WASTEWATER TREATMENT PLANT
EVALUATION

NOVEMBER 13, 2019

HW PROJECT NO. 2019088

PREPARED BY:

WASTEWATER TREATMENT PLANT
EVALUATION

NOVEMBER 13, 2019

HW PROJECT NO. 2019088

PREPARED BY:

HAWKINS-WEIR ENGINEERS, INC.
211 NATURAL RESOURCES DRIVE
LITTLE ROCK, ARKANSAS 72205

Table of Contents

Acronyms

ADH	Arkansas Department of Health
CBOD or BOD	Biochemical Oxygen Demand
CAO	Consent Administrative Order
CAP	Corrective Action Plan
cfs	Cubic Feet per Second
COD	Chemical Oxygen Demand
DEQ	Arkansas Department of Environmental Quality
EPA	Environmental Protection Agency
^{o}F	Degrees Fahrenheit
FCB	Fecal Coliform Bacteria
ft	Feet
gpcd	Gallons per Capita per Day
GPD or gpd	Gallons per Day
GPH or gph	Gallons per Hour
HW or Engineer	Hawkins-Weir Engineers, Inc.
I&I	Infiltration and Inflow
MG	Million Gallons
MGD or mgd	Million Gallons per Day
mg/L	Milligrams per Liter
MMR	Monthly Monitoring Report
NH_3-N	Ammonia Nitrogen
sq ft or sf or ft^2	Square Feet
STEP	Septic Tank Effluent Pump Unit
SWD	Side Water Depth
TBD	To Be Determined
TDH	Total Dynamic Head
TKN	Total Kjeldahl Nitrogen
TN	Total Nitrogen
TP	Total Phosphorus
TRC	Total Residual Chlorine
TSS	Total Suspended Solids
U.N.O.	Unless Noted Otherwise
WAS	Waste Activated Sludge
WWTP	Wastewater Treatment Plant
WWTU	Wastewater Treatment Unit
TMDL	Total Maximum Daily Load

List of Figures

List of Tables

List of Exhibits

1. Introduction

1.1 Authorization

The City of Bethel Heights, AR authorized the preparation of this Wastewater Treatment System Evaluation by Hawkins-Weir Engineers, Inc. (HW) in accordance with an Agreement for professional services executed on August 27, 2019.

1.2 Purpose

The purpose of this Wastewater Treatment System Evaluation is to evaluate the existing Wastewater Treatment Plant (WWTP) as required by the City's Consent Administrative Order (CAO). The primary objectives of the Wastewater System Evaluation are as follows:

- Evaluate the viability of the existing wastewater treatment plant
- Evaluate the long-term wastewater capacity needs for the City of Bethel Heights
- Evaluate long-term wastewater alternatives for the City of Bethel Heights

In addition to addressing the CAO requirements, this report provides a long-range evaluation the City of Bethel Heights' wastewater treatment needs. When comparing project alternatives, the following design goals were considered:

- Provide consistent compliance with permit requirements
- Reduce operation and maintenance issues associated with the Utility's WWTP

1.3 Permit

In April 2003, the Arkansas Department of Environmental Quality (DEQ) granted approval to Bethel Heights (DEQ Permit No. 4725-W) to operate a decentralized wastewater treatment system with subsurface dispersal. The initial system was approved for a capacity of 12,500 gpd and was intended to serve fifty residences. The first expansion of the system was approved in December of that same year under DEQ Permit No. 4725-WR-1. That expansion increased the total system capacity to 45,000 gpd to allow it to provide service to up to 180 residences. The second facility expansion was permitted nine months later under DEQ Permit No. 4725-WR-2. This modification expanded the total system capacity to 79,400 gpd to provide treatment to an unspecified total number or residences and commercial customers. The third and final expansion of the wastewater treatment facility was permitted in March 2006 under DEQ Permit No. 4725-WR-3. That modification increased the capacity by an additional 90,000 gpd to achieve a total treatment capacity of 169,400 gpd, making this installation one of the largest of its kind in Arkansas. Every five years thereafter, in accordance with DEQ's regulations, the City of Bethel Heights was granted a renewed permit.

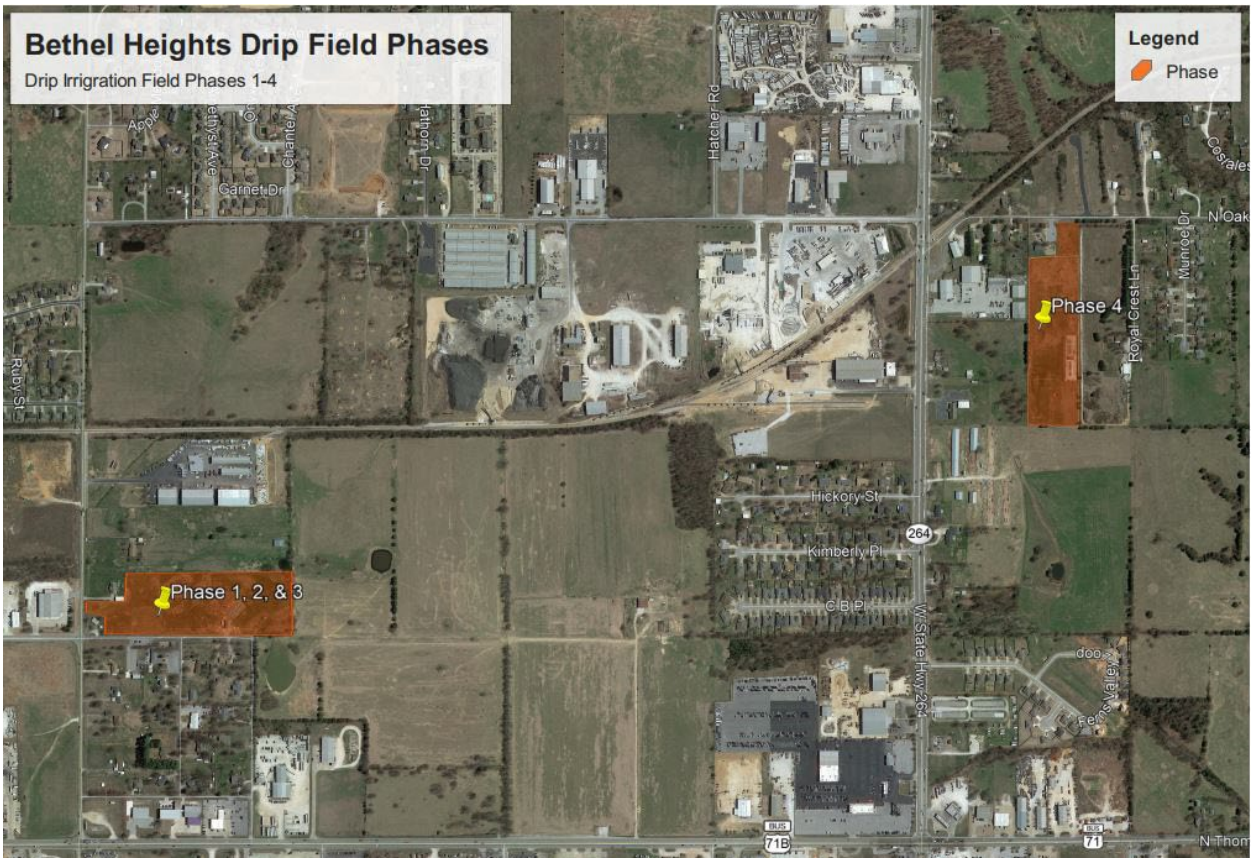
The City's current permit, Permit No. 4725-WR-5, was issued in September 2015. The Permit authorizes the City of Bethel Heights to operate two (2) separate decentralized wastewater treatment units (WWTU), which are subdivided into total of four (4) phases of treatment systems and subsurface drip dispersal fields, with a total permitted capacity of up to 180,000 gpd. The permit expires on August 31, 2020. Specific Permit requirements are listed in Section 2.2.3 of this Report.

2. Existing Wastewater Treatment System

2.1 Location

The City of Bethel Heights is located within Benton County, Arkansas. The City's municipal boundaries comprise approximately 2.22 square miles. Bethel Heights' wastewater treatment system includes two (2) Wastewater Treatment Units. The WWTUs are located within the city limits at 901 S. Lincoln St and on N. Oak Street. The Lincoln St WWTU is located on an 11-acre parcel and contains Phases I, II, and III. The N. Oak St WWTU is located on a 10-acre parcel and contains Phase IV. The locations of the WWTUs are presented in Exhibit 2.1.

Exhibit 2.1: WWTU Locations



2.2 Historical Data

2.2.1 Historical Influent Flow Rates

To establish average influent flow rates and future treatment needs, flow rates recorded by the WWTU staff from April 2019 to October 2019 were analyzed. Flow metering was conducted on the influent force mains at each WWTU and on the effluent lines before each phase of the drip dispersal fields. Table 2.1 presents the reported historical influent flows for each WWTU.

Table 2.1: Historical Influent Flows

WWTP INFLUENT FLOW DATA (GPD)					
	LINCOLN ST. WWTU			N. OAK ST WWTU	
	Phase I	Phase II	Phase III	Phase IV-A	Phase IV-B
Average Daily Influent Flow Rate, GPD	60,447			35,707	
Max Daily Influent Flow Rate, GPD[1]	116,138			80,740	
Combined Average Influent Flow Rate, GPD	96,154				
Combined Max Daily Influent Flow Rate, GPD[1]	156,708				

[1] **Historical maximum flow at each phase may occur on separate months from the combined maximum flow observed at the WWTU.**

Based on the combined influent data from April 2019 to October 2019, the system receives an average flow rate of approximately 96,000 gpd and a peak flow rate of approximately 157,000 gpd. Therefore, the influent peaking factor for the system was calculated to be approximately 1.63. It should be noted that each facility may experience peak flows at different times and the reported max daily influent flow is a combination of each system's peak flow.

It is typical for wastewater systems to experience different flow rates on weekdays versus weekends. This is due to the increase or decrease in total population associated with non-working days. In communities where the majority of the population works outside the city, the peaking factor can be magnified. Bethel Heights' historical influent flow data was analyzed to determine an approximate average weekday and weekend day flow rate. This data is presented in Table 2.2. The data indicates that Bethel Heights' Wastewater Treatment System receives an increase of approximately 5,000 gpd on Saturdays and Sundays. The majority of the additional weekend flow is received at the N. Oak Street Facility.

Table 2.2: Weekend and Weekday WWTU Average Influent Flows

	Lincoln St WWTU Average Daily Influent Flow Rate, GPD	N. Oak St WWTU Average Daily Influent Flow Rate, GPD	Total Average Daily Influent Flow, GPD
Weekend	61,220	38,793	100,012
Weekday	60,136	34,464	94,600

2.2.2 Historical Effluent Flow Rates

The City of Bethel Heights reports the total monthly effluent flow rate and the maximum daily effluent flow rate treated by each phase monthly to DEQ via MMRs. The flow rates of each phase are measured by flow meters on the effluent lines before the treated wastewater effluent is discharged to the drip dispersal fields. The total monthly flow rate of each phase is then divided by the total area of the drip dispersal zones in each phase to approximate the loading rates of the individual zones reported in the MMRs. Table 2.3 presents the average effluent flow rates and peak daily flow rates for each phase. It may be noted that the combined influent flow rate of the WWTUs does not precisely match the reported combined effluent flow rate. The flow rate variance is, however, within an acceptable tolerance based on the compounded error percentage that is normal for the type of flow meters employed at the WWTUs.

Table 2.3: Historical Effluent Flow Data

WWTU EFFLUENT FLOW					
	LINCOLN ST. WWTU			N. OAK ST WWTU	
	Phase I	Phase II	Phase III	Phase IV-A	Phase IV-B
Average Effluent Flow Rate, GPD	17,147	24,285	17,735	18,643	21,148
Average Loading Rate, GPD/SF	0.32	0.28	0.20	0.16	0.18
Max Daily Effluent Flow Rate, GPD[1]	42,000	48,000	33,100	47,100	43,700
Average Reported Effluent Flow Rate per WWTU, GPD	59,167			39,791	

[1] **Historical maximum flow at each phase may occur within separate months.**

Bethel Heights' WWTUs have a permitted total treatment capacity of 180,000 gpd at full buildout. However, the treatment system has not been constructed to full build out, as detailed later within this report. The actual capacities of the Bethel Heights WWTUs are based on the number of treatment pods installed at each WWTU as well as the permitted loading rate of its associated drip dispersal field.

The historical daily peak flow rates reported in the City's MMRs indicate that individual phases have experienced effluent peak flow rates above the influent peaking factor of 1.63 calculated as a part of this evaluation. The peak flow rates recorded within each zone could be the result of several factors including treatment unit operation and the layout of the pressurized sewer

collection system. Table 2.4 presents the maximum peaking factor recorded for each phase along with the month of occurrence and the average daily effluent flow rate.

Table 2.4: Effluent Peaking Factor by Phase[1]

Phase	Average (GPD)	Peaking Factor	Month
I	17,147	2.45	April 2018
II	24,285	1.98	March 2018
III	17,735	1.86	September 2018
IV-A	18,643	2.53	June 2019
IV-B	21,148	2.07	March 2019

[1] **January 2018 - August 2019**

2.2.3 Permit Requirements

The City of Bethel Heights is authorized to operate two (2) decentralized wastewater treatment systems with sub-surface dispersal under DEQ No-Discharge Water Permit No. 4725-WR-5. This permit became effective on September 1, 2015 and will expire on August 31, 2020. A summary of the permit effluent limits, monitoring, and reporting requirements is presented in Table 2.5. DEQ No-Discharge Water Permit No. 4725-WR-5 is attached to this Report as Appendix C.

Table 2.5: No-Discharge Permit Limits

Constituents	Permit Limit (mg/L, U.N.O)	Monitoring
Carbonaceous 5-day Biochemical Oxygen Demand (CBOD5)	15	Grab sample once per month
Total Suspended Solids (TSS)	15	
Fecal Coliform Bacteria (FCB)	2,000	
pH	6.0 - 9.0 S.U.	
Total Phosphorus (TP)	Report	
Total Kjeldahl Nitrogen (TKN)	Report	Grab sample once per quarter
Nitrate Nitrogen (NO_3-N) + Nitrite Nitrogen (NO_2-N)	Report	
Plant Available Nitrogen (PAN)	Report	
Flow, Monthly Total	Report, MGD	Total flow per month
Flow, Daily Maximum	Report, MGD	Daily
Loading Rate	Report, gpd/sf	

2.2.4 Effluent Quality

The City of Bethel Heights' WWTUs have a long history of non-compliance with their permit requirements. Effluent quality violations are known to have occurred on a regular basis for at least the past ten years. Effluent surfacing has been noted since as early as 2007. The City entered into a Consent Administrative Order (CAO) with the DEQ in 2015. That CAO listed 147 violations of permitted effluent limits for the period of January 1, 2012 through June 30, 2015. Effluent surfacing was also noted to be occurring within all four Phases of the drip dispersal fields. Loading rates during that period of time were reported to average 0.22 GPD/SF with a maximum loading rate of 0.27 GPD/SF. The CAO was closed in January 2017. Effluent violations and surfacing that continued to be reported by the City led to the current CAO, which was issued on October 15, 2019.

The City's WWTUs were designed to distribute wastewater effluent directly into the soil via a subsurface drip dispersal system installed for each Phase. The City is required to submit an MMR for each Phase with effluent quality testing results. HW tabulated these reports to determine the quality of effluent and the quantity of sample results exceeding the permit limits at each WWTU over the period of January 2018 to August 2019. The Lincoln Street WWTU reported 69 sample results exceeding the permit limits over the evaluated period: 22 for CBOD5, 44 for TSS, and three (3) for FCB. The N. Oak Street WWTU reported four (4) sample results exceeding the permit limits over the same period: One (1) for CBOD, two (2) for TSS, and one (1) for FCB. Table 2.6 through Table 2.10 show the sample results reported to DEQ in the MMRs. Sample results exceeding the permit limits are indicated in red.

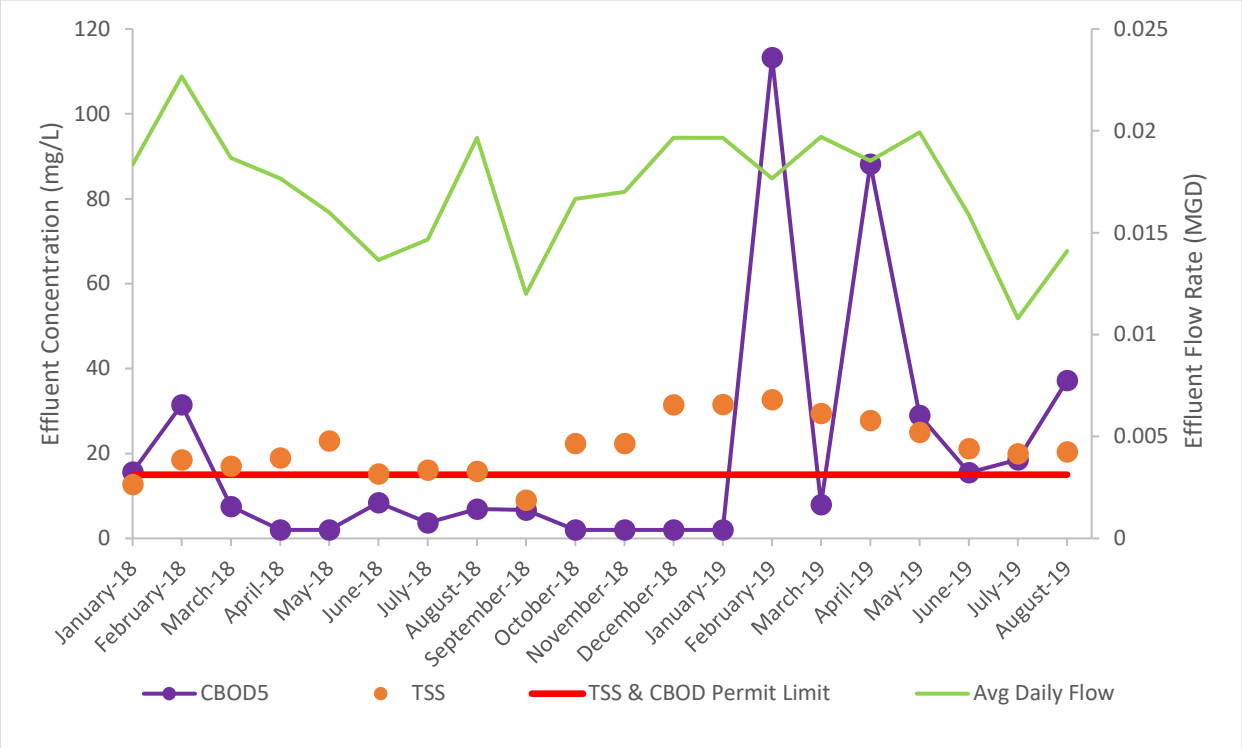
Bethel Heights' staff attributed the high FCB counts in February 2018 for Phase I and Phase II to the testing lab pulling samples shortly after the biological treatment pods' textile media were cleaned. Potential causes of CBOD and TSS permit limit exceedances are discussed further in Section 3.3.2.

2.2.4.1 Phase I

Table 2.6: Phase I MMR Values

	Phase I					
	Total Phosphorous (mg/l)	CBOD (mg/l)	pH (S.U)	TSS (mg/l)	Ammonia Total Nitrogen (mg/l)	FCB (#/100ml)
Permit Limit	--	15	6-9	15	--	2000
January-18	6.2	15.7	7.2	12.7	42.2	4
February-18	7.2	31.5	7.3	18.5	41.8	7200
March-18	6.0	7.5	7.1	17.0	23.7	4
April-18	6.3	2	6.9	19	21	4
May-18	9.8	2	7.8	23	0.1	10
June-18	9.4	8.4	6.4	15.2	7.6	4
July-18	7.9	3.7	6.9	16.1	44.1	100
August-18	8.5	6.9	6.7	15.8	22.4	10
September-18	9	6.7	6.6	9	6.3	10
October-18	8.56	2	7.1	22.4	35.6	10
November-18	6.66	2	7	22.4	20.1	10
December-18	6.54	2	7.3	31.5	32.7	10
January-19	6.54	2	7.1	31.6	16.6	10
February-19	7.41	113.3	7.1	32.7	54.2	538
March-19	7.6	8	7	29.5	53.8	10
April-19	7.9	88.2	6.9	27.8	NR	4
May-19	5.7	29	7.1	25	NR	196
June-19	8.1	15.5	6.9	21.2	43.3	1100
July-19	6.7	18.5	6.9	20	NR	15
August-19	8	37.2	6.77	20.4	NR	5210

Figure 2.1: Phase I Effluent CBOD5 and TSS vs Permit Limits

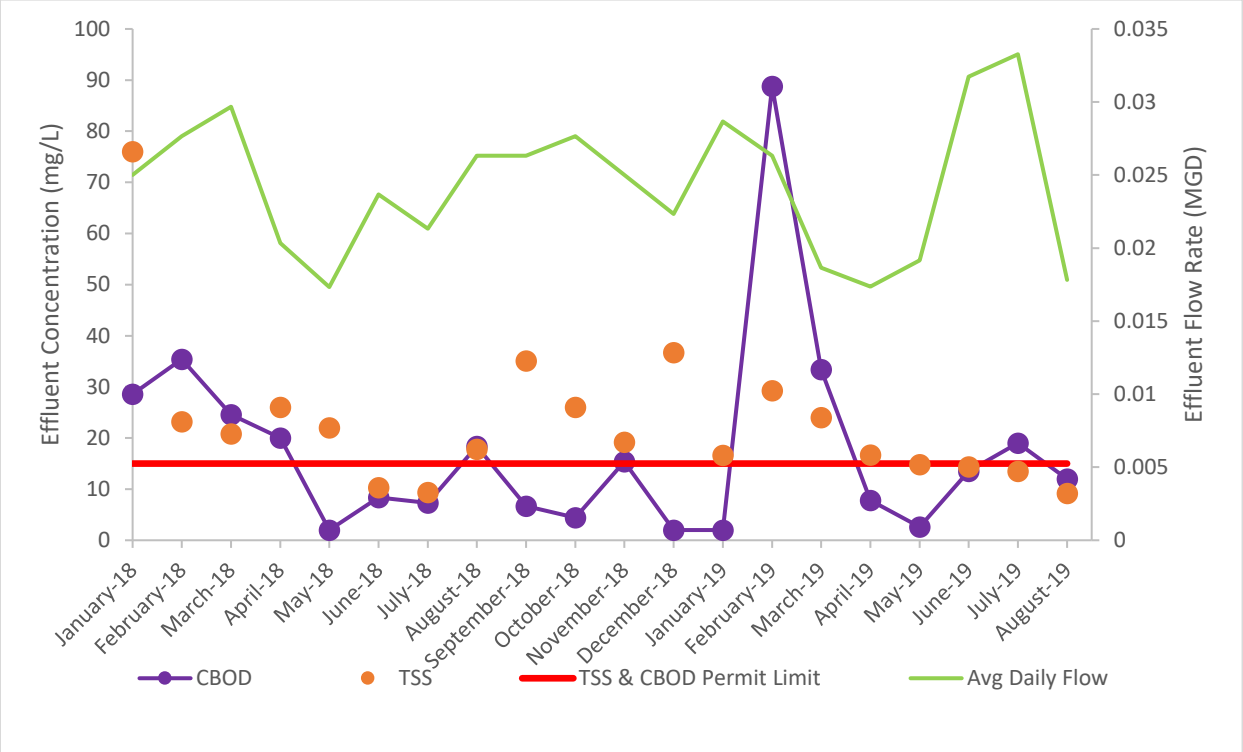


2.2.4.2 Phase II

Table 2.7: Phase II MMR Values

Phase II						
	Total Phosphorous (mg/l)	CBOD (mg/l)	pH (S.U)	TSS (mg/l)	Ammonia Total Nitrogen (mg/l)	FCB (#/100ml)
Permit Limit	--	15	6-9	15	--	2000
January-18	6.9	28.6	7.1	76	12.7	4
February-18	6.9	35.4	7.3	23.2	47.2	60000
March-18	5.8	24.6	7.2	20.8	31.8	1000
April-18	6.4	20	7.3	26	39.7	4
May-18	8.3	2	6.4	22	17.6	20
June-18	0.7	8.4	8.3	10.3	0.5	4
July-18	7.7	7.3	6.7	9.4	28.8	10
August-18	7.5	18.4	7	17.8	45.9	10
September-18	8.5	6.7	7.2	35.1	32.6	10
October-18	8.07	4.4	6.8	26	46.2	10
November-18	7.35	15.4	7.1	19.2	37.6	10
December-18	9.21	2	7.3	36.7	32.7	10
January-19	7.1	2	6.8	16.6	20	10
February-19	7.82	88.8	7.2	29.3	56	2
March-19	7.6	33.4	7.3	24	49.2	10
April-19	9	7.8	6.3	16.7	NR	10
May-19	5.9	2.6	6.8	14.8	NR	136
June-19	8.2	13.5	6.8	14.4	37.3	26
July-19	7.8	19	6.9	13.5	NR	308
August-19	7.5	12	6.93	9.2	NR	1553

Figure 2.2: Phase II Effluent CBOD5 and TSS vs Permit Limits

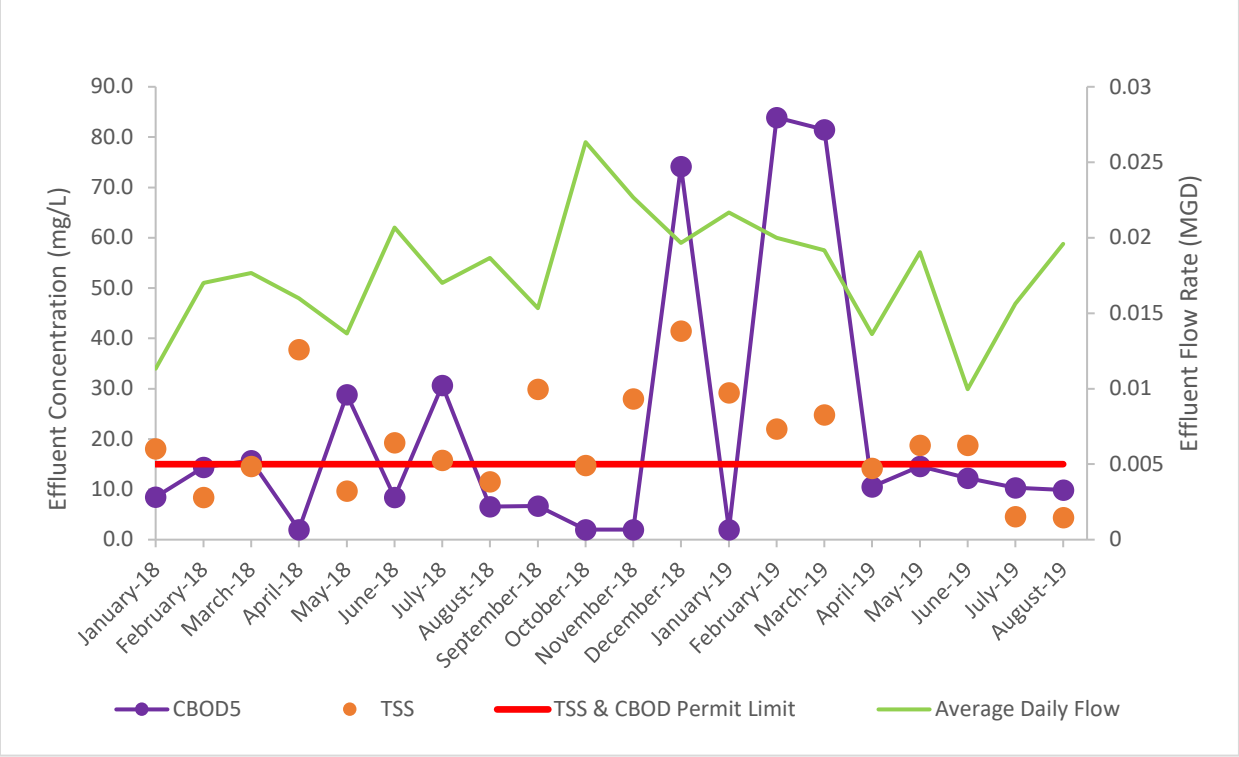


2.2.4.3 Phase III

Table 2.8: Phase III MMR Values

	Phase III					
	Total Phosphorous (mg/l)	CBOD (mg/l)	pH (S.U)	TSS (mg/l)	Ammonia Total Nitrogen (mg/l)	FCB (#/100ml)
Permit Limit	--	15	6-9	15	--	2000
January-18	5.80	8.5	7.2	18.1	18.1	90
February-18	5.80	14.4	7.2	8.4	8.4	90
March-18	7.60	15.7	6.9	14.6	14.6	100
April-18	7.10	2.0	7.1	37.8	37.8	10
May-18	8.80	28.8	6.7	9.7	9.7	14
June-18	8.20	8.4	6.9	19.3	19.3	4
July-18	7.80	30.7	6.8	15.8	15.8	573
August-18	7.10	6.6	6.9	11.5	11.5	10
September-18	7.80	6.7	7.0	29.9	29.9	1
October-18	6.67	2.0	6.8	14.8	14.8	10
November-18	7.38	2.0	8.7	28.0	28.0	10
December-18	7.09	74.2	7.3	41.5	41.5	1789
January-19	6.71	2.0	6.9	29.2	29.2	10
February-19	6.02	83.9	7.2	22.0	22.0	2
March-19	7.10	81.5	7.2	24.8	24.8	10
April-19	8.60	10.5	6.9	14.2	14.2	31
May-19	5.80	14.6	6.7	18.8	18.8	4
June-19	9.10	12.2	6.6	18.8	18.8	62
July-19	7.10	10.3	6.6	4.6	4.6	NR
August-19	7.00	9.9	6.7	4.4	4.4	1986

Figure 2.3: Phase III Effluent CBOD5 and TSS vs Permit Limits

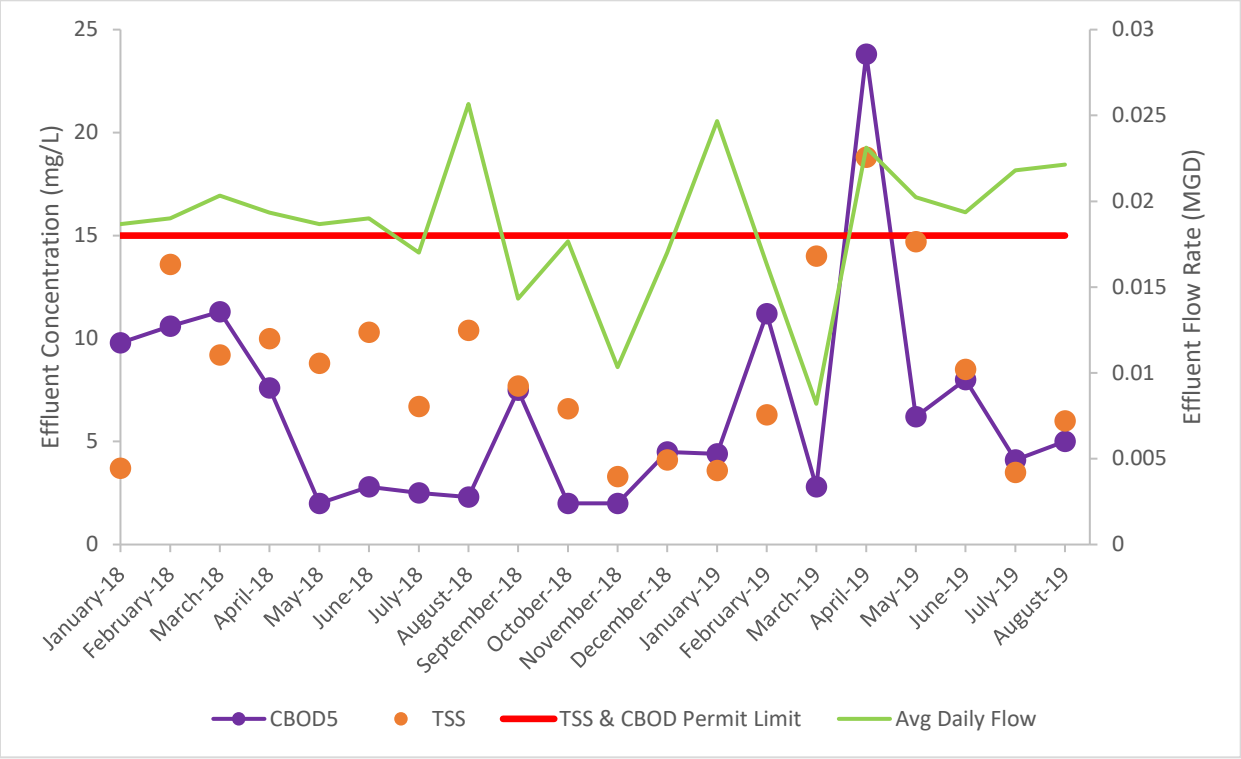


2.2.4.4 Phase IV-A

Table 2.9: Phase IV-A MMR Sample Results

Phase IV-A						
	Total Phosphorous (mg/l)	CBOD (mg/l)	pH (S.U)	TSS (mg/l)	Ammonia Total Nitrogen (mg/l)	FCB (#/100ml)
Permit Limit	--	15	6-9	15	--	2000
January-18	6.4	9.8	7.3	3.7	41.1	400
February-18	6.3	10.6	7.4	13.6	43.4	100
March-18	6.1	11.3	7.2	9.2	39.1	450
April-18	6.1	7.6	6.7	10	26.3	100
May-18	7.1	2	6.8	8.8	25	20
June-18	7.9	2.8	6.6	10.3	9.7	4
July-18	7.3	2.5	6.5	6.7	6.3	10
August-18	7.1	2.3	6.5	10.4	5.1	10
September-18	7.4	7.5	6.9	7.7	11.7	117.8
October-18	6.56	2	6.2	6.6	13.2	10
November-18	8.24	2	6.8	3.3	5.42	10
December-18	6.02	4.5	7.2	4.1	12.3	10
January-19	6.36	4.4	6.6	3.6	4.18	10
February-19	6.48	11.2	6.6	6.3	9.01	10
March-19	8.36	2.8	6	14	8.02	10
April-19	7.4	23.8	7.4	18.8	NR	74
May-19	7.4	6.2	6.7	14.7	NR	5
June-19	6.6	8	6.7	8.5	14.1	387
July-19	8.1	4.1	6.4	3.5	NR	62
August-19	7.3	5	6.58	6	NR	77

Figure 2.4: Phase IV-A Effluent CBOD5 and TSS vs Permit Limits

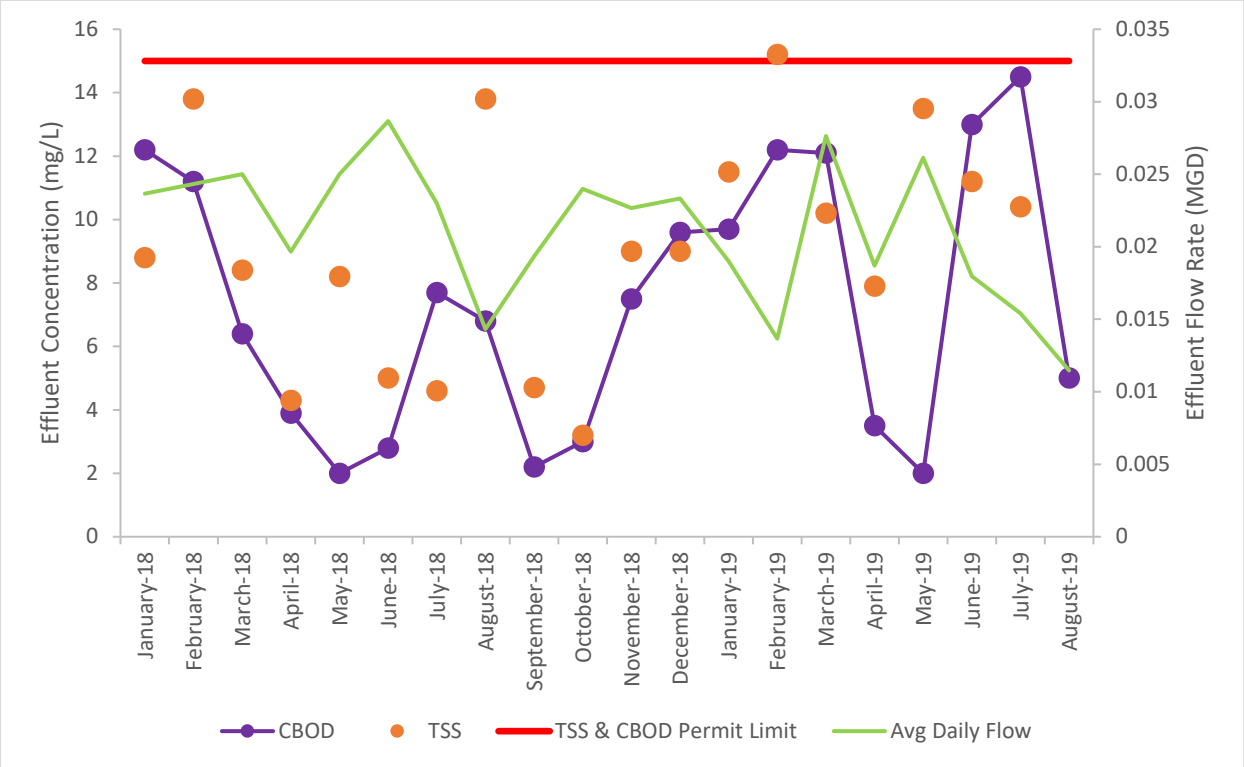


2.2.4.5 Phase IV-B

Table 2.10: Phase IV-B MMR Sample Results

Phase IV-B						
	Total Phosphorous (mg/l)	CBOD (mg/l)	pH (S.U)	TSS (mg/l)	Ammonia Total Nitrogen (mg/l)	FCB (#/100ml)
Permit Limit	--	15	6-9	15	--	2000
January-18	6.6	12.2	7.2	8.8	30	590
February-18	6.4	11.2	7.2	13.8	31.9	1800
March-18	6.2	6.4	7.1	8.4	23.4	170
April-18	6.5	3.9	7.3	4.3	12.1	2000
May-18	7	2	6.6	8.2	8.7	16
June-18	8	2.8	6.9	5	11.1	4
July-18	7.6	7.7	6.9	4.6	17.1	10
August-18	7.1	6.8	6.8	13.8	9.2	10
September-18	6.6	2.2	6.9	4.7	8.2	30.9
October-18	6.65	3	6.6	3.2	8.76	20
November-18	6.17	7.5	6.9	9	17.4	52
December-18	6.27	9.6	7.2	9	17.1	10
January-19	6.27	9.7	7	11.5	16.2	110
February-19	7.12	12.2	6.9	15.2	26.5	10
March-19	6.93	12.1	7	10.2	20.7	1043
April-19	6.7	3.5	7.1	7.9	NR	10
May-19	6.8	2	7	13.5	NR	644
June-19	6.8	13	6.9	11.2	36.5	1560
July-19	7.8	14.5	6.8	10.4	NR	8
August-19	6.2	5	6.36	ND	NR	ND

Figure 2.5: Phase IV-B Effluent CBOD5 and TSS vs Permit Limits



2.3 Existing Treatment Facilities

2.3.1 Septic Tank Effluent Pump Units

Bethel Heights' operates a pressurized sewer collection system. Each sewer customer discharges wastewater to an Orenco septic tank effluent pump (STEP) system where primary treatment of raw sewage occurs. Heavy solids as well as trash and debris settle to the bottom of the fiberglass tank, while lighter material floats to the top of the liquid content. Within the tanks, anaerobic organisms digest the organic matter into gases such as carbon dioxide and methane. Solids collected in the septic tanks are reported to be periodically pumped for disposal. Effluent from each STEP is pumped from the mid-level of the unit through a force main to either the Lincoln Street WWTU or N. Oak Street WWTU. The specific receiving WWTU for a given area of the City can be adjusted by a series of manual isolation valves within the collection system. These valves afford the City limited ability to control the volume of flow received by each WWTU.

Each STEP unit consists of a fiberglass tank and an Orenco High-Head Effluent P100 series pump. Effluent pumps are installed in an Orenco Bio-Tube Pump Vault with a Biotube Filter Cartridge to further reduce solids leaving the tank. All customers have a minimum 1,500-gallon STEP unit capable of at least 24-hours of storage. According to the City's current permit, the system was originally designed assuming each residence contained 2.6-persons and discharged an average of 80 gallons per capita per day. Commercial STEP units were designed on a case-by-case basis to handle expected daily flow rates and provided adequate storage.

2.3.2 Process Layout

Each of the phases of the City's WWTUs are generally the same. They were designed to be equipped with the following components:

- One (1) Blend Tank
- One (1) Recirculation Tank
- One (1) Recirculation Tank with Duplex Pump Units
- Nine (9) AdvanTex AX100 Biological Treatment Pods
- One (1) Dose Tank with Duplex Pump Unit(s)
- Micro-disc Filtration
- Ultraviolet (UV) Disinfection
- Drip Dispersal Field

At each WWTU, partially treated STEP effluent is split between the treatment phases by a series of valves and a splitter box. Within each phase, the wastewater is split between three (3) sets of three (3) biological treatment pods. The system is designed to treat the wastewater in several cycles; therefore, a large portion of the filtered effluent is returned back to the recirculation tanks for additional treatment cycles. If flow is below a predetermined level in the recirculation tank, it is directed back to the recirculation tank from the pods. When the water surface elevation is above that same level in the recirculation tank, flow is directed to the dose tank. From the dosing tank, effluent is pumped to the micro-disc filters and UV disinfection units. After disinfection the wastewater is delivered to the drip dispersal fields. Each drip dispersal field consists of multiple zones, which are dosed intermittently. It is understood that, the system is designed to dose one drip dispersal zone at a time within the phase, so that flow alternates through each zone

sequentially. Drip dispersal zones for each phase are shown in Appendix A. Process flow diagrams for each phase are presented as Appendix B.

2.3.3 Biological Treatment

The biological treatment pods installed for each WWTU phase are AdvanTex AX100 treatment systems manufactured by Orenco Systems. Each Phase contains three (3) sets of three (3) treatment pods for a total of nine (9) pods per phase. The AdvanTex AX100 pods are packed bed filters that utilize a textile material to facilitate growth of the microorganisms required for treatment. A ventilation fan is included for each phase of the system to supply the necessary oxygen for the growth of aerobic organisms. Attached growth filters are typically designed for removal of CBOD5, TSS, and ammonia. Removal efficiencies are dependent on the recirculation ratio and loading rate, the latter of which is discussed below.

2.3.3.1 Phase I, II, and III (Lincoln St. WWTU)

The original design of the Lincoln Street WWTU included thirty-six (36) AX100 pods. Nine (9) of the pods included with Phase III were reported to have been removed from that Phase and incorporated into Phase IV, during the construction of the N. Oak Street WWTU. Additionally, three (3) pods within Phase I are out of service due to floating and one (1) pod in Phase 2 has been taken out of service due to an apparent leak. Based on this information, the Lincoln Street WWTU has 23 of 36 filter pods in service.

Taking into account the reduced number of pods and at the system manufacturer's reported average day treatment capacity of 2,500 gallons per day per pod, the Lincoln Street WWTU has a design capacity of 57,500 gpd. This capacity is dependent on the ventilation system providing adequate oxygen as required by the pods and the condition of the textile media. Orenco Systems "Commercial Treatment Systems Design Criteria" document indicates the AX100 pods have a design peaking factor of 2 (5,000 gallons per pod per day). This is based on a peak hydraulic loading rate of 50 gpd/sf and a total treatment area of 100 sf. Therefore, according to the system manufacturer's design loading rates and the current number of pods in service, the WWTU has a theoretical peak capacity of 115,000 gpd.

2.3.3.2 Phase IV (N. Oak St WWTU)

The N. Oak St WWTU is documented to have an average design capacity of 45,000 gpd and a peak capacity of 90,000 gpd. The facility includes eighteen (18) AX100 pods. Just like the Lincoln Street WWTU, the pods have a design capacity of 2,500 gpd with a peak capacity of 5,000 gpd. As with the Lincoln Street WWTU, the actual treatment capacity is a function of system maintenance and operation.

2.3.3.3 Evaluation by Manufacturer

Separate from this evaluation, the biological treatment system manufacturer, Orenco Systems, performed a site evaluation in September 2019 to assess the current condition of the portion of the City's treatment systems that is utilizing their equipment. Bethel Heights' CAO requires that the findings of that evaluation be incorporated into this Report. Orenco conducted a similar evaluation in 2015 in response to the City's previous CAO. Orenco concluded that several deficiencies identified in 2015 still exist at the Lincoln Street WWTU today.

Actionable recommendations provided by Orenco Systems concerning the components of the treatment system that they manufactured are listed below. These recommendations are geared towards restoring the treatment system to its originally intended design capacity.

- Orenco noted that at least four (4) AX100 pods that had floated at the Lincoln Drive treatment site and need to be returned to service.
- Multiple pumps were noted by Orenco to have been replaced throughout the system. Orenco recommended that the City pull all pumps to determine the pump model number and horsepower and confirm proper operation of the pump. Orenco noted their willingness to review and verify the pump sizing in accordance with the original design.
- Orenco recommended that the City develop a corrective action plan to return all pods to service.
- Orenco recommended that they City install new above-ground fan assemblies to replace buried fan assemblies. They further recommended that the existing above ground fan assemblies that are inoperable be updated with new fans and carbon filters.
- Orenco noted that recirculating pumps and pod dosing sequences were not correct or had been modified. They recommended that the City confirm that all recirculating pumps are alternating and that all distribution valves are sequencing through the three pods that they dose. They recommended that any improperly operating pumps be corrected.
- Orenco recommended that the Owner reset the textile sheets in their tracks and clean the media using the methods and equipment recommended in the O&M manual.
- Orenco recommended that the City update or replace the malfunctioning control panels.

2.3.4 Post-Filtration and Disinfection

After biological treatment, effluent is pumped through parallel micro-disc filters prior to disinfection. The manual disc filters are 2" Dual Lite Filters manufactured by Netafim™. The units include 120 Mesh / 130 Micron filter discs. The units appear to be more commonly used for point of use drinking water filtration. Typical wastewater effluent filters utilize media with openings in the 5 to 10-micron range. The filters have a manufacturer recommended flow rate between 400 gpd and 900 gpd each. In this application, the filters are intended to polish the effluent prior to disinfection. This has the added benefit of protecting the UV units from the growth of biofilms. Bethel Heights' staff indicated the disc filters are cleaned multiple times per week.

The UV disinfection system for each phase consists of two (2) Sanitron Model S2500C ultra violet light disinfection units operating in series. The design flow rate for each of these units is 40 gpm, indicating a redundant capacity of 57,600 gpd for each phase. This exceeds the maximum treatment capacity of each phase; therefore, the UV system is sized consistently with the manufacturer's recommendations. It should be noted that this evaluation did not include an analysis of the UV transmittance percentage of the effluent, which is a key factor in determining the appropriate UV dosage. It may be necessary for Bethel Heights to perform further evaluation of the UV disinfection units at the WWTUs to ensure that they are sized properly.

HW noted that in addition to the micro-disc filter units and UV disinfection system, Phase I includes an additional process unit; an unidentified pressurized reaction vessel. The City was unsure of its intended operation and it is not believed to provide treatment benefit. This unit was not included in the facility's construction permit application and should be removed from the WWTU.

2.3.5 Chemical Feed Systems

Currently, the City of Bethel Heights does not feed any chemicals as a part of their treatment process. However, several different chemical feeds systems could be considered by the City to assist with the treatment process. These include chlorine to assist with disinfection, or a polymer to assist with solids separation. Prior to the inclusion of any chemical feed system at the WWTUs a permit modification and construction permit will be required.

2.3.6 Electrical and Controls

The Bethel Heights WWTUs each have a proprietary control system installed with the original Orenco equipment. Each phase contains a custom single board controller (SBC) manufactured by and proprietary to Orenco. The SBCs at each WWTU are connected to a central Siemens Simatic S7-200 PLC for relay outputs to control the recirculation pumps, dosing pumps, and drip dispersal field valves. The installed PLCs are original to the WWTUs and are no longer supported by integrators within the area. The control systems operate as an open loop. As voltage is applied to pumps and/or valves, no signal returns to the plant verifying the command was performed. The operation system is time based with sequential operation for the pumps and valves; however, the plant control rooms do not have a method to indicate which equipment, valves, pumps, or zones are currently active.

Bethel Heights' operations staff reported that some toggle switches on the control panel that control the dispersal valves for the drip dispersal zones would not stay in the automatic or manual position. Some toggle switches were observed to be held in the manual position with screws. Operations staff also reported that the fuses for the warning lights on the control panel door at the Lincoln St WWTU continued to fault, preventing the built-in warning system from operating properly.

The WWTU sites do not contain stand-by power for operation during loss of electrical service. Although the STEP systems are designed to have a minimum of 24-hours storage capacity and each phase contains storage within the tanks, emergency backup power is still considered necessary to provide service during extended periods of loss of electrical power. With regards to the electrical service within the drip dispersal fields, there is reported to be very little protection for electrical boxes located in the drip dispersal zones and splices have been made directly to solenoids inside the underground system. HW did not perform an electrical code evaluation of any component of the treatment facility as a part of this evaluation.

2.3.7 Drip Dispersal Fields

A drip dispersal system is defined by ADH as dispersal technology for the distribution of treated wastewater uniformly over a large area beneath the soil surface. Drip dispersal systems typically consist of small diameter flexible piping installed in a grid system throughout the intended application area of the treated wastewater. The drip lines are typically installed with flow emitters, evenly spaced along the length of the drip line to allow for even dispersal of the flow.

2.3.7.1 Existing Drip Dispersal Fields

Both WWTUs in the Bethel Heights' Treatment System are designed with subsurface drip dispersal systems as the method for the dispersal of treated wastewater. As described previously within this report, the treatment units for the Bethel Heights system are divided into phases. Each

phase of treatment is equipped with a dedicated drip dispersal system and application area. The dedicated drip dispersal systems for each phase are further broken down into dispersal zones that can individually be activated or isolated from the remaining portion of the application area by distribution valves, which are controlled by the WWTU's control system. The breakdown of the dispersal zones is designed to allow sections of the drip dispersal system within each phase to be operated on an alternating schedule. The alternating schedule means that zones may receive flow and subsequently be rested for a predetermined period of time while flow is diverted to the remaining active zones within the phase's dispersal system. Table 2.11 provides a summary of the drip dispersal fields and the dispersal area of each phase. It should be noted that three (3) drip dispersal zones within Phase IV have been reported by plant operating staff to be out of service. The area of these three (3) zones has been removed from the available drip dispersal area to estimate the current Bethel Heights treatment system capacity.

Table 2.11: Drip Dispersal Field Areas

WWTU Phase	Zones per Phase	Drip Dispersal Field Area (sf)
I	12	53,446
II	21	87,160
III	21	88,400
IV-A	16	208,800
IV-B	13	

2.3.7.2 Drip Dispersal Field Deficiencies

The subsurface drip dispersal fields are reported to have a number of issues that result in operational difficulties and permit violations. Surfacing of treated wastewater within the drip dispersal fields is a violation of the City's permit. It has been documented that the drip dispersal fields are experiencing surfacing in all four (4) phases of treatment operations. Table 2.12 lists reported surfacing events from January 2019 to August 2019.

The City's permit also notes that the drip dispersal field shall be maintained with a vegetative cover for additional treatment and to minimize erosion. Bermuda, fescue, and rye grasses are specified as approved vegetative covers. Regulatory agency site visits have documented that some areas of the drip fields consist of water primrose as a vegetative cover. Cover crop vegetation that is not specifically approved through the permit has the potential to reduce the available nitrogen uptake and evapotranspiration rates of the soil. This can result in lower allowable soil loading rates than the original design.

Table 2.12: Historical Records of Drip Dispersal Field Surfacing

Month (2019)	Phase I	Phase II	Phase III	Phase IV-A	Phase IV-B
January	X	X	X	X	
February	X	X	X	X	X
March					
April					
May	X	X	X	X	
June		X			
July	X	X	X		
August	X	X	X	X	X
Totals	**5**	**6**	**5**	**4**	**2**
				Combined Total	**22**

Previous site visits have reported that there are issues with the control system that regulates the loading cycle of the drip dispersal system. The operators have noted that the automatic portions of the control system are not functional, resulting in zone loadings performed manually by Bethel Heights WWTU operators. Section 7 of the ADH Rules and Regulations Pertaining to Drip Dispersal Systems (ACT 402 OF 1977, Effective Date July 4, 2010) states that timed dosing is the only allowable method for controlling the dose of drip dispersal loading cycles. Manual operation of drip zones has the potential to result in dosing flow rates above the design loading rate of the soils, potentially resulting in permit violations due to effluent surfacing.

2.3.7.3 Drip Dispersal Field Permitted Loading Rate

The drip dispersal fields were sized based on permitting allowances for the flow of treated wastewater effluent that can be applied over the drip dispersal field, which is typically defined as a soil loading rate. This soil loading rate is measured in gallons per day per square foot of drip dispersal field area (gpd/sf). Current practices for the regulation of subsurface drip dispersal systems require the system owner to receive a permit from DEQ for the subsurface discharge and an approved soil loading rate that is reviewed by ADH. In 2002, a soil evaluation was performed at the site of the Lincoln Street WWTU to determine the acceptable loading capacity of the proposed drip dispersal field installation. During the evaluation, 41 test pits were excavated and the soil was analyzed by a professional soil classifier in accordance with current permitting requirements. The soil evaluation included analysis of the soil classification, porosity, water table depth, and a calculated loading rate for each test pit that was excavated. The loading rate calculations derived from this evaluation were used by the system's original design engineer as a basis to calculate the required area of subsurface drip dispersal for the Lincoln Street WWTU (Phases I, II, and III). These calculations were also used in the permitting application and approval process by the regulating agencies. An additional 33 test pits were excavated at the Oak Street WWTU (Phase IV) to be used in the loading rate evaluation for the Phase IV drip dispersal system.

The soil loading rates for each phase of the treatment system, in accordance with the currently active permit (DEQ Permit No. 4725-WR-5) are listed in Table 2.13. As shown in Table 2.13, a uniform loading rate was permitted across each phase of the drip dispersal system.

Table 2.13: Soil Loading Rates per Permit 4725-WR-5

WWTU Phase	DEQ Permitted Soil Loading Rate (gpd/sf)
I	0.54
II	0.54
III	0.54
IV (A & B)	0.40

The regulations governing acceptable soil loading rates in Arkansas have been revised since Bethel Height's Treatment Facility was originally permitted. New applications permitted on similar soils in Northwest Arkansas are typically assigned a much lower allowable loading rate than that included in Bethel Height's Permit.

2.3.7.4 Modified Drip Dispersal Field Loading Rate Estimate

Bethel Heights' CAO requires that this Evaluation include an estimate for revised drip dispersal field loading rates intended to mitigate effluent surfacing. No approved method is known to HW to conclusively determine appropriate loading rate of a drip dispersal field after the field area in question has been operated as a drip dispersal field for an extended period of time. HW performed the evaluation described below to estimate a modified loading rate in compliance with the City's CAO requirement. We cannot provide sufficient justification, however, that the DEQ should modify the City's permitted loading rate to the values concluded using this methodology.

HW reviewed the original soil analysis and loading rate reports for Bethel Height's treatment facility as a part of this Evaluation. Using that information, a modified design loading rate for each phase of the Bethel Heights drip dispersal system was calculated with assistance from a soil scientist registered in the State of Arkansas in accordance with the current ADH Rules and Regulations Pertaining to Drip Dispersal Systems (ACT 402 of 1977, Effective Date July 4, 2010). The ADH loading rate design guide for drip dispersal systems dictates that the loading rate of the receiving soil for the subsurface drip dispersal system shall be calculated based on the seasonal water table level. Table 1 within the ADH document tabulates an approved loading rate for the receiving soil based on the depth to the brief, moderate, and long seasonal water table. In this evaluation, the limiting factor for the loading rate calculation is the adjusted moderate seasonal water table (AMSWT). That value was provided in the referenced original soil evaluation reports for each test pit. The location of each original test pit is also shown on the record drawings. The AMSWT values listed in each of the original soil evaluation reports can be used to estimate the approximate design loading rates for each phase of the existing drip dispersal fields if they had been permitted under the current standards. Loading rate calculations based on the AMSWT, as reported in the original soil evaluation, and in accordance with current ADH soil loading standards are shown in Table 2.14.

Table 2.14: Recalculated Soil Loading Rates based on Current Permitting Requirements

WWTU Phase	Loading Rate Based on Deepest Recorded AMSWT (gpd/sf)	Loading Rate Based on Shallowest Recorded AMSWT (gpd/sf)	Loading Rate Based on Average AMSWT (gpd/sf)
I	0.239	0.120	0.169
II	0.246	0.157	0.207
III	0.246	0.144	0.200
IV (A & B)	0.205	0.103	0.153

As previously noted herein, each phase of the drip dispersal fields is divided into smaller dispersal zones that can be individually activated. The Lincoln Street WWTU drip dispersal field consists of 54 zones. The original soil analysis included the excavation of 41 test pits with only 29 of these pits being located within the limits of a drip dispersal phase. Given the lack of representative data for each zone and the layout of the installed drip dispersal piping, an accurate loading rate cannot be calculated for each dispersal zone as requested by Bethel Heights' CAO. Similarly, due to the lack of information regarding the location of the soil borings that were performed to evaluate the original soil loading rate at the Oak Street WWTU drip dispersal field, the loading rate for each zone of the Phase IV drip dispersal field also cannot be calculated. To estimate the zone loading rate, the average soil loading rate of the Phase in which the zone is located was utilized.

The estimated modified drip dispersal field loading rates listed in Table 2.14 were used to estimate the effective treatment capacity of the Bethel Heights WWTUs' drip dispersal fields as originally constructed. The estimated original effective treatment capacities of the Bethel Heights drip dispersal fields are listed in Table 2.15.

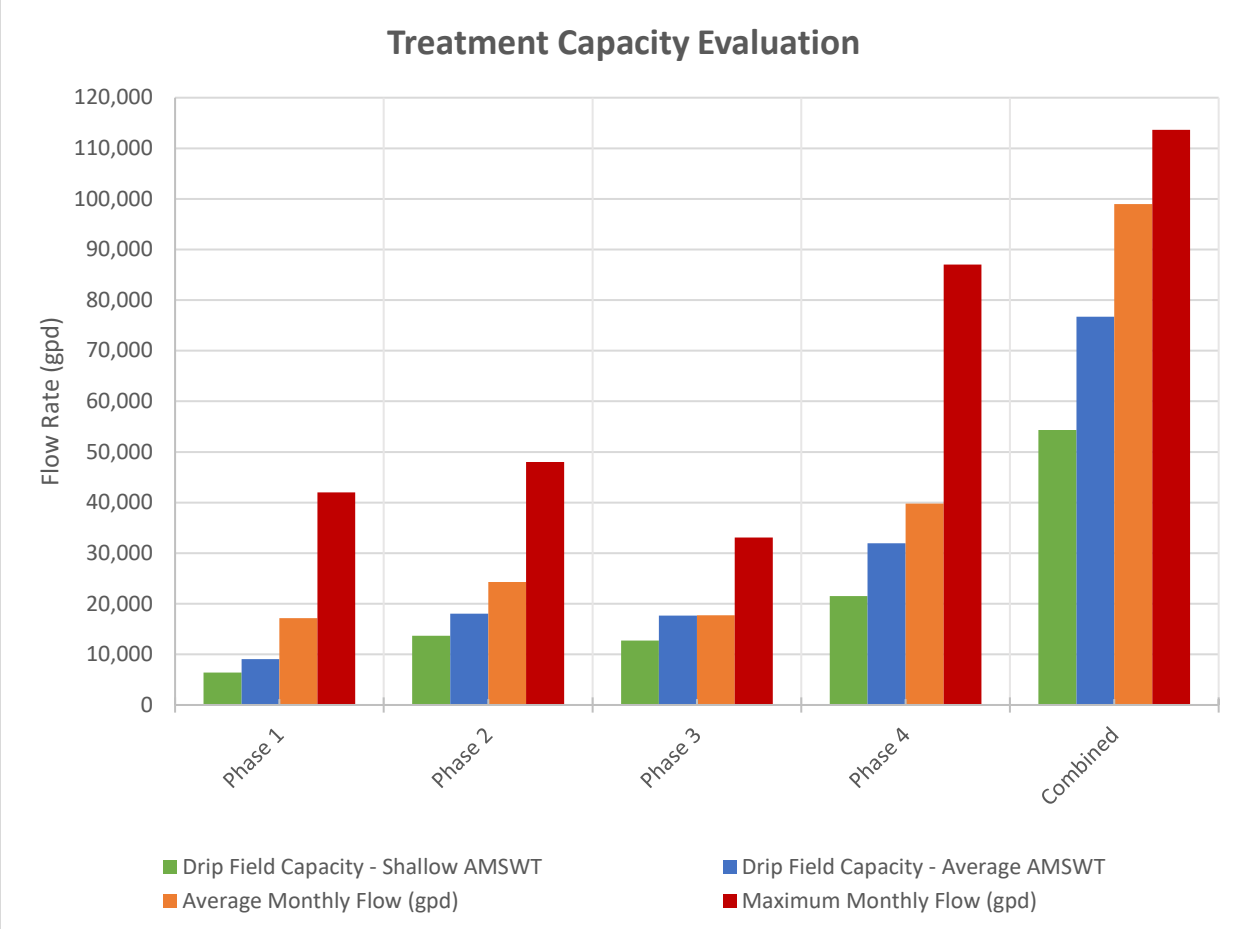
Table 2.15: WWTU Capacities from Recalculated Soil Loading Rates

WWTU Phase	Deepest AMSWT Soil Loading Rate (gpd)	Shallowest AMSWT Soil Loading Rate (gpd)	Average Soil Loading Rate (gpd)
I	12,774	6,414	9,032
II	21,441	13,684	18,042
III	21,746	12,730	17,680
IV (A & B)	42,804	21,506	31,946
Combined	98,865	54,334	76,701

2.3.7.5 Drip Dispersal Field Capacity Evaluation

The estimated soil loading capacities from Table 2.15 were evaluated in an effort to determine if the existing drip dispersal fields were acceptably sized for the current treatment flow rates that are reported at each phase of the Bethel Heights WWTUs. To perform this evaluation, the calculated loading rates can be compared to the maximum reported monthly effluent flow shown in Table 2.3 herein. The results of this comparison are shown as Figure 2.6.

Figure 2.6: Comparison of Recalculated WWTU Capacity and Maximum Monthly Flow



This evaluation was performed in compliance with the City's CAO to estimate an acceptable loading rate of Bethel Heights' dispersal fields. The evaluation revealed that the current maximum monthly flow to the Bethel Heights WWTU is greater than the loading capacity of the drip dispersal fields when estimated using the highest, lowest, or average AMSWT from the original soil evaluation and current ADH allowable drip dispersal loading capacities. Current deficiencies relating to the subsurface drip dispersal system can be found in Section 3.3.3 herein.

The estimated acceptable loading rates listed in Table 2.13 are based on the initial soil conditions of the system using the current ADH soil loading rate standards. Several factors including over-loading due to faulty zone dosing controls, improper maintenance of vegetative cover, and insufficient quality of wastewater effluent are likely to have had long term negative effects on the allowable loading rate of the drip dispersal areas. An engineering evaluation performed by others for Bethel Heights in 2016 reported surfacing issues in Phase 2 of the treatment facility in 2007 when the loading rates were less than the modified rates calculated herein (0.16 GPD/SF). Given these factors in addition to the empirical evidence of the consistent effluent surfacing that has been reported to have occurred over the life of this facility, HW cannot conclude that reducing the facility's loading rates to those shown in Table 2.13 would result in consistent compliance with permit requirements.

2.3.7.6 Drip Dispersal Field Loading Rate Estimate – Field Evaluation

In a further attempt to accurately represent the currently available loading rate of the existing drip dispersal fields, a Professional Soil Classifier registered in the State of Arkansas was contracted to perform a loading rate evaluation at both Bethel Heights WWTUs. The evaluation was performed on October 9, 2019. Six (6) total test pits were excavated to perform the soil evaluation, four (4) at the Lincoln Street WWTU and two (2) at the Oak Street WWTU, in an attempt to gather information that can be representative of the current state of all treatment phases within the Bethel Heights treatment system. The results of this soil evaluation were presented in the form of seasonal water table depths, recommended loading rates, and recommended loading rates with the installation of a curtain drain dewatering system. The dewatering system was suggested as a method of regulating the elevation of the brief seasonal water table (BSWT) by lowering the elevation of the water table; subsequently increasing the soil loading rate. The results of this soil evaluation are shown in Table 2.16.

Table 2.16: Soil Loading Rates based on Soil Evaluation Performed October 9, 2019

Lincoln Street WWTU				
Pit No.	Depth to BSWT (inches)	Depth to MSWT (inches)	Recommended Loading Rate (gpd/sf)	Loading Rate with Dewatering (gpd/sf)
1	0	15	0	0.103
2	0	15	0	0.103
3	28	N/A	0.574	N/A
4	0	27	0	0.164
Oak Street WWTU				
Pit No.	Depth to BSWT (inches)	Depth to MSWT (inches)	Recommended Loading Rate (gpd/sf)	Loading Rate with Dewatering (gpd/sf)
1	N/A	15	0.103	0.103
2	0	26	0	0.157

The soil scientist that performed this evaluation was also involved in the original soil classification at this facility. She noted that the site appears to have a significantly higher BSWT than what was recorded in the original design soil evaluation. The soil scientist further hypothesized that the raised water table is likely caused by continued loading of the in-situ soils with wastewater effluent from the WWTUs. Years of saturating the soil through the drip dispersal system may have changed the physical properties of the soil; resulting in a reported BSWT elevation that includes any soil that has been saturated by the dispersal operations. As shown by the test results, the BSWT is recorded at the immediate surface elevation for three out of four (3 of 4) test pits at the Lincoln Street WWTU and one out of two (1 of 2) test pits at the Oak Street WWTU. A water table elevation at the ground surface elevation indicates that the soil cannot be acceptably dosed at any flow rate.

2.3.7.7 Recent Drip Dispersal Field Improvements

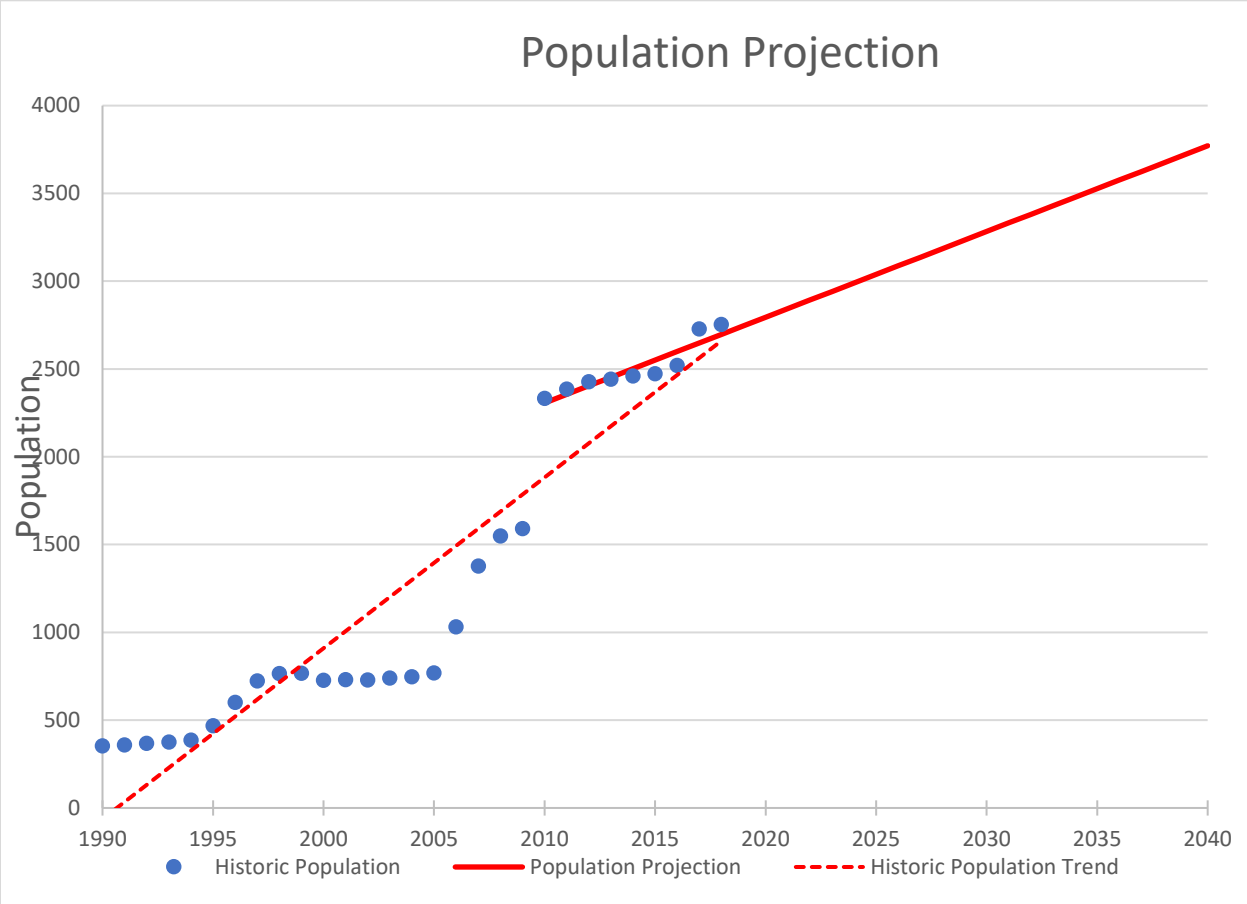
On October 14, 2019, Bethel Heights reported the progress of work performed for the year 2019 to achieve compliance with their Permit. The city reported that 27 drip dispersal zones have been replaced or repaired. This includes 12 zones in Phase I, 8 zones in Phase II, 7 zones in Phase III, and 3 Zones in Phase IV-B. This work involved removing the old drip line tubing, re-contouring the drip line trenches, installing new drip line tubing, backfilling, and re-seeding the areas. Operations staff reported that the original ½ gallon per hour drip dispersal tubing installed at 2-foot centers was replaced with 1 gallon per hour tubing installed at 4-foot centers. The newly installed drip dispersal tubing is understood to be bedded in clean rock.

3. Long Range Wastewater Treatment Needs

3.1 Flow Projections

Based on demographic data obtained from the U.S. Census Bureau, the population of Bethel Heights was reported as 2,372 in the 2010 census and has been reported at 2,752 for 2018.[1] Bethel Heights saw large population growth from 1990 to 2010. From 2010 to 2018 population growth has slowed. The population in Bethel Heights has increased approximately 15% from 2010 to 2018. The population growth rate from 2010 to 2018 will be used to project future city populations for this report. The population projections are shown in Figure 3.1. Assuming population growth trends remain the same, the projected 2040 population is approximately 3,770.

Figure 3.1: Population Projection



This report evaluates the City's wastewater needs over the next 20 years and assumes that the current per capita per day flow rates and peaking factor will remain constant of the planning period. Bethel Heights reported 615 accounts in 2018, eight (8) of those being commercial. Historic influent flow rates show the average monthly flow per account is approximetly 4,850 gallons per month. For determining projected flows, this report will use an assumed monthly flow

[1] U.S. Census Bureau (2019). Retrieved from https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF

of 5,000 gallons per account per month. The projected collection system flows are shown in Table 3.1, assuming the number of accounts increases at the same rate as the population.

Table 3.1: Projected Flows

Year	Projected Population	Projected Accounts	Projected Avg. Flow Rate (GPD)	Projected Peak Flow Rate (GPD)
2020	2,792	625	103,000	168,000
2030	3,282	734	121,000	197,000
2040	3,771	843	139,000	227,000

Based on the flow projections, the City of Bethel Heights can expect an average influent flow rate of approximately 139,000 gpd with a peak of 227,000 gpd by 2040. Because of the potential for growth exceeding projections due to new housing developments, a peak flow rate projection of 250,000 gpd was selected for Bethel Heights. This conservative projection would allow Bethel Heights to experience variable growth rates and ensure adequate wastewater treatment capacity.

3.2 Available WWTU Capacity

The Bethel Heights wastewater treatment system can be divided into two (2) primary components: The treatment system which includes the tanks, treatment pods, disc filtration units, and UV units; and the drip dispersal fields. For this reason, the available treatment capacity will be evaluated for each of the treatment components separately.

3.2.1 Treatment System Capacity

The Lincoln Street WWTU, Phases I, II, and III, was constructed with 27 treatment pods, providing an average day capacity of 67,500 gpd and a peak treatment capacity of 135,000 gpd, assuming the system is maintained and operated correctly. Based on the historical MMRs the Lincoln Street WWTU has an average influent flow of approximately 60,450 gpd and a peak influent flow of approximately 116,140 gpd. Based on this, the treatment components of the WWTU is operating at approximately 90% of its designed capacity with peak flows reaching 86% of the peak designed capacity. As described earlier, four (4) filtration pods at the Lincoln Street WWTU are currently out of service, decreasing the treatment capacity to 57,500 gpd with a peak treatment capacity of 115,000 gpd. With four (4) pods out of service, the treatment portion of WWTU is operating at 105% of its capacity with peak flows reaching 101% of the peak capacity.

The N. Oak Street WWTU, Phases IV-A and IV-B, was constructed with 18 treatment pods, providing an average day capacity of 45,000 gpd with a peak treatment capacity of 90,000 gpd. Based on the historical MMRs, the N. Oak Street WWTU has an average influent flow of approximately 35,710 gpd and a peak influent flow of approximately 80,740 gpd. Based on this, the WWTU treatment system is operating at approximately 80% of its treatment capacity and 90% of its peak treatment capacity.

As discussed within this report, with all pods in service, the combined design treatment capacity of the WWTUs is 112,500 gpd with a peak capacity of 225,000 gpd. The treatment capacity of the treatment system, when accounting for currently offline treatment pods, is 102,500 gpd average day with a peak capacity of 205,000 gpd. That capacity rating assumes proper maintenance of the other system components and correct system operation.

3.2.2 Drip Dispersal System Capacity

As discussed earlier in this report, the subsurface drip dispersal systems at the Bethel Heights WWTUs are sized based on an allowable soil loading rate that is reviewed by ADH and permitted by the DEQ through a no-discharge permit. The Lincoln Street WWTU is currently permitted for a 0.54 gpd/sf loading rate and the Oak Street WWTU is currently permitted for a 0.40 gpd/sf loading rate. The facility's permit is set to expire in 2020. One of the requirements of the City's CAO is to re-evaluate the original permitted loading rate for the subsurface drip dispersal systems based on current ADH standards. HW attempted to establish an acceptable loading rate using the original soil analysis data for both WWTUs and current ADH standards. The results of those calculations are listed in Table 2.13. The loading rates resulting from that methodology were not determined to be reliable based on empirical evidence and reasonably assumed changes to the original soil conditions. Soil loading rate calculations were also performed by a soil scientist following the method currently approved by ADH. The results of that evaluation are also believed to be unreliable due to the site history.

The CAO requires that this evaluation recommend a modified soil loading rate for the Bethel Heights Treatment Facility. Since the loading rates calculated based on the original soil conditions are suspect due to changing conditions, HW can only propose that the City's permitted loading rate be modified based on the recent soil study, which required dewatering. The soil scientist believed these results to be overly conservative based on impacts to the soil morphology from WWTU use, but no other reasonable basis for a recommendation is known at this time. The recommended revised average soil loading rate for each phase is shown in Table 3.2. The recommended new loading rates are approximately one-fifth of the currently permitted rates. Reducing the loading rate by this amount should significantly diminish but may not completely eliminate the risk of effluent surfacing. Many other factors contribute to effluent surfacing as much if not more than the approved loading rate. These factors include loading duration and antecedent moisture conditions. DEQ and ADH will ultimately be responsible for determining the appropriate soil loading rate, if any, to include in Bethel Heights' Permit renewal.

Table 3.2: Re-evaluated Soil Loading Rates Used in Capacity Evaluation

WWTU Phase	Permitted Loading Rate (gpd/sf)	Loading Rate Original Soil Conditions at Average SWT (gpd/sf)	Loading Rate From 2019 Soil Evaluation with Dewatering (gpd/sf)
1	0.54	0.169	0.103
2	0.54	0.207	0.103
3	0.54	0.200	0.164
4	0.40	0.153	0.103

Utilizing the revised loading rates, the capacities for the drip dispersal field in each Phase were calculated assuming that a dewatering system is installed for each Phase of the treatment system. Table 3.3 presents the total capacity of the drip dispersal systems based on the reduced loading rates. In compliance with CAO requirements, the individual capacity of each drip dispersal zone is shown on the process flow diagrams included in Appendix B.

Table 3.3: Recommended Drip Dispersal Capacity

WWTU Phase	Capacity from Revised Loading Rate (gpd)	Capacity from Current Permit Loading Rate (gpd)	Reduction in Loading Capacity (gpd)	Percent Reduction (%)
1	5,505	28,861	23,356	81
2	8,977	47,066	38,089	81
3	14,498	47,736	33,238	69
4	21,506	83,520	62,014	74
Total	**50,486**	**207,183**	**156,697**	**76**

3.2.3 Effective Treatment Capacity

The evaluated capacity for each component of each WWTU within the Bethel Heights Treatment System is shown in Table 3.4.

Table 3.4: Effective System Capacities

WWTU	Treatment System Capacity (gpd)	Drip Dispersal System Capacity (gpd)
Lincoln St.	57,500	28,980
Oak St.	45,000	21,506
Total	**102,500**	**50,486**

Based on the estimated capacities, the drip dispersal system is the limiting factor in the effective treatment capacity for both the Lincoln Street and N. Oak Street WWTUs. It should be noted that the reported average daily flow rate is higher than the evaluated capacity of the drip dispersal system. In accordance with the requirements of the CAO, any wastewater received to the WWTUs that exceeds the allowable treatment capacity of the system must be removed and hauled to an approved location. In an attempt to estimate the total quantity of wastewater to be hauled, as required by the City's CAO, the reported average dry weather flow to each phase of the drip dispersal system was compared to the recommended drip dispersal capacity. This comparison is shown in Table 3.5. The average dry-weather effluent flow rate was calculated by taking the average effluent flow rate during historically dry-weather months. For the purposes of this report, these were assumed to be May through October. It should be noted that the estimated daily wastewater haul volumes reported in Table 3.5 are conservative estimates, which may not be achievable by the City. The actual quantity of wastewater required to be hauled should be evaluated daily for each phase of the Bethel Heights wastewater treatment system due to the varying conditions that impact effluent surfacing.

Table 3.5: Estimated Daily Wastewater Haul Volume

WWTU Phase	Revised Drip Dispersal Capacity (gallons)	Reported Average Dry-Weather Flow (gpd)	Estimated Daily Wastewater Haul Volume (gallons)
1	5,505	14,278	8,773
2	8,977	22,488	13,511
3	14,498	17,096	2,598
4	21,506	32,442	10,936
Total	**50,486**	**86,304**	**35,818**

4. WWTP Improvement Alternatives

This evaluation has concluded that Bethel Heights' existing treatment system is not capable of meeting the City's current or future treatment needs due primarily to the limitations of the drip dispersal field. This conclusion is supported by the numerous effluent quality exceedances and effluent surfacing events reported by the City over the past decade. The following section evaluates potential alternatives to satisfy the City's current and projected wastewater treatment needs.

4.1 Alternative 1: Discharge to Springdale's Collection System

4.1.1 Description of Preliminary Design

Project Alternative No. 1 includes the construction of a new dedicated force main to convey STEP unit effluent from the City of Bethel Heights collection system to Springdale Water Utility's (SWU) sanitary sewer collection system. This alternative proposes to construct a central lift station at the Lincoln Street WWTU and a dedicated 4-inch force main to collect wastewater from the existing Bethel Heights force mains and pump the collected wastewater to SWU's system. A new effluent flow meter would be installed on the force main to accurately measure flows from Bethel Heights. The preliminary design for the treatment units assumes an average flow rate of 140,000 gpd and a peak flow rate of 250,000 gpd. These flow rates were selected based on the flow projections described earlier in this report.

4.1.2 Interim Measures

If this alternative is adopted, the existing WWTUs would need to remain in service during the period of time to design and construct this alternative option. Design and bidding for this alternative is estimated to take approximately six (6) months, with construction lasting an additional six (6) months for a total project time of twelve (12) months. The existing WWTUs would need to be repaired to reduce the possibility of permit violations and maintain treatment capacities during the design and construction period.

4.1.3 Viability of Alternative

It is HW's understanding that this alternative is not viable at this time due to Springdale's policy to not accept wastewater from outside their City's boundaries. Although this policy is not unlike the position of many municipalities across Arkansas, HW was not empowered to discuss this alternative with the City of Springdale and is unaware if any possibility of temporary or permanent policy variance exists.

4.2 Alternative 2: Discharge to NACA

4.2.1 Description of Preliminary Design

Project Alternative No. 2 includes the construction of a dedicated force main to convey untreated STEP effluent from the City of Bethel Heights to the Northwest Arkansas Conservation Authority's (NACA) regional treatment facility. This alternative proposes to construct a lift station at the Lincoln Street WWTU and a 6-inch dedicated force main to convey untreated STEP effluent from the existing Bethel Heights force mains to NACA. A new effluent flow meter would be installed on the force main to accurately measure flows from Bethel Heights.

4.2.2 Discharge Location

This alternative assumed that a connection to the NACA treatment facility would be utilized to discharge wastewater from Bethel Heights. It is the understanding of HW that NACA has the capacity and is willing to accept the additional wastewater from Bethel Heights.

4.2.3 Influent Pumping

Project Alternative No. 2 proposes to utilize the existing STEP system to convey wastewater to the new treatment facility. The collection system would require further evaluation prior to final design to confirm this assumption. This alternative includes construction of modifications to the existing force main system to convey wastewater from the individual septic tanks to the new lift station.

4.2.4 Interim Measures

If this alternative is adopted, the existing WWTUs would need to remain in service during the period of time to design and construct this alternative option. Funding, design, and easement acquisition for this alternative is estimated to take approximately eighteen (18) months, with construction lasting an additional eighteen months for a total project time of three (3) years. The existing WWTUs would need to be repaired to reduce the likelihood of permit violations and maintain treatment capacities.

4.2.5 Engineer's Opinion of Probable Cost

A preliminary cost estimate was prepared for Project Alternative No. 1. This estimate was prepared utilizing a 20% contingency and cost provisions for Contractor's overhead and profit, engineering services, administrative and legal expenses, and construction administration and inspection. It should be noted that this cost estimate was prepared utilizing a conceptual force main route. A formal route selection study would be required prior to design and construction. Additionally, the project cost estimate does not include fees and rates associated with discharging wastewater to the NACA WWTP. The preliminary capital cost estimate is conservative based on the conceptual route and the assumption that 50% of the route would require permanent easement acquisition. It was assumed that the force main would utilize public right-of-way 50% of the route's length.

NACA's monthly treatment rates are based on the customer's percentage of the NACA facilities total flow for the month. Treatment costs for the facility are divided out based on the percentage of flow from each customer to determine monthly rates. NACA also charges a connection fee based on the average daily flow rate expected to be received from the customer. Bethel Heights has reported to have been made aware by the ANRC that loan forgiveness may be available to

offset this connection charge. ANRC was also reported to state that a special loan interest rate of 1% is available for projects intended to connect existing treatment works to the regional facility.

Along with the capital costs to convey wastewater to the NACA facility, the cost associated with decommissioning the existing WWTUs should be considered for this alternative. The costs associated with decommissioning the WWTUs were not included in this estimate and would require additional evaluation.

Table 4.1: Project Alternative No. 2: Probable Cost Opinion

Project Alternative No. 2	
NACA Connection Estimated Capital Cost	$5,044,000
NACA Connection Fee	$1,105,000
Interim Measures	$320,000
Decommission Existing WWTP	TBD
Total	**$6,469,000**

4.3 Alternative 3: Discharge to NACA: Cave Springs Collaboration

4.3.1 Description of Preliminary Design

As a part of Project Alternative No. 3, the potential to connect to NACA by sharing a portion of a pipeline planned to be constructed by Cave Springs was evaluated. It is the understanding of HW that the City of Cave Springs is in the process of establishing the infrastructure to convey wastewater to NACA and could potentially have the capacity to accept the additional flows from Bethel Heights. This alternative proposes the construction of a central lift station, dedicated 6-inch force main and connection to the Cave Spring's system. A new effluent flow meter would be installed on the force main to accurately measure flows from Bethel Heights.

4.3.2 Discharge Location

As a part of this alternative, a connection to the Cave Springs system along W. Monroe Avenue was evaluated. It should be noted that this cost estimate was prepared utilizing a conceptual force main route to Cave Springs. A formal route selection study would be required prior to design and construction and it is possible that a connection located closer to Bethel Heights could be utilized as connections to reduce force main lengths and costs. Also, an additional evaluation would be required to ensure Cave Springs' collection system would be able to handle the additional flows. It is the understanding of HW that NACA has the capacity and is willing to accept the additional wastewater from Bethel Heights.

4.3.3 Influent Pumping

Project Alternative No. 3 proposes to utilize the existing STEP system to convey wastewater to the new treatment facility. The collection system would require further evaluation prior to final design to confirm this assumption. This alternative includes construction of modifications to the existing force main system to convey wastewater from the individual septic tanks to the new lift station.

4.3.4 Shared Pipeline Considerations

Some consideration must be given to the difficulties that may come with a shared pipeline. Some but not all considerations are listed below:

1. Hydraulics of the Pipeline:
    a. Pipeline hydraulics are affected when pumps turn on and off. The status of pumps within the shared system can cause increased loads on other pumps. Sizing and design of pumps would need to account for potential increases in head pressures within the system.
    b. On/Off cycles of pumps in the system could potentially shorten the life expectancy of Bethel Heights' pumps and pipeline due to the cyclic loading.
    c. It would be essential for the pumps in both systems of the shared pipeline to implement controls that considered the other system planned operation.

2. Capacity and growth of the individual systems may be limited.
    a. Capacity and growth in the individual systems is limited to the capacity of the shared pipeline. Growth of one system may restrict growth of the other system due to the capacity of the pipeline. An agreement should be in place at the onset of any collaboration regarding how future capacity would be allocated.

3. Operations and Maintenance:
    a. If the shared pipeline is taken out of service for maintenance or a failure of the pipeline, the other utility may be affected and would need to consider storage or emergency options.

4.3.5 Interim Measures

If this alternative is adopted, the existing WWTP would need to remain in service during the period of time to design and construct this alternative option. Funding, design, and easement acquisition for this alternative is estimated to take approximately eighteen (18) months, with construction lasting an additional eighteen (12) months for a total project time two and one-half (2.5) years. The existing WWTP would need to be repaired to reduce the likelihood of permit violations and maintain treatment capacities.

4.3.6 Engineer's Opinion of Probable Cost

Costs for partnering with Cave Springs on a pipeline to NACA were not available for this evaluation. It is assumed that the overall costs for this alternative would be less than Alternative No. 2, but given the unknowns concerning the costs Cave Springs would asses to Bethel Heights to share a pipeline to NACA this alternative would require further evaluation and coordination with Cave Springs before consideration. It is understood that the connection costs and discharge rates to NACA would be similar to Alternative No. 2, however additional costs for this alternative may include a percentage of the Cave Springs' pipeline costs, a percentage of the Cave Springs' connection fees, a percentage of the Cave Springs' discharge rates, and shared pipeline O&M costs.

4.4 Alternative 4: New Wastewater Treatment Plant

4.4.1 Description of Preliminary Design

Project Alternative No. 4 includes the construction of a new activated sludge treatment plant for the City of Bethel Heights. This alternative proposes to construct a solids removal headworks, an activated sludge treatment unit, a tertiary filter for effluent polishing, a disinfection unit, and a solids-handling facility. The preliminary design for the treatment units assumes an average flow rate of 140,000 gpd and a peak flow rate of 250,000 gpd. These flow rates were selected based on the flow projections described earlier in this report.

4.4.2 Location

No site for the proposed WWTP was selected as a part of this evaluation. For the purposes of this Report, a 14-acre property owned by the City of Bethel Heights was assumed to be the location of this new WWTP. It is recommended that a site selection study be performed prior to design if this alternative is selected.

4.4.3 Discharge Location

As part of this evaluation, no specific discharge location was selected for the WWTP. Several discharge alternatives exist for the City of Bethel Heights; these include a low flow stream within the City Limits and Spring Creek outside the City Limits. For the purposes of this evaluation, HW assumed discharge permit limits based on permit limits for other utilities within the Illinois River Watershed. These assumed permit limits are presented in Table 4.2. DEQ will determine actual permit limits based on the discharge location selected.

Table 4.2: Assumed Permit Limits for Proposed WWTP

Constituent	Assumed Permit Limit (mg/L)
CBOD5	10
TSS	15
Ammonia - N	2
Total Phosphorus	0.1
Residual Chlorine	0.011

4.4.4 Influent Pumping

Project Alternative No. 4 proposes to utilize the existing STEP system to convey wastewater to the new treatment facility. This alternative includes construction of modifications to the existing force main system to convey wastewater from the individual septic tanks to the new WWTP. A new influent flow meter will be installed on the force main entering the WWTP to accurately measure influent flow rates.

4.4.5 Headworks

Although the STEP systems theoretically remove large solids such as trash, debris, wipes, etc., from the influent flow stream, the potential always exists for a tank failure that allows large solids to enter the WWTP. To protect the WWTP equipment, Project Alternative No. 4 proposes to construct a solids removal system at the headworks of the treatment plant. Several equipment

alternatives are available such as mechanically raked bar screens and screw conveyor systems, all of which should be considered by Bethel Heights during design.

4.4.6 Wastewater Treatment Unit

This project alternative proposes to construct a new activated sludge treatment plant at a site to be selected. The activated sludge treatment process would be designed to remove BOD, TSS, ammonia, and total phosphorus to within the permit limits described within this Section. The conceptual design assumes the new treatment unit would utilize a Biological Nutrient Removal (BNR) process to remove all of the required constituents. The BNR process would have the additional benefit of providing total nitrogen removal. Although total nitrogen is not listed in the assumed permit limits, limits are becoming compulsory.

The conceptual design assumes the treatment unit will be sized to treat both average day flows in the present day as well as peak flows over the entire 20-year planning period. Waste Activated Sludge produced from this unit would be discharged and to and treated at a new solids-handling facility. This treatment unit will be discussed in more detail within Section 4.4.8.

4.4.7 Tertiary Filtration

Phosphorus limits below 1 mg/L are difficult to reach with a BNR process. Therefore, this project alternative proposes to install a tertiary filtration system to polish effluent and remove additional phosphorus to below the assumed permit limit. Multiple applicable filtration technologies exist, all of which should be considered by Bethel Heights prior to design. Two (2) units would be constructed to provide Bethel Heights the necessary redundancy to ensure the quality of their effluent.

4.4.8 Disinfection

Residual chlorine permit limits of 0.011 mg/L are anticipated for this facility based on the absence of the option for a receiving stream with a significant background flow. These limits frequently require quenching through the addition of additional chemicals such as sulfur dioxide or sodium thiosulphate. Dechlorination systems require additional chemical storage, injection equipment, pumping systems, and containment equipment. To avoid these costs and potential operational difficulty, this alternative proposes to utilize an ultraviolet light disinfection system in lieu of chlorination. UV systems require no quenching prior to discharge and have the added benefit of providing disinfection with very little contact time. Two (2) units would be constructed to ensure adequate disinfection of the WWTP's effluent during maintenance periods.

4.4.9 Effluent Pump Station

As discussed previously, a specific discharge location nor WWTP site were selected as part of this Report. For this reason, HWEI included costs for an effluent pump station and force main from the conceptual WWTP site within the city limits to a location on Spring Creek. It is recommended that Bethel Heights further evaluate both the WWTP site and discharge location prior to final design.

4.4.10 Solids Handling

The proposed activated sludge treatment unit will produce a daily volume of Waste Activated Sludge. This alternative proposes to install a solids-handling system such as a belt filter press or centrifuge to increase the solids percentage prior to disposal at a landfill. These systems typically

require steady loading rates; therefore, an aerated sludge holding tank would be constructed to store the additional sludge volume prior to dewatering. Dewatered sludge from the filter press would be hauled off site to a landfill. HW did not account for any tipping fees associated with landfill disposal.

4.4.11 Treatment Building and Site Improvements

A small operations building would be required on the WWTP site to house a laboratory space, bathroom, office, and the solids handling equipment. Additionally, the operations building will house the chemical feed systems required for solids handling. This alternative also includes construction of a driveway, parking area, fencing, sidewalks, and other required site improvements.

4.4.12 Interim Measures

If this alternative is adopted, the existing WWTP would need to remain in service during the period of time to design and construct this alternative option. Funding, site selectin, design, and permitting for this alternative is estimated to take approximately eighteen (18) months, with construction lasting an additional 24 months for a total project time of three and one-half (3.5) years. The existing WWTP would need to be repaired to maintain treatment capacities and minimize the likelihood of further permit violations.

4.4.13 Engineer's Opinion of Probable Cost

A preliminary cost estimate was prepared for Project Alternative No. 4. This estimate was prepared utilizing a 20% contingency and cost provisions for Contractor's overhead and profit, engineering services and construction administration and resident observation. Along with the cost to construct the new WWTP, the costs to decommission the existing WWTUs should be considered for this alternative. The cost to decommission the WWTUs was not included in this estimate and would require additional evaluation.

Table 4.3: Project Alternative No. 4: Probable Cost

Project Alternative No. 4	
New WWTP	$ 5,500,000
Interim Measures	$ 320,000
Decommission Existing WWTP	TBD
Total	$ 5,820,000

5. Conclusion

5.1 Existing Wastewater Treatment System

This evaluation, performed in compliance with the City of Bethel Height's CAO, included analysis of the historic influent and effluent flow rates, the condition and capacity of each treatment unit within the WWTUs, and the estimation of revised loading rates for the City's drip dispersal fields based on historic soils data and recent field evaluations.

5.1.1 Influent Flow Rates

Influent flow rates were collected from historic MMRs and analyzed to determine average and peak daily flows. This data is presented in Table 5.1.

Table 5.1: WWTP Influent Flow Data

WWTP INFLUENT FLOW DATA (GPD)[1]					
	LINCOLN ST. WWTU			N. OAK ST WWTU	
	Phase I	Phase II	Phase III	Phase IV-A	Phase IV-B
Average Daily Influent Flow Rate, GPD	60,447			35,707	
Max Daily Influent Flow Rate, GPD[2]	91,028			80,740	
Combined Total Average Influent Flow Rate, GPD	96,154				
Combined Max Daily Influent Flow Rate, GPD	132,248				

[1] April 2019-October 2019 influent flow data.
[2] Maximum Daily Flow Rate for each WWTU may not occur at the same time.

5.1.2 Treatment Capacity

The Bethel Heights treatment system can be divided into two (2) distinct components: The Orenco treatment units (treatment system) and the drip dispersal fields. Bethel Heights currently has 45 AX100 filter pods, each with a design capacity of 2,500 gpd. Four (4) of the treatment pods at the Lincoln Street WWTU are currently out of service. Based on this, the combined design capacity of the treatment system is 102,500 gpd. The allowable loading capacity of the subsurface drip dispersal fields has been re-evaluated as a part of this report. The current capacity was assumed based a new soil study performed at the drip dispersal sites. The recalculated total capacity of the drip dispersal fields is 50,486 gpd, thus limiting the effective capacity of the Bethel Heights system to the capacity of the drip dispersal fields.

Table 5.2: Capacity by Treatment Component

Treatment Facility	Current Influent Flow Rate (GPD)	Treatment Component	Average Capacity (GPD)	Peak Capacity (GPD)
Lincoln Street WWTU	60,477	Orenco WWTU	57,500	115,000
		Drip Dispersal Field	28,980	
Oak Street WWTU	35,707	Orenco WWTU	45,000	90,000
		Drip Dispersal Field	21,506	

The treatment capacity can be further evaluated for each of the four (4) phases included in the treatment system. The capacity of each phase, for both the Orenco treatment units and the drip dispersal fields, is shown in Table 5.3.

Table 5.3: Capacity by Treatment Component

WWTU Phase	Capacity from Revised Loading Rate (gpd)	Capacity of Orenco Treatment Units (gpd)	Dry-Weather Average Effluent Flow Rate (gpd)	Average Daily Haul Volume (gallons)
1	5,505	15,000	14,278	8,773
2	8,977	20,000	22,488	13,511
3	14,498	22,500	17,096	2,598
4	21,506	45,000	32,442	10,936
Total	**50,486**	**102,500**	**86,304**	**35,818**

5.2 Manufacturer's System Evaluation

As discussed within this Report, Orenco Systems performed a series of evaluations on the existing wastewater treatment system. Below is a summary of the items that, per Orenco Systems, require immediate action from the City of Bethel Heights:

- Orenco recommended that Bethel Heights repair and reset the four (4) out of service filtration pods that have floated. HW does not agree that this is necessary since the treatment capacity at the Lincoln Street WWTU is not limiting.
- Orenco recommended that Bethel Heights confirm the size and condition of each pump. HW concurs with this recommendation to ensure proper operation of the treatment facility.
- Orenco recommended that Bethel Heights install new above-ground fan assemblies for each phase of each WWTU. HW concurs with this recommendation as aeration is essential to efficient biological treatment.
- Orenco recommended that Bethel Heights reset textile media sheets in proper locations and clean those with excessive biological growth. HW concurs with this recommendation.
- Orenco recommended that Bethel Heights update or replace the existing control systems. HW believes this to be the most critical of all of Orenco's recommendations since the control systems control the duration of loading for each zone.

5.3 Improvement Alternatives

Four (4) treatment system alternatives were evaluated as a part of this evaluation. Table 5.4 presents the currently viable alternatives as well as the estimated capital costs associated with those alternatives. Alternative 3 should be revisited if negotiations can be held with the City of Cave Springs.

Table 5.4: WWTP Improvement Alternatives

Alternative	Description	Total Estimated Cost
2	Discharge to NACA WWTP	$6,469,000
4	New Wastewater Treatment Plant	$5,820,000

5.4 Present Worth Analysis

A present worth analysis was performed on Project Alternatives No. 2 and No. 4 to compare present and future O&M costs. For the purpose of this evaluation, the analysis included a select group of costs and is therefore not exhaustive. The analysis serves to accurately express O&M expenses within the total project cost in an effort to improve this report's role as a decision-making tool for the City of Bethel Heights. Included in the present worth analysis were costs for electricity, O&M, chemicals, wastewater hauling prior to construction of the improvement, payroll costs, and disposal of dewatered sludge at a landfill.

The present worth analysis is based on a 20-year planning period. An electricity cost of $ 0.10 per kilowatt-hour (kWh) was utilized. Additionally, the expected O&M cost was assumed to be approximately 1.5% of the total construction cost. This was selected based on information provided by several activated sludge treatment plants in western Arkansas which indicated the annual O&M costs on their mechanical systems were typically 1% - 2% of the total construction cost. The cost to decommission the existing treatment facility was not included as it is the same for both alternatives. This analysis also does not account for any special funding options that may be available for Alternative No. 2. The results of the present worth analysis are presented in Table 5.5. This analysis reveals that the life-cycle costs of both alternatives are essentially equal.

Table 5.5: Present Worth Analysis

Item	Alternative No. 2 Discharge to NACA	Alternative No. 4 New WWTP
20-Year Present Value	$17,520,000	$17,620,000

5.5 Recommendation

Hawkins-Weir Engineers recommends that the City of Bethel Heights pursue Alternative 2, Discharge to NACA WWTP, to provide its long-term wastewater treatment needs. Operating a new WWTP, with the anticipated stringent permit limits normal for Northwest Arkansas, would require that the City increase their wastewater staff, which would include hiring a Class IV Wastewater Operator. That option would also continue to leave the City exposed to the risk of future permit violations. The City of Bethel Heights is a member of NACA and has long considered treatment from that facility as the long-term solution for the City's wastewater treatment needs. Preliminary discussions with funding agencies indicate that special loan forgiveness (i.e. grants) would likely be available for any option that included discharge to NACA. That special funding is believed to be sufficient to make Alternative 2 the less expensive option. Discussions should also be had with the City of Cave Springs to determine if sufficient project savings could be realized through a joint effort for a portion of the pipeline to NACA.

Appendix A – Record Drawings

BETHEL HEIGHTS TREATMENT PLANTS

Waste Water Treament Facilities Record Plans

Phase 1,2,3,4A and 4B

Bethel Heights, AR

EDA Project No. 2114

August 5, 2019

CITY:

CITY HALL
530 SUNRISE DRIVE
BETHEL HEIGHTS, AR 72764
479-751-7481

ENGINEER:

EARTHPLAN DESIGN ALTERNATIVES, PA
134 WEST EMMA
SPRINGDALE, AR 72764
1-479-756-1266
No. 15162
jrg@eda-pa.com

SURVEYOR:

JAMES LAYOUT SERVICES, LLC
P.O. BOX 611
FARMINGTON, AR 72730
479-439-9929
PLS 1845
matt@jlsnwa.com

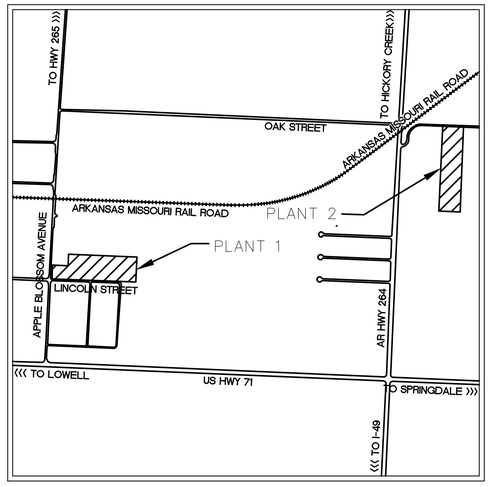
Notes:

Subsurface Tanks, Pods, Plumbing, Drip Fields, Meters, Valves and other Equipment contained in these plans are based on construction plans. General location of above ground items was completed with the use of survey data, review of available aerial photography, site visits and conversations with the Operator.

Control Panels, Computers, Zone Location and other Plant Systems are based on construction plans and conversations with the Operator. Actual Zone Location, Dose Timing, and Other Plant Systems were not determined in the scope of these plans.

Subsurface and environmental conditions were not examined nor considered.

Due to the scale of the drawings, certain symbols and horizontal coordinates of certain features will not be to scale due to production purposes.



Vicinity Map

Not to Scale

INDEX

RECORD DRAWING

Know what's **below.**
Call before you dig.

DRAWN BY: CLP | CHECKED BY: JRG | DATE | # | REVISION DESC.

DRAWING CREATION DATE: 080519

JOB NUMBER: 2114

P:\PROJECTS\2114\CIVIL\2114 RECORD PLANS.DWG
LAST SAVED@8/8/2019 10:14 AM
PLOT DATE@8/8/2019 10:15 AM

CERTIFICATE OF AUTHORIZATION
EARTHPLAN DESIGN ALTERNATIVES, PA
No. 322
ARKANSAS ENGINEER

COVER

TREATMENT FACILITIES
BETHEL HEIGHTS, AR

Earthplan Design Alternatives, PA
Civil Engineering / Landscape Architecture
(479) 756-1266
Fax (479) 750-0570
www.eda-pa.com
EDA
134 West Emma Avenue
Springdale, Arkansas 72764

COVER

PLANT 1 AND 2

300 0 300 600
300 SCALE GRAPHIC SCALE IN FEET

RECORD DRAWING

OVERALL SITE

TREATMENT FACILITIES
BETHEL HEIGHTS, AR

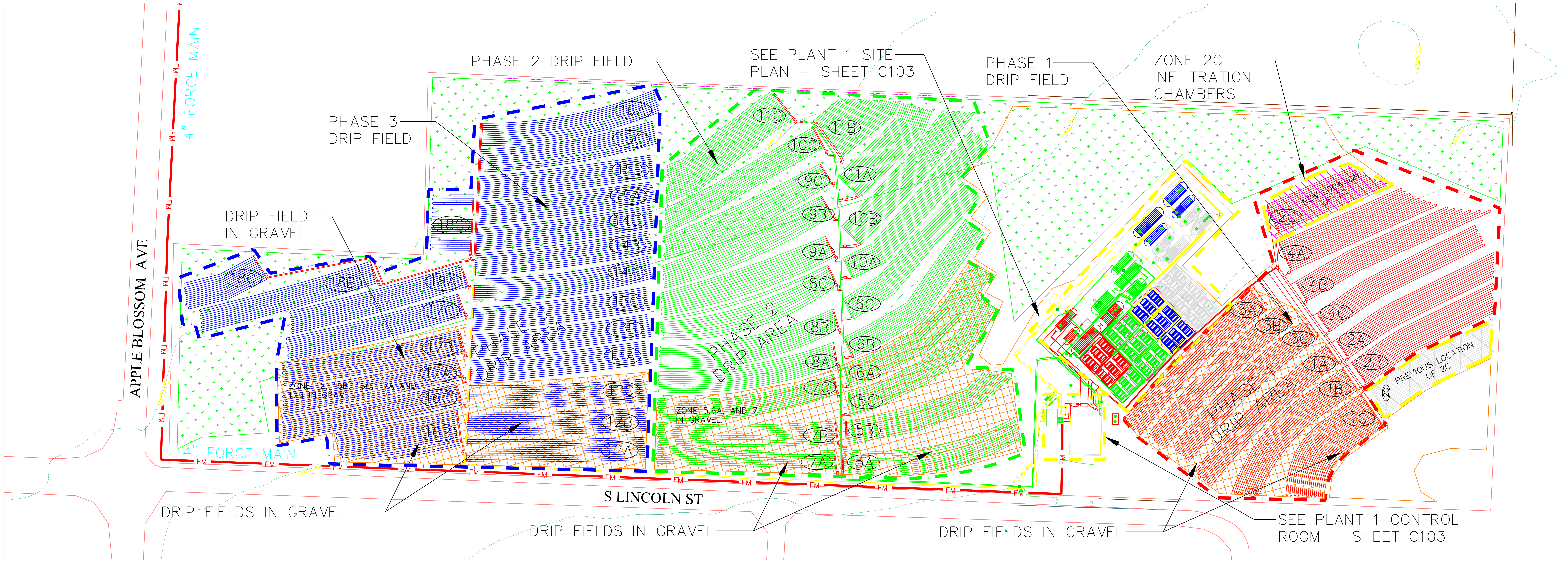
DATE	#	REVISION DESC.

DRAWN BY: CLP CHECKED BY: JRG
DRAWING CREATION DATE: 080519
JOB NUMBER: 2114
X:\2114\CIVIL\2114 RECORD PLANS.DWG
LAST SAVED:10/4/2019 8:55 AM
PLOT DATE:10/4/2019 9:06 AM

CERTIFICATE OF AUTHORIZATION
EARTHPLAN DESIGN ALTERNATIVES, P.A.
No. 322
ARKANSAS ENGINEER

Earthplan Design Alternatives, PA
Civil Engineering / Landscape Architecture
134 West Emma Avenue
Springdale, Arkansas 72764
(479) 756-1266
Fax: (479) 755-3570
www.eda-pa.com

C101



PLANT 1 DRIP FIELDS

PHASE 1 AND 2 COLLECTIONS
PHASE 1,2 AND 3 DRIP FIELDS
5891 LINCOLN DR
BETHEL HEIGHTS, AR

RECORD DRAWING

Legend

- (1A) Drip Zone Designation
- Alternate Area Outline
- FM Alternate Area Outline
- Phase 1
- Phase 2
- Phase 3
- See Other Sheet Outline
- 2C Zone Relocation
- Contours
- Phase 1 Drip Field
- Phase 2 Drip Field
- Phase 3 Drip Field
- Drip Field in Chambers
- Graveled Drip Field

Notes:

Subsurface Tanks, Pods, Plumbing, Drip Fields, Meters, Valves and other Equipment contained in these plans are based on construction plans. General location of above ground items was completed with the use of survey data, review of available aerial photography, site visits and conversations with the Operator.

Control Panels, Computers, Zone Location and other Plant Systems are based on construction plans and conversations with the Operator. Actual Zone Location, Dose Timing, and Other Plant Systems were not determined in the scope of these plans.

Subsurface and environmental conditions were not examined nor considered.

Due to the scale of the drawings, certain symbols and horizontal coordinates of certain features will not be to scale due to production purposes.

50 0 50 100
50 SCALE GRAPHIC SCALE IN FEET

DATE	#	REVISION DESC.

DRAWN BY:	CLP	CHECKED BY:	JRG
DRAWING CREATION DATE:			080519
JOB NUMBER:	2114		

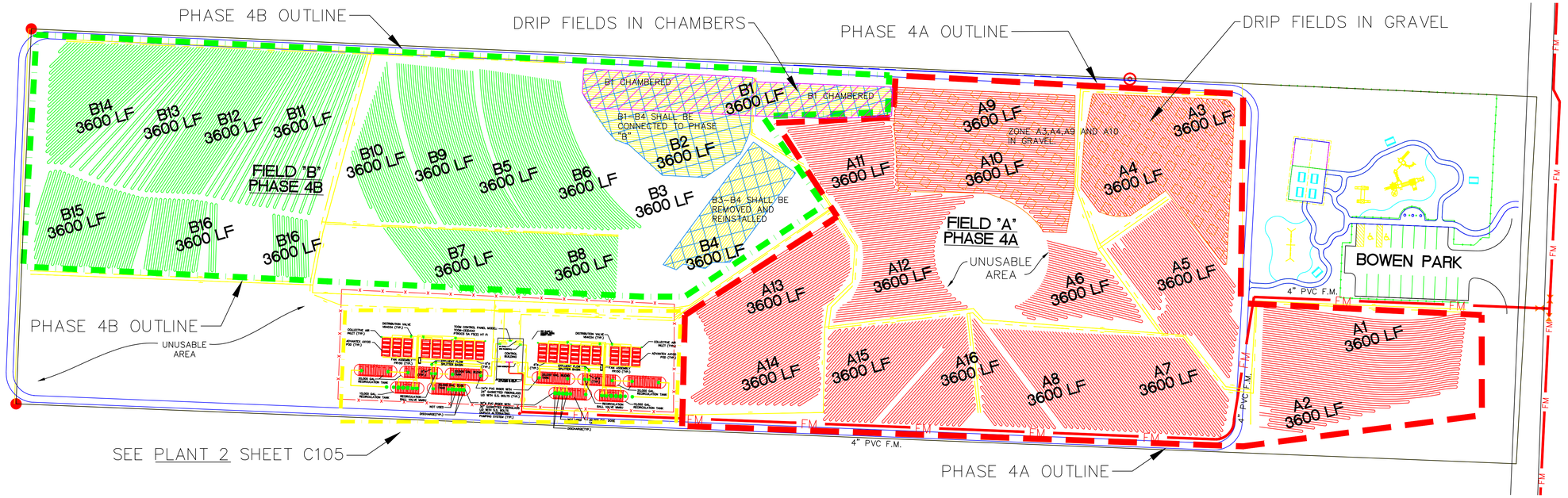
X:\2114\CIVIL\2114 RECORD PLANS.DWG
LAST SAVED:10/4/2019 8:55 AM
PLOT DATE:10/4/2019 8:56 AM

CERTIFICATE OF AUTHORIZATION
EARTHPLAN DESIGN ALTERNATIVES, PA
No. 322
ARKANSAS ENGINEER

PHASE 1,2 AND 3 DRIP FIELDS
TREATMENT FACILITIES
BETHEL HEIGHTS, AR

Earthplan Design Alternatives, PA
Civil Engineering / Landscape Architecture
134 West Emma Avenue
Springdale, Arkansas 72764
(479) 756-1266
Fax: (479) 755-3570
www.eda-pa.com

C102



PLANT 2 DRIP FIELDS

PHASE 4 COLLECTIONS
PHASE 4A AND 4B DRIP FIELDS
4322 N OAK ST.
BETHEL HEIGHTS, AR

Legend

- Found Iron Pin
- Meter
- A1 3600 LF — Drip Zone Designation
- Phase 4B Area
- Phase 4A Area
- Phase 4A Drip Lines
- Phase 4B Drip Lines
- Phase 4B Drip Lines Connected to 4A
- Chambered Drip Field
- Graveled Drip Field
- Field Dosing out of Phase

Notes:

Subsurface Tanks, Pods, Plumbing, Drip Fields, Meters, Valves and other Equipment contained in these plans are based on construction plans. General location of above ground items was completed with the use of survey data, review of available aerial photography, site visits and conversations with the Operator.

Control Panels, Computers, Zone Location and other Plant Systems are based on construction plans and conversations with the Operator. Actual Zone Location, Dose Timing, and Other Plant Systems were not determined in the scope of these plans.

Subsurface and environmental conditions were not examined nor considered.

Due to the scale of the drawings, certain symbols and horizontal coordinates of certain features will not be to scale due to production purposes.

50 0 50 100
50 SCALE GRAPHIC SCALE IN FEET

RECORD DRAWING

#	REVISION DESC.	DATE

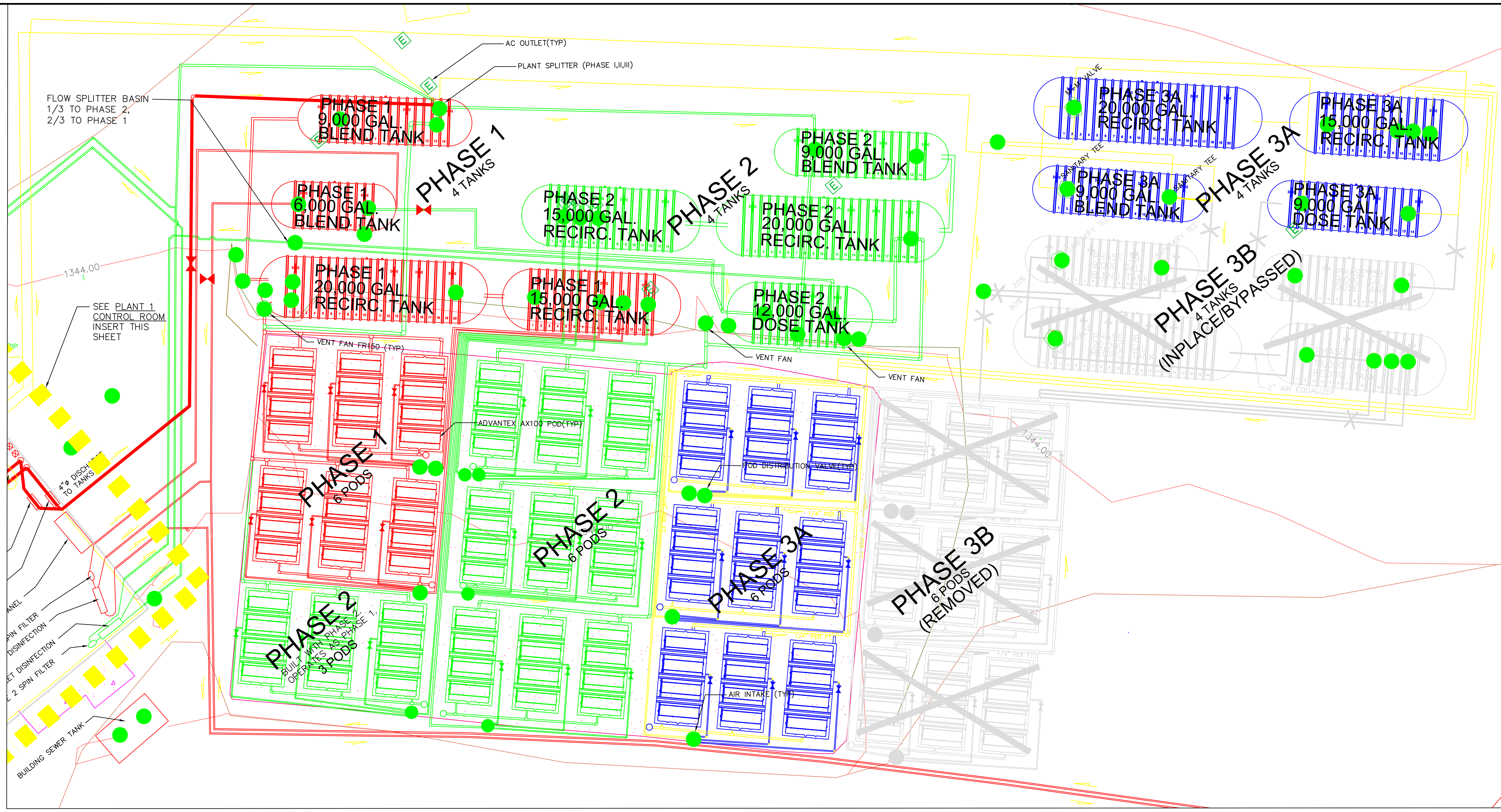
DRAWN BY: CLP | CHECKED BY: JRG
DRAWING CREATION DATE: 080519
JOB NUMBER: 2114
P:\PROJECTS\2114\CIVIL\2114 RECORD PLANS.DWG
LAST SAVED 8/8/2019 10:14 AM
PLOT DATE 8/8/2019 10:17 AM

CERTIFICATE OF AUTHORIZATION
EARTHPLAN DESIGN ALTERNATIVES, P.A.
No. 322
ARKANSAS ENGINEER

PHASE 4A AND 4B DRIP FIELDS
TREATMENT FACILITIES
BETHEL HEIGHTS, AR

Earthplan Design Alternatives, PA
Civil Engineering / Landscape Architecture
(479) 756-1266
Fax (479) 751-3001
www.edapa.com
134 West Emma Avenue
Springdale, Arkansas 72764

C103

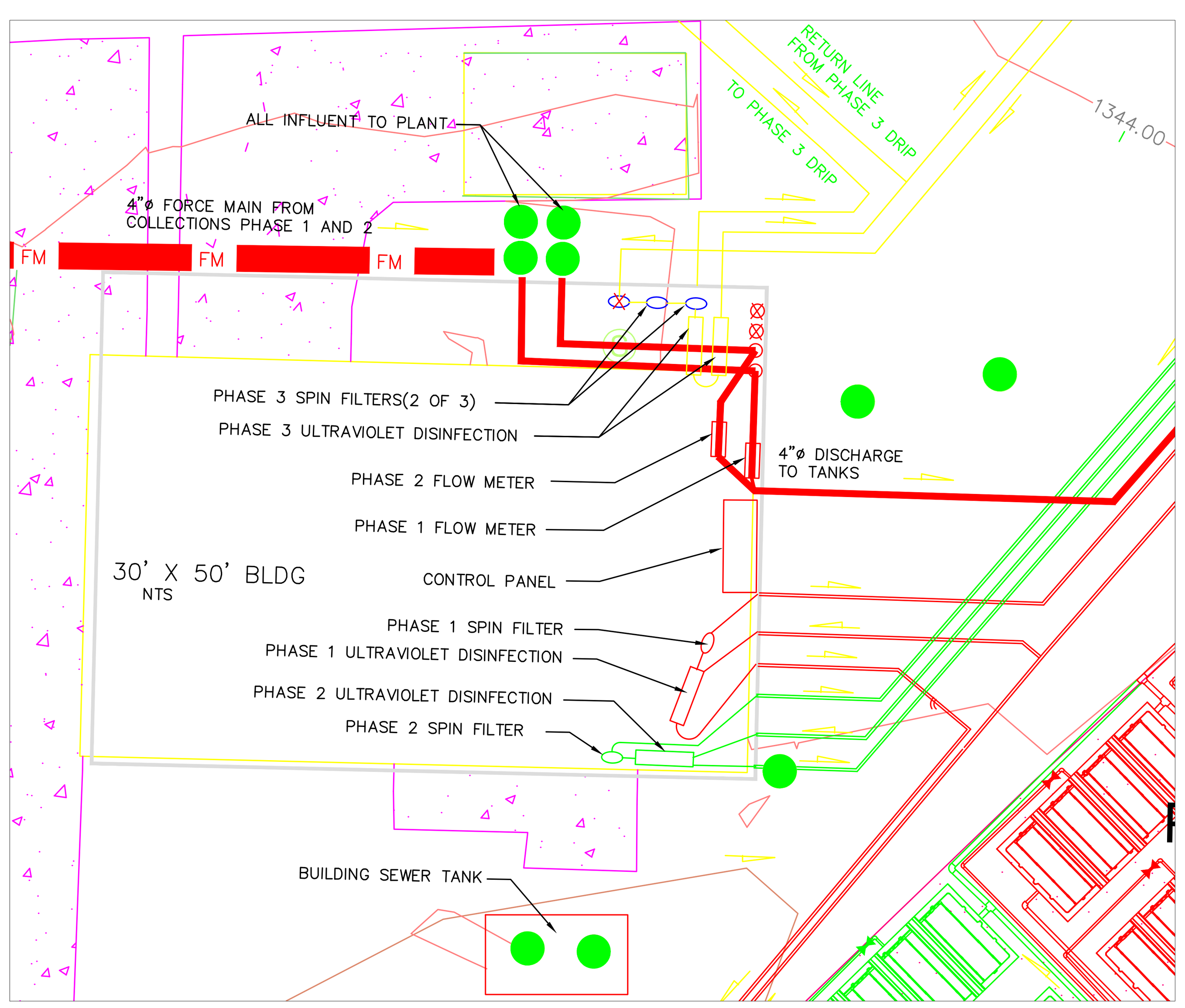


PLANT 1 TANKS AND PODS

EXISTING STRUCTURES, BYPASSED STRUCTURES
AND STRUCTURES FROM PAST CONTRACTS
REMOVED FROM SITE

Legend

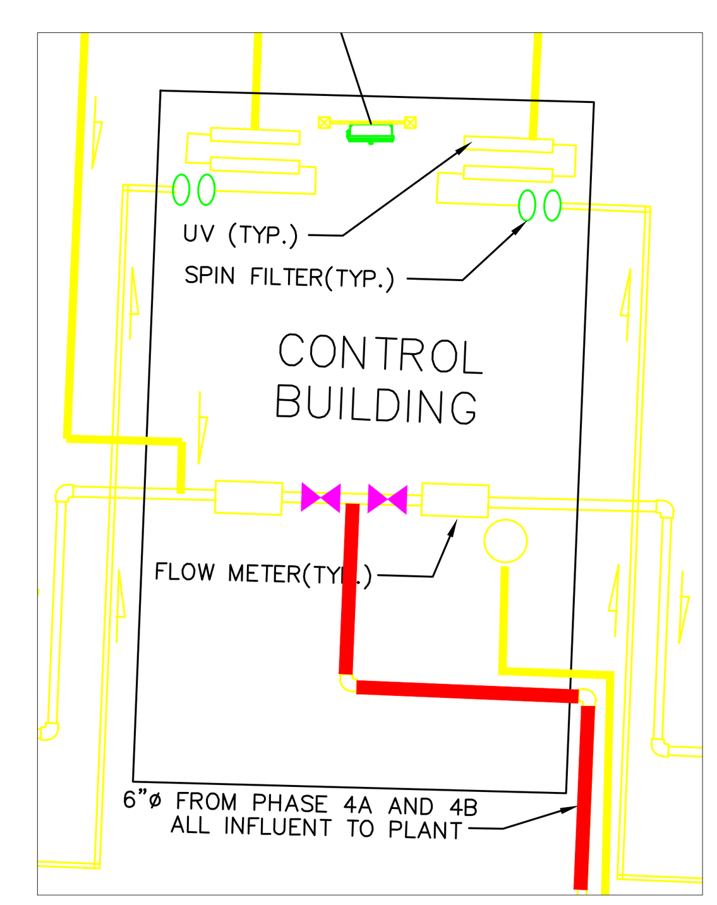
- Flow Direction
- Access Lid
- Electric Outlet Riser
- Valve
- Contours
- See Insert Outline
- Collections Phase 1 and 2 Raw Discharge From Control Room To Tanks
- Force Main Phase 1 and 2 From Collections to Plant
- Phase 1 Pipe and Structures
- Phase 2 Pipe and Structures
- Phase 3A Pipe and Structures
- Phase 3B (Removed or Bypassed)



PLANT 1 - CONTROL ROOM

Legend

- Flow Direction
- Access Lid
- Abandon Influent Conduit
- Phase 1 and 2 Influent Conduit through Floor
- Contours
- Phase 1 Pipe
- Phase 2 Pipe
- Phase 3 Pipe
- Phase 3B (Removed or Bypassed)
- Force Main Phase 1 and 2 Collections
- Spin Filers
- Influent Meters
- UV Disinfection



PLANT 2 - CONTROL ROOM

Notes:

Subsurface Tanks, Pods, Plumbing, Drip Fields, Meters, Valves and other Equipment contained in these plans are based on construction plans. General location of above ground items was completed with the use of survey data, review of available aerial photography, site visits and conversations with the Operator.

Control Panels, Computers, Zone Location and other Plant Systems are based on construction plans and conversations with the Operator. Actual Zone Location, Dose Timing, and Other Plant Systems were not determined in the scope of these plans.

Subsurface and environmental conditions were not examined nor considered.

Due to the scale of the drawings, certain symbols and horizontal coordinates of certain features will not be to scale due to production purposes.

10 0 10 20
10 SCALE GRAPHIC SCALE IN FEET

RECORD DRAWING

DATE	#	REVISION DESC.

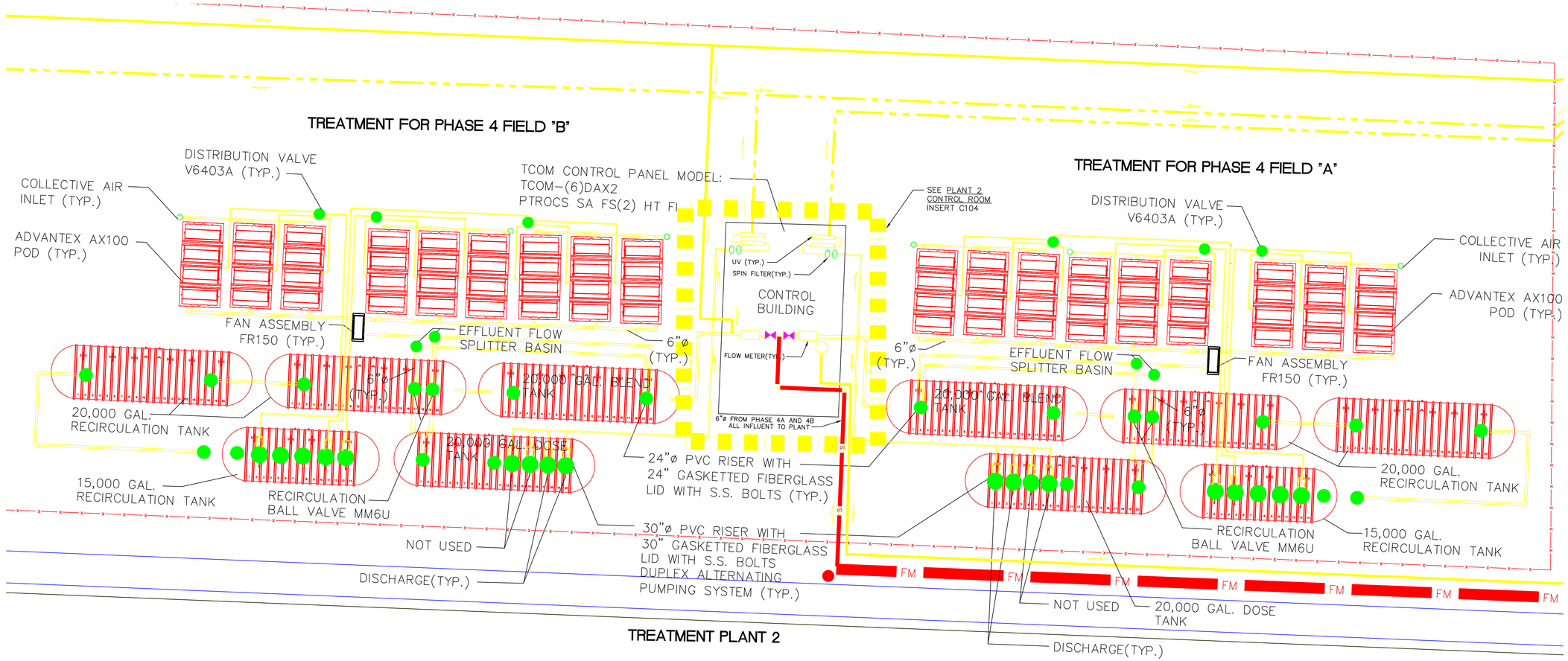
DRAWN BY: CLP CHECKED BY: JRG
DRAWING CREATION DATE: 080519
JOB NUMBER: 2114
P:\PROJECTS\2114\CIVIL\2114 RECORD PLANS.DWG
LAST SAVED:8/9/2019 10:18 AM
PLOT DATE:8/9/2019 10:18 AM

CERTIFICATE OF AUTHORIZATION
EARTHPLAN DESIGN ALTERNATIVES, P.A.
No. 322
ARKANSAS ENGINEER

PLANT 1
TREATMENT FACILITIES
BETHEL HEIGHTS, AR

Earthplan Design Alternatives, PA
Civil Engineering / Landscape Architecture
134 West Emma Avenue
Springdale, Arkansas 72764
(479) 756-1266
Fax: (479) 756-3570
www.eda-pa.com

C104



PLANT 2 TANKS AND PODS

5576 N OAK ST
BETHEL HEIGHTS, AR

Legend

- Flow Direction
- Access Lid
- E — Electric Outlet Riser
- Valve
- 1342.00 — Contours
- See Insert Outline
- Collections Phase 1 and 2 Raw Discharge From Control Room To Tanks
- FM — Force Main Phase 1 and 2 From Collections to Plant
- Phase 1 Pipe and Structures
- Phase 2 Pipe and Structures
- Phase 3A Pipe and Structures
- Phase 3B (Removed or Bypassed)

Notes:

Subsurface Tanks, Pods, Plumbing, Drip Fields, Meters, Valves and other Equipment contained in these plans are based on construction plans. General location of above ground items was completed with the use of survey data, review of available aerial photography, site visits and conversations with the Operator.

Control Panels, Computers, Zone Location and other Plant Systems are based on construction plans and conversations with the Operator. Actual Zone Location, Dose Timing, and Other Plant Systems were not determined in the scope of these plans.

Subsurface and environmental conditions were not examined nor considered.

Due to the scale of the drawings, certain symbols and horizontal coordinates of certain features will not be to scale due to production purposes.

10 0 10 20
10 SCALE GRAPHIC SCALE IN FEET

RECORD DRAWING

#	REVISION DESC.	DATE

DRAWN BY: CLP | CHECKED BY: JRG | DRAWING CREATION DATE: 080519 | JOB NUMBER: 2114
P:\PROJECTS\2114\CIVIL\2114 RECORD PLANS.DWG
LAST SAVED8/8/2019 10:19 AM
PLOT DATE8/8/2019 10:19 AM

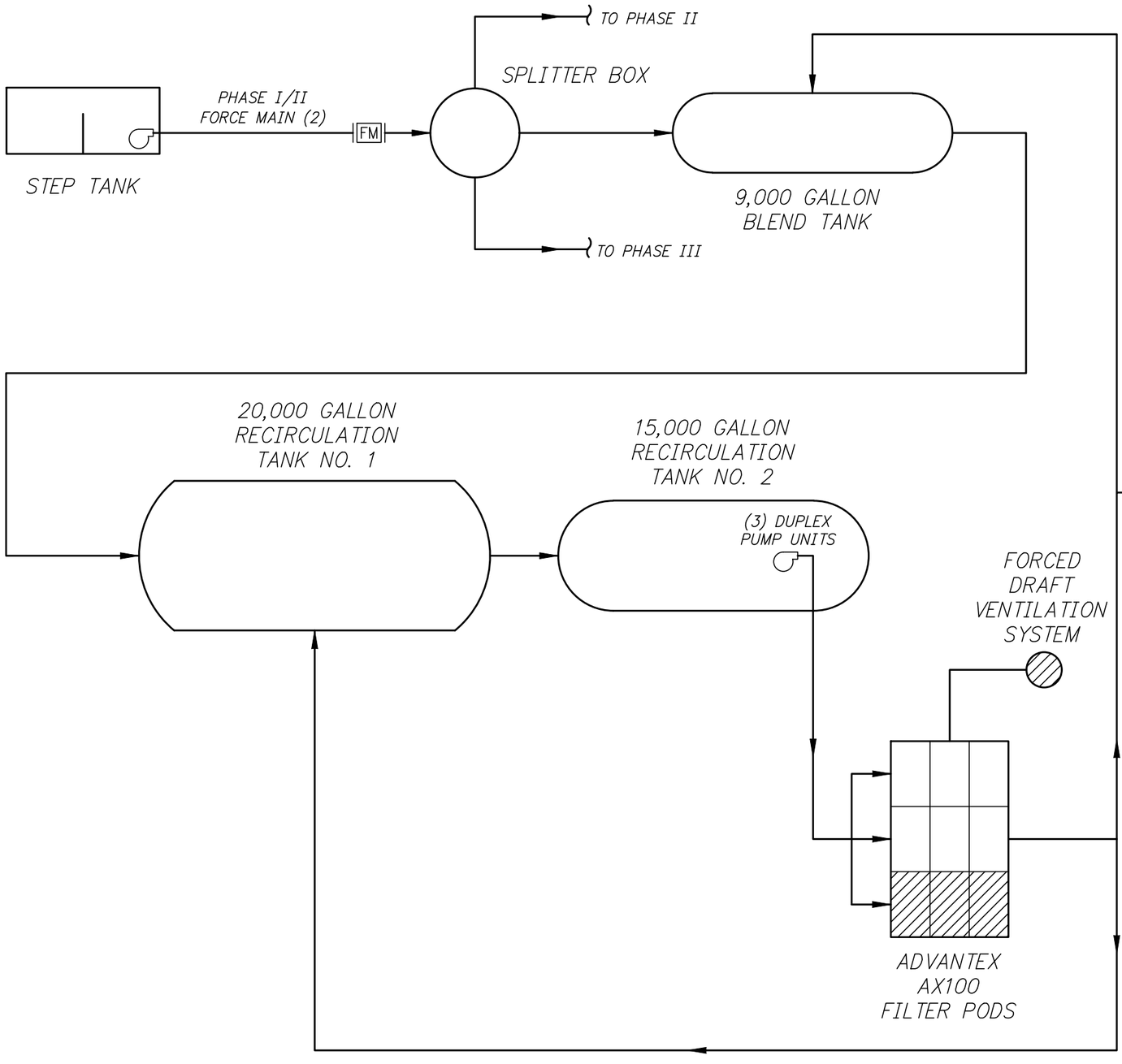
CERTIFICATE OF AUTHORIZATION — EARTHPLAN DESIGN ALTERNATIVES, P.A. No. 322 — ARKANSAS ENGINEER

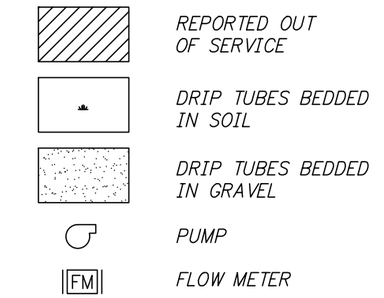
PLANT 2
TREATMENT FACILITIES
BETHEL HEIGHTS, AR

Earthplan Design Alternatives, PA
Civil Engineering / Landscape Architecture
(479) 756-1266
(479) 757-1266 Fax
www.edp-pa.com
134 West Emma Avenue
Springdale, Arkansas 72764

C105

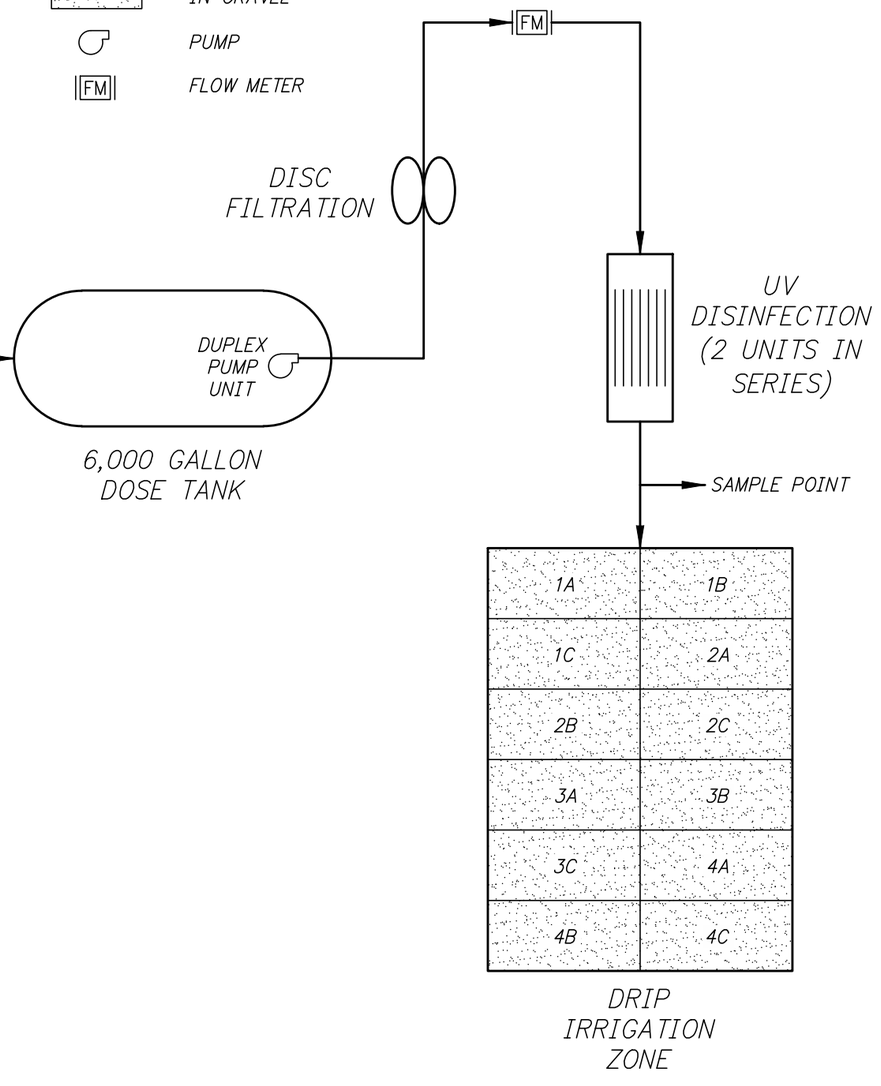
Appendix B – Process Diagrams





NOTES:

1. DRIP IRRIGATION ZONE NUMBERS ARE SHOWN FOR REFERENCE ONLY. REFER TO RECORD DRAWINGS FOR INSTALLED LOCATIONS



PROCESS FLOW DIAGRAM
BETHEL HEIGHTS TREATMENT FACILITY
LINCOLN STREET WWTU PHASE I

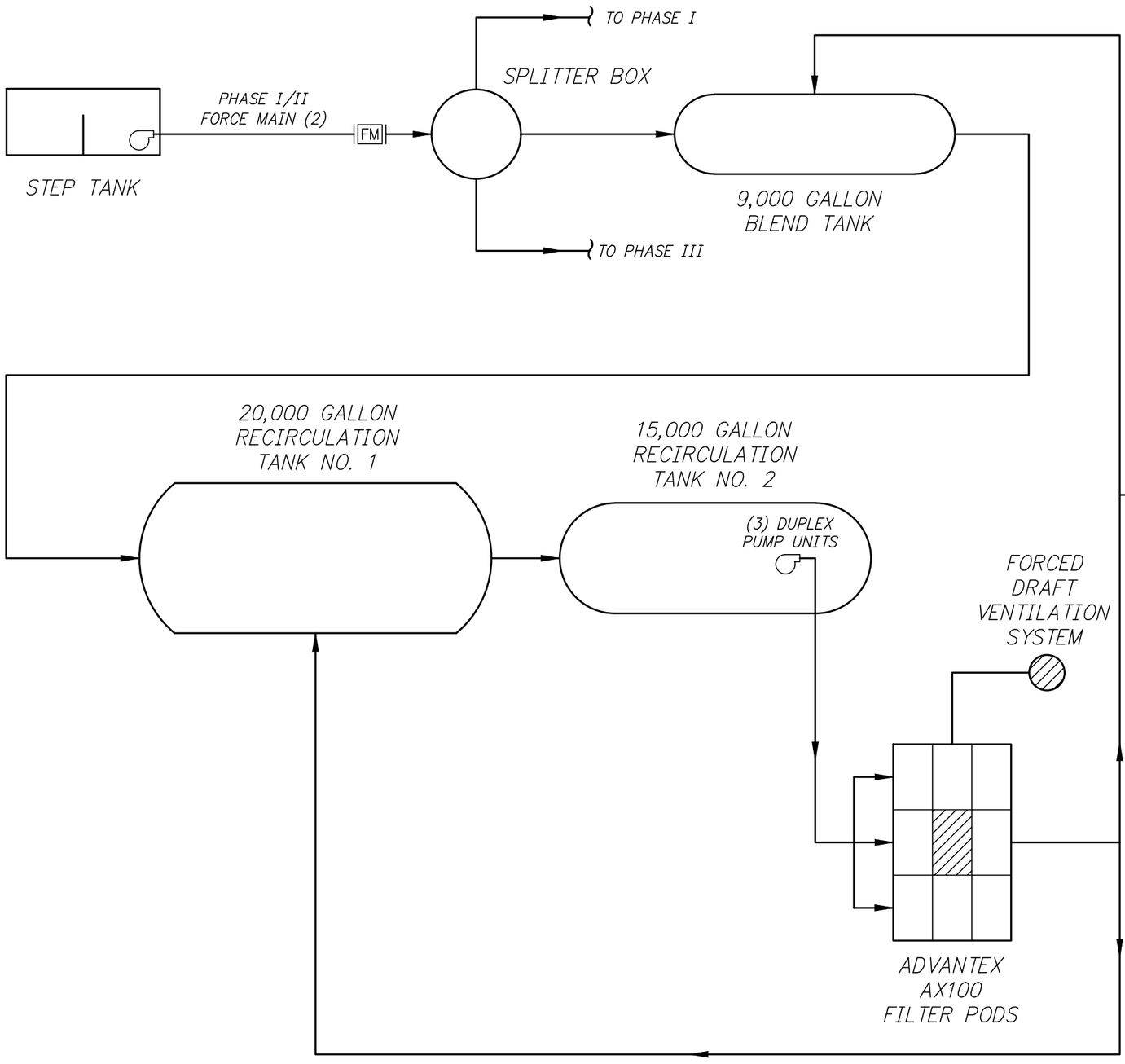
BETHEL HEIGHTS, ARKANSAS

NOVEMBER 2019	SCALE: N.T.S.	JOB NO. 2019088

HAWKINS WEIR ENGINEERS, INC.

Van Buren (479) 474-1227 | Fort Smith (479) 242-4685 | Fayetteville (479) 455-2206 | Little Rock (501) 374-4846

www.hawkins-weir.com

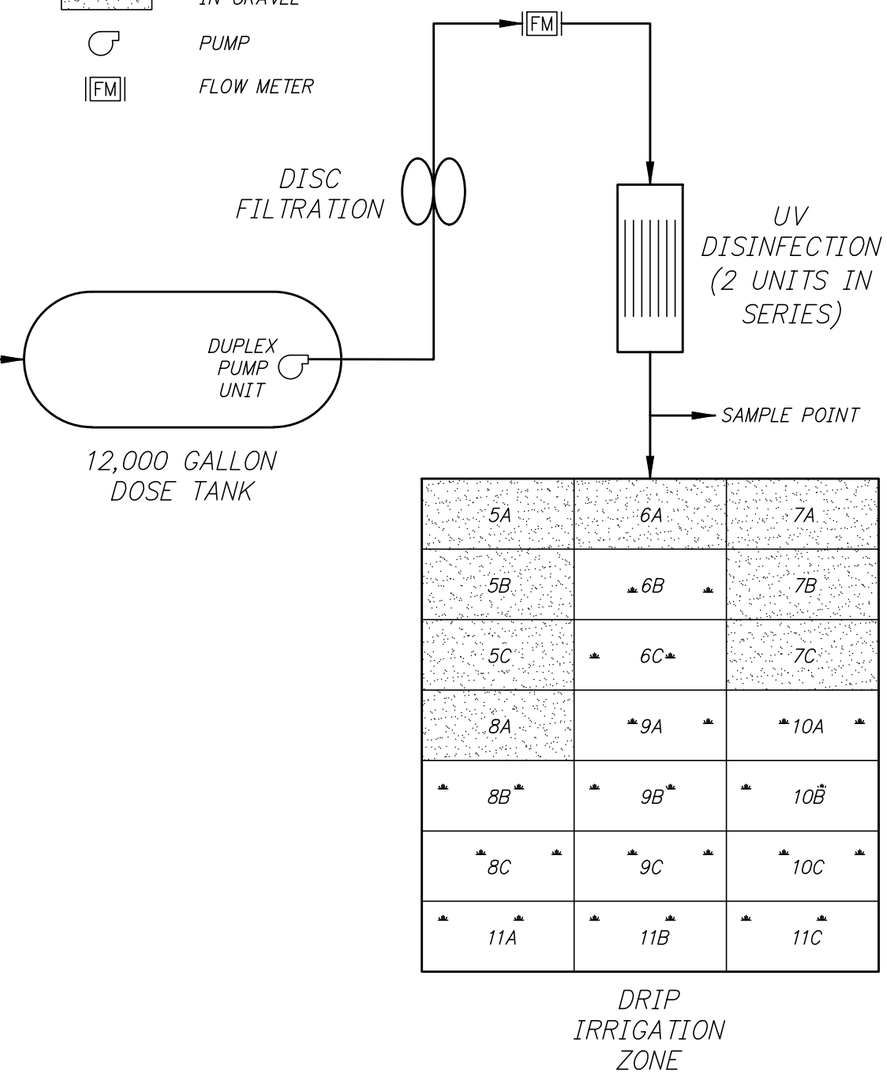


LEGEND

- REPORTED OUT OF SERVICE
- DRIP TUBES BEDDED IN SOIL
- DRIP TUBES BEDDED IN GRAVEL
- PUMP
- FM — FLOW METER

NOTES:

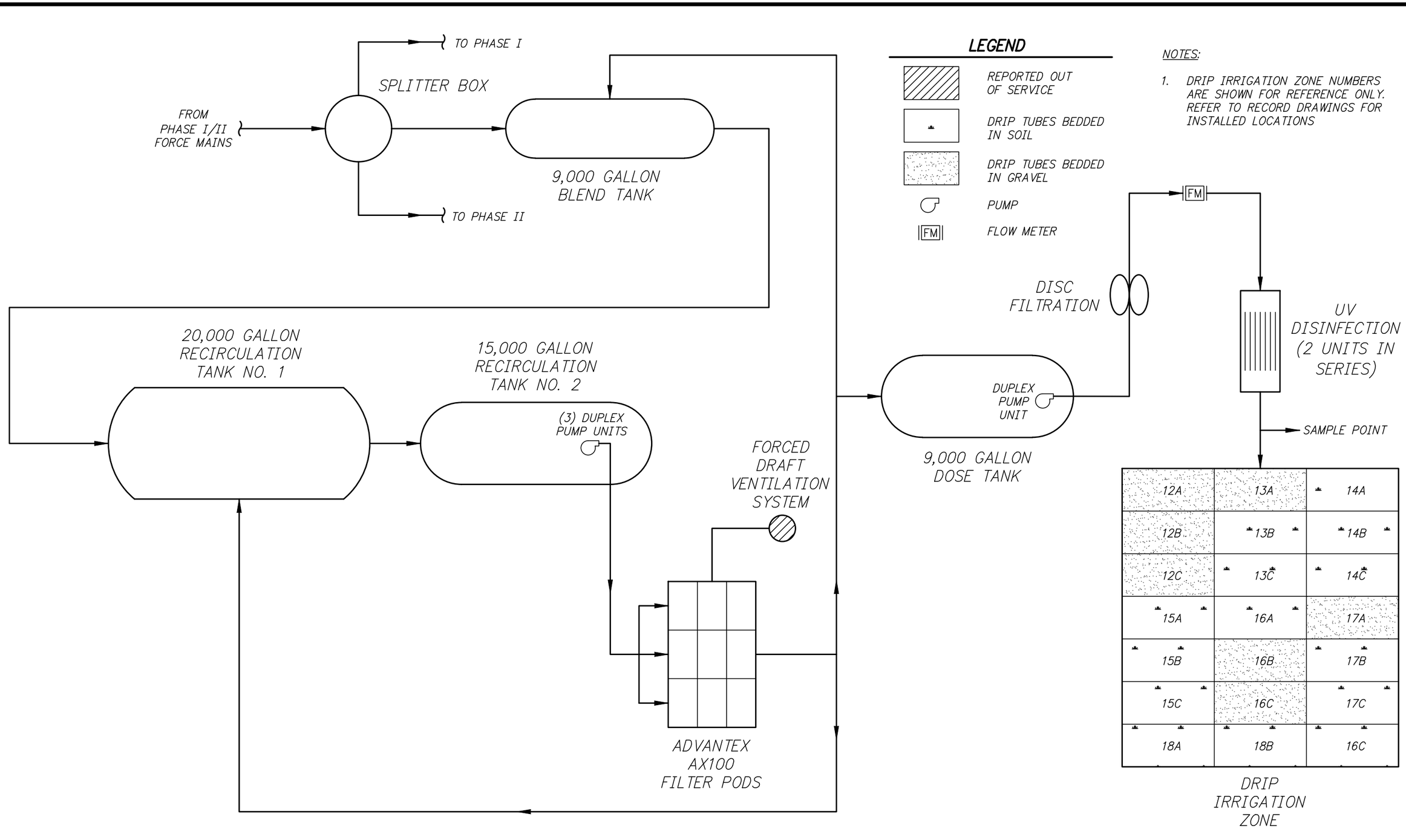
1. DRIP IRRIGATION ZONE NUMBERS ARE SHOWN FOR REFERENCE ONLY. REFER TO RECORD DRAWINGS FOR INSTALLED LOCATIONS



PROCESS FLOW DIAGRAM
BETHEL HEIGHTS TREATMENT FACILITY
LINCOLN STREET WWTU PHASE II
BETHEL HEIGHTS, ARKANSAS

NOVEMBER 2019	SCALE: N.T.S.	JOB NO. 2019088

HAWKINS WEIR ENGINEERS, INC.
Van Buren (479) 474-1227 | Fort Smith (479) 242-4685 | Fayetteville (479) 455-2206 | Little Rock (501) 374-4846
www.hawkins-weir.com



LEGEND

- REPORTED OUT OF SERVICE
- DRIP TUBES BEDDED IN SOIL
- DRIP TUBES BEDDED IN GRAVEL
- PUMP
- FM — FLOW METER

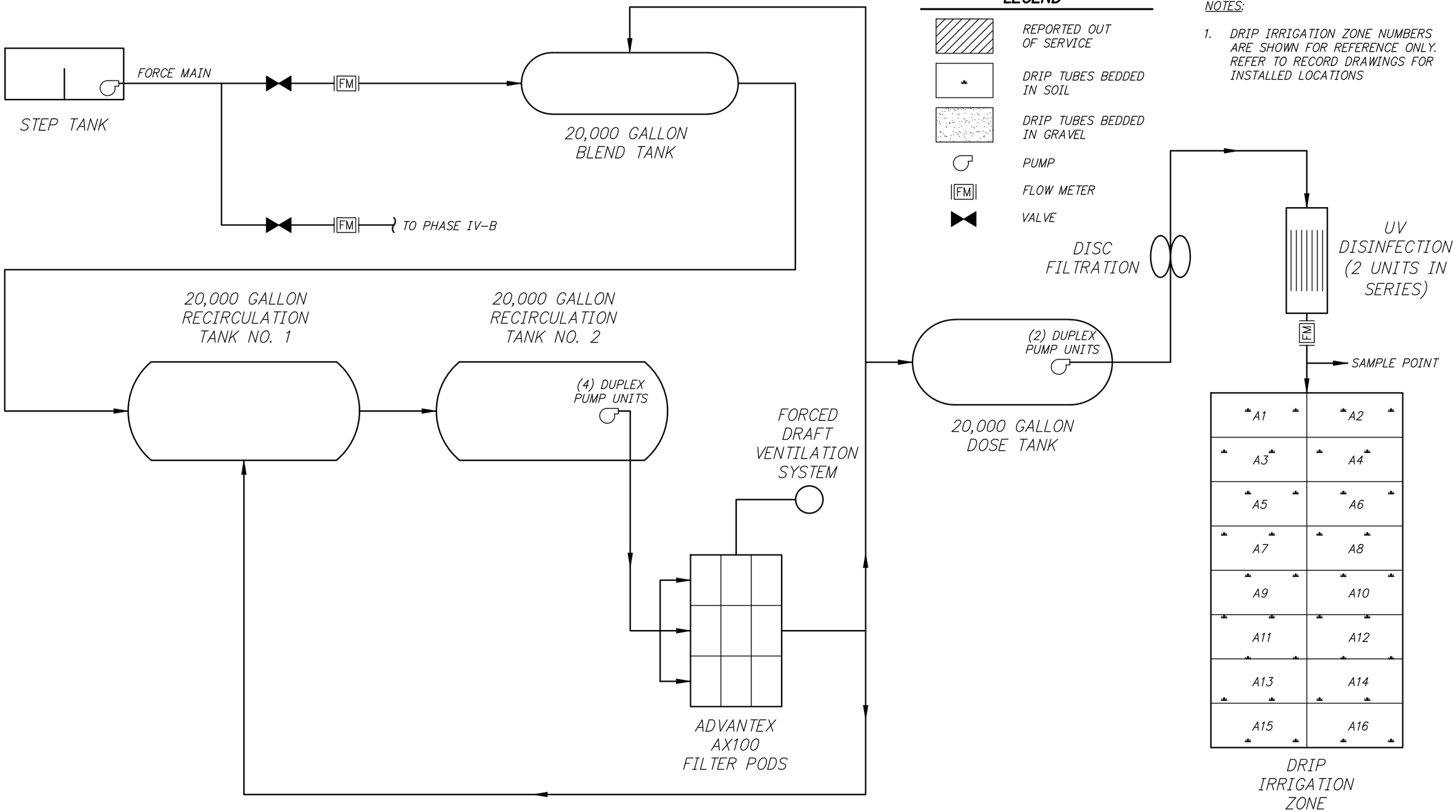
NOTES:

1. DRIP IRRIGATION ZONE NUMBERS ARE SHOWN FOR REFERENCE ONLY. REFER TO RECORD DRAWINGS FOR INSTALLED LOCATIONS

PROCESS FLOW DIAGRAM
BETHEL HEIGHTS TREATMENT FACILITY
LINCOLN STREET WWTU PHASE III
BETHEL HEIGHTS, ARKANSAS

NOVEMBER 2019	SCALE: N.T.S.	JOB NO. 2019088

HAWKINS WEIR ENGINEERS, INC.
Van Buren (479) 474-1227 | Fort Smith (479) 242-4685 | Fayetteville (479) 455-2206 | Little Rock (501) 374-4846
www.hawkins-weir.com



NOTES:

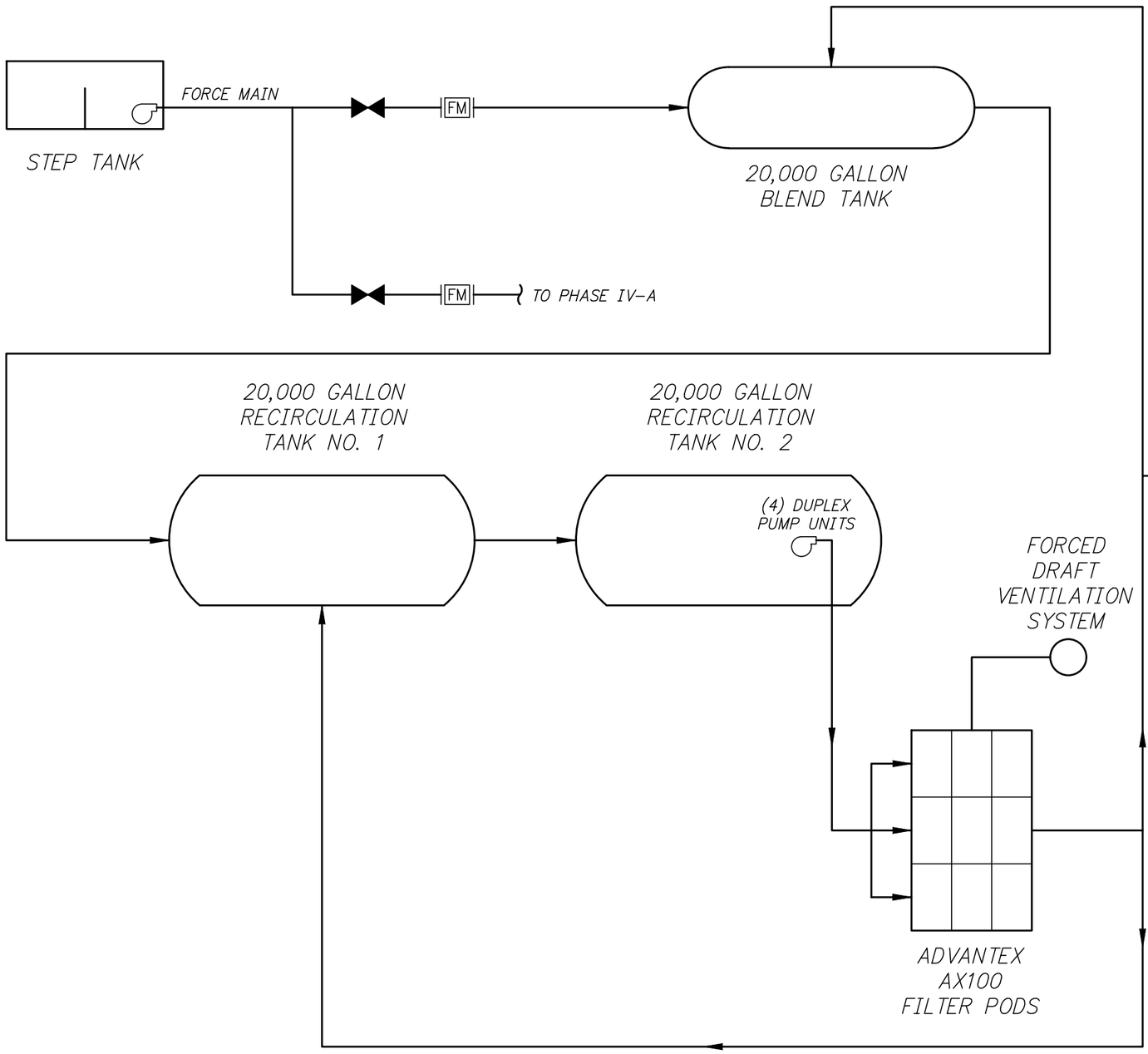
1. DRIP IRRIGATION ZONE NUMBERS ARE SHOWN FOR REFERENCE ONLY. REFER TO RECORD DRAWINGS FOR INSTALLED LOCATIONS

PROCESS FLOW DIAGRAM
BETHEL HEIGHTS TREATMENT FACILITY
OAK STREET WWTU PHASE IV-A

BETHEL HEIGHTS, ARKANSAS

NOVEMBER 2019	SCALE: N.T.S.	JOB NO. 2019088

HAWKINS WEIR ENGINEERS, INC.
Van Buren (479) 474-1227 | Fort Smith (479) 242-4685 | Fayetteville (479) 455-2206 | Little Rock (501) 374-4846
www.hawkins-weir.com

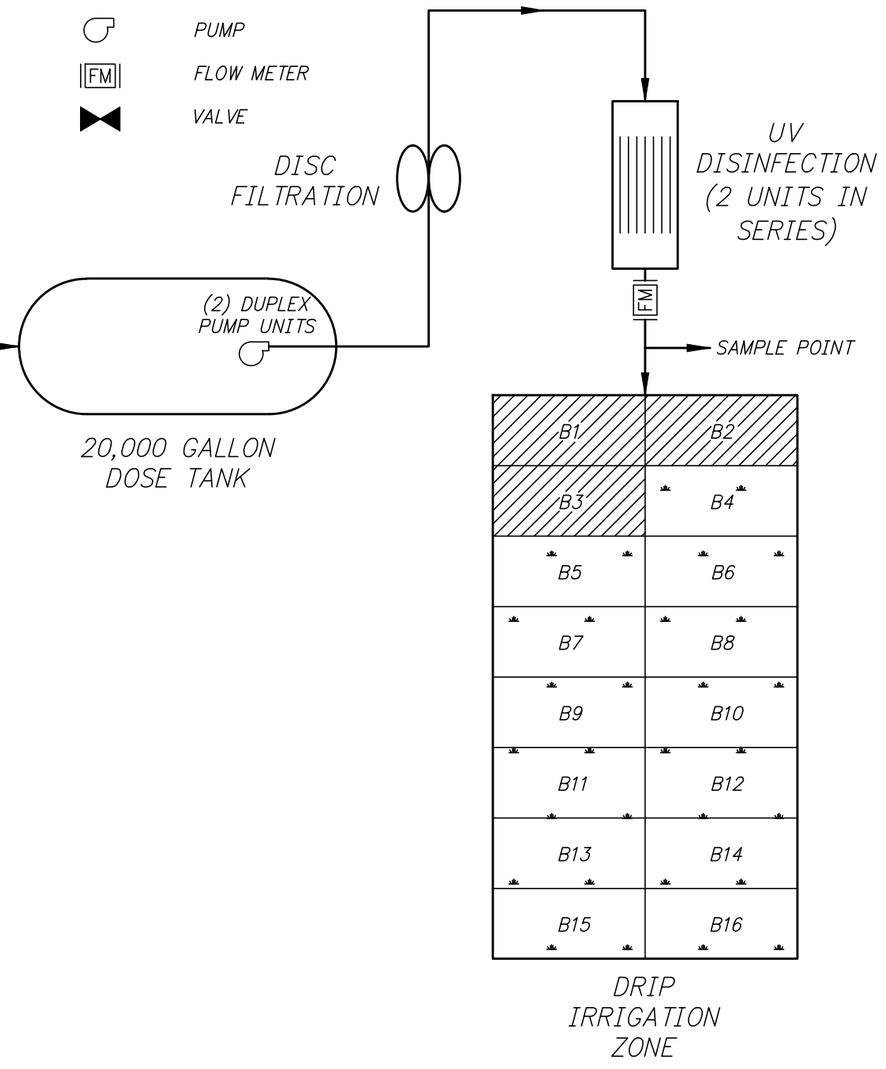


LEGEND

- REPORTED OUT OF SERVICE
- DRIP TUBES BEDDED IN SOIL
- DRIP TUBES BEDDED IN GRAVEL
- PUMP
- FLOW METER (FM)
- VALVE

NOTES:

1. DRIP IRRIGATION ZONE NUMBERS ARE SHOWN FOR REFERENCE ONLY. REFER TO RECORD DRAWINGS FOR INSTALLED LOCATIONS



PROCESS FLOW DIAGRAM
BETHEL HEIGHTS TREATMENT FACILITY
OAK STREET WWTU PHASE IV-B

BETHEL HEIGHTS, ARKANSAS

NOVEMBER 2019	SCALE: N.T.S.	JOB NO. 2019088

HAWKINS WEIR ENGINEERS, INC.

Van Buren (479) 474-1227 | Fort Smith (479) 242-4685 | Fayetteville (479) 455-2206 | Little Rock (501) 374-4846

www.hawkins-weir.com

Phase I Soil Loading Rates				
Zone	Surface Area (sf)	Loading Rate (gpd/sf)	Capacity (gpd)	Flow Meter
1A	4,650	0.103	479	x
1B	4,372	0.103	450	x
1C	4,548	0.103	468	x
2A	4,110	0.103	423	x
2B	4,244	0.103	437	x
2C	4,132	0.103	426	x
3A	4,284	0.103	441	x
3B	4,968	0.103	512	x
3C	4,524	0.103	466	x
4A	4,598	0.103	474	x
4B	4,384	0.103	452	x
4C	4,632	0.103	477	x
Total	53,446	N/A	5,505	N/A

Phase II Soil Loading Rates				
Zone	Surface Area (sf)	Loading Rate (gpd/sf)	Capacity (gpd)	Flow Meter
5A	4,200	0.103	433	x
5B	4,200	0.103	433	x
5C	4,200	0.103	433	x
6A	4,200	0.103	433	x
6B	4,200	0.103	433	
6C	4,200	0.103	433	
7A	4,200	0.103	433	x
7B	4,200	0.103	433	x
7C	4,200	0.103	433	x
8A	4,200	0.103	433	x
8B	4,200	0.103	433	
8C	4,200	0.103	433	
9A	4,200	0.103	433	
9B	4,200	0.103	433	
9C	4,200	0.103	433	
10A	4,200	0.103	433	
10B	4,480	0.103	461	
10C	4,200	0.103	433	
11A	3,360	0.103	346	
11B	2,880	0.103	297	
11C	5,040	0.103	519	
Total	87,160	N/A	8,977	N/A

Phase III Soil Loading Rates				
Zone	Surface Area (sf)	Loading Rate (gpd/sf)	Capacity (gpd)	Flow Meter
12A	4,200	0.164	689	x
12B	4,200	0.164	689	x
12C	4,200	0.164	689	x
13A	4,200	0.164	689	x
13B	4,200	0.164	689	
13C	4,200	0.164	689	
14A	4,200	0.164	689	
14B	4,200	0.164	689	
14C	4,200	0.164	689	
15A	4,200	0.164	689	
15B	4,200	0.164	689	
15C	4,200	0.164	689	
16A	4,200	0.164	689	
16B	4,200	0.164	689	x
16C	4,200	0.164	689	x
17A	4,200	0.164	689	x
17B	4,200	0.164	689	
17C	4,200	0.164	689	
18A	4,200	0.164	689	
18B	4,200	0.164	689	
18C	4,400	0.164	722	
Total	88,400	N/A	14,498	N/A

Phase IV-A Soil Loading Rates				
Zone	Surface Area (sf)	Loading Rate (gpd/sf)	Capacity (gpd)	Flow Meter
A1	7,200	0.103	742	
A2	7,200	0.103	742	
A3	7,200	0.103	742	
A4	7,200	0.103	742	
A5	7,200	0.103	742	
A6	7,200	0.103	742	
A7	7,200	0.103	742	
A8	7,200	0.103	742	
A9	7,200	0.103	742	
A10	7,200	0.103	742	
A11	7,200	0.103	742	
A12	7,200	0.103	742	
A13	7,200	0.103	742	
A14	7,200	0.103	742	
A15	7,200	0.103	742	
A16	7,200	0.103	742	
Total	115,200	N/A	11,866	N/A

Phase IV-B Soil Loading Rates				
Zone	Surface Area (sf)	Loading Rate (gpd/sf)	Capacity (gpd)	Flow Meter
B1	7,200	0.103	742	
B2	7,200	0.103	742	
B3	7,200	0.103	742	
B4	7,200	0.103	742	
B5	7,200	0.103	742	
B6	7,200	0.103	742	
B7	7,200	0.103	742	
B8	7,200	0.103	742	
B9	7,200	0.103	742	
B10	7,200	0.103	742	
B11	7,200	0.103	742	
B12	7,200	0.103	742	
B13	7,200	0.103	742	
B14	7,200	0.103	742	
B15	7,200	0.103	742	
B16	7,200	0.103	742	
Total	115,200	N/A	11,866	N/A

SOIL LOADING RATES
PHASES I – IV-B

BETHEL HEIGHTS, ARKANSAS

NOVEMBER 2019 | *SCALE: N.T.S.* | *JOB NO. 2019088*

HAWKINS WEIR ENGINEERS, INC.
Van Buren (479) 474-1227 | Fort Smith (479) 242-4685 | Fayetteville (479) 455-2206 | Little Rock (501) 374-4846
www.hawkins-weir.com

Appendix C – No Discharge Permit No. 4725 -WR-5

Permit No. 4725-WR-5
AFIN 04-00630

AUTHORIZATION FOR A NO-DISCHARGE WATER PERMIT UNDER THE ARKANSAS WATER AND AIR POLLUTION CONTROL ACT

In accordance with the provisions of the Arkansas Water and Air Pollution Control Act (Ark. Code Ann. § 8-4-101 et seq.) and Arkansas Pollution Control and Ecology Commission (APC&EC) and Regulation No. 17 Arkansas Underground Injection Control (UIC) Code.

City of Bethel Heights

is authorized to operate the decentralized wastewater treatment system with drip irrigation dispersal of the treated wastewater from the facility located at 901 S. Lincoln St. Bethel Heights, AR 72764 in Benton County at the following coordinates:

Latitude: 36° 14′ 12″ N; Longitude: 94° 7′ 55″ W

The facility is located in Stream Segment 3J of the Arkansas River Basin.

Operation shall be in accordance with all conditions set forth in this permit.

Response to comments is attached.

Effective Date: September 1, 2015

Expiration Date: August 31, 2020

Ellen Carpenter
Chief, Water Division
Arkansas Department of Environmental Quality

July 2, 2015
Issue Date

PART I
Permit Requirements

LIMITATIONS AND MONITORING REQUIREMENTS:

The following tables detail the constituent limits, monitoring frequencies and the requirements for reporting results to ADEQ for each respective parameter listed in the table heading.

Table 1: Effluent Limits, Monitoring, and Reporting Requirements			
Parameter	**Limit[1]**	**Units**	**Monitoring**
Carbonaceous Biochemical Oxygen Demand (CBOD5)	15	mg/l	Grab sample once per month[2]
Total Suspended Solids (TSS)	15	mg/l	
Fecal Coliform Bacteria (FCB)	2,000	colonies/100 ml	
pH	6.0 – 9.0	s.u.	
Total Phosphorus (TP)	Report	mg/l	
Total Kjeldahl Nitrogen (TKN)	Report	mg/l	Grab sample once per quarter[2]
Ammonia Nitrogen (NH_3-N)	Report	mg/l	
Nitrate Nitrogen (NO_3-N) + Nitrite Nitrogen (NO_2-N)	Report	mg/l	
Plant Available Nitrogen (PAN)[3]	Report	mg/l	
Flow, monthly total	Report	MGD	Total flow per calendar month[4]
Flow, daily maximum	Report	MGD	Daily
Loading Rate	Report[4]	gpd/ft^2	

[1]This is the maximum parameter limit.
[2]Refer to Condition 17 of Part II of the permit.
[3]Refer to Condition 6 of Part II of the permit.
[4]The maximum loading rate cannot exceed those specified in Table 3 below.

Table 2: Drip Field Soil Loading Rates			
Phase 1			
Zone Identification	**Zone Area (ft^2)**	**Loading Rate (gpd/ft^2)**	**Maximum Capacity (gpd)**
Zone 1A	4,650	0.54	2,511
Zone 1B	4,372	0.54	2,360.88
Zone 1C	4,548	0.54	2,455.92
Zone 2A	4,110	0.54	2,219.4
Zone 2B	4,244	0.54	2,291.76
Zone 2C	4,132	0.54	2,231.28
Zone 3A	4,284	0.54	2,313.36
Zone 3B	4,968	0.54	2,682.72
Zone 3C	4,524	0.54	2,442.96
Zone 4A	4,598	0.54	2,482.92
Zone 4B	4,384	0.54	2,367.36
Zone 4C	4,632	0.54	2,501.28

Phase 2			
Zone Identification	Zone Area (ft^2)	Loading Rate (gpd/ft^2)	Maximum Capacity (gpd)
Zone 1A	4,200	0.54	2,268
Zone 1B	4,200	0.54	2,268
Zone 1C	4,200	0.54	2,268
Zone 2A	4,200	0.54	2,268
Zone 2B	4,200	0.54	2,268
Zone 2C	4,200	0.54	2,268
Zone 3A	4,200	0.54	2,268
Zone 3B	4,200	0.54	2,268
Zone 3C	4,200	0.54	2,268
Zone 4A	4,200	0.54	2,268
Zone 4B	4,200	0.54	2,268
Zone 4C	4,200	0.54	2,268
Zone 5A	4,200	0.54	2,268
Zone 5B	4,200	0.54	2,268
Zone 5C	4,200	0.54	2,268
Zone 6A	4,200	0.54	2,268
Zone 6B	4,480	0.54	2,419.2
Zone 6C	4,200	0.54	2,268
Zone 7A	3,360	0.54	1,814.4
Zone 7B	2,880	0.54	1,555.2
Zone 7C	5,040	0.54	2,721.6
Phase 3			
Zone Identification	Zone Area (ft^2)	Loading Rate (gpd/ft^2)	Maximum Capacity (gpd)
Zone 12A	4,200	0.54	2,268
Zone 12B	4,200	0.54	2,268
Zone 12C	4,200	0.54	2,268
Zone 13A	4,200	0.54	2,268
Zone 13B	4,200	0.54	2,268
Zone 13C	4,200	0.54	2,268
Zone 14A	4,200	0.54	2,268
Zone 14B	4,200	0.54	2,268
Zone 14C	4,200	0.54	2,268
Zone 15A	4,200	0.54	2,268
Zone 15B	4,200	0.54	2,268
Zone 15C	4,200	0.54	2,268
Zone 16A	4,200	0.54	2,268
Zone 16B	4,200	0.54	2,268
Zone 16C	4,200	0.54	2,268
Zone 17A	4,200	0.54	2,268
Zone 17B	4,200	0.54	2,268
Zone 17C	4,200	0.54	2,268
Zone 18A	4,200	0.54	2,268
Zone 18B	4,200	0.54	2,268

Phase 3			
Zone Identification	Zone Area (ft^2)	Loading Rate (gpd/ft^2)	Maximum Capacity (gpd)
Zone 18C	4,400	0.54	2,376
Total	**229,006**		**123,663.2**

Table 3: Drip Field Soil Loading Rates			
Phase 4			
Zone Identification	Zone Area (ft^2)	Loading Rate (gpd/ft^2)	Maximum Capacity (gpd)
Zone 1A	14,400	0.4	5,760
Zone 1B	14,400	0.4	5,760
Zone 1C	14,400	0.4	5,760
Zone 1D	14,400	0.4	5,760
Zone 2A	14,400	0.4	5,760
Zone 2B	14,400	0.4	5,760
Zone 2C	14,400	0.4	5,760
Zone 2D	14,400	0.4	5,760
Zone 3A	14,400	0.4	5,760
Zone 3B	14,400	0.4	5,760
Zone 3C	14,400	0.4	5,760
Zone 3D	14,400	0.4	5,760
Zone 4A	14,400	0.4	5,760
Zone 4B	14,400	0.4	5,760
Zone 4C	14,400	0.4	5,760
Zone 4D	14,400	0.4	5,760
Total	**230,400**		**92,160**

Part II
Specific Conditions

1. This permit is for the operation of a decentralized wastewater treatment system with drip irrigation dispersal of the treated wastewater for a municipality. This type of system is also classified as a Class V shallow injection wells under the provisions of Regulation No. 17.

2. The drip irrigation operation shall be managed in accordance with the March 13, 2015 Waste Management Plan (WMP). If the WMP is inconsistent with this permit, the drip irrigation operation shall be managed in accordance with the terms of the permit and the WMP shall be revised to conform to the permit conditions.

3. Wastewater shall not be discharged from this operation to the waters of the State or onto the land in any manner that may result in pooling, ponding, or runoff to the waters of the State. If any of the above conditions occur, dispersal shall cease immediately. Resumption of application activities cannot occur until all conditions of the permit are met. *Note: Any evidence of runoff must be reported within 24 hours to the Enforcement Branch of the Water Division in accordance with Standard Condition 13 of Part III.*

4. Under the provisions of Regulation No. 17 and Title 40 of the Federal Code of Regulations (CFR) Parts 144 and 146, promulgated under Part C of the Safe Drinking Water Act (SDWA), no owner or operator shall construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that may allow the movement of fluid containing any contaminant into an underground source of drinking water.

5. The permittee shall keep current and complete records of all activities related to the removal of solid materials, oil, grease, wastewater, etc., from the operation. The following information must be recorded and made available to ADEQ personnel on request: date of the activity, volume, or weight of material removed, type of material removed, interim or final destination of the material discarded, and complete identification of the carrier(s) transporting the material. If the waste is to be recycled or reused, document the name and address of the receiving entity or firm.

6. Plant Available Nitrogen (PAN) shall be calculated using the following equations:

PAN Equations	
For Subsurface applied or Incorporated waste, PAN (mg/l)	$0.3(TKN - NH_3) + NH_3 + NO_3 + NO_2$
Conversion from PAN(mg/l) to PAN(lbs/1000 gal)	0.00834 * PAN(mg/l)

The waste must be applied at a rate (calculated in units of 1000 gal/acre) that provides a quantity of PAN (lbs N/acre) that is equal to or less than the nitrogen uptake rate of the cover crop (lbs/acre). See the table below for a list of Nitrogen uptakes for crops mentioned in the waste management plan. Any crop not listed in the following table may be added to the permit as an update to the WMP.

Nitrogen Uptake of Cover Crops	
Crop Name	Uptake (lbs/acre)
Bermuda	300
Fescue	138
Rye	50

7. The drip irrigation field shall be maintained with a vegetative cover for additional treatment and to minimize erosion.

8. When the vegetative cover is mowed, clippings shall be removed from the drip field.

9. Vegetation not appropriate for the drip field cover, such as tree and shrub growth, shall be removed. The drip field shall be protected from any activity that might damage the irrigation system.

10. The drip field shall be inspected for damage 24 hours, but no later than 36 hours, after mowing or other activities that may damage the field have ceased. Damaged lines or other system components shall be repaired as soon as possible. Records of inspections and any required repairs shall be kept on-site for review and shall be submitted to the Department upon request.

11. Signs shall be posted around the disposal area indicating that the area is irrigated with treated wastewater effluent.

12. The reserve drip irrigation field shall be maintained in a condition to be used should the reserve area need to be brought into service upon failure of the primary drip irrigation field.

13. The waste disposal system shall be operated by a minimum of a licensed Class II wastewater treatment plant operator by the State of Arkansas in accordance with Ark. Code Ann. § 8-5-205 *et seq.* and APC&EC Regulation No. 3.

14. A complete "Operations and Maintenance (O&M) Manual" of the wastewater treatment system shall be maintained and followed.

15. Should the facility under this permit cease operations, the permittee shall submit to the Department, for approval, a closure plan for the system's storage and treatment structures within sixty (60) days of the final day of operation.

16. The current permitted treatment process may require modifications to comply with future total Phosphorous concentration limit requirements for nutrient surplus designated areas. This revision will require a permit modification.

17. Parameters sampled in Table 1 of Part I shall be reported to the Department prior to the 15th of the following month. Parameters sampled quarterly shall be reported to the Department prior to the 15th of the following month after sampling.

Part III
Standard Conditions

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Arkansas Water and Air Pollution Control Act and is grounds for civil and administrative enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

2. Penalties for Violations of Permit Conditions

The Arkansas Water and Air Pollution Control Act provides that any person who violates any provisions of a permit issued under the Act shall be guilty of a misdemeanor and upon conviction thereof shall be subject to imprisonment for not more than one (1) year, or a fine of not more than twenty-five thousand dollars ($25,000) or both for each day of such violation. Any person who violates any provision of a permit issued under the Act may also be subject to civil penalty in such amount as the court shall find appropriate, not to exceed ten thousand dollars ($10,000) for each day of such violation. The fact that any such violation may constitute a misdemeanor shall not be a bar to the maintenance of such civil action.

3. Permit Actions

A. This permit may be modified; revoked and reissued; or terminated for cause including, but not limited to the following:

   i. Violation of any terms or conditions of this permit;
   ii. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts;
   iii. A determination that the permitted activity endangers human health or the environment and can only be regulated to acceptable levels by permit modification or termination; or
   iv. Failure of the permittee to comply with the provisions of Arkansas Pollution Control and Ecology Commission (APC&EC) Regulation No. 9 (Permit fees).

B. The filing of a request by the permittee for a permit modification; revocation and reissuance; termination; or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

4. Civil and Criminal Liability

Nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance. Any false or materially misleading representation or concealment of information required to be reported by the provisions of this permit or applicable state statutes or regulations which defeats the regulatory purposes of the permit may subject the permittee to criminal enforcement pursuant to the Arkansas Water and Air Pollution Control Act.

5. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Clean Water Act and Section 106 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

6. State Laws

Nothing in this permit shall 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.

7. Property Rights

The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize 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.

8. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provisions of this permit to any circumstance is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

9. Permit Fees

The permittee shall comply with all applicable permit fee requirements (i.e., including annual permit fees following the initial permit fee that will be invoiced every year the permit is active) for No-Discharge permits as described in APC&EC Regulation No. 9 (Regulation for the Fee System for Environmental Permits). Failure to promptly remit all required fees shall be grounds for the Director to initiate action to revoke this permit.

10. Proper Operation and Maintenance

A. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

B. The permittee shall provide an adequate and trained operating staff which is duly qualified to carry out operation, maintenance, and testing functions required to insure compliance with the conditions of this permit.

11. Duty to Mitigate

The permittee shall take all reasonable steps to prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health, the environment, or the water receiving the discharge.

12. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of waste waters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering the waters of the State.

13. Reporting of Violations and Unauthorized Discharges

A. Any violations to this permit must be reported to the Enforcement Branch of the Department immediately. Any leaks or seeps shall be reported to the Department and appropriately corrected. Any discharge from the fluids storage system such as an overflow, a broken pipe, etc., shall be immediately reported to the Department.

B. The operator shall visually monitor and report immediately (within 24 hours) to the Enforcement Branch any unauthorized discharge from any facility caused by dike or structural failure; equipment breakdown; human error; etc., and shall follow up with a written report within five (5) days of such occurrence. The written report shall contain the following:

i. A description of the permit violation and its cause;
ii. The period of the violation, including exact times and dates;
iii. If the violation has not been corrected, the anticipated time expected to correct the violation; and
iv. Steps taken or planned to reduce, eliminate, and prevent the recurrence of the violation.

C. Reports shall be submitted to the Enforcement Branch at the following address:

Arkansas Department of Environmental Quality
Water Division, Enforcement Branch
5301 Northshore Dr.
North Little Rock, Arkansas 72118
Fax (501) 682-0880

Or

Water-enforcement-report@adeq.state.ar.us

14. Penalties for Tampering

The Arkansas Water and Air Pollution Control Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under the Act shall be guilty of a misdemeanor and upon conviction thereof shall be subject to imprisonment for not more than one (1) year or a fine of not more than ten thousand dollars ($10,000) or by both such fine and imprisonment.

15. Laboratory Analysis

All laboratory analyses submitted to the Department shall be completed by a laboratory certified by ADEQ under Ark. Code Ann. § 8-2-201 *et seq*. Analyses for the permittee's internal quality control or process control do not need to be performed by an ADEQ certified laboratory.

16. Retention of Records

The permittee shall retain records of all monitoring information, copies of all reports required by this permit, and records of all data used to complete the application for this permit for a period of at least 3 years from the date of the sample, measurement, report, or application. This period may be extended by request of the Director at any time.

17. Record Contents

Records and monitoring information shall include:

A. The date, exact place, time, and methods of sampling or measurements, and preservatives used, if any;
B. The individuals(s) who performed the sampling or measurements;
C. The date(s) the analyses were performed;
D. The individual(s) who performed the analyses;
E. The analytical techniques or methods used; and
F. The measurements and results of such analyses.

18. Inspection and Entry

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

A. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
B. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
C. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit,
D. Sample, inspect, or monitor at reasonable times, for the purposes of assuring permit compliance any substances or parameters at any location.

19. Planned Changes

The permittee shall give notice and provide the necessary information to the Director for review and approval prior to any planned physical alterations or additions to the permitted facility.

20. Anticipated Noncompliance

The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

21. Transfers

The permit is nontransferable to any person except after notice to the Director. The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Act.

22. Duty to Provide Information

The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying; revoking and reissuing; terminating this permit; or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit. Information shall be submitted in the form, manner, and time frame requested by the Director.

23. Duty to reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The complete application shall be submitted at least 180 days before the expiration date of this permit. The Director may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date. Conditions of this permit will continue in effect past the expiration date pending issuance of a new permit, if:

A. The permittee has submitted a timely and complete application; and
B. The Director, through no fault of the permittee, does not issue a new permit prior to the expiration date of the previous permit.

24. Signatory Requirements

A. All applications, reports, or information submitted to the Director shall be signed and certified. All permit applications shall be signed as follows:

   i. For a corporation: by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:

      a. A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or
      b. The manager of one or more manufacturing, production, or operation facilities, provided the manager is authorized to make management decisions which govern the operation of the regulated facility including: having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

   ii. For a partnership or sole proprietorship: by a general partner or proprietor, respectively; or

   iii. For a municipality, State, Federal, or other public agency; by either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a Federal agency includes:

      a. The chief executive officer of the agency, or
      b. A senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

B. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   i. The authorization is made in writing by a person described above.
   ii. The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, or position of equivalent

responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and

iii. The written authorization is submitted to the Director.

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

25. Availability of Reports

Except for data determined to be confidential under the Arkansas Trade Secrets Act (Ark. Code Ann. § 4-75-601 *et seq.*), all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Department of Environmental Quality. As required by the Regulations, the name and address of any permit applicant or permittee, permit applications, permits, and effluent data shall not be considered confidential.

26. Penalties for Falsification of Reports

The Arkansas Air and Water Pollution Control Act provides that any person who knowingly makes any false statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained under this permit shall be subject to civil penalties and/or criminal penalties under the authority of the Arkansas Water and Air Pollution Control Act.

27. Applicable Federal, State, or Local Requirements

Permittees are responsible for compliance with all applicable terms and conditions of this permit. Receipt of this permit does not relieve any operator of the responsibility to comply with any other applicable Federal, State, or local statute, ordinance policy, or regulation.

Part IV
Definitions

"Act" means the Arkansas Water and Air Pollution Control Act (Ark. Code Ann. § 8-4-101 et seq.)

"APC&EC" means the Arkansas Pollution Control and Ecology Commission.

"ANRC" means the Arkansas Natural Resources Commission.

"Available Acreage" means total acreage minus buffer zones

"Daily Maximum" means the highest allowable "daily discharge" during the calendar month.

"Department" means the Arkansas Department of Environmental Quality (ADEQ).

"Director" means the Director of the Arkansas Department of Environmental Quality.

"Grab sample" means an individual sample collected in less than 15 minutes in conjunction with an instantaneous flow measurement.

"MG" means million gallons.

"MGD" means million gallons per day.

"mg/l" means milligrams per liter or parts per million (ppm).

"NH_3" means Ammonia Nitrogen.

"$NO_3 + NO_2$" means Nitrate + Nitrite Nitrogen.

"PAN" means Plant Available Nitrogen.

"ppm" means parts per million.

"Sewage sludge" means the solids, residues, and precipitate separated from or created in sewage by the unit processes a publicly-owned treatment works. Sewage as used in this definition means any wastes, including wastes from humans, households, commercial establishments, industries, and storm water runoff that are discharged to or otherwise enter a publicly-owned treatment works.

"s.u." means standard units.

"TKN" means Total Kjeldahl Nitrogen.

"Visisble sheen" means a presence of a film or sheen or a discoloration of the surface of the sample fluids.

"Annual" or "Yearly" is defined as a fixed calendar year or any portion of the fixed calendar year for an effluent characteristic or parameter with a measurement frequency of once/year. A calendar year is January through December, or any portion thereof.

Monitoring and Reporting:

When a permit becomes effective, monitoring requirements are of the immediate period of the permit effective date. Where the monitoring requirement for an effluent characteristic is monthly or more frequently, the No-Discharge Monitoring Report (NMR) shall be submitted by the 15th of the month following the sampling. Monthly is defined as a calendar month or any portion of a calendar month for monitoring requirement frequency of once/month or more frequently.

STATEMENT OF BASIS

This Statement of Basis is for information and justification of the permit limits only and is not enforceable. This permit decision is for renewal of a No-Discharge operation under permit number 4725-WR-5 and AFIN 04-00630. A 2nd public notice is required because the City of Bethel Heights requested to remove land application of treated effluent from the application and submitted a revised Waste Management Plan on March 13, 2015. Only the modified sections of the permit and the waste management plan are open to public comments.

1. Permitting Authority

Arkansas Department of Environmental Quality
Water Division, Permits Branch
5301 Northshore Drive
North Little Rock, Arkansas 72118-5317

2. Applicant

City of Bethel Heights Treatment Facility
530 Sunrise Drive
Bethel Heights, AR 72764

3. Facility Location

The facility located as follows: Located at the Southeast corner of Apple Blossom and Lincoln Streets of Bethel Heights in Section 13, Township 18 North, Range 30 West, in Benton County, Arkansas. The facility is located at the following coordinates:

Latitude: 36° 14′ 12″ N Longitude: 94° 7′ 55″ W

4. Receiving Stream Location

The facility is located in Stream Segment 3J of the Arkansas River Basin, which is in the Nutrient Surplus Area. Surrounding areas were evaluated to determine if any Extraordinary Resource Waters (ERWs), Ecologically Sensitive Waterbodies (ESWs), Natural or Scenic Rivers, or waterbodies in the 2008 ADEQ 303(d) list of impaired waterbodies in the State of Arkansas are near the facility. It was determined that the facility is approximately 2 miles from Spring Creek, which is on the 303(d) list for total phosphorus and pathogens from unknown sources. The facility meets the required setbacks; therefore, no additional requirements are needed.

5. Previous Permit Activity

Previous Permit No.: 4725-WR-4
Effective Date: November 1, 2009
Expiration Date: October 31, 2014

The permittee submitted a permit renewal application which was received on 6/3/2014 with additional information submitted on 6/18/2014, 6/19/2014, 8/4/2014, 8/18/2014, 9/3/2014, 9/5/2014,

9/10/2014, 10/22/2014, and 3/12/2015. An updated waste management plan was submitted on 3/12/15 to remove the land application activity. It is proposed that the current water No-Discharge permit be reissued for a 5-year term. The permit was originally drafted on 1/09/2015 and is being redrafted based on the changes listed in No. 6 below.

No-Discharge Monitoring Report Review:

The No-Discharge Monitoring Reports (NMR's) since the last inspection were reviewed during the permitting process. For Phases 1, 2, and 3, there were eight monitoring violations for Carbonaceous Biochemical Oxygen Demand (CBOD5), four monitoring violations for total suspended solids (TSS), and six monitoring violations for fecal coliform bacteria (FCB). For Phase 4, there were four monitoring violations for CBOD5, four monitoring violations for TSS, and four monitoring violations for FCB. The facility has repaired system components to address the effluent violations.

Legal Order Review:

There are currently no active Consent Administrative Orders (CAOs) or Notice of Violations (NOVs) for this facility.

Site Visits/Inspections:

The last inspection was performed on December 9, 2014. The inspection revealed several violations including continued effluent violations, effluent surfacing, and not notifying the Department of these violations. The facility is currently working with the Enforcement Branch to resolve these violations.

6. Changes From the Previously Drafted Permit

A. Removal of all land application from drafted permit (Part I, Part II, and Statement of Basis) in accordance with March 13, 2015 Waste Management Plan.
B. Added requirements to monitor and report Ammonia Nitrogen, Nitrate Nitrogen, Nitrite Nitrogen, and Plant Available Nitrogen. See Table I of Part I, Condition 6 of Part II and Statement of Basis 13.A.ii.i and Statement of Basis 13.B.ii.
C. Removal of requirements for lysimeters and groundwater monitoring, including monitoring requirements. See Statement of Basis 13.B.iv-v.

7. Applicant Activity

Under the standard industrial classification (SIC) code 4952 or North American Industry Classification System (NAICS) code 22132, the applicant activities are for the operation of sewage treatment facilities. This permit is for the operation of a decentralized wastewater treatment with drip irrigation dispersal of the treated wastewater.

8. Consultant for this Facility

James Geurtz, P.E.
Earthplan Design Alternatives, P.A.
134 W. Emma Ave.
Springdale, AR 72764

9. Facility Type, Size, and Design Flowrates

The facility is comprised of four separate phases with Phases 1 through 3 operating on an eleven acre parcel and Phase 4 operating on a ten acre parcel. Each site is self-contained. The total design capacity for the facility is 180,000 gallons per day with the current operating average flow of 80,000 gallons per day. The facility was designed by assuming each residence contained 2.6 persons and discharged an average of 80 gallons per day from its Septic Tank Effluent Pump (STEP) unit. Commercial contributions to the systems were calculated on a case by case basis.

10. Waste Treatment and Storage Components

Each residence or commercial business is connected to a STEP unit where primary treatment of raw sewage occurs. Each residence is connected to a 1,500 gal STEP unit, and each commercial business is connected to at least a 1,500 gal STEP unit. The effluent is pumped to a centralized location through small diameter (2", 3" and 4") pressure lines and treated with AdvanTex AX100 pods. The effluent passes through recirculation tanks where additional settlement of solids occurs. A portion of the effluent enters the dose tank from the recirculation tank for disposal in the drip dispersal field.

The drip field consists of individual zones, which were sized to equally distribute effluent across the fields. Dispersal in Phase 1 consists of 26,723 linear feet of drip field lines. Dispersal in Phase 2 consists of 43,580 linear feet of drip field lines. Dispersal in Phase 3 consists of 44,200 linear feet of drip field lines. Dispersal in Phase 4 consists of 115,250 linear feet of drip field lines.

11. Drip Irrigation Field Size and Loading Rate

Phase 1, 2 and 3 has a minimum drip field size of 5.25 acres. Phase 4 has a minimum drip field size of 6.46 acres. Phase 1 consists of 26,723 linear feet, 53,446 sq ft. Phase 2 consists of 43,580 linear feet, 87,160 sq ft. Phase 3 consists of 44,200 linear feet, 88,400 sq ft. Phase 4 consists of 115,250 linear feet, 230,400 sq ft.

12. Reserve Irrigation Field Size

Phase 1, 2 and 3 have 3.97 acres in reserve. Phase 4 has 0.08 acres in reserve.

13. Basis for Permit Conditions

The Arkansas Department of Environmental Quality has made a determination to issue a permit for the No-Discharge facility as described in the application and waste management plan. Permit requirements and conditions are authorized pursuant to the Arkansas Water and Air Pollution Control Act (Ark. Code Ann. 8-4-101 *et seq.* and Ark. Code Ann. § 8-4-201 *et seq.*) and regulations promulgated there to and Regulation No. 17 Arkansas Underground Injection Control (UIC) Code.

Specific permit conditions and limits and their sources are listed as follows:

A. Part I – Permit Requirements

i. Monitoring Frequency

a. Drip Irrigation

The waste cannot be sampled prior to every application as waste is constantly being applied. Therefore, frequent monitoring of the effluent is required to ensure the effluent is meeting the requirements of the permit.

ii. Waste Conditions

a. Reporting requirements for monthly total flow and daily maximum flow

The monthly total flow and daily maximum flow are required to be monitored and reported to assess whether the system is being operated at or below the design flow rates.

b. Limit for Carbonaceous Biochemical Oxygen Demand (CBOD5)

This limit is intended to prevent the formation of algae that contributes to the clogging of emitters and other equipment within the drip irrigation system. According to the Onsite Wastewater Treatment Systems Manual, Drip Irrigation systems are capable of meeting CBOD5 concentrations as low as 5 mg/l. The Department has determined that a concentration of 15 mg/l is a consistently achievable limit and appropriate because treated effluent is being dispersed in a non-public area and is receiving additional treatment by the soil.

c. Limit for Total Suspended Solids (TSS)

This limit is required to prevent the small diameter spray emitters within the drip system from becoming clogged with suspended solids or algae growth within the wastewater. According to the Onsite Wastewater Treatment Systems Manual, Drip Irrigation systems are capable of meeting TSS concentrations as low as 5 mg/l. The Department has determined that a concentration of 15 mg/l is a consistently achievable limit and appropriate because treated effluent is being dispersed in a non-public area and is receiving additional treatment by the soil.

d. Limit for Fecal Coliform Bacteria (FCB)

According to the Onsite Wastewater Treatment Systems Manual, Drip Irrigation systems are capable of meeting low levels of Fecal Coliform. The Department has determined that bacteria concentration of 10,000 col/100ml is a consistently achievable limit and appropriate where treated effluent is being dispersed in a non-public area and is receiving additional treatment by the soil. However, since the depth of the groundwater table is less than five feet at this location, there may be insufficient soil to treat the fecal coliform bacteria before entering waters of the State.

Therefore the permittee must meet a discharge concentration of 2,000 col/100 ml for fecal coliform in accordance APC&EC Regulation 2.

e. Minimum and maximum pH

The allowable pH range of 6.0-9.0 is adopted from APC&EC Regulation No. 2 because this range also supports bacteria and plant growth in the drip irrigation field.

f. Reporting requirements for Total Phosphorus (TP)

Monitoring and reporting requirements for Total Phosphorus are required to evaluate the amount of phosphorus being added to the drip irrigation field. Phosphorus has been determined to cause eutrophication in surface waters, which may be reached due to drip irrigation activities or heavy rains. Also, see 13.B.ii of the Statement of Basis.

g. Reporting requirements for percent total solids in the waste

This parameter is required to convert effluent analysis values between a wet and dry basis.

h. Drip field loading rates

The drip irrigation field soil loading rates are determined by a Professional Soil Classifier registered in the state of Arkansas to ensure that the drip field zones are not hydraulically overloaded. Loading rates by the system should not exceed the soil loading rates to avoid hydraulically overloading the soil. Effluent flow to a zone can be used to calculate the loading rate of the specified zone. If the calculated loading rate exceeds the design soil loading rate, or visual observation of surfacing effluent, the zone is hydraulically overloaded should be removed from the dosing rotation or dose volume reduced until sufficient time has passed for the zone to dry out.

i. Reporting requirements for all nitrogen compounds in the waste

These concentrations are required to calculate the plant available nitrogen to comply with Part II, Condition No. 6 of the permit. The plant available nitrogen dispersed to the irrigation field should not exceed the nitrogen uptake of the vegetation in the drip irrigation area, otherwise nitrogen compounds could migrate to Waters of the State.

B. Part II – Specific Conditions

i. Requirements for maintaining a reserve drip irrigation field

A reserve drip irrigation field is required in the event that the drip irrigation field becomes hydraulically overloaded and no longer absorbs the volume of treated effluent at the soil loading rates for the associated zone.

ii. No pooling, no ponding, no discharge

Any activity occurring under this permit shall not discharge to the waters of the State. A discharge from this site may result in pollutants entering the waters of the State, which is a violation of Ark. Code Ann. § 8-4-217. In order to prevent a discharge from the permitted operation, the facility shall control the rate of application to prevent pooling, ponding, overland flow, or runoff.

iii. Reporting requirements for all nitrogen compounds in the treated waste, Plant Available Nitrogen (PAN) application limit and vegetation cover requirement

Any land application of treated waste is limited by the nitrogen uptake of the cover crop. Nitrate-Nitrogen, Nitrite-Nitrogen, Ammonia-Nitrogen, and Total Kjeldahl Nitrogen need to be monitored and reported on an annual basis to calculate the Plant Available Nitrogen (PAN) in order to comply with Condition No. 6 of Part II of the permit and to ensure that the waste is not being over applied to the land application sites. The application rate is designed to provide the amount of nitrogen needed by the crop or vegetation while minimizing the risk of nitrogen supplied in the waste from migrating to the groundwater. This limit ensures that nitrogen supplied in the waste will have no greater impact on groundwater than that supplied in agricultural operations using commercial fertilizers or manure. A vegetative cover is required for stabilization purposes to reduce the risk of soil erosion and runoff.

If the PAN of the effluent exceeds the nitrogen uptake of the cover crop, the facility may be required to adjust their treatment system at the next permit renewal to reduce the PAN of the effluent so that it does not exceed the nitrogen uptake rate of the cover crop.

iv. Requirement to inspection for damage of drip field 24 hours after activities have ceased

The facility has a history of damaged drip field lines or system components occurring during activities such as disking or mowing the field; therefore, the drip field should be inspected after any activity that may cause damage to the field is completed. Because surfacing of effluent from damaged lines will take time, inspections of the drip field should occur 24 hours after activity has ceased in that area of the drip field. Any damaged lines or other system components should be repaired immediately. The Department requires that records be kept on-site for review of inspections and when repairs are began and completed.

v. Removal of lysimeter requirements

Upon review of approximately four years of quarterly monitoring data, the Department has determined that the laboratory analyses of the fluids collected in the lysimeters are not providing sufficient information to assess the environmental impact of the treatment unit. Adherence to the treated effluent limitations in Part I, Table 1 of the permit and monthly monitoring of the treated effluent will minimize any migration of pollutants to water of the State. Additionally, the soil provides additional treatment of the effluent in the drip irrigation field. To prevent hydraulically overloading in the drip field, the addition of the requirement for inspections for damage 24 hours after activities have ceased and the

increase in monitoring of flow to twice per week were added to the permit in place of lysimeters.

vi. Removal of monitoring well requirements

Upon review of approximately four years of quarterly monitoring data, the Department has determined that the laboratory analysis of the fluids collected from the monitoring wells are not providing sufficient information to assess the environmental impact of the treatment unit. Adherence to the treated effluent limitations in Part I, Table 1 of the permit and monthly monitoring of the treated effluent will minimize any migration of pollutants to water of the State. Additionally, the soil provides additional treatment of the effluent in the drip irrigation field.

C. *Part III – Standard Conditions*

Standard Conditions have been included in this permit based on generally accepted scientific knowledge, engineering practices and the authority of the Arkansas Water and Air Pollution Control Act (Ark. Code Ann. § 8-4-101 et seq.).

D. *Part IV – Definitions*

All definitions in Part IV of the permit are self-explanatory.

14. Response to Comments from the Public Notice for the 1st Draft Permit

The Department originally drafted a permit for the operation of a decentralized wastewater treatment system with drip irrigation dispersal of the treated wastewater for a municipality and the land application of treated effluent. Based on the request from the City of Bethel Heights, the March 12, 2015 Waste Management Plan, and the changes listed in No.6 of the Statement of Basis, this permit had to be redrafted and sent to another public notice period in accordance with APC&EC Regulation 8.103(V). Four (4) comments were received from the Arkansas Department of Health (ADH) during the public comment period. Below are the comments submitted from the 1st public notice of the permit with the Department response.

Comment 1 It is our understanding that Bethel Heights is proposing to spray apply treated effluent on the property belonging to two different land owners. Please provide details on the spray application methods.

Response: The Department acknowledges the comment. The permittee has requested to remove land application from the permit; therefore, the permit has been redrafted to remove land application.

Comment 2 The application sites appear to be the gross area of the property, not the actual available application area. Please provide maps or drawings showing the sites and the setbacks so that the available land application area is clearly delineated.

Response: The Department acknowledges the comment. The permittee has requested to remove land application from the permit; therefore, the permit has been redrafted to remove land application.

Comment 3 What is the current peak daily flow through the treatment plants?

Response: The Department acknowledges this comment. According to the most recent No-Discharge Monthly Monitoring Report submitted to the Department, the maximum daily flow for Phase 1 is 12,509 gallons per day. For Phase 2, it is 28,005 gallons per day. For Phase 3, it is 18,998 gallons per day. For Phase 4, it is 23,363 gallons per day.

Comment 4 The Engineering Section requires that plans be submitted for review and approval before construction is initiated.

Response: The Department acknowledges this comment. The Department has not received any new plans for the facility that have not already been approved for previous permits.

15. Point of Contact

For additional information, contact

Katherine McWilliams
Engineer
Permits Branch, Water Division
5301 Northshore Drive
North Little Rock, AR 72118-5317
501-682-0651
E-mail: mcwilliamsk@adeq.state.ar.us

Technical review

Jamal Solaimanian, Ph.D., P.E.
Engineer Supervisor, No Discharge Section
Permits Branch, Water Division
5301 Northshore Drive
North Little Rock, AR 72118-5317
501-682-0620
E-mail: jamal@adeq.state.ar.us

16. Sources

The following Sources were used to draft the permit:

A. APC&EC Regulation No. 2, Regulation Establishing Water Quality Standards for Surface Waters of the State of Arkansas.
B. APC&EC Regulation No. 3, Licensing of Wastewater Treatment Plant Operators.
C. APC&EC Regulation No. 5, Liquid Animal Waste Management Systems, as amended.
D. APC&EC Regulation No. 8, Administrative Procedures.
E. APC&EC Regulation No. 9, Fee System for Environmental Permits, as amended.
F. APC&EC Regulation No. 17, Arkansas Underground Injection Control Code.
G. Ark. Code Ann. § 8-4-101 et seq., Arkansas Water and Air Pollution Control Act.
H. Ark. Code Ann. §§ 8-4-203 and 8-5-703, as amended.
I. Ark. Code Ann. § 8-5-205, as amended.
J. 40 C.F.R Parts 144 and 146.
K. Integrated Water Quality and Assessment Report (305(b) Report).
L. Arkansas Department of Health, "Rules and Regulations Pertaining to Onsite Wastewater Systems."
M. Application No. 4725-WR-5 received 6/3/2014.
N. Waste Management Plan dated March 13, 2015.
O. Additional information received 6/18/2014, 6/19/2014, 8/4/2014, 8/18/2014, 9/3/2014, 9/5/2014, 9/10/2014, and 10/22/2014.
P. Inspection report dated 7/9/2013.
Q. No-Discharge Monthly Monitoring Reports.

RESPONSE TO COMMENTS
FINAL PERMITTING DECISION

Permit No.: 4725-WR-5

Applicant: City of Bethel Heights

Prepared by: Katherine McWilliams

The following are responses to comments received regarding the draft permit number above and are developed in accordance with regulations promulgated at APC&EC Regulation No. 8, Administrative Procedures.

Introduction

The above permit was submitted for public comment on May 24, 2015. The public comment period ended on June 23, 2015.

The Arkansas Department of Health (ADH) sent one (1) comment to the ADEQ during the public notice period.

	Commenter	# of comments raised
1.	ADH	1

Comment 1 Bethel Heights needs to accurately measure, record and report daily flow rates of each separate treatment facility.

Response: The Department acknowledges the comment. The permit requires the facility to monitor and report daily maximum flow as well as report the total monthly flow in Table 1 of the permit. The facility must monitor and report daily the loading rate for each approved zone in each phase of the facility.

Appendix D – Original Soil Analysis Phases I, II, & III

Herron's
Soil
Interpretations

Post Office Box 1086
Farmington, Arkansas 72730

Phone 479-267-3991
Fax 479-267-5683

SUMMARY OF SOIL INTERPRETATIONS & LOADING RATES
12 ACRES ADJACENT TO BETHEL HEIGHTS CITY HALL

PIT NO.	LIMITING TEXTURE	% POROSITY	BRIEF	MODERATE	ADJUSTED MODERATE (IN)	ADJUSTED MODERATE (FT)	EVAPOTRANS.	LOADING RATE
5000	Silt	0.3	15	33	27	2.25	0.28	0.56
5001	Silt	0.3	26	50	42	3.50	0.28	0.72
5002	Silt	0.3	0	40	27	2.22	0.28	0.56
5003	Silt	0.3	28	40	36	3.00	0.28	0.65
5006	Silt	0.3	0	32	21	1.78	0.28	0.50
5007	Silt	0.3	20	36	31	2.56	0.28	0.60
5008	Silt	0.3	20	28	25	2.11	0.28	0.54
5009	Silt	0.3	25	30	28	2.36	0.28	0.57
5010	Silt	0.3	31	36	34	2.86	0.28	0.64
5011	Silt	0.3	28	36	33	2.78	0.28	0.63
5012	Silt	0.3	30	50	43	3.61	0.28	0.73
5013	Silt	0.3	26	33	31	2.58	0.28	0.60
5014	Silt	0.3	38	50	46	3.83	0.28	0.76
5015	Silt	0.3	28	37	34	2.83	0.28	0.63
5016	Silt	0.3	34	50	45	3.72	0.28	0.74
5017	Silt	0.3	28	50	43	3.56	0.28	0.72
5018	Silt	0.3	26	41	36	3.00	0.28	0.65
5019	Silt	0.3	22	32	29	2.39	0.28	0.58
5020	Silt	0.3	25	50	42	3.47	0.28	0.71
5021	Silt	0.3	28	32	31	2.56	0.28	0.60
5022	Silt	0.3	0	50	33	2.78	0.28	0.63
5023	Silt	0.3	23	32	29	2.42	0.28	0.58
5024	Silt	0.3	25	50	42	3.47	0.28	0.71
5025	Silt	0.3	20	25	23	1.94	0.28	0.52
5026	Silt	0.3	16	28	24	2.00	0.28	0.53
5027	Silt	0.3	15	19	18	1.47	0.28	0.46
5028	Silt	0.3	0	25	17	1.39	0.28	0.45
5029	Silt	0.3	0	34	23	1.89	0.28	0.52
5030	Silt	0.3	23	26	25	2.08	0.28	0.54
5031	Silt	0.3	22	29	27	2.22	0.28	0.56
5032	Silt	0.3	23	29	27	2.25	0.28	0.56
5033	Silt	0.3	20	26	24	2.00	0.28	0.53
5034	Silt	0.3	0	29	19	1.61	0.28	0.48
5035	Silt	0.3	17	25	22	1.86	0.28	0.51
5036	Silt	0.3	23	26	25	2.08	0.28	0.54
5037	Silt	0.3	20	26	24	2.00	0.28	0.53
5038	Silt	0.3	31	37	35	2.92	0.28	0.64
5039	Silt	0.3	22	26	25	2.06	0.28	0.54
5040	Silt	0.3	22	27	25	2.11	0.28	0.54
5041	Silt	0.3	23	29	27	2.25	0.28	0.52
5042	Silt	0.3	23	27	26	2.14	0.28	0.55

Appendix E – Original Soil Analysis Phase IV

SOIL DESCRIPTION FOR DRIP IRRIGATION - BETHEL HEIGHTS N. OAK STREET

PIT #	DEPTH (IN)	DEPTH TO REDUCED/ DEPLETED IRON (IN)	REDOX COLORS	MOST LIMITINGT EXTURE	STRUCTURE IN DRIP ZONE	MOST LIMITING CONSISTENCE	DEPTH TO 90% + ROCK (IN)	DEPTH TO SATURATION (IN)	LOADING RATE (GPD/SQ.FT.)
1	31	21	10YR 6/2	SICL	MOD SBK	FRIABLE	31	N/A	0.4
2	48	21	10YR 6/2	SICL	MOD PRIS	FRIABLE	35	N/A	0.4
3	48	23	10YR 6/2	SICL	MOD SBK	FRIABLE	36	N/A	0.4
4	52	30	10YR 6/2	SICL	MOD SBK	FRIABLE	36	N/A	0.4
5	48	21	10YR 7/1	SICL	MOD SBK	FRIABLE	20	N/A	0.4
6	48	21	10YR 6/2	SICL	MOD SBK	FRIABLE	24	N/A	0.4
7	48	15	10YR 6/2	SICL	MOD SBK	FRIABLE	30	N/A	0.4
8	48	26	10YR 6/2	SICL	MOD SBK	FRIABLE	27	N/A	0.4
9	50	21	10YR 6/2	SICL	MOD SBK	FRIABLE	25	N/A	0.4
10	52	24	10YR 6/2	SICL	MOD SBK	FRIABLE	26	N/A	0.4
11	54	32	10YR 6/2	SICL	MOD SBK	FRIABLE	29	N/A	0.4
12	48	26	10YR 6/2	SICL	MOD SBK	FRIABLE	24	N/A	0.4
13	53	24	10YR 6/2	SICL	MOD SBK	FRIABLE	26	N/A	0.4
14	48	26	10YR 6/2	SICL	MOD SBK	FRIABLE	24	N/A	0.4
15	50	22	10YR 6/2	SICL	MOD SBK	FRIABLE	24	N/A	0.4
16	45	21	10YR 6/2	SICL	MOD SBK	FRIABLE	30	N/A	0.4
17	48	24	10YR 6/2	SICL	MOD SBK	FRIABLE	25	N/A	0.4
18	45	24	10YR 6/2	SICL	MOD SBK	FRIABLE	27	N/A	0.4
19	50	28	10YR 6/2	SICL	MOD SBK	FRIABLE	33	N/A	0.4
20	DISTURBED - 28" OF FILL ON TOP								0.4
21	46	29	10YR 6/2	SICL	MOD SBK	FRIABLE	34	N/A	0.4
22	48	21	10YR 6/2	SICL	MOD SBK	FRIABLE	30	N/A	0.4
23	52	21	10YR 6/2	SICL	MOD SBK	FRIABLE	27	N/A	0.4
24	46	26	10YR 6/2	SICL	MOD SBK	FRIABLE	22	N/A	0.4
25	49	24	10YR 6/2	SICL	MOD SBK	FRIABLE	25	N/A	0.4
26	48	24	10YR 6/2	SICL	MOD SBK	FRIABLE	27	N/A	0.4
27	47	21	10YR 6/2	SICL	MOD SBK	FRIABLE	24	N/A	0.4
28	48	20	10YR 6/2	SICL	MOD SBK	FRIABLE	UNKNOWN	6	NONE
29	48	15	10YR 6/2	SICL	MOD SBK	FRIABLE	UNKNOWN	6	NONE
30	50	18	10YR 6/2	SICL	MOD SBK	FRIABLE	UNKNOWN	6	NONE
31	48	16	10YR 6/2	SICL	MOD SBK	FRIABLE	UNKNOWN	4	NONE
32	50	24	10YR 6/2	SICL	MOD SBK	FRIABLE	23	7	NONE
33	50	20	10YR 6/2	SICL	MOD SBK	FRIABLE	26	6	NONE

From:	McWilliams, Katherine
To:	Richardson, Stefanie
Subject:	FW: 4725-WR-5 (Bethel Heights)
Date:	Monday, August 04, 2014 12:08:20 PM
Attachments:	image003.png SOILS4DRIP.pdf

4725-WR-5

From: Steve Hesse [mailto:sah@eda-pa.com]
Sent: Monday, August 04, 2014 10:19 AM
To: McWilliams, Katherine
Cc: 'James Geurtz'
Subject: RE: 4725-WR-5 (Bethel Heights)

Ms. McWilliams, attached is the soils information from the original drip dispersal design for Phase 4.

Let me know if you need anything else.

Steve A. Hesse, PE, CFM

Earthplan Design Alternatives, PA
Civil Engineering / Landscape Architecture

134 West Emma Ave.
Springdale, AR 72764
P 479-756-1266
F 479-756-2129
www.eda-pa.com

From: James Geurtz [mailto:jrg@eda-pa.com]
Sent: Friday, July 25, 2014 3:25 PM
To: 'Steve Hesse'
Subject: FW: 4725-WR-5 (Bethel Heights)

-James Geurtz, P.E.

From: McWilliams, Katherine [mailto:MCWILLIAMSK@adeq.state.ar.us]
Sent: Monday, July 21, 2014 9:24 AM
To: 'James Geurtz '
Subject: 4725-WR-5 (Bethel Heights)

Mr. Geurtz,

After reviewing the submitted waste management plan with this application as well as information on the website for the drip irrigation portion of the permit, I could not find the soil loading rate used for the Phase 4 site. Could you please provide this? I am still reviewing the land application portion.

Thanks,
Katherine McWilliams
Engineer
ADEQ, Water Division
501-682-0651

Appendix F – 2019 Drip Dispersal Field Soil Analysis

Corbitt Environmental Consulting
corbittenvironmentalconsulting@gmail.com
PO Box 937
Lowell, AR 72745
479-466-6183

October 15, 2019

City of Bethel Heights
c/o Rick Sayre

cc: Engineering Design Associates
c/o James Guertz

Soil Morphology testing results

Date performed: **October 9, 2019**

Address or Location performed: **5901 S. Lincoln Street, Lowell, AR**

County: **Benton**

Parcel # and acreage: **20-00035-010**

Requested by **James Geurtz**

# of tests performed: **4**

Results:

Pit 1 (south)
>36" to bedrock
Brief Seasonal Water Table at 0" with Mn and Fe
Moderate Seasonal Water Table at 15" with chroma 2 Fe depletions
In areas where the slope is >3% a curtain drain can be utilized to lower the brief seasonal water table down to 18".
With a curtain drain the loading rate for this pit would be .103 gal/ft.^{2}/day

Pit 2 (middle)
>36" to bedrock
Brief Seasonal Water Table at 0" with Mn and Fe
Moderate Seasonal Water Table at 15" with chroma 2 Fe depletions
In areas where the slope is >3% a curtain drain can be utilized to lower the brief seasonal water table down to 18".
With a curtain drain the loading rate for this pit would be .103 gal/ft.^{2}/day

Pit 3 (middle)
>36" to bedrock
Brief Seasonal Water Table at 28" with >2 mm Mn
The loading rate for this pit would be .574 gal/ft.^{2}/day

Pit 4 (north)
>36" to bedrock
Brief Seasonal Water Table at 0" with Mn and Fe
Moderate Seasonal Water Table at 27" with chroma 2 Fe depletions
In areas where the slope is >3% a curtain drain can be utilized to lower the brief seasonal water table down to 18".
With a curtain drain the loading rate for this pit would be .164 gal/ft.^{2}/day

A brief water table is defined as the following and is the least restrictive:

-Iron Concentrations or depletions on soil surfaces with chroma >3 and not more than 50% or more on soil surfaces
-Manganese masses on >2% of soil surfaces
-Iron or manganese nodules or concentrations >2 mm in diameter

A moderate water table is defined as the following and more restrictive:
-Any chroma 2 iron depletions on soil surfaces
-50% or > Chroma 3 iron depletions on soil surfaces
-35-49% clay

Loading rate:
The higher the loading rate the better the soil test and the less amount of line you need. The lower the number the less suitable the soil test is and the more lateral line you need.

Drip lines must maintain the following setbacks:

10' from property lines, structures, and buried utilities

50' from a pond on the same parcel

100' from a pond on an adjoining parcel, well, creek, stream, spring, etc.

Conclusion

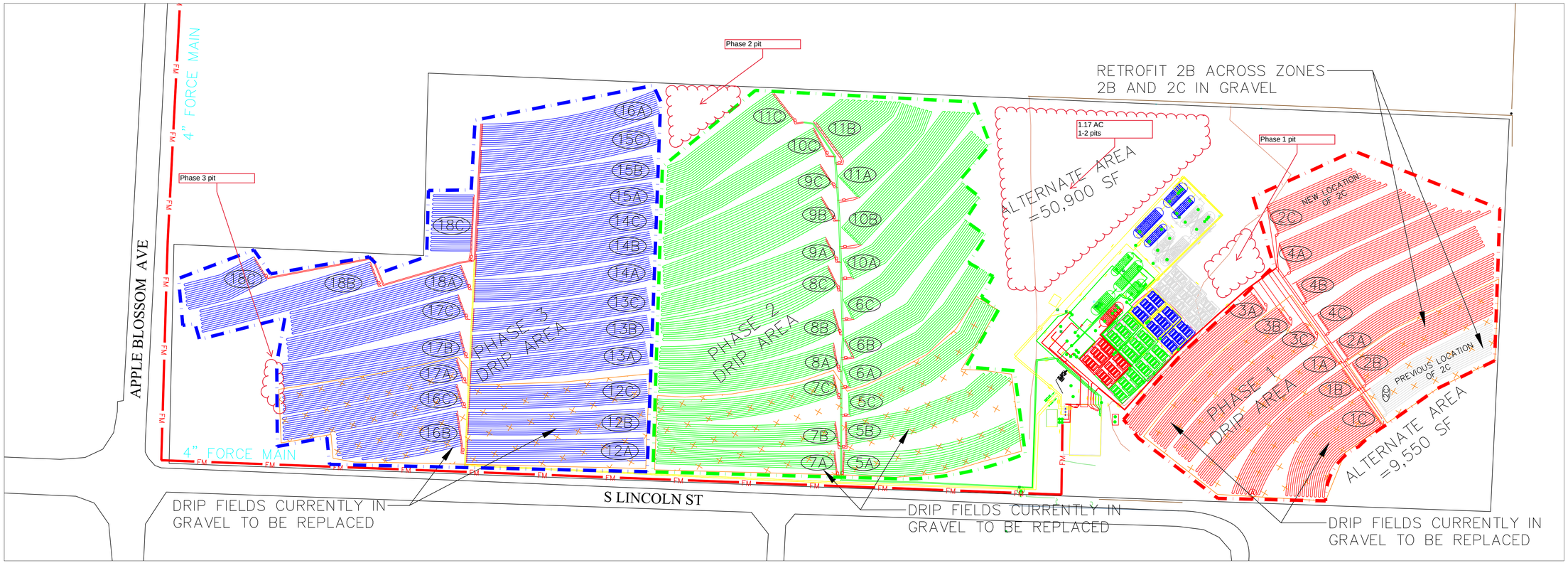
Our conclusion is that the soil in the pits observed on the property is marginally suitable in three of the four pits observed with the addition of a curtain drain and where the slope is at least 3%. I observed these pits along with Samuel Dunn and Kyle Krievans of the Arkansas Department of Health. The information above will have to be reviewed by the Arkansas Department of Environmental Quality and verified on site before any permit or approval for the use of these soils for a sewage disposal system can be granted. The soil in other areas of the property could be more or less suitable.

If you have any questions about any of the information within this report please, call, or email me for further explanation. We appreciate your business!

Sincerely,

Rebecca Corbitt

Rebecca Corbitt, Professional Soil Classifier #60
Corbitt Environmental Consulting



PLANT 1 DRIP FIELDS

PHASE 1 AND 2 COLLECTIONS
PHASE 1,2 AND 3 DRIP FIELDS
5891 LINCOLN DR
BETHEL HEIGHTS, AR

Revised Drip Field Zone Identification

Phase 1		Phase 2			Phase 3	
Zone ID	*Zone Area (ft^2)	Zone ID	Previous Zone ID	*Zone Area (ft^2)	Zone ID	*Zone Area (ft^2)
1A	3894	5A	1A	4200	12A	4200
1B	4372	5B	1B	4200	12B	4200
1C	4548	5C	1C	4200	12C	4200
2A	4110	6A	2A	4200	13A	4200
2B	4244	6B	2B	4200	13B	4200
2C	4080	6C	2C	4200	13C	4200
3A	4080	7A	3A	4200	14A	4200
3B	4080	7B	3B	4200	14B	4200
3C	4524	7C	3C	4200	14C	4200
4A	4598	8A	4A	4200	15A	4200
4B	4178	8B	4B	4200	15B	4200
4C	4080	8C	4C	4200	15C	4200
	50,788.00	9A	5A	4200	16A	4200
		9B	5B	4200	16B	4200
		9C	5C	4200	16C	4200
		10A	6A	4200	17A	4200
		10B	6B	4480	17B	4200
		10C	6C	4200	17C	4200
		11A	7A	3360	18A	4200
		11B	7B	2880	18B	4200
		11C	7C	5040	18C	4400
				87,160.00		**88,400.00**

* Zone Area calculations based on Design (ft^2)from Construction Plan

Legend

- 1A — Drip Zone Designation
- Alternate Area Outline
- Phase 1
- Phase 2
- Phase 3
- 1342.00 — Contours
- Phase 1 Drip Field
- Phase 2 Drip Field
- Phase 3 Drip Field
- Drip Field in Chambers
- Drip Area to be Graveled

Notes:

Subsurface Tanks, Pods, Plumbing, Drip Fields, Meters, Valves and other Equipment contained in these plans are based on construction plans. General location of above ground items was completed with the use of survey data, review of available aerial photography, site visits and conversations with the Operator.

Control Panels, Computers, Zone Location and other Plant Systems are based on construction plans and conversations with the Operator. Actual Zone Location, Dose Timing, and Other Plant Systems were not determined in the scope of these plans.

Subsurface and environmental conditions were not examined nor considered.

Due to the scale of the drawings, certain symbols and horizontal coordinates of certain features will not be to scale due to production purposes.

50 0 50 100
50 SCALE GRAPHIC SCALE IN FEET

INTERIM OPERATING PLAN

PHASE 1,2 AND 3 DRIP FIELDS
TREATMENT FACILITIES
BETHEL HEIGHTS, AR

DATE	#	REVISION DESC.

DRAWN BY: CLP | CHECKED BY: JRG
DRAWING CREATION DATE: 080519
JOB NUMBER: 2114
P:\PROJECTS\2114\CIVIL\2114 RECORD PLANS.DWG
LAST SAVED 8/8/2019 10:20 AM
PLOT DATE 8/8/2019 10:21 AM

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 15,162
JAMES R. GEURTZ

CERTIFICATE OF AUTHORIZATION
EARTHPLAN DESIGN ALTERNATIVES, P.A.
No. 322
ARKANSAS ENGINEER

Earthplan Design Alternatives, PA
Civil Engineering / Landscape Architecture
(479) 756-1266
(479) 750-2570
Fax: (479) 750-2570
www.edapa.com
134 West Emma Avenue
Springdale, Arkansas 72764

Corbitt Environmental Consulting
corbittenvironmentalconsulting@gmail.com
PO Box 937
Lowell, AR 72745
479-466-6183

October 15, 2019

City of Bethel Heights
c/o Rick Sayre

cc: Engineering Design Associates
c/o James Guertz

Soil Morphology testing results

Date performed: **October 9, 2019**

Address or Location performed: **Bowen Park,S. Oak Street, Lowell, AR**

County: **Benton**

Parcel # and acreage: **20-00092-000**

Requested by **James Geurtz**

# of tests performed: **2**

Results:

Pit 1 (east)
>36" to bedrock
Moderate Seasonal Water Table at 15" with chroma 2 Fe depletions
The loading rate for this pit would be .103 gal/ft.^{2}/day

Pit 2 (west)
>36" to bedrock
Brief Seasonal Water Table at 0" with Mn and Fe
Moderate Seasonal Water Table at 26" with chroma 2 Fe depletions
In areas where the slope is >3% a curtain drain can be utilized to lower the brief seasonal water table down to 18".
With a curtain drain the loading rate for this pit would be .157 gal/ft.^{2}/day

A brief water table is defined as the following and is the least restrictive:

-Iron Concentrations or depletions on soil surfaces with chroma >3 and not more than 50% or more on soil surfaces
-Manganese masses on >2% of soil surfaces
-Iron or manganese nodules or concentrations >2 mm in diameter

A moderate water table is defined as the following and more restrictive:

-Any chroma 2 iron depletions on soil surfaces
-50% or > Chroma 3 iron depletions on soil surfaces
-35-49% clay

Loading rate:

The higher the loading rate the better the soil test and the less amount of line you need. The lower the number the less suitable the soil test is and the more lateral line you need.

Drip lines must maintain the following setbacks:

10' from property lines, structures, and buried utilities

50' from a pond on the same parcel

100' from a pond on an adjoining parcel, well, creek, stream, spring, etc.

Conclusion

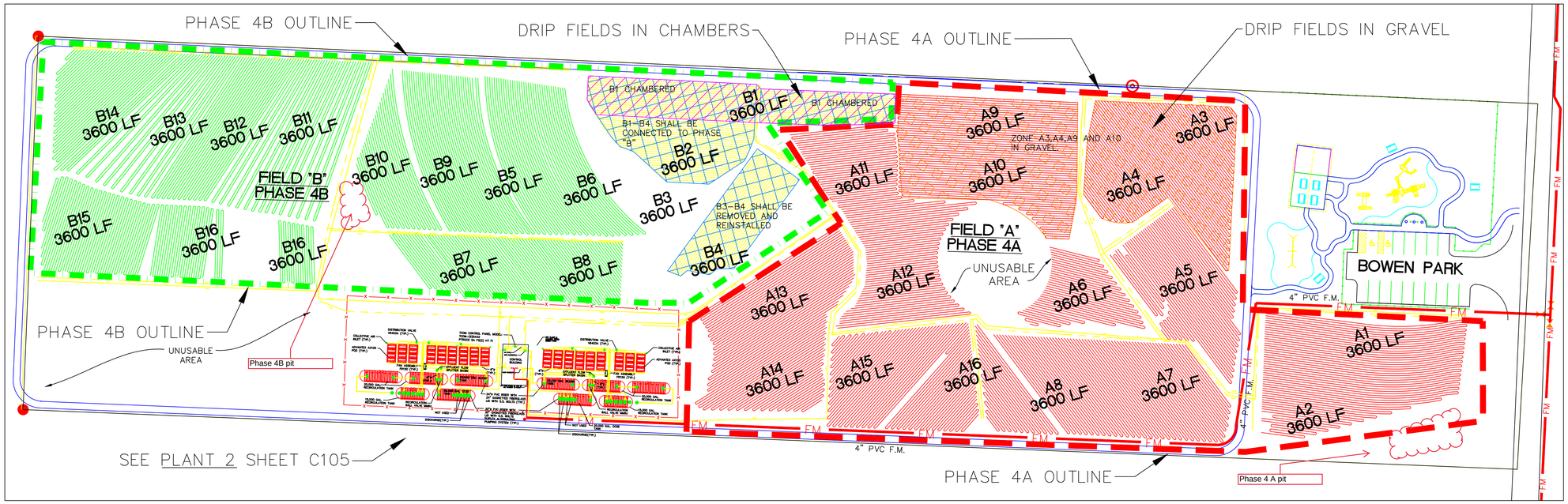
Our conclusion is that the soil in the pits observed on the property is marginally suitable in one of the two pits observed with the addition of a curtain drain and where the slope is at least 3%. I observed these pits along with Samuel Dunn and Kyle Krievans of the Arkansas Department of Health. The information above will have to be reviewed by the Arkansas Department of Environmental Quality and verified on site before any permit or approval for the use of these soils for a sewage disposal system can be granted. The soil in other areas of the property could be more or less suitable.

If you have any questions about any of the information within this report please, call, or email me for further explanation. We appreciate your business!

Sincerely,

Rebecca Corbitt

Rebecca Corbitt, Professional Soil Classifier #60
Corbitt Environmental Consulting



PLANT 2 DRIP FIELDS

PHASE 4 COLLECTIONS
PHASE 4A AND 4B DRIP FIELDS
4322 N OAK ST.
BETHEL HEIGHTS, AR

Revised Drip Field Zone Identification

Phase 4A				Phase 4B		
Zone ID	**Previous Zone ID	*Zone Area (ft^2)		Zone ID	**Previous Zone ID	*Zone Area (ft^2)
A1	1A	7200		B1	3A	7200
A2	*1A*	7200		B2	*3A*	7200
A3	1B	7200		B3	3B	7200
A4	*1B*	7200		B4	*3B*	7200
A5	1C	7200		B5	3C	7200
A6	*1C*	7200		B6	*3C*	7200
A7	1D	7200		B7	3D	7200
A8	*1D*	7200		B8	*3D*	7200
A9	2A	7200		B9	4A	7200
A10	*2A*	7200		B10	*4A*	7200
A11	2B	7200		B11	4B	7200
A12	*2B*	7200		B12	*4B*	7200
A13	2C	7200		B13	4C	7200
A14	*2C*	7200		B14	*4C*	7200
A15	2D	7200		B15	4D	7200
A16	*2D*	7200		B16	*4D*	7200
		115,200.00				**115,200.00**

* Zone Area calculations based on Design (ft^3)from Construction Plan
** *Italicized* zones were previously combined with thier unitalicized counterpart, overall area remains unchanged

Legend

- Found Iron Pin
- Meter
- A1 3600 LF — Drip Zone Designation
- Graveled Area
- Phase 4B Area
- Phase 4A Area
- Phase 4A Drip Lines
- Phase 4B Drip Lines
- Phase 4B Drip Lines Connected to 4A
- Chambered Drip Field
- Graveled Drip Field
- Field Dosing out of Phase

Notes:

Subsurface Tanks, Pods, Plumbing, Drip Fields, Meters, Valves and other Equipment contained in these plans are based on construction plans. General location of above ground items was completed with the use of survey data, review of available aerial photography, site visits and conversations with the Operator.

Control Panels, Computers, Zone Location and other Plant Systems are based on construction plans and conversations with the Operator. Actual Zone Location, Dose Timing, and Other Plant Systems were not determined in the scope of these plans.

Subsurface and environmental conditions were not examined nor considered.

Due to the scale of the drawings, certain symbols and horizontal coordinates of certain features will not be to scale due to production purposes.

50 0 50 100
50 SCALE GRAPHIC SCALE IN FEET

INTERIM OPERATING PLAN

#	REVISION DESC.	DATE

DRAWN BY: CLP | CHECKED BY: JRG | DRAWING CREATION DATE: 080519 | JOB NUMBER: 2114
P:\PROJECTS\2114\CIVIL\2114 RECORD PLANS.DWG
LAST SAVED8/8/2019 10:24 AM
PLOT DATE8/8/2019 10:24 AM

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No.15,162
JAMES R GEURTZ

CERTIFICATE OF AUTHORIZATION
EARTHPLAN DESIGN ALTERNATIVES, PA
No. 322
ARKANSAS ENGINEER

PRELIMINARY

PHASE 4A AND 4B DRIP FIELDS
TREATMENT FACILITIES
BETHEL HEIGHTS, AR

Earthplan Design Alternatives, PA
Civil Engineering / Landscape Architecture
(479) 756-1266
(479) 215-5303
Fax
www.edp-pa.com
134 West Emma Avenue
Springdale, Arkansas 72764

IOP2

HAWKINS • WEIR
ENGINEERS, INC.
Engineering Client Success