternation of the lead blower shall be capable of being based on a set time and day of the week.

F. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each blower

b. D.O. (I-393 & I-492)

c. Blower operating Hz

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each blower

b. D.O. trend data for both reactors

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. D.O. set point in each reactor

b. Manually select lead blower

c. Disengage the automatic alternation of pumps

d. Override the blower lockout in order to operate the blowers without the jet system pumps operating in order to backflush the system.

G. Alarms

1) The Contractor/Integrator shall be responsible for identifying all available alarms on the existing equipment and the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

19. Nitrification Reactor No. 2 – Process Instrumentation

A. Equipment

1) Level Sensor – I-491
2) D.O. Sensor – I-492
3) pH Sensor – I-493

B. HMI
1) At a minimum, the following shall be displayed on the HMI Screen:
a. Nitrification Reactor No. 2 liquid level
b. Display D.O. level
c. Display pH level
2) At a minimum, the following data shall be maintained in the PLC:
a. Record D.O. trend data
b. Record pH trend data

C. Alarms
1) High Water Level (HWL) Alarm
2) Low Water Level (LWL) Alarm

20. Nitrate Recycle Pump Station

A. Equipment
1) Pump – P-412
2) Pump – P-413

B. Associated Equipment
1) Flow Meter – I-481
2) Level Sensor – I-391
3) Level Sensor – I-491

C. MCC Controls
1) Manually operate, On/Off, pumps
2) Adjust pump operating speed
3) Prevent pump from operating at Nitrification Reactor No. 2 LWL (I-491)
4) Prevent pump from operating at Anoxic Reactor No. 1 HWL (I-391)
5) Auto

D. PLC Controls
1) Manual Control
a. Manually operate, On/Off, pumps
b. Adjust pump operating speed
c. Prevent pump from operating at Nitrification Reactor No. 2 LWL (I-491)

d. Prevent pump from operating at Anoxic Reactor No. 1 HWL (I-391)

2) Automatic Control

a. Adjust pump speed to maintain operator set discharge flow rate (I-481)

i. NOTE: Normally two pumps will operate to maintain the required Nitrate Recycle flow rate.

b. Prevent pump from operating at Nitrification Reactor No. 2 LWL (I-491)

c. Prevent pump from operating at Anoxic Reactor No. 1 HWL (I-391)

E. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Flow rate, gpm (I-481)

c. Pump operating Hz

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

b. Flow volume pumped the previous day (I-481)

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. Adjust pump discharge flow rate.

F. Alarms

1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

21. Anoxic Reactor No. 3 Existing Blowers

A. Equipment

1) Ex. Blower B-520

2) Ex. Blower B-521

3) Ex. Blower B-522

B. MCC Controls

1) Existing

C. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each Blower

b. Blower operating Hz

D. Alarms

1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

22. Anoxic Reactor No. 3 Existing Mixers (SAM Units)

A. Equipment

1) Ex. SAM Unit – MA-540

2) Ex. SAM Unit – MA-541

3) Ex. SAM Unit – MA-542

4) Ex. SAM Unit – MA-543

5) Ex. SAM Unit – MA-544

6) Ex. SAM Unit – MA-545

B. MCC Controls

1) Existing

C. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each SAM Unit

b. Pump operating Hz

D. Alarms

1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

23. Anoxic Reactor No. 3 – Process Instrumentation

A. Equipment

1) Level Sensor – I-591

2) ORP Sensor – I-592

3) D.O. Sensor – I-593

4) pH Sensor – I-594

5) ORP Sensor – I-595

6) D.O. Sensor – I-596

7) pH Sensor – I-597

B. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Anoxic Reactor No. 3 liquid level

b. Display ORP level

c. Display D.O. level

d. Display pH level

2) At a minimum, the following data shall be maintained in the PLC:

a. Record ORP trend data

b. Record D.O. trend data

c. Record pH trend data

C. Alarms

1) High Water Level (HWL) Alarm

2) Low Water Level (LWL) Alarm

24. Aerobic Reactor No. 4 Existing Blowers

A. Equipment

1) Ex. Blower B-523

2) Ex. Blower B-524

3) Ex. Blower B-525

B. MCC Controls

1) Existing

C. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each Blower

b. Blower operating Hz

D. Alarms

1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

25. Aerobic Reactor No. 4 – Process Integration

A. Equipment

1) D.O. Sensor – I-598

B. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Display D.O. level

2) At a minimum, the following data shall be maintained in the PLC:

a. Record D.O. trend data

26. Clarifier Flocc Tank – Mixer

A. Equipment

1) Vertical Shaft Mixer – MXR-630

B. Associated Equipment

1) Level Sensor – I-691

C. MCC Controls

1) Manually operate, On/Off, Mixer

2) Control mixer speed

3) Auto

D. PLC Controls

1) Manual Controls

a. Manually operate, On/Off, mixer

b. Adjust mixer speed

2) Automatic Controls

a. Adjust mixer speed based on liquid level

E. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of Mixer

b. Mixer operating Hz

c. Liquid Level in the Clarifier Flocc Tank (I-691)

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for the mixer

F. Alarms

1) High Water Alarm

2) Low Water Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the

equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

27. Clarifier Flocc Tank Weir Gates

A. Equipment

1) Weir Gate – GS-651

2) Weir Gate – GS-652

B. Associated Equipment

1) Flow Meter – I-681

2) Flow Meter – I-682

C. MCC Controls

1) Adjust weir gate position

2) Auto

D. PLC

1) Manual Controls

a. Adjust weir gate position

2) Automatic Controls

a. Adjust weir gate position to maintain operator set flow rate

E. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Position of each weir gate

28. Filter Influent Pump Station

A. Equipment

1) Pump – P-716

2) Pump – P-717

3) Pump – P-718

B. Associated Equipment

1) Flow Meter – I-784

2) Level Sensor – I-791

3) Level Float HWL – I-792

4) Level Float LWL – I-793

C. MCC Controls

1) Manually operate, On/Off, pumps

2) Adjust pump speed

3) Prevent pump from operating at LWL - Level Float I-793
4) Pump on at HWL – Level Float I-792
5) Auto

D. PLC Controls
1) Manual Control
a. Manually operate, On/Off, pumps
b. Adjust pump speed
c. Pump Off at LWL
2) Automatic Control
a. Adjust pump speed to maintain operator set liquid level in the wet well.
b. Pumps on at full speed at HWL
c. Pump Off at LWL

E. Pump Alternation
1) The alternation of the lead pump shall be capable of being based on operational run time
2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.

F. HMI
1) At a minimum, the following shall be displayed on the HMI Screen:
a. Operational status of each pump
b. Flow rate, gpm (Flow Meter I-784)
c. Pump operating Hz
d. Liquid level in the wet well
2) At a minimum, the following data shall be maintained in the PLC:
a. Run time data for each pump
b. Flow volume pumped the previous day (Flow Meter I-784)
3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
a. Select lead pump
b. Disengage the automatic alternation of pumps

G. Alarms
1) High Water Level Alarm
2) Low Water Level Alarm
3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic

Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

29. Return Activated Sludge (RAS) Pump Station

A. Equipment

1) Pump – P-710
2) Pump – P-711
3) Pump – P-712
4) Pump – P-713

B. Associated Equipment

1) Flow Meter – I-781
2) Flow Meter – I-782
3) Level Sensor – I-391

C. MCC Controls

1) Manually operate, On/Off, pumps
2) Adjust pump speed
3) Auto

D. PLC Controls

1) Manual Control
   a. Manually operate, On/Off, pumps
   b. Adjust pump speed
   c. Pump Off at HWL in Anoxic Reactor No. 1 (I-391)
2) Automatic Control:
   a. Adjust pump (P-710 & 711) speed to maintain operator set discharge flow rate (I-781)
   b. Adjust pump (P-712 & 713) speed to maintain operator set discharge flow rate (I-782)
   c. Pump Off at HWL in Anoxic Reactor No. 1 (I-391)

E. Pump Alternation

1) The alternation of the lead pump shall be capable of being based on operational run time
2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.

F. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:
    a. Operational status of each pump
    b. Flow rate, gpm (I-781)
    c. Flow rate, gpm (I-782)
    d. Pump operating Hz
2) At a minimum, the following data shall be maintained in the PLC:
    a. Run time data for each pump
    b. Flow volume pumped the previous day (I-781)
    c. Flow volume pumped the previous day (I-782)
3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
    a. Select lead pump
    b. Disengage the automatic alternation of pumps
    c. Adjust pump discharge flow rate.

G. Alarms

1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

30. Waste Activated Sludge (WAS) Pump Station

A. Equipment

1) Pump – P-714
2) Pump – P-715

B. Associated Equipment

1) Flow Meter – I-783
2) Pressure Sensor – I-794
3) Pressure Sensor – I-795

C. MCC Controls

1) Manually operate, On/Off, pumps
2) Adjust pump speed
3) Auto

D. PLC Controls

1) Manual Control
    a. Manually operate, On/Off, pumps

b. Adjust pump speed

c. Prevent pump from operating at high discharge pressure

2) Automatic Control

a. Adjust pump speed to maintain operate set discharge flow rate.

b. Prevent pump from operating at high discharge pressure

E. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Flow rate, gpm (I-783)

c. Pump operating Hz

d. Pump discharge pressure

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

b. Flow volume pumped the previous day (I-783)

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. Select lead pump

b. Adjust pump discharge flow rate.

F. Alarms

1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

31. Tertiary Sand Filters

A. Local Control Panel

B. The Contractor/Integrator shall be responsible for identifying all available alarms and I/Os on the equipment to be provided and recommend alarm functionality and I/Os in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

32. UV Disinfection System

A. Local Control Panel

B. The Contractor/Integrator shall be responsible for identifying all available alarms and I/Os on the equipment to be provided and recommend alarm functionality and I/Os in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC.

Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

33. Final Effluent Flow Meter

A. Equipment

1) Flow Meter – I-881

B. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Flow rate, gpm (I-881)

2) At a minimum, the following data shall be maintained in the PLC:

a. Flow volume pumped the previous day (I-881)

34. Plant Site Pump Station No. 1

A. Equipment

1) Pump – P-910

2) Pump – P-911

B. Associated Equipment

1) Level Sensor – I-991

2) Level Float – I-992

3) Level Float – I-993

C. MCC Controls

1) Manually operate, On/Off, pumps

2) Control Speed

3) Alarm and prevent pump from operating at LWL - Level Float I-992

4) Alarm and Pump On at full speed at HWL – Level Float I-993

5) Auto

D. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

b. Control Speed

c. Pump Off at LWL

d. Alarm at HWL

2) Automatic Control

a. Adjust pump speed to maintain set liquid level

b. Pump off at LWL

c. Lead pump on

d. Lag pump on

e. Alarm at HWL

E. Pump Alternation

1) The alternation of the lead pump shall be capable of being based on operational run time

2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.

F. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Pump operating Hz

c. Liquid Level in the wet well (Level Sensor I-991)

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. Select lead pump

b. Disengage the automatic alternation of pumps

c. Adjust set liquid levels

G. Alarms

1) High Water Alarm (I-992) Audible Visual

2) Low Water Alarm (I-993) Audible Visual

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

35. Plant Site Pump Station No. 2

A. Equipment

1) Pump – P-1010

2) Pump – P-1011

B. Associated Equipment

1) Level Sensor – I-1091

2) Level Float – I-1092

3) Level Float – I-1093

C. MCC Controls

1) Manually operate, On/Off, pumps
2) Control Speed
3) Alarm and prevent pump from operating at LWL - Level Float I-1092
4) Alarm and Pump On at full speed at HWL – Level Float I-1093
5) Auto

D. PLC Controls

1) Manual Control
   a. Manually operate, On/Off, pumps
   b. Control Speed
   c. Pump Off at LWL
   d. Alarm at HWL
2) Automatic Control
   a. Adjust pump speed to maintain set liquid level
   b. Pump off at LWL
   c. Lead pump on
   d. Lag pump on
   e. Alarm at HWL

E. Pump Alternation

1) The alternation of the lead pump shall be capable of being based on operational run time
2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.

F. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:
   a. Operational status of each pump
   b. Pump operating Hz
   c. Liquid Level in the wet well (Level Sensor I-1091)
2) At a minimum, the following data shall be maintained in the PLC:
   a. Run time data for each pump
3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
   a. Select lead pump
   b. Disengage the automatic alternation of pumps

c. Adjust set liquid levels

G. Alarms

1) High Water Alarm (I-1092) Audible Visual

2) Low Water Alarm (I-1093) Audible Visual

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

36. Waste Activated Sludge Aerobic Digester No. 1 – Mixers

A. Equipment

1) Mixer – M-1130 (with Blower)

2) Mixer – M-1131 (with Blower)

3) Mixer – M-1132 (with Blower)

4) Mixer – M-1133 (with Blower)

5) Mixer – M-1134 (with Blower)

6) Mixer – M-1135 (with Blower)

B. MCC Controls

1) Manually operate, On/Off, pumps

2) Auto

C. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

D. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each mixer

b. Operational status of each mixer's blower

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each mixer and mixer blower

E. Alarms

1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the

equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

37. Waste Activated Sludge Aerobic Digester No. 1 – Existing Aerators

A. Equipment

1) Aerator – D-1140
2) Aerator – D-1141
3) Aerator – D-1142
4) Aerator – D-1143
5) Aerator – D-1144

B. MCC Controls

1) Manually operate, On/Off, pumps
2) Auto

C. PLC Controls

1) Manual Control
   a. Manually operate, On/Off, pumps

D. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:
   a. Operational status of each Aerator
2) At a minimum, the following data shall be maintained in the PLC:
   a. Run time data for each Aerator

E. Alarms

1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

38. Waste Activated Sludge Aerobic Digester No. 1 Pump Station

A. Equipment

1) Pump – P-1110
2) Pump – P-1111

B. Associated Equipment

1) Flow Meter – I-1181
2) Level Sensor – I-1191
3) Pressure Sensor – I-1192

4) Pressure Sensor – I-1193

C. MCC Controls

1) Manually operate, On/Off, pumps

2) Adjust pump speed

3) Auto

D. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

b. Adjust pump speed

c. Prevent pump from operating at high discharge pressure

2) Automatic Control

a. Adjust pump speed to maintain operate set discharge flow rate.

b. Prevent pump from operating at high discharge pressure

E. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Flow rate, gpm (I-1181)

c. Pump operating Hz

d. Pump discharge pressure

e. Digester liquid level

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

b. Flow volume pumped the previous day (I-1181)

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. Adjust pump discharge flow rate.

F. Alarms

1) HWL Alarm

2) LWL Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

39. Waste Activated Sludge Aerobic Digester No. 2 & 3 – Mixers

A. Equipment

1) Mixer – M-1230 (with Blower)

2) Mixer – M-1231 (with Blower)

3) Mixer – M-1232 (with Blower)

4) Mixer – M-1233 (with Blower)

B. MCC Controls

1) Manually operate, On/Off, pumps

2) Auto

C. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

D. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each mixer

b. Operational status of each mixer's blower

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each mixer and mixer blower

E. Alarms

1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

40. Waste Activated Sludge Aerobic Digester No. 2 & 3 Transfer Pump Station

A. Equipment

1) Pump – P-1210

2) Pump – P-1211

B. Associated Equipment

1) Flow Meter – I-1281

2) Level Sensor – I-1291

3) Level Float – I-1292

4) Level Sensor – I-1293

5) Level Float – I-1294

6) Pressure Sensor – I-1295

7) Pressure Sensor – I-1296

8) Level Sensor – I-1391 (Sludge Dewatering Influent Tank)

C. MCC Controls

1) Manually operate, On/Off, pumps

2) Adjust pump speed

3) Prevent pump from operating at LWL (floats)

4) Auto

D. PLC Controls

1) Manual Control

a. Manually operate, On/Off, pumps

b. Adjust pump speed

c. Prevent pump from operating at high discharge pressure

d. Prevent pump from operating at LWL in the digester (based on associated level sensor)

e. Prevent pump from operating at HWL (I-1391) when the pump is pumping to the Sludge Dewatering Influent Tank

2) Automatic Control

a. Adjust pump speed to maintain operate set discharge flow rate when transferring between digesters

b. Automatically adjust pump speed to maintain set liquid level (I-1391) in the Sludge Dewatering Influent Tank when pumping to the Sludge Dewatering Influent Tank

c. Prevent pump from operating at high discharge pressure

d. Prevent pump from operating at LWL in the digester (based on associated level sensor)

e. Prevent pump from operating at HWL (I-1391) when the pump is pumping to the Sludge Dewatering Influent Tank

E. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of each pump

b. Flow rate, gpm (I-1281)

c. Pump operating Hz

d. Pump discharge pressure

e. Digester liquid levels

f. Liquid level of Sludge Dewatering Influent Tank

2) At a minimum, the following data shall be maintained in the PLC:

a. Run time data for each pump

b. Flow volume pumped the previous day (I-1281)

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

a. Identify which tank each pump is pumping from for level control

b. Identify to which tank each pump is pumping for level control (Digester #2, Digester #3 or Sludge Dewatering Influent Tank)

c. Adjust pump discharge flow rate.

F. Alarms

1) HWL Alarm

2) LWL Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

41. Sludge Dewatering Influent Tank

A. Equipment

1) Mixer – MXR-1330

2) Level Sensor – I-1391

B. MCC Controls

1) Manually operate, On/Off, mixer

2) Adjust mixer speed

C. PLC Controls

1) Manual Control

a. Manually operate, On/Off, mixer

b. Adjust mixer speed

D. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

a. Operational status of the mixer

b. Liquid level of the Sludge Dewatering Influent Tank

E. Alarms

1) HWL Alarm

2) LWL Alarm

3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

EQUIPMENT SCHEDULE

EQUIP #	EQUIPMENT NAME	HP	VFD Y/N	MCC OR LCP	VOLTS/PHASE	PLC CONTROL INFORMATION		ASSOCIATED EQUIPMENT	COMMENTS
						HAND	AUTO	INSTRUMENTATION AND PROTECTION DEVICES	
						WASTEWATER TREATMENT SYSTEM			
P-310	Anoxic Reactor #1 - Jet Pump #1	200	N	MCC	460/3	On; off; auto; manual speed control	On; off; manual speed control		
P-311	Anoxic Reactor #2 - Jet Pump #2	200	N	MCC	460/3	On; off; auto; manual speed control	On; off; manual speed control		
P-410	Nitrification Reactor #2 - Jet Pump #1	200	Y	MCC	460/3	On; off; auto; manual speed control	On; off; manual speed control		
P-411	Nitrification Reactor #2 - Jet Pump #2	200	Y	MCC	460/3	On; off; auto; manual speed control	On; off; manual speed control		
B-420	Nitrification Reactor #2 - Blower #1	200	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control and on/off control to maintain set D.O.; Operator select which D.O. probe provides operational control information; blower lockout when pump is not operating.	D.O. Sensor I-492 D.O. Sensor I-393 (Emergency Operation Only)	The blower shall be prevented from operating when the jet pump is not operational; however there must be a manual override for allowing the blower to operate without the jet pump operating.
B-421	Nitrification Reactor #2 - Blower #2	200	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control and on/off control to maintain set D.O.; Operator select which D.O. probe provides operational control information; blower lockout when pump is not operating.	D.O. Sensor I-492 D.O. Sensor I-393 (Emergency Operation Only)	The blower shall be prevented from operating when the jet pump is not operational; however there must be a manual override for allowing the blower to operate without the jet pump operating.
B-422	Nitrification Reactor #2 - Blower #3	200	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control and on/off control to maintain set D.O.; Operator select which D.O. probe provides operational control information; blower lockout when pump is not operating.	D.O. Sensor I-492 D.O. Sensor I-393 (Emergency Operation Only)	The blower shall be prevented from operating when the jet pump is not operational; however there must be a manual override for allowing the blower to operate without the jet pump operating.
B-423	Nitrification Reactor #2 - Blower #4	200	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control and on/off control to maintain set D.O.; Operator select which D.O. probe provides operational control information; blower lockout when pump is not operating.	D.O. Sensor I-492 D.O. Sensor I-393 (Emergency Operation Only)	The blower shall be prevented from operating when the jet pump is not operational; however there must be a manual override for allowing the blower to operate without the jet pump operating.
B-424	Nitrification Reactor #2 - Blower #5	200	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control and on/off control to maintain set D.O.; Operator select which D.O. probe provides operational control information; blower lockout when pump is not operating.	D.O. Sensor I-492 D.O. Sensor I-393 (Emergency Operation Only)	The blower shall be prevented from operating when the jet pump is not operational; however there must be a manual override for allowing the blower to operate without the jet pump operating.
P-412	Nitrate Recycle Pump Station - Pump #1	40	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set discharge flow rate	Flow Meter I- 481	
P-413	Nitrate Recycle Pump Station - Pump #2	40	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set discharge flow rate	Flow Meter I-481	
GS-451	Nitrification Reactor Slide Gate #1			MCC	460/3	Forward, Reverse, Auto	Manual Forward, Reverse		Open and Closed Limit Switches Position feed back I/O
GS-452	Nitrification Reactor Slide Gate #2			MCC	460/3	Forward, Reverse, Auto	Manual Forward, Reverse		Open and Closed Limit Switches Position feed back I/O
MXR-630	Clarifier Inf. Flocc Tank Mixer	5	Y	MCC	460/3	On; off; auto	On; off; manual speed control		
631	Clarifier #1 - Mechanism	0.5	N	MCC	460/3				
n	Clarifier #2 - Mechanism	0.5	N	MCC	460/3				
P-716	Filter Influent Pump Station - Pump #1	30	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set liquid level; HWL pump on and alarm; LWL pump off and alarm	Radar Level Sensor I-791 Level Float I-792 Level Float I-793	
P-717	Filter Influent Pump Station - Pump #2	30	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set liquid level; HWL pump on and alarm; LWL pump off and alarm	Radar Level Sensor I-791 Level Float I-792 Level Float I-793	
P-718	Filter Influent Pump Station - Pump #3	30	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set liquid level; HWL pump on and alarm; LWL pump off and alarm	Radar Level Sensor I-791 Level Float I-792 Level Float I-793	
MXR-730	Polymer Tank Mixer	2	Y	MCC	460/3	On; off; manual speed control			
MXR-731	Polymer Tank Mixer	2	Y	MCC	460/3	On; off; manual speed control			
CP-750	Polymer Feed Pump Skid - Pump #1	0.5	Y	LCP	120/1				
CP-751	Polymer Feed Pump Skid - Pump #2	0.5	Y	LCP	120/1				
P-810	Filter Backwash Pump Station - Pump #1 - ***(Future)***	15	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set liquid level; HWL Alarm; pump shut off at LWL	Radar Level Sensor I- Level Float I- Level Float I-	
P-811	Filter Backwash Pump Station - Pump #2 - ***(Future)***	15	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set liquid level; HWL Alarm; pump shut off at LWL	Radar Level Sensor I- Level Float I- Level Float I-	
P-710	RAS Pump Station - Pump #1	50	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set discharge flow rate	Flow Meter I-781	
P-711	RAS Pump Station - Pump #2	50	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set discharge flow rate	Flow Meter I-781	
P-712	RAS Pump Station - Pump #3	50	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set discharge flow rate	Flow Meter I-782	
P-713	RAS Pump Station - Pump #4	50	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set discharge flow rate	Flow Meter I-782	
P-714	WAS Pump Station - Pump #1	10	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set discharge flow rate; Pump Off at High Discharge Pressure	Flow Meter I-783 Pressure Sensor I-794	
P-715	WAS Pump Station - Pump #2	10	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set discharge flow rate; Pump Off at High Discharge Pressure	Flow Meter I-783 Pressure Sensor I-795	
C-861	Filter Air Compressor #1	20							

EQUIPMENT SCHEDULE

EQUIP #	EQUIPMENT NAME	HP	VFD Y/N	MCC OR LCP	VOLTS/PHASE	PLC CONTROL INFORMATION		ASSOCIATED EQUIPMENT	COMMENTS
						HAND	AUTO	INSTRUMENTATION AND PROTECTION DEVICES	
C-862	Filter Air Compressor #2	20							
C-883	Filter Air Compressor Air Drier #1								
U-871	UV Disinfection System Bank #1								
U-872	UV Disinfection System Bank #2								
U-873	UV Disinfection System Bank #3								
P-910	Plant Site PS #1 - Pump #1	20	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set liquid level; HWL pump on and alarm; LWL pump off and alarm	Radar Level Sensor I-991 Level Float I-992 Level Float I-993	
P-911	Plant Site PS #1 - Pump #2	20	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set liquid level; HWL pump on and alarm; LWL pump off and alarm	Radar Level Sensor I-991 Level Float I-992 Level Float I-993	
P-1010	Plant Site PS #2 - Pump #1	15	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set liquid level; HWL pump on and alarm; LWL pump off and alarm	Radar Level Sensor I-1091 Level Float I-1092 Level Float I-1093	
P-1011	Plant Site PS #2 - Pump #2	15	Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set liquid level; HWL pump on and alarm; LWL pump off and alarm	Radar Level Sensor I-1091 Level Float I-1092 Level Float I-1093	
P-1110	WAS Aerobic Digester #1 Decant/Transfer PS - Pump #1	25	Y	MCC	460/3	On; off; auto; manual speed control	**To Digester #2 & #3:** On; off; automatic speed control to maintain set pump rate; pump off at LWL in Digester #1; Pump off at High Discharge Pressure **To Screw Press Influent Tank:** Alternative automatic speed control to maintain set liquid level in the Screw Press Influent Tank; pump off at LWL in Digester #1; pump off at HWL in the Screw Press Influent Tank; Pump off at High Discharge Pressure	Radar Level Sensor I-1191 Radar Level Sensor I-1391 Flow Meter I-1181 Pressure Transducer I-1192	
P-1111	WAS Aerobic Digester #1 Decant/Transfer PS - Pump #2	25	Y	MCC	460/3	On; off; auto; manual speed control	**To Digester #2 & #3:** On; off; automatic speed control to maintain set pump rate; pump off at LWL in Digester #1; Pump off at High Discharge Pressure **To Screw Press Influent Tank:** Alternative automatic speed control to maintain set liquid level in the Screw Press Influent Tank; pump off at LWL in Digester #1; pump off at HWL in the Screw Press Influent Tank; Pump off at High Discharge Pressure	Radar Level Sensor I-1191 Radar Level Sensor I-1391 Flow Meter I-1181 Pressure Transducer I-1193	
1120	Chemical Feed - Carbon Source Pump #1				120 V				
1121	Chemical Feed - Carbon Source Pump #2				120 V				
1122	Chemical Feed - Mag Pump #1	1			230/460, 3 Ph				
1123	Chemical Feed - Mag Pump #2	1			230/460, 3 Ph				
	Mag Tank #1 Mixer	2			230/460, 3 Ph				
	Mag Tank #2 Mixer	2			230/460, 3 Ph				
	Reuse Water Pump Station - Pump #1 - (***Future***)		Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set liquid level; HWL Alarm; pump shut off at LWL	Radar Level Sensor I- Level Float I- Level Float I-	
	Reuse Water Pump Station - Pump #2 - (***Future***)		Y	MCC	460/3	On; off; auto; manual speed control	On; off; automatic speed control to maintain set liquid level; HWL Alarm; pump shut off at LWL	Radar Level Sensor I- Level Float I- Level Float I-	
M-1130	Digester #1 - Mixer #1 - Mixer Motor	60.0	N	MCC	60.030/460, 3 Ph				
B-1130	Digester #1 - Mixer #1 - Blower Motor	10.0	N	MCC	10.030/460, 3 Ph				
M-1131	Digester #1 - Mixer #2 - Mixer Motor	60.0	N	MCC	60.030/460, 3 Ph				
B-1131	Digester #1 - Mixer #2 - Blower Motor	10.0	N	MCC	10.030/460, 3 Ph				
M-1132	Digester #1 - Mixer #3 - Mixer Motor	60.0	N	MCC	60.030/460, 3 Ph				
B-1132	Digester #1 - Mixer #3 - Blower Motor	10.0	N	MCC	10.030/460, 3 Ph				
M-1133	Digester #1 - Mixer #4 - Mixer Motor	60.0	N	MCC	60.030/460, 3 Ph				
B-1133	Digester #1 - Mixer #4 - Blower Motor	10.0	N	MCC	10.030/460, 3 Ph				
M-1134	Digester #1 - Mixer #5 - Mixer Motor	60.0	N	MCC	60.030/460, 3 Ph				
B-1134	Digester #1 - Mixer #5 - Blower Motor	10.0	N	MCC	10.030/460, 3 Ph				
M-1135	Digester #1 - Mixer #6 - Mixer Motor	60.0	N	MCC	60.030/460, 3 Ph				
B-1135	Digester #1 - Mixer #6 - Blower Motor	10.0	N	MCC	10.030/460, 3 Ph				
M-1230	Digester #2 - Mixer #1 - Mixer Motor	50.0	N	MCC	50.030/460, 3 Ph				
B-1230	Digester #2 - Mixer #1 - Blower Motor	7.5	N	MCC	7.530/460, 3 Ph				
M-1231	Digester #2 - Mixer #2 - Mixer Motor	50.0	N	MCC	50.030/460, 3 Ph				
B-1231	Digester #2 - Mixer #2 - Blower Motor	7.5	N	MCC	7.530/460, 3 Ph				
M-1232	Digester #3 - Mixer #1 - Mixer Motor	50.0	N	MCC	50.030/460, 3 Ph				
B-1232	Digester #3 - Mixer #1 - Blower Motor	7.5	N	MCC	7.530/460, 3 Ph				
M-1233	Digester #3 - Mixer #2 - Mixer Motor	50.0	N	MCC	50.030/460, 3 Ph				
B-1233	Digester #3 - Mixer #2 - Blower Motor	7.5	N	MCC	7.530/460, 3 Ph				

EQUIPMENT SCHEDULE

EQUIP #	EQUIPMENT NAME	HP	VFD Y/N	MCC OR LCP	VOLTS/PHASE	PLC CONTROL INFORMATION		ASSOCIATED EQUIPMENT	COMMENTS
						HAND	AUTO	INSTRUMENTATION AND PROTECTION DEVICES	
P-1210	Digester #2 & #3 Pump Station Pump #1	15	Y	MCC	460 / 3	On; off; auto; manual speed control	**Transfer Between Digesters:** Pump off at LWL in tank pumping "from"; pump off at HWL in tank pumping "to"; Pump off at High Discharge Pressure **To Screw Press Influent Tank:** automatic speed control to maintain liquid level in the screw press influent tank; pump off at LWL in tank pumping "from"; pump off at HWL in tank pumping "to"; Pump off at High Discharge Pressure	Radar Level Sensor I-1191 Level Float I-1192 Radar Level Sensor I-1291 Level Float I-1292 Radar Level Sensor I-1391 Pressure Transducer I-1295	
P-1211	Digester #2 & #3 Pump Station Pump #2	15	Y	MCC	460 / 3	On; off; auto; manual speed control	**Transfer Between Digesters:** Pump off at LWL in tank pumping "from"; pump off at HWL in tank pumping "to"; Pump off at High Discharge Pressure **To Screw Press Influent Tank:** automatic speed control to maintain liquid level in the screw press influent tank; pump off at LWL in tank pumping "from"; pump off at HWL in tank pumping "to"; Pump off at High Discharge Pressure	Radar Level Sensor I-1191 Level Float I-1192 Radar Level Sensor I-1291 Level Float I-1292 Radar Level Sensor I-1391 Pressure Transducer I-1296	
	Digester #2 & #3 Pump Station Building Sump Pump	0.25			120 V				
P-1310	Screw Press Influent Pump Station Pump #1	5 or 7.5 HP	Y	MCC / LCP	Approx. 5 HP30/460, 3 Ph	On; off, auto; manual speed control	On; off; speed controlled based on input from the Dewater Screw Press LCP; Pump off at LWL in Sludge Dewatering Influent Tank; Pump off at High Discharge Pressure	Radar Level Sensor I-1391 Dewatering Screw Press LCP Flow Meter I-1381 Pressure Transducer I-1392	
P-1311	Screw Press Influent Pump Station Pump #2	5 or 7.5 HP	Y	MCC / LCP	Approx. 5 HP30/460, 3 Ph	On; off, auto; manual speed control	On; off; speed controlled based on input from the Dewater Screw Press LCP; Pump off at LWL in Sludge Dewatering Influent Tank; Pump off at High Discharge Pressure	Radar Level Sensor I-1391 Dewatering Screw Press LCP Flow Meter I-1382 Pressure Transducer I-1393	
P-1312	Screw Press Influent Pump Station Pump #3	5 or 7.5 HP	Y	MCC / LCP	Approx. 5 HP30/460, 3 Ph	On; off, auto; manual speed control	On; off; speed controlled based on input from the Dewater Screw Press LCP; Pump off at LWL in Sludge Dewatering Influent Tank; Pump off at High Discharge Pressure	Radar Level Sensor I-1391 Dewatering Screw Press LCP Flow Meter I-1383 Pressure Transducer _1394	
MXR-1330	Sludge Dewatering Influent Tank Mixer	5	Y	MCC	530/460, 3 Ph	On; off; manual speed control			
S-1371	Dewatering Screw Press #1 - Motor	5	Y	MCC	230/460 V, 3 PH				The Manufacturer will provide a LCP for control only.
	Screw Press #1 - Spray Wash	0.25	Reversing Starter	MCC					Attached to Screw Press #1
S-1372	Dewatering Screw Press #2 - Motor	5	Y	MCC	230/460 V, 3 PH				The Manufacturer will provide a LCP for control only.
	Screw Press #2 - Spray Wash	0.25	Reversing Starter	MCC					Attached to Screw Press #2
S-1373	Dewatering Screw Press #3 - Motor ***(Future)***	5	Y	MCC	230/460 V, 3 PH				The Manufacturer will provide a LCP for control only.
	Screw Press #3 - Spray Wash ***(Future)***	0.25	Reversing Starter	MCC					Attached to Screw Press #3
AU-1361	Screw Press Sludge Cake Auger #1	2	Non-reversing starter	MCC					
AU-1362	Screw Press Sludge Cake Auger #2	2	Non-reversing starter	MCC					
AU-1363	Screw Press Sludge Cake Auger #3 ***(Future)***	2	Non-reversing starter	MCC					
AU-1364	Sludge Cake Transfer Auger ***(Future)***	2	Non-reversing starter	MCC					To be located above the sludge cake truck in the future.
CP-1351	Chemical Feed - Screw Press Polymer Skid #1	0.5		LCP	120 / 1			Dewatering Screw Press LCP	
CP-1352	Chemical Feed - Screw Press Polymer Skid #2	0.5		LCP	120 / 1			Dewatering Screw Press LCP	
CP-1353	Chemical Feed - Screw Press Polymer Skid #3 ***(Future)***	0.5		LCP	120 / 1			Dewatering Screw Press LCP	
C-1354	Dewatering Screw Press System Air Compressor	2			120 / 1				
WASTEWATER PRETREATMENT SYSTEM									
P-1410	Raw Wastewater Pump Station - Pump No. 1	50	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set liquid level in the wet well. Pump Off at LWL, Pump On at HWL. Alarm at HHWL	Radar Level Transmitter - I-1490 Level Float - I-1491 Level Float - I-1492 Flow Meter - I-1480	
P-1411	Raw Wastewater Pump Station - Pump No. 2	50	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set liquid level in the wet well. Pump Off at LWL, Pump On at HWL. Alarm at HHWL	Radar Level Transmitter - I-1490 Level Float - I-1491 Level Float - I-1492 Flow Meter - I-1480	
P-1412	Raw Wastewater Pump Station - Pump No. 3	50	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set liquid level in the wet well. Pump Off at LWL, Pump On at HWL. Alarm at HHWL	Radar Level Transmitter - I-1490 Level Float - I-1491 Level Float - I-1492 Flow Meter - I-1480	
B-1420	FET #1 Blower No. 1	200	Y	MCC	460 / 3	On; off; auto; manual speed control	On; off; speed control		
B-1421	FET #1 Blower No. 2	200	Y	MCC	460 / 3	On; off; auto; manual speed control	On; off; speed control		
B-1422	FET #1 Blower No. 3	200	Y	MCC	460 / 3	On; off; auto; manual speed control	On; off; speed control		

EQUIPMENT SCHEDULE

EQUIP #	EQUIPMENT NAME	HP	VFD Y/N	MCC OR LCP	VOLTS/PHASE	PLC CONTROL INFORMATION		ASSOCIATED EQUIPMENT	COMMENTS
						HAND	AUTO	INSTRUMENTATION AND PROTECTION DEVICES	
P-1510	FET #1 Effluent Pump Station - Pump No. 1	50	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set flow rates to Primary DAF #1A and #1B separately. Pump Off at LWL, Alarm at HHWL	Radar Level Transmitter - I-1493 Level Float - I-1494 Level Float - I-1495 Flow Meter - I-1580 Flow Meter - I-1581	
P-1511	FET #1 Effluent Pump Station - Pump No. 2	50	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set flow rates to Primary DAF #1A and #1B separately. Pump Off at LWL, Alarm at HHWL	Radar Level Transmitter - I-1493 Level Float - I-1494 Level Float - I-1495 Flow Meter - I-1580 Flow Meter - I-1581	
P-1512	FET #1 Effluent Pump Station - Pump No. 3	50	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set flow rates to Primary DAF #1A and #1B separately. Pump Off at LWL, Alarm at HHWL	Radar Level Transmitter - I-1493 Level Float - I-1494 Level Float - I-1495 Flow Meter - I-1580 Flow Meter - I-1581	
DAF-1601	First Stage DAF #1B - Recycle Pump 1 - 40 HP - Recycle Pump 2 - 40 HP - Skimmer - 1 HP - Air Compressor - 10 HP	91		LCP	460 / 3				
P-1610	DAF #1B Sludge Pump Station - Pump No. 1	5	Y	MCC	460 / 3	On; off; auto; manual speed control: Prevent pump from operating at high discharge pressure	On; off; automatic speed control to maintain set flow rate. Pump Off at high discharge pressure	Flow Meter - I-1680 Pressure Transducer - I-1690 Pressure Transducer - I-1691	
P-1611	DAF #1B Sludge Pump Station - Pump No. 2	5	Y	MCC	460 / 3	On; off; auto; manual speed control: Prevent pump from operating at high discharge pressure	On; off; automatic speed control to maintain set flow rate. Pump Off at high discharge pressure	Flow Meter - I-1680 Pressure Transducer - I-1690 Pressure Transducer - I-1691	
P-1710	First Stage DAF Effluent Pump Station - Pump No. 1	50	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set liquid level in the wet well. Pump Off at LWL, Pump On at HWL. Alarm at HHWL	Radar Level Transmitter - I-1790 Level Float - I-1791 Level Float - I-1792 Flow Meter - I-1780	
P-1711	First Stage DAF Effluent Pump Station - Pump No. 2	50	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set liquid level in the wet well. Pump Off at LWL, Pump On at HWL. Alarm at HHWL	Radar Level Transmitter - I-1790 Level Float - I-1791 Level Float - I-1792 Flow Meter - I-1780	
P-1712	First Stage DAF Effluent Pump Station - Pump No. 3	50	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set liquid level in the wet well. Pump Off at LWL, Pump On at HWL. Alarm at HHWL	Radar Level Transmitter - I-1790 Level Float - I-1791 Level Float - I-1792 Flow Meter - I-1780	
P-1910	FET #2A - Jet Pump No. 1	100	N	MCC	460 / 3	On; off; auto; prevent pump from operating at LWL	On; off; Pump Off at LWL	Radar Level Transmitter - I-1990 Level Float - I-1991 Level Float - I-1992	
P-1911	FET #2A - Jet Pump No. 2	100	N	MCC	460 / 3	On; off; auto; prevent pump from operating at LWL	On; off; Pump Off at LWL	Radar Level Transmitter - I-1990 Level Float - I-1991 Level Float - I-1992	
P-1912	FET #2B - Jet Pump No. 1	100	N	MCC	460 / 3	On; off; auto; prevent pump from operating at LWL	On; off; Pump Off at LWL	Radar Level Transmitter - I-1993 Level Float - I-1994 Level Float - I-1995	
P-1913	FET #2B - Jet Pump No. 2	100	N	MCC	460 / 3	On; off; auto; prevent pump from operating at LWL	On; off; Pump Off at LWL	Radar Level Transmitter - I-1993 Level Float - I-1994 Level Float - I-1995	
B-1920	FET #2 Blower #1	150	Y	MCC	460 / 3	On; off; auto; manual speed control; interlock with jet pumps	On; off; automatically adjust speed to maintain set D.O.; interlock with jet pumps	D.O. Sensor - I-1996 D.O. Sensor - I-1997	
B-1921	FET #2 Blower #2	150	Y	MCC	460 / 3	On; off; auto; manual speed control; interlock with jet pumps	On; off; automatically adjust speed to maintain set D.O.; interlock with jet pumps	D.O. Sensor - I-1996 D.O. Sensor - I-1997	
B-1922	FET #2 Blower #3	150	Y	MCC	460 / 3	On; off; auto; manual speed control; interlock with jet pumps	On; off; automatically adjust speed to maintain set D.O.; interlock with jet pumps	D.O. Sensor - I-1996 D.O. Sensor - I-1997	
B-1923	FET #2 Blower #4	150	Y	MCC	460 / 3	On; off; auto; manual speed control; interlock with jet pumps	On; off; automatically adjust speed to maintain set D.O.; interlock with jet pumps	D.O. Sensor - I-1996 D.O. Sensor - I-1997	
B-1924	FET #2 Blower #5	150	Y	MCC	460 / 3	On; off; auto; manual speed control; interlock with jet pumps	On; off; automatically adjust speed to maintain set D.O.; interlock with jet pumps	D.O. Sensor - I-1996 D.O. Sensor - I-1997	
P-2010	FET #2 Effluent Pump Station - Pump No. 1	40	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set discharge flow rate. Pump Off at LWL, Alarm at HHWL	Radar Level Transmitter - I-1990 (FET #2A) Radar Level Transmitter - I-1993 (FET #2B) Level Float - I-1991 (FET #2A) Level Float - I-1992 (FET #2A) Level Float - I-1994 (FET #2B) Level Float - I-1995 (FET #2B) Flow Meter - I-2080	
P-2011	FET #2 Effluent Pump Station - Pump No. 2	40	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set discharge flow rate. Pump Off at LWL, Alarm at HHWL	Radar Level Transmitter - I-1990 (FET #2A) Radar Level Transmitter - I-1993 (FET #2B) Level Float - I-1991 (FET #2A) Level Float - I-1992 (FET #2A) Level Float - I-1994 (FET #2B) Level Float - I-1995 (FET #2B) Flow Meter - I-2080	
P-2012	FET #2 Effluent Pump Station - Pump No. 3	40	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set discharge flow rate. Pump Off at LWL, Alarm at HHWL	Radar Level Transmitter - I-1990 (FET #2A) Radar Level Transmitter - I-1993 (FET #2B) Level Float - I-1991 (FET #2A) Level Float - I-1992 (FET #2A) Level Float - I-1994 (FET #2B) Level Float - I-1995 (FET #2B) Flow Meter - I-2080	

EQUIPMENT SCHEDULE

EQUIP #	EQUIPMENT NAME	HP	VFD Y/N	MCC OR LCP	VOLTS/PHASE	PLC CONTROL INFORMATION		ASSOCIATED EQUIPMENT	COMMENTS
						HAND	AUTO	INSTRUMENTATION AND PROTECTION DEVICES	
P-2110	Second Stage DAF Cell #3 Sludge Pump No. 1	10	Y	MCC	460 / 3	On; off; auto; manual speed control: Prevent pump from operating at high discharge pressure	On: off; automatic speed control to maintain set flow rate. Pump Off at high discharge pressure	Flow Meter - I-2180 Pressure Transducer - I-2190 Pressure Transducer - I-2191	
P-2111	Second Stage DAF Cell #3 Sludge Pump No. 2	10	Y	MCC	460 / 3	On; off; auto; manual speed control: Prevent pump from operating at high discharge pressure	On: off; automatic speed control to maintain set flow rate. Pump Off at high discharge pressure	Flow Meter - I-2180 Pressure Transducer - I-2190 Pressure Transducer - I-2191	
P-2210	Second Stage DAF Cell #3 Effluent Pump Station - Pump No. 1	60	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set liquid level in the wet well. Pump Off at LWL, Pump On at HWL. Alarm at HHWL	Radar Level Transmitter - I-2290 Level Float - I-2291 Level Float - I-2292 Flow Meter - I-2280	
P-2211	Second Stage DAF Cell #3 Effluent Pump Station - Pump No. 2	60	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set liquid level in the wet well. Pump Off at LWL, Pump On at HWL. Alarm at HHWL	Radar Level Transmitter - I-2290 Level Float - I-2291 Level Float - I-2292 Flow Meter - I-2280	
P-2212	Second Stage DAF Cell #3 Effluent Pump Station - Pump No. 3	60	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set liquid level in the wet well. Pump Off at LWL, Pump On at HWL. Alarm at HHWL	Radar Level Transmitter - I-2290 Level Float - I-2291 Level Float - I-2292 Flow Meter - I-2280	
P-2310	Stormwater First Flush /Offspec Lagoon PS - Pump No. 1	5	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set discharge flow rate. Pump Off at LWL, Alarm at HHWL	Radar Level Transmitter - I-2390 Flow Meter - I-2380	
P-2311	Stormwater First Flush /Offspec Lagoon PS - Pump No. 2	5	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set discharge flow rate. Pump Off at LWL, Alarm at HHWL	Radar Level Transmitter - I-2390 Flow Meter - I-2380	
FINAL EFFLUENT									
P-2410	New Spray Irrigation Pond No. 2 PS - Pump No. 1	75	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set discharge flow rate. Pump Off at LWL, Alarm at HHWL	Radar Level Transmitter - I-2490 Flow Meter - I-2480	
P-2411	New Spray Irrigation Pond No. 2 PS - Pump No. 2	75	Y	MCC	460 / 3	On; off; auto; manual speed control; prevent pump from operating at LWL	On; off; automatic speed control to maintain set discharge flow rate. Pump Off at LWL, Alarm at HHWL	Radar Level Transmitter - I-2490 Flow Meter - I-2480	

INSTRUMENTATION SCHEDULE

EQUIP #	INSTRUMENTATION	REMOTE READOUT Y/N	LOCATION	COMMENTS
WASTEWATER TREATMENT SYSTEM				
I-391	Radar Level Sensor	Y	Anoxic Reactor #1	
I-392	ORP Sensor	Y	Anoxic Reactor #1	
I-393	D.O. Sensor	Y	Anoxic Reactor #1	
I-394	pH Sensor	Y	Anoxic Reactor #1	
I-481	Magnetic Flow Meter	Y	Nitrate Recycle Pump Station	
I-491	Radar Level Sensor	Y	Nitrification Reactor #2	
I-492	D.O. Sensor	Y	Nitrification Reactor #2	
I-493	pH Sensor	Y	Nitrification Reactor #2	
I-591	Radar Level Sensor	Y	Anoxic Reactor #3	
I-592	ORP Sensor	Y	Anoxic Reactor #3	
I-593	D.O. Sensor	Y	Anoxic Reactor #3	
I-594	pH Sensor	Y	Anoxic Reactor #3	
I-595	ORP Sensor	Y	Anoxic Reactor #3	
I-596	D.O. Sensor	Y	Anoxic Reactor #3	
I-597	pH Sensor	Y	Anoxic Reactor #3	
I-598	D.O. Sensor	Y	Aerobic Reactor #4	
I-681	Magnetic Flow Meter	Y	Clarifier Flocc Tank	
I-682	Magnetic Flow Meter	Y	Clarifier Flocc Tank	
I-691	Radar Level Sensor	Y	Clarifier Flocc Tank	
I-781	Magnetic Flow Meter	Y	RAS Pump Station	
I-782	Magnetic Flow Meter	Y	RAS Pump Station	
I-783	Magnetic Flow Meter	Y	WAS Pump Station	
I-784	Magnetic Flow Meter	Y	Filter Influent Pump Station	
I-791	Radar Level Sensor	Y	Filter Influent Pump Station	
I-792	Level Float		Filter Influent Pump Station	
I-793	Level Float		Filter Influent Pump Station	
I-794	Pressor Sensor	Y	WAS PS Pump #1	Prevent high discharge pressure
I-795	Pressor Sensor	Y	WAS PS Pump #2	Prevent high discharge pressure
I-881	Ultrasonic Level Sensor - Flow Meter	Y	Final Effluent Parshall Flume	
I-890	Magnetic Flow Meter ***(Future)***	Y	Filter Backwash Wastewater PS	
I-891	Radar Level Sensor ***(Future)***	Y	Filter Backwash Wastewater PS	
I-892	Level Float ***(Future)***		Filter Backwash Wastewater PS	
I-893	Level Float ***(Future)***		Filter Backwash Wastewater PS	
I-991	Radar Level Sensor	Y	New Plant Site PS #1	
I-992	Level Float		New Plant Site PS #1	
I-993	Level Float		New Plant Site PS #1	
I-1091	Radar Level Sensor	Y	Plant Site Pump Station #2	
I-1092	Level Float		Plant Site Pump Station #2	
I-1093	Level Float		Plant Site Pump Station #2	
I-1181	Magnetic Flow Meter	Y	WAS Aerobic Digester #1 Transfer PS	
I-1191	Radar Level Sensor	Y	WAS Aerobic Digester #1 PS	
I-1192	Pressor Sensor	Y	WAS Aerobic Digester #1 PS	Prevent high discharge pressure
I-1193	Pressor Sensor	Y	WAS Aerobic Digester #1 PS	Prevent high discharge pressure
I-1281	Magnetic Flow Meter	Y	WAS Aerobic Digester #2 & #3 PS	
I-1291	Radar Level Sensor	Y	WAS Aerobic Digester #2	
I-1292	Level Float		WAS Aerobic Digester #2	

INSTRUMENTATION SCHEDULE

EQUIP #	INSTRUMENTATION	REMOTE READOUT Y/N	LOCATION	COMMENTS
I-1293	Radar Level Sensor	Y	WAS Aerobic Digester #3	
I-1294	Level Float		WAS Aerobic Digester #3	
I-1295	Pressure Sensor	Y	WAS Aerobic Digester #2 & #3 PS	Prevent high discharge pressure
I-1296	Pressure Sensor	Y	WAS Aerobic Digester #2 & #3 PS	Prevent high discharge pressure
I-1381	Magnetic Flow Meter	Y	Screw Press Influent	Functions as part of the Sludge
I-1382	Magnetic Flow Meter	Y	Screw Press Influent	Functions as part of the Sludge
I-1383	Magnetic Flow Meter	Y	Screw Press Influent	Functions as part of the Sludge
I-1391	Radar Level Sensor	Y	Screw Press Feed Tank	
I-1392	Pressure Sensor	Y	Screw Press Feed PS	Prevent high discharge pressure
I-1393	Pressure Sensor	Y	Screw Press Feed PS	Prevent high discharge pressure
I-1394	Pressure Sensor ***(Future)***	Y	Screw Press Feed PS	Prevent high discharge pressure
WASTEWATER PRETREATMENT SYSTEM				
I-1480	Flow Meter	Y	Raw Wastewater Pump Station	
I-1490	Level Transmitter - Radar	Y	Raw Wastewater Pump Station	
I-1491	Level Switch - Float		Raw Wastewater Pump Station	
I-1492	Level Switch - Float		Raw Wastewater Pump Station	
I-1493	Level Transmitter - Radar	Y	FET No. 1	
I-1494	Level Switch - Float		FET No. 1	
I-1495	Level Switch - Float		FET No. 1	
I-1580	Flow Meter	Y	FET No. 1 Eff PS	
I-1581	Flow Meter	Y	FET No. 1 Eff PS	
I-1680	Flow Meter	Y	First Stage DAF Sludge PS	
I-1690	Pressure Transmitter	Y	First Stage DAF Sludge PS	Pump Off at High Pressure
I-1691	Pressure Transmitter	Y	First Stage DAF Sludge PS	Pump Off at High Pressure
I-1790	Level Transmitter - Radar	Y	First Stage DAF Eff. PS Wet Well	
I-1791	Level Switch - Float		First Stage DAF Eff. PS Wet Well	Pump Off at LWL
I-1792	Level Switch - Float		First Stage DAF Eff. PS Wet Well	Pump On and Alarm at HWL
I-1990	Level Transmitter - Radar	Y	FET No. 2A	
I-1991	Level Switch - Float		FET No. 2A	Jet Pump Off at LLWL
I-1992	Level Switch - Float		FET No. 2A	Alarm at HWL
I-1993	Level Transmitter - Radar	Y	FET No. 2B	
I-1994	Level Switch - Float		FET No. 2B	Jet Pump Off at LLWL
I-1995	Level Switch - Float		FET No. 2B	Alarm at HWL
I-1996	D.O. Sensor	Y	FET No. 2A	
I-1997	D.O. Sensor	Y	FET No. 2B	
I-2080	Flow Meter	Y	7-Day FET No. 2 Eff. PS	
I-2180	Flow Meter	Y	Second Stage DAF Sludge PS	
I-2190	Pressure Transmitter	Y	Second Stage DAF Sludge PS	Pump Off at High Pressure
I-2191	Pressure Transmitter	Y	Second Stage DAF Sludge PS	Pump Off at High Pressure
I-2280	Flow Meter	Y	Second Stage DAF Sludge PS	
I-2290	Level Transmitter - Radar	Y	Second Stage DAF Sludge PS	
I-2291	Level Switch - Float		Second Stage DAF Sludge PS	Pump Off at LWL
I-2292	Level Switch - Float		Second Stage DAF Sludge PS	Pump On and Alarm at HWL
I-2380	Flow Meter	Y	Stormwater First Flush/Offspec Lagoon Eff. PS	
I-2390	Level Transmitter - Radar	Y	Stormwater First Flush/Offspec Lagoon Eff. PS	Alarm at HWL, Pump Off at LWL
FINAL EFFLUENT				
I-2480	Flow Meter	Y	Spray Irrigation Pond No. 2 PS	
I-2490	Level Transmitter - Radar	Y	Spray Irrigation Pond No. 2	Alarm at HWL, Pump Off at LWL