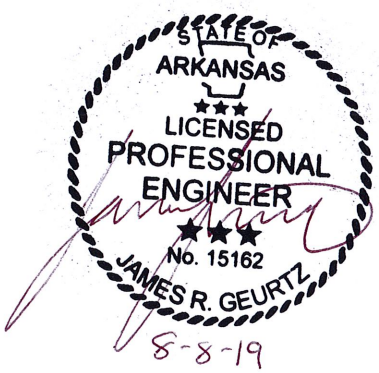
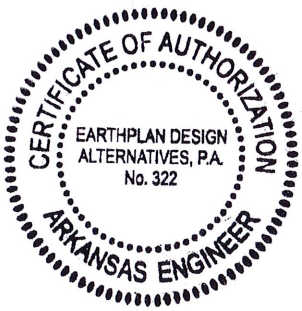
CORRECTIVE ACTION PLAN

(CAP)

For the City of Bethel Heights, AR's Wastewater Treatment Plants (AFFIN 0400630)

Creation Date: 8.5.2019







Earthplan Design Alternatives, P.A.
134 West Emma Avenue
Springdale, Arkansas 72764
479-756-1266

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LOCATION & PERMIT BACKGROUND

Site Location

The City of Bethel Heights is located within Benton County, Arkansas. The population as of the 2010 U.S. Census was 2,372. The city's municipal boundaries comprise approximately 2.22 square miles.

System Information

In 2003, the Arkansas Department of Environmental Quality (ADEQ) granted approval to Bethel Heights (permit number 4725-W) to begin a decentralized wastewater treatment system. Every five years thereafter, in accordance with ADEQ's regulations, the City of Bethel Heights was granted approval by ADEQ to expand their plant in accordance with ADEQ regulations.

In September 2015, under ADEQ permit number 4725-WR-5, ADEQ reauthorized the City of Bethel Heights, AR to operate two (2) separate no-discharge decentralized wastewater treatment systems comprised of a total of four (4) phases at: 901 S. Lincoln St. and at N. Oak Street; both are located within the City of Bethel Heights, AR. 4725-WR-5's expiration date is August 31, 2020. This system's four phases are as described on the following pages.

EFFLUENT LIMITS, MONITORING, AND REPORTING REQUIREMENTS:			
Parameter	Limit	Units	Monitoring
Carbonaceous Biochemical Oxygen Demand (BCOD5)	15	mg/l	Grab sample once per month
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
Ammonia Nitrogen (NH_3-N)	Report	mg/l	
Nitrate Nitrogen ($N0_3$-N) + Nitrite Nitrogen ($N0_2$-N)	Report	mg/l	
Plan Available Nitrogen (PAN)	Report	mg/l	
Flow, monthly total	Report	MGD	Total flow per calendar month
Flow, daily maximum	Report	MGD	Daily
Loading Rate	Report	Gpd/ft	

PHASE I			
Zone ID	zone area (ft2)	loading rate (gpd/ft2)	maximum capacity (gpd)
1A	4650	0.54	2511
1B	4372	0.54	2360.88
1C	4548	0.54	2455.92
2A	4110	0.54	2219.4
2B	4244	0.54	2291.76
2C	4132	0.54	2231.28
3A	4284	0.54	2313.36
3B	4968	0.54	2682.72
3C	4524	0.54	2442.96
4A	4598	0.54	2482.92
4B	4384	0.54	2367.36
4C	4632	0.54	2501.28

PHASE II			
Zone ID	zone area (ft2)	loading rate (gpd/ft2)	maximum capacity (gpd)
1A	4200	0.54	2268
1B	4200	0.54	2268
1C	4200	0.54	2268
2A	4200	0.54	2268
2B	4200	0.54	2268
2C	4200	0.54	2268
3A	4200	0.54	2268
3B	4200	0.54	2268
3C	4200	0.54	2268
4A	4200	0.54	2268
4B	4200	0.54	2268
4C	4200	0.54	2268
5A	4200	0.54	2268
5B	4200	0.54	2268
5C	4200	0.54	2268
6A	4200	0.54	2268
6B	4480	0.54	2419.2
6C	4200	0.54	2268
7A	3360	0.54	1814.4
7B	2880	0.54	1555.2
7C	5040	0.54	2721.6

PHASE III			
Zone ID	zone area (ft2)	loading rate (gpd/ft2)	maximum capacity (gpd)
12A	4200	0.54	2268
12B	4200	0.54	2268
12C	4200	0.54	2268
13A	4200	0.54	2268
13B	4200	0.54	2268
13C	4200	0.54	2268
14A	4200	0.54	2268
14B	4200	0.54	2268
14C	4200	0.54	2268
15A	4200	0.54	2268
15B	4200	0.54	2268
15C	4200	0.54	2268
16A	4200	0.54	2268
16B	4200	0.54	2268
16C	4200	0.54	2268
17A	4200	0.54	2268
17B	4200	0.54	2268
17C	4200	0.54	2268
18A	4200	0.54	2268
18B	4200	0.54	2268
18C	4400	0.54	2376
Total	*229,006*		*123,663.2*

PHASE IV			
Zone ID	zone area (ft2)	loading rate (gpd/ft2)	maximum capacity (gpd)
1A	14400	0.4	5760
1B	14400	0.4	5760
1C	14400	0.4	5760
1D	14400	0.4	5760
2A	14400	0.4	5760
2B	14400	0.4	5760
2C	14400	0.4	5760
2D	14400	0.4	5760
3A	14400	0.4	5760
3B	14400	0.4	5760
3C	14400	0.4	5760
3D	14400	0.4	5760
4A	14400	0.4	5760
4B	14400	0.4	5760
4C	14400	0.4	5760
4D	14400	0.4	5760
Total	*230,400*		*92,160*

WASTEWATER OPTIONS

The City of Bethel Heights is committed to proper and permitted disposal of its wastewater. To that end the City has reached out to Springdale Water Utility, Rogers Water Utility, and NACA to explore options for wastewater disposal. EDA also reached outed to the Arkansas Natural Resource Commission to discuss possible funding availability.

Rogers Water Utility

- Rogers' Water Utility Reported to EDA that the City of Rogers does not currently accept wastewater from outside their city limits. Rogers is located approximately 3.5 miles to the north of Bethel heights along the new highway 265.

Springdale Water Utility

- Springdale Water Utility's (SWU) reported to EDA that Springdale Water does have capacity at their treatment plants to accept Bethel Heights' waste. There are suitable locations within the City of Bethel Heights where it would be possible to tie into Springdale Water Utility's sewer system. A detailed review would need to be conducted in order to ensure proper capacity in any of the collection lines owned by SWU. A design and plan would need to be created and approved before this option could be initiated. Also, agreements would need to be reached between the City of Springdale and Bethel Heights before any connections would be allowed.

NACA

- EDA contacted the Northwest Arkansas Conservation Authority (NACA) to explore the possibility of connecting to their system. Bethel Heights has been on their Board since NACA's inception and the option of connecting to NACA is a long-term goal of the City of Bethel Heights. NACA reported that they are able and willing to accept Bethel Heights' wastewater. A design and plan would need to be created and approved before this option could be initiated.

Alternate Wastewater Treatment Options

- Alternate Wastewater treatment options without the use of drip fields. A design and plan would need to be created and approved before this option could be initiated

The City of Bethel Heights has issued a request for proposals from Engineering firms to evaluate the above options as requested in the ADEQ letter dated May 6, 2019. The requested items (cost comparison, rate study & audit, population projections, and etc..) are very similar in scope to items required in a Preliminary Engineering Report that could be used to determine

funding opportunities through the Arkansas Natural Resource Commission (ANRC). The City will select a consulting Engineer by August 6th. The City Council will approve the Consulting Contract at the August 20th City Council meeting.

Additional Items Requested:

- Copies of the Operations and Maintenance Manual are provided as requested, see Appendix D.
- Concerning the email dated May 10, 2013. As all parties listed on ADEQ's letter are no longer employed by the City or are retired. It is unknown what actions were taken.
- EDA understands that the uncapped pipe in photograph #24 was a part of the force main collection system at the Parkside Cove Subdivision. Homes within the subdivision were all under construction at the time. Upon inspection by the Operator it was discover that an end of line clean out valve was tampered with. Also, the cap was also removed. The City immediately shut the valve off and replaced the collar and cap. This was noted in the City's report on April 18th.

RECORD SEARCH

Record Drawings

A search of our archive files for records found the following:

Phase 1:

- Record Drawings, see Appendix E.
- Construction drawings were discovered, see Appendix F for construction plans with the latest stamped sets.
- Arkansas Department of Health Approval, see Appendix C.

Phases 2-3:

- Record Drawings were not discovered. It is unknown if Record Drawings were created at the time. Construction drawings were discovered, see Appendix G thru H for construction plans with the latest stamped sets.
- Arkansas Department of Health Approval letter found and is included with this report, see Appendix C.

Phases 4:

- Record Drawings were not discovered. It is unknown if Record Drawings were created at the time. Construction drawings were discovered, see Appendix I for construction plans with the latest stamped sets.

Field Investigations

Field Investigations were carried out through site visits, collected survey data, and through conversations with City Staff to discover potential historical changes to the wastewater plants. Below is what was discovered:

Phase 1 (Lincoln St. Plant):

- Zone 2C was abandoned and relocated to an alternate area on the east side of Zone 4A. This field was also placed into chambers. This is understood to have been done per Arkansas Department of Health (ADH) guidance.
- Zone 1A, 1B, 1C, 3A, 3B, & 3C were placed in gravel trenching, understood to have been done per ADH guidance. The current wastewater operator has stated, that he learned through his conversations with Sam Dunn with ADH, that the previous gravel trenching was not done correctly. The recommended 4' spacing was not achieved,

gravel was not laid ‘on contour’, and gravel was not segregated from the supply and return lines.

- No records found as to why changes occurred.
- Alternate Fields to the east of the treatment plant area contain abandoned drip tubing from experiments conducted by the Arkansas Department of Health. Currently no wastewater is going to these drip lines.
- Early on and for a short amount of time, the City had the drip fields hayed. The equipment used was the standard farm equipment for creating round hay bales. It is probable that some amount of soil compaction occurred due to this action. This no longer occurs.

Phase 2 (Lincoln St. Plant):

- Zone designation numbers are different from those shown on the permit vs what the panels in the control room are labeled. A corrected Zone designation list will be provided with this CAP that matches field designations.
- Zones 5A, 5B, 5C, 6A, 7A, 7B, & 7C were placed in gravel trenching, understood to have been done per ADH guidance. The operator has stated, through his conversations with Sam Dunn with ADH, that the previous gravel trenching was not done correctly. Recommended 4’ spacing was not achieved, gravel was not laid ‘on contour’, and gravel was not segregated from the supply and return lines.
- Previous spot checking by the Operator reveled only 6” of cover on some areas of drip tubing. Construction plans specifies for 10” of cover on drip tubing.
- No records found as to why changes occurred.

Phase 3 (Lincoln St. Plant):

Plans show that Phase 3’s treatment was to be completed in phases. Only 3 of the AdvanTex treatment Pods shown for Phase 3B’s treatment were installed. Thus, nine treatment pods were not installed as was originally approved.
One Dose Tank, two Recirculation tanks, and one blending tank were installed but are not in use. These tanks appear to have been originally intended for use with the nine treatment pods not installed (Phase 3B treatment).

- Zone 12A, 12B, 12C, 16B, 16C, 17A, & 17B were placed in gravel trenching, understood to have been done per ADH guidance. The operator has stated, through his conversations with Sam Dunn with ADH, that the previous gravel trenching was not done correctly. Recommended 4’ spacing was not achieved, gravel was not laid ‘on contour’, and gravel was not segregated from the supply and return lines.
- Previous spot checking by the Operator reveled only 6” of cover on some areas of drip tubing. Construction plans specifies for 10” of cover on drip tubing.

- No records found as to why changes occurred.

Phase IV (N. Oak Plant):

- Zone designations numbers are different from those shown on the permit vs what the panels in the control room are labeled. A corrected Zone designation list will be provided with this CAP that matches field designations.
- Zones B3 and B4 lines were installed incorrectly. It appears that approximately half the drip tubing was installed and was plumbed together as one zone.
- Zones B1, B2, B3, and B4 are connected to Side A and the approved plan shows those should be connected to Side B.
- Review of various construction documents is conflicting as to which side is Side A and Side B. Going forward, Side A is on the East and Side B is on the West. This naming convention will be reflected correctly as part of this CAP.
- Zone A3, A4, A9, and A10 were installed with gravel trenches per ADH's guidance.
- Zone B1 was installed with chambers, per ADH's guidance.
- Plans show that 18 AdvanTex treatment pods were not installed (north row of treatment pods).
- The ADEQ permit indicates 16 drip zones with each zone having 14,400 sf per zone for a total of 230,400 sf. The latest plans and control board indicates 32 drip zones with 7,200 ft per zone. The total area is still 230,400 sf.
- No records found as to why changes occurred.

Historical Wastewater Flow:

EDA reviewed the past year's wastewater flow reports to determine how much the system is treating. These flow numbers represent the influent wastewater from the City's force main collection system. Phase 1,2 &3 have two separate influent lines. Phase 4 has only one influent line.

INFLUENT (GPD)			
Month	**Phase 1, 2, & 3**	**Phase 4**	**Total**
May, 2018	55,361	41,776	97,136
June, 2018	56,536	42,612	99,148
July, 2018	59,796	40,947	100,743
August, 2018	64,535	38,651	103,186
September, 2018	63,749	35,629	99,378
October, 2018	63,158	36,497	99,656
November, 2018	68,220	31,644	99,864
December, 2018	67,494	31,109	98,604

January, 2019	76,186	31,767	107,953
February, 2019	76,731	15,035	91,766
March, 2019	59,409	29,605	89,014
April, 2019	54,479	40,496	94,975
May, 2019	63,364	39,057	102,421
Average daily flow	**63,771**	**34,987**	**98,757**

Existing Customers:

EDA contacted the City and obtained the number of residential customers and commercial customers:

Calculated Average Design Flow based on Existing Accounts				
	Number of Accounts	**Estimated Persons per Account**	**Average Person Flow per Day (gal/person/day)**	**Average Daily flow (GPD)**
Residential Customers	582	2.5	80	116,400
Commercial Customers	33		50	1,650
Total Customers	**615**			
Total Average Design Flow				**118,050**

The above average design flow is based upon standard engineering practices for estimating wastewater flow based on population. Actual historical flows will vary from this amount due to local population's demographics. This basis for this report will be the historical flows.

Evaluation of Treatment Plants & Fields

Weather Conditions

- Review of rainfall data for the past year indicates abnormally high amounts of rainfall for both the winter and springs months. The increase in rainfall limits the capacity of the fields to absorb wastewater which can lead to surfacing issues.

Geotechnical Investigation

- Material Testing of Arkansas (MTA) has been retained to perform the geotechnical testing
- MTA recommended that a Shelby tube testing be performed to determine the infiltration rate for the soils. Samples have been collected by MTA and the City is awaiting a report. Once completed and received, this report will be forward ADEQ.

Phase 1, 2, & 3 (Lincoln St. Plant)

- Surfacing has been noted to intermittently occur in multiple zones. Areas of temporary ponding appear to not be running off the permitted site during dry weather. It is unknown if water is running off the site during rain events.
- No evidence in the City's storm ditches, downstream of the plant, indicating dry weather flows.
- Abandoned tanks are not connected to the treatment plant or drip fields. Tanks appear to be full of water so as not to float out of the ground.
- Multiple geese were seen occupying the drip fields. Wildlife is a known contributor to E. coli and Fecal Coliform.
- Review of treatment capacity at Phases 1,2, & 3 was conducted to understand the impact of the removal of the treatment pods. Existing AdvenTex pods are designed to treat 2,500gal/day/pod. 27 AdvenTex pods are installed at the plant:

$$2{,}500\ GPD\ \times 27 = 67{,}500\ GPD$$

Average daily flow is 63,771 GPD. Treatment capacity is therefore within reason for the amount of flow coming into the plant. While there are violations of permit limits, the Operator is aware of violations and is adjusting treatment control parameters within the plant to meet permit limits.

- Review of Phase 3's ADH approval letter indicates the following drip dispersal calculations were agreed upon:

DRIP DISPERSAL			
	Field Area (sf)	**Soil Loading Rate (gal/sf/day)**	**Dispersal Rate (GPD)**
Phase 1	50,788	0.26	13,205
Phase 2	87,160	0.46	40,094
Phase 3	88,400	0.217	19,183
	226,348		**72,481**

  It appears that the ADH approval letter for Phase 3 made amendments to the previous phases approvals in how the fields are dosed. The ADH letter indicates that the total average daily flow should be set to 72,481 GPD per the consultants' calculations. Also, there are inconsistencies between the ADEQ permit and ADH approval with concern to both the soil loading rate and the drip dispersal rate. Clarification is needed between ADEQ, ADH and the City on the allowable soil loading rate. Items indicated above could create confusion to the Operator as to what proper settings are needed to operate the plant.

  Currently, the Average Daily flow is 63,771 GPD which is below the ADH average drip dispersal rate of 72,481 GPD.

Due to potential early-on compaction by farm equipment and the long-term effects of dosing soils, the capacity for soil intake may have decreased. A review of soil testing results from the geotechnical data is needed to ensure proper dosing. Also, incorrect installation of drip tubing, incorrect installation of the gravel trenching, and drip field dispersal rate settings in the plant are all potentially contributing to the surfacing issue seen at this location. Excessive rains also played a part in causing surfacing problems in the past year. Both the loading rate and wastewater flowrate can be impacted by excessive rain. Increased wastewater flow during rain events could be due to inflow and infiltration at STEP tanks due to damaged lids.

Phase 4 (N. Oak Plant)

- Surfacing has occurred in a limited number of zones. Areas of ponding appear to not be running off during dry weather. It is unknown if water is running off the site during rain events
- The incorrectly installed zone B3/B4 and incorrectly connected side of B1, B2, B3/B4 to side A is the probable cause of the surfacing on side B.
- Dosing settings might not be programmed correctly due to the issues concerning zones B1, B2, B3 & B4. This is due to the fact that the dosing on each side (A and B) doses

two zones (even number) at a time. With the B3/B4 being treated as a single zone, this introduces an odd number of zones on one side. Also, Side B currently has fewer available drip fields to distribute the dose. This could result in overdosing Side B and underdosing Side A.

- Review of treatment capacity at Plant 4 was conducted to understand the impact of the removal of the treatment pods. Existing AdvenTex pods are designed to treat 2,500gal/day/pod. 18 AdveTex pods are installed at the plant:

$$2{,}500\ GPD\ \times 18 = 45{,}000\ GPD$$

  Average daily flow is 34,987 GPD. Treatment capacity is within reason for the amount of flows coming into the plant. While there are violations of permit limits, the Operator is aware of violations and is adjusting treatment control parameters within the plant to meet permit limits.

- EDA was unable to find the ADH approval letter for this Phase. Though, the construction plans have a Calculation sheet that provides relevant flow and field sizing information for the design that is consistent with how the Phase was constructed.

DRIP DISPERSAL			
	Field Area (sf)	**Soil Loading Rate (gal/sf/day)**	**Dispersal Rate (GPD)**
Side A	115,200	0.4	46,080
Side B	115,200	0.4	46,080
	230,400		**92,160**

  The ADEQ permit and the Construction plans appear to have inconsistency between the Zone Identification's. The constructed Phase consist of 32 zones split between 16 zones on each Side (Side A and Side B). Total design area and design flows remain consistent with the permitted Total Area and Total Capacity.

  Currently, the Average Daily flow is 34,987 GPD which is below the drip dispersal rate of 92,160 GPD.

The plant located at Phase 4 appears to be within operating limits. Surfacing appears to be a result of incorrect installation of Zone B3/B4 and connecting B1, B2, B3 & B4 to the incorrect side of the plant. This has probably resulted in a program error or caused incorrect field dosing with the control board that needs to be corrected. Excessive rains also played a part in causing surfacing problems in the past year. Both the soil loading rate and wastewater flow

rate can be impacted by excessive rain. Increased wastewater flow during rain events could be due to inflow and infiltration at STEP tanks due to damaged lids. Treatment capacity will need to be reviewed as development occurs within the city.

CORRECTIVE ACTION PLAN & COMPLIANCE SCHEDULE

Corrective Action Plan

Long Term Plan:

Select consultant to Evaluate Wastewater Options and prepare Action Plan:

- Request for Qualifications was submitted to the local newspaper **(Completed 7/28/19)**.
- Selection of Consultant by the City August 6th. **(Completed 8/6/19)**
- Consultant to prepare proposal for services and approval by City Council. **(August 20, 2019)**
- Prepare Preliminary Engineering Report (PER) based on criteria in the CAP request letter and potential funding agency requirements and submit to ADEQ. **(December 2, 2019)**
- Funding secured for selected option. **(February 2020)**
- Design of selected option. **(March 2020)**
- Construction Permit Received for selected option. **(March 2021)**
- Started of construction of selected option. **(May 2021)**
- Completion of construction. **(November 2022)**

Interim Operating Plan:

NACA (Northwest Arkansas Conservation Authority) Haul Off

Immediate (August 2019 - as needed)

- Approximately 18,000 gallons per week shall be hauled off to NACA.
- As of July 29, 2019, a temporary service contract was obtained. This contract is an agreement by NACA to provide treatment services for a period of approximately six (6) months from July 29, 2019 until January 31, 2020. The contract will be extended as needed.
- The city will use a Licensed Septic hauler to transport the wastewater to the NACA plant.

- The number of gallons per week is approximately equivalent to the permitted amount for a zone in Phase 1,2 & 3. This will allow for maintenance to occur on a zone by zone basis while not putting any additional wastewater on another zone.
- Continually evaluate if additional haul-off is required to meet permit limits as other portions of this plan progress. Request extension to contract as needed.

HAUL OFF CALCULATIONS	
4,500	gal/truck
2	number trucks/day
2	number of days removed per week (Tuesday and Friday)
18,000	gallons removed / week
2,571	equivalent gallons removed / day

Phase I, II, and III (Lincoln St. Plant)

1st Phase-Immediate actions (August 2019-November 2019).

- Troubleshoot electrical connections to ensure proper operations.
- Evaluate and correct drip dispersal operations to ensure proper dosing to fields.
- Review geotechnical testing report to ensure proper drip dispersal.
- Interim Operating Plans shall reflect updated zone identifications based on field discoveries.
- Provide amended Zone identifications and Soil Loading Rate chart for the Drip Field Soil Loading Rates in Permit No. 4725-WR-5.
- Install gravel trenches per ADH guidance and repair previously incorrectly installed gravel trenches.
- Correct discrepancies between the approved plans and what was constructed.
- Apply lime to impede any E. coli and fecal coliform growth on any surfacing waters.
- Compile an inventory of damage STEP tanks.

2nd Phase-Evaluate results from 1st Phase (November 2019-April 2020).

Evaluate the status of the items in Phase 1 to determine if additional actions are required:

- Design and permit drip lines to be placed in the alternate fields designated on the original plans.
- Once permitted, construct lines in Alternate field and connect to treatment plant.

- Review options to utilize abandoned tanks to provide additional storage during wet weather events.
- Repair damaged STEP tanks based on inventory complied during phase 1.

3rd Phase-Evaluate results from 2nd Phase (April 2020-September 2020).

Evaluate the status of the items in phase 1 and 2 to determine if additional actions are required:

Phase IV (N. Oak St. Plant)

- **1st Phase (August 2019 to February 2020)**
  - Remove incorrectly constructed Zone B3/B4 and reconstruct Zone B3 and B4 correctly per the original plan.
  - Disconnect Zones B1, B2, and B3 from side "A" and connect to side "B".
  - Ensure that Zones B1, B2, B3, and B4 all connect to side "B" per the original plan.
  - Troubleshoot electrical connections to ensure proper operations.
  - Provide a correct Zone Identification chart with proper areas and capacities.
  - Compile an inventory of damage STEP tanks.
- **2nd Phase – Evaluate results from 2nd phase (February 2019 to September 2020).**

  Evaluate the status of the items in phase 1 to determine if additional actions are required:
  - Repair damaged STEP tanks based on inventory complied during phase 1.

Quarterly reports will be provided to ADEQ on the status of the Interim Operating Plan.

APPENDIX

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Appendix A: ADEQ Permit 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 B: NACA Haul Off Contract

Temporary Service Contract

Between

Bethel Heights

And Northwest Arkansas Conservation Authority

This temporary service contracted dated as of the 29 day of July, 2019 and ending on 31st day of January, 2020.

The authority agrees to provide treatment services for trucked in wastewater for the city of Bethel Heights for a period of approximately six months from the date of execution of contract ending on January 31, 2020. The city agree to be solely responsible for the transport of waste water to the authority and agrees to pay a tipping fee of $25.00 per truck delivered to the Authority as well as a monthly treatment cost based on percentage of flow. This will be billed monthly to the city.

Deliveries of wastewater must be completed between the hours of 8:00 a.m. and 2:00 p.m., Monday through Friday only and also excluding holidays that the NACA plant is closed, and all dumping must be completed and the truck off Authority property no later than 3:00 p.m. No deliveries will be allowed outside of normal working hours for the authority. The city will be responsible for overseeing scheduling and informing the authority within 48 hours prior to delivery of trucked in waste water.

The city will provide all equipment necessary for the trucks to safely unload including hoses and any other equipment deemed necessary to safely and without spilling to deliver waste water to the authority.

The city will be required to provide the authority with all lab testing data preformed during the time the authority is accepting trucked in waste water.

This agreement ends on January 31, 2020 unless the parties agree to extend it, or unless either party terminates it before that date. Extension of this agreement is only valid if made in writing and signed by the parties. Early termination may be made for the convenience of either party upon fourteen (14) days written notice given to the other party. Such written notice may be provided in the case of NACA to the Plant Manager and if in the case of Bethel Heights to the Mayor of Bethel Heights. The parties intend to negotiate an arrangement to extend these services and it is contemplated that such extension may require Bethel Heights to pay the Authority's "connection fee."

BETHEL HEIGHTS, ARKANSAS

BY: Cynthia J. Black
Mayor

NORTHWEST ARKANSAS
CONSERVATION AUTHORITY

BY: Guy R. Spencer
Chairman, Board of Directors

Appendix C: Arkansas Department of Health Approval Letters

PERMIT APPLICATION FOR SUBSURFACE DISPOSAL

for

BETHEL HEIGHTS SEWER - PHASE I

BETHEL HEIGHTS, ARKANSAS

EDA #0656

December 10, 2002

EDA
Engineering Design Associates, P.A.
134 West Emma Avenue
Springdale, Arkansas 72764
479-756-1266 FAX 479-756-2129

WATER POLLUTION CONTROL PERMIT APPLICATION
ARKANSAS DEPARTMENT OF ENVIRONMENTAL QUALITY

Septic Tank and Leach Field

Revised January 31, 2002

Permit No.:	CSN No.:	SIC Code:	NAICS Code:
(Office use only)	(Office use only)	(Office use only)	(Office use only)

1. Permit Action Requested: (Please check one of the following.)

X New Permit for New Facility	____ New Permit for Existing Facility	____ Permit Renewal
____ Modification of Existing Permit, Please Describe: ____		

2. Name and Mailing Address of Organization/Individual Requesting Permit:

Owner/Organization Name: (Mr / Mrs / Ms) CITY OF BETHEL HEIGHTS		
Address: 530 SUNRISE DRIVE		Phone:
City: BETHEL HEIGHTS	State: AR	Zip: 72764
Contact Person: (Mr / Mrs / Ms) MAYOR BONNIE RAMSEY		Phone:

3. Type of Waste Management: (Please check all that apply to your system.)

____ Car Wash	____ Truck Wash	____ Laundromat	____ Slaughterhouse
X Other, Please Describe: WASTEWATER EFFLUENT TREATMENT			

4. Waste Treatment Facility Location: ***(actual facility address is required; NO P.O. BOXES)***

Facility Name:				
Address: 901 S. LINCOLN ST.			Phone: 479-756	
City: BETHEL HEIGHTS			State: AR	Zip: 72764
1/4 Sec.: NW	Section: 13	Township: 18 N	Range: 30 W	County: BENTON
Latitude: 36° 14' 12"	Longitude: 94° 07' 55"		Nearest Town: BETHEL HEIGHTS	
Name and Distance to Nearest Stream: SPRING CREEK, 1.75 mi				

5. Consultant Information:

Name: (Mr) / Mrs / Ms) STEVE A. HESSE		
Consulting Firm Name: ENGINEERING DESIGN ASSOCIATES, PA		
Address: 134 W. EMMA		Phone: 479-756-1266
City: SPRINGDALE	State: AR	Zip: 72764

6. Please describe the location of the facility with respect to roads, towns and other easily identifiable landmarks:

S. E. CORNER OF APPLE BLOSSOM & LINCOLN

7. Please list and describe all waste storage and/or treatment components:

EACH RESIDENTIAL LOT OR COMMERCIAL DEVELOPMENT WILL CONTAIN A S.T.E.P. UNIT THAT WILL HOLD ALL SOLIDS. ANTICIPATED TANK PUMPING INTERVAL: 10-12 YRS. EFFLUENT WILL BE PUMPED TO A TREATMENT AREA THAT WILL CONTAIN ADVANTEX FILTERS & SUBSURFACE DRIPPER DISPERSAL LINES.

8. Has the applicant previously submitted, or have on file with the Department, a complete "Disclosure Statement" as required by Act 454 of 1991? ____ Yes __X__ No

If yes, please provide the following: Date Submitted _____ To What Division? _____

If no and the application is submitted for a new permit (whether for a new or existing facility), the applicant must complete and submit the "Disclosure Statement" form included with the application. Additional copies of the "Disclosure Statement" form may be obtained from ADEQ.

MUNICIPALITY

9. Is the applicant organized as a corporation? YES or NO If yes, is it foreign or domestic? _____

Is the corporation currently registered to do business with the Arkansas Secretary of State? YES or NO

Please read the following carefully and sign below.

I certify under penalty of law that this document and all attachments were prepared under my direction and 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.

SIGNATORY REQUIREMENTS: The signature below must be in compliance with Part I, Item 4 on page (ii) of the Procedures for Submitting an Application.

BONNIE RAMSEY
Name of Individual Signing Application (Please Print)

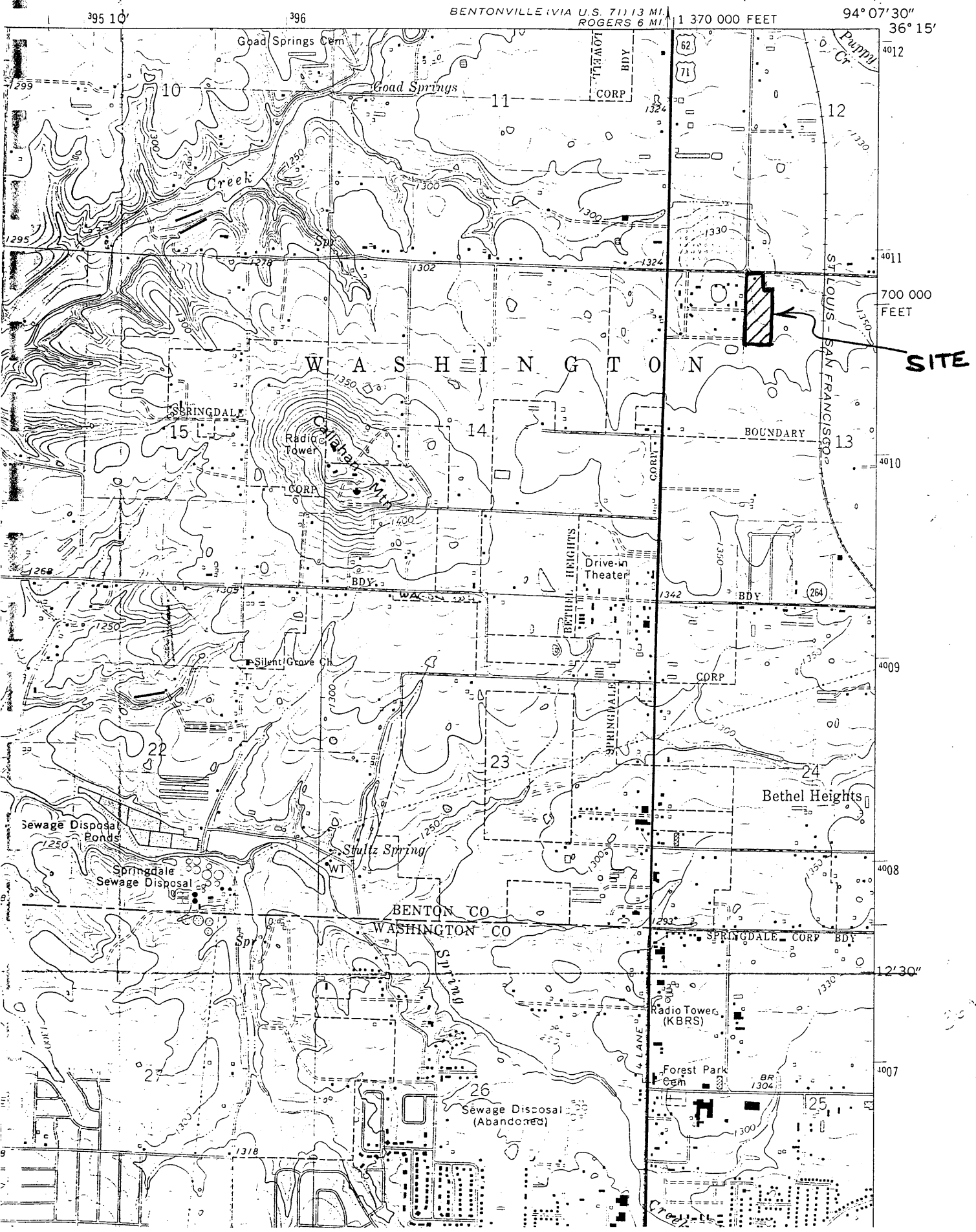
MAYOR
Title

Bonnie K. Ramsey
Signature

12/16/02
Date

SPRINGDALE QUADRANGLE
ARKANSAS
7.5 MINUTE SERIES (TOPOGRAPHIC)

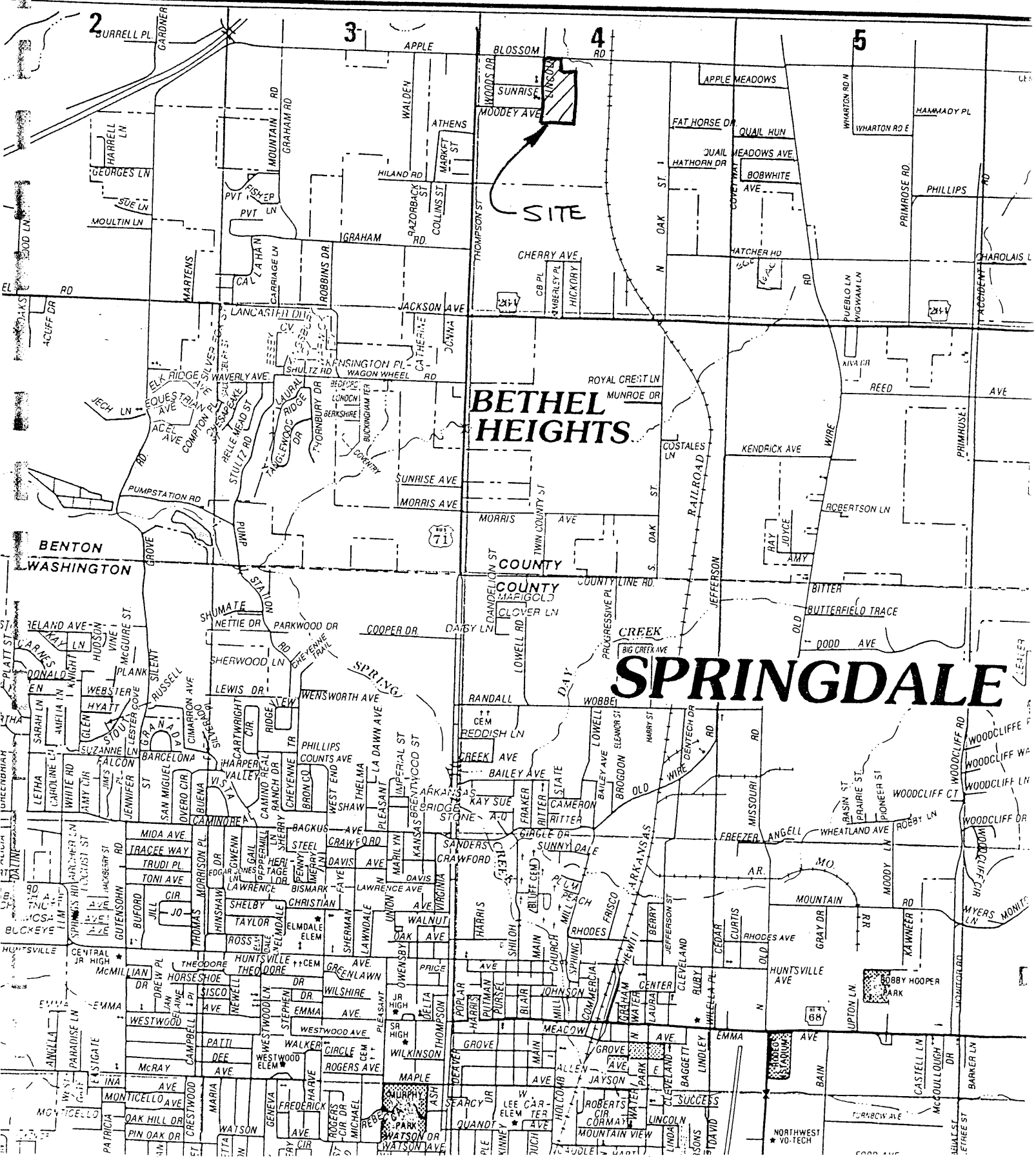
7156 I SE (ROGERS)



509 E. Emma Ave.
Downtown Springdale

501-751-4861

750-3999
http://www.cnci.net
1301 E. Robinson Springdale • Signature Square-Suite B-13
CREATIVE NETWORK CONCEPTS, INC



WASTE MANAGEMENT PLAN

Phase I of the proposed sewer system for the City of Bethel Heights consists of the installation of interceptor / pump tanks at each residence or commercial business and a force-main collection system - also know as a Septic Tank Effluent Pump (S.T.E.P.) system. The proposed collection system will utilize small diameter pressure lines which can be laid at much shallower depths than conventional gravity sewers and are not dependent upon slope to operate.

Raw sewage will flow from each house or business to a watertight underground interceptor / pump tank, where it is pretreated. The filtered effluent will then be pumped to a centralized location where it can be treated with a fixed film biological filter and discharged into "dripper" irrigation lines. The quality of effluent produced by these filters is similar to that of recirculating sand filters. The net effect of this removal of solids and Carbon source is that biomat formation does not occur at the trench/soil interface and the clarified effluent infiltrates into the soil at much higher rates than untreated septic tank effluent.

The City has purchased an eleven (11) acre site that will contain the treatment equipment and the drip dispersal lines.

The system will have a state-of-the-art "web-based" monitoring system so the operator can monitor the system from the office or home.

The entire system will be owned and operated by the City of Bethel Heights. The City is in the process of establishing a Class I operator to oversee the operation and maintenance of the facility.

It is anticipated that the City will have a long-term contract with a septic tank pumping company to pump the solids from the STEP tanks when needed.

An operation and maintenance manual will be completed and a copy sent to the Arkansas Department of Health and to the Arkansas Department of Environmental Quality.

The current phase has an average flow of 12,500 gallons per day. Please refer to the attached calculations for information on pumps, collection line sizes, etc.

Each septic tank will contain 24 hours of storage.

Engineering Design Associates, P.A.
134 W. Emma Avenue
Springdale, Arkansas 72764
479-756-1266

September 26, 2002

Roy Davis
District Engineer
Arkansas Department of Health
Division of Engineering
4815 West Markham - Slot 37
Little Rock, AR 72205-3867

RE: Preliminary Engineering Plans
Phase I - Bethel Heights Sewer Improvements
Bethel Heights, AR
EDA # 0656.1
ADH # 39584-6

Dear Mr. Davis:

Attached are two sets of plans and specifications for the proposed sewer improvements for the above referenced project. I think that this submittal will satisfy the comments listed on your letter dated September 6, 2002 for the Lexington Addition project (ADH# 40138-3).

Each residence will use a 1,500 gallon STEP unit. This is a septic interceptor tank will contain a patented Biotube Effluent Filter that prevents solids from leaving the tank and a high-head effluent pump to move the effluent through the force main lines to the treatment / disposal field.

The City will construct the force main lines within Lexington Addition and run the line to the new treatment area. The treatment area contains 11 acres and is located near City Hall. Ms. Sheri Herron of Herron Soil Interpretations has completed the soil investigations at the treatment site. Test pits were excavated at a 100 foot grid over the entire 11 acre site. Also, attached are example calculations from Ms. Herron to demonstrate how the loading rates for each pit were determined. The loading rate for each pit is indicated on the plans.

The total projected flow is based on 50 residential units, 100 gallons per person per day, 2.5 persons per house. This equates to a total flow of 12,500 gpd. Six Advantex 100 filters will provide the secondary treatment before discharging the treated effluent to the dripper irrigation disposal fields.

Also included in this package are specifications for the force main installation and testing.

Please do not hesitate to call if you have any questions or need additional information.

Sincerely,

Steve A. Hesse
Professional Engineer

cc: Bonnie Ramsey - Mayor of Bethel Heights
file

GEOFLOW

SUBSURFACE DRIP SYSTEMS

October 15, 2002

Mr. Steve A. Hesse, PE
Engineering Design Associates, P.A.
134 Emma Avenue
Springdale, AR 72764

Subject: Bethel Heights, AR sewer project: drip irrigation disposal field

Dear Steve:

I have reviewed the set of plans for the proposed sewer project in Bethel Heights. Specifically, I have reviewed the proposed design for the drip irrigation disposal field. I have the following comments:

(1) I would reduce the length of each line to 340 linear feet. This can be accomplished by installing two 170-foot long runs that would be looped at one end. This would allow you to install both the supply and return (flush) manifolds in the same trench. It will also reduce the friction loss in the dripline considerably, allowing sufficient pressure necessary to flush the lines at a minimum velocity of 1 ft/sec.

(2) Feed both fields from the center (i.e., between the two fields). This will allow for all of the manifold lines to be installed in the same trench, reducing the length of piping that will be required.

(3) To prevent low-head drainage of the driplines, install the lines along the contours, with no more than 4 inches of fall/100 ft.

(4) Install one (1) vacuum breaker on each zone at the highest elevation.

(5) Provide a check valve on each zone, prior to connection to the main manifold.

(6) Your plans show the use of a separate headworks (filter/valve) box on each zone. Because of the large flows for this project, I would recommend the use of a dual, pressure sand filter following the pumping station. A distribution valve can be installed following the sand filters in order to split the flow to the two (2) fields.

(7) As an alternative to the use of the distribution valves to split the flow to six (6) zones, you may wish to consider the use of six (6) solenoid valves. This would

307-N W. Tremont Avenue • Charlotte, NC 28203 • (704) 347-3476 • (800) 828-3388 • Fax (704) 347-0706 • Website: www.geoflow.com

reduce the amount of piping required, as well as reducing the pressure loss necessary to operate the distribution valves.

(8) In order to maintain a 2 ft/sec flushing velocity in the PVC manifold lines, I would recommend the use of 1 ½ " diameter Sch. 40 piping for the supply lines and 1" piping for the return lines.

I have also completed the following hydraulic calculations for the system. These calculations are based upon the suggested revisions discussed above, which include the provision of six (6) zones, each consisting of 4080 sq ft. In addition, each zone will consist of six (6) lines, each 340 ft long. I have calculated the pressure loss using 6 separate screen filters. I also assumed that electric solenoid valves would be used to split the flow to each of the six zones.

Hydraulic Calculations:

D.A.F. = 12,500 gpd
Soil Loading Rate = 0.54 gpd/sq ft
Minimum Area Required = 12,500 gpd / 0.54 gpd/sq ft = 23,148 sq ft

The design provides for 24,480 sq ft, which exceeds the minimum requirements.

Total area = 24,480 sq ft
Linear feet of dripline = 24,480 sq ft / 2 sq ft/ft of dripline = 12,240 linear feet of dripline
Emitters = 12,240 LF / 2 ft/emitter = 6,120 emitters
Total flow in gallons/hour = 6,120 emitters x 0.53 gph/emitter = 3,244 gph
Total flow in gallons/minute = 3,244 gph / 60 min/hr =54 gpm
Total flow/zone (with 6 zones) = 54 gpm / 6 zones = 9 gpm/zone
Total pumping time = 12,500 gpd / 9 gpm/zone / 6 zones = 231 minutes/day/zone
Total pumping time for entire system = 231 minutes/day/zone x 6 zones = 1332 min/day
(1,389 min/day / 60 min/hr = 23 hours, 9 minutes)

Each zone = 12200 LF / 6 zones = 2040 ft/zones
Length of each line in the zone = 340 ft/line (6 lines/zone)
Flush volume @ 1 ft/sec (0.75 gpm/line) = 6 lines x 0.75 gpm/line = 4.5 gpm
Operating volume = 9 gpm

Total pumping requirement = 9 gpm (dosing) + 4.5 gpm (field flush) = 13.5 gpm

Pressure requirements (dosing): 9 gpm

Static head	= 7.0 ft (3.0 psi)
Pressure loss through 1 inch screen filter	= 4.6 ft (2.0 psi)
Solenoid valve	= 4.4 ft (1.9 psi)
185 ft of 1 ½ inch supply line to field dist. valve	= 1.3 ft (0.56 psi)
Distribution valve to 3 zones/field	= 11.6 ft (5.0 psi)

100 ft of 1 ½ inch submain	= 0.7 ft (0.3 psi)
Static head (negative) from valve to zone	= -2.0 ft (-0.9 psi)
Pressure at beginning of zone (dripline)	= 34.9 ft (15.1 psi)
Friction loss in 340 ft of Wasteflow PC dripline	= 11.8 ft (5.1 psi)
Subtotal	= 88.2 ft (38.2 psi)
10 % of subtotal for fittings, etc.	= 9.0 ft (3.8 psi)
Pressure at end of dripline	= 23.1 ft (10 psi)
Total Dynamic Head	**= 78.7 ft (34.1psi)**

Pump requirements during operation = 9 gpm @ 78.7 ft TDH

Pressure requirements during field flush @ 13.5 gpm

Static head	= 7.0 ft (3.0 psi)
Pressure loss through 1 inch screen filter	= 4.6 ft (2.0 psi)
Solenoid valve	= 4.4 ft (1.9 psi)
185 ft of 1 ½ inch PVC supply line to valve	= 2.1 ft (0.9 psi)
Distribution valve to four (4) zones	= 11.6 ft (5.0 psi)
Static head (negative) to zone	= -2.0 ft (-0.9 psi)
Pressure at beginning of zone	= 53.0 ft (22.3 psi)
Friction loss in 340 ft of Wasteflow PC dripline	= 29.9 ft (12.9 psi)
Static head (negative) from field to pretreatment	= -6.0 ft (-2.6 psi)
Friction loss in 120 ft of 1 inch PVC @ 2 ft/sec	= 1.8 ft (0.8 psi)
Subtotal	=132.0 ft (57.1 psi)
10% add-on for fittings, etc.	= 13.2 ft (5.7 psi)
Total Dynamic Head	**=126.6 ft (54.8 psi)**

Pump requirements during field flush @ 1 ft/sec = 13.5 gpm @ 127 ft TDH

In order to provide for the hydraulic requirements during both the operating and field flush modes, you will need a pump capable of providing a minimum of 13.5 gpm @ a TDH of 145 ft.

Please feel free to contact me at (618) 659-1169 if you have any questions regarding the contents of this letter.

Sincerely,

Calvin Locker, R.S.
Regional Manager

Herron's
Soil
Interpretations

Post Office Box 1086
Farmington, Arkansas 72730

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

September 24, 2002

EDA
Steve Hesse
134 W. Emma
Springdale, AR 72764

RE: Bethel Heights Soil Loading Rates

Steve:

Attached you will find a summary of the soil interpretations and projected loading rates for 41 pits for the 12 acres adjacent to City Hall in Bethel Heights. This investigation was conducted during the week of September 2. Alison West, Sanitarian with the Benton County Department of Health, inspected the pits on September 13 and 15, and the attached interpretations were approved on September 23.

I have also attached the methodology for calculating the loading rates, using one of the pits at the 12-acre site as an example. This information will be submitted to Alison West on September 25. To calculate storage, I am using estimated soil porosity at field capacity, which is the soil moisture storage capacity after one to three days of drainage following precipitation. This is added to the evapotranspiration rate for the stress period to get the actual loading rate.

Please contact me if you need additional information.

Sincerely,

Sheri Herron
Principal Soil Scientist

Attachments

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

DRIP IRRIGATION LOADING RATE CALCULATIONS

METHOD: Use percent soil water at field capacity to determine the quantity of treated effluent that the soil can store above the adjusted moderate seasonal water table, assuming 7.48 gal/ft^3. Determine field capacity from the most limiting soil texture within the storage zone above the adjusted moderate water table (sand is most limiting, then silt, then clay). Determine evapotranspiration rates for wettest month and for type of plants on site. Divide volume of effluent by soil storage (in gallons) to get cubic feet of soil required each day. Multiply that number by 18 to allow for storage during the 18-day stress period. Divide the cubic feet of storage required during the stress period by the cubic feet of soil available above the adjusted moderate seasonal water table to get square feet of area based on storage only. Add storage loading rate to evapotranspiration rate for actual loading rate for drip irrigation.

Design Calculations

Percent soil water at field capacity (silt loam) = 30% (1 ft^3 of soil stores approx. 2.24 gal.)

Evapotranspiration for tall fescue in Fayetteville in May = 0.28 gal/ft^2/day

Design flow: 12,500 gallons/day

Adjusted moderate seasonal water table = 2.18 feet

Stress period = 18 days

12,500 gpd / 2.24g/ft^3 : 5,580 ft^3/day of soil needed for storage only

5,580 ft^3 x 18 days = 100,440 ft^3 of soil needed to store during the stress period

199,440 ft^3 / 3.3 ft = 30,436 ft^2 of area needed for storage only

12,500 gpd / 30,436 ft^2 0.41 gpd/ft^2 storage loading rate

Add Storage & Evapotranspiration to obtain actual loading rate:

0.41 + 0.28 = 0.69 gpd/ft^2

12,500 gpd / 0.69 gpd. 18,116 ft^2 of area required for drip irrigation

BETHEL HEIGHTS SOIL DESCRIPTION 12 ACRES ADJACENT TO CITY HALL

PIT NO.	SWT	DEPTH	TEXTURE	REDOX	STRUCTURE	BOUNDARY
5000		0-15"	silt loam		moderate fine subangular blocky	clear wavy
	B	15-33"	silt loam	10YR 7/3	moderate fine subangular blocky	clear wavy
	M	33-50"	silt loam	10YR 6/2; 10YR 6/6; 2.5YR 4/6	moderate fine subangular blocky	
5001		0-8"	silt loam		moderate fine subangular blocky	clear smooth
		8-26"	silty clay loam		moderate medium subangular blocky	clear smooth
	B	26-50"	silty clay loam	10YR 7/3; Mn	moderate medium subangular blocky	
5002		0-12"	silt loam		moderate medium subangular blocky	clear smooth
		12-21"	silt loam		moderate medium subangular blocky	clear smooth
		21-40"	silty clay loam		moderate medium subangular blocky	clear smooth
	M	40-45"	silt loam	10YR 6/2; 10YR 7/6	moderate medium subangular blocky	
5003		0-8"	silt loam		moderate medium subangular blocky	clear smooth
		8-28"	silt loam		moderate coarse subangular blocky	clear wavy
	B	28-40"	silty clay loam	2.5YR 3/6; Mn	moderate medium subangular blocky	clear wavy
	M	40-50"	silty clay loam	Mn; 10YR 6/2; 10YR 7/3	moderate coarse subangular blocky	
5006		0-10"	silt loam		moderate medium subangular blocky	clear smooth
		10-17"	silt loam		moderate medium subangular blocky	clear smooth
		17-32"	silty clay loam	Mn < 2mm	strong coarse subangular blocky	clear wavy
	M	32-40"	silty clay loam	10YR 6/2; 10YR 7/6	strong coarse subangular blocky	
5007		0-10"	silt loam		moderate medium subangular blocky	clear smooth
		10-20"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
	B	20-36"	silty clay loam	Mn masses; 10YR 7/4	moderate medium subangular blocky	clear wavy
	M	36-45"	silt loam	Mn concr.; 10YR 6/2	moderate medium subangular blocky	
5008		0-10"	silt loam		moderate fine subangular blocky	clear smooth
		10-20"	silty clay loam		moderate medium subangular blocky	clear wavy
	B	20-28"	silty clay loam	10YR 6/3	moderate medium subangular blocky	clear wavy
	M	28-45"	silty clay loam	10YR 6/2; 10YR 7/3	strong medium subangular blocky	
5009		0-4"	silt loam		moderate medium subangular blocky	clear smooth
		4-10"	silt loam		moderate medium subangular blocky	clear smooth
		10-18"	silt loam		moderate medium subangular blocky	clear smooth
		18-25"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
	B	25-30"	silty clay loam	Mn & FeMn	moderate medium subangular blocky	clear wavy
	M	30-45"	silty clay loam	10YR 6/1; 10YR 5/4	moderate medium subangular blocky	
5010		0-14"	silt loam		moderate medium subangular blocky	clear smooth
		14-31"	silt loam		moderate medium subangular blocky	clear smooth
	B	31-36"	silty clay loam	10YR 7/3; 2.5YR 4/6	moderate medium subangular blocky	clear wavy
	M	36-43"	silty loam	10YR 6/2; 10YR 7/4	moderate medium subangular blocky	

BETHEL HEIGHTS SOIL DESCRIPTION 12 ACRES ADJACENT TO CITY HALL

PIT NO.	SWT	DEPTH	TEXTURE	REDOX	STRUCTURE	BOUNDARY
5011		0-9"	silt loam		moderate medium subangular blocky	clear smooth
		9-28"	silt loam		moderate medium subangular blocky	clear wavy
	B	28-36"	silty clay loam	10YR 7/4; 2.5YR 4/8	moderate medium subangular blocky	clear wavy
	M	36-45"	silty clay loam	10YR 6/2; 10YR 7/4	moderate medium subangular blocky	
5012		0-13"	silt loam		moderate medium subangular blocky	clear smooth
		13-30"	silt loam		moderate medium subangular blocky	clear wavy
	B	30-45"	silt loam	7.5YR 6/4	moderate medium subangular blocky	
5013		0-8"	silt loam		moderate medium subangular blocky	clear smooth
		8-13"	silt loam		moderate medium subangular blocky	clear smooth
		13-19"	silt loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
		19-26"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
	B	26-33"	silty clay loam	2.5YR 3/6; 10YR 6/4	moderate fine subangular blocky	clear wavy
	M	33-45"	silty clay loam	10YR 5/3; 10YR 6/2	moderate medium subangular blocky	clear wavy
5014		0-12"	silt loam		moderate medium subangular blocky	clear smooth
		12-27"	silt loam		moderate medium subangular blocky	clear smooth
		27-38"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	clear wavy
	B	38-50"	silty clay loam	10YR 7/3	moderate medium subangular blocky	
5015		0-9"	silt loam		moderate medium subangular blocky	clear smooth
		9-28"	silt loam		moderate medium subangular blocky	clear smooth
	B	28-37"	silty clay loam	2.5YR 4/6; Mn stains	moderate medium subangular blocky	clear wavy
	M	37-45"	silt loam	10YR 6/2; 10YR 6/6	moderate medium subangular blocky	
5016		0-12"	silt loam		moderate medium subangular blocky	clear smooth
		12-22"	silt loam		moderate medium subangular blocky	clear smooth
		22-34"	silty clay loam	Mn masses	moderate medium subangular blocky	clear wavy
	B	34-50"	silty clay loam	Mn Concr; 10YR 7/3	moderate medium subangular blocky	
5017		0-7"	silt loam		moderate fine subangular blocky	clear smooth
		7-13"	silt loam		moderate medium subangular blocky	clear smooth
		13-20"	silt loam		moderate medium subangular blocky	clear smooth
		20-28"	silty clay loam		weak fine subangular blocky	clear wavy
	B	28-40"	silty clay loam	10YR 7/3	weak fine subangular blocky	
5018		0-15"	silt loam		weak medium subangular blocky	clear smooth
		15-26"	silty clay loam		moderate medium subangular blocky	clear smooth
	B	26-41"	silty clay loam	10YR 7/3; 2.5YR 4/6	moderate medium subangular blocky	clear wavy
	M	41-50"	silt loam	10YR 6/2; 10YR 7/3; 10YR 6/6	moderate medium subangular blocky	

BETHEL HEIGHTS SOIL DESCRIPTIONS 12 ACRES ADJACENT TO CITY HALL

PIT NO.	SWT	DEPTH	TEXTURE	REDOX	STRUCTURE	BOUNDARY
5019		0-9"	silt loam		weak medium subangular blocky	clear smooth
		9-22"	silty clay loam	Mn masses	moderate medium subangular blocky	clear wavy
	B	22-32"	silty clay loam	5YR 5/8; 10YR 6/4	moderate medium subangular blocky	clear wavy
	M	32-44"	silty clay loam	10YR 6/2; 10YR 7/4	moderate medium subangular blocky	
5020		0-17"	silt loam		moderate medium subangular blocky	clear smooth
		17-25"	silt loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
	B	25-45"	silty clay loam	10YR 7/3; 10R 4/6	moderate medium subangular blocky	clear wavy
5021		0-8"	silt loam		moderate fine subangular blocky	clear smooth
		8-17"	silt loam		moderate fine subangular blocky	clear smooth
		17-28"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	clear wavy
	B	28-32"	silty clay loam	10YR 6/3; 10YR 6/6; 5YR 5/6	moderate coarse subangular blocky	clear wavy
	M	32-42"	silty clay loam	10YR 6/2; Mn concr.	weak fine subangular blocky	
5022		0-11"	silt loam		moderate medium subangular blocky	clear smooth
		11-22"	silt loam		moderate medium subangular blocky	clear smooth
		22-30"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
		30-40"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	
5023		0-15"	silt loam		moderate medium subangular blocky	clear smooth
		15-23"	silt loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
	B	23-32"	silty clay loam	2.5YR 4/6; 10YR 6/8	moderate medium subangular blocky	clear wavy
	M	32-42"	silty clay loam	10YR 6/2; 2.5YR 4/6; 10YR 6/6	moderate medium subangular blocky	
5024		0-17"	silt loam		moderate medium subangular blocky	clear smooth
		17-25"	silt loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
	B	25-45"	silty clay loam	10YR 7/3; 10YR 4/6	moderate medium subangular blocky	
5025		0-9"	silt loam		moderate medium subangular blocky	clear smooth
		9-20"	silty clay loam		moderate medium subangular blocky	clear wavy
	B	20-25"	silty clay loam	10YR 6/3	moderate fine subangular blocky	clear wavy
	M	25-41"	silt loam	10YR 6/2; 10YR 7/3	moderate fine subangular blocky	
5026		0-16"	silt loam		moderate medium subangular blocky	clear smooth
	B	16-28"	silt loam	2.5YR 5/6	moderate medium subangular blocky	clear wavy
	M	28-50"	silty clay loam	10YR 6/2	moderate medium subangular blocky	
5027		0-15"	silt loam		moderate medium subangular blocky	clear wavy
	B	15-19"	silty clay loam	2.5YR 4/6; 10YR 7/3	moderate medium subangular blocky	clear wavy
	M	19-42"	silty clay loam	10YR 6/2; 10YR 6/1; 10YR 6/6	moderate medium subangular blocky	
5028		0-9"	silt loam		moderate medium subangular blocky	clear smooth
		9-25"	silty clay loam		moderate medium subangular blocky	clear smooth
	M	25-50"	silty clay loam	10YR 6/2; 7.5YR 5/6	moderate medium subangular blocky	
5029		0-9"	silt loam		weak fine subangular blocky	clear smooth
		9-21"	silt loam		moderate medium subangular blocky	clear wavy
		21-34"	silty clay loam		moderate medium subangular blocky	clear wavy
	M	34-45"	silty clay loam	10YR 6/2; 10YR 7/3	moderate fine subangular blocky	

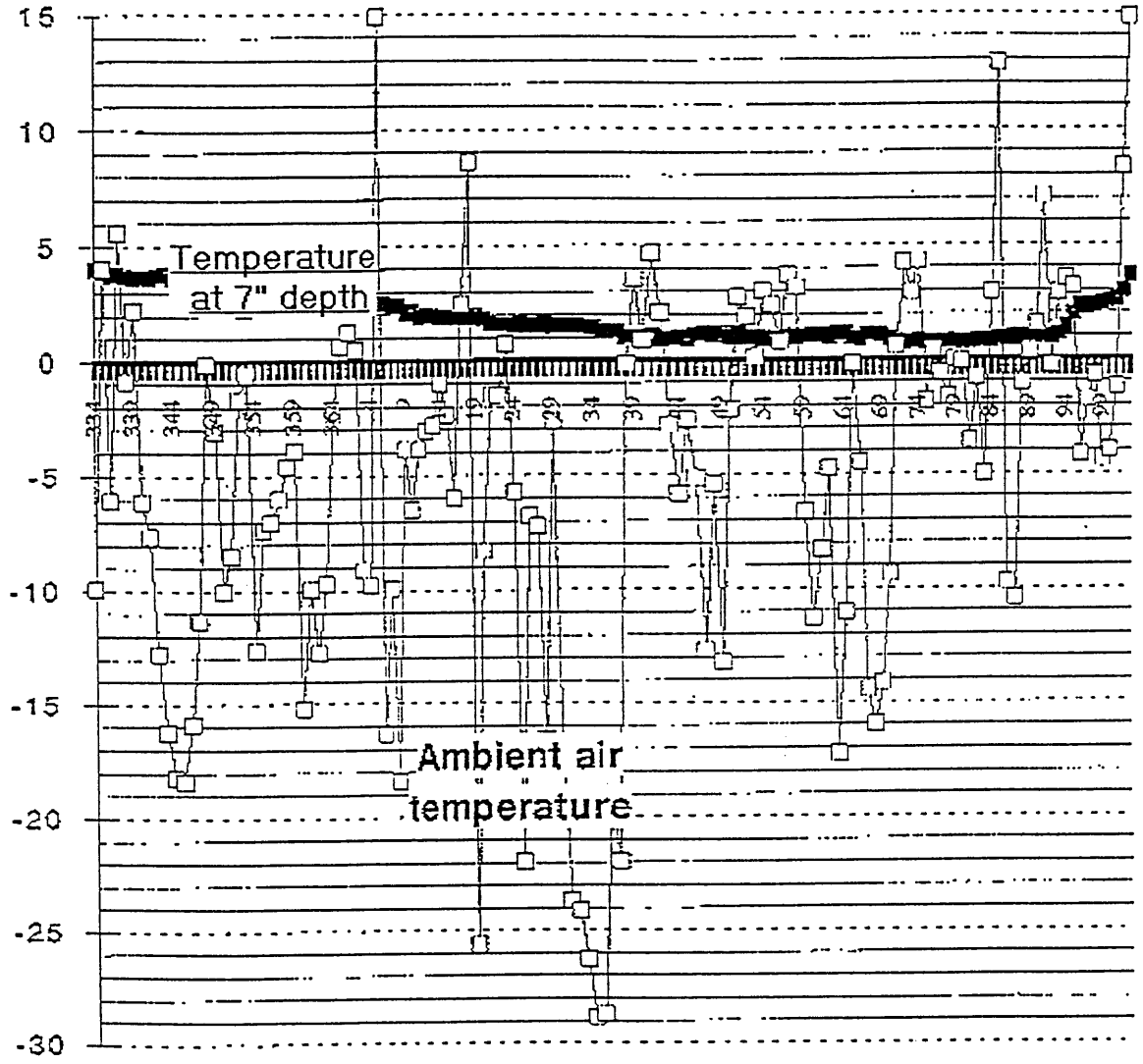
BETHEL HEIGHTS SOIL DESCRIPTIONS 12 ACRES ADJACENT TO CITY HALL

PIT NO.	SWT	DEPTH	TEXTURE	REDOX	STRUCTURE	BOUNDARY
5030		0-10"	silt loam		weak fine subangular blocky	clear smooth
		10-23"	silty clay loam	Mn stains	moderate medium subangular blocky	clear wavy
	B	23-26"	silty clay loam	10YR 7/3	moderate medium subangular blocky	clear wavy
	M	26-50"	silt loam	10YR 7/2; 2.5YR 4/6	moderate medium subangular blocky	
5031		0-15"	silt loam		moderate medium subangular blocky	clear smooth
		15-22"	silty clay loam		moderate medium subangular blocky	clear wavy
	B	22-29"	silty clay loam	10YR 7/3; 2.5YR 4/6	moderate medium subangular blocky	clear wavy
	M	29-45"	silt loam	7.5YR 4/6; 10YR 6/1; 10YR 7/4	moderate medium subangular blocky	
5032		0-9"	silt loam		moderate fine subangular blocky	clear smooth
		9-23"	silty clay loam	Mn stains	moderate medium subangular blocky	clear smooth
	B	23-29"	silty clay loam	10YR 6/3; 10YR 6/6	moderate medium subangular blocky	clear wavy
	M	29-45"	silty clay loam	10YR 6/2; 10YR 6/6	moderate medium subangular blocky	
5033		0-8"	silt loam		moderate medium subangular blocky	clear smooth
		8-16"	silt loam		moderate medium subangular blocky	clear smooth
		16-20"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	clear wavy
	B	20-26"	silty clay loam	10YR 7/3	moderate medium subangular blocky	clear wavy
	M	26-50"	silt loam	10YR 6/2; 10YR 6/4	moderate medium subangular blocky	
5034		0-17"	silt loam		moderate medium subangular blocky	clear smooth
		17-29"	silty clay loam		moderate medium subangular blocky	clear wavy
	M	29-50"	silty clay loam	10YR 6/2;10YR 7/3	moderate medium subangular blocky	
5035		0-17"	silt loam		moderate medium subangular blocky	clear smooth
	B	17-25"	silty loam	7.5YR 5/6; 2.5YR 4/6	moderate medium subangular blocky	clear wavy
	M	25-43"	silt loam	10YR 6/2; 7.5YR 4/6; 10YR 7/4	moderate medium subangular blocky	
5036		0-11"	silt loam		moderate fine subangular blocky	clear smooth
		11-23"	silty clay loam		moderate medium subangular blocky	clear smooth
	B	23-26"	silty clay loam	7.5YR 6/4	moderate medium subangular blocky	clear wavy
	M	26-45"	silt loam	10YR 6/2; 10YR 6/6	strong medium subangular blocky	
5037		0-9"	silt loam		moderate medium subangular blocky	clear smooth
		9-20"	silty clay loam		moderate medium subangular blocky	clear wavy
	B	20-26"	silty clay loam	2.5YR 3/6; 10YR 7/3	moderate medium subangular blocky	clear wavy
	M	26-50"	silt loam	10YR 7/2; 10YR 6/6	moderate fine subangular blocky	
5038		0-17"	silt loam		moderate medium subangular blocky	clear smooth
		17-31"	silty clay loam		moderate medium subangular blocky	clear wavy
	B	31-37"	silty clay loam	10YR 7/4; 2.5YR 4/8	moderate medium subangular blocky	clear wavy
	M	37-44"	silt loam	2.5YR 4/6; 10YR 6/2; 10YR 7/4	moderate medium subangular blocky	
5039		0-14"	silt loam		moderate medium subangular blocky	clear smooth
		14-22"	silty clay loam		moderate medium subangular blocky	clear wavy
	B	22-26"	silty clay loam	10YR 7/3; 2.5YR 4/6	moderate medium subangular blocky	clear wavy
	M	26-50"	silt loam	10YR 6/2; 2.5YR 4/6	moderate medium subangular blocky	

BETHEL HEIGHTS SOIL DESCRIPTION[illegible]12 ACRES ADJACENT TO CITY HALL

PIT NO.	SWT	DEPTH	TEXTURE	REDOX	STRUCTURE	BOUNDARY
5040		0-9"	silt loam		weak fine subangular blocky	clear smooth
		9-22"	silty clay loam		moderate medium subangular blocky	clear smooth
	B	22-27"	silty clay loam	10YR 6/3; 10YR 5/6	moderate medium subangular blocky	clear wavy
	M	27-45"	silt loam	10YR 6/2; 7.5YR 4/6; 10YR 7/4	strong coarse subangular blocky	
5041		0-9"	silt loam		moderate fine subangular blocky	clear smooth
		9-20"	silty clay loam	Mn < 2mm	moderate fine subangular blocky	clear smooth
	B	20-25"	silty clay loam	7.5YR 5/6	moderate fine subangular blocky	clear wavy
	M	25-48"	silty clay loam	10YR 6/2; 10YR 6/4	moderate fine subangular blocky	
5042		0-11"	silt loam		moderate fine subangular blocky	clear smooth
		11-23"	silt loam		moderate medium subangular blocky	clear wavy
	B	23-27"	silty clay loam	10YR 6/6	moderate medium subangular blocky	clear wavy
	M	27-40"	silty clay loam	10YR 6/2; 10YR 7/3	moderate medium subangular blocky	

GEOFLOW WASTEFLOW DRIP IRRIGATION SYSTEM UNDER FREEZING CONDITIONS - DISPOSING OF AEROBIC TREATED EFFLUENT - DATA COLLECTED BY AN INDEPENDENT THIRD PARTY.



Day # from December 1995 to April 1996

SECTION 02220

EXCAVATING, BACKFILLING AND COMPACTING

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. This section includes earthwork required for the construction of utility pipes and appurtenances, drainage pipes and appurtenances, and electrical conduit. Included are excavation, backfilling and compaction of backfill around utility pipes (embedment) and appurtenances.

1.2 RELATED SECTIONS:

A. Section 01530 - Barriers and Enclousers

B. Section 02100 - Site Preparation

1.3 QUALITY ASSURANCE:

A. Methods of Testing

1. The moisture density relations of material shall be determined in the laboratory in accordance with AASHTO T-99 or T-180, as specified.

2. Field density of backfill shall be determined in accordance with ASTM D 2922

PART 2 - PRODUCTS

2.1 BACKFILL MATERIAL:

A. Material excavated from the job site shall be used for backfill to the maximum extent possible. Material shall be free of rock, manmade debris and organic material larger than 6 inches in any dimension or as specified by local codes and regulations.

B. Bedding and haunching material for all PVC water and sanitary sewer mains shall meet ASTM D448 size #67, or ASTM D2774.

PART 3 - EXECUTION

3.1 TRENCH EXCAVATION:

A. General

1. Cut and remove all natural growth, and remove all manmade debris from planned location of the trench. Dispose of cleared material in a manner approved by the Engineer and applicable governmental regulations.

2. After backfill of trench has settled, all sod shall be replaced to a condition equal to or better than that prior to construction. In the event that insufficient sod has been stored, or sod has been lost or destroyed, provide and install new ground cover of the existing type.

3. Excavate with caution so that location of underground conduits and structures can be protected.

4. Excavate material encountered to the lines and elevations necessary to complete the project.

5. Relocate surface water before excavating and protect excavated trench from entrance of surface water. It is essential that the discharge of any trench dewatering pumps be conducted to natural drainage channels, or storm sewers.

6. All excavation shall be dewatered before any construction is begun. Concrete shall be placed only upon dry, firm foundation material and pipe shall be laid only in dry trenches.

7. Provide and install bracing and shoring necessary for safety of personnel, protection of work, and compliance with governmental agencies.

B. Utilities

1. The location and/or elevation of existing utilities as shown on the Drawings is based on records of the various utility companies and, where possible, measurements taken in the field. The information is not to be relied on as being exact or complete. Call the respective utility owner at least 48 hours before any excavation to request exact field location of utilities.

2. Protect utilities encountered during excavation.

3. Do not interrupt service in utilities encountered during excavation without approval of the utility owner.

4. If utilities are damaged or utility service is interrupted by work under this section, the utility owner has the first right to repair. If public health or safety is at risk, Contractor shall take appropriate prudent action to repair damage and service interruption. Costs of utility protection and repair shall be borne by the Contractor.

5. If existing utilities are found to interfere with the permanent facility being constructed, notify the Engineer for instructions.

6. Do not proceed with permanent relocation of utilities without written instructions from the Engineer.

C. Trench Depth

1. Excavate to the elevation necessary to provide the depth of bedding material under the barrel of the pipe, noted on the drawings or in these specifications, whichever is greater.

2. The trench for all sanitary sewers shall be excavated to at least 4 inches below the grade required to provide proper pipe embedment and a minimum earth cover of 24 inches. The trench for all water lines shall be excavated to the established pipe grade (unless structural or foundation requirements indicate otherwise) so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at every point between bell holes. The minimum pipe cover for water or force mains shall be 36 inches.

3. Bell hole excavation shall also be sufficient to allow proper placing of the joint compound, where joint compound is used. No weight of dirt or pipe shall be supported by the bell of the pipe.

4. All over-excavation up to 2 feet, shall be backfilled with bedding material in 6 inch layers, tamped to a bearing capacity equal to the adjacent undisturbed earth. Over excavation greater than 2 feet will require that excavation operations be stopped until an engineered backfill is determined.

5. The subgrade beneath the centerline of the pipe shall be finished to within 0.03 feet of a straight line between pipe joints or batter boards, and all tolerances shall be above the specified grade. The finished subgrade shall be prepared accurately by means of hand tools.

D. Trench Width

1. Excavate to the width ample to permit pipe jointing, bedding placement, and compaction as specified. Specified width dimensions must be maintained from trench bottom to an elevation 12 inches above barrel of pipe. Over

width excavation will require excavation operation to stop until additional earth loads can be compared to strength of pipe.

2. If the Contractor over excavates the trench, he shall provide additional pipe bedding gravel or concrete as necessary to prevent crushing of the pipe due to excessive earth loads.

E. Trench Length

1. Excavate to a maximum distance of 75 feet from the pipe jointing operation. Longer distances will be considered when conditions warrant.

F. Excavation In Rock

1. When rock is encountered, excavate to an elevation 6 inches below and on each side of all pipe, valves and fittings for pipes 24 inches in diameter or less, and 9 inches for pipes larger than 24 inches in diameter. Every trench in rock shall be fully opened at least 50 feet in advance of the place where pipe is being laid or concrete masonry work is in progress.

2. Rock excavation shall consist of igneous, metamorphic, and sedimentary rock which cannot be excavated without blasting, and all boulders or other detached stones each having a volume of 1 cubic yard or more.

   a. Before explosives are used, Contractor shall notify Engineer, Owner, neighboring property occupants, neighboring owners and local governing agency at least 8 hours in advance of blasting. The Engineer must be notified so as to record rock elevations etc. in order to record quantity of rock excavated. Failure to notify Engineer could result in loss of payment to contractor for rock excavated.

   b. Storage and use of explosives shall be in accordance with applicable governmental regulations. Contractor shall obtain all necessary permits from governmental agencies.

   c. Contractor shall be responsible for any damage resulting from the use of explosives.

   d. No rock excavation will be paid for that is excavated without the prior notification and measurement and approval by the Engineer.

G. Excavation In Unstable Soil

1. Where the planned bottom of trench is found to be unstable in the judgement of the Engineer, excavation shall stop until an engineered subgrade

stabilization is determined. The contractor shall excavate and remove such unsuitable material to the width and depth ordered by the Engineer.

2. Before the pipe is laid, the subgrade shall be made by backfilling with clean crushed rock or gravel (ASTM D 2487, Class I material), or crushed stone (AHTD Class 7), or as specified by local governing agency, in 6 - 8 inch uncompacted layers. The layers shall be thoroughly tamped by hand or machine to the density of adjacent undisturbed soil so as to provide a uniform and continuous bearing and support for the pipe at every point between the bell holes.

H. Excavation In Wet Conditions

1. Where the planned bottom of trench contains water or trench bottom is soft from excess water, excavation depth shall increase a minimum of 6 inches.

2. Remove water to an elevation below bottom edge of pipe joint or structure base.

3. Trench dewatering system shall discharge to natural drainage channel or storm sewer.

4. The trench will be brought back to grade with clean crushed rock or gravel (ASTM D 2487, Class I material), or crushed stone (AHTD Class 7), or as specified by local governing agency, in 6 - 8 inch uncompacted layers. The layers shall be thoroughly tamped by hand or machine to the density of adjacent undisturbed soil so as to provide a uniform and continuous bearing and support for the pipe at every point between the bell holes.

I. Excavation At Unforseen Structure

1. Preserve unforseen structures encountered in excavation.

2. Advise Engineer when unforseen structure interferes with planned work. Engineer will determine if plan will change or if structure will be abandoned.

J. Unauthorized Excavation

1. Unauthorized excavation is removal of materials beyond specified elevations or dimensions.

K. Unsuitable and Excess Excavated Material

1. Excavated material not suitable for backfilling during the excavation shall be disposed of at a site selected by Contractor and in a manner approved by the Engineer and applicable governmental regulations.

L. Bracing and Shoring

1. The sides of any excavation, when deemed necessary, shall be properly supported with shielding, bracing, shoring, or sheeting as the need may be and required by local governing agencies. Such bracing, shoring, or sheeting shall be withdrawn as the work progresses in such a manner as not to endanger life and property and allow for backfilling of the trench in accordance with these specifications.

2. If the excavation is close enough to buildings or other foundations as to endanger their stability by removing such bracings, then they shall be made secure and left in place, and the line trench shall be backfilled and thoroughly tamped with the bracing in place.

3. Where trench walls are sloped away from the trench to prevent slides or cave-ins, it will be permissible to cut the trench banks on a slope above an elevation two (2) feet above the crown of the pipe.

4. Contractor shall be responsible for maintaining the excavation free from slides or cave-ins and safe for workmen, and to comply with federal labor requirements for trench safety. No observation by the Engineer or Engineer's Representative will reduce the Contractor's responsibility.

M. Manhole Excavation

1. Excavation for manholes shall be of such dimension and depth as to allow the construction of the manhole as shown on the drawings. The area of excavation for the base shall be only that necessary to provide an adequate base with its sides and bottom poured against undisturbed earth. All over excavation below the required grade shall be filled with concrete poured monolithically with the base.

3.2 BACKFILLING AND COMPACTION

A. Backfilling shall closely follow pipe laying and be within 5 feet of the end of the last pipe at the end of workday.

B. Backfill around the pipe (pipe embedment) is specified as noted in Paragraph 2.1 of this Section.

C. Backfill where ground surface is not graveled or paved for vehicle or pedestrian use:

1. Initial backfill, for the 2 foot distance above pipe embedment shall be free of rock, organic material, man made debris or frozen lumps with a dimension greater than three inches measured in any direction.

2. Backfill for the remainder of the trench shall be free of rock, organic material or man made debris with a maximum dimension of 6 inches measured in any direction.

3. All backfill above pipe embedment may be mechanically compacted to a density equal to 85 percent standard proctor or better. Contractor shall backfill trench settlement until Engineer determines settlement is complete.

D. Backfill where ground surface is graveled for vehicle use or paved for pedestrian use only.

1. The entire trench up to a point 2 feet below existing or proposed subgrade shall be backfilled with AHTD Class 7 aggregate and compacted to 90 percent Modified Proctor Density. The remaining 2 feet shall be backfilled with AHTD Class 7 placed in 6 inch lifts and compacted to 95 percent Modified Proctor Density.

E. Backfill under existing or proposed public streets

1. The entire trench shall be backfilled up to the subgrade with AHTD Class 7 aggregate in 4-6 inch lifts and compacted to 95 percent Modified Proctor Density.

F. Backfill Unstable Trench Bottom

1. Provide and place AHTD Class 1 or AHTD Class 2 crushed aggregate, compacted to 95 percent maximum density, to bottom elevation of pipe bedding.

G. Backfill Wet Condition Trench Bottom

1. Provide and place AHTD Class 1 or AHTD Class 2 crushed aggregate, compacted to 95 percent maximum density, from trench bottom to bottom elevation of pipe bedding.

H. Manhole backfill

1. Backfilling of manholes up to 12 inches from the base shall be done with pipe protection. Backfill of manholes shall be compacted to a density of not less than 90 percent Modified Proctor. Obtain 90 percent density the entire depth of excavation except that in public street or roadways where a density of 95% shall be obtained.

2. Backfill around manholes shall not be completed until adequate strength has been obtained to support the backfill without damage to the manhole. In no case will backfill be allowed on manholes until the concrete is at least 48

hours old. Manholes must be leak tested prior to backfilling.

3.3 ELECTRICAL CONDUIT TRENCHING

A. Excavate trenches for installation of electrical conduit by electric utility. Trench width, depth, and location shall be as directed by the governing electric company.

B. Backfill trench after electric utility indicates their work is complete. Use backfill material specified in Paragraph 2.1, except use Class 7 crushed stone base course as specified in Section 02230 for entire trench depth at locations indicated in paragraphs 3.2.D and 3.2.E, and compacted as required in those paragraphs.

END OF SECTION

SECTION 02731

SANITARY SEWAGE FORCE MAINS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. This section includes performing, excavating, backfilling, and testing of all requirements for work of this Section. Furnishing and installation of pressure sanitary sewage systems as described in the Contract Documents.

1.2 RELATED SECTIONS:

B. Section 02220 - Excavating, backfilling, & compaction for utilities

1.4 QUALITY ASSURANCE:

A. Regulatory Requirements -

1. All installation shall be in accordance with local governing authority and State codes.

PART 2 - PRODUCTS

2.1 COMPONENTS:

A. Pressure Sewer Pipe

1. All pressure sewer pipe shall be manufactured from class 12454-A or 12454-B materials conforming to ASTM D 1784, Type 1, Grade 1 (PVC 1120) resins and shall conform to the requirements of specification ASTM D 2241 as amended and/or revised with Standard Dimension Ratio (SDR) of 26.

2. The pipe shall be permanently marked by the manufacturer and coded for the date, batch and shift in which the pipe was make along with other required marking as set forth in ASTM specifications.

B. PVC Fittings - less than 4" diameter

1. All fittings and specials used in connection with the pipe shall conform to recommendations by the pipe manufacturer or be of proven equal. The pipe and fittings shall be installed in accordance with the recommendations of the pipe manufacturer and Engineer.

C. Ductile iron - 4" diameter and above

1. All fitting and specials used in connection with the pipe shall conform to AWWA short or long bodied ductile iron fittings using a mechanical joint system with hardened or duck tipped type of rubber gaskets in accordance with AWWA Specifications C-110 and C-111. The fittings shall be cement-lined in accordance with AWWA Specification C-104. The pipe and fittings shall be installed in accordance with the recommendations of the pipe manufacturer and Engineer. The use of torque type wrenches shall be mandatory to tighten the glands as required by the manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General

1. Excavate and backfill as specified in Section 02220 with the following additional requirements:

2. All pipe runs shall be constructed as close as possible to those shown on the approved Construction Drawings.

3. Excavate to required depth and grade to obtain fall required. The trench shall be excavated to at least 4 inches below the grade required to provide proper pipe embedment and a minimum of 24 inches of earth cover. Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipes, valves, and fittings for pipes 24 inches in diameter or less, 9 inches for pipes larger than 24 inches in diameter.

4. Width of trenches shall be constructed according to the detail shown on the drawings.

5. Remove debris from trench prior to laying of pipe.

6. Embedment material shall be restricted to material meeting requirements of ASTM D448, size #67, or ASTM D2774.

7. Provide trench bracing and drainage so that workmen may work therein safely and efficiently. It is essential that the discharge of any trench dewatering pumps be conducted to natural drainage channel, drains, or storm drains. The contractor shall be responsible for any discharge permits that may be required.

8. The contractor is responsible for the repair of any other utility lines damaged because of the contractors carelessness.

B. Wet Excavation

1. When water or unstable soil is encountered in the bottom of the trench, the Contractor will be required to excavate below grade a minimum of 6 inches, and the trench bottom will be brought back to grade with clean crushed rock or gravel (ASTM D2487, Class I material), or (AHTD Class 7).

C. Safety structures

1. The sides of any excavation, when deemed necessary, shall be properly supported with shielding, bracing, shoring, or sheeting as the need may be. Such bracing, or sheeting shall be withdrawn as the work progresses in such a manner as not to endanger life and property and to allow for backfilling of the trench in accordance with these specifications. It is the Contractor's responsibility to follow all of OSHA's requirements.

D. Explosives

1. In the event that the use of explosives is necessary for the efficient prosecution of the work, the Contractor shall notify the Architect in advance of their use, and shall exercise every precaution to protect the completed work, neighboring property, water lines, or other underground utility. Any damages to private property resulting from the use of explosives shall be the liability of the Contractor.

E. Embedment

1. All pipelines shall be installed using embedment materials as defined in 3.1.A.6 above.

F. Initial Backfilling

1. Initial backfilling shall be completed using the same material as for the embedment as defined above. Initial backfilling shall be completed to a depth of 6" above the pipe.

G. Final Backfilling

1. Backfilling of pipelines shall include the refilling and consolidation (compaction) of the fill in the excavation up to the surrounding ground surface or road grade at crossings. All pipeline trench backfill shall be placed in layers of appropriate thickness not to exceed 24 inches; and compacted by hand or approved mechanical methods. All trench backfill (except that under paved areas) shall be compacted to a minimum density of 85% of that of the adjacent soil as determined in accordance with ASTM D2922.

2. Where trenches are under existing or proposed paved area, the entire trench up

to a point (2) feet below the existing or proposed subgrade shall be backfilled with AHTD Class 7 and compacted to 90 percent Modified Proctor Density as determined by AASHTO T-180. The remaining 2 feet shall be backfilled with AHTD Class 7 placed in 6 inch lifts and compacted to 95% Standard Proctor Density as determined by AASHTO T-99. Density shall be verified in the field by the use of a calibrated nuclear density gauge, with a minimum of three tests per project, or 1 per 100 lineal feet, whichever is greater.

3. Where the trench is located under an existing or proposed public street, the entire remaining depth of the trench (after the embedment and initial backfilled area has been installed) shall be backfilled up to the subgrade with AHTD Class 7 placed in lifts of 6 to 8 inches and compacted to 95% Standard Proctor Density as determined by AASHTO T-99. Tests shall be taken as in (2) above to verify density.

4. Minimum cover over top of pipe is to be 30".

3.2 QUALITY ASSURANCE:

A. General

1. All pressure sewers shall be tested in accordance with the governing utility and shall be made in the presence of the Engineer and a representative of the governing water and sewer entity or as defined below, whichever is more strict.

B. Perform construction in accordance with utility company and/or municipality requirements.

C. Valves: Manufacturer's name and pressure rating marked on valve body.

D. Water distribution system pipe installed below grade and outside building shall be tested in accordance with the following procedures:

1. Perform testing of pipe materials, joints, and other materials incorporated into construction of water mains and force mains to determine leakage and watertightness. Pressure pipeline shall be tested in accordance with Section 4 of AWWA C600. In event state or local code requires more stringent test, more stringent shall apply.

2. Pressure Test:

After pipe has been laid, newly laid pipe or valved section thereof shall be subjected to hydrostatic pressure of at least 1.5 times working pressure at point of testing and not less than 1.25 times working pressure at highest point along test section. This test shall be performed in the presence of the Engineer or Engineer representative and shall be held for a duration of 2 hours.

3. Leakage Test:

Leakage test shall be conducted concurrently with pressure test. Leakage is defined as quantity of water that must be pumped into the newly laid pipeline or valved section thereof to regain a pressure equal to the pressure reading at the start of the test after air in pipeline has been expelled and pipeline has been filled with water. Leakage shall not be measured by drop in pressure in test section over period of time.

The maximum allowable leakage is defined by the formula listed below. No pipeline installation will be accepted if the actual leakage is greater than the amount calculated by the following formula:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

L = allowable leakage, (gallons per hour)
S = length of pipe tested, (feet)
D = nominal diameter of pipe, (inches)
P = average test pressure during test, (psig)

4. Visible Leakage:

Visible leaks shall be repaired regardless of amount of leakage measured.

5. Acceptance of Installation:

If test of pipe laid in place discloses leakage greater than that specified, Contractor shall, at his own expense, locate all leaks and make repairs as necessary until leakage is within specified allowance.

Water for testing shall be supplied by the contractor at no expense to the Owner.

END OF SECTION 02731

175' of 1"PVC(sch 40) Force Main to L.Fd
Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\bethel h.fm2
Worksheet	13,220 ~~20,000~~ GPD Dripper Line Design
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Pressure at 2

Input Data	
Pressure at 1	170.00 feet H20
Elevation at 1	1,335.00 ft
Elevation at 2	1,345.00 ft
Length	175.00 ft
C Coefficient	150.0
Diameter	1.00 in
Discharge	6.8 gal/min

Results		
Pressure at 2	154.12	feet H20 = 66.8 PSI
Headloss	5.88	ft
Energy Grade at 1	1,505.11	ft
Energy Grade at 2	1,499.23	ft
Hydraulic Grade at 1	1,504.99	ft
Hydraulic Grade at 2	1,499.11	ft
Flow Area	0.01	ft^2
Wetted Perimeter	0.26	ft
Velocity	2.76	ft/s
Velocity Head	0.12	ft
Friction Slope	0.033613	ft/ft

Geoflow Subsurface Dripline Disposal Field Calculation

Job Description: Bethel Heights Sewer - Phase I
Contact: Steve Hesse & Charlee Presley
Prepared by:
Date: 09/26/2002

Please fill in the shaded areas below:

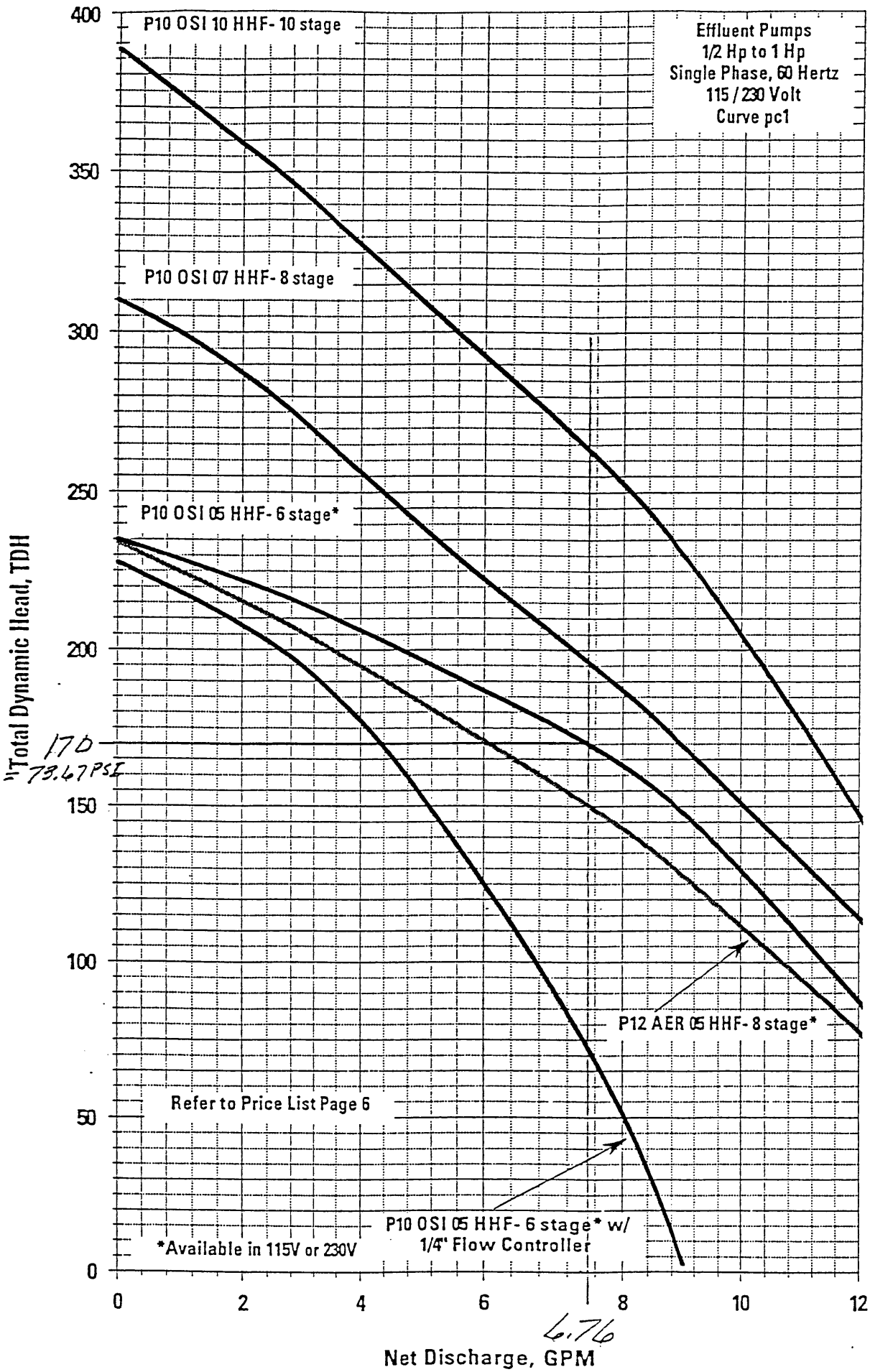
Note. This worksheet can be found in Geoflow's Design and Installation Manual

Worksheet - Field Design

		Single Zone	Multiple Zones	
Number of Zones		1	8	zone(s)
A)	Quantity of effluent to be disposed per day	13,220	1,653	gallons / day
B)	Hydraulic loading rate	0.54	0.54	gallons / sq.ft. / day
C)	Determine total area required	24,481	3,060	square ft.
D)	Choose spacing between WASTEFLOW lines	2	2	ft.
D)	Choose spacing between WASTEFLOW emitters	2	2	ft.
E)	Total linear ft.	12,241	1,530	each
F)	Total number of emitters	6,120	765	each
G)	Write "Classic" for WASTEFLOW Classic or write "PC" for pressure compensating dripline	PC	PC	WASTEFLOW dripline
H)	Pressure at the beginning of the dripfield		60	psi
I)	Feet of Head at the beginning of the dripfield	0	138.6	ft.
J)	What is the flow rate per emitter in gph?	0.53	0.53	gallons per hour
K)	Total flow for the area (gph)	3,244	405	gallons per hour
	Total flow for the area (gpm)	54.06	6.76	gallons per minute
L)	Select pipe diameters for manifolds and submains	2.5	1	inch
M)	Select Vortex Filter (item no.)	AP4E150-4 (1.5in./4holes)	AP4E-75 (0.75in)	
N)	Maximum length of each WASTEFLOW line. Sketch a layout of the WASTEFLOW lines in the disposal plot to make sure that the maximum lateral length of each WASTEFLOW dripline is not exceeded.		See Plans	ft.

Dosing			
Number of doses per day/zone:	12	12	
Pump run time per dose/zone (minutes):	20.38	20.38	minutes
Pump run time per day/zone (hours):	4.08	4.08	hours
Pump run time per day/all zones (hours):	4.08	32.60	hours

Dripline Volume			
Tubing Inside diameter	0.55	0.55	inches
Total length of WASTEFLOW dripline / zone	12,241	1,530	ft
Total Volume in dripline / zone	151.08	18.89	gallons



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97479-9012

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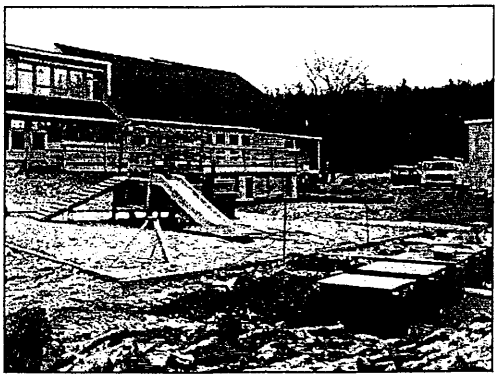
O R E N C O

CASE STUDY

Warren, Vermont:

AdvanTex® System Provides Superior Treatment in a Small Footprint



The Warren Elementary School playground sits less than ten feet from a row of AdvanTex® AX10 pods. Orenco's highly efficient AdvanTex Treatment System allows children at the school to play without fear of health or safety hazards.

In the fall of 1999, the town of Warren, Vermont discovered problems in the elementary school's water supply. The culprit was the school's failing leach field, which was ponding and causing a public health hazard.

Clearly, the septic system had to be replaced. However, there was not enough land — far enough away from the well — for a conventional leach field. The town's consulting engineers recognized that they needed a compact but high-performing wastewater treatment and dispersal system . . . at a price the town could afford. After an intensive lifecycle cost analysis of several systems, they chose Orenco's AdvanTex® Treatment System with a pressurized, shallow, narrow drainfield.

Fitting into less than half the area of conventional systems, the AdvanTex system became fully operational by the end of the school's winter break. Within two days of installation (supervised by Orenco distributor Dave Cotton of WTI), effluent testing showed considerable reduction in biochemical oxygen demand. Warmer weather brought increased biological activity in the system and BOD/TSS reductions of up to 90%, with BOD_5 at 7.5 mg/L and TSS at 5.9 mg/L.

Recognizing the system's superior design and performance, the American Consulting Engineers Council awarded its Vermont Engineering Grand Award for Water Resource Projects to the system's design engineers, the town's environmental consulting firm, and the regional planning commission.

Since the system has been operational, there have been no problems. An advanced remote telemetry control system sends information on treatment system functions via modem to a computer in the town offices. If a problem occurs, the control panel pages the town's sewage officer. School staff no longer need to worry about another septic system failure.

Warren Elementary School is an EPA National Demonstration System — a model approach to solving onsite wastewater treatment and dispersal problems faced across the country.

(Continued on back)

"We live in a cold environment, but I've had no wintertime problems with this system. Just really good smokin' numbers. AdvanTex gets BOD and TSS down to five [mg/L]. You can't beat that!"

Mike Mayo
Sewage Officer
Town of Warren

Orenco Systems®
Incorporated

Changing the Way the World Does Wastewater®

1-800-348-9843

www.orenco.com

SUMMARY OF SPECIFICATIONS

Warren, Vermont Effluent Sewer and AdvanTex® Treatment System
Using Orenco Systems Equipment

Installation Date
January 2001

Total Project Cost
$150,000

Environmental Consultant
Stone Environmental, Inc.

System Engineer
Forcier Aldrich & Associates

Contractor
New England Water Systems

Distributor
Wastewater Technologies, Inc.

Design Flow
4,600 gpd

Treatment System
Existing 4,000-gallon septic tank
Existing 3,000-gallon dosing pump station
New 3,000-gallon septic tank with effluent filter
New 5,000-gallon recirc/blend tank with pumps
12 AdvanTex-AX10 textile filters

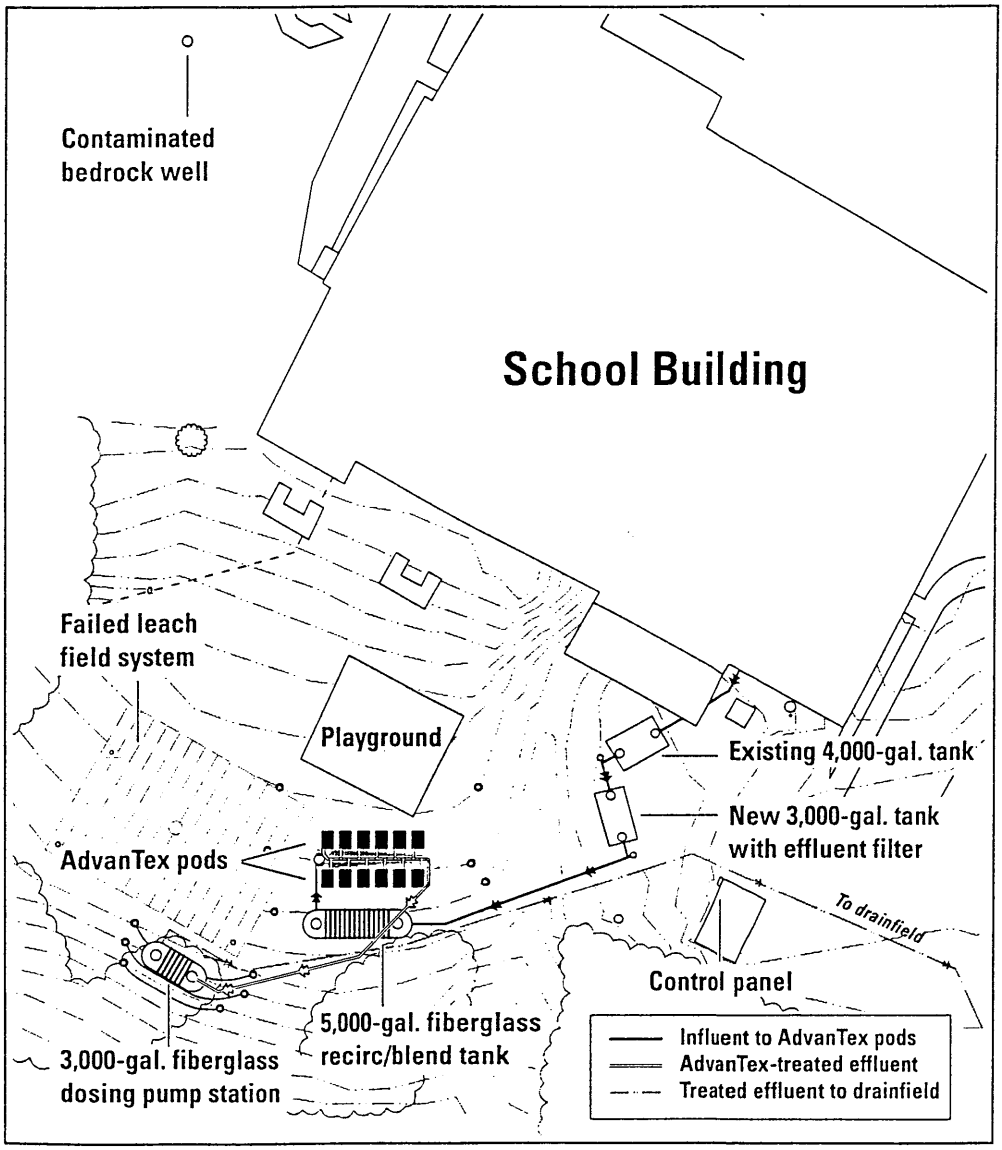
Effluent Quality
Effluent BOD averages are 7.5 mg/L; TSS averages are 5.9 mg/L.

Dispersal
Pressurized, shallow, narrow drainfield

Operation/Maintenance Costs (Annual)
Onsite facilities

Septic tank pumping	$800
Electrical	$80
Engineering inspection	$500
Operator labor	$1,000
Telemetry/paging (telephone charges)	$650
Annual cost	$3,030

Per EPA/DEM, monthly influent/effluent quality testing to be performed the first two years of operation.



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Pipeline

Fall 2000
Vol. 11, No. 4

NATIONAL SMALL FLOWS CLEARINGHOUSE

Small Community Wastewater Issues Explained to the Public

Decentralized Wastewater Treatment Systems

The town of Pegram sits along the scenic Harpeth River approximately 10 miles west of Nashville, Tennessee. Pegram has a population of about 2,000 people and supports several businesses including a bank, a restaurant, a flower shop, and the locally famous Harpeth Clock and Quilt Company.

In 1997, Pegram faced a difficult situation. Many of the businesses that used septic tanks and drainfields had failing systems. The Pegram Elementary School, as well as several homes, also had failing systems.

Town leaders evaluated their options for providing wastewater treatment service to the area. They initially looked at a centralized system to collect and treat wastewater and dispose of it in the Harpeth River.

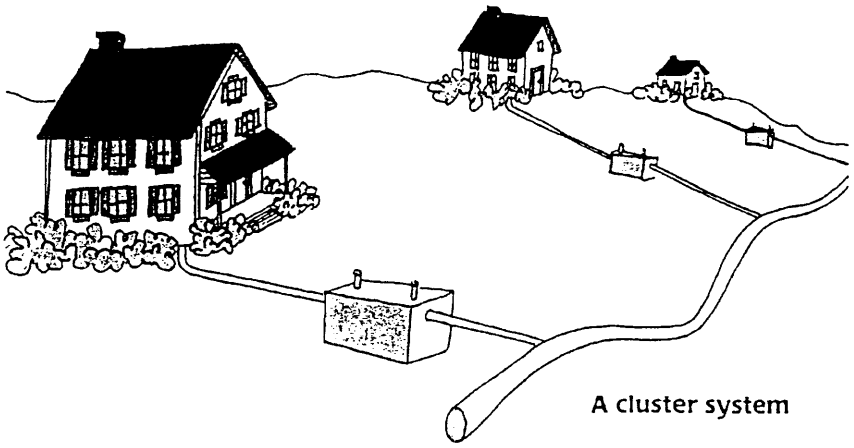
This option proved to be impossible because of the close proximity of a neighboring town's drinking water intake. Besides, many of the town's residents were actively working to protect their local environment and did not want to see treated wastewater (effluent) discharged into the river.

The town also looked into installing a centralized collection system and running sewage pipes to Nashville's treatment system. However, the cost for the extensive piping to go the 10 miles was prohibitive, and the cost of having the city of Nashville treat their wastewater would have resulted in high sewer bills for Pegram's residents.

The last option city leaders looked into was installing a cluster system that uses watertight effluent collection pipes, sand-gravel filter treatment, and effluent disposal by subsurface drip irrigation in a nearby farm pasture.

This choice takes what is known as a "decentralized approach," using a combination of processes to treat and dispose of wastewater. The town of Pegram decided that a cluster system, using new watertight interceptor (septic) tanks at each home or business and a watertight collection system running to a treatment facility, was the most feasible way for them to

continued on page 2



A cluster system

Key Terms

An **onsite system** is a natural system or mechanical device used to collect, treat, and discharge or reclaim wastewater from an individual dwelling without the use of community-wide sewers or a centralized treatment facility. A conventional onsite system includes a septic tank and a drainfield. Other types of alternative onsite systems include at-grade systems, mound systems, media filters, small aerobic units, and pressure distribution systems.

A **cluster system** is a wastewater collection and treatment system that serves two or more dwellings, but less than an entire community. Individual septic tanks or aerobic units may pretreat wastewater from several homes before it is transported through low cost, alternative sewers to a treatment unit that is relatively small compared to centralized systems.

A **decentralized system** is an onsite or cluster wastewater system that is used to treat and dispose of relatively small volumes of wastewater, generally originating from individual or groups of dwellings and businesses that are located relatively close together. Onsite and cluster systems are commonly used in combination.

Adapted from the *Response to Congress on use of Decentralized Wastewater Treatment Systems.*

Why Decentralize?

The decentralized approach to wastewater treatment is seen as beneficial for a number of reasons.
This approach:

- saves money by deciding on a preventive strategy (such as assessing a community's needs and conditions) to manage wastewater before a crisis occurs, thereby avoiding unnecessary cost;
- allows homeowners to continue to use their properly functioning septic systems;
- enables better watershed maintenance by eliminating the large transfers of water from one watershed to another that happens with centralized treatment;
- may be the most cost-effective treatment strategy for rural communities with sparse populations; and
- is appropriate for varying site conditions including ecologically sensitive areas—treatment methods can be tailored to suit different site conditions.

What's Right for Your Town?

When town leaders face having to upgrade wastewater treatment, the first choice usually is to build a centralized collection and treatment facility. However, centralized collection and treatment may not be the right answer for every community's wastewater disposal needs. (See table on page 3.)

Small and rural communities often cannot afford these expensive facilities, and their populations may be too spread out to make centralized treatment a realistic option. Additionally, some existing onsite systems may function effectively, so they don't need to be replaced.

In circumstances like these, decentralized wastewater treatment is often the best solution for wastewater management. Decentralized treatment involves using a combination of treatment technology options, both traditional and innovative, where they are most appropriate in a community. Conventional onsite systems, alternative onsite systems, cluster systems for groups of homes and businesses, and some use of centralized treatment can all be included when considering decentralized community wastewater management. The decentralized system is then managed (with varying degrees of control) to ensure each component functions properly.

Two Options Usually Considered

In the time since wastewater treatment has been an issue, only two options were ordinarily considered, the previously mentioned centralized systems and conventional septic systems. Onsite systems have been used for centuries, evolving from simple outhouses to cesspools to septic tanks and drainfields to the more advanced treatment units available now.

A conventional septic system, consisting of a tank and drainfield, treats wastewater at its source. But, older septic systems that were built without thought of adequate soil depth and/or that have not been properly maintained can fail, leading to surface and groundwater contamination. This potential for failure most often results from neglect of maintenance or inappropriate drainfield siting. Nevertheless, this process remains an option where soils are suitable.

Centralized systems require a network of collection pipes (sewers) leading from all homes and businesses

continued on next page

Introduction

continued from page 1

achieve their wastewater treatment goals.

All of the businesses in town were required to hook into the cluster system, while homes had the option of connecting, depending on whether or not their existing septic systems worked properly.

Taking this decentralized wastewater treatment approach was not only financially realistic, but Pegram was able to build the system and serve the businesses, as well as many of the failing home systems. The project was financed through available town funds and through revolving loan funds from the state of Tennessee.

Many towns find themselves in circumstances similar to Pegram's. They may need to upgrade or replace most of their wastewater treatment processes. And, they may find that running extensive sewer lines or building a single, centralized treatment facility cannot be done for any number of reasons.

This issue of *Pipeline* discusses decentralized wastewater treatment systems and how they can meet both public health and environmental protection goals in areas where centralized treatment is impractical or not cost-effective. Management and funding issues are presented plus the various treatment options that may be part of a decentralized system.

Readers are encouraged to reprint this issue or any *Pipeline* articles in flyers, newspapers, newsletters, or educational presentations. We ask that you include the name and phone number of the National Small Flows Clearinghouse (NSFC) on the reprinted information and send us a copy for our files.

If you have questions about reprinting articles or about the topics discussed in the newsletter, please contact the editor at (800) 624-8301 or (304) 293-4191.

PERMIT APPLICATION FOR SUBSURFACE DISPOSAL

for

BETHEL HEIGHTS SEWER - PHASE II

BETHEL HEIGHTS, ARKANSAS

EDA #0656.4

September 16, 2003

EDA
Engineering Design Associates, P.A.
134 West Emma Avenue
Springdale, Arkansas 72764
479-756-1266 FAX 479-756-2129

WATER POLLUTION CONTROL PERMIT APPLICATION
ARKANSAS DEPARTMENT OF ENVIRONMENTAL QUALITY

Septic Tank and Leach Field

Revised July 18, 2003

Permit No.:	AFIN No.:	SIC Code:	NAICS Code:
(Office use only)	(Office use only)	(Office use only)	(Office use only)

1. Permit Action Requested: (Please check one of the following.)

____ New Permit for New Facility	____ New Permit for Existing Facility	____ Permit Renewal
X Modification of Existing Permit, Please Describe: ENLARGEMENT OF PREVIOUSLY PERMITTED FACILITY.		

2. Name and Mailing Address of Organization/Individual Requesting Permit:

Owner/Organization Name: (Mr. / Mrs. / Ms.) CITY OF BETHEL HEIGHTS		
Address: 530 SUNRISE DRIVE		Phone: 479-751-7481
City: BETHEL HEIGHTS	State: AR	Zip: 72764
Contact Person: (Mr. / Mrs. / Ms.) MAYOR FRED JACK		Phone: 479-751-7481

3. Type of Waste Management: (Please check all that apply to your system.)

____ Car Wash	____ Truck Wash	____ Laundromat	____ Slaughterhouse
X Other, Please Describe: WASTEWATER EFFLUENT TREATMENT			

4. Waste Storage and/or Treatment Facility Location: *(actual facility address is required; NO P.O. BOXES)*

Facility Name: BETHEL HEIGHTS WASTEWATER TREATMENT FACLITY				
Address: 901 S. LINCOLN ST.			Phone: 479-751-7481	
City: BETHEL HEIGHTS		State: AR	Zip: 72764	
¼ Sec.: NW	Section: 13	Township: 18 N	Range: 30 W	County: BENTON
Latitude: 36° 14' 12"	Longitude: 94° 07' 55"	Source Datum: ___WGS 84	___NAD 83	___NAD 27
Name and Distance to Nearest Stream: SPRING CREEK, 1.75 mi		Nearest Town:		

5. Consultant Information:

Name: (Mr.) / Mrs. / Ms.) STEVE A. HESSE		
Consulting Firm Name: ENGINEERING DESIGN ASSOCIATES, PA		
Address: 134 WEST EMMA		Phone: 479-756-1266
City: SPRINGDALE	State: AR	Zip: 72764

6. Please describe the location of the facility with respect to roads, towns and other easily identifiable landmarks:

S.E. CORNER OF APPLE BLOSSOM & LINCOLN

7. Please list and describe all waste storage and/or treatment components:

EACH RESIDENTIAL LOT OR COMMERCIAL DEVELOPMENT WILL CONTAIN A S.T.E.P. UNIT THAT WILL HOLD ALL SOLIDS. ANTICIPATED TANK PUMPING INTERVAL: 10-12 YRS. EFFLUENT WILL BE PUMPED TO A TREATMENT AREA THAT WILL CONTAIN ADVANTEX FILTERS & SUBSURFACE DISPERSAL LINES.

8. Has the applicant previously submitted, or have on file with the Department, a complete "Disclosure Statement" as required by Act 454 of 1991? _____ Yes _X_ No

If yes, please provide the following: Date Submitted _____ To What Division? _____

If no and the application is submitted for a new permit (whether for a new or existing facility), the applicant must complete and submit the "Disclosure Statement" form included with the application. Additional copies of the "Disclosure Statement" form may be obtained from ADEQ.

9. Is the applicant organized as a corporation? ____YES or MUNICIPALITY _____NO; If yes, is it foreign or domestic? _____

Is the corporation currently registered to do business with the Arkansas Secretary of State? ____YES or ____NO

Please read the following carefully and sign below.

I certify under penalty of law that this document and all attachments were prepared under my direction and 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, which may include fines and/or imprisonment.

SIGNATORY REQUIREMENTS: The signature below must be in compliance with Part I, Item 4 on pages 1-2.

FRED JACK
Name of Individual Signing Application (Please Print)

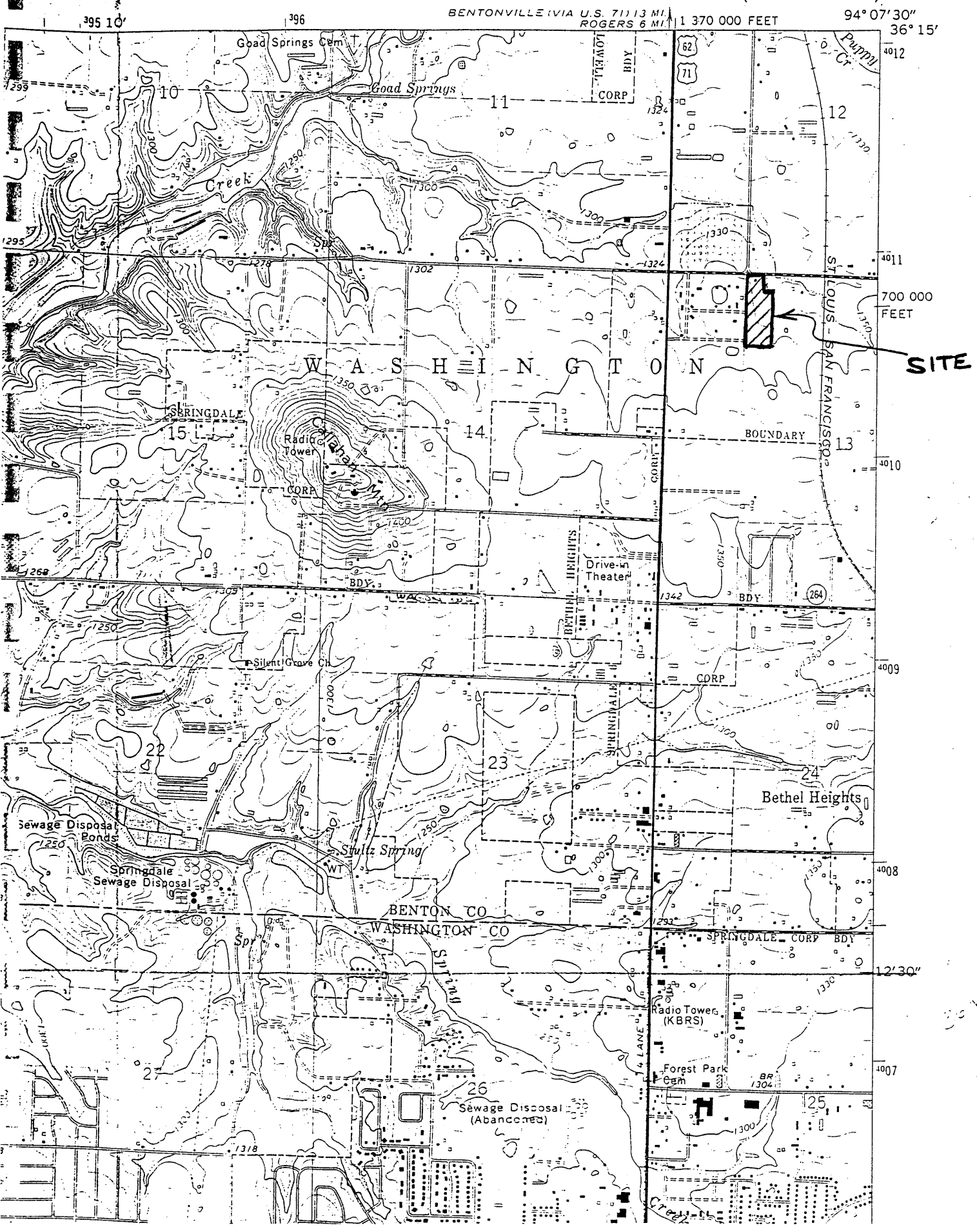
MAYOR
Title

Signature

9/17/03
Date

SPRINGDALE QUADRANGLE
ARKANSAS
7.5 MINUTE SERIES (TOPOGRAPHIC)

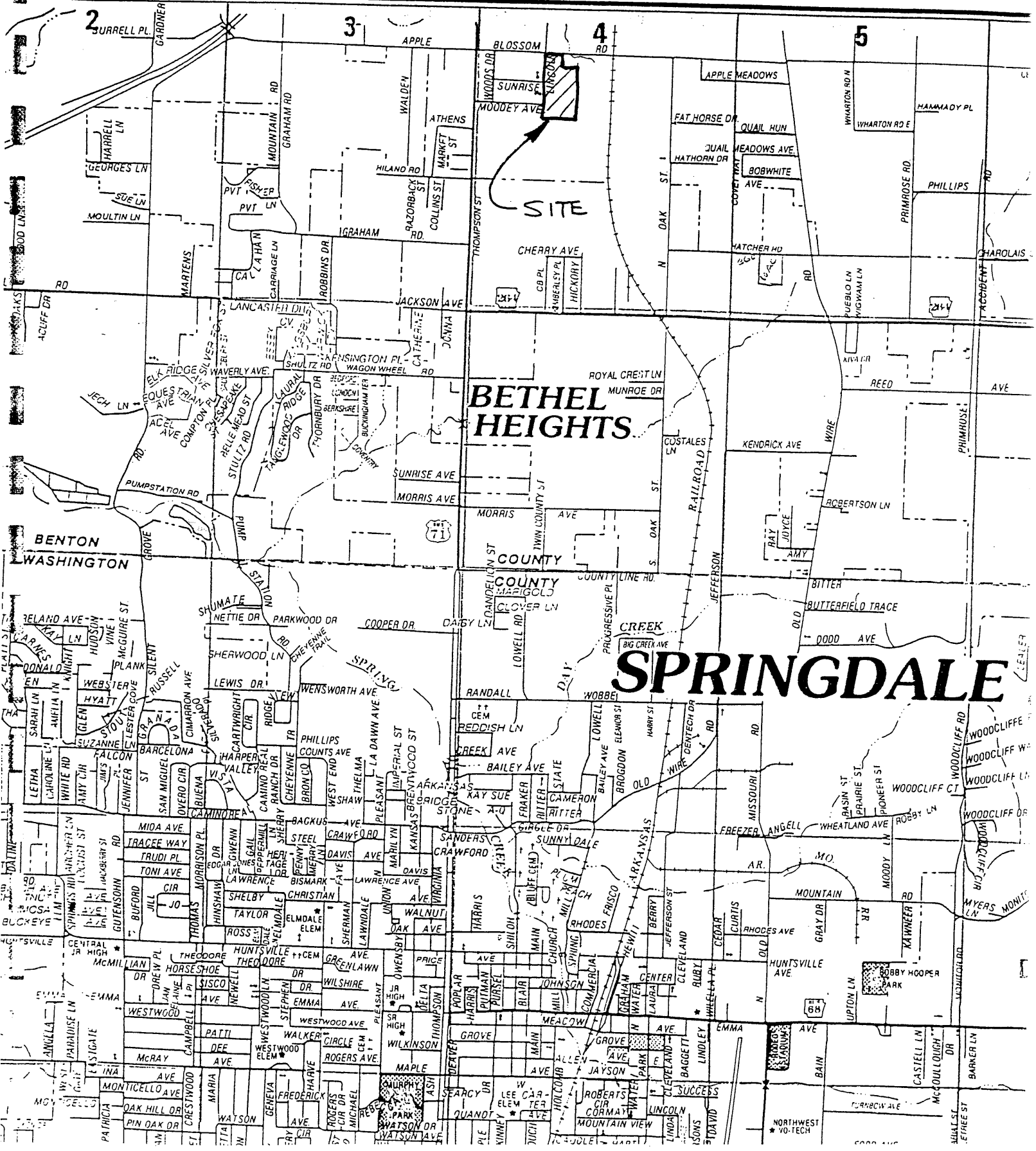
7156 I SE (ROGERS)



509 E. Emma Ave.
Downtown Springdale

501-751-4861

750-3999
http://www.cnci.net
1301 E. Robinson Springdale • Signature Square-Suite B-13
CREATIVE NETWORK CONCEPTS, INC



WASTE MANAGEMENT PLAN

Phase II of the proposed sewer system for the City of Bethel Heights consists of the installation of interceptor / pump tanks at each residence or commercial business and a force-main collection system - also know as a Septic Tank Effluent Pump (S.T.E.P.) system. The proposed collection system will utilize small diameter pressure lines which can be laid at much shallower depths than conventional gravity sewers and are not dependent upon slope to operate.

Raw sewage will flow from each house or business to a watertight underground interceptor / pump tank, where it is pretreated. The filtered effluent will then be pumped to a centralized location where it can be treated with a fixed film biological filter and discharged into "drip" irrigation lines. The quality of effluent produced by these filters is similar to that of recirculating sand filters. The net effect of this removal of solids and Carbon source is that biomat formation does not occur at the trench/soil interface and the clarified effluent infiltrates into the soil at much higher rates than untreated septic tank effluent.

The City has purchased an eleven (11) acre site that will contain the treatment equipment and the drip dispersal lines.

The system will have a state-of-the-art "web-based" monitoring system so the operator can monitor the system from the office or home.

The entire system will be owned and operated by the City of Bethel Heights. The City is in the process of establishing a Class I operator to oversee the operation and maintenance of the facility.

It is anticipated that the City will have a long-term contract with a septic tank pumping company to pump the solids from the STEP tanks when needed.

An operation and maintenance manual will be completed and a copy sent to the Arkansas Department of Health and to the Arkansas Department of Environmental Quality.

The current phase has an average flow of 32,500 gallons per day. Please refer to the attached calculations for information on pumps, collection line sizes, etc.

Each septic tank will contain 24 hours of storage.

Arkansas Department of Health

4815 West Markham Street • Little Rock, Arkansas 72205-3867 • Telephone (501) 661-2000
Fay W. Boozman, MD, MPH, Director
Mike Huckabee, Governor

September 16, 2003

Steve A. Hesse, PE
Engineering Design Associates, P.A.
134 West Emma Avenue
Springdale, Arkansas 72764

RE: Conditional Approval
Sewer Force Main and Treatment System
Phase II to serve Wilkins Subdivision
Bethel Heights, Washington County
ADH# 43600-2

Dear Mr. Hesse:

The plans and specifications for the captioned project, dated August 2003, prepared by Engineering Design Associates, P.A. and submitted to the Division of Engineering on 06/12/2003 have been reviewed and are conditionally approved.

1. The Division of Engineering relied upon the statements and representations made in the engineer's report, plans, and specifications. In case any statement or representation in the aforementioned documents is found to be incorrect, this Approval may be revoked.

2. There shall be no deviation from the plans and specifications unless revised plans and specifications have been first submitted for review and written consent given.

3. The review and approval of the plans and specifications were for functional and sanitary features and in no way constitute an analysis of structural design.

4. If construction on this project is not started within one year of the date affixed hereto, this Letter of Approval is void.

5. Engineering Design Associates, P.A. shall provide construction inspection services.

While we concur with the overall concept and sizing of this project, we feel that several questions were unanswered during our review process. Because certain areas were not addressed properly, this approval is conditional upon the following items.

1. After completion of the project, provide detailed complete as built plans of the entire sewer treatment system for Phases 1 and 2.

2. Provide pump curves for the actual pumps installed for the dosing systems. These pumps must meet the 27.4 gpm dosing rate for the cells.

3. Provide an operators manual for the Sewage Treatment Plant to include set up and programming of timers for the separate zones and cells and any preventive maintenance items that must be performed for the different system components. Procedures to flush the field lines must be included.

4. Based on the advice of your soil consultant, the first two phases were approved using a soil porosity of 30%. Later information provided to this office has indicated a more reasonable figure would be 15-25%. This information will probably dictate that future drip disposal systems may be up to 50% larger in area than those approved in this project.

5. Provide this office the results of any testing of the water from the site's monitoring wells or of the dosed effluent.

One set of plans and specifications will be retained for our files, and one set of plans and Specs. will be returned.

When submitting correspondence pertaining to this project, please include our reference number ADH# 43600-2.

Herron's
Soil
Interpretations

Post Office Box 1086
Farmington, Arkansas 72730

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

September 24, 2002

EDA
Steve Hesse
134 W. Emma
Springdale, AR 72764

RE: Bethel Heights Soil Loading Rates

Steve:

Attached you will find a summary of the soil interpretations and projected loading rates for 41 pits for the 12 acres adjacent to City Hall in Bethel Heights. This investigation was conducted during the week of September 2. Alison West, Sanitarian with the Benton County Department of Health, inspected the pits on September 13 and 15, and the attached interpretations were approved on September 23.

I have also attached the methodology for calculating the loading rates, using one of the pits at the 12-acre site as an example. This information will be submitted to Alison West on September 25. To calculate storage, I am using estimated soil porosity at field capacity, which is the soil moisture storage capacity after one to three days of drainage following precipitation. This is added to the evapotranspiration rate for the stress period to get the actual loading rate.

Please contact me if you need additional information.

Sincerely,

Sheri Herron
Principal Soil Scientist

Attachments



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

DRIP IRRIGATION LOADING RATE CALCULATIONS

METHOD: Use percent soil water at field capacity to determine the quantity of treated effluent that the soil can store above the adjusted moderate seasonal water table, assuming 7.48 gal/ft^3. Determine field capacity from the most limiting soil texture within the storage zone above the adjusted moderate water table (sand is most limiting, then silt, then clay). Determine evapotranspiration rates for wettest month and for type of plants on site. Divide volume of effluent by soil storage (in gallons) to get cubic feet of soil required each day. Multiply that number by 18 to allow for storage during the 18-day stress period. Divide the cubic feet of storage required during the stress period by the cubic feet of soil available above the adjusted moderate seasonal water table to get square feet of area based on storage only. Add storage loading rate to evapotranspiration rate for actual loading rate for drip irrigation.

Design Calculations

Percent soil water at field capacity (silt loam) = 30% (1 ft^3 of soil stores approx. 2.24 gal.)

Evapotranspiration for tall fescue in Fayetteville in May = 0.28 gal/ft^2/day

Design flow 12,500 gallons/day

Adjusted moderate seasonal water table = 2.18 feet

Stress period = 18 days

12,500 gpd / 2.24g/ft^3 = 5,580 ft^3/day of soil needed for storage only

5,580 ft^3 x 18 days = 100,440 ft^3 of soil needed to store during the stress period

199,440 ft^3 / 3.3 ft = 30,436 ft^2 of area needed for storage only

12,500 gpd / 30,436 ft^2 0.41 gpd/ft^2 storage loading rate

Add Storage & Evapotranspiration to obtain actual loading rate:

0.41 + 0.28 = 0.69 gpd/ft^2

12,500 gpd / 0.69 gpd. 18,116 ft^2 of area required for drip irrigation

BETHEL HEIGHTS SOIL DESCRIPTIONS 12 ACRES ADJACENT TO CITY HALL

PIT NO.	SWT	DEPTH	TEXTURE	REDOX	STRUCTURE	BOUNDARY
5000		0-15"	silt loam		moderate fine subangular blocky	clear wavy
	B	15-33"	silt loam	10YR 7/3	moderate fine subangular blocky	clear wavy
	M	33-50"	silt loam	10YR 6/2; 10YR 6/6; 2.5YR 4/6	moderate fine subangular blocky	
5001		0-8"	silt loam		moderate fine subangular blocky	clear smooth
		8-26"	silty clay loam		moderate medium subangular blocky	clear smooth
	B	26-50"	silty clay loam	10YR 7/3; Mn	moderate medium subangular blocky	
5002		0-12"	silt loam		moderate medium subangular blocky	clear smooth
		12-21"	silt loam		moderate medium subangular blocky	clear smooth
		21-40"	silty clay loam		moderate medium subangular blocky	clear smooth
	M	40-45"	silt loam	10YR 6/2; 10YR 7/6	moderate medium subangular blocky	
5003		0-8"	silt loam		moderate medium subangular blocky	clear smooth
		8-28"	silt loam		moderate coarse subangular blocky	clear wavy
	B	28-40"	silty clay loam	2.5YR 3/6; Mn	moderate medium subangular blocky	clear wavy
	M	40-50"	silty clay loam	Mn; 10YR 6/2; 10YR 7/3	moderate coarse subangular blocky	
5006		0-10"	silt loam		moderate medium subangular blocky	clear smooth
		10-17"	silt loam		moderate medium subangular blocky	clear smooth
		17-32"	silty clay loam	Mn < 2mm	strong coarse subangular blocky	clear wavy
	M	32-40"	silty clay loam	10YR 6/2; 10YR 7/6	strong coarse subangular blocky	
5007		0-10"	silt loam		moderate medium subangular blocky	clear smooth
		10-20"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
	B	20-36"	silty clay loam	Mn masses; 10YR 7/4	moderate medium subangular blocky	clear wavy
	M	36-45"	silt loam	Mn concr.; 10YR 6/2	moderate medium subangular blocky	
5008		0-10"	silt loam		moderate fine subangular blocky	clear smooth
		10-20"	silty clay loam		moderate medium subangular blocky	clear wavy
	B	20-28"	silty clay loam	10YR 6/3	moderate medium subangular blocky	clear wavy
	M	28-45"	silty clay loam	10YR 6/2; 10YR 7/3	strong medium subangular blocky	
5009		0-4"	silt loam		moderate medium subangular blocky	clear smooth
		4-10"	silt loam		moderate medium subangular blocky	clear smooth
		10-18"	silt loam		moderate medium subangular blocky	clear smooth
		18-25"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
	B	25-30"	silty clay loam	Mn & FeMn	moderate medium subangular blocky	clear wavy
	M	30-45"	silty clay loam	10YR 6/1; 10YR 5/4	moderate medium subangular blocky	
5010		0-14"	silt loam		moderate medium subangular blocky	clear smooth
		14-31"	silt loam		moderate medium subangular blocky	clear smooth
	B	31-36"	silty clay loam	10YR 7/3; 2.5YR 4/6	moderate medium subangular blocky	clear wavy
	M	36-43"	silty loam	10YR 6/2; 10YR 7/4	moderate medium subangular blocky	

BETHEL HEIGHTS SOIL DESCRIPTION 12 ACRES ADJACENT TO CITY HALL

PIT NO.	SWT	DEPTH	TEXTURE	REDOX	STRUCTURE	BOUNDARY
5011		0-9"	silt loam		moderate medium subangular blocky	clear smooth
		9-28"	silt loam		moderate medium subangular blocky	clear wavy
	B	28-36"	silty clay loam	10YR 7/4; 2.5YR 4/8	moderate medium subangular blocky	clear wavy
	M	36-45"	silty clay loam	10YR 6/2; 10YR 7/4	moderate medium subangular blocky	
5012		0-13"	silt loam		moderate medium subangular blocky	clear smooth
		13-30"	silt loam		moderate medium subangular blocky	clear wavy
	B	30-45"	silt loam	7.5YR 6/4	moderate medium subangular blocky	
5013		0-8"	silt loam		moderate medium subangular blocky	clear smooth
		8-13"	silt loam		moderate medium subangular blocky	clear smooth
		13-19"	silt loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
		19-26"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
	B	26-33"	silty clay loam	2.5YR 3/6; 10YR 6/4	moderate fine subangular blocky	clear wavy
	M	33-45"	silty clay loam	10YR 5/3; 10YR 6/2	moderate medium subangular blocky	clear wavy
5014		0-12"	silt loam		moderate medium subangular blocky	clear smooth
		12-27"	silt loam		moderate medium subangular blocky	clear smooth
		27-38"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	clear wavy
	B	38-50"	silty clay loam	10YR 7/3	moderate medium subangular blocky	
5015		0-9"	silt loam		moderate medium subangular blocky	clear smooth
		9-28"	silt loam		moderate medium subangular blocky	clear smooth
	B	28-37"	silty clay loam	2.5YR 4/6; Mn stains	moderate medium subangular blocky	clear wavy
	M	37-45"	silt loam	10YR 6/2; 10YR 6/6	moderate medium subangular blocky	
5016		0-12"	silt loam		moderate medium subangular blocky	clear smooth
		12-22"	silt loam		moderate medium subangular blocky	clear smooth
		22-34"	silty clay loam	Mn masses	moderate medium subangular blocky	clear wavy
	B	34-50"	silty clay loam	Mn Concr; 10YR 7/3	moderate medium subangular blocky	
5017		0-7"	silt loam		moderate fine subangular blocky	clear smooth
		7-13"	silt loam		moderate medium subangular blocky	clear smooth
		13-20"	silt loam		moderate medium subangular blocky	clear smooth
		20-28"	silty clay loam		weak fine subangular blocky	clear wavy
	B	28-40"	silty clay loam	10YR 7/3	weak fine subangular blocky	
5018		0-15"	silt loam		weak medium subangular blocky	clear smooth
		15-26"	silty clay loam		moderate medium subangular blocky	clear smooth
	B	26-41"	silty clay loam	10YR 7/3; 2.5YR 4/6	moderate medium subangular blocky	clear wavy
	M	41-50"	silt loam	10YR 6/2; 10YR 7/3; 10YR 6/6	moderate medium subangular blocky	

BETHEL HEIGHTS SOIL DESCRIPTION 12 ACRES ADJACENT TO CITY HALL

PIT NO.	SWT	DEPTH	TEXTURE	REDOX	STRUCTURE	BOUNDARY
5019		0-9"	silt loam		weak medium subangular blocky	clear smooth
		9-22"	silty clay loam	Mn masses	moderate medium subangular blocky	clear wavy
	B	22-32"	silty clay loam	5YR 5/8; 10YR 6/4	moderate medium subangular blocky	clear wavy
	M	32-44"	silty clay loam	10YR 6/2; 10YR 7/4	moderate medium subangular blocky	
5020		0-17"	silt loam		moderate medium subangular blocky	clear smooth
		17-25"	silt loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
	B	25-45"	silty clay loam	10YR 7/3; 10R 4/6	moderate medium subangular blocky	clear wavy
5021		0-8"	silt loam		moderate fine subangular blocky	clear smooth
		8-17"	silt loam		moderate fine subangular blocky	clear smooth
		17-28"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	clear wavy
	B	28-32"	silty clay loam	10YR 6/3; 10YR 6/6; 5YR 5/6	moderate coarse subangular blocky	clear wavy
	M	32-42"	silty clay loam	10YR 6/2; Mn concr.	weak fine subangular blocky	
5022		0-11"	silt loam		moderate medium subangular blocky	clear smooth
		11-22"	silt loam		moderate medium subangular blocky	clear smooth
		22-30"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
		30-40"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	
5023		0-15"	silt loam		moderate medium subangular blocky	clear smooth
		15-23"	silt loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
	B	23-32"	silty clay loam	2.5YR 4/6; 10YR 6/8	moderate medium subangular blocky	clear wavy
	M	32-42"	silty clay loam	10YR 6/2; 2.5YR 4/6; 10YR 6/6	moderate medium subangular blocky	
5024		0-17"	silt loam		moderate medium subangular blocky	clear smooth
		17-25"	silt loam	Mn < 2mm	moderate medium subangular blocky	clear smooth
	B	25-45"	silty clay loam	10YR 7/3; 10YR 4/6	moderate medium subangular blocky	
5025		0-9"	silt loam		moderate medium subangular blocky	clear smooth
		9-20"	silty clay loam		moderate medium subangular blocky	clear wavy
	B	20-25"	silty clay loam	10YR 6/3	moderate fine subangular blocky	clear wavy
	M	25-41"	silt loam	10YR 6/2; 10YR 7/3	moderate fine subangular blocky	
5026		0-16"	silt loam		moderate medium subangular blocky	clear smooth
	B	16-28"	silt loam	2.5YR 5/6	moderate medium subangular blocky	clear wavy
	M	28-50"	silty clay loam	10YR 6/2	moderate medium subangular blocky	
5027		0-15"	silt loam		moderate medium subangular blocky	clear wavy
	B	15-19"	silty clay loam	2.5YR 4/6; 10YR 7/3	moderate medium subangular blocky	clear wavy
	M	19-42"	silty clay loam	10YR 6/2; 10YR 6/1; 10YR 6/6	moderate medium subangular blocky	
5028		0-9"	silt loam		moderate medium subangular blocky	clear smooth
		9-25"	silty clay loam		moderate medium subangular blocky	clear smooth
	M	25-50"	silty clay loam	10YR 6/2; 7.5YR 5/6	moderate medium subangular blocky	
5029		0-9"	silt loam		weak fine subangular blocky	clear smooth
		9-21"	silt loam		moderate medium subangular blocky	clear wavy
		21-34"	silty clay loam		moderate medium subangular blocky	clear wavy
	M	34-45"	silty clay loam	10YR 6/2; 10YR 7/3	moderate fine subangular blocky	

BETHEL HEIGHTS SOIL DESCRIPTION[illegible]12 ACRES ADJACENT TO CITY HALL

PIT NO.	SWT	DEPTH	TEXTURE	REDOX	STRUCTURE	BOUNDARY
5030		0-10"	silt loam		weak fine subangular blocky	clear smooth
		10-23"	silty clay loam	Mn stains	moderate medium subangular blocky	clear wavy
	B	23-26"	silty clay loam	10YR 7/3	moderate medium subangular blocky	clear wavy
	M	26-50"	silt loam	10YR 7/2; 2.5YR 4/6	moderate medium subangular blocky	
5031		0-15"	silt loam		moderate medium subangular blocky	clear smooth
		15-22"	silty clay loam		moderate medium subangular blocky	clear wavy
	B	22-29"	silty clay loam	10YR 7/3; 2.5YR 4/6	moderate medium subangular blocky	clear wavy
	M	29-45"	silt loam	7.5YR 4/6; 10YR 6/1; 10YR 7/4	moderate medium subangular blocky	
5032		0-9"	silt loam		moderate fine subangular blocky	clear smooth
		9-23"	silty clay loam	Mn stains	moderate medium subangular blocky	clear smooth
	B	23-29"	silty clay loam	10YR 6/3; 10YR 6/6	moderate medium subangular blocky	clear wavy
	M	29-45"	silty clay loam	10YR 6/2; 10YR 6/6	moderate medium subangular blocky	
5033		0-8"	silt loam		moderate medium subangular blocky	clear smooth
		8-16"	silt loam		moderate medium subangular blocky	clear smooth
		16-20"	silty clay loam	Mn < 2mm	moderate medium subangular blocky	clear wavy
	B	20-26"	silty clay loam	10YR 7/3	moderate medium subangular blocky	clear wavy
	M	26-50"	silt loam	10YR 6/2; 10YR 6/4	moderate medium subangular blocky	
5034		0-17"	silt loam		moderate medium subangular blocky	clear smooth
		17-29"	silty clay loam		moderate medium subangular blocky	clear wavy
	M	29-50"	silty clay loam	10YR 6/2;10YR 7/3	moderate medium subangular blocky	
5035		0-17"	silt loam		moderate medium subangular blocky	clear smooth
	B	17-25"	silty loam	7.5YR 5/6; 2.5YR 4/6	moderate medium subangular blocky	clear wavy
	M	25-43"	silt loam	10YR 6/2; 7.5YR 4/6; 10YR 7/4	moderate medium subangular blocky	
5036		0-11"	silt loam		moderate fine subangular blocky	clear smooth
		11-23"	silty clay loam		moderate medium subangular blocky	clear smooth
	B	23-26"	silty clay loam	7.5YR 6/4	moderate medium subangular blocky	clear wavy
	M	26-45"	silt loam	10YR 6/2; 10YR 6/6	strong medium subangular blocky	
5037		0-9"	silt loam		moderate medium subangular blocky	clear smooth
		9-20"	silty clay loam		moderate medium subangular blocky	clear wavy
	B	20-26"	silty clay loam	2.5YR 3/6; 10YR 7/3	moderate medium subangular blocky	clear wavy
	M	26-50"	silt loam	10YR 7/2; 10YR 6/6	moderate fine subangular blocky	
5038		0-17"	silt loam		moderate medium subangular blocky	clear smooth
		17-31"	silty clay loam		moderate medium subangular blocky	clear wavy
	B	31-37"	silty clay loam	10YR 7/4; 2.5YR 4/8	moderate medium subangular blocky	clear wavy
	M	37-44"	silt loam	2.5YR 4/6; 10YR 6/2; 10YR 7/4	moderate medium subangular blocky	
5039		0-14"	silt loam		moderate medium subangular blocky	clear smooth
		14-22"	silty clay loam		moderate medium subangular blocky	clear wavy
	B	22-26"	silty clay loam	10YR 7/3; 2.5YR 4/6	moderate medium subangular blocky	clear wavy
	M	26-50"	silt loam	10YR 6/2; 2.5YR 4/6	moderate medium subangular blocky	

BETHEL HEIGHTS SOIL DESCRIPTION[illegible]12 ACRES ADJACENT TO CITY HALL

PIT NO.	SWT	DEPTH	TEXTURE	REDOX	STRUCTURE	BOUNDARY
5040		0-9"	silt loam		weak fine subangular blocky	clear smooth
		9-22"	silty clay loam		moderate medium subangular blocky	clear smooth
	B	22-27"	silty clay loam	10YR 6/3; 10YR 5/6	moderate medium subangular blocky	clear wavy
	M	27-45"	silt loam	10YR 6/2; 7.5YR 4/6; 10YR 7/4	strong coarse subangular blocky	
5041		0-9"	silt loam		moderate fine subangular blocky	clear smooth
		9-20"	silty clay loam	Mn < 2mm	moderate fine subangular blocky	clear smooth
	B	20-25"	silty clay loam	7.5YR 5/6	moderate fine subangular blocky	clear wavy
	M	25-48"	silty clay loam	10YR 6/2; 10YR 6/4	moderate fine subangular blocky	
5042		0-11"	silt loam		moderate fine subangular blocky	clear smooth
		11-23"	silt loam		moderate medium subangular blocky	clear wavy
	B	23-27"	silty clay loam	10YR 6/6	moderate medium subangular blocky	clear wavy
	M	27-40"	silty clay loam	10YR 6/2; 10YR 7/3	moderate medium subangular blocky	

Phase II - Bethel Heights Sewer Improvements
Revised Preliminary Hydraulic Calculations:
9-11-03

130 residential lots (homes)
2.5 persons per home
100 gallons per person per day

Design Average Flow = 32,500 gpd
Allowable Average Soil Loading Rate = 0.46 gpd/sf

Drip Lines Provided: 21 zones - 87,160 sf - 43,580 LF
Actual Average Soil Loading Rate: 32,500 gpd / 87,160 sf = 0.37 gpd/sq ft

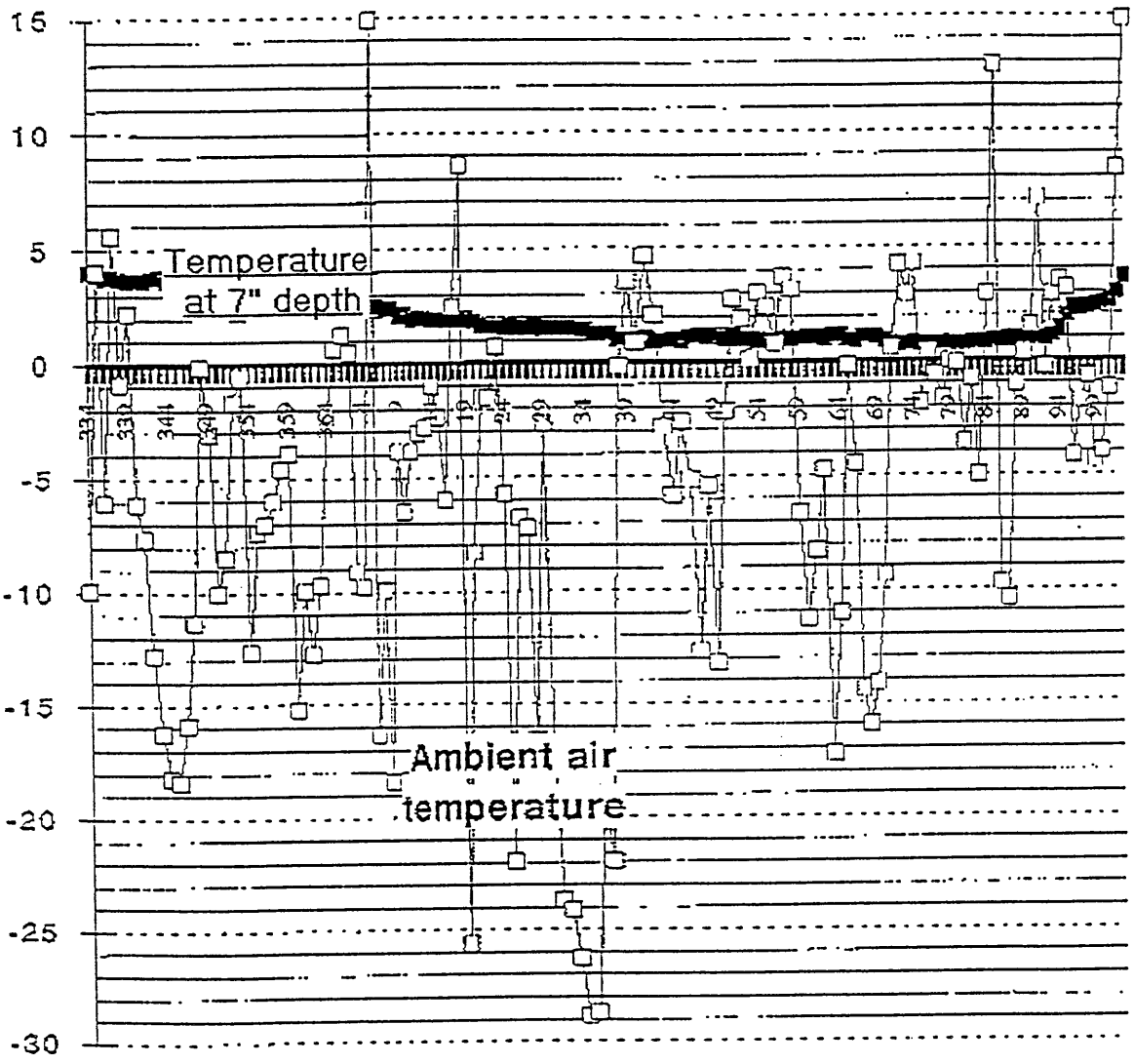
emitters = 43,580 LF / 2 ft/emitter = 21,790 emitters
Total flow in gallons/hour = 21,790 emitters x 0.53 gph/emitter = 11,549 gph
Total flow in gallons/minute = 11,549 gph / 60 min/hr = 192 gpm

Total flow/zone (with 21 zones) = 192 gpm / 21 zones = 9.1 gpm/zone
1 cell = 3 zones
Dose 1 cell (3 zones) simultaneously
Total flow/cell (with 7 cells) = 192 gpm / 7 cells = 27.4 gpm/cell

Total pumping time = 32,500 gpd / 27.4 gpm/cell / 7 cells = 169 minutes/day/zone
Total pumping time for entire system = 169 minutes/day/cell x 7 cell = 1,183 min/day
Per pump (with 2 pumps) = 592 minutes/day or 9.8 hrs/day

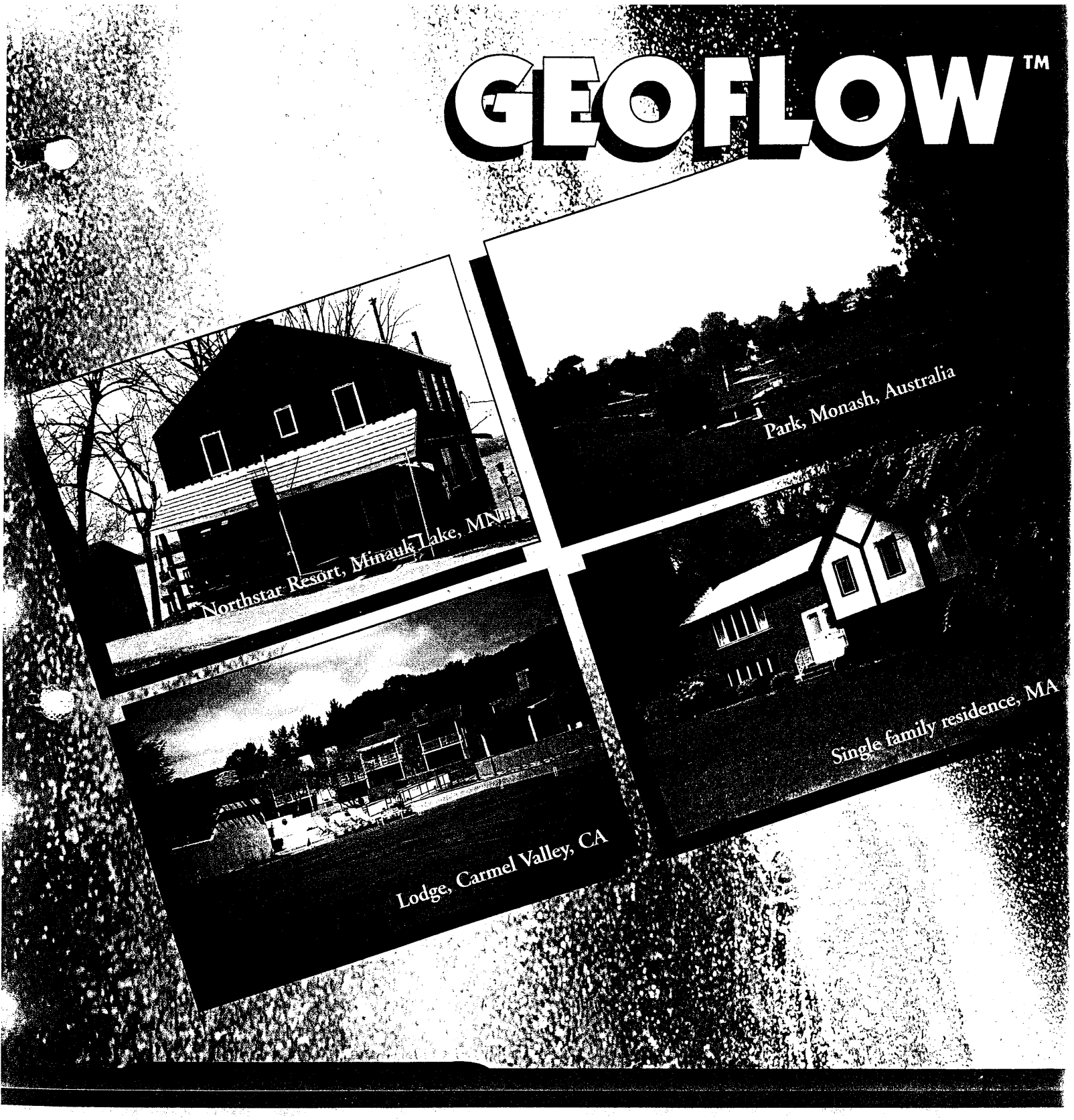
Total pumping requirements: **27.4 gpm (dosing)**
17.75 gpm (field flush)

GEOFLOW WASTEFLOW DRIP IRRIGATION SYSTEM UNDER FREEZING CONDITIONS - DISPOSING OF AEROBIC TREATED EFFLUENT - DATA COLLECTED BY AN INDEPENDENT THIRD PARTY.



Day # from December 1995 to April 1996

GEOFLOW™



WASTEFLOW® Drip Systems for Subsurface Wastewater Disposal & Reuse

WASTEFLOW

Drip Systems for Subsurface Wastewater Disposal & Reuse

Geoflow is proud to offer **WASTEFLOW®** drip systems to the onsite wastewater industry for disposal or reuse of effluent. The flexible polyethylene dripline is 1/2-inch (16mm) in diameter with emitters pre-spaced evenly along the line. The dripline is typically buried six inches below the surface in the biologically active soil horizon where the effluent is pumped slowly and uniformly, reducing ponding, even in difficult soils and hilly terrain.

WASTEFLOW is easily adaptable for projects ranging in size from single-family homes to multi-million gallon per day commercial and municipal projects.

Plow single or multiple driplines at a time



WASTEFLOW is Built to Last

ROOTGUARD®

Each emitter has ROOTGUARD protection, a patented process that prevents roots from entering the emitters. The active ingredient, Treflan®, is impregnated into the emitter during the molding process to direct root growth away from the emitter. It is non-toxic.

BACTERICIDE

Geoflow's WASTEFLOW dripline is coated on the inside with a bactericide, Ultra Fresh DM-50, to inhibit bacterial growth on the walls of the tube and in the emitter, eliminating the need to scour the dripline with velocities exceeding turbulent flow. It does not migrate through plastic nor does it leach into the water.

10-YEAR WARRANTY

WASTEFLOW dripline is supported with a ten-year warranty against manufacturing defects and root intrusion.

Characteristics

Reliable and economic.

The low cost of the system and low cost of installation make it possible to cover large areas or have backup fields without incurring high costs.

No ponding, surfacing or deep percolation.

Effluent is uniformly distributed over the entire area using low flow rate, uniformly spaced emitters. Water is slowly applied at each individual point, enabling the water to move laterally through capillary action, reducing percolation.

Flexible and easy to install.

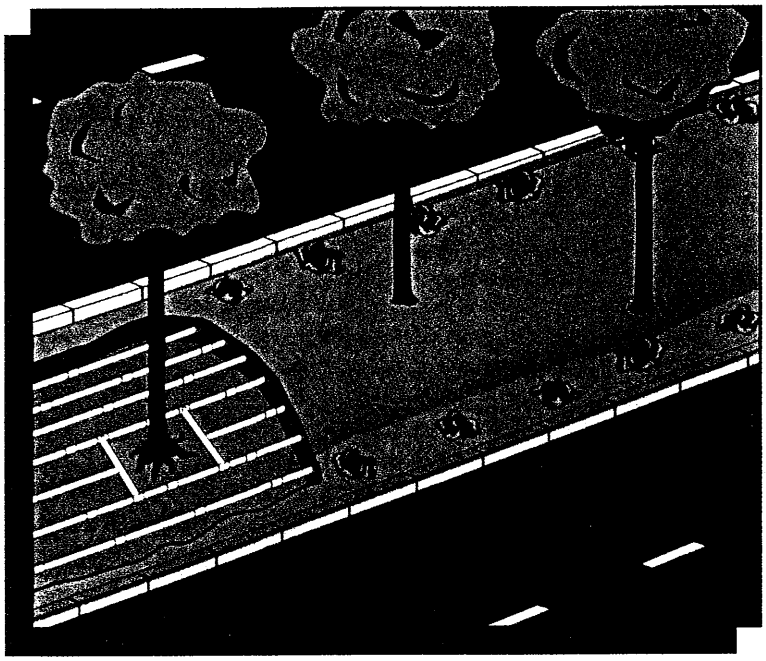
A small vibratory plow or trencher is all that is required to install several thousand feet of tubing.

Easy to design.

The flow characteristics of the emitters and the uniform water distribution make it very easy to design a safe and reliable system.

Resistant to plugging.

Geoflow's drip systems are installed with self-cleaning Vortex Filters to keep large particles from entering the drip field. The emitters are made with large orifices, raised entry ports and turbulent flow paths to keep particles from collecting in the emitters. Incorporation of ROOTGUARD guarantees protection from root intrusion and bactericide inside the tube inhibits slime formation on the walls of the tube.



Purple stripes.

2 stripes identify the WASTEFLOW quality product.

Can be used for irrigation.

The system is ideal for irrigating landscapes or agricultural crops.

Solves limited area and soil problems.

Can be used in small and odd shaped areas, and where soil type or steep slopes preclude conventional systems.

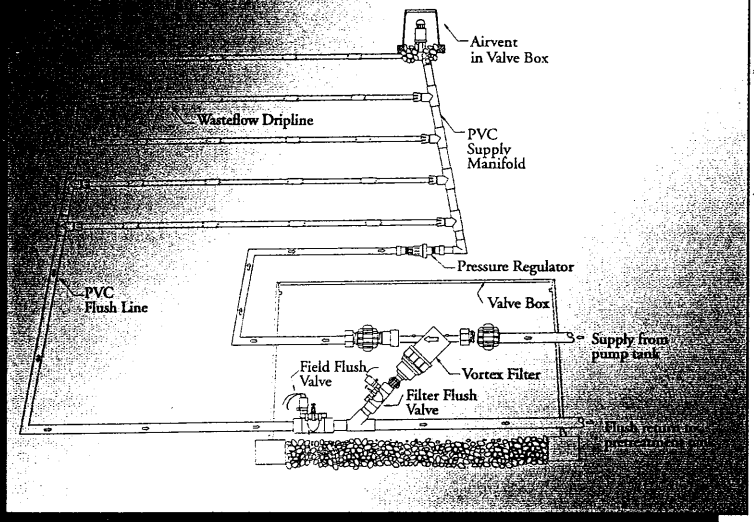
Freezing conditions.

WASTEFLOW has proven successful in freezing conditions.

WASTEFLOW is manufactured under U.S. patents 5 332 160, 5 116 414 & foreign equivalents.
WASTEFLOW and ROOTGUARD are registered trademarks of A.I. Innovations.
Treflan® is a registered trademark of Dow AgroSciences.

Made in the U.S.A.

Typical Dripfield Layout



GEOFLOW™

GEOFLOW, INC.
Tel: 800.828.3388
Fax: 415.553.4110
Homepage: www.geoflow.com

GEOFLOW

Design and Installation Manual

Subsurface Drip for Onsite Wastewater Reuse and Disposal

INTRODUCTION

Geoflow's WASTEFLOW® drip system disposes of effluent below the ground surface through ½" pressurized pipes. It is designed using the grid concept with supply and flush manifolds at each end creating a closed loop system. The result of the grid design is a complete subsurface wetted area.

The objective with effluent disposal is usually to dispose of the effluent using the minimum area as quickly and safely as possible at an approximately uniform rate throughout the year. If the main purpose of the Geoflow system is to irrigate, then please use the standard irrigation manual for landscape available from Geoflow, Inc.

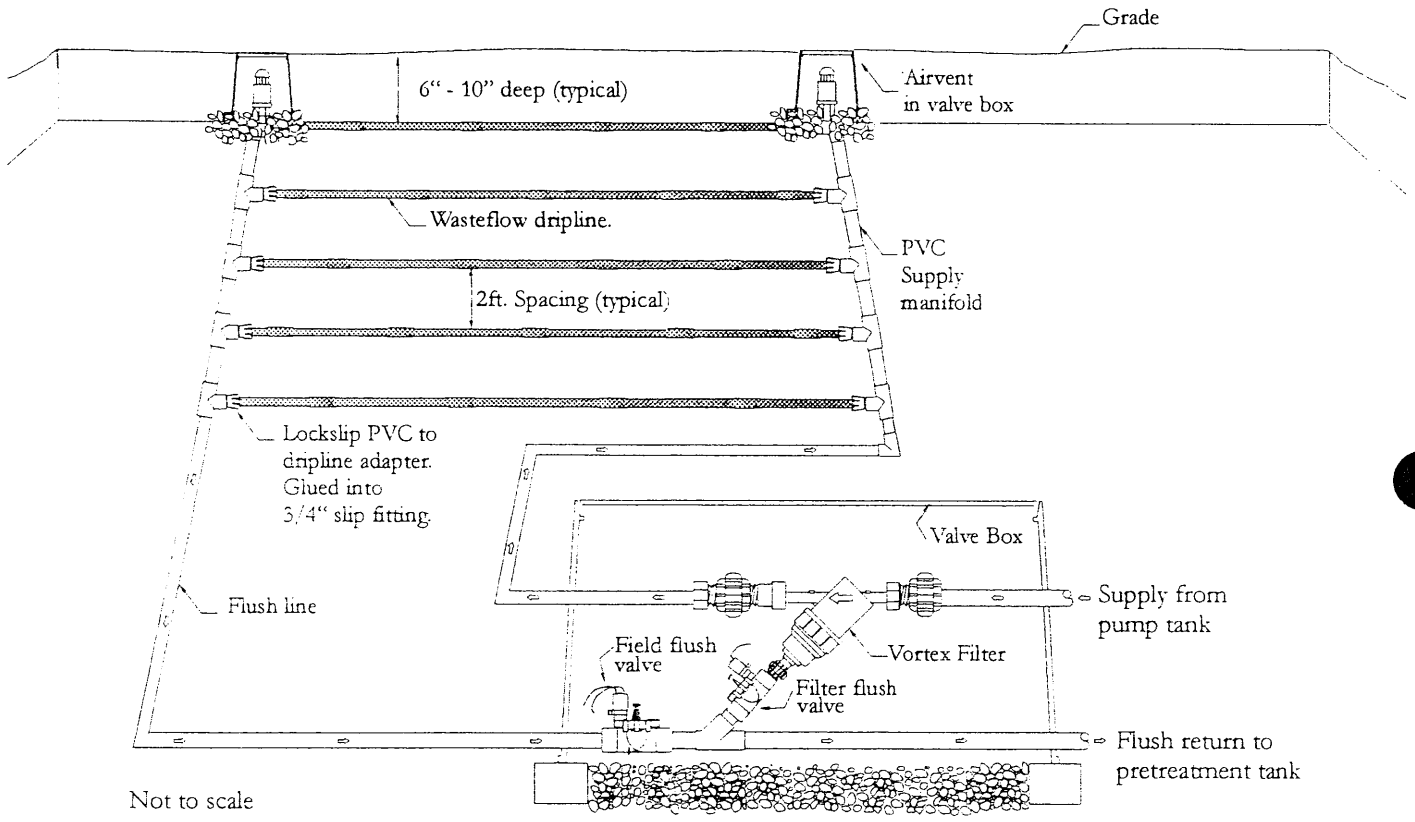
Subsurface drip is the most efficient method to dispose of effluent. Small, precise amounts of water are uniformly applied under the soil surface from multiple points.

The main advantages of Geoflow's subsurface irrigation for effluent disposal are:

- Human and animal contact with effluent is minimized, reducing health risks.
- Correctly designed systems will not cause puddling or runoff.
- It can be used under difficult circumstances of high water tables, tight soils, rocky terrain, steep slopes, around existing buildings, trees or other vegetation, and on windy sites.
- Disposal of water is maximized by means of evapotranspiration.
- The system requires no gravel. It is easy to install directly into indigenous soils and the natural landscape can be maintained.
- Minimizes deep percolation.
- Consumption of nitrates by the plant material is increased.
- Invisible and vandal proof installations.
- Ten-year warranty for root intrusion, workmanship and materials. Systems are durable with a long expected life.
- Non intrusive. It allows use of the space while operating.
- Easily automated.
- Effluent can be re-used for irrigation.

WASTEFLOW® is a registered trademark of A.I.Innovations

DIAGRAM 1: TYPICAL DRIP FIELD LAYOUT



SYSTEM COMPONENTS:

See Diagram 1 on page 3.

A typical drip system installation will consist of the elements listed below:

1. WASTEFLOW® DRIPLINE

(See Appendix 1 on page 21 for product specification)

WASTEFLOW lines carry the water into the disposal/reuse area. WASTEFLOW lines are connected to the supply and return with Compression or Lockslip fittings. Standard spacing between lines and emitters is 24" on center. The pipe has no joints that may pull apart during installation and is ideal for tractor mounted burying machines. It is sold in 500-ft rolls. For export 400-m rolls are available. Rolls of alternative lengths may be special ordered.

WASTEFLOW dripline features:

a) ROOTGUARD®
The risk of root intrusion with an emitter slowly releasing nutrient rich effluent directly into the soil is well known to anyone who has observed a leaking sewer pipe. Geoflow has an exclusive license for ROOTGUARD, to protect emitters from root intrusion. ROOTGUARD carries a 10 year warranty against root intrusion.

b) Turbulent flow path
Wasteflow drip emitters are pre-inserted in the tube 6", 12" or 24" apart with 24" being the most popular. Angles in the emitter flow path are designed to cause turbulence in order to equalize flow between emitters and keep the emitters clean. Geoflow emitters boast large flow paths, which, coupled with turbulent flow, have proven over the years to be extremely reliable and dependable.

c) Bactericide
Geoflow's WASTEFLOW has an inner lining impregnated with a bactericide, Ultra Fresh DM-50, to inhibit bacterial growth on the walls of the tube and in the emitter.

d) WASTEFLOW Classic and WASTEFLOW PC Dripline
For WASTEFLOW Classic the flow rate delivered by the emitter is a function of the pressure at the emitter. WASTEFLOW PC will have a constant flow rate at all pressures from 7 to 60 psi - to ensure a long life the recommended operating range is 10 to 45 psi.
We recommend that WASTEFLOW PC be used when the advantages are of substantial economic value.

i) Wasteflow PC can be run longer distances than WASTEFLOW Classic.
ii) Steep slopes. Systems should be designed for the dripline lateral to follow the contour. When this is practical, the extra cost of installing pressure regulators required for WASTEFLOW Classic would likely be less than the incremental cost of WASTEFLOW PC.
iii) Rolling terrain. If the difference in height from trough to peak exceeds six feet then WASTEFLOW PC should be used. Vacuum relief valves must be placed at the top of each rise.

ROOTGUARD® is a registered trademark of A.I.Innovations.

2. CONTROLLERS

(See Appendix 3 on page 27 for product specifications)

Controllers are used for time dosing and time flushing of the filter and dripfields. GEO controllers include a programmable logic control interface for field modifications. They can be used on systems ranging in size from one to four zones at the time this manual was printed. All controllers include a surge arrestor, elapsed time meter and counter. For larger systems please inquire about our Wasteflow Manager controller which has monitoring and telemetry capabilities.

3. PUMPS

WASTEFLOW dripfields depend on pumps to supply effluent and pressure to the field. These must be sized according to flow and pressure requirements. Look for submersible effluent pumps from a dependable source. Geoflow does not endorse a single manufacturer, but does advocate you use a pump that is readily serviced in your area.

4. FILTERS

(See Appendix 2 on page 24 for product specifications)

Geoflow systems use a self-cleaning Vortex Filter with a stainless screen 150 mesh / or 100 micron filter element. The self-cleaning action is efficient over a range of flow rates depending on the filter size. The clean-out port is at the base and can be opened or closed manually or automatically. If using a manual flush valve, please keep the valve cracked open slightly at all times for continuous flushing. The controller will fully open automatic flush valves.

5. SUPPLY MANIFOLD

This carries the water from the dosing tank to the disposal area. Rigid PVC is usually used and must be designed to slope back to the pump tank in freezing conditions. The velocity in the manifold should be between 2 feet per second and 5 feet per second (fps). Refer to PVC pipe sizing chart in the appendix to determine the best diameter for your application.

6. RETURN MANIFOLD

In order to help clean the system, the ends of the drip lines are connected together into a common return line, most often made of rigid PVC. This line will help equalize pressures in the system. Flushing should be done frequently during the installation period. Periodic flushing under full system pressure will guarantee a long system life. The return manifold should be installed to drain the line back to the pretreatment tank in freezing climates.

7. PRESSURE REGULATOR

(See Appendix 6 on page 32 for product specification)

Pressure regulators fix the inlet pressure at a given rate and are required with WASTEFLOW Classic. Under normal operating conditions, pressure in the drip lines should be:

10 psi to 45 psi for WASTEFLOW Classic and

7 psi to 60 psi for WASTEFLOW PC

8. Air Vacuum Breaker

(See Appendix 5 on page 31 for product specification)

Air vacuum breakers are installed at the high points to keep soil from being sucked into the emitters due to back siphoning or backpressure. This is an absolute necessity with underground drip systems. They are also used for proper draining of the supply and return manifolds in freezing conditions. Use one on the high end of the supply manifold and one on the high point of the return manifold. Maximum flow per vacuum breaker is 50 gpm. Freezing conditions require the air vacuum breaker be protected with insulation.

9. Filter Flush Valves

(See Appendix 4 on page 29 for product specifications)

Used to flush debris from the filter cleanout port back to the pretreatment tank, this can be an electronically activated solenoid valve or a manual ball valve. If manual, it should be opened for a full flushing at least every six months and left cracked open slightly to flush continuously. Cracking open a manual valve may be used to increase flow through the system to be within the efficient flow rate of the filter and/or pump, if necessary. Certain States may require automated electronic flushing. Please refer to your State codes.

10. Field Flush valves.

(See Appendix 4 on page 29 for product specifications)

Used to flush out fine particles which have passed through the filter and accumulate on the bottom of the tube at the end of each lateral. The field flush valve can be manual or electronic. If manual, it should be opened for full flushing at least every six months and left cracked open slightly to flush continuously and provide for drainage of the flush line in freezing conditions. Cracking open a manual valve can also be used to increase the flow through the system to be within the efficient flow rate of the filter and/or pump if necessary. Certain States do require automated electronic flushing. Please refer to your State codes.

11. Wasteflow headworks

(See Appendix 7 on page 33 for product specifications)

WASTEFLOW Headworks is a pre-assembled unit including the filter, valves and pressure gauge in a jumbo box. It is installed between the pump and the field. Be sure to insulate the box in freezing climates.

GEOFLOW, Inc.
SUBSURFACE DRIP SYSTEMS

Large Geoflow WASTEFLOW Systems Include:

City of Oakleigh (Melbourne, Australia)
Consulting Engineers:
Peter Gearing
URS
Bank Direct Centre
13-15 College Hill
P. O. Box 821
Auckland, NEW ZEALAND
Tel: 011-649-3551332
Fax: 011-649-3551333
mailto:peter_gearing@urscorp.com

Approximately 250,000 sq. ft. disposal field in turf. School playing fields and park.
Installed 1994.
(Photographs available)

Kukuiula Development Project (Kauai, Hawaii)
Designed and installed by:
Mike Farrell or Elson Gushiken
Irrigation Technology Corp. (ITC)
Box 458
Haleiwa, HI 96712
Tel: 808-637-5078
Fax: 808-637-4779

1 million gpd under turf.
Installed about 1993
(Photographs available)

Brigham Young University (Laie, Hawaii)
Designed by:
CH2MHILL
(with advise from ITC)
Peter H. Rude, P.E.
2525 Airport Drive 96001-2443
Redding, CA 96049-2478
Tel: 916-243-5886
Maintained by:
Brigham Young University
Brett Borup
368 CB
Provo, UT 84601
Tel: 801-378-6311

350,000 gpd irrigating approximately 57 acres of landscape, agriculture, playing fields and turf.
Installed 1994
(Photographs available)



Hawaii Kai golf Course (Hawaii)
Designed and installed by:
Mike Farrell or Elson Gushiken
Irrigation Technology Corp. (ITC)
Box 458
Haleiwa, HI 96712
Tel: 808-637-5078
Fax: 808-637-4779

Subsurface drip used in the perimeter of the golf course where spray setbacks are 100 ft..
Very saline water.
(Photographs available)

Ocala Airport (Ocala, Florida)
Ocala Airport
Designed and installed by:
Russel Daniel Irrigation
Forest Vickery
Tel: 706-543-0168
Fax: 706-549-4045
Maintained by:
Edward T. Earnest, P.E.
City of Ocala
Tel: 352-629-8521

600,000 gpd under 43 acres below flight path.
1/2gph pressure compensating emitters spaced 3ft apart. 4 ft. spacing between rows. No complaints from population due to smell and wind drift, which they do get at other city sites.
"Lowest maintenance" disposal site.
Measuring nitrates and there are none.
(Photographs available)

Calusa Casino (Calusa, California)
Calusa Casino
Designed, installed and maintained by:
Mark Hedenland
7H Technical Services
431 Crown Point Circle, Suite C
Grass Valley, CA 95945
Tel: 530-271-1848
e-mail: mark@7h.net

50,000 gpd on a 4 acre disposal field.
(Photographs available)

Aluminum Smelter (Invercargill, NZ)
Consulting Engineers:
Peter Gearing
URS
Bank Direct Centre
13-15 College Hill
P. O. Box 821
Auckland, NEW ZEALAND
Tel: 011-649-3551332
Fax: 011-649-3551333
mailto:peter_gearing@urscorp.com

Disposing 78,000 gallons of human effluent per day over 12.35 acres.
½ gph pressure compensating emitters spaced 2ft apart with 2.5 ft spacing between lines.
Installed May 1998.

Homes on a golf course (Oklahoma)
Calvin Locker
Geoflow, Inc.
401 Valley View Drive
Edwardsville, IL 62025
Tel: 618-659-1169
mailto:cal@geoflow.com

2001 installed 6,000 ft. WFPC16-2-24 along cart path between the homes (condos) and the fairway. This is for four 2-bedroom condos. Each condo has aerobic treatment. More dripline will be installed as more condos are sold.

Sysco Systems (North of Sacramento. CA)
.Mark Kahl
7H Technical Services
Grass Valley, CA 95945
Tel: 530-271-1600
mailto:aussie@7h.net

20,000 gpd. Installed Summer 2001

Bernadus Lodge (Carmel Valley, CA)
Designed by Questa Engineering
Norm Hantzsche, P.E.
Richmond, CA 94807
Tel: 510-236-6114
mailto:questa@questaec.com

25,000 gpd – extensive landscaping
(Photographs available)

Tenaya Lodge (Fish Camp, CA)
Designed by:
Glenn Dombeck
SUMMIT ENGINEERING
1400 N Dutton Ave, Suite 24
Santa Rosa, CA 95401
Tel: 707-527-0775
mailto:glenn@summit-sr.com
Project overseen by Jack Niblett
Fish Camp, CA 93623
Tel: 559-683-6555

Installed Summer 2000. Slope in excess of 50% at the top of the section.
20,000 gpd.
(Video and photographs available)

Golf Course near Auckland N.Z.



Consulting Engineers:
Peter Gearing
URS
Auckland, NEW ZEALAND
Tel: 011-649-3551332
Fax: 011-649-3551333
mailto:peter_gearing@urscorp.com

2,000,000'+ covering an entire golf course except the greens. Rolling hills. Completed early 2002.

Lake Maxinkuckee (IN)
Designed by
J.F. New & Associates, Inc.
Andrew Bender
Indianapolis, IN 46254
Tel: 317-388-1982

18,000 ft. of dripline
Installed Summer 2001
Drip irrigation follows Wetlands

Wacon Daho Camp (KY)
Designed by:
GRW Engineering
Joe Pavoni
KY
Tel: 859-223-3999

Dripfield in wooded area around Pavilion next to sports field. High access area.

Crossville High School. (AL)
Designed by:
ADL Inc., Engineering Services
Darrell Sears
Fort Payne, AL

Drip distribution in sports practice field.

Hidden Lake Academy (Dahlonega GA)
Designed by: Jordan Jones & Goulding
John D. Todd, P.E.
2000 Clearview Ave. NE
Atlanta, GA 30340
Tel: 770-455-8555

Camp for troubled teens. Dripfield next to sports field.

City of Yreka
Mark Kahl
7H Technical Services
Grass Valley, CA 95945
Tel: 530-271-1600
mailto:aussie@7h.net

City disposal in a gravel soil. 2.3 million gpd. Installation scheduled be complete early 2002. (Photographs available)

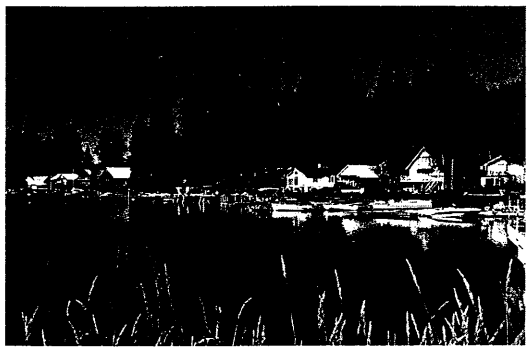


O R E N C O

CASESTUDY

Diamond Lake, Washington:

12-Year Old Effluent Sewer Requires Little Maintenance



The community of Diamond Lake, in northeast Washington state, saved its beautiful 800-acre lake by replacing all its old, leaking septic tanks and inadequate disposal systems with watertight tanks and an Orenco effluent sewer system. Diamond Lake's wastewater system serves more than 500 homes, as well as one of the largest Boy Scout camps in the country.

In the early 1970's, the residents of Diamond Lake, Washington (533 households) knew that something had to be done about their wastewater. According to Bob McGowan, long-time member of the Diamond Lake Water & Sewer Commission, "Our lake was being destroyed by leaking septic tanks and failing drainfields."

The community needed federal funding assistance. Even so, "A gravity system was way out of reason," recalls Larry Garwood, system operator. After nearly 15 years of research and planning, the Commission decided on an effluent sewer and purchased ProSTEP™ pumping systems from Orenco.

Construction began in 1987. Installation went well but was not easy, since the soil was heavy clay, with high groundwater. In addition, about 25% of the excavation had to be blasted for the tanks and minimum 42"-deep collection lines. "If the engineers had known about the rock, the cost estimates for the gravity sewer would have been even higher," says Garwood.

"We're operating this system – water and sewer – with just two guys. More than 500 sewer customers and 600 water customers. It's easy to maintain."

Larry Garwood
Diamond Lake
Water & Sewer District

More than a dozen years later, everyone is pleased with the system, according to Garwood and McGowan. All wastewater and water system maintenance is handled by just two operators. "The system is easy to learn and maintain," says Garwood. "We don't have many alarm calls. Pump motors never give us a problem, and the lines are performing well." (See "Operation/ Maintenance" summary on back.)

Equally as important, wastewater services are very cost-effective, both for the district and its citizens. Customers pay $15/month for residential properties and $25/month for commercial properties.

Best of all, there's the lake. Within three years after Orenco's effluent sewer was installed, it was clear and clean again. "It recovered very early on," says Commissioner McGowan. "Diamond Lake is now a showcase." (*Continued on back.*)

Orenco Systems
Incorporated
800/348-9843
www.orenco.com

SUMMARY OF SPECIFICATIONS

Diamond Lake, Washington Effluent Sewer
Using Orenco Systems' Equipment

INSTALLATION DATE
1987

TOTAL PROJECT COST
$2,951,280 (excluding lagoon)
$5,540 per home

ON-SITE FACILITIES
533 EDU's, mostly residential
529 STEP units, 4 STEG units

TANKS
RESIDENTIAL
1,000 gal single-compartment concrete tank with effluent filters or screened pump vaults.

Tanks were tested extensively for watertightness and structural integrity.

COMMERCIAL
Multiple 1,000 gal or 2,000 gal tanks.

PUMPS
1/2 Hp (8 gpm typical) turbine effluent pumps.

COLLECTION SYSTEM
Each lot has 1.5" - 2" service lines
6.5+ miles of 3" - 8" main lines

Effluent quality of collection system (measured at inlet of first lagoon):
BOD = ~170± mg/L ('89-'91)
TSS = ~40± mg/L ('89-'91)

TREATMENT SYSTEM
3-CELL AERATED LAGOON:
1 cell is 3/4 acre x 10.5' deep (on average)
2 cells are 3.75 acre x 16' deep
180,000 gpd design

Q (summer average) = 68,000 gpd
Q (winter average) = 45,000 gpd
37.9 million gallons winter storage capacity (on average)

DISPOSAL
410,000 gpd irrigation to 38-acre alfalfa field
(Winter hold; summer irrigate)

OPERATION/MAINTENANCE
Entire system (wastewater and water) maintained by two full-time operators.

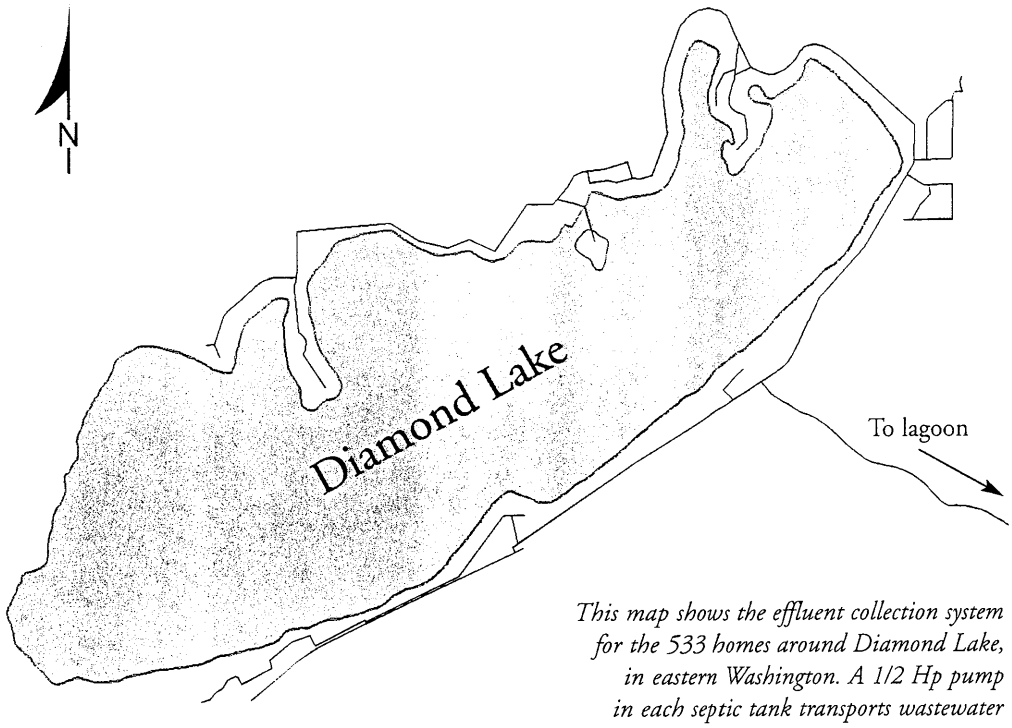
About 2 alarm calls per week (often for customer power failure), 110 per year.

Average time spent at site for an alarm: 20 min.

Calls typically broken out as follows:

Screen cleanings: 30
Pumps (cleaning): 30
Miscellaneous: 20
Control panels: 11
Discharge assemblies: 10
Floats: 5
Service lines: 2
Pump motors: 1

FEES
$15/month residential
$25/month commercial



This map shows the effluent collection system for the 533 homes around Diamond Lake, in eastern Washington. A 1/2 Hp pump in each septic tank transports wastewater to an aerated lagoon, six miles distant, with no lift stations required.

Orenco Systems®
Incorporated

Changing the Way the World Does Wastewater®

1-800-348-9843

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O R E N C O

CASESTUDY

Elkton, Oregon:

Effluent Sewer Provides Superior Treatment at Low Cost



This aerial view shows the community of Elkton, Oregon, with its 100 residences, stores, restaurants and schools. Orenco's highly efficient recirculating sand filter is in the lower right corner (circled).

In the late eighties, individual onsite septic systems in Elkton, Oregon — along the beautiful Umpqua River — were failing, threatening the river's water quality. In addition the septic systems were limited in capacity, and merchants realized they couldn't expand their businesses without making improvements.

In 1989, Orenco installed a ProSTEP™ watertight effluent sewer system that conveys effluent from about 100 onsite septic systems — of which 1/3 are gravity (STEG) and 2/3 are pump (STEP) — to a 60' x 120' recirculating sand filter (RSF) designed to treat 30,000 gallons per day. Final disposal of the treated effluent is to a sequentially dosed drainfield consisting of 11,000 lineal feet, divided into 12 zones.

Effluent quality is outstanding. BOD and TSS from the ProSTEP collection system average 130 and 34 mg/L, respectively. After treatment by the RSF, effluent dosed to the drainfield averages 6 mg/L for both!

"The river is a big part of our lives, so protecting it is a priority. Orenco's recirculating sand filter does an excellent job at a cost we can afford."

Linda Higgins
Elkton City Manager

The cost to homeowners is minimal. After an initial $400 connection charge, homeowners pay a low $20 monthly fee that includes system payback and maintenance. That's because maintenance is also minimal, averaging less than an hour per day for routine maintenance to the collection system and for recording daily meter readings for the RSF and dosing pumps.

With a total system cost of $897,800, the average installation was less than $7,000 per connection. The community of Elkton found a cost-effective, environmentally sound solution to its wastewater treatment needs. And because only two-thirds of the systems' capacity is being used, Orenco's ProSTEP technology will serve Elkton long into the foreseeable future.

Orenco Systems
Incorporated
800/348-9843
www.orenco.com

SUMMARY OF SPECIFICATIONS

Elkton, Oregon Effluent Sewer and Recirculating Sand Filter
Using Orenco Systems' Equipment

INSTALLATION DATE
1989

TOTAL PROJECT COST
$897,800

ON-SITE FACILITIES
135 EDU's, mostly residential

67 STEP Units, 34 STEG Units

TANKS

RESIDENTIAL
1,000 gal, 1-piece construction, single-compartment concrete tank fitted w/effluent filters or screened pump vaults.

COMMERCIAL
Larger than 1,000 gal and/or multiple tanks.

PUMPS
1/2 hp (10 gpm typical) effluent pumps.

COLLECTION SYSTEM
Main lines mostly 2" diameter, some 3".

TREATMENT SYSTEM
Recirculating gravel filter discharging to drainfield.

Q (Design) = 30,000 gpd
Q (Average) = 17,000 gpd
Actual RR = 3.2:1

29,500 gal recirculation tank, with four, 1 hp pumps.

Per DEQ, Media depth = 35", D10 = 3.5 mm; Cu = 1.8 (Current standards provide for media depth of 24" and media size of 1.2-2.5.)

Flow splitter tank divides 20% of return flow to drainfield. During low flows, motorized valve actuates, resulting in 100% recirculation.

DISPOSAL
3,000 gal dosing tank with three, 1/2 hp, 70 gpm pumps. Each pump doses to 4 valves that sequentially direct flow to hydrosplitter with 5 zones each.

127 (2") laterals with 1/8" orifices on 24" spacing, placed in 12" x 48" trenches.

11,000 LF drainfield is located within 6 acres.

EFFLUENT QUALITY

Influent BOD and TSS average 130 and 34 mg/L, respectively. Effluent averages 6 mg/L for both (see chart, below).

OPERATION/MAINTENANCE

ONSITE FACILITIES
Alarm calls average 3.7/yr. for first 7 yrs.
No residential tanks have needed pumping.

In 1996, a full audit was performed at each septic tank. Little maintenance was required.

COLLECTION SYSTEM
2 contract operators on-call.

TREATMENT SYSTEM
1 part-time operator; less than 1 hr/day, including daily meter readings (weekly would be adequate).

Per WPCF permit, effluent analysis performed quarterly.

RSF distribution laterals flushed annually (preventative maintenance).

FUNDING/FEES
71% grants, 29% loan

$400 connection fee

$20/mo/EDU for < 5,000 gpd flows (winter average)

Additional $4/1,000 gpd for > 5,000 gpd flows

$175/mo flat fee for 2" commercial meters

New gravity installations cost about $2,000

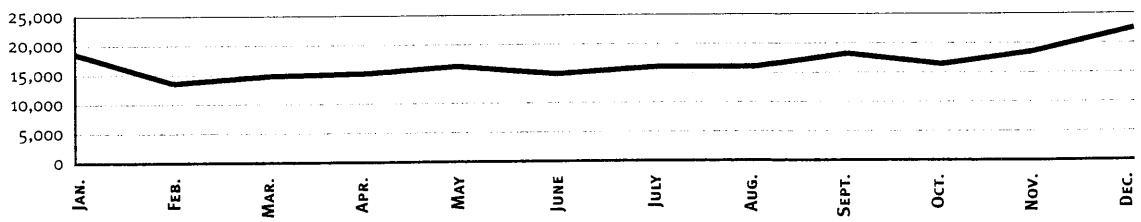
New pump system installations cost about $3,000.

DATA COMPARING INFLUENT(I) TO EFFLUENT(E)

ANNUAL AVERAGE	BOD I/E	TSS I/E	NH3 I/E	NO3 I/E
1990	247/14	37/-	58/1	1/8
1991	116/7.5	25/4.0	33/3	1/11
1992	-/13	26/-	-/4	-/24
1993	134/4.3	40/5.1	56/11	3/26
1994	114/2.9	30/4.3	47/8	2/36
1995	122/3.9	40/11	50/9	1/30
1996	92/2.3	46/4.0	44/13	2/20
1997	128/5.5	38/7.7	41/8	3/14
1998	130/3.3	29/4.9	50/9	2/27
1999	146/5.9	33/5.1	45/5	1/23
2000	85/3.8	30/4.7	41/4	1/22
2001 (through July)	76/3.0	28/4.5	31/5	.4/28

BOD Biochemical Oxygen Demand **TSS** Total Suspended Solids **NH3** Ammonia **NO3** Nitrate

MONTHLY AVERAGE FLOW, GPD



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Pipeline

Winter 1999
Vol. 10, No. 1

Small Community Wastewater Issues Explained to the Public

SPRAY AND DRIP IRRIGATION FOR WASTEWATER REUSE, DISPOSAL

Did you ever wonder how golf courses keep their large fairways looking so lush, healthy, and green all season long? The answer may surprise you.

In many communities in the U.S. and around the world, treated wastewater is reused to irrigate golf courses, lawns, landscaping, forests, and even crops. Because water is such a precious commodity, recycling wastewater can have both economic and environmental benefits for communities. Irrigation also can be the most practical and environmentally-friendly way communities can dispose of treated effluent from wastewater treatment plants and individual home systems.

Better for the Environment

Currently, the most common way community treatment plants dispose of wastewater after treatment is to discharge it to surface waters. However, as populations grow, the burden to local streams and rivers is increasing. Reusing wastewater to irrigate land can help protect precious surface water resources by preventing pollution and by conserving potable water for other uses.

Another benefit of applying wastewater to land is that the soil provides additional treatment through naturally occuring physical, biological, and chemical processes. Irrigating with wastewater also adds nutrients and minerals to soil that are good for plants, and it helps to recharge valuable groundwater resources.

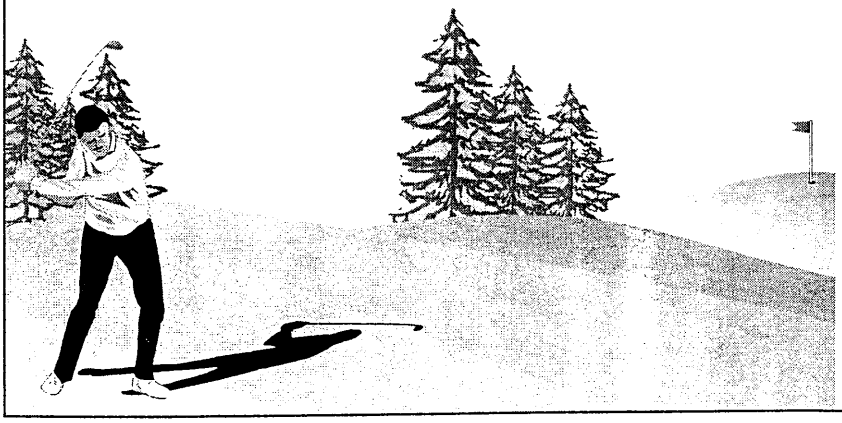
A Solution for "Problem" Sites

Irrigation systems often can be used in place of soil absorption fields (drainfields) to provide final treatment and disposal of wastewater from individual onsite systems, such as septic systems and home aerobic treatment units. As the demand for land in rural areas is increasing, more sites are being developed in places previously considered unsuitable for onsite systems. Irrigation sometimes is permitted as an alternative wastewater disposal method for difficult sites, such as areas with slowly permeable soils, shallow soils, or complex topographies.

This *Pipeline* issue provides a brief overview of two types of wastewater irrigation systems—spray systems and subsurface drip systems—how they work, their advantages and disadvantages, and when they may be a good option for homes, businesses, and communities. Operation and maintenance issues also are discussed.

Treated wastewater can be reused to irrigate . . .

- lawns;
- parks;
- landscaped areas around offices and industrial developments;
- landscaped areas around residences;
- pasture grass;
- highway medians;
- golf courses;
- cemeteries;
- forests;
- trees, corn, alfalfa, and other feed, fodder, and fiber crops; and
- food crops.



Readers are encouraged to reprint *Pipeline* articles in local newspapers or include them in flyers, newsletters, or educational presentations. Please include the name and phone number of the National Small Flows Clearinghouse (NSFC) on the reprinted information and send us a copy for our files.

If you have any questions about reprinting articles or about any of the topics discussed in this newsletter, please contact the NSFC at (800) 624-8301 or (304) 293-4191.

Is irrigating with wastewater a good option for your home or community?

If you live in an area where water must be conserved or is expensive, or where other options for disposing of wastewater are restricted, then reusing wastewater for irrigation may be a good option for your home, farm, business, or community. It also can be a good choice simply because it is an efficient use of local resources.

In arid climates, such as in Arizona, New Mexico, and parts of California, for example, or where the demand for water threatens to exceed the supply, as it does in parts of Florida, many homes and businesses could not afford to maintain grass lawns or landscaped areas without reusing wastewater. In Hawaii, treated wastewater is used to irrigate pineapples and sugar cane to save money and conserve fresh water for other uses.

Irrigation also can serve as an alternative onsite disposal method for lots deemed unsuitable for conventional septic tank/soil absorption systems. Because irrigation systems are designed to deliver wastewater slowly at rates beneficial to vegetation, and because the wastewater is applied either to the ground surface or at shallow depths, irrigation may be permitted on certain sites with high bedrock, high groundwater, or slowly permeable soils. Irrigation systems also can be designed to accommodate sites with complex terrains.

Local governments sometimes choose to reuse wastewater from community treatment plants for irrigation, rather than discharging all of it to local surface waters. Irrigation can help communities to save money or avoid exceeding surface discharge permit limits, while preserving the quality of local water resources for drinking water, aquatic life, and recreation. Some communities even have two separate distribution systems—one for potable water and another for reclaimed water for watering lawns and other irrigation needs.

Is it safe?

Irrigating with wastewater is safe when all federal, state, and local regulations regarding its treatment and use are strictly followed. When regulatory requirements are met, the wastewater returned to the environment after irrigation usually is higher quality than the wastewater discharged from treatment plants due to the additional treatment provided in the soil.

Regulations protect public health and the environment by requiring that wastewater always be pretreated prior to irrigation and by restricting its quality, use, and the manner and location of its application. Cumulative levels of nutrients, salts, heavy metals, and disease-causing organisms also must be monitored in the soil at some sites.

Regulations Vary

Wastewater reuse is not permitted everywhere. Regulations vary from state to state and sometimes from community to community. State and local governments may have additional or more stringent requirements than the federal regulations.

Community residents can contact local health agency officials to find out about regulations in their area. The National Small Flows Clearinghouse (NSFC) also offers information about federal and state regulations. *(Refer to the contacts list on page 7 and the products information on page 8.)*

Pretreatment Is Required

After wastewater receives primary and sometimes secondary treatment in a community treatment plant or individual onsite treatment system, additional treatment steps often are required prior to irrigation to reduce the amount of suspended solids and organisms in the wastewater. Both can pose a threat to public health and clog systems. Microorganisms, such as bacteria, can collect or multiply and create slime that clogs systems. Pretreatment also minimizes odors in wastewater, so there is less potential for creating a public nuisance and attracting animals that can spread diseases.

Different degrees of pretreatment are required for the wastewater depending on how it will be used and the intended method of irrigation. For example, standards are more rigorous for surface irrigation methods, such as spray irrigation, and when irrigating food or feed crops or land intended for public use. Biological pretreatment to remove organic matter from the wastewater is followed by filtration, to remove small particles from the wastewater, and disinfection.

Subsurface drip irrigation systems also employ filters mainly to protect against system clogging. Additional treatment may be necessary to protect the receiving environment and may include secondary treatment plus disinfection. This adds to the cost of building, operating, and maintaining systems, which should be considered when determining whether irrigation is a practical wastewater disposal option.

Site Conditions Are Important

Not all sites are appropriate for wastewater application. Communities wishing to dispose of wastewater from treatment plants through irrigation sometimes must purchase or lease suitable land for disposal or enter into cooperative arrangements with local farmers or landowners. Sites near surface water or high groundwater often are restricted, especially when these are used as drinking water sources. Regulations typically require minimum separation distances or buffer zones from ground and surface water resources and public areas to minimize contact with wastewater.

Other important site selection criteria include the type of soil, soil wetness, slope, drainage patterns, and local climate, including rainfall amounts and evaporation rates. In areas that have cold or wet weather part of the year, wastewater often must be stored in lagoons or holding tanks until irrigation is needed. Some irrigation equipment also can freeze in very cold weather.

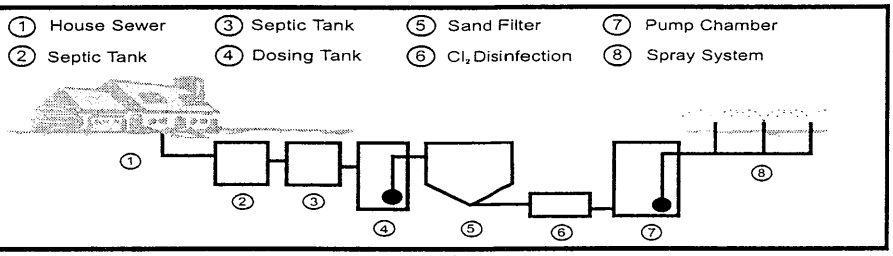
Maintenance Is Necessary

All systems, including irrigation systems, have operation and maintenance requirements. These include periodic checking and cleaning of filters, checking valves, pumps, and timers, and, in some cases, monitoring wastewater quality and its impact on soils. Large systems serving farms, businesses, or communities often have operators, but most systems are at least partially automated.

Although spray and subsurface drip irrigation systems serving individual homes may only need maintenance about once or twice per year, homeowners should consider that these systems will require more attention than conventional onsite systems.

Spray Systems Irrigate Lawns, Parks, Crops

Example residential spray system schematic



Spray irrigation is an efficient way to nourish plants and apply reclaimed wastewater to land. Some spray systems are very similar to potable-water sprinkler systems used to irrigate lawns. Others are specifically designed for agricultural applications.

While there are many possible spray system designs, they all work by distributing treated wastewater across the soil surface. Systems should be designed by qualified professionals who have specific experience working with irrigation systems.

System Design

Because spray systems apply effluent above-ground, the wastewater must be treated to a high enough level to protect public health and reduce odors. In general, regulations require that effluent used for surface irrigation at least meet secondary treatment standards plus disinfection.

With spray systems, therefore, after primary treatment in a septic tank or community treatment plant, the wastewater usually goes to a home aerobic treatment unit, sand filter, recirculating sand filter, or other filter, and then to a dosing tank or pump chamber. The wastewater is then disinfected with chlorine, ozone, or ultraviolet light before it is stored in a lagoon or holding tank for later use or just prior to its application to land. In some community systems, aerated or facultative lagoons provide treatment as well as additional storage area for the wastewater.

After treatment, filtration, and disinfection, a pump equipped with timers sends the wastewater under pressure through the mains and lines of the spray distribution system at preset times and rates as needed for irrigation. The area to be irrigated (the spray field) can be sloped up to 30 percent, depending on local regulatory requirements, but must be vegetated and landscaped to minimize runoff and erosion.

Chlorination is the most common disinfection method used with spray irrigation. One common chlorinator design accepts chlorine tablets or powder; another doses liquid chlorine into the wastewater. With chlorination, adequate contact time is necessary to allow the chlorine time to kill harmful bacteria and other pathogens.

A holding tank or lagoon is another necessary component in most spray systems, because storage space allows operators to adjust application rates, if needed. In some onsite systems that employ a recirculating sand filter, the recirculation tank serves as the storage tank. However, spray systems in cold or wet climates may need to store 130 days of design flow or more. Systems may be permitted to apply wastewater only certain months of the year, or they may be required to include subsurface drainage to help prevent runoff and erosion during wet weather.

Large community systems sometimes reduce the amount of storage area they need by obtaining controlled discharge permits, which allow them to release wastewater to surface water in winter or during times of high stream flows.

Spray Equipment

There is an impressive array of high-tech spray equipment available for irrigating crops. Some consist of series of sprinkler heads mounted to elevated distribution pipes, which move across fields either laterally, by means of drive units at both ends of the pipe (called linear move), or in a circular motion from one fixed end (called pivot move). The height and amount of pressure with which the spray nozzles emit wastewater can be adjusted. Systems even can be programmed to adjust application rates for different parts of the field and to shut off automatically during rain or high winds. And some can be operated remotely.

Another design used to irrigate row crops, called a portable irrigation reel, is a little less high-tech. It consists of a hard plastic hose wound to a drum reel. One end of the hose is attached to a portable sprinkler cart, which is pulled away from the reel during setup, and the other end of the hose is attached to a hydrant. A motor or turbine rewinds the reel and crops are irrigated as the sprinkler cart moves along the uncultivated irrigation paths, which must be kept clear for this purpose.

There also is a variety of sprinkler designs for irrigating smaller field crops, lawns, and landscaping, which are similar to potable-water lawn sprinkler systems. The sprinklers can be fixed (called solid-set) or moveable, buried or above-ground, and some designs are telescoping to adjust the height of application to fit the height of the plants. Other variations exist in the amount of pressure and manner in which the wastewater is released from the sprinklers—examples include full circle, partial circle, gun, and microspray. Different pressure amounts are appropriate for irrigating different plant types. Individual home systems use low trajectory sprinklers to minimize aerosol production.

Fixed, buried sprinkler systems usually are among the most expensive designs to purchase and install, but they have certain advantages. They are less likely to be vandalized or accidently damaged and they make maneuvering farm equipment and lawn mowers easier. However, some moveable system components can be stored indoors in the winter. Most spray system designs include valves and controls that allow operators or homeowners to adjust the flow to certain areas of the spray field. Some larger systems have both automated and manual controls.

continued on page 4

Some Advantages of Spray Systems Include . . .

- When properly designed, installed, and operated, most spray systems provide uniform distribution of wastewater to plants and eliminate discharge to streams.
- Above-ground irrigation is needed for some germinating plants.
- Spray irrigation increases levels of nitrogen, phosphorus, and minerals in the soil.
- Above-ground spray system components are easier to inspect, control, and service than subsurface drip irrigation components.
- When performed during the heat of the day it has a cooling effect on some crops and decorative landscape plants.
- Evaporation contributes to the rate of wastewater disposal.

Some Disadvantages of Spray Systems Include . . .

- Spray systems generate aerosols, which can pose a threat to public health. Therefore, regulations typically require large minimum setback distances, buffers, and other restrictions that make spray systems inappropriate for small lots.
- Wet soil surface promotes weed growth, making some crops and landscaping difficult to maintain.
- Wet soil surface makes weeding, harvesting, and operating lawn mowers and farm equipment more difficult.
- Applications of insecticides and fungicides to crops must be scheduled carefully between spray irrigation applications to allow maximum contact/exposure times.
- Above-ground spray equipment is exposed to the elements and can be accidentally damaged or vandalized.
- Bacteria tends to survive better in wet, cool soil conditions.

Spray Systems Irrigate Lawns, Parks, Crops

continued from page 3

Setbacks and Buffer Zones

To guard against the possibility that drifting aerosols and runoff created by spray irrigation systems will reach and contaminate nearby public areas and water resources, regulations typically require considerable minimum setback distances or buffer zones to nearby residences, property lines, public areas, wells, streams, rivers, lakes, and wetlands. Minimum setbacks of as much as 150 to 500 feet from neighboring residences and water sources are not unusual, depending on local regulations. Buffers also may be required from water lines, embankments, drains, drainage ditches, and public rights of way. A minimum vertical separation distance to the water table also applies.

Because of these setback requirements, spray systems tend to be mainly practical for irrigating crops, fields, and larger land areas or home lots.

Operation and Scheduling

Unlike traditional irrigation systems whose sole purpose is to deliver water to plants, several additional factors must be considered when managing wastewater irrigation systems. The timing and rate of wastewater application must be designed so that plants benefit as much as possible from the nutrients and other constituents in the wastewater without being overwhelmed by them. In addition, there is the potential that certain wastewater constituents may accumulate in the soil and plants over time and become toxic to the plants, clog the soil, or alter the soil structure.

For example, too much nitrogen can result in nitrate accumulation in crops, but too little can result in reduced yields. If evaporation regularly exceeds precipitation, too much salt may remain in the soil, which can damage roots. The particular characteristics of the wastewater must be considered in relation to such factors as climate and the individual nutrient requirements of the crops, grass, or landscape plants selected.

In addition, the need to dispose of the wastewater has to be balanced with the needs of the plants during various stages of growth and the hydraulic capacity of the soil and its ability to effectively provide treatment.

Farmers must schedule irrigation times and rates carefully, always adjusting for different rainfall and evaporation amounts. Some use devices, such as tensiometers, to measure soil wetness, and rain gauges and pan evaporation tests to keep track of irrigation needs. Spray irrigation of crops also needs to be scheduled around applications of pesticides and fungicides to plants.

Scheduling the irrigation of other types of spray fields is usually less complicated. Unrestricted public access sites, such as the lawns of homes or businesses, landscaping, parks, highway medians, and golf courses, often are irrigated only at night or during off-hours to minimize the potential for public contact with the wastewater. Small systems and systems serving individual homes often are designed to apply a set amount of wastewater twice a week or so at predetermined rates and times. The system designer estimates the amount needed based on records showing average precipitation and evaporation rates in the area. Homeowners usually can adjust or override the pump settings if needed.

If a system is designed and sized primarily for wastewater disposal, the loading rates permitted for the wastewater may be below the irrigation needs of the plants. Therefore, additional water may be required for irrigation with some systems.

Monitoring and Maintenance

The pump, disinfection system, and spray heads in spray irrigation systems require regular maintenance. For example, the chlorine tablets in chlorinators need to be replenished regularly—approximately once per month for home systems. Open pipes and spray heads can become damaged, plugged, or frozen. Any changes in pressure in the system can alter the spray patterns in the field, so spray patterns should be tested to ensure that the system still complies with all setback requirements.

Other monitoring requirements vary depending on state and local regulations, public access to the site, and system size. In some systems, regular daily or weekly monitoring is needed to check influent and effluent quality, system storage capacity, wind speed and direction, signs of ponding or runoff in the spray field, and depth to water table. Cumulative levels of nutrients, heavy metals, fecal coliforms, and other wastewater constituents must be monitored in the soils (and groundwater) at some sites once or twice per year.

Subsurface Drip Irrigation Systems Have Many Advantages

Drip irrigation systems (also known as "trickle" systems) are another efficient and proven technology many small communities can chose to recycle and dispose of wastewater. Drip irrigation technology using treated wastewater is used in Israel and throughout the world as a way to conserve water resources. These systems require less water than spray systems to irrigate plants, and the technology has been used for more than 30 years for various agricultural and landscape applications.

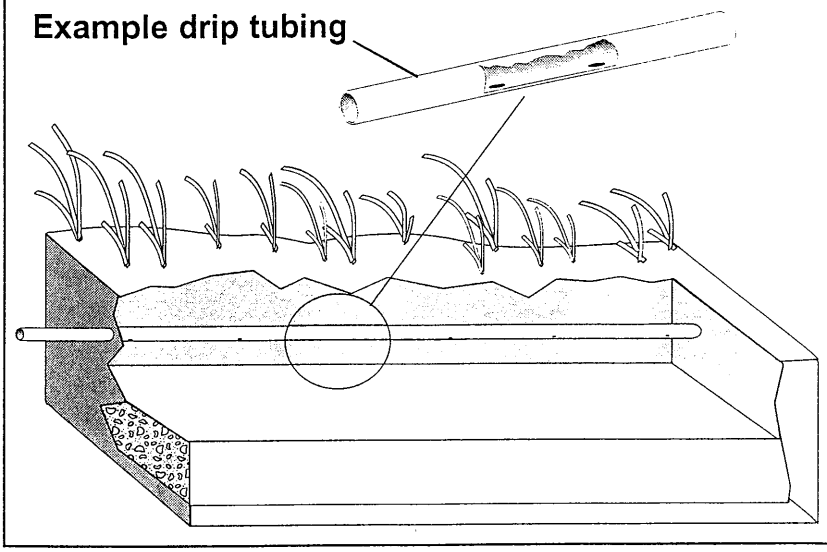
Subsurface Drip Systems Deliver Effluent to Plant Roots

With drip systems, treated wastewater is applied to soil slowly and uniformly from a network of narrow tubing (0.5- to 0.75-inch diameter), usually plastic or polyethylene, placed either on the ground surface or below ground at shallow depths of 6 to 12 inches in the plant root zone. The wastewater is pumped through the tubes under pressure, but drips out slowly from a series of evenly-spaced openings. The openings may be simple holes or, as is the case in most subsurface systems, they may be fitted with turbulent flow or pressure-compensating emitter devices. These emitter designs are proprietary and vary depending on the manufacturer of the system. *(The graphic below is meant to illustrate a generic subsurface drip tube design.)*

Drip system emitters are designed to ensure that the wastewater is always released at the same slow rate at atmospheric pressure, even though the water pressure inside the tubes can range from 5 to 70 pounds per square inch (psi) during a dosing cycle. However, most systems are engineered to maintain relatively consistent pressure inside the tubes, usually about 20 psi. The pressure-compensating feature of emitters allows drip irrigation lines to be installed at different elevations at a site while maintaining uniform flow.

Because subsurface drip systems release wastewater below-ground directly to plant roots, they irrigate more efficiently and have advantages different from those of surface irrigation systems. For example, the soil surface tends to stay dry, which means there is less water lost to evaporation and there is almost no opportunity for the wastewater to come in contact with plant foliage, humans, or animals. Also, percolation losses are reduced because the wastewater is applied to a wide area of soil at a slow rate directly to plant roots.

In addition, in drip systems the wastewater is delivered to the most biologically active part of the soil, which enhances treatment and minimizes the possibility of groundwater contamination. The constant moisture in the root zone also may increase the availability of nutrients to plants, reducing the delivery of nitrogen to groundwater. *(Refer to page 6 for a list of some advantages and disadvantages of subsurface drip systems.)*



Other System Design Elements

As with spray irrigation systems, wastewater must be pretreated prior to drip irrigation to protect public health and the environment and to prevent systems from clogging. Settleable and floatable solids are removed by primary treatment, which may take place in a community treatment plant or lagoon or on individual home lots in a septic tank or home aerobic treatment unit. Primary treatment always is followed by filtration in a particle-size filter to protect the tubing from clogging.

In most systems, effluent flows to a tank or pump chamber equipped with controls, where it is stored until a predetermined dosing volume is reached. All drip systems are equipped with a filtration system before the distribution system, such as a series of disc filters or mesh screen filter membranes, to remove small suspended solid materials from the wastewater that can clog tubes and emitters. Some systems also include a disinfection step to protect public health.

The U.S. Environmental Protection Agency approves the use of the chemical trifluralin to prevent root intrusion into emitters, although some states may not permit it. One manufacturer of drip system tubing incorporates a chemical barrier to root intrusion directly into the tubing material itself. However, the consistently wet conditions in the soil and the pressure compensating emitter design discourages root growth into the distribution lines.

The distribution system in subsurface drip systems usually includes a mainline, submain, and narrow drip laterals with emitters. The total length of drip tubing will depend on the restrictiveness of the site, the area needing irrigation, and the amount of storage space available. The laterals normally are installed in narrow trenches (approximately 10 centimeters wide) dug with a vibratory plow. Because of the flexibility of the laterals and their shallow placement, drip lines can be laid around trees and other topographic features with little disturbance to the site.

continued on page 6

Advantages of Subsurface Drip Systems Include . . .

- Water and nutrients are delivered directly to plant roots.
- Less water is required when irrigating with drip systems than with spray systems and other suface irrigation methods.
- Wastewater is distributed more evenly with drip systems than spray systems and open irrigation trenches.
- Evaporation losses and weed growth are reduced because the soil surface remains dry.
- Operating lawnmowers and farm equipment is easier because system components are buried and the soil surface stays dry.
- There is no aerosol generation and no wastewater contact with plant foliage.
- Crops irrigated with drip systems can be harvested sooner than when irrigated with spray systems.
- Fewer problems exist with odors, ponding, and runoff.
- There is less chance of wastewater carrying additional chemicals, such as pesticides and fungicides, from the ground surface to groundwater.
- Studies suggest nitrogen in wastewater may be better absorbed by plants and less likely to pollute groundwater when applied directly to plant roots.
- In some cases, fewer pretreatment steps are required for wastewater with drip systems.
- It is less likely that subsurface drip components can be accidently or intentionally damaged.
- Flexible tubing can accommodate sites with complex topographies.
- There are generally fewer operation and maintenance requirements than with spray systems.

Disadvantages of Subsurface Drip Systems Include . . .

- Emitters can potentially clog, affecting the uniformity of application.
- Temporary use of sprinklers or other surface irrigation may be necessary during plant germination period.
- It is difficult to monitor and correct potential emitter clogging.
- Effects of freezing temperatures on drip systems and applying wastewater to frozen ground is still the subject of study and debate.

Subsurface Drip Systems Have Many Advantages

continued from page 5

The submains supply the amount of water required by the individual laterals it feeds, and valves are located between the main and the submains to control the flow of water to different parts of the system.

Clogging

Drip system emitter clogging was more of a problem in the past than it is today. Root intrusion into the drip tubing and internal clogging from the buildup of sediment, suspended solids, algae, and bacterial slime have been diminished greatly by better pretreatment, filtration, disinfection, and new tubing and emitter designs. Most systems allow weekly or biweekly forward flushing of the tubes to scouring velocity to remove slime and sediment buildup.

The size of the emitter orifices also is important to prevent clogging and should range from four to six times the maximum size of the particles that can pass through the mesh of the filter screen preceding the distribution system. For example, a system using a filter screen size of 115 microns (140 mesh) should have emitters approximately 800 microns in diameter to achieve about a six-to-one ratio.

When even a few emitters do clog, it can affect the pressure inside the tubes and the uniformity of wastewater distribution in the field. It also may be difficult to identify and service buried emitters that clog. And like traditional soil absorption systems used with septic systems, saturation of the soil around the emitters of a drip system can eventually lead to the formation of a biological clogging mat, which can cause system failure. However, in general, subsurface drip systems are considered to be a manageable and reliable technology.

Filters on all drip systems need to be checked and periodically backflushed or cleaned. Backflushing reverses the water flow through the lines and the filters to release trapped sediments. Some systems can be set up to backwash automatically at preset intervals, or operators can do it manually as needed. The wastewater flow needs to checked periodically to determine if any emitters are plugging. If a scale buildup develops on emitters, an acid treatment may be necessary.

Setbacks and Buffer Zones

As with spray irrigation systems, regulations typically require that drip systems be installed at minimum distances from nearby residences, property lines, public areas, wells, surface water resources, and groundwater. However, because drip systems deliver wastewater below ground and do not produce aerosols, buffer zones of 25 to 50 feet are generally required to neighboring residences—considerably less than is required for spray systems, making drip disposal more practical for smaller home lots.

Operation, Maintenance, and Scheduling

As with spray systems, drip irrigation must be scheduled so that plants benefit from the nutrients and other constituents in the wastewater without being overwhelmed by them, and the needs of the plants must be balanced with the capacity of the soil to treat the most restrictive components in the wastewater. These concerns must be balanced in turn with climate and other site factors.

Less labor usually is required for operating and maintaining fixed subsurface drip system components as compared to spray systems and surface drip systems with moveable components. For small and individual home systems, the pattern of flow may be fixed or adjusted manually or automatically by the homeowner or operator, depending on the system design and sophistication. In general, the best care for subsurface drip systems is provided by following the individual manufacturer recommendations.

Some communities may require homeowners and small system owners to maintain a service contract with an authorized manufacturer's representative to ensure appropriate monitoring and maintenance. Larger systems often have full-time operators to maintain and service systems and to control the pattern of wastewater flow to irrigate different crops or fields. Some systems can be operated and monitored remotely through telemetry.

Refer to the list of NSFC documents on page 8 and the list of contacts on page 7 for more detailed information on subsurface drip systems.

Wisconsin Drip System Is an "Educational Opportunity"

If you were to pinpoint the center of Wisconsin on a map, you just might find Nasonville Elementary School. Located in the rural Marshfield School District, in the middle of dairy country, Nasonville has plans to consolidate with another local school adding 67 students to the 95 currently enrolled. But before health officials would approve the additional students, the school needed to upgrade its old wastewater system.

"In our part of Wood County, we have some of the densest clay soils ever seen," explained Paul Rodenbeck, the school district's building and grounds director. "For years, the school's wastewater system consisted of a septic tank that discharged across an open field. Because of the difficult local site conditions (heavy silt loam over massive clays), our options for upgrading were somewhat limited."

Holding tanks are the only new onsite wastewater systems being permitted in the area. But Rodenbeck, a former municipal wastewater treatment plant operator, was inspired to research possible onsite wastewater treatment alternatives for the school.

One option that may have been appropriate for Nasonville was a mound system, but the school was not keen on the way it might look on the school grounds, the earthwork involved, or the prospect of having to mow it. Repair costs were another concern. "Even if only one part of the system needs to be repaired, the mound has to be dug up," Rodenbeck said.

Rodenbeck's inquiries led him to work with Duane Grueul of the Wood County Planning and Zoning Department. Grueul suggested several area design firms that have experience with onsite systems. He also introduced Rodenbeck to Dr. James Converse of the University of Wisconsin's Small Scale Waste Management Project, one of the first research programs in the country to study onsite systems.

The firm the school chose for the project, Ayres and Associates of Madison, worked together with Dr. Converse, Grueul, and Rodenbeck to design a solution for the site—namely, a subsurface drip system. The system was installed in August 1998 and is part of the University of Wisconsin's research project.

"Because we are working with the university, we were able to get an experimental permit for a drip system," Rodenbeck said. "Graduate students from the university regularly monitor the system's performance, which is good for us and an educational opportunity for them."

Nasonville's new system is sized to handle 2,500 gallons of wastewater flows per day, which is enough to accommodate approximately 350 students. Rodenbeck estimated the system size needed by checking daily water use at other area schools. The system consists of a 3,000-gallon septic tank equiped with a Zabel™ filter at the outlet. From the septic tank the wastewater flows to a recirculation tank where the wastewater is pumped to a recirculating gravel filter. After treatment in the gravel filter, the wastewater returns to the recirculation tank and then flows to an intermediate settling tank equipped with another Zabel™ filter at the outlet. Next, the wastewater flows to a dosing tank where it is sent to the drip distribution system.

"The system is designed to dose over a 24-hour period," explained Rodenbeck. The drip system itself has four zones or cells and takes up about one acre of the 10-acre school lot.

Rodenbeck said that the system has been working well. "Due to mechanical problems, the gravel filter was taken out of service during the winter, and we had to bypass the filter all together," he said. "The university requested that we not fix this problem, but, instead, operate the system with just the septic tank effluent going through the drip system filters and then to the drip lines. The system has been working fine this way. None of the emitters have plugged and I haven't even had to clean the filters. The gravel filter will be modified and be online for the start of school."

The university students continually monitor the performance of the system and levels of bacteria in the soil as well as investigate the effect of temperature on the levels of bacteria in the soil.

To learn more about Nasonville's system and the University of Wisconsin study, contact Dr. Converse at (608) 262-1106.



CONTACTS

The National Small Flows Clearinghouse (NSFC)

The NSFC offers technical assistance and free and low-cost information about onsite and small community wastewater technologies and issues, including spray and drip irrigation, wastewater reuse, and state and federal regulations. Only a few of the NSFC's many resources and services are mentioned in this issue. Visit the NSFC's Web site at www.nsfc.wvu.edu, or call (800) 624-8301 or (304) 293-4191 for assistance or to request a free catalog.

Local and State Health Agencies

For more information about spray and drip irrigation, local regulations, or permit requirements, community residents should contact their local or county health department officials. Community leaders who wish to evaluate irrigation as an alternative to direct discharge should contact their state health agency. State and local agencies usually are listed in the government section or blue pages of local phone directories.

Extension Service Offices

Many universities have U.S. Department of Agriculture Extension Service offices on campus and in other locations, which provide a variety of services and assistance to individuals and small communities. For the number of the Extension Service office in your area, check the government pages of your local phone directory, call the NSFC, or call the U.S. Department of Agriculture directly at (202) 720-3377.

The Irrigation Association (IA)

The IA is the irrigation industry's trade organization and has members who can provide professional assistance in all aspects of irrigation. IA members include researchers, technicians, manufacturers, distributors, dealers, system designers, consultants, installers, and contractors. Visit its Web site at www.irrigation.org to conduct a search of IA's membership or for consumer information, including how to hire an irrigation contractor. Or, contact IA headquarters in Fairfax, Virginia, at (703) 573-3551 for assistance.

RESOURCES AVAILABLE FROM NSFC

To order any of the following products, call the National Small Flows Clearinghouse (NSFC) at (800) 624-8301 or (304) 293-4191, fax (304) 293-3161, e-mail nsfc_orders@estd.wvu.edu, or write NSFC, West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064. Be sure to request each item by number and title. ***A shipping and handling charge will apply.***

Spray and Drip Irrigation Technology Package

A selection of useful articles about spray and drip irrigation with wastewater is presented in this publication. The articles are chosen from the NSFC's Bibliographic Database. Onsite irrigation systems and the application of wastewater to forest lands and parks are among the topics discussed. Case studies also are included. The price is $16.25. Request Item #WWBKGN53.

Guidelines for Water Reuse

This EPA manual presents federal guidelines for implementing a water reuse system and how to evaluate water reclamation and reuse opportunities. Chapters are devoted to each of the technical, financial, legal, institutional, and public involvement considerations that a reuse planner might examine.The price is $30.00. Request Item #WWBKDM72.

Computer Search: Drip Irrigation

This booklet is a compilation of article abstracts on drip irrigation compiled from a search of the NSFC's Bibliographic Database. Complete copies of the articles can be ordered from the NSFC. The price is $2.75. Request Item #WWBLCM18.

Computer Search: Spray Systems

Spray systems as an alternative to conventional methods of wastewater disposal is the topic of this NSFC Bibliographic Database search. Abstracts of spray system articles are included. The price is $6.75. Request Item #WWBLCM19.

Manufacturers and Consultants Database

Customized searches of the NSFC's Manufacturers and Consultants Database are available upon request. Contact the NSFC and ask to speak with a technical assistance specialist to request a search of irrigation system manufacturers, dealers, designers, consultants, and operators in your area. The price varies. Request Item #WWPCCM16.

Guide to State Level Onsite Regulations

This guide provides information about state regulations regarding onsite wastewater systems. Contacts, keywords, and definitions are included. The price is $12.50. Request Item #WWBKRG01.

Free Brochure: Water Reuse Via Dual Distribution Systems

This free brochure examines the benefits of a wastewater reuse system and includes information on system operation, design, cost, and public acceptance issues. Request Item #WWBRGN15.

PIPELINE

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SECTION 02220

EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. This section includes earthwork required for the construction of utility pipes and appurtenances, drainage pipes and appurtenances, and electrical conduit. Included are excavation, backfilling and compaction of backfill around utility pipes (embedment) and appurtenances.

1.2 RELATED SECTIONS:

A. Section 01530 - Barriers and Enclousers

B. Section 02100 - Site Preparation

1.3 QUALITY ASSURANCE:

A. Methods of Testing

1. The moisture density relations of material shall be determined in the laboratory in accordance with AASHTO T-99 or T-180, as specified.

2. Field density of backfill shall be determined in accordance with ASTM D 2922

PART 2 - PRODUCTS

2.1 BACKFILL MATERIAL:

A. Material excavated from the job site shall be used for backfill to the maximum extent possible. Material shall be free of rock, manmade debris and organic material larger than 6 inches in any dimension or as specified by local codes and regulations.

B. Bedding and haunching material for all PVC water and sanitary sewer mains shall meet ASTM D448 size #67, or ASTM D2774.

PART 3 - EXECUTION

3.1 TRENCH EXCAVATION:

A. General

1. Cut and remove all natural growth, and remove all manmade debris from planned location of the trench. Dispose of cleared material in a manner approved by the Engineer and applicable governmental regulations.

2. After backfill of trench has settled, all sod shall be replaced to a condition equal to or better than that prior to construction. In the event that insufficient sod has been stored, or sod has been lost or destroyed, provide and install new ground cover of the existing type.

3. Excavate with caution so that location of underground conduits and structures can be protected.

4. Excavate material encountered to the lines and elevations necessary to complete the project.

5. Relocate surface water before excavating and protect excavated trench from entrance of surface water. It is essential that the discharge of any trench dewatering pumps be conducted to natural drainage channels, or storm sewers.

6. All excavation shall be dewatered before any construction is begun. Concrete shall be placed only upon dry, firm foundation material and pipe shall be laid only in dry trenches.

7. Provide and install bracing and shoring necessary for safety of personnel, protection of work, and compliance with governmental agencies.

B. Utilities

1. The location and/or elevation of existing utilities as shown on the Drawings is based on records of the various utility companies and, where possible, measurements taken in the field. The information is not to be relied on as being exact or complete. Call the respective utility owner at least 48 hours before any excavation to request exact field location of utilities.

2. Protect utilities encountered during excavation.

3. Do not interrupt service in utilities encountered during excavation without approval of the utility owner.

4. If utilities are damaged or utility service is interrupted by work under this section, the utility owner has the first right to repair. If public health or safety is at risk, Contractor shall take appropriate prudent action to repair damage and service interruption. Costs of utility protection and repair shall be borne by the Contractor.

5. If existing utilities are found to interfere with the permanent facility being constructed, notify the Engineer for instructions.

6. Do not proceed with permanent relocation of utilities without written instructions from the Engineer.

C. Trench Depth

1. Excavate to the elevation necessary to provide the depth of bedding material under the barrel of the pipe, noted on the drawings or in these specifications, whichever is greater.

2. The trench for all sanitary sewers shall be excavated to at least 4 inches below the grade required to provide proper pipe embedment and a minimum earth cover of 24 inches. The trench for all water lines shall be excavated to the established pipe grade (unless structural or foundation requirements indicate otherwise) so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at every point between bell holes. The minimum pipe cover for water or force mains shall be 36 inches.

3. Bell hole excavation shall also be sufficient to allow proper placing of the joint compound, where joint compound is used. No weight of dirt or pipe shall be supported by the bell of the pipe.

4. All over-excavation up to 2 feet, shall be backfilled with bedding material in 6 inch layers, tamped to a bearing capacity equal to the adjacent undisturbed earth. Over excavation greater than 2 feet will require that excavation operations be stopped until an engineered backfill is determined.

5. The subgrade beneath the centerline of the pipe shall be finished to within 0.03 feet of a straight line between pipe joints or batter boards, and all tolerances shall be above the specified grade. The finished subgrade shall be prepared accurately by means of hand tools.

D. Trench Width

1. Excavate to the width ample to permit pipe jointing, bedding placement, and compaction as specified. Specified width dimensions must be maintained from trench bottom to an elevation 12 inches above barrel of pipe. Over

width excavation will require excavation operation to stop until additional earth loads can be compared to strength of pipe.

2. If the Contractor over excavates the trench, he shall provide additional pipe bedding gravel or concrete as necessary to prevent crushing of the pipe due to excessive earth loads.

E. Trench Length

1. Excavate to a maximum distance of 75 feet from the pipe jointing operation. Longer distances will be considered when conditions warrant.

F. Excavation In Rock

1. When rock is encountered, excavate to an elevation 6 inches below and on each side of all pipe, valves and fittings for pipes 24 inches in diameter or less, and 9 inches for pipes larger than 24 inches in diameter. Every trench in rock shall be fully opened at least 50 feet in advance of the place where pipe is being laid or concrete masonry work is in progress.

2. Rock excavation shall consist of igneous, metamorphic, and sedimentary rock which cannot be excavated without blasting, and all boulders or other detached stones each having a volume of 1 cubic yard or more.

   a. Before explosives are used, Contractor shall notify Engineer, Owner, neighboring property occupants, neighboring owners and local governing agency at least 8 hours in advance of blasting. The Engineer must be notified so as to record rock elevations etc. in order to record quantity of rock excavated. Failure to notify Engineer could result in loss of payment to contractor for rock excavated.

   b. Storage and use of explosives shall be in accordance with applicable governmental regulations. Contractor shall obtain all necessary permits from governmental agencies.

   c. Contractor shall be responsible for any damage resulting from the use of explosives.

   d. No rock excavation will be paid for that is excavated without the prior notification and measurement and approval by the Engineer.

G. Excavation In Unstable Soil

1. Where the planned bottom of trench is found to be unstable in the judgement of the Engineer, excavation shall stop until an engineered subgrade

stabilization is determined. The contractor shall excavate and remove such unsuitable material to the width and depth ordered by the Engineer.

2. Before the pipe is laid, the subgrade shall be made by backfilling with clean crushed rock or gravel (ASTM D 2487, Class I material), or crushed stone (AHTD Class 7), or as specified by local governing agency, in 6 - 8 inch uncompacted layers. The layers shall be thoroughly tamped by hand or machine to the density of adjacent undisturbed soil so as to provide a uniform and continuous bearing and support for the pipe at every point between the bell holes.

H. Excavation In Wet Conditions

1. Where the planned bottom of trench contains water or trench bottom is soft from excess water, excavation depth shall increase a minimum of 6 inches.

2. Remove water to an elevation below bottom edge of pipe joint or structure base.

3. Trench dewatering system shall discharge to natural drainage channel or storm sewer.

4. The trench will be brought back to grade with clean crushed rock or gravel (ASTM D 2487, Class I material), or crushed stone (AHTD Class 7), or as specified by local governing agency, in 6 - 8 inch uncompacted layers. The layers shall be thoroughly tamped by hand or machine to the density of adjacent undisturbed soil so as to provide a uniform and continuous bearing and support for the pipe at every point between the bell holes.

I. Excavation At Unforseen Structure

1. Preserve unforseen structures encountered in excavation.

2. Advise Engineer when unforseen structure interferes with planned work. Engineer will determine if plan will change or if structure will be abandoned.

J. Unauthorized Excavation

1. Unauthorized excavation is removal of materials beyond specified elevations or dimensions.

K. Unsuitable and Excess Excavated Material

1. Excavated material not suitable for backfilling during the excavation shall be disposed of at a site selected by Contractor and in a manner approved by the Engineer and applicable governmental regulations.

L. Bracing and Shoring

1. The sides of any excavation, when deemed necessary, shall be properly supported with shielding, bracing, shoring, or sheeting as the need may be and required by local governing agencies. Such bracing, shoring, or sheeting shall be withdrawn as the work progresses in such a manner as not to endanger life and property and allow for backfilling of the trench in accordance with these specifications.

2. If the excavation is close enough to buildings or other foundations as to endanger their stability by removing such bracings, then they shall be made secure and left in place, and the line trench shall be backfilled and thoroughly tamped with the bracing in place.

3. Where trench walls are sloped away from the trench to prevent slides or cave-ins, it will be permissible to cut the trench banks on a slope above an elevation two (2) feet above the crown of the pipe.

4. Contractor shall be responsible for maintaining the excavation free from slides or cave-ins and safe for workmen, and to comply with federal labor requirements for trench safety. No observation by the Engineer or Engineer's Representative will reduce the Contractor's responsibility.

M. Manhole Excavation

1. Excavation for manholes shall be of such dimension and depth as to allow the construction of the manhole as shown on the drawings. The area of excavation for the base shall be only that necessary to provide an adequate base with its sides and bottom poured against undisturbed earth. All over excavation below the required grade shall be filled with concrete poured monolithically with the base.

3.2 BACKFILLING AND COMPACTION

A. Backfilling shall closely follow pipe laying and be within 5 feet of the end of the last pipe at the end of workday.

B. Backfill around the pipe (pipe embedment) is specified as noted in Paragraph 2.1 of this Section.

C. Backfill where ground surface is not graveled or paved for vehicle or pedestrian use:

1. Initial backfill, for the 2 foot distance above pipe embedment shall be free of rock, organic material, man made debris or frozen lumps with a dimension greater than three inches measured in any direction.

2. Backfill for the remainder of the trench shall be free of rock, organic material or man made debris with a maximum dimension of 6 inches measured in any direction.

3. All backfill above pipe embedment may be mechanically compacted to a density equal to 85 percent standard proctor or better. Contractor shall backfill trench settlement until Engineer determines settlement is complete.

D. Backfill where ground surface is graveled for vehicle use or paved for pedestrian use only.

1. The entire trench up to a point 2 feet below existing or proposed subgrade shall be backfilled with AHTD Class 7 aggregate and compacted to 90 percent Modified Proctor Density. The remaining 2 feet shall be backfilled with AHTD Class 7 placed in 6 inch lifts and compacted to 95 percent Modified Proctor Density.

E. Backfill under existing or proposed public streets

1. The entire trench shall be backfilled up to the subgrade with AHTD Class 7 aggregate in 4-6 inch lifts and compacted to 95 percent Modified Proctor Density.

F. Backfill Unstable Trench Bottom

1. Provide and place AHTD Class 1 or AHTD Class 2 crushed aggregate, compacted to 95 percent maximum density, to bottom elevation of pipe bedding.

G. Backfill Wet Condition Trench Bottom

1. Provide and place AHTD Class 1 or AHTD Class 2 crushed aggregate, compacted to 95 percent maximum density, from trench bottom to bottom elevation of pipe bedding.

H. Manhole backfill

1. Backfilling of manholes up to 12 inches from the base shall be done with pipe protection. Backfill of manholes shall be compacted to a density of not less than 90 percent Modified Proctor. Obtain 90 percent density the entire depth of excavation except that in public street or roadways where a density of 95% shall be obtained.

2. Backfill around manholes shall not be completed until adequate strength has been obtained to support the backfill without damage to the manhole. In no case will backfill be allowed on manholes until the concrete is at least 48

hours old. Manholes must be leak tested prior to backfilling.

3.3 ELECTRICAL CONDUIT TRENCHING

A. Excavate trenches for installation of electrical conduit by electric utility. Trench width, depth, and location shall be as directed by the governing electric company.

B. Backfill trench after electric utility indicates their work is complete. Use backfill material specified in Paragraph 2.1, except use Class 7 crushed stone base course as specified in Section 02230 for entire trench depth at locations indicated in paragraphs 3.2.D and 3.2.E, and compacted as required in those paragraphs.

END OF SECTION

SECTION 02731

SANITARY SEWAGE FORCE MAINS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. This section includes performing, excavating, backfilling, and testing of all requirements for work of this Section. Furnishing and installation of pressure sanitary sewage systems as described in the Contract Documents.

1.2 RELATED SECTIONS:

B. Section 02220 - Excavating, backfilling, & compaction for utilities

1.3 QUALITY ASSURANCE:

A. Regulatory Requirements -

1. All installation shall be in accordance with the Standard Specification for the City of Bethel Heights and all applicable State codes.

PART 2 - PRODUCTS

2.1 COMPONENTS:

A. Pressure Sewer Pipe

1. All sewer pipe shall be class 160, gasketed pressure pipe, manufactured from class 12454-A or 12454-B materials conforming to ASTM D 1784, Type 1, Grade 1 (PVC 1120) resins and shall conform to the requirements of specification ASTM D 2241 as amended and/or revised with Standard Dimension Ratio (SDR) of 26, pressure class 160.

2. The pipe shall be permanently marked by the manufacturer and coded for the date, batch and shift in which the pipe was make along with other required marking as set forth in ASTM specifications.

3. All joints shall be flexible gasketed joints, compression type with a gasket confined in a machine groove in the spigot end of the pipe. Rubber gasket rings shall conform to the requirements of ASTM D-1689. Gaskets shall be neoprene or other synthetic material. Natural rubber gaskets will not be acceptable.

B. PVC Fittings

1. All bends, tees, plugs, adaptors, wyes, or other fittings shall meet the with the requirements of the type of pipe used and all joint shall meet with the requirements for the joints listed above.

2. PVC sewer wyes, tees, bends or other fittings shall be one piece molded construction with:

   a. elastometeric gaskets conforming to ASTM 3212
   b. self cleansing sanitary flow
   c. design meeting ASTM 3034 standards

3. The pipe and fittings shall be installed in accordance with the recommendations of the pipe manufacturer and Engineer.

C. Ductile iron - 4" diameter and above

1. All fitting and specials used in connection with the pipe shall conform to AWWA short or long bodied ductile iron fittings using a mechanical joint system with hardened or duck tipped type of rubber gaskets in accordance with AWWA Specifications C-110 and C-111. The fittings shall be cement-lined in accordance with AWWA Specification C-104. The pipe and fittings shall be installed in accordance with the recommendations of the pipe manufacturer and Engineer. The use of torque type wrenches shall be mandatory to tighten the glands as required by the manufacturer.

D. Valves

1. All valves 2" and smaller shall be PVC True Union ball valves by Spears Manufacturing Company.

2. All valves 3" to larger shall be PVC True Union ball valves by Hayward Industrial Products, Inc.

E. Valve Boxes

1. All valve boxes shall be screw type roadway valve boxes and cover shall be made of cast iron conforming to the requirements of ASTM A 48, Class 30 B. All lids must contain the work "sewer".

F. Air and/or Vacuum Release Valve

1. Air-release, air/vacuum, and combination air valves shall be manufactured in accordance with AWWA C512. Valves shall be furnished with threaded ends unless otherwise noted in the Approved Plans. Valves shall have a cast iron body and cast iron cover. The internal compound level mechanism shall be

stainless steel and all other internals including float shall be stainless steel to avoid galvanic action. The stainless steel float shall withstand a minimum pressure of 1,000 psi. An isolating valve shall be installed between the main line and the air/vacuum release valve for maintenance.

G. Pigging Ports

A pipeline pig is a projectile that is forced through the inside of a pipe to clean pressure pipelines. A pigging port is used as a point to send and retrieve the pig.

1. A pig launching / retrieval facility (pigging port assembly) will be required at the following locations:

   a. At a change in pipeline sizes or as indicated on the construction plans.

2. Appropriately sized poly pigs by approved manufacturers and having a minimum density of $2lb/ft^3$ and recommended for wiping shall be installed into the main to ensure force mains are swept when the system is first charged.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General

1. Excavate and backfill as specified in Section 02220 with the following additional requirements:

2. All pipe runs shall be constructed as close as possible to those shown on the approved Construction Drawings.

3. Excavate to required depth and grade to obtain fall required. The trench shall be excavated to at least 4 inches below the grade required to provide proper pipe embedment and a minimum of 24 inches of earth cover. Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipes, valves, and fittings for pipes 24 inches in diameter or less, 9 inches for pipes larger than 24 inches in diameter.

4. Width of trenches shall be constructed according to the detail shown on the drawings.

5. Remove debris from trench prior to laying of pipe.

6. Embedment material shall be restricted to material meeting requirements of ASTM D448, size #67, or ASTM D2774.

7. Provide trench bracing and drainage so that workmen may work therein safely and efficiently. It is essential that the discharge of any trench dewatering pumps be conducted to natural drainage channel, drains, or storm drains. The contractor shall be responsible for any discharge permits that may be required.

8. The contractor is responsible for the repair of any other utility lines damaged because of the contractors carelessness.

B. Wet Excavation

1. When water or unstable soil is encountered in the bottom of the trench, the Contractor will be required to excavate below grade a minimum of 6 inches, and the trench bottom will be brought back to grade with clean crushed rock or gravel (ASTM D2487, Class I material), or (AHTD Class 7).

C. Safety structures

1. The sides of any excavation, when deemed necessary, shall be properly supported with shielding, bracing, shoring, or sheeting as the need may be. Such bracing, or sheeting shall be withdrawn as the work progresses in such a manner as not to endanger life and property and to allow for backfilling of the trench in accordance with these specifications. It is the Contractor's responsibility to follow all of OSHA's requirements.

D. Explosives

1. In the event that the use of explosives is necessary for the efficient prosecution of the work, the Contractor shall notify the Architect in advance of their use, and shall exercise every precaution to protect the completed work, neighboring property, water lines, or other underground utility. Any damages to private property resulting from the use of explosives shall be the liability of the Contractor.

E. Embedment

1. All pipelines shall be installed using embedment materials as defined in 3.1.A.6 above.

F. Initial Backfilling

1. Initial backfilling shall be completed using the same material as for the embedment as defined above. Initial backfilling shall be completed to a depth of 6" above the pipe.

G. Final Backfilling

1. Backfilling of pipelines shall include the refilling and consolidation

(compaction) of the fill in the excavation up to the surrounding ground surface or road grade at crossings. All pipeline trench backfill shall be placed in layers of appropriate thickness not to exceed 24 inches; and compacted by hand or approved mechanical methods. All trench backfill (except that under paved areas) shall be compacted to a minimum density of 85% of that of the adjacent soil as determined in accordance with ASTM D2922.

2. Where trenches are under existing or proposed paved area, the entire trench up to a point (2) feet below the existing or proposed subgrade shall be backfilled with AHTD Class 7 and compacted to 90 percent Modified Proctor Density as determined by AASHTO T-180. The remaining 2 feet shall be backfilled with AHTD Class 7 placed in 6 inch lifts and compacted to 95% Standard Proctor Density as determined by AASHTO T-99. Density shall be verified in the field by the use of a calibrated nuclear density gauge, with a minimum of three tests per project, or 1 per 100 lineal feet, whichever is greater.

3. Where the trench is located under an existing or proposed public street, the entire remaining depth of the trench (after the embedment and initial backfilled area has been installed) shall be backfilled up to the subgrade with AHTD Class 7 placed in lifts of 6 to 8 inches and compacted to 95% Standard Proctor Density as determined by AASHTO T-99. Tests shall be taken as in (2) above to verify density.

4. Minimum cover over top of pipe is to be 30".

3.2 QUALITY ASSURANCE:

A. General

1. All pressure sewers shall be tested in accordance with the governing utility and shall be made in the presence of the Engineer and a representative of the governing water and sewer entity or as defined below, whichever is more strict.

B. Perform construction in accordance with utility company, municipality and manufacturer's requirements.

C. Valves: Manufacturer's name and pressure rating marked on valve body.

D. Sewer force main pipe installed below grade and outside building shall be tested in accordance with the following procedures:

1. Perform testing of pipe materials, joints, and other materials incorporated into construction of water mains and force mains to determine leakage and watertightness. Pressure pipeline shall be tested in accordance with Section 4 of AWWA C600. In event state or local code requires more stringent test, more stringent shall apply.

2. Pressure Test:

After pipe has been laid, newly laid pipe or valved section thereof shall be subjected to hydrostatic pressure of at least 1.5 times working pressure at point of testing and not less than 1.25 times working pressure at highest point along test section. This test shall be performed in the presence of the Engineer or Engineer representative and shall be held for a duration of 2 hours.

3. Leakage Test:

Leakage test shall be conducted concurrently with pressure test. Leakage is defined as quantity of water that must be pumped into the newly laid pipeline or valved section thereof to regain a pressure equal to the pressure reading at the start of the test after air in pipeline has been expelled and pipeline has been filled with water. Leakage shall not be measured by drop in pressure in test section over period of time.

The maximum allowable leakage is defined by the formula listed below. No pipeline installation will be accepted if the actual leakage is greater than the amount calculated by the following formula:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

L = allowable leakage, (gallons per hour)
S = length of pipe tested, (feet)
D = nominal diameter of pipe, (inches)
P = average test pressure during test, (psig)

4. Visible Leakage:

Visible leaks shall be repaired regardless of amount of leakage measured.

5. Acceptance of Installation:

If test of pipe laid in place discloses leakage greater than that specified, Contractor shall, at his own expense, locate all leaks and make repairs as necessary until leakage is within specified allowance.

Water for testing shall be supplied by the contractor at no expense to the Owner.

E. Contractor is required to perform initial cleaning of all pressure pipes that were installed in the contract in accordance with manufacturers recommendations using the appropriate size "poly pig". Contractor to furnish one poly pig of each size to Owner.

END OF SECTION 02731

PERMIT APPLICATION FOR SUBSURFACE DISPOSAL

for

BETHEL HEIGHTS SEWER - PHASE III

BETHEL HEIGHTS, ARKANSAS

EDA #0656.6

June 4, 2004

EDA

Engineering Design Associates, P.A.
134 West Emma Avenue
Springdale, Arkansas 72764
479-756-1266 FAX 479-756-2129

WATER POLLUTION CONTROL PERMIT APPLICATION
ARKANSAS DEPARTMENT OF ENVIRONMENTAL QUALITY

Septic Tank and Leach Field

Revised July 18, 2003

Permit No.:	AFIN No.:	SIC Code:	NAICS Code:
(Office use only)	(Office use only)	(Office use only)	(Office use only)

1. Permit Action Requested: (Please check one of the following.)

____ New Permit for New Facility	____ New Permit for Existing Facility	____ Permit Renewal
X Modification of Existing Permit, Please Describe: ENLARGEMENT OF PREVIOUSLY PERMITTED FACILITY.		

2. Name and Mailing Address of Organization/Individual Requesting Permit:

Owner/Organization Name: (Mr. / Mrs. / Ms.) CITY OF BETHEL HEIGHTS		
Address: 530 SUNRISE DRIVE		Phone: 479-751-7481
City: BETHEL HEIGHTS	State: AR	Zip: 72764
Contact Person: (Mr. / Mrs. / Ms.) MAYOR FRED JACK		Phone: 479-751-7481

3. Type of Waste Management: (Please check all that apply to your system.)

____ Car Wash	____ Truck Wash	____ Laundromat	____ Slaughterhouse
X Other, Please Describe: WASTEWATER EFFLUENT TREATMENT			

4. Waste Storage and/or Treatment Facility Location: *(actual facility address is required; NO P.O. BOXES)*

Facility Name: BETHEL HEIGHTS WASTEWATER				
Address: 901 S. LINCOLN STREET				Phone: 479-751-7481
City: BETHEL HEIGHTS			State: AR	Zip: 72764
¼ Sec.: NW	Section: 13	Township: 18 N	Range: 30 W	County: BENTON
Latitude: 36° 14' 12"	Longitude: 94° 07' 55"	Source Datum: ___WGS 84	___NAD 83	___NAD 27
Name and Distance to Nearest Stream: SPRING CREEK, 1.75 MI			Nearest Town:	

5. Consultant Information:

Name: (Mr.) Mrs. / Ms.) STEVE A. HESSE, PE		
Consulting Firm Name: ENGINEERING DESIGN ASSOCIATES, PA		
Address: 134 WEST EMMA AVE		Phone: 479-756-1266
City: SPRINGDALE	State: AR	Zip: 72764

6. Please describe the location of the facility with respect to roads, towns and other easily identifiable landmarks:

S.E. CORNER OF APPLE BLOSSOM & LINCOLN

7. Please list and describe all waste storage and/or treatment components:

EACH RESIDENTIAL OR COMMERCIAL CUSTOMER WILL CONTAIN A S.T.E.P. UNIT THAT WILL HOLD ALL SOLIDS & PROVIDE PRIMARY TREATMENT. TANK WILL BE PUMPED BY CITY. EFFLUENT WILL THEN BE PUMPED TO A TREATMENT SITE CONTAINING ADVANTEX FILTERS & SUBSURFACE DRIP DISPERSA

8. Has the applicant previously submitted, or have on file with the Department, a complete "Disclosure Statement" as required by Act 454 of 1991? ____ Yes ___X___ No

If yes, please provide the following: Date Submitted _____ To What Division? _____

If no and the application is submitted for a new permit (whether for a new or existing facility), the applicant must complete and submit the "Disclosure Statement" form included with the application. Additional copies of the "Disclosure Statement" form may be obtained from ADEQ.

9. Is the applicant organized as a corporation? ____YES or MUNICIPALITY ____NO; If yes, is it foreign or domestic? _____

Is the corporation currently registered to do business with the Arkansas Secretary of State? ____YES or ____NO

Please read the following carefully and sign below.

I certify under penalty of law that this document and all attachments were prepared under my direction and 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, which may include fines and/or imprisonment.

SIGNATORY REQUIREMENTS: The signature below must be in compliance with Part I, Item 4 on pages 1-2.

FRED JACK
Name of Individual Signing Application (Please Print)

MAYOR
Title

Signature

Date

Arkansas Department of Health

4815 West Markham Street • Little Rock, Arkansas 72205-3867 • Telephone (501) 661-2000
Fay W. Boozman, MD, MPH, Director
Mike Huckabee, Governor

November 21, 2003

Steve A. Hesse, PE
Engineering Design Associates, P.A.
134 West Emma Avenue
Springdale, Arkansas 72764

RE: Drip Disposal of Wastewater
Alternate Field Areas

Dear Mr. Hesse:

One of the issues on the Bethel Heights sewer project has been the requirement for alternate areas in case of failure of the primary disposal area. "Rules and Regulations Pertaining to Sewage Disposal Systems, Designated Representatives, and Installers" requires that lots which will utilize individual sewage disposal systems have twice the required area for the leach field. This allows an alternate area for use in the event of the failure of the primary area.

ADH has developed guidelines for the use of and sizing of drip disposal systems for Individual Sewage Disposal systems. For larger systems, sizing the disposal area at twice the required area is probably over conservative.

ADH Engineering proposes the following design guidelines for large drip disposal systems.

1. Drip disposal fields should be sized in accordance with "Guidelines for the Design and Construction of Drip Dispersal Systems"

2. Alternate areas are required and are sized as follows:

DESIGN FLOW	MINIMUM ALTERNATE AREA SIZE
≤10,000 GPD	100% of primary field size
>10,000 and ≤25,000 GPD	75% of primary field size
>25,000 and ≤50,000 GPD	50% of primary field size
>50,000 GPD	25% of primary field size

ADH has very limited experience with drip disposal of wastewater and still considers Drip Disposal of wastewater to be a new technology. In the future, when long-term performance data is available, it may be appropriate to revise this guideline.

If you have any questions or comments regarding this proposal, feel free to contact this office at 501-661-2623.

Sincerely,

Robert Hart, P.E.
Chief Engineer
Division of Engineering

Cc: Mike Mathis, P.E.
Mathis, Carter & Associates
4052 E. Van Buren Ste. G
Eureka Springs, Arkansas 72632

Don Adams

Engineering Design Associates, P.A.
134 W. Emma Avenue
Springdale, Arkansas 72764
479-756-1266

March 23, 2004

Roy Davis
District Engineer
Arkansas Department of Health
Division of Engineering
4815 West Markham - Slot 37
Little Rock, AR 72205-3867

RE: Bethel Heights Sewer Improvements - Phase III
Bethel Heights, AR
EDA # 0656.6

Dear Mr. Davis:

Enclosed are drawings and calculations for Phase III of the Bethel Heights treatment system.

As you may know, Phase I has been online for approximately 3 months. Phase II is currently under construction and should be online within 60 days.

Phase III consists of the treatment required for two new residential subdivisions that are being proposed along N. Oak Street.

Oak Place Subdivision is a 61 lot subdivision currently being designed by Engineering Services, Inc. The exact status of this project is unknown.

Chantel is a 123 lot subdivision currently being designed by our firm and will be forwarded to you very soon. It has been recently approved by the Springdale Water Utility.

As in the first two phases, both subdivisions will utilize a Septic Tank Effluent Pump (S.T.E.P.) system using Orenco STEP units at each residence for primary treatment. Secondary treatment and dispersal will consist of Orenco AX-100 treatment units and pumps, Xerxes tanks and Geoflow drip dispersal equipment.

We intend to utilize the remaining portion of the City property that was purchased for this treatment. In order to prevent any additional property from being used for the treatment, we are requesting that a sewer flow rate of 74 gallons per person per day be allowed to be used for this Phase of the project (both previous phases were designed at 100 gpcd). Alternate area requirements will be based on the current ADH standards and equate to 1.30 acres. The City owned property across Lincoln Street near City Hall will be designated for the alternate area.

Please do not hesitate to call if you have any questions or need additional information.

Sincerely,

Steve A. Hesse
Professional Engineer

SAH/sah

xc: Fred Jack - Mayor of Bethel Heights
file

B.H. TREATMENT EXPANSION
(PHASE III)

REVISED 3-11-03

	# LOTS
OAK PLACE SUBDIVISION	61
CHENTEL	12.5 (2 EDU FOR CLUBHOUSE)

186 x 74 x 2.5 = 34,400 GPD

TREATMENT PODS: 34,400 / 2,500 = 13.8 UNITS REQ'D

PROPOSING 18 UNITS

DRIP DISPERSAL:

$\frac{34,400}{0.39}$ = 88,200 SF REQ'D

PROVIDED: 7 FIELDS @ 12,600 S.F. = 88,200 S.F.

ALTERNATE AREA REQ'MTS:

	FLOW (GPD)	DRIP AREAS	
PH 1	12,500	50,788	
PH 2	32,500	87,160	
PH 3	34,400	88,200	→ ADH REQUIREMENT
	79,400	226,148	x 0.25 = 56,537 SF
			= 1.30 AC

Bethel Heights Sanitary Sewer

Phase III

Drip Dispersal - Loading Rates

01-02-04

	Pit Number	Loading Rate
1	5000	0.28
2	5001	0.70
3	5002	0.42
4	5003	0.37
5	5006	0.33
6	5007	0.32
7	5008	0.26
8	5009	0.29
9	5010	0.36
10	5011	0.35
11	5012	0.70
12	5013	0.32
	Total	4.7
	Average	0.39

Arkansas Department of Health

4815 West Markham Street • Little Rock, Arkansas 72205-3867 • Telephone (501) 661-2000
Fay W. Boozman, MD, MPH, Director
Mike Huckabee, Governor

April 2, 2004

Steve A. Hesse, PE
Engineering Design Associates, P.A.
134 West Emma Avenue
Springdale, Arkansas 72764

Re: Sewer Treatment Plant Expansion
Phase 3 Drip Dispersal System
Bethel Heights, Benton County
ADH# 47211-2

Dear Mr. Hesse:

The plans and specifications for the above-referenced project have been reviewed and the following comments are in order.

1. Please revise the notes showing the number of drip lines and drip line lengths for field 16B to correspond with the plan view.

2. Please revise your design flows to 80 gpcd or higher. This is based upon 3 or fewer bedrooms per lot. If more bedrooms are likely in the proposed development, higher design flows need to be utilized.

3. Based upon our latest "Guidelines for the Design and Construction of Drip Dispersal Systems" and originally submitted Soil Interpretations for this site, it appears that a soil loading rate of 0.217 gallons/ft^2/day is appropriate. This was based upon adjusted moderate water table depths as furnished by Sherri Herron, Ar. Registered Soil Classifier in a 10-21-2002 report on file with our Agency. The size of the field based upon your calculations would then be 158,525 square feet, not the 88,200 provided.

4. If design flows for all three phases are reduced to 80 gpcd, additional drip fields capable of handling 28,200

REC'D 4-5-04

gpd are need. At 0.217 gallons/ft^2/day the drip field area needs to be at least 130,000 square feet.

5. Provide revised layout sheets showing both the revised drip fields and showing an alternate area with a square footage of at least 25% of combined phases 1, 2, and 3 drip field area.

6. If the alternate area or any proposed drip fields are not contiguous to the existing site, address how effluent will be transported to other sites and how the quality of the effluent will be effected.

Review of this project will continue upon your response to the above comments.

When submitting correspondence please include our project number ADH# 47211-2.

Sincerely,

Roy A. Davis
District Engineer
Division of Engineering

RH:CSC:RAD:rd

Cc: Bethel Heights Sewer Dept.

REVISED CALCS ON PH-III

FLOW CALCS

	# EDA	GAL/EDU	GPD
LEXINGTON S/D	41	200	8,200
WILKINS S/D	126	200	25,200
OAK PLACE S/D	61	200	12,200
CHANTEL S/D	124	200	24,800
			→ 70,400

TREATMENT PODS: 36 @ 2,500 = 90,000 GPD
(18 EXISTING, 18 PROPOSED FOR PH 3)

DRIP DISPERSAL:

PHASE 1: 50,788 S.F. @ 0.26 G/SF/D = 13,205 GPD
PHASE 2: 87,160 S.F. @ 0.46 " = 40,094 GPD
PHASE 3: 88,400* S.F. @ 0.217 " = 19,183 GPD
226,348 → 72,482 GPD

ALTERNATE AREA REQMTS: (226,348)(0.25) = 56,587 SF

* 88,400 S.F. IS SHOWN ON CURRENT PLAN FOR PH.3

Engineering Design Associates, P.A.
134 W. Emma Avenue
Springdale, Arkansas 72764
479-756-1266

April 30, 2004

Roy Davis
District Engineer
Arkansas Department of Health
Division of Engineering
4815 West Markham - Slot 37
Little Rock, AR 72205-3867

RE: Response Letter
Bethel Heights Sewer Improvements - Phase III
Bethel Heights, AR
EDA # 0656.6
ADH# 47211-2

Dear Mr. Davis:

1. Please revise the notes showing the number of drip lines and drip line lengths for field 16B to correspond with the plan view.

   The notes on the plans have been revised to agree with the drawing.

2. Please revise your design flows to 80 gpcd or higher. This is based upon 3 or fewer bedrooms per lot. If more bedrooms are likely in the proposed development, higher design flows need to be utilized.

   We concur with the 80 gpcd.

3. Based upon our latest "Guidelines for the Design and Construction of Drip Dispersal Systems" and originally submitted Soil Interpretations for this site, it appears that a soil loading rate of 0.217 gallons/ft^2/day is appropriate. This was based upon adjusted moderate water table depths as furnished by Sherri Harron, Ar. Registered Soil Classifier in a 10-21-2002 report on file with our Agency. The size of the field based upon your calculations would then be 158,525 square feet, not the 88,200 provided.

   If we look at all four subdivisions that are proposed to be served by all phases of the Bethel Heights treatment system, we estimate a total daily flow of 70,400 gpd (see attached calculation sheet). Calculating the drip dispersal field areas separately for each phase we should have more than enough area to serve the four developments.

4. If design flows for all three phases are reduced to 80 gpcd, additional drip fields capable of handling 28,200 gpd are need. At 0.217 gallons/ft^2/day the drip field area needs to be at least 130,000 square feet.

   I do not follow this. I think this is addressed in #3 above.

5. Provide revised layout sheets showing both the revised drip fields and showing an alternate area with a square footage of at least 25% of combined phases 1, 2, and 3 drip field area.

   The plans have been revised to show the location of the designated alternate area. The required alternate area is 56,587 SF, the designated area shown on the plan is 60,450 SF.

6. If the alternate area or any proposed drip fields are not contiguous to the existing site, address how effluent will be transported to other sites and how the quality of the effluent will be effected.

   We are now utilizing the remaining areas of the treatment site, so effluent transportation and quality should no longer be an issue.

Please look forward to your continued review.

Do not hesitate to call if you have any questions or need additional information.

Sincerely,

Steve A. Hesse
Professional Engineer

SAH/sah

xc: Fred Jack - Mayor of Bethel Heights
file

Arkansas Department of Health

4815 West Markham Street • Little Rock, Arkansas 72205-3867 • Telephone (501) 661-2000
Fay W. Boozman, MD, MPH, Director
Mike Huckabee, Governor

May 7, 2004

Steve A. Hesse, PE
Engineering Design Associates, P.A.
134 West Emma Avenue
Springdale, Arkansas 72764

Re: Sewer Treatment Plant Expansion
Phase 3 Drip Dispersal System
Bethel Heights, Benton County
ADH# 47211-2

Dear Mr. Hesse:

The plans for the captioned project, revised 04/30/2004, prepared by Engineering Design Associates, P.A.and submitted to the Division of Engineering on 05/03/2004 have been reviewed and are hereby approved with the following conditions.

1. The Division of Engineering relied upon the statements and representations made in the engineer's report, plans, and specifications. In case any statement or representation in the aforementioned documents is found to be incorrect, this Approval may be revoked.

2. There shall be no deviation from the plans and specifications unless revised plans and specifications have been first submitted for review and written consent given.

3. The review and approval of the plans and specifications were for functional and sanitary features and in no way constitute an analysis of structural design.

4. If construction on this project is not started within one year of the date affixed hereto, this Letter of Approval is void.

5. Engineering Design Associates, P.A. shall provide construction inspection services.

6. Specifications as submitted for ADH# 43600 Phase II will be utilized for this project.

7. Approval of the Arkansas Department of Environmental Quality is also required.

One Set of plans will be retained for our files. One set of plans are included.

When submitting correspondence pertaining to this project, please include our reference number ADH# 47211-2.

Sincerely,

Robert Hart, P.E.
Chief Engineer
Division of Engineering

RH:CSC:RAD:rd:

Enclosure

cc: Benton County Sanitarian
Ody Bien, Area 1 Plumbing Inspector
Bethel Heights Sewer Department
Arkansas Department of Environmental Quality

Appendix D: Operation and Maintenance Manuals

AdvanTex®
Treatment Systems

Installation and Operation & Maintenance

USERNAME OSE u/c
PANEL l/c
PASS

Bethel Heights – Phase I & II
Bethel Heights, AR

Bethel Heights – Phase I & II

Orenco Systems® Incorporated
1-800-348-9843

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© 11/03, Orenco Systems®, Inc.

Introduction

About Orenco

Orenco Systems®, Inc. is one of the nation's leading suppliers of equipment for residential and community wastewater collection and treatment systems. At Orenco, we manufacture complete systems, and wastewater collection and treatment is our only job. You can be confident that you have purchased the best equipment available.

Assistance

In addition to providing quality equipment, Orenco prides itself on its outstanding customer service and technical assistance. Should you find any of our instructions to be unclear or confusing, please contact us for assistance. Please let the receptionist know you would like assistance for "Bethel Heights AdvanTex® Treatment System O&M Manual".

When Your Equipment Arrives

Inspect your order for completeness and inspect each component for shipment damage. Check to be sure instructions and items supplied comply with your state and local regulations. Carefully read and follow all instructions. Improper installation may void warranties.

Bethel Heights General Overview

The Bethel Heights AdvanTex® treatment system will be built in two phases. Phase I will include the installation of a recirculation tank with four pumps dosing to six AX100 pods. Phase II will see two pumps and three AX100 pods added to the existing treatment system from Phase I in addition to another recirculation tank with six pumps dosing to nine AX100 pods. Final build out will yield a total of eighteen AX100 pods.

About the Bethel Heights – Phase I Treatment System

Properly sized primary septic tanks, at each dwelling, will collect and retain sewage. In the septic tank, heavy solids (known as sludge) settle to the bottom while the lighter material (known as scum) floats to the top of the liquid contents. Facultative and anaerobic digestion converts the organic matter to gases. Facultative microbes solubilize the complex organic material to volatile organic acids while strict anaerobes ferment the volatile organic acids to gases (methane, carbon dioxide, etc.). For the system to operate properly and be in compliance with State and County regulations, it is essential that all tanks be watertight.

Relatively clear effluent from mid-level of each primary septic tank will be pumped to one of two recirculation tanks. The recirculation tanks are connected and sized so that the combined shared liquid

retention. The tank is set up so that incoming effluent from the septic tank and effluent from the AdvanTex® system enter opposite of the pump discharge to the pods. This allows blending of the effluent before being dosed onto the AdvanTex treatment system. Pumps operate intermittently and sequentially 24 hours per day, seven days per week.

The textile system with Phase I and Phase II combined is designed to handle a peak of 90,000 gpd at a loading rate of 50 gpd/ft^2, and an average of 45,000 gpd at 25 gpd/ft^2. Based on the flow, expected waste strength, and treatment requirements, twelve additional AX100 pods are required, bringing the number of pods at final build out to 18. Phase II will add an additional cell to Phase I that will include three of the twelve additional pods sequentially dosed by a 3-way distributing valve. The other nine pods will be split into three 3-zone cells sequentially dosed by a 3-way distributing valve.

The additional cell added to Phase I will add another duplex system where one pod in a cell will be pressurized by one of two alternating P500712, 3/4-HP, 230-Volt, 1 phase effluent pumps. With a recirculation ratio of 4:1, the programmable timer in the panel should be initially set for 1.4 minutes "on" and 1.65 minutes "off." Pump 1, 3, and 7 will operate through the first cycle and Pump 2, 4, and 6 will operate through the next, etc. The pumps for Phase I will be controlled by the first tri-duplex controls of an Orenco Systems®, Inc. Model TCOM-**TDAX**/DAX/TDAX/DAX2 **PTROCS**/ PTROCS/PTROCS/PTROCS FS, with remote telemetry.

For Phase II, each pod in a cell will be pressurized by one of two alternating P500712, 3/4-HP, 230-Volt, 1 phase effluent pumps. With a recirculation ratio of 4:1, the programmable timer in the panel should be initially set for 1.4 minutes "on" and 1.65 minutes "off." Pumps 9, 11, and 13 will operate through the first cycle and Pumps 10, 12 and 14 will operate through the next, etc. The pumps for Phase II will be controlled by the second tri-duplex controls of an Orenco Systems®, Inc. Model TCOM-TDAX/DAX/**TDAX**/DAX2 PTROCS/ PTROCS/**PTROCS**/PTROCS FS, with remote telemetry.

Each time the pods for Phase II are dosed by the pumps in the recirculation tank, the effluent trickles through the media where it is treated by naturally occurring microorganisms populating the filter. After passing through the filter media, the treated effluent is collected at the bottom of the filter through which it is conveyed back to the Recirculating Splitter Valve, Model RSV4U in the recirculating/blend tank. The RSV4U will either return 100% of the flow to the recirculation tank (during periods of low flow when the RSV4U buoy is not seated against the stinger seat) or will send 20% of the effluent to final disposal in the dose tank and 80% of the effluent back to the recirculation tank (during periods of high flow when the RSV4U buoy is seated against the stinger seat).

The dosing tank discharges effluent to a drip drainfield. The drainfield is dosed by one of two alternating P200512, 1/2-HP, 230-Volt, 1 phase effluent pumps controlled by the second duplex controls of the TCOM-TDAX/DAX/TDAX/**DAX2** PTROCS/PTROCS/PTROCS/**PTROCS** FS control panel. Pump 15 will operate through the first cycle and Pump 16 will operate through the next, etc. Timer settings will be determined by the engineer.

Safety Procedures

Before start up, maintenance or service to any wastewater treatment system, the following safety procedures should be observed for the safety and health of all service personnel working with or around wastewater, effluent and its associated equipment:

Preventive Maintenance

As with any engineered system, such as a car or heat pump, your wastewater treatment system will work better and last longer if it is regularly maintained by a qualified service provider. The service provider should be present during installation, so he or she is familiar with the system, especially those service lines, conduits, and connections that get buried.

Your system will work better and last longer if you learn what **not** to put into the treatment system. As a general rule, nothing should go into any wastewater treatment system that hasn't been ingested, other than toilet tissue, mild detergents, and wash water. Every qualified service provider should be familiar with the basic guidelines below:

- No septic additives
- No flammable or toxic products
- No excessive household cleaners, especially floor wax and rug cleaners
- No chlorine bleach, chlorides, and pool or spa products
- No pesticides, herbicides, or agricultural chemicals or fertilizers
- No RV waste (unless the system is specifically designed and engineered to treat such waste)
- No surface runoff and storm water
- No excessive amounts of fats, oils and grease (FOG)
- No food byproducts
- No cigarette butts
- No paper towels, newspapers, sanitary napkins, diapers, gum or candy wrappers
- No baby wipes

Preventive maintenance should start with some facility and/or homeowner education. Orenco Systems®, Inc. can provide a homeowner manual to distribute upon request. To request multiple copies of the *Homeowner's Manual,* contact Orenco Systems, Inc. at 1-800-348-9843.

With preventive maintenance, along with periodic inspections, the wastewater treatment system will function for decades.

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Start Up & Operation – Phase I

The designer should be at the site during start up to answer questions.

Recirculation Tank Pump Start-up

The recirculation tank pumps are controlled by the first tri-duplex controls of a Model TCOM-**TDAX**/DAX/TDAX/DAX2 **PTROCS**/PTROCS/PTROCS/PTROCS FS control panel with a Model MF3A-YP,G,W float assembly. Your system has three floats with the following color codes and functions:

Pumps 1 & 2

Top Float (Yellow/Purple Marker)	High Level Alarm/Lag Enable
Second Float (Green Marker)	Override Timer On/Off
Bottom Float (White Marker)	Redundant Off/Low Level Alarm

Pumps 3 & 4

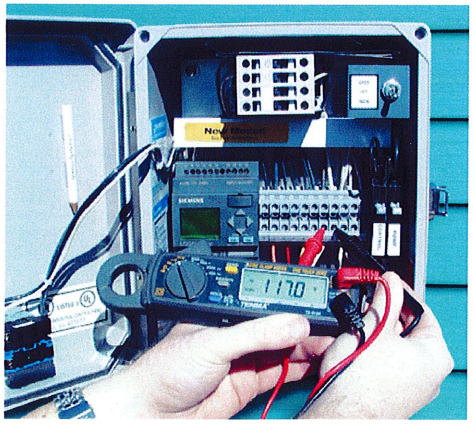
Single Float (White Marker)	Redundant Off/Low Level Alarm

NOTE: Phase I will only see the operation of Pumps 1, 2, 3, and 4. Pumps 5 and 6 will be added at the completion of Phase II.

The remote telemetry control panel for this system can be accessed either remotely over a standard phone line, or can be accessed directly at the site through a null modem cable. For access instructions see *"Custom VCOM Control Panels and HyperTerminal Access"* in Appendix F.

NOTE: All panels are tested before leaving the production facility. If there is a problem with function, please check the wiring diagrams in Appendix F for proper wiring or follow any recommendations provided.

1. ***Simulate normal operation.*** During normal operation, both "Redundant Off/Low Level Alarm" floats will be in the upright position. Raise both "Redundant Off/Low Level Alarm" floats to the upright position to simulate normal operation.



2. ***Check Static Voltage.*** Place all pump MOA switches to the OFF position. Using standard electrical probes, measure the incoming voltage to Pump 1 by touching one probe to the top wire of the pump circuit breaker and the other probe to a neutral terminal. Record these values in the appropriate spaces on the following page. Repeat step for Pumps 2, 3, and 4.

Fully open the ball valve on the discharge plumbing assembly. Be sure the pumps are submerged in water before continuing.

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reactivation of the visual alarm. *(Note: Audible alarm is delayed for 12 hours in TCOM control panels.)*

7. ***Check the automatic operation of the pumps.*** Check the automatic operation of the pumps by moving the MOA switches for Pumps 1, 2, 3, and 4 to the automatic (AUTO) position. Raise both "Redundant Off/Low Level Alarm" floats to the upright position to simulate normal operation. The lead pumps will cycle with the timer *(Note: The timer starts in the off position first)*. Observe the complete cycling of the pumps through a few cycles and observe that Pumps 1 & 3alternate in the lead and lag position with Pumps 2 & 4 and turn on and off with the timer.

8. ***Check the operation of the Override Timer.*** Check the override timer feature of the panel by moving the MOA switches for Pumps 1, 2, 3, and 4 to the automatic (AUTO) position. Raise both "Redundant Off/Low Level Alarm" floats to the upright position to simulate normal operation. The lead pumps will cycle with the timer. Slowly raise the middle (Override Timer On/Off) float to its upright position. This float activates the override timer function when lifted for more than 2 seconds, controlling the lead pumps cycles during high flow conditions. Observe the complete cycling of the override timer through a few cycles and observe that Pumps 1 & 3 alternate in the lead and lag position with Pumps 2 & 4 and turn on and off with the override timer. The override timer function will remain active until the float has lowered then normal timer operations will resume.

9. ***Check the operation of the High Level Alarm/Lag Pump Enable.*** Check the High Level Alarm and Lag Pump Enable feature of the panel by moving the MOA switches for Pumps 1, 2, 3 and 4 to the automatic (AUTO) position. Raise both "Redundant Off/Low Level Alarm" floats and "Override Timer On/Off" float to their upright positions to simulate a normal rising liquid level. Lift up the top float and verify that all pumps have turned on and that the High Level Alarm has been activated *(TCOM light only, audible delayed 12 hours)*. At this time, all pumps will cycle through the override timer settings. Now lower the top float and the middle float. The system will resume normal operation.



10. ***Check the Redundant Off/Low Level Alarm.*** The "Redundant Off/Low Level Alarm" feature functions only during automatic operation. Move the MOA switches for Pumps 1, 2, 3, and 4 to the automatic (AUTO) position. Hold both "Redundant Off/Low Level Alarm" floats in the upright position. Wait for the timer to enter its "on" cycle, so that the lead pumps will be running. Lower one bottom float and verify that the Low Level Alarm has activated and that the lead pumps have shut off. *(Note: Audible alarm is delayed for 12 hours in TCOM control panels).*

IMPORTANT! Record the event counter and elapsed time meter readings on the card provided in the control panel. See "Custom VCOM Control Panels and HyperTermial Access" in Appendix F.

11. ***Check for easy removal of components for maintenance.*** The ability to easily remove the Biotube® pump vault for maintenance is essential and depends upon careful installation in accordance with the instructions *"Biotube® Pump Vault"* in Appendix B. To be certain that correct installation has been

Dosing Tank Pump Start-up

The dosing tank pumps are controlled by the first duplex controls on a Model TCOM-TDAX/**DAX**/TDAX/DAX2 PTROCS/**PTROCS**/PTROCS/PTROCS FS control panel with a Model MF4AYP,B,R,W float assembly. Your system has four floats with the following color codes and functions:

Top Float (Yellow/Purple Marker)	High Level Alarm/Lag Enable
Second Float (Green Marker)	Override Timer On/Off
Third Float (Red Marker)	Timer On/Off
Bottom Float (White Marker)	Redundant Off/Low Level Alarm

The telemetry control panel for this system can be accessed either remotely over a standard phone line, or can be accessed directly at the site through a null modem cable. For access instructions see *"Custom VCOM Control Panels and HyperTerminal Access"* in Appendix F. .

Note: All panels are tested before leaving the production facility. If there is a problem with function, please check the wiring diagrams for proper wiring or follow any recommendations provided.

1. ***Simulate normal operation.*** During normal operation, the bottom (Redundant Off/Low Level Alarm) float will be in the upright position. Raise the "Redundant Off/Low Level Alarm" float to the upright position to simulate normal operation.

2. ***Check Static Voltage.*** Place all pump MOA switches to the OFF position. Using standard electrical probes, measure the incoming voltage to Pump 7 by touching one probe to the top wire of the pump circuit breaker and the other probe to a neutral terminal. Record these values in the appropriate spaces below. Repeat step for Pump 8.

Fully open the ball valve on the discharge plumbing assembly. Be sure the pumps are submerged in water before continuing.

3. ***Check the operation of the pumps.*** Set the MOA switch for Pump 7 in the control panel to the manual (MAN) position. Ensure that the pump is now running. A 1/8-inch diameter bypass orifice is provided in the discharge head of Orenco pumps. During the pumping cycle, some noise as a result of the recirculation within the flow inducer is to be expected. Check the cycle counter and elapsed time meters to ensure that the cycles and run times are recorded in the telemetry software.

4. ***Check pump amperages and dynamic voltage.*** While Pump 7 is running, use a loop ammeter around the pump cable. The amperage should approximately be in the range of 6 amps. If the amperage is higher than 10, check the connections and cable sizing. Measure the voltage while Pump 7 is running (dynamic voltage). Record these values in the control panel on the label provided and the appropriate spaces below. Repeat Steps 3 & 4 for Pump 8.

Date of Start Up:

Static Voltage Pump #7:	_____	Static Voltage Pump #8:	_____
Dynamic Voltage Pump #7:	_____	Dynamic Voltage Pump #8:	_____
Amperage Pump #7:	_____	Amperage Pump #8:	_____

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Low Level Alarm has activated and that the lead pump has shut off. *(Note: Audible alarm is delayed for 12 hours in TCOM control panels.)*

IMPORTANT! Record the event counter and elapsed time meter readings on the card provided in the control panel. See "Custom VCOM Control Panels and HyperTermial Access" in Appendix F.

11. ***Check for easy removal of components for maintenance.*** The ability to easily remove the Biotube® pump vault for maintenance is essential and depends upon careful installation in accordance with the instructions *"Biotube® Pump Vault"* in Appendix B. To be certain that correct installation has been achieved and to avoid future maintenance problems, exercise the removal process described as follows (steps a-i).

    IMPORTANT! Before removing system components, switch off the power to the system at the service entrance pane and set the circuit breakers in the panel to their "OFF" positions.

    a. Completely close the ball valve on the pump discharge assembly.

    b. Disconnect the PVC union located next to the ball valve.

    c. Remove each pump from its flow inducer, setting it aside on the fiberglass lid or on a piece of plastic film to protect it from mud or sand. The pump's electrical cord need not be disconnected.

    d. Remove the float assembly from the vault and lay it aside.

    e. Pull the Biotube® pump vault out of the tank. There should be ample clearance between the ball valve and the splice box to allow unhindered removal of the vault.

    f. Once vault removal is demonstrated, replace the float assembly into the vault and lower the vault into the tank. To prevent the vault from floating, run clear water (as from a hose) into the vault to sink it. Replace pumps and reconnect plumbing.

    g. Open the ball valve completely.

    h. Replace access riser lid.

CAUTION! The tank access lid must be properly secured to the riser at all times. If bolts are lost or damaged, contact Orenco immediately for replacements.

AN UNLOCKED LID OR OPEN TANK ACCESS IS A SAFETY HAZARD!

    i. Reset circuit breakers to "ON" and switch on the power to the system at the service entrance panel.

Start Up & Operation – Phase II

The designer should be at the site during start up to answer questions.

Recirculation Tank Pump Start-up – Additional Duplex to Phase I

The recirculation tank pumps from Phase I are controlled by the first tri-duplex controls of a Model TCOM-**TDAX**/DAX/TDAX/DAX2 **PTROCS**/PTROCS/PTROCS/PTROCS FS control panel with a Model MF3A-YP,G,W float assembly. Your system has three floats with the following color codes and functions:

Pumps 1 & 2

Top Float (Yellow/Purple Marker)	High Level Alarm/Lag Enable
Second Float (Green Marker)	Override Timer On/Off
Bottom Float (White Marker)	Redundant Off/Low Level Alarm

Pumps 3 & 4

Single Float (White Marker)	Redundant Off/Low Level Alarm

Pumps 5 & 6

Single Float (White Marker)	Redundant Off/Low Level Alarm

The remote telemetry control panel for this system can be accessed either remotely over a standard phone line, or can be accessed directly at the site through a null modem cable. For access instructions see *"Custom VCOM Control Panels and HyperTerminal Access"* in Appendix F.

NOTE: All panels are tested before leaving the production facility. If there is a problem with function, please check the wiring diagrams in Appendix F for proper wiring or follow any recommendations provided.

1. ***Simulate normal operation.*** During normal operation, all three "Redundant Off/Low Level Alarm" floats will be in the upright position. Raise all three "Redundant Off/Low Level Alarm" floats to the upright position to simulate normal operation.

2. ***Check Static Voltage.*** Place all pump MOA switches to the OFF position. Using standard electrical probes, measure the incoming voltage to Pump 5 by touching one probe to the top wire of the pump circuit breaker and the other probe to a neutral terminal. Record these values in the appropriate spaces on the following page. Repeat step for Pump 6.

Fully open the ball valve on the discharge plumbing assembly. Be sure the pumps are submerged in water before continuing.

3. ***Check the operation of the pumps.*** Set the MOA switch for Pump 5 in the control panel to the manual (MAN) position. Ensure that the pump is now running. A 1/8-inch diameter bypass orifice is provided in the discharge head of Orenco pumps. During the pumping cycle, some noise as a

operation. The lead pumps will cycle with the timer. Slowly raise the middle (Override Timer On/Off) float to its upright position. This float activates the override timer function when lifted for more than 2 seconds, controlling the lead pumps cycles during high flow conditions. Observe the complete cycling of the override timer through a few cycles and observe that Pumps 1, 3, and 5 alternate in the lead and lag position with Pumps 2, 4, and 6 and turn on and off with the override timer. The override timer function will remain active until the float has lowered then normal timer operations will resume.

9. ***Check the operation of the High Level Alarm/Lag Pump Enable.*** Check the High Level Alarm and Lag Pump Enable feature of the panel by moving the MOA switches for Pumps 1, 2, 3, 4, 5, and 6 to the automatic (AUTO) position. Raise all three "Redundant Off/Low Level Alarm" floats and "Override Timer On/Off" float to their upright positions to simulate a normal rising liquid level. Lift up the top float and verify that all pumps have turned on and that the High Level Alarm has been activated *(TCOM light only, audible delayed 12 hours)*. At this time, all pumps will cycle through the override timer settings. Now lower the top float and the middle float. The system will resume normal operation.

IMPORTANT! Record the event counter and elapsed time meter readings on the card provided in the control panel. See "Custom VCOM Control Panels and HyperTermial Access" in Appendix F.

10. ***Check for easy removal of components for maintenance.*** The ability to easily remove the Biotube® pump vault for maintenance is essential and depends upon careful installation in accordance with the instructions *"Biotube® Pump Vault"* in Appendix B. To be certain that correct installation has been achieved and to avoid future maintenance problems, exercise the removal process for the vault contain Pumps 5 & 6 described as follows (steps a-i).

    IMPORTANT! Before removing system components, switch off the power to the system at the service entrance pane and set the circuit breakers in the panel to their "OFF" positions.

    a. Completely close the ball valve on the pump discharge assembly.

    b. Disconnect the PVC union located next to the ball valve.

    c. Remove each pump from its flow inducer, setting it aside on the fiberglass lid or on a piece of plastic film to protect it from mud or sand. The pump's electrical cord need not be disconnected.

    d. Remove the float assembly from the vault and lay it aside.

    e. Pull the Biotube® pump vault out of the tank. There should be ample clearance between the ball valve and the splice box to allow unhindered removal of the vault.

    f. Once vault removal is demonstrated, replace the float assembly into the vault and lower the vault into the tank. To prevent the vault from floating, run clear water (as from a hose) into the vault to sink it. Replace pumps and reconnect plumbing.

    g. Open the ball valve completely.

Recirculation Tank Pump Start-up

The recirculation tank pumps for Phase II are controlled by the second tri-duplex controls of a Model TCOM-TDAX/DAX/**TDAX**/DAX2 PTROCS/PTROCS/**PTROCS**/PTROCS FS control panel with a Model MF3A-YP,G,W float assembly. Your system has three floats with the following color codes and functions:

Pumps 9 & 10

Top Float (Yellow/Purple Marker)	High Level Alarm/Lag Enable
Second Float (Green Marker)	Override Timer On/Off
Bottom Float (White Marker)	Redundant Off/Low Level Alarm

Pumps 11 & 12

Single Float (White Marker)	Redundant Off/Low Level Alarm

Pumps 13 & 14

Single Float (White Marker)	Redundant Off/Low Level Alarm

The remote telemetry control panel for this system can be accessed either remotely over a standard phone line, or can be accessed directly at the site through a null modem cable. For access instructions see *"Custom VCOM Control Panels and HyperTerminal Access"* in Appendix F.

NOTE: All panels are tested before leaving the production facility. If there is a problem with function, please check the wiring diagrams in Appendix F for proper wiring or follow any recommendations provided.

1. ***Simulate normal operation.*** During normal operation, all three "Redundant Off/Low Level Alarm" floats will be in the upright position. Raise all three "Redundant Off/Low Level Alarm" floats to the upright position to simulate normal operation.

2. ***Check Static Voltage.*** Place all pump MOA switches to the OFF position. Using standard electrical probes, measure the incoming voltage to Pump 9 by touching one probe to the top wire of the pump circuit breaker and the other probe to a neutral terminal. Record these values in the appropriate spaces on the following page. Repeat step for Pumps 10 - 14.

Fully open the ball valve on the discharge plumbing assembly. Be sure the pumps are submerged in water before continuing.

3. ***Check the operation of the pumps.*** Set the MOA switch for Pump 9 in the control panel to the manual (MAN) position. Ensure that the pump is now running. A 1/8-inch diameter bypass orifice is provided in the discharge head of Orenco pumps. During the pumping cycle, some noise as a result of the recirculation within the flow inducer is to be expected. Check the cycle counter and elapsed time meters to ensure that the cycles and run times are recorded in the telemetry software.

4. ***Check pump amperages and dynamic voltage.*** While Pump 9 is running, use a loop ammeter around the pump cable to measure the amperage. The amperage should approximately be in the

8. ***Check the operation of the Override Timer.*** Check the override timer feature of the panel by moving the MOA switches for Pumps 9 - 14 to the automatic (AUTO) position. Raise all three "Redundant Off/Low Level Alarm" floats to the upright position to simulate normal operation. The lead pumps will cycle with the timer. Slowly raise the middle (Override Timer On/Off) float to its upright position. This float activates the override timer function when lifted for more than 2 seconds, controlling the lead pumps cycles during high flow conditions. Observe the complete cycling of the override timer through a few cycles and observe that Pumps 9, 11, and 13 alternate in the lead and lag position with Pumps 10, 12, and 14 and turn on and off with the override timer. The override timer function will remain active until the float has lowered then normal timer operations will resume.

9. ***Check the operation of the High Level Alarm/Lag Pump Enable.*** Check the High Level Alarm and Lag Pump Enable feature of the panel by moving the MOA switches for Pumps 9 - 14 to the automatic (AUTO) position. Raise all three "Redundant Off/Low Level Alarm" floats and "Override Timer On/Off" float to their upright positions to simulate a normal rising liquid level. Lift up the top float and verify that all pumps have turned on and that the High Level Alarm has been activated *(TCOM light only, audible delayed 12 hours)*. At this time, all pumps will cycle through the override timer settings. Now lower the top float and the middle float. The system will resume normal operation.

IMPORTANT! Record the event counter and elapsed time meter readings on the card provided in the control panel. See "Custom VCOM Control Panels and HyperTermial Access" in Appendix F.

10. ***Check for easy removal of components for maintenance.*** The ability to easily remove the Biotube® pump vault for maintenance is essential and depends upon careful installation in accordance with the instructions *"Biotube® Pump Vault"* in Appendix B. To be certain that correct installation has been achieved and to avoid future maintenance problems, exercise the removal process described as follows (steps a-i). Repeat for all pumping systems

    IMPORTANT! Before removing system components, switch off the power to the system at the service entrance pane and set the circuit breakers in the panel to their "OFF" positions.

    a. Completely close the ball valve on the pump discharge assembly.

    b. Disconnect the PVC union located next to the ball valve.

    c. Remove each pump from its flow inducer, setting it aside on the fiberglass lid or on a piece of plastic film to protect it from mud or sand. The pump's electrical cord need not be disconnected.

    d. Remove the float assembly from the vault and lay it aside.

    e. Pull the Biotube® pump vault out of the tank. There should be ample clearance between the ball valve and the splice box to allow unhindered removal of the vault.

    f. Once vault removal is demonstrated, replace the float assembly into the vault and lower the vault into the tank. To prevent the vault from floating, run clear water (as from a hose) into the vault to sink it. Replace pumps and reconnect plumbing.

elapsed time meters to ensure that the cycles and run times are recorded in the telemetry software.

4. ***Check pump amperages and dynamic voltage.*** While Pump 15 is running, use a loop ammeter around the pump cable. The amperage should approximately be in the range of 6 amps. If the amperage is higher than 10, check the connections and cable sizing. Measure the voltage while Pump 15 is running (dynamic voltage). Record these values in the control panel on the label provided and the appropriate spaces below. Repeat Steps 3 & 4 for Pump 16.

Date of Start Up:			
Static Voltage Pump #15:	_____	Static Voltage Pump #16:	_____
Dynamic Voltage Pump #15:	_____	Dynamic Voltage Pump #16:	_____
Amperage Pump #15:	_____	Amperage Pump #16:	_____

5. ***Check the timer settings.*** Using the instructions from *"Custom VCOM Control Panels and HyperTerminal Access"* in Appendix F, set the programmable timer to the desired settings and record in the spaces provided below. The timer settings should be determined by the engineer.

Standard:			**Override:**		
Timer ON	_____	minutes	Timer ON	_____	minutes
Timer OFF	_____	minutes	Timer OFF	_____	minutes

6. ***Check the automatic operation of the alarm.*** Check the operation of the High Level Alarm by raising the top float. After a brief delay, the operator should be notified by a visual alarm on front of the panel. If the light does not illuminate, check the lamp for possible damage during shipment. Check for the automatic reset of the alarm by lowering and again lifting the float and checking for reactivation of the visual alarm. *(Note: Audible alarm is delayed for 12 hours in TCOM control panels.)*

7. ***Check the automatic operation of the pumps.*** Check the automatic operation of the pumps by moving the MOA switches for Pumps 15 & 16 to the automatic (AUTO) position. Raise the "Redundant Off/Low Level Alarm" and "Timer On/Off" floats to the upright position to simulate normal rising liquid level. The lead pump will cycle with the timer *(Note: The timer starts in the off position first)*. Observe the complete cycling of the pumps through a few cycles and observe that the pumps alternate in the lead and lag position and turn on and off with the timer.

8. ***Check the operation of the Override Timer.*** Check the override timer feature of the panel by moving the MOA switches for Pumps 15 & 16 to the automatic (AUTO) position. Raise the "Redundant Off/Low Level Alarm" and "Timer On/Off" floats to the upright position to simulate normal rising liquid level. The lead pump will cycle with the timer. Slowly raise the "Override Timer On/Off" float to its upright position. This float activates the override timer function when lifted for more than 2 seconds, controlling the pump cycles during high flow conditions. Observe the complete cycling of the override timer through a few cycles and observe that the pumps alternate in the lead and lag position and turn on and off with the override timer. The override timer function will remain active until the float has lowered then normal timer operations will resume.

h. Replace access riser lid.

CAUTION! The tank access lid must be properly secured to the riser at all times. If bolts are lost or damaged, contact Orenco immediately for replacements.

AN UNLOCKED LID OR OPEN TANK ACCESS IS A SAFETY HAZARD!

i. Reset circuit breakers to "ON" and switch on the power to the system at the service entrance panel.

AdvanTex® Start Up

IMPORTANT! The transport line should always be flushed with clean water before connecting to the distributing valve and pods. Any dirt, gravel, or other foreign objects that may have been in the pipe during installation can easily become lodged in the valve or manifold, causing malfunction.

One pump will be required to pressurize one AX100 pod. In the control panel, set the MOA switch for Pump 9 to the manual (MAN) position. Pump 9 should engage and pressurize Pod 10 of the AdvanTex® pods. If Pod 11 or 12 is pressurized, close and open the ball valve on the distributing valve assembly to check that it rotates the flow to Pod 10. Ensure that all nozzles have a uniform spray and are discharging equal amounts of effluent.

Measure the residual pressure of the nozzles at the inlet to the pod. The minimum residual pressure per nozzle should be between 4.5 -5 psi. If the pressure exceeds 5 psi, throttle the inlet valve to achieve the desired pressure and record below. Repeat the procedure above to test and record the residual pressure for all remaining pods and pumps.

Note: These values will be used in the future to determine clogged nozzles, so measure and record carefully.

Date of Start Up:

Residual Pressure Pod #10:	_____	Residual Pressure Pod #11:	_____
Residual Pressure Pod #12:	_____	Residual Pressure Pod #13:	_____
Residual Pressure Pod #14:	_____	Residual Pressure Pod #15:	_____
Residual Pressure Pod #16:	_____	Residual Pressure Pod #17:	_____
Residual Pressure Pod #18:	_____		

IMPORTANT! After testing and recording, be sure to return the MOA switches to AUTO for proper operation of the system.

Distributing Valves

Please refer to the document, *Orenco Automatic Distributing Valve Assemblies for Wastewater Effluent Systems* and the Hydrotek Valve booklet that is provided in Appendix E for the sequencing of the valve outlets (the booklet is also provided with the valve). One pump in each duplex unit will alternate dosing

Maintenance

Tools, Equipment, and Spare Parts List

Many of the recommended maintenance and troubleshooting procedures require specialized tools, equipment, and spare parts. Refer to the *"Standard AdvanTex® O&M Manual"* in Appendix H for a list of items to have on hand.

Record Keeping

Maintain a written diary describing all activities relating to the AdvanTex® system. This information is very valuable for analysis and trouble shooting if problems should occur. A maintenance checklist, field maintenance report form and field report form may be found in the *"Standard AdvanTex® O&M Manual"* in Appendix H.

Monthly Maintenance

Once a month, during the first year of operation, make a visual inspection of the septic tank's liquid level. The liquid level should never be lower than the "Redundant Off" float. If liquid leaks out of the tank, the scum layer can drop to the level of the perimeter holes in the pump vaults and cause the screen to plug. A watertight septic tank is important and any leakage must be corrected.



Once a month, during the first year of operation, the Biotube® Pump Vaults should be examined to determine if cleaning of the Biotube filter is necessary. If the liquid level inside the vault is discernibly different from the level outside the pump vault while the pump is running, cleaning is required. Remove the filter cartridge and clean it following the steps from *"Biotube® Pump Vault"* in Appendix B.

Read the hour meters and event counters for the recirculating tank's pumps once a month. Each pump in the recirculation tank should run approximately the same number of hours and turn on approximately the same number of times. If the run and/or cycle times differ significantly between pumps, determine the cause of the discrepancy and take corrective measures. An ETM/CT log and worksheet may be found in the *"Standard AdvanTex® O&M Manual"* in Appendix H.

Manually operate a pump in each recirculation tank duplex system through thee cycles and ensure that the distributing valves are operating properly by observing that effluent squirts from each successive pod.

Quarterly Maintenance

Check and record the cycle counter and elapsed time meter readings. The pumps in each system should run approximately the same number of hours and turn on approximately the same number of times as

2. ***Measuring the sludge layer.*** Using a sludge judge or similar tool, measure the thickness of the sludge layer. With this measurement, determine if the distance from the top surface of the sludge to the bottom of the outlet tee is 6" or less. If so, again, it's time to pump out the contents from the tank (scum, sludge, and liquid completely). If the tank is fitted with a pump vault or effluent filter discharge assembly, measurement will be from top surface of the sludge layer to the bottom of the vault's inlet ports (see Figure 1). After removing the septage contents from the tank, refill it with water to its normal operating level.

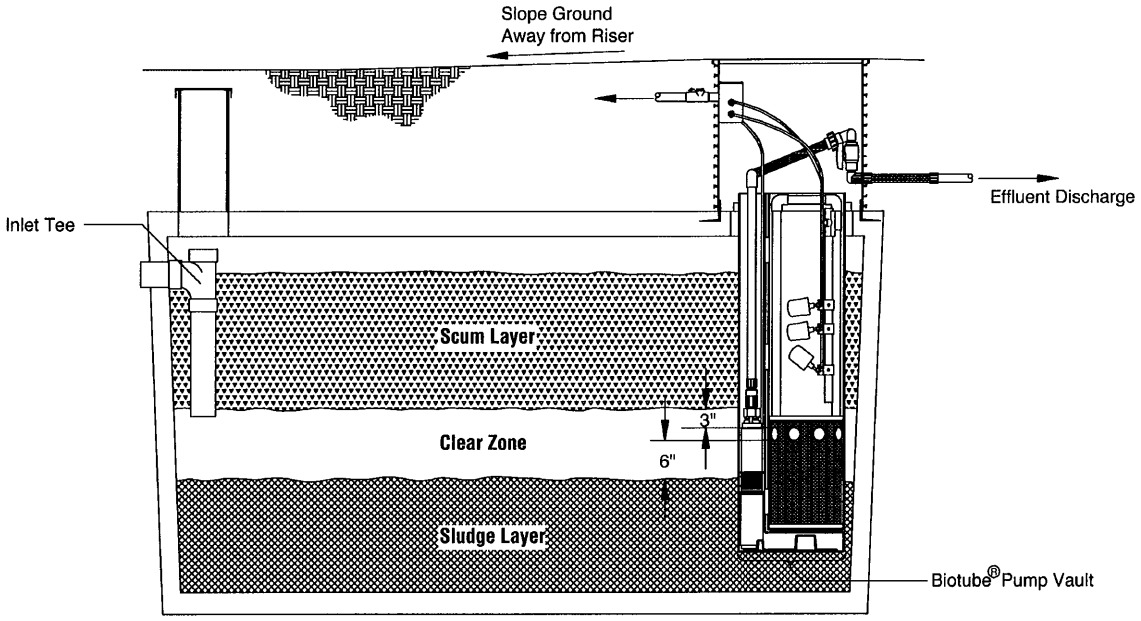

Figure 1

Flush the laterals on an annual basis. The laterals should be flushed at least once per year regardless of the inspected squirt heights. Once a year, send copies of the complete activity diary to the appropriate person. This information is very valuable for analysis and trouble shooting if problems should occur.

Corrective Maintenance

An alarm is triggered when the liquid in the tank reaches a level that is either higher or lower than it should be, under normal operating conditions.

When responding to an alarm, first discern whether a high- or low-level condition or pump failure has caused the alarm. If it is due to pump failure, test each pump manually and locate the failed pump. To replace the pump, see **Removing & Replacing Inoperative Pumps**. Remove the access riser lid and visually inspect the liquid level. If a high liquid level has caused the alarm, follow the ensuing procedures. If a low liquid level caused the condition, see **Low Liquid Level Alarm**.

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IMPORTANT! Before doing any work on either the wiring to the level control floats and pump or in the pump control panel, switch off the power to the system at the service entrance panel and set the circuit breakers in the panel to their "OFF" positions.



8. Remove the access riser lid and the stainless steel screws from the splice box lid, being careful not to drop the screws into the tank. If the splice box was submerged, or if there is a crack in the conduit, there may be water in the splice box. If this is the case, remove the water with a syringe or other appropriate method. Carefully check the splices to ensure that they are intact and remain watertight. If all splices are found to be watertight, replace the splice box lid. In the control panel, carefully tug on each wire going to the splice box. Correct any wires that are loose. Reactivate and retest the system.

9. If the system operates but can't keep up with the flow, check the system for watertightness. A leaking tank can infiltrate enough water to overcome the pump. Also check for leaking fixtures in the home, though it is unlikely that a leaky fixture could provide enough liquid to overcome the pump.

Low Liquid Level Alarm

1. Determine the actual flows in the system. If the flows are considerably less than the timer is set for, then adjust the timer settings to match current flows. If low level exists in the drainfield pump basin, then ensure that the minimum runtime is appropriately set.

When a low liquid level condition exists, the source of the problem is likely one of the following:

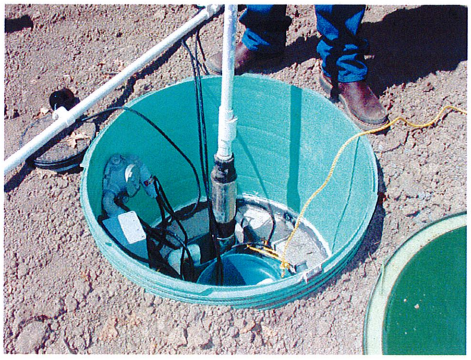
2. The tank may be siphoning. Inspect the liquid level in the tank. If the liquid level is below the "Redundant Off/Low Level Alarm" float, then likely the problem is either a leaky tank or siphoning. Siphoning typically occurs when the system is pumping downhill. A system will not necessarily siphon every time it operates. It is dependent on the system design. A siphoning system can be retrofitted with an anti-siphon valve. Most siphoning problems will manifest in the first months of operation.

3. If the hydraulics of the system do not allow for siphoning, then it is likely that the tank is leaking. Fill the tank to a normal operating level and return to inspect the tank at a later time. If the liquid level is below the normal operating level, the tank is leaking and needs to be repaired or replaced.

4. The pump may be high cycling. This is caused when the pump vault cartridge is clogged, causing the liquid level in the vault to drop faster then the liquid level in the tank. Remove the filter cartridge and clean it following the steps from *"Biotube® Pump Vault"* in Appendix B.

1. Close the ball valve on the discharge plumbing assembly, disconnect the union, and carefully remove the pump and attached plumbing from the tank. Disconnect the pump from the discharge plumbing assembly.

2. Remove the stainless steel screws from the splice box lid, being careful not to drop the screws into the tank. If the splice box was submerged, or if there is a crack in the conduit, there may be water in the splice box. If this is the case, remove the water with a syringe or other appropriate method. Loosen the cord grip at the splice box and identify the appropriate splice for the pump. Cut out the splices and label the wires.



3. Remove the inoperative pump and replace it with a new one of the same type. Push the pump cable through the watertight cord grip into the electrical splice box. Leave an adequate length of electrical cord coiled inside the riser to allow for easy removal of the pump. Tighten the cord grip *by hand, not by tool*, then test the tightness of the cord grip by tugging on the cord. A cable is secure when the cord grip is tight enough to prevent slippage. An adequate length of cord should be left within the splice box to allow for easy removal for future disconnecting and re-splicing.

4. Splice the pump wires to the appropriate wires from the control panel following the wiring schematics provided in Appendix F. Always use watertight heat shrink splice kits for all connections!

5. Reattach the discharge plumbing assembly and carefully lower the pump into the flow inducer alongside the Biotube® pump vault. Be careful not to lower the pump by the cable or to pinch the cable when lowering it into the flow inducer. Reconnect the union and open the ball valve.

6. Reconnect power and test the unit as per the instructions provided in the **Start Up & Operation** section of this manual.

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Appendix A

Warranty & Material List

Commercial and Multi-Family
AdvanTex® Treatment System
3-Year Limited Warranty

I, as the AdvanTex® Treatment System Owner, acknowledge that I have read, understand, and accept, all terms of this AdvanTex Treatment System Warranty provided by Orenco Systems®, Inc. I further acknowledge that Orenco's AdvanTex Treatment Systems must be operated within specified design flows and influent characteristics and must be properly maintained by an Orenco Authorized Service Provider, and that failure to operate this System within its design flows and influent characteristics or to perform scheduled maintenance shall void this Warranty. Abuse of this System will also void this Warranty.

AdvanTex® Treatment System Owner

(signature) _____

(printed name) _____ (date) _____

Organization/Address/Telephone

_____

_____

AdvanTex Dealer or Authorized Agent of Dealer

(signature) _____

(printed name) _____ (date) _____

Organization/Address/Telephone

_____

_____

W A R R A N T Y

1. **System Address:**

   _____

   _____

   _____

2. **Wastewater Treatment System Description as Exhibit A**

3. **Definitions**

   "Orenco" shall mean Orenco Systems, Incorporated.

   "Dealer" shall mean an authorized Orenco AdvanTex Treatment System Dealer.

   "System" shall mean the wastewater treatment system described in Exhibit A, attached hereto, and it shall exclude any and all components of the soil dispersal system.

   "Warranty" shall mean this System Limited Warranty.

   "Influent" shall mean the wastewater and solid, liquid, or gaseous contaminants within that wastewater that enter the AdvanTex recirculation tank from the primary tank.

   "Effluent" shall mean the wastewater leaving the System for dispersal in the drainfield or other receiving medium.

   "System Owner" shall mean the person(s) who own(s) the System at the time of installation.

   "Industrial Cleaning Products" shall mean chemicals and cleaners that are not normally present in human sewage or gray water, including but not limited to the following: carpet cleaners, scale removers, bleaches, wax strippers, metal polishes, drain cleaners, organic or chlorinated organic solvents, and degreasers or similar cleaning products.

4. **Limited Warranty**

   Subject to the conditions and limitations contained herein, Orenco warrants that System is free from defects in materials and workmanship, for a period of three years from the date of installation.

5. **Exclusive Remedy**

   The exclusive remedy for breach of this limited Warranty shall be for Orenco or an agent designated by Orenco to repair or replace all or part of the System (at Orenco's sole discretion).

Material List – Phase I

Orenco Systems®
Incorporated
1-800-348-9843

Recirculation/Blend Tanks

26	RP30	Riser Pipe; 13' Lengths; per ft., 30" Dia.
8	FL30G	Fiberglass Lid, 30" Dia. w/ gasket
2	G1L	Grommet, Loose, 1" Dia.
2	G125L	Grommet, Loose, 1-1/4" Dia.
6	G2L	Grommet, Loose, 2" Dia.
2	G4L	Grommet, Loose, 4" Dia.
12	ADHP10	Epoxy, 1 Pint
1	SB3	PVC Splice Box w/ 3 Cord Grips
1	SB5	PVC Splice Box w/ 5 Cord Grips
1	SBCS075	Conduit Seal Kit, 3/4" Dia.
1	SBCS100	Conduit Seal Kit, 1" Dia.
2	PVU95-3630-L	Universal Biotube® Pump Vault, 24" cartridge
4	P500712	OSI Effluent Pump; 3/4Hp, 230V, 60Hz, 10' Lead
4	PAWARRANTY	Pump Warranty, 5 year on OSI Pumps
4	HV200BCX	Hose & Valve Assembly, 2" Dia. w/ ball, check valve
1	MF3A-YP,G,W-48V	Float Assembly; (YP,G,W); 48" stem; pre-set
1	MF1A-W	Signal float w/collar; (W); 10ft cord
1	RSV4U	Recirculating Splitter Valve, 4" Dia. w/ unions

Treatment

2	V6403A	Distributing Valve Assembly, 2 outlets
2	RR2424	PVC Access Riser, 24" Dia.
2	FL24I2-4B	Fiberglass Lid, 24" Dia. w/ 2" insulation, 4-bolts
6	AX100	AdvanTex® Filter, Commercial, 100sqft.
1	AXPG15	AdvanTex® Pressure Gauge, 0-15 psi
6	AXVB1217	Valving Enclosure for AX100
4	AXVFA-VENT	Air inlet for AdvanTex®, commercial
1	AXVFA150	Ventilation Fan Assembly for AdvanTex®, FR150
1	AX-EXHAUST BASIN	Basin for Exhausting AdvanTex® Units
1	PBFS3036	PVC Pump Basin, 30" Dia.
1	FL30G	Fiberglass Lid, 30" Dia. w/ gasket

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Appendix B

Installation & Maintenance Instructions

Access Risers & Tank Adapters

Orenco Systems® Incorporated
1-800-348-9843

Installation Instructions

Access risers provide access to septic tank openings, simplifying inspection and maintenance procedures. It is important that the riser be sized correctly and installed properly to ensure a watertight seal. Without a watertight seal, groundwater or surface water can leak into the tank, reducing the tank's performance. When setting a riser, aim the grommets in the appropriate directions before bonding to the tank.

Riser Sizing

The installed riser should extend about 3 inches above the original ground level (approximately 2 inches for tank settlement and 1 inch to ensure drainage away from the riser). If the riser is too long, it may be cut to the appropriate height using a circular saw or table saw. Always cut excess length from the bottom of the riser. To ensure a good fit and watertight joint, a square cut is essential. If the riser is too short, a grade ring may be used as an extension.

Selecting a Riser and Tank Adapter Installation Method

To select an appropriate riser and tank adapter installation method, first determine the type of tank being used: concrete or fiberglass. Then refer to the chart, below, as you follow these steps:

Concrete Tanks

1. Determine desired riser diameter.
2. Determine if the riser tank adapter will be cast-in or bolted down.
3. Referring to the chart below, pick the appropriate tank adapter for your riser diameter and method of attachment. If the bolt-down method is being used, make sure the adapter you selected will cover the tank's opening.

Orenco Designed Fiberglass Tanks (contact your distributor or Orenco for other FRP tanks)

1. For 30" riser, choose the FRTA30-FRP tank adapter. (24" riser fits tank directly.)

Tank Adapter	Method of Attachment	Riser Diameter	Maximum Tank Opening
PRTA24	Bolted down or cast into concrete tank	24"	24" round/15" square
RRFTA	Bolted down to concrete tank or epoxied to top of non-Orenco FRP tank	21" or 24"	21" round/24" square
RRFTA30	Bolted down to concrete tank	30"	30" round/24" square
FRTA30	Bolted down or cast into concrete tank	30"	30" round/20" square
FRTA30-CAST	Cast into concrete tank	30"	20" round
FRTA30-BOLT	Bolted down to concrete tank	30"	29" round/21" square
FRTA30-FRP	Glued onto Orenco FRP tank or PRTA24, allowing it to accept 30" riser.	30"	23.5" round

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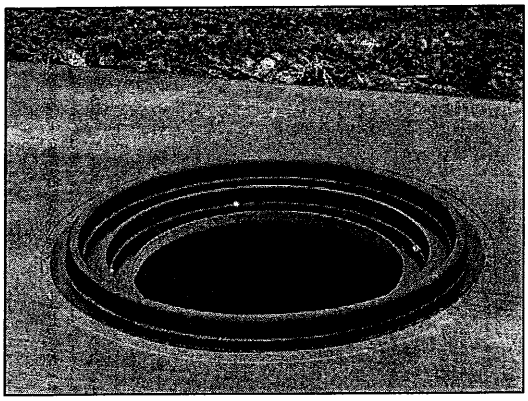
Installation Instructions (continued)

Instruction Set 1: Cast-In Adapters

Adapter Type Used: PRTA24, FRTA30, or FRTA30-CAST

Adhesive Used: ADH100 and/or MA320

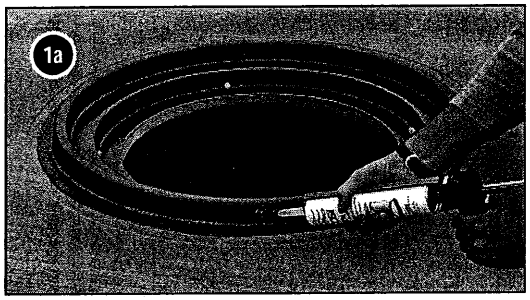
Bolt-Down Kit Used: None



Cast-in FRTA30-CAST tank adapter

Step 1a: Applying Adhesive

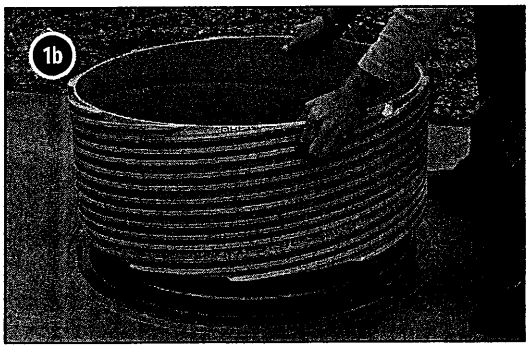
Apply adhesive to the outside surface of the riser tank adapter. Because ADH100 does not provide a structural joint for approximately 24 hours and may therefore slow the installation and backfilling process (if you have to backfill the same day), the use of both ADH100 and MA320 may be beneficial. Apply MA320 to the outside surface of the riser tank adapter for a quick structural joint (typically less than one hour). Then apply ADH100 to the inside of the adapter and the riser joint, for a watertight seal.



Applying adhesive to tank adapter

Step 1b: Placing Riser

Carefully slide the riser onto the adapter. Be sure to orient the riser correctly before adhesive cures.



Placing riser over tank adapter

Step 1c: Sealing Adapter-to-Riser Joint

Apply adhesive to the inside of the adapter and riser joint. Use a putty knife or similar tool to form a continuous fillet between the tank adapter and the inside of the riser.

Step 1d: Curing Adhesive

Allow adhesive to harden before backfilling. For ADH100, handling strength is typically achieved within 12 hours. For MA320, cure time is achieved within 30 minutes to 3 hours, depending on temperature.



Sealing riser to tank adapter joint

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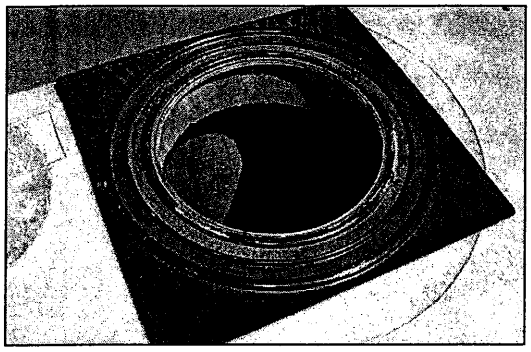
Installation Instructions (continued)

Instruction Set 3: Square Bolt-Down Adapters

Adapter Type Used: RRFTA, RRFTA30
Adhesive Used: ADH10 (IPS810)
Bolt-Down Kit Used: RRFTABDKIT, RRFTA30BDKIT



RRFTA tank adapter

Step 3a: Marking Bolt Hole Locations

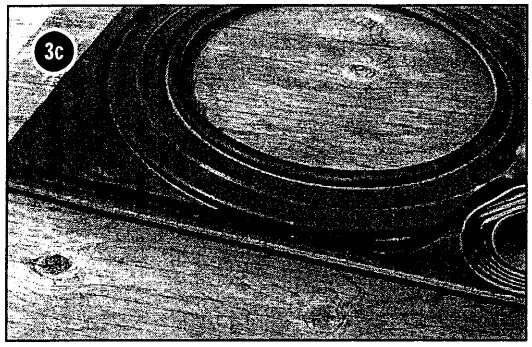
Using the tank adapter as a template, mark the bolt hole locations on the concrete tank.

Step 3b: Drilling Holes

Using a 1/4" masonry drill bit, drill each hole a minimum 1.375" deep to accept the concrete anchors. Clear hole of debris.

Step 3c: Applying Butyl Tape to Adapter

Apply Butyl tape just inboard of the bolt pattern to the underside of the tank adapter. Be sure to thoroughly clean the tape mating surface before applying. Place tank adapter on tank surface, Butyl tape side down, lining up the mounting holes.



Applying Butyl tape to RRFTA tank adapter

Step 3d: Assembling Anchor

Install the washer and begin threading the nut on the end of the concrete anchor. Leave nut flush with end of anchor to protect the threads.

Step 3e: Locating Anchor

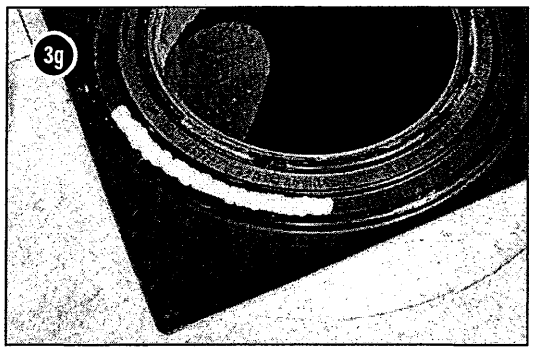
Using a hammer, drive the concrete anchor through the tank adapter mounting holes into the drilled recess in the concrete, until the anchor is bottomed out in the hole.

Step 3f: Securing Anchor

Bolt the tank adapter to the tank by tightening the anchor nut 3 to 5 turns past the hand tight position. Repeat the process until all concrete anchors are firmly attached. The Butyl tape should form a watertight seal between the adapter and tank.

Step 3g: Applying Adhesive to Adapter

Determine which groove in the adapter you will be using by test fitting your riser. RRFTA adapter accommodates both 21" and 24" diameter risers and require one pint of adhesive to fill the locating groove. RRFTA30 has only one groove for 30" diameter risers, and requires one quart of adhesive to fill the locating groove.



Applying adhesive to riser-locating-groove

Step 3h: Placing Riser

Set the riser in place by twisting gently while working it into the groove. If necessary, use a putty knife on the inside of the riser to shape the bead of displaced adhesive into a continuous, watertight fillet. Be sure to orient the riser correctly before adhesive cures.

Step 3i: Curing Adhesive

Allow adhesive to harden before backfilling.

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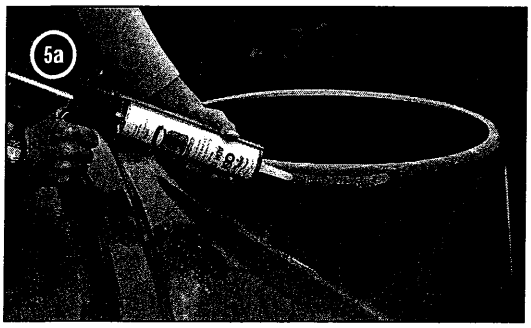
Installation Instructions (continued)

Instruction Set 5: Orenco 30" FRP Tank Adapter

Adapter Type Used: FRTA30-FRP
Adhesive Used: MA320 and/or ADH100
Bolt-Down Kit Used: None

Step 5a: Applying Adhesive

Apply adhesive to the outside surface of the riser tank adapter. Because ADH100 does not provide a structural joint for approximately 24 hours and may therefore slow the installation and backfilling process, the use of both ADH100 and MA320 may be beneficial. Apply MA320 to the outside surface of the riser tank adapter for a quick structural joint (typically less than one hour). Then apply ADH100 to the inside of the adapter and the riser joint, for a watertight seal.

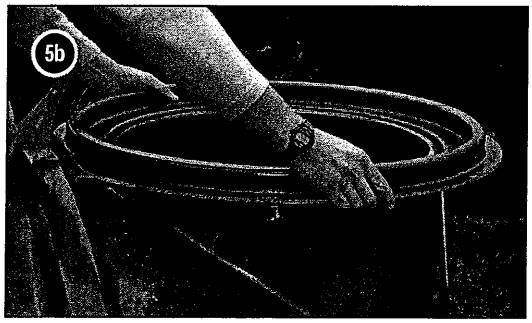


Applying adhesive to tank

Step 5b: Installing Riser

The riser may be installed and sealed to the adapter in the same way as with the cast-in adapter. (Refer to Instruction Set 1, steps 1b - 1d.)

Note: Adapter is only required with 30" risers. Orenco tanks accept 24" risers directly, with appropriate adhesive.



Placing adapter onto tank

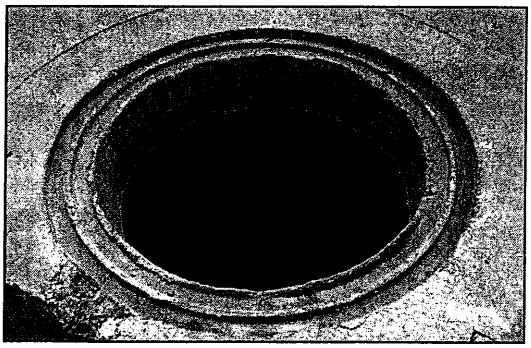
Instruction Set 6: Grooves in Tank

(Least effective method)

Adapter Type Used: None
Adhesive Used: ADH10 (IPS810)
Bolt-Down Kit Used: None

Step 6a: Preparing Mounting Surface

Roughen, clean, and dry the surfaces of the riser and tank where they are to be joined. If the groove is wet, sponge up as much water as possible, then dry thoroughly.

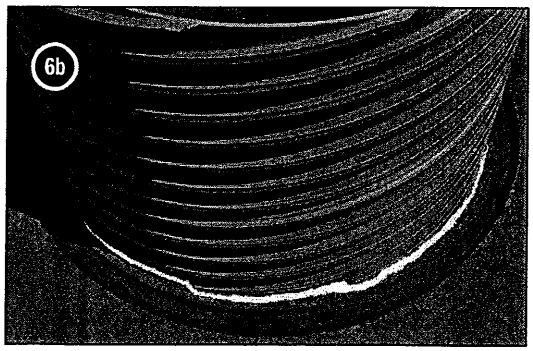

Groove formed in the top of septic tank outlet

Step 6b: Applying Adhesive to Groove

Fill the groove with approximately one pint of adhesive for 21" or 24" diameter grooves or one quart of adhesive for 30" diameter grooves.

Step 6c: Placing Riser

Set the riser in place by twisting gently while working it into the groove. Use a putty knife on the inside of the riser to shape the bead of displaced adhesive into a continuous, watertight fillet. Be sure to orient the riser correctly before adhesive cures.



Placing riser in locating groove

Step 6d: Curing Adhesive

Allow adhesive to harden before backfilling.

Caution: This method susceptible to failure due to tank settlement and frost heave.

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Splice Boxes

Orenco Systems® Incorporated
1-800-348-9843

Installation, Operation and Maintenance Instructions
Model SB__

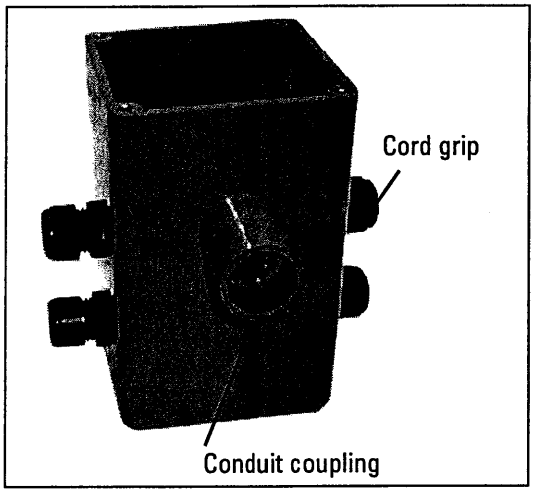
Installation Instructions:

The electrical splice box provides a safe and legal space for splicing cables, typically from pumps or float switches. It should be mounted inside the access riser, over the pump or filter unit, where the components being spliced are within sight of the installer. For explosion proof (Class 1, Div. 1) splice boxes, please see document NIN-SB-SBX-1.

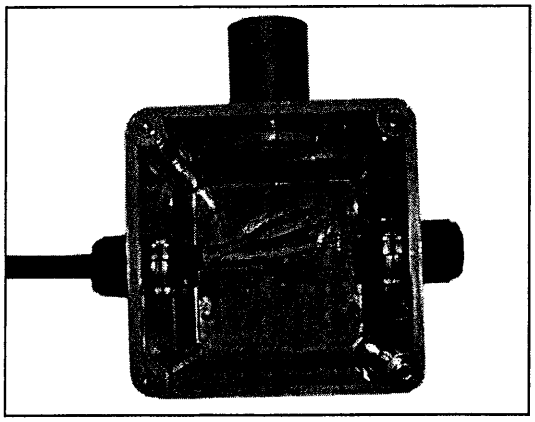
The splice box is provided with heat shrink butt connectors and waterproof wire nut(s) necessary to splice the appropriate floats and pumps.

1. The splice box should be mounted inside the access riser. The access riser is typically supplied with a grommet for installation of the splice box. If a grommet is not installed, please refer to riser, lid, and accessary instructions document NIN-RLA-G-1 for grommet installation instructions.

   Lubricate both the outside of the conduit coupling and the grommet. Slide the coupling through the grommet in the access riser wall. Make sure the box is pushed snug against the wall, allowing for removal of any pumping equipment.



2. Push the appropriate pump and level control wires through the watertight cord grips into the electrical splice box. Leave an adequate length of electrical cable coiled inside the riser to allow for easy removal of the pump and float assembly. **Do not remove the colored markers or the paper tags from the float cables, and do not try to thread the markers and tag through the cord grip.** Tighten the cord grips by hand, not by tool, then test the tightness of the cord grips by tugging on each cable. A cable is secure when the cord grip is tight enough to prevent slippage. Adequate lengths of cable should be left within the splice box to allow easy removal for future disconnecting and re-splicing.



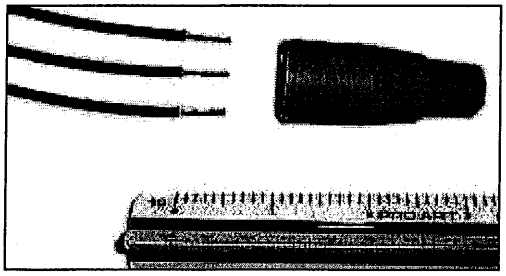
Installation Instructions (continued)

All splices within the splice box shall be made waterproof using wire nuts or butt connectors and heat shrink tubing as shown on the appropriate splice box diagram. The splices must be waterproof! Splices that are not waterproof may cause a malfunction of the pump controls if water should leak into the splice box. Refer to the Splice Box Wiring Diagram(s) provided for instructions on how to connect the floats switches.

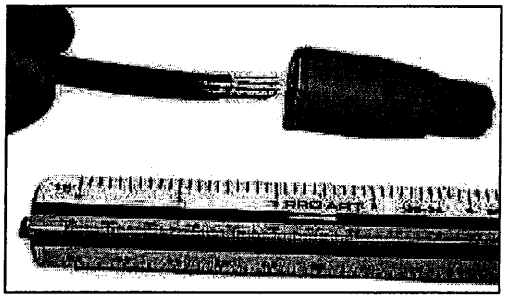
4. Splicing With Waterproof Wirenuts

a. Remove approximately 1/2" of insulation from the end of each wire to be connected.

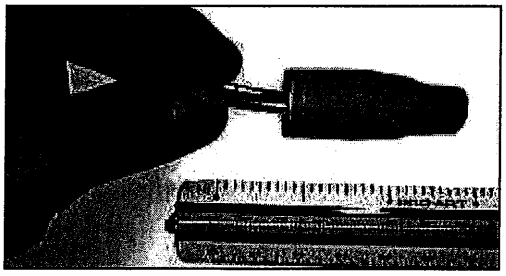
   Prevent frayed strands as much as possible.

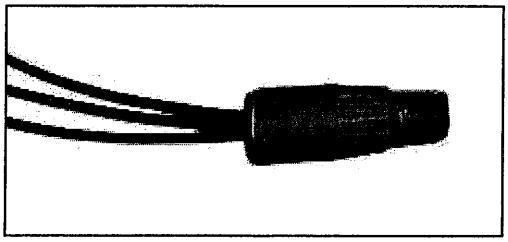


b. Do not pre-twist entire wire bundle. Only twist individual stranded wires slightly if needed. Hold wire bundle firmly 2 inches from wire ends. Fully insert all the wires together through the sealant into the connector. Continuing to hold wires firmly, twist connector clockwise onto wires.



c. Once a connection is made, tug on each wire entering the connector to check the mechanical connection. ***Note: Watertight connectors are not reusable. To change a splice, twist off and replace with a new connector.***





Operation and Maintenence

Remove splice box lid and check for moisture. Make repairs as required. Some condensation is normal.

Biotube® Pump Vault

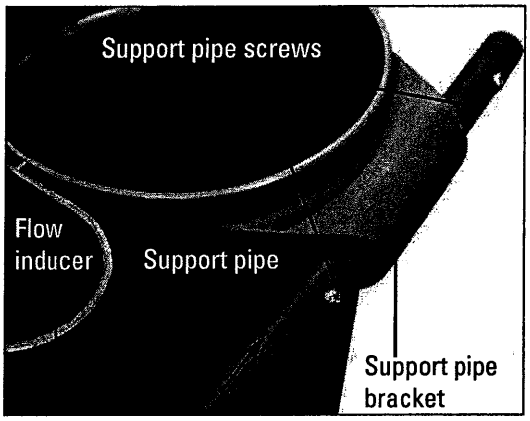
Orenco Systems® Incorporated
1-800-348-9843

Installation and Maintenance Instructions
Model PVU____

The Biotube Pump Vault* is suspended in the septic tank by schedule 80 support pipes. The vault comes with a Biotube filter cartridge, float stem bracket, and support pipes. Each pump vault houses either one (Simplex) or two (Duplex) High Head Effluent Pumps, discharge assembly(ies), Biotube filter cartridge, float switch assembly, and float stem bracket.

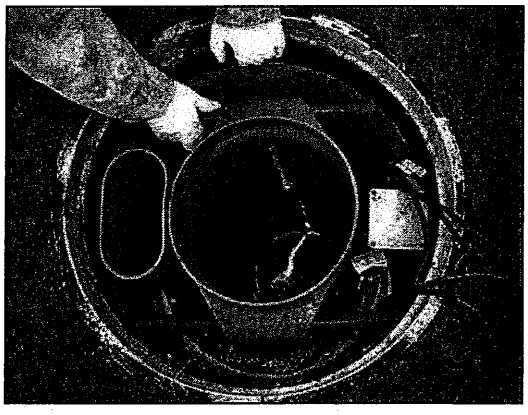
1. The Biotube Pump Vault's support pipes are typically pre-installed. If you need longer pipes, you can cut them in the field. Remove one support pipe screw, pull the standard support pipe out, and re-install your longer ones.

   If you're installing Orenco's longer, 30" support pipes (instead of cutting your own), position the support pipes with the long end oriented towards the flow inducer, so that the pre-drilled holes are outside the bracket. Screw down the stainless steel screws until 1/4" of thread is showing, to lock the support pipes into place.



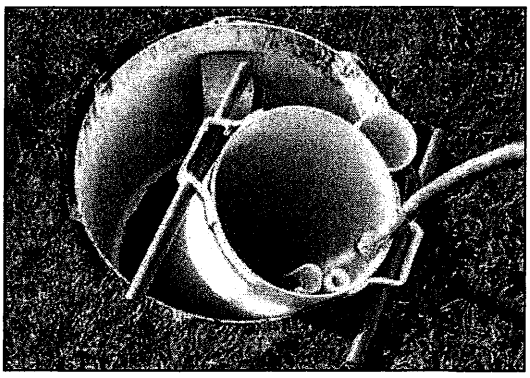
Step 1: Preparing the support pipes

2. Gently lower the vault into position in the access riser. The support pipes should rest on the top of the tank (unless the vault was designed specifically to rest on the bottom of the tank).



Step 2: Lowering vault into riser

Important: If the tank is full of sewage, rest the vault on top of the liquid surface and lower it by filling the vault with water (from a hose) to prevent any floating materials from entering the vault through the inlet holes, as well as to counteract the buoyancy of the empty vault.



Important: Sinking the vault

* U.S. Patent Nos. 4,439,323 and 5,492,635

Biotube® Pump Vault

Orenco Systems® Incorporated
1-800-348-9843

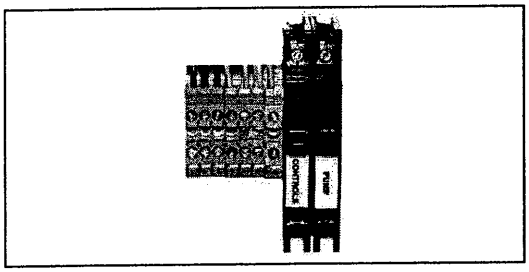
Maintenance Instructions
Model PVU____

Inspecting the Filter Cartridge

Determine whether the Biotube effluent filter needs cleaning by testing the change in the tank's liquid level when the pump is on. Turn the recirc pump on by flipping the MOA switch in the control panel to Manual. **Watch the liquid level inside the screened vault as the pump is running for about 30 seconds to determine if there is any noticeable liquid level differential between it and the tank liquid level.** Return the MOA switch to Auto. When the liquid level difference between the inside and outside of the vault is about two inches or more, of if the low-level alarm is activated, the Biotube cartridge may need to be cleaned. **

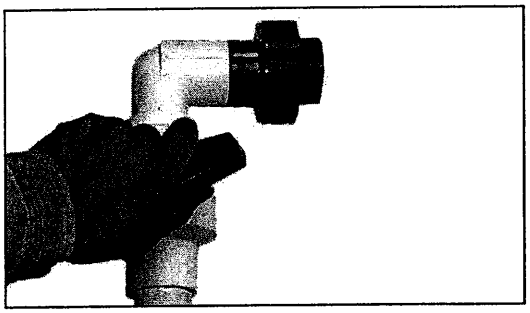
Filter Cartridge Cleaning

1. Disable power to the pump. This can easily be done by switching the HOA switch to the "Off" position, flipping the pump control circuit breaker(s) and the control circuit breaker to "Off." All these features should be readily accessible in the control panel.



Step 1: Turning power off

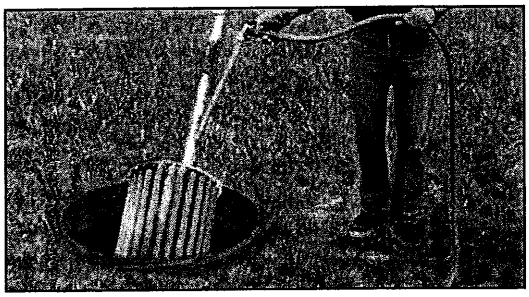
2. If the discharge assembly contains a ball valve, make sure it is completely closed. If necessary, disconnect the union in order to allow removal of the filter cartridge.



Step 2: Closing ball valve

3. Slide the cartridge out of the vault and hold it over the open inlet of a septic tank. The float assembly may need to be removed. Carefully spray the buildup that has formed on the cartridge tubes back into the the tank. Do not clean over open vault! If significant solids are evident in the bottom of the vault, go to step 5 for cleaning the vault.

Important: After cleaning the filter cartridge, inspect the pump vault, pump, and float stem assembly. If any further maintenance is required, do not replace the filter cartridge as described in Step 4. Go to step 5.



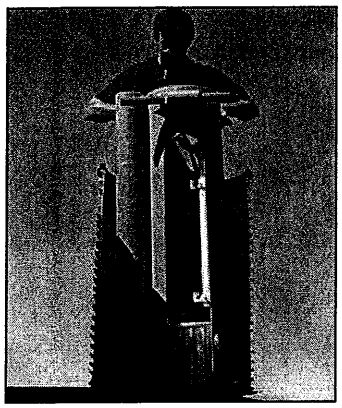
Step 3: Cleaning the filter cartridge

** U.S. Patent Nos. 4,439,323 and 5,492,635*

*** Premature plugging of the cartridge may result from abuse of the system. Such abuse might take the form of a large scale home canning project with concurrent overuse of the garbage disposal. More likely though, it will be excessive inflow resulting from a plumbing leak under the house, a leaky septic tank, a homeowner taking in laundry, two or more families using a tank designed for one, etc. Plugging of the cartridge, however, should be considered a success, not a failure, as the cartridge serves to protect the integrity of the collection and treatment facilities. Cleaning a cartridge is quick and easy and infinitely preferable to the damage that solids carryover can cause downstream in the system.*

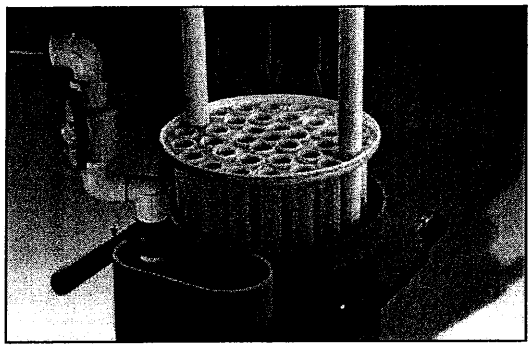
Maintenance Instructions (continued)

6. Slowly lift the Biotube vault out of the tank, allowing the effluent in the vault to empty out the drain flap. Any solids should be dumped back into the septic tank.



Step 6: Lifting vault from tank

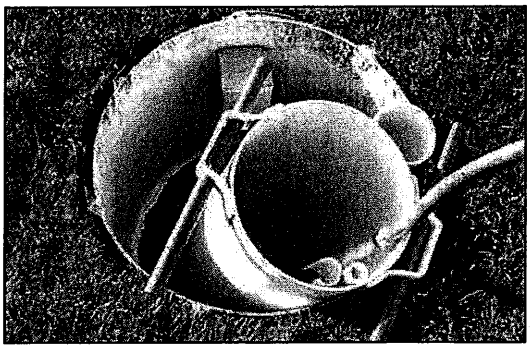
7. Slide the cleaned cartridge (see Steps 1-4) into the vault. Clip the float stem assembly onto the cartridge. Return the vault into the tank and gently lower the pump into the vault.



Step 7: Sliding filter cartridge back into vault

Important: To prevent the vault from floating and the cartridge from being fouled by solids floating in the tank, it is essential to run clear water (as from a hose) into the vault to sink it. If the pump chamber has been pumped, refill the tank with clean water to the system's normal operating level.

8. Connect the union and make sure the ball valve is open.

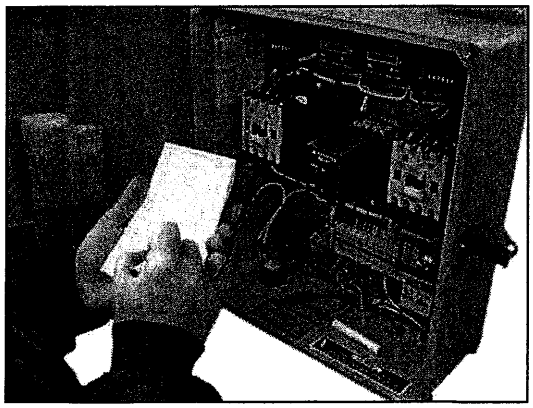


Important: Sinking the vault

9. On the form that follows, record that you have cleaned the cartridge. Also record any observations that you made regarding the tank or system in general.

10. Return power to the system.

Make sure to clean up thoroughly when finished.



Step 9: Recording activities

Discharge Plumbing Assemblies

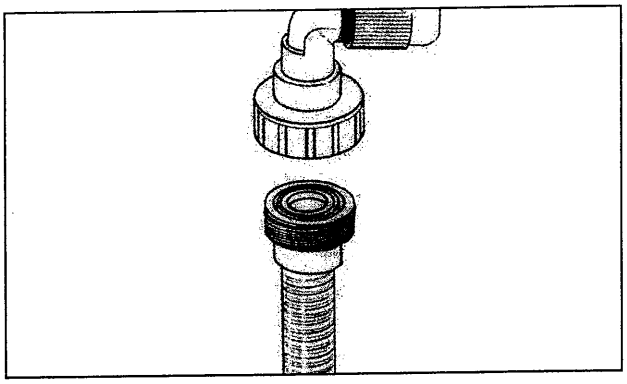
Orenco Systems® Incorporated
1-800-348-9843

Installation, Operation and Maintenance Instructions
Models HV100__, HV125__, HV150__, HV200__

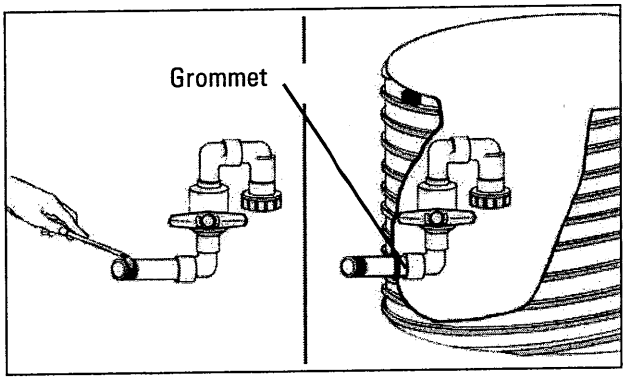
Installation Instructions:

The Discharge Plumbing Assembly (a.k.a. "Hose & Valve" Assembly) is the route by which the effluent travels from the effluent pump to the transport pipe. It is composed of rigid PVC pipe, a flexible PVC hose, a union, and a series of threaded elbows. Options include ball valves, check valves, gate valves, external flex hose assemblies, and anti-siphon assemblies.

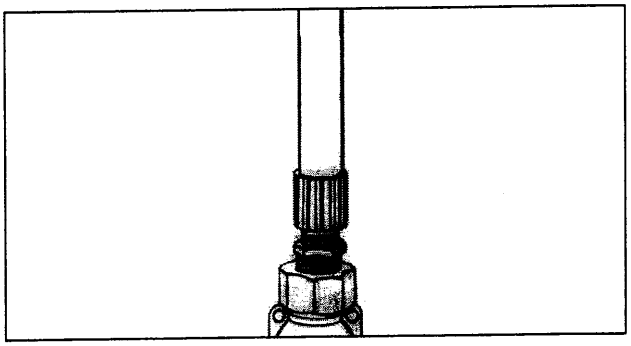
1. Unscrew the union in the discharge plumbing assembly. Set the section including the stem aside.



2. Lubricate the pipe grommet in the access riser and the grey sch. 80 nipple with vaseline or an equivalent product. Push the nipple through the pipe grommet, leaving as much of the grey PVC on the outside of the riser as possible to minimize obstruction within the riser.

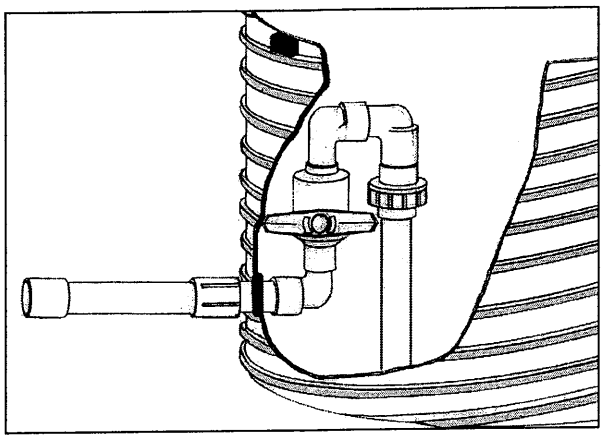


3. Screw the male adapter at the bottom of the discharge plumbing assembly stem into the pump discharge.



Installation Instructions (continued)

6. If an external flex is included, apply teflon paste or tape to the threads of the sch. 80 nipple extending from the access riser and screw the female threaded end of the flex connection onto the nipple.
7. Glue the transport pipe to the coupling on the end of the flex connection.



Adjusting the Height of the Assembly

If the stem of the discharge plumbing assembly is too short, it can easily be extended. Simply cut a piece of PVC pipe to length as needed, and glue adapters (one male and one female) on each end. Insert this piece between the pump discharge and the bottom of the discharge plumbing assembly stem.

If the stem of the discharge plumbing assembly is too long, cut length out of the stem and reattach with a slip coupling.

Float Switch Assemblies

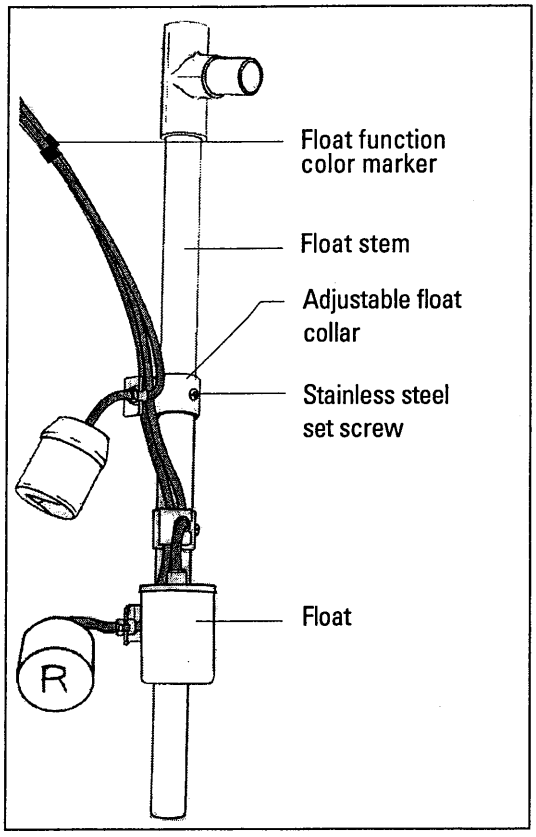
Orenco Systems® Incorporated
1-800-348-9843

Installation, Operation and Maintenance Instructions
Model MF__

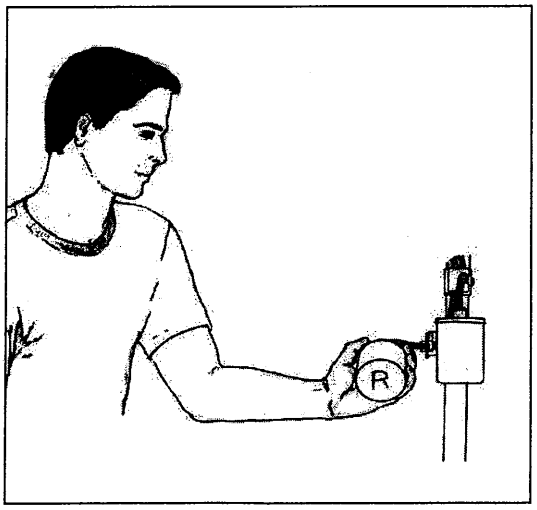
Installation Instructions:

The float switch assembly is typically mounted in the screened pump vault or effluent screen inside of a septic or dosing tank. The assembly is detachable without removal of the screened pump vault or effluent screen. A typical float switch assembly is shown below.

1. Each float cable is provided with a color marker. This marker indicates the function of the float. Make sure that your float cable color markers correspond with the testing instructions and splice box wiring diagrams provided. If the testing instructions or splice box wiring diagram do not match your float cable marker colors, contact Orenco Systems® Inc. or your local dealer for assistance.

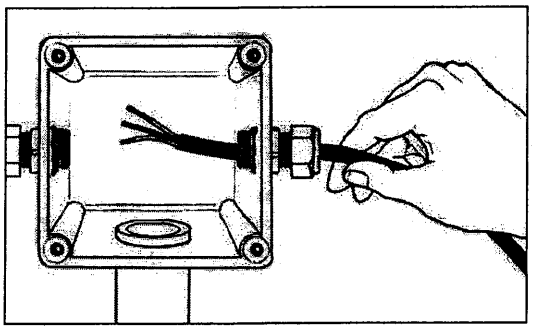


2. To check for proper float switch operation, move each switch up and down and check for interference. Remove the assembly from its holding bracket by snapping it out of the holding bracket.



Installation Instructions (continued)

7. When used with an Orenco electrical splice box:



Push the level control wires through the watertight cord grips into the electrical splice box. Leave an adequate length of electrical cable coiled inside the riser to allow for easy removal of the pump and float assembly. **Do not remove the colored markers or the paper tags from the float cables, and do not try to thread the markers and tag through the cord grip.** Tighten the cord grips *by hand, not by tool*, then test the tightness of the cord grips by tugging on each cable. A cable is secure when the cord grip is tight enough to prevent slippage. Adequate lengths of cable should be left within the splice box to allow easy removal for future disconnecting and re-splicing.

See the splice box instructions, document NIN-SB-SB-1 and corresponding splice box diagram for connection instructions.

Maintenance Instructions on page 4.

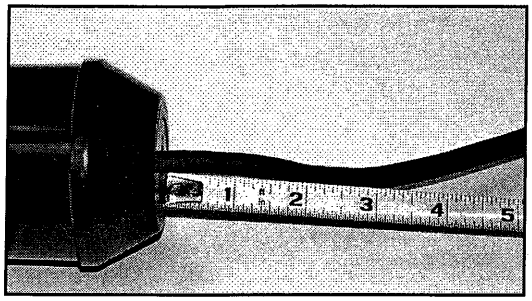
Float Collar Instruction Guide

Orenco Systems® Incorporated
1-800-348-9843

Float Collar Installation

Step 1: Marking Float Cord Tether Length

Using the manufacturers instructions provided with your floats, determine the proper float cord tether length, and mark the position on the cord.



Marking Float Cord Tether Length

Step 2: Attaching Float Collar to Float

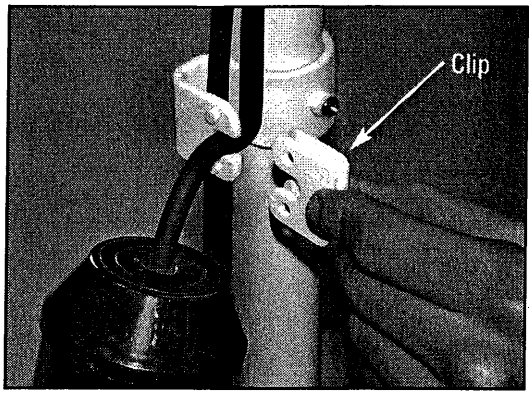
Insert the marked portion of the float cord into the slot in the float collar, and slide the clip onto the collar. The clip is secured by two retaining pegs molded onto the float collar.

The clip is labeled with an "L" on one side, and an "S" on the other, as viewed from the side facing away from the collar. The range of float cord diameters each clip position will clamp is listed below:

"L" Clip position: up to 0.35"

"S" Clip position: down to 0.28"

Use the clip position that holds the cord the tightest without distorting the clip. The cord should not slip when pulled moderately by hand.

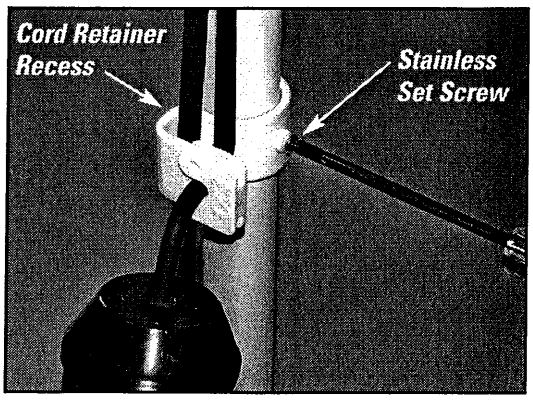


Attaching Float Collar

Step 3: Securing Float Collar to 1" Schedule 40 PVC Pipe

Secure float collars in proper location, using stainless steel set screw provided in the kit. Tighten the set screw until float collar is firmly clamped.

Note: A cord retainer recess is built into the collar. The cords from lower floats can be tucked into the recess, keeping the cords from becoming tangled with floats.



Securing Float Collar to Float Stem

Float Collar Adjustments

Adjusting Float Height

Float height can be adjusted by loosening the stainless steel set screw and simply sliding the float collar up or down the float stem.

Adjusting Float Cord Tether Length

Float cord tether length can be adjusted by removing the clip, adjusting the cord's position, and reinstalling the clip.

AX100 Inlet Valve Assembly

Orenco Systems® Incorporated
1-800-348-9843

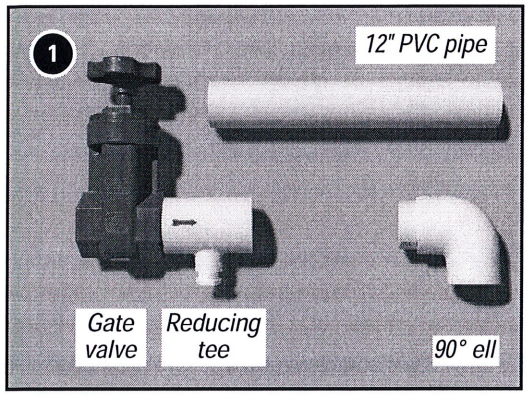
Assembly and Installation Instructions

The inlet valve assembly connects the transport lines of a commercial AdvanTex® Treatment System to the AX100 pods. It consists of three components ❶ that are joined differently depending on whether the installation is to be exposed or bermed:

- *1-1/2" PVC gate valve and reducing tee assembly (with threaded plug)*
- *1-1/2" PVC 90-degree ell (with stub nipple)*
- *1-1/2" PVC pipe (12" long)*

Your order might also include the enclosure for bermed installations and a pressure gauge kit (for either configuration), which includes a gauge and a reducer bushing. (These kits must be ordered separately.)

IMPORTANT: Flush all transport lines before connecting inlet valve assembly.

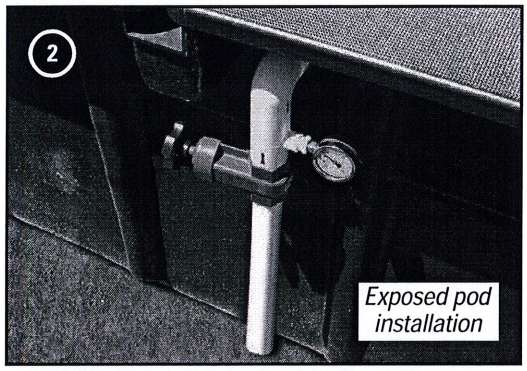


Exposed pod installation

If you are leaving the AdvanTex pods exposed, glue the stub end of the ell to the **reducing tee** (downstream) end of the assembly, orienting the ell such that it faces away from the red "flow direction" arrow ❷.

Cut a 3.5" length from the 12" pipe and glue it to the open end of the ell.

Glue the gate valve end of the assembly to the (vertical) transport pipe and glue the 3.5" pipe to the pod inlet. The red "flow direction" arrow on the assembly should face out and point up.



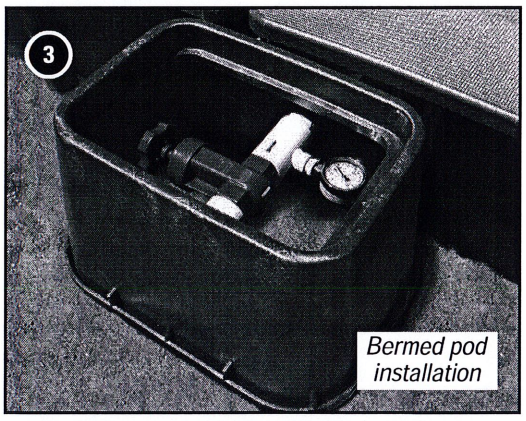
Bermed pod installation

If you are berming around the pods, glue the stub end of the ell to the **gate valve** (upstream) end of the assembly, orienting the ell such that it faces away from the red "flow direction" arrow ❸.

Use the supplied 12" pipe (or any minimum 10" length) to connect the assembly to the pod inlet. Direct the pipe through the hole in the side of the enclosure (ordered separately) and glue it to the pod inlet and to the reducing tee end of the assembly. The red "flow direction" arrow should face up and point in toward the pod.

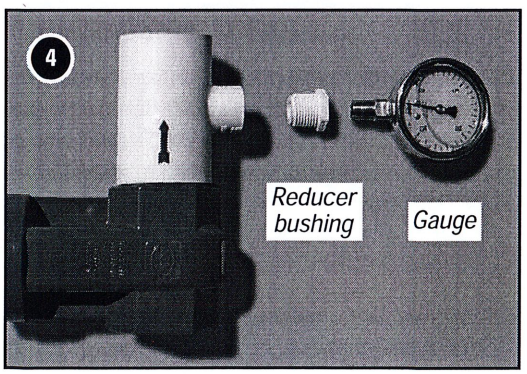
NOTE: Make sure the assembly is positioned in the enclosure so that the pressure gauge can be easily connected and disconnected.

Glue the open end of the ell to the (vertical) transport pipe.



Pressure gauge installation

The pressure gauge (ordered separately) is used for system start-up and maintenance. When using the pressure gauge for either configuration, remove the threaded plug from the reducing tee and insert the reducer bushing ❹. Insert the pressure gauge and hand tighten until the face of the gauge is positioned for easy readability.



Finishing up

Backfill using sand, pea gravel, or native soil free of all deleterious material. Paint exposed PVC pipe for protection against ultraviolet rays.

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Ventilation Fan Wiring

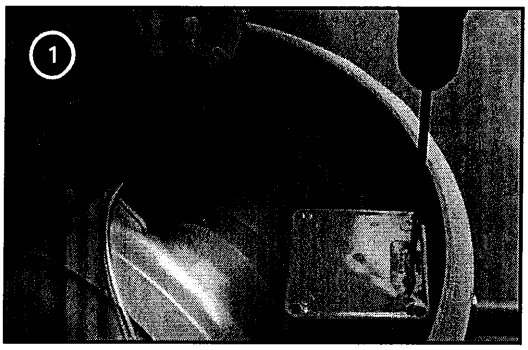
Orenco Systems®
Incorporated
1-800-348-9843

Installation and wiring instructions for AX-VFA (150, 160, 200, 250) and RX-VFA (100)

Step 1:

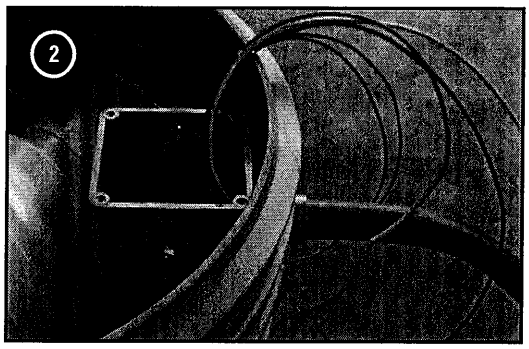
Unscrew the splice box cover and remove the pressure sensor assembly from the splice box. Set the pressure sensor assembly aside.

NOTE: Do <u>not</u> wire the pressure sensor in line with the fan as a pressure switch.



Step 2:

Bring the electrical conduit into the splice box wiring entrance in the riser, and push five wires through the conduit: a ground wire (green) and two control wires (red) for the pressure sensor (if a fan failure alarm is desired); and a hot (black) and a neutral (white) for the fan.



Step 3:

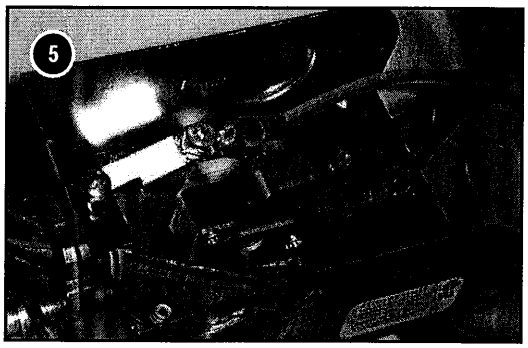
Remove the pressure sensor cover.

Step 4:

Insert a chase nipple (not provided) into the the hole in the pressure sensor junction box; then run the two red wires and the ground wire through the chase nipple into the pressure sensor junction box.

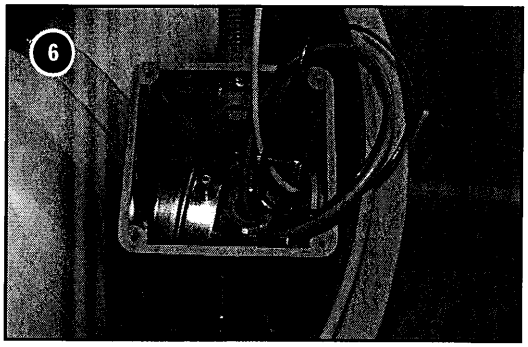
Step 5:

Crimp push connectors onto the red control wires and a fork connector onto the ground wire. Then clip the two control wires to the terminal prongs on the pressure sensor and fasten the ground wire fork with the grounding screw.



Step 6:

Replace the pressure sensor assembly cover and reinsert the pressure sensor into the splice box. Make sure the hose barb is sticking up and the chase nipple is close to the outer rim of the riser (where the conduit enters the splice box).



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Appendix C

Submittals

Access Risers – Perma-Loc Submittal Data Sheet

Orenco Systems®
Incorporated
1-800-348-9843

Applications

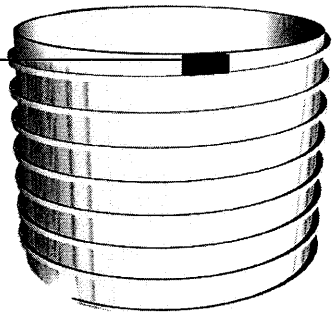
Orenco Access Risers are used to provide easy entry to septic tank access ports for maintenance purposes.

General

Orenco Perma-Loc Access Risers are constructed of ribbed PVC pipe and are available in 21", 24", and 30" diameters. 21" and 30" risers come with bolt catches for fastening lids. 24" risers come with a gasketed ABS lid adapter for fastening lids. Risers are available in any height in one-inch increments.

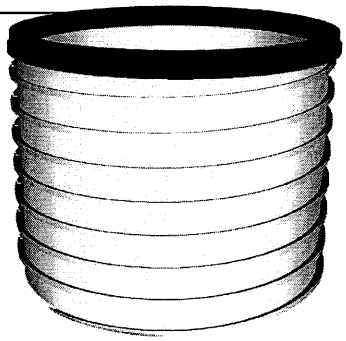
Bolt Catch

For use with 21" and 30" fiberglass access lids



Lid Adapter

For use with 24" fiberglass access lids



Standard Models

RR21XX, RR24XX, RR30XX

Nomenclature

RR □□ □□ + ____ + ____

- Ribbed riser
- Indicates riser diameter: 21", 24", 30"
- Indicates riser height (inches)
- Indicates splice box option:
  S = 1" grommet installed
  L = 1.25" grommet installed
  S1 = SB1 attached
  S2 = SB2 attached
  S3 = SB3 attached
  S4 = SB4 attached
  L5 = SB5 attached
  L6 = SB6 attached
- Indicates discharge grommet option:
  10 = 1"
  12 = 1-1/4"
  15 = 1-1/2"
  20 = 2"

Specifications

Dimensions

	Model RR21XX	Model RR24XX	Model RR30XX
I.D. (in.)	20.75	23.5	29.5
Wall Thickness - excluding ribs (in.)	0.12	0.14	0.20
O.D. - including ribs (in.)	21.91	24.82	31.00

Materials of Construction

Ribbed PVC pipe: PVC
Bolt catch: PVC
Lid adapter: ABS

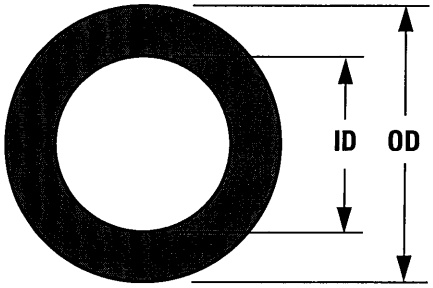
Pipe Grommets

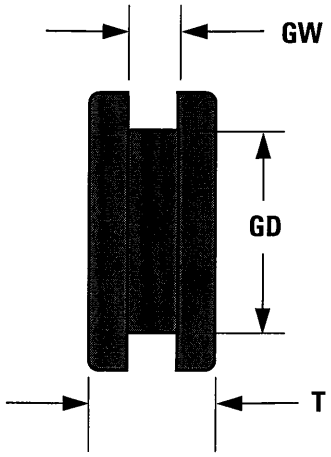
Submittal
Data Sheet

Orenco Systems®
Incorporated
1-800-348-9843

Applications

Orenco Pipe Grommets are used to provide a seal to prevent the passage of liquids through pipe ports.





General

Orenco Pipe Grommets are constructed of corrosion-resistant rubber to provide long-lasting seals. Grommets conform to standard IPS sizes. Not all models conform exactly to the depiction shown.

Standard Models

G05L, G075L, G1L, G125L, G150L, G2L, G3L, G4L, G6L

Nomenclature

G □□□ L

- L — Indicates not installed
- □□□ — Indicates grommet diameter:
  - 05 = 1/2"
  - 075 = 3/4"
  - 1 = 1"
  - 125 = 1-1/4"
  - 150 = 1-1/2"
  - 2 = 2"
  - 3 = 3"
  - 4 = 4"
  - 6 = 6"
- G — Grommet

Specifications

Dimensions

Model	G05L	G075L	G1L	G125L	G150L	G2L	G3L	G4L	G6L
OD (inches)	1 1/4	1 1/2	1 7/8	2 1/8	2 1/2	3 7/8	5	6	8 1/8
ID (inches)	3/4	1	1 1/4	1 1/2	1 3/4	2 1/8	3 1/4	4 3/16	6 11/16
GD (inches)	1	1 1/4	1 5/8	1 3/4	2 1/8	2 11/16	3 13/16	4 15/16	7 5/8
GW (inches)	3/16	3/16	1/4	1/4	1/4	5/16	5/16	1/4	1/4
T (inches)	1/2	7/16	9/16	5/8	5/8	15/16	15/16	7/8	13/16
Holesaw Size (inches)	1	1 1/4	1 9/16	1 3/4	2 1/8	2 3/4	3 7/8	5	7

Material of Construction:

EPDM synthetic rubber in accordance with MIL-STD-417, 60 durometer.

Fiberglass Access Lids

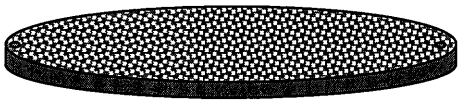
Submittal Data Sheet

Orenco Systems®
Incorporated
1-800-348-9843

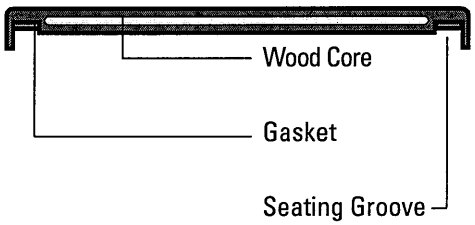
Applications

Orenco Fiberglass Access Lids are used as riser covers, pump basin covers, and access port covers. Lids fit "Perma-Loc" and "Ultra-Rib" type pipe.

Actual View



Cutaway View



General

Orenco Fiberglass Access Lids are molded using fiberglass reinforced polyester resin encapsulating a wood core. The finish is green and the top surface is textured to provide a non-skid surface. (Gasketed lids include a polyurethane gasket, which is cast-in). Lid comes with either two or four 1/4" or 5/16" stainless steel flathead socket cap screws and a hex key wrench. The 1/4" screws are used with Orenco inserts and the 5/16" screws are used with bolt catches and with Orenco's Riser-to-Lid Adapter.

Standard Models

FL18G-4BU, FL21G, FL24G, FL24-4B, FL24G-4BU, FL30G, FL48G

Nomenclature

FL □□ □

- □: Indicates options:
  G = gasket
  V = vent
  CF = carbon filter
  I2 = 2" insulation
  I4 = 4" insulation
  4B = 4 bolt hole lid with four 5/16" bolts
  4BU = 4 bolt hole lid with four 1/4" bolts
- □□: Lid diameter: 18", 21", 24", 30", 48"
- FL: Fiberglass lid

Specifications

Dimensions

	Model FL18	Model FL21	Model FL24	Model FL30	Model FL48
O.D. (in.)	20	22.5	25.5	32	53.875
Groove I.D. (in.)	17.5	20.75	23.5	29.5	47.5
Avg. Thickness (in.)	.625	1	1	1.25	1.5

Orenco Fiberglass Access Lids are capable of supporting a 2500 lb. wheel load; however, they are not designed or recommended for vehicular traffic.

Options Available

Feature	Model Code Adder	Optional/Standard
Air Vent	V	Optional
Carbon Filter*	CF	Optional
Lid Insulation	I2 or I4	Optional

*For more information on this option, refer to the Carbon Filters submittal data sheet, ESU-RLA-CF-1.

Materials of Construction:

Fiberglass Reinforced Polyester
Wood Core
Polyurethane Gasket

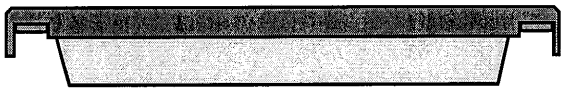
Lid Insulation (for fiberglass access lids)

Submittal Data Sheet

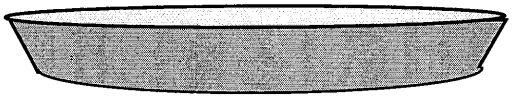
Orenco Systems®
Incorporated
1-800-348-9843

Applications

Orenco Lid Insulation is used to insulate Orenco fiberglass access lids.



Side View
(lid insulation in place)



Side View

General

Orenco Lid Insulation is attached to the Orenco fiberglass lid using stainless steel screws and a screw plate. Insulation is stackable for additional thermal protection.

Standard Models

INS212, INS242, INS302

Nomenclature

INS XX X

- X: Indicates insulation thickness (inches)
- XX: Indicates diameter of lid being fitted (inches)

Specifications

Dimensions

	Model INS21X	Model INS24X	Model INS30X
O.D. (in.)	20	23	28.5
Thickness Increments (in.)	2	2	2
R-Value (per increment)	10	10	10
Taper Angle (approx.)	15	15	15

Materials of Construction:

Insulation:	Blue Styrofoam
Screws:	Stainless Steel
Screw Plate:	PVC per ASTM D-1784

NSU-RLA-INS-1
Rev. 2.1, © 9/99

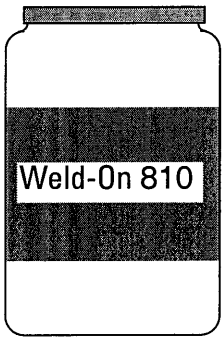
Weld-On 810 Epoxy

Submittal
Data Sheet

Orenco Systems®
Incorporated
1-800-348-9843

Applications

Weld-On 810 is used for joining, fabricating, or repairing PVC fittings, CPVC fittings, and dissimilar materials.





General

Weld-On 810 is a two-part opaque white plastic resin adhesive (epoxy). It adheres to both plastic and nonplastic products for strong, watertight joints. Upon curing, the seal created is both water- and chemical-resistant.

Weld-On 810 can be used for dissimilar products such as PVC, ABS, fiberglass, acrylic polycarbonate, styrene, metals, concrete, and clay.

Standard Model

ADHP10, ADHQ10, ADHG10.

Nomenclature

ADH□10

Amount of epoxy
P = pint
Q = quart
G = gallon

Specifications

Upon mixing of the components A and B, pot life is approximately 30 minutes at 75° F.

Hard gel cure time is approximately 2 hours; ultimate bond strength occurs after 24 hours at 70° F. Cure time, however, increases greatly with a decrease in temperature.

Expected shelf life is approximately 12 months when stored at temperatures between 45 - 85° F.

Materials of Construction:

Component A:	Acrylic reactive cement. Mixture of acrylic resin (45%) and methyl methacrylate (55%). Chemical formula withheld for proprietary reasons by IPS Corporation.
Component B:	Organic peroxide solution. Contains methyl ethyl ketone (55%) and benzoyl peroxide (10%). Chemical formula withheld for proprietary reasons by IPS Corporation.

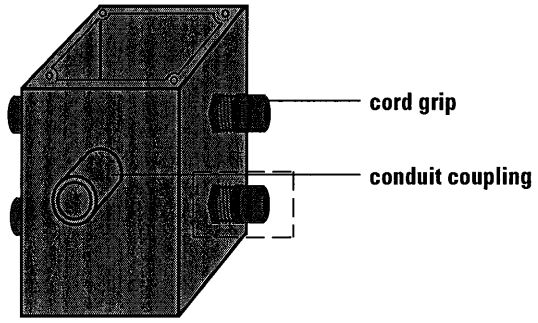
Splice Boxes

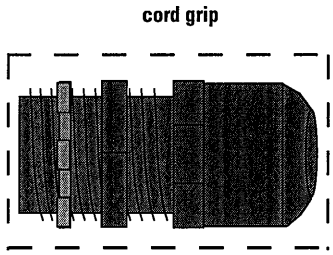
Submittal
Data Sheet

Orenco Systems®
Incorporated
1-800-348-9843

Applications

Orenco Splice Boxes are used in risers to house spliced wire connections between an electrical control panel and such equipment as effluent pumps and float switches.





General

Orenco Splice Boxes are available with one to six watertight cord grips. Included are heat shrink connectors, a neoprene sealing gasket, and four stainless steel lid screws.

Standard Models

SB1, SB2, SB3, SB4, SB5, SB6.

Nomenclature

SB □ □

A = Splice box is to be factory-installed to the riser or pump basin

Number of cord grips

Splice box

Specifications

Model	No. of Cord Grips	Conduit Size (in.)
SB1	1	3/4
SB2	2	3/4
SB3	3	3/4
SB4	4	3/4
SB5	5	1
SB6	6	1

Splice Boxes are 4" wide x 3.45" long x 6.25" deep. They conform to UL 514C, CSA C22.2 No. 85 1968, and have a NEMA 4X rating. Neoprene seal can withstand water pressures up to 70 psi.

Cord grips are registered under U.S. patent No. 5,405,172 and are listed under UL file number E-51579 and CSA file number LR-93876. Grips can house cords with diameters between 0.17" and 0.47" and can withstand temperatures of up to 212° F.

Materials of Construction:

Splice box:	PVC per ASTM D-1784
Conduit coupling:	PVC per ASTM D-1784
Cord grip:	Nylon
Locknut:	Stainless steel

Universal Biotube® Pump Vaults

Submittal Data Sheet

Orenco Systems®
Incorporated
1-800-348-9843

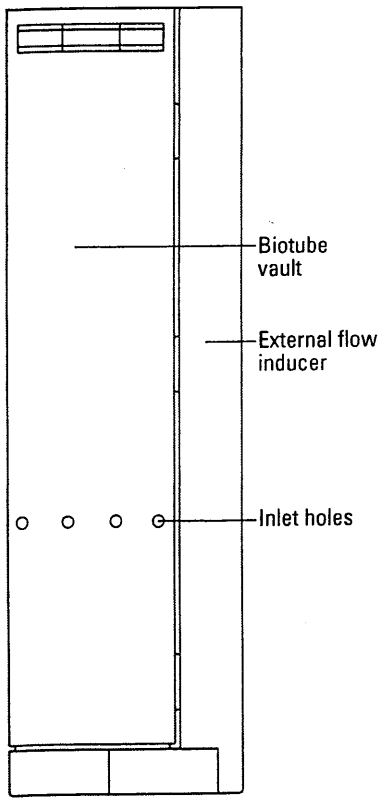
For use with Orenco 4" Submersible Effluent Pumps

Applications

Orenco Biotube Pump Vaults are used to filter effluent being pumped from septic tanks or separate dosing tanks in STEP systems and onsite wastewater disposal systems. Removes two-thirds of suspended solids, on average. When pumping from a single compartment tank or two compartment septic tank where both compartments are simultaneously drawn down during pumping, the discharge rate should not exceed approximately 40 gpm. Higher flow rates require a water-tight baffle or multiple tank arrangement, typically with an effluent filter in the primary tank.

General

The Orenco Biotube Pump Vault includes a molded polyethylene housing with an internal filter cartridge constructed of polypropylene and PVC. Schedule 80 PVC support pipes are included to suspend the vault in tank openings. The filter cartridge can be removed without pulling the pump or vault. Effluent enters through inlet holes around the perimeter of the Biotube vault and flows through the Biotubes to the external flow inducer. The external flow inducer accommodates one or two pumps. Orenco Biotube Pump Vaults are covered by US patents #4439323 and 5492635.



Side view

Standard Models

PVU57-1819, PVU57-2419

Nomenclature

PVU □□-□□ □□

- □□ (last): Indicates inlet hole height: (inches) 13", 19" standard
- □□ (middle): Cartridge height = 18", 24" standard, 36"*
- □□ (first): Vault height: 57", 66"-96" in 6" increments*
- PVU: Universal Pump Vault

*36" cartridge height and vault height of 66"-96" in 6" inch increments available mid-2001

Tank Access and Riser Diameter

Biotube Series	Tank Access Dia. (Minimum)	Tank Access Dia. (Recommended)	Riser Dia. (Minimum)
PVU w/Simplex Pump	19"	20"	24"
PVU w/Duplex Pumps	19"	20"	30"

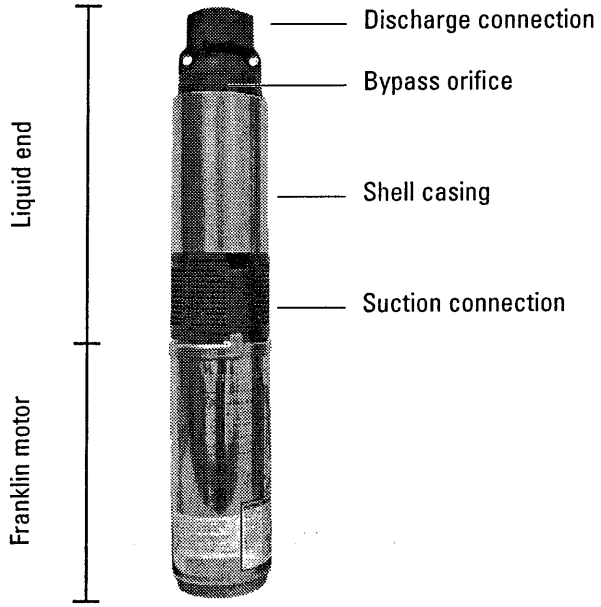
P Series
High-Head Effluent Pumps

Technical Data Sheet

Applications

Our submersible High-Head Effluent Pumps are designed to transport screened effluent (with low TSS counts) from septic tanks or separate dosing tanks to collection and treatment systems. All our pumps are constructed of lightweight, corrosion-resistant stainless steel and engineered plastics; all are field-serviceable and repairable with common tools; and all standard P Series models are UL and CSA listed for use with effluent.

Orenco High-Head Effluent Pumps are used in a variety of applications, including: drainfields, packed bed filters, mounds, aerobic units, effluent irrigation, effluent sewers, wetlands, lagoons, and more.



Actual view

Features/Unique Specifications

To specify this pump for your installation, require the following:

- minimum 24-hour run-dry capability without water lubrication;
- 1/8-inch bypass orifice to ensure flow recirculation for motor cooling and to prevent air bind;
- floating stack design to protect against upthrust and increase pump life;
- repairable (nondisposable) liquid end for better long-term cost of ownership;
- corrosion-resistant construction;
- Franklin motor rated for continuous use and frequent cycling;
- type SOOW motor cable (suitable for Class I, Division 1 and 2 applications);
- optional 5-year extended warranty against defects in materials or workmanship.

Standard Models

See specifications (on back) for a complete list. Call Orenco or your nearest distributor for three-phase specifications.

Nomenclature

P □□ □□ □ □ - □□

- Pump (P Series)
- Nominal flow (gpm): 10, 20, 30, 50
- Horsepower: 05 = 1/2 hp; 07 = 3/4 hp; 10 = 1 hp; 15 = 1-1/2 hp; 20 = 2 hp; 30 = 3 hp; 50 = 5 hp
- Phase: 1 = single-phase; 3 = three-phase
- Voltage: 1 = 115 (1/2 hp only); 2 = 230
- Cord length: Blank = 10'; 20 = 20'; 30 = 30'

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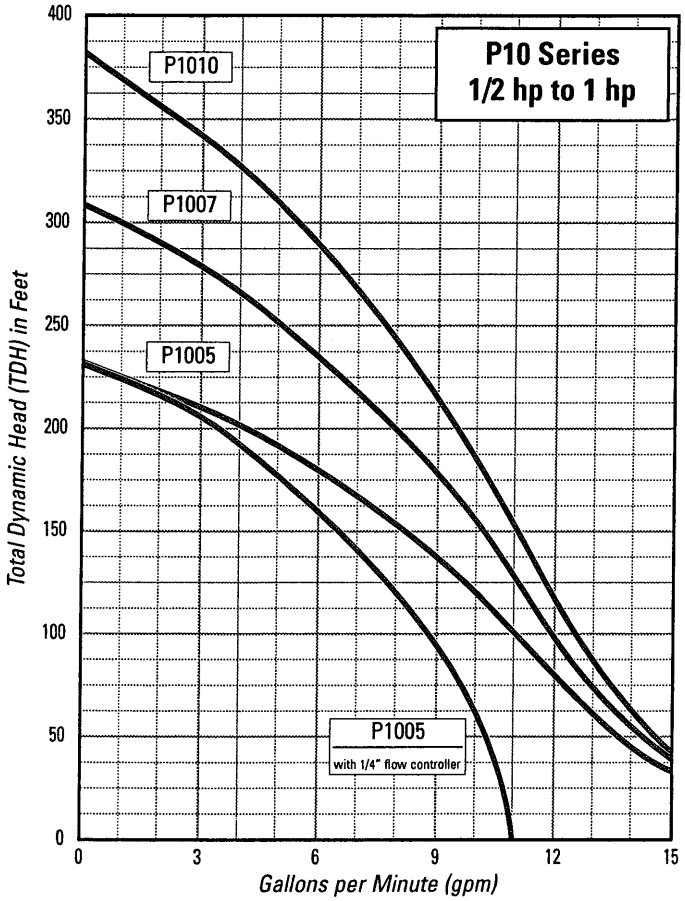
1-800-348-9843

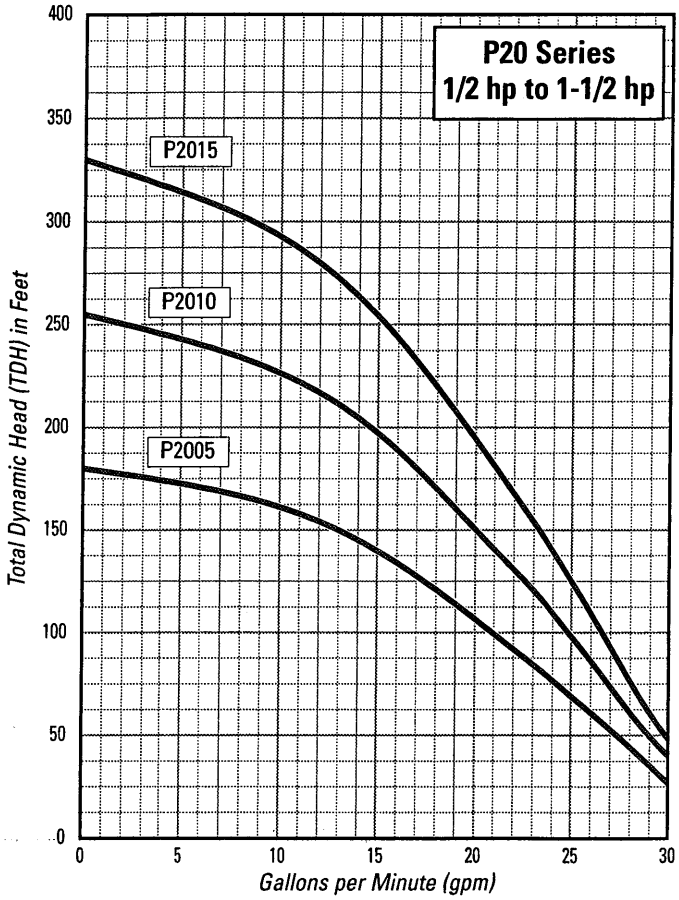
P Series Pump Curves

Technical Data Sheet

Using a Pump Curve

A *pump curve* helps you determine the best pump for your system. Pump curves show the relationship between flow (gpm) and pressure (TDH), providing a graphical representation of a pump's optimal performance range. Pumps perform best at their *nominal flow rate*—the value, measured in gpm, expressed by the first two numerals in an Orenco pump nomenclature.





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Discharge Assemblies

Submittal
Data Sheet

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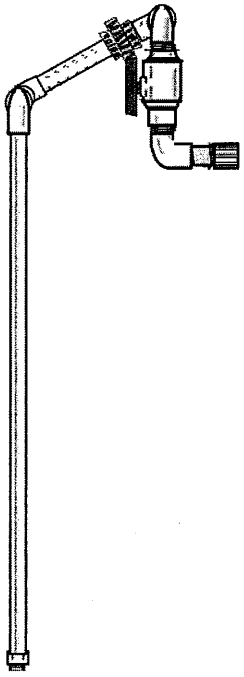
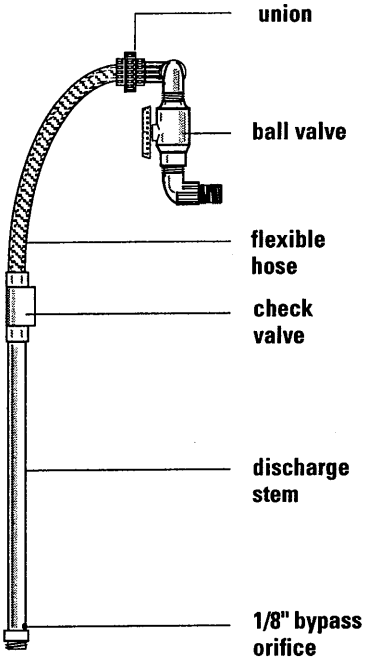
1-800-348-9843

Applications

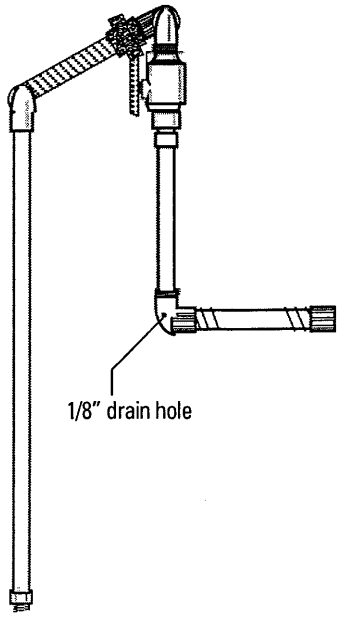
Discharge Assemblies include all of the necessary plumbing (pipe, fittings, etc.) to convey effluent from a pump to the outside of a riser or pump basin.



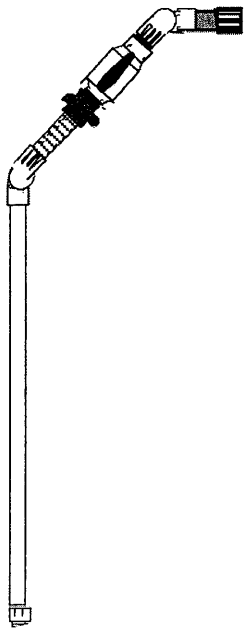
High-Head



Low Head



Cold Weather



Drainback

General

Orenco Discharge (Hose & Valve) Assemblies are corrosion resistant and adjustable for a proper fit. The flexible hose dampens vibration from the pump and allows for easy installation. All parts are either solvent welded or threaded and sealed with teflon paste.

"Low head style" discharge assemblies are designed for use with common effluent pumps; "high head style" discharge assemblies are designed for use with submersible turbine effluent pumps.

Standard Models

HV100, HV125, HV150, HV200.

Nomenclature

HV □□□ □ - □ □

- □ □: Indicates stem length (inches): 4, 5*, 6*, 8*, 9*, 10*, 11, 12*, 14*, 15*, 16*, 17, 18*, 19*, 20, 21*, 22*, 23, 26, 29, 32, 35, 38, 41, 47
  **15" sand filter basin only*
- □: Indicates HV configuration:
  Blank = field cut (high-head style)
  H = high-head style pump
  L = low-head style pump
  DB = drain back (always field cut)
  15SF = 15" sand filter basin
- □: Indicates options:
  B = ball valve
  C = check valve
  FC = flow controller
  AS = anti-siphon
- □□□: Indicates discharge diameter (inches):
  100 = 1"
  125 = 1-1/4"
  150 = 1-1/2"
  200 = 2"
- HV: Pump discharge assembly

HVCW □□□ KIT

- KIT: Indicates kit
- □□□: Indicates discharge diameter (inches):
  100 = 1"
  125 = 1-1/4"
  150 = 1-1/2"
  200 = 2"
- CW: Indicates cold weather application
- HV: Pump discharge assembly

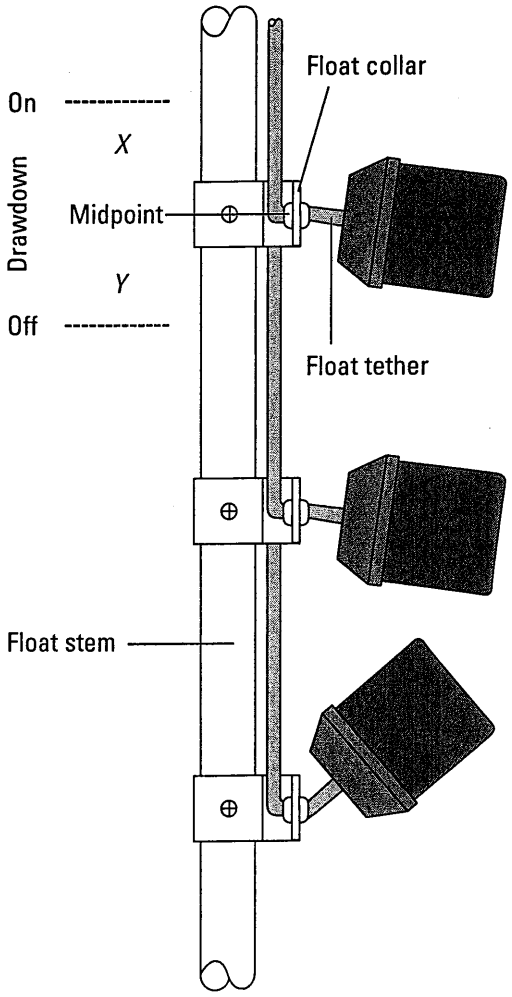
Float Switch Assemblies

Submittal Data Sheet

Orenco Systems® Incorporated
1-800-348-9843

Applications

Float switches are used to signal liquid level positions for alarm and pump control applications. Orenco float switch assemblies can be mounted in pump vaults, effluent screens, pump basins, and risers. Float switch assemblies are preassembled with one or more floats mounted on a 1" PVC float stem. ABS float collars are used to provide secure mounting that is easily adjustable.



The "On" and "Off" positions describe normally open floats. For normally closed floats, the functions are reversed.

General

All models listed are horsepower-rated and UL listed and CSA certified for use in water or sewage. Model "A" floats are also CE certified for sale in European Union countries.

Floats are typically ordered in assemblies that include a float stem (ordering explained below) and float collars.

Standard Models

A, B, C, D, G, T

Nomenclature

MF □ [ ] - □

- Cord length (feet):
  Blank = 10' cord (standard)
  20 = 20' cord
  30 = 30' cord
- Float switch model (from top of the tank down)
  A, B, C, D, G, T
- Number of float switches (for multiples of the same model)
  Blank = no float collar (for single floats only)
- Mechanical or mercury float switch assembly

Examples: An MFAB indicates one "A" float and one "B" float, with the "B" float being lower on the float stem; an MF3AT indicates three "A" floats and a "T" float (in order from the top of the float stem down).

Materials of Construction

Float housing:	Impact-resistant, noncorrosive PVC plastic for use in liquids up to 140° F (60° C)
Float cord:	Flexible 2-conductor (UL, CSA) SJOW; water-resistant (CPE); neoprene coating
Float collar:	ABS

VeriComm™ Remote Telemetry Unit

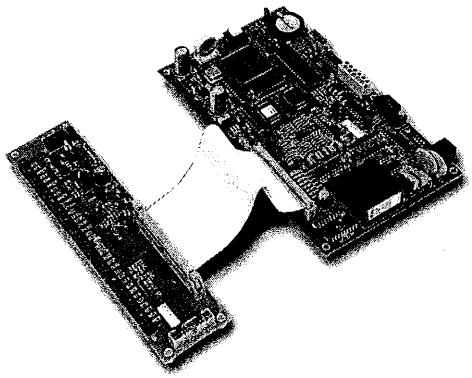
Technical Data Sheet

Model: ATRTU-400

Applications

Orenco's line of affordable remote telemetry units give water/wastewater system operators and maintenance organizations the ability to monitor and control each individual system's performance remotely, with real time efficiency. Ideal for:

- Wastewater Collection and Treatment
- Water Systems
- Environmental Monitoring
- Industrial Processes



VeriComm™ ATRTU-400 telemetry board

Features/Unique Specifications

To specify this panel for your installation, require the following:

- Automatic call-out to pagers during alarm conditions or when panel detects trends that could lead to system failure
- Ability to maintain logs for system conditions and events, such as Pump Run Time, Pump Cycles, and Alarm Conditions
- Downloadable logs into a *.dif or ASCII format for simple conversion to common spreadsheet or word processor programs
- No proprietary computer software needed for remote monitoring and control. VT100 protocol allows remote access and control from any computer modem (Mac or PC) with a simple communications program (e.g. Windows® HyperTerminal)
- Multi-level password security to ensure that only qualified personnel can remotely access site
- Simple interface using status, reference, and control parameters (Points). Points are viewable/editable by the operator. The following "point" types are supported:
  - Digital: on or off condition
  - Analog: numeric range (± 99999.9)
  - Date: mm/dd/yy format
  - Time: 24 hour clock
  - Label: Text (7 character max)
- Program logic (Rules) consists of simple conditional "If...Then" declarations. Rules can be written based on several operands, including the following:
  - Input / Output status
  - Point status
  - Date: mm/dd/yy format
  - Time of day: 24 hour clock
  - Timers
  - Historical data (allows for control optimization or detection of trends)
- Schedule Functions to control digital "Points" based on date or day of week / time.
- Automatic daylight savings time adjustment
- Optional graphical interface software to view system status and permit interactive system control
- Optional Automated Data Collection software for gathering alarm conditions

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Distributing Valves

Submittal
Data Sheet

Orenco Systems®
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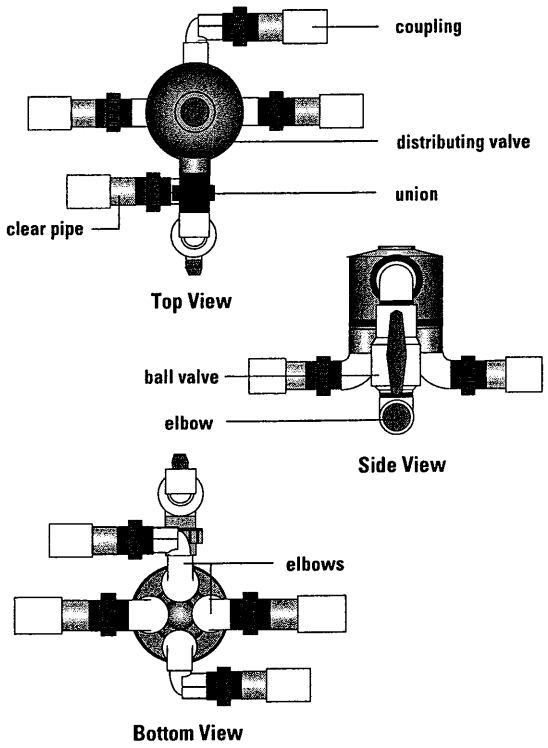
1-800-348-9843

Applications

Automatic Distributing Valve Assemblies are used to pressurize multiple zone distribution systems including textile filters, sand filters and drainfields.



General

Orenco's Automatic Distributing Valve Assemblies are mechanically operated and sequentially redirect the pump's flow to multiple zones or cells in a distribution field. Valve actuation is accomplished by a combination of pressure and flow. Automatic Distributing Valve Assemblies allow the use of smaller horsepower pumps on large sand filters and drainfields. For example, a large community drainfield requiring 300 gpm can use a six-line Valve Assembly to reduce the pump flow rate requirement to only 50 gpm.

Orenco only warrants Automatic Distributing Valves when used in conjunction with High-Head Effluent Pumps with Biotube® Pump Vaults to provide pressure and flow requirements, and to prevent debris from fouling valve operation. An inlet ball valve and a section of clear pipe and union for each outlet are provided for a complete assembly that is easy to maintain and monitor. Ideal valve location is at the high point in the system. Refer to Automatic Distributing Valve Assemblies (NTP-VA-1) for more information.

Standard Models

V4402A, V4403A, V4404A, V4605A, V4606A, V6402A, V6403A, V6404A, V6605A, V6606A.

Nomenclature

V □□ □□ A

- A — Indicates assembly
- □□ — Number of active outlets
- □□ — Model series:
  - 44 = 4400 series (2-4 outlets)
  - 46 = 4600 series (5-6 outlets)
  - 64 = 6400 series (2-4 outlets)
  - 66 = 6600 series (5-6 outlets)
- V — Distributing valve

Specifications

Materials of Construction

All Fittings:	Sch. 40 PVC per ASTM specification
Unions:	Sch. 80 PVC per ASTM specification
Ball Valve:	Sch. 40 PVC per ASTM specification
Clear Pipe:	Sch. 40 PVC per ASTM specification
V4XXX Distributing Valves:	High-strength noncorrosive ABS polymer and stainless steel
V6XXX Distributing Valves:	High-strength noncorrosive ABS polymer, stainless steel, and die cast metal

AdvanTex® AX100 Filter

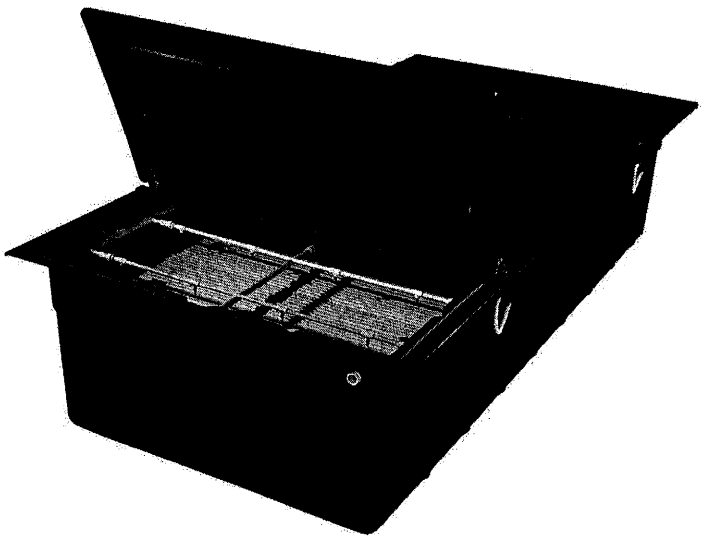
Commercial Technical Data Sheet

Applications

Orenco's AdvanTex® Treatment System* is an innovative technology for onsite treatment of domestic-strength wastewater. The heart of the System is the AdvanTex Filter, a sturdy, watertight fiberglass basin filled with an engineered textile material. This lightweight, highly absorbent textile material treats a tremendous amount of wastewater in a small space. The AdvanTex Treatment System is ideal for:

- Small sites
- System upgrades and repairs
- New construction
- Poor soils
- Nitrogen reduction
- Price-sensitive markets
- Pretreatment

For sizing, see *AdvanTex® Design Criteria* (NDA-ATX-COMM-2).



** Covered by U.S. patent numbers 6,540,920; 6,372,135; 5,980,748; 5,531,894; 5,492,635; 5,480,561; 5,360,556; and 4,439,323. Additional patents pending.*

Features/Unique Specifications

To specify this product, require the following:

- Wastewater treatment to better than "Secondary" Treatment Standards
- Consistent treatment, even during peak flows
- Timer operation for flow monitoring, flow modulation, and surge control
- Fixed film textile media (a polyester plastic), operated in an unsaturated condition
- Consistent media quality
- Low maintenance requirements
- Low energy consumption
- Complete premanufactured package, ready-to-install
- Watertight construction, corrosion-proof materials, lid bolts
- Quiet operation

Standard Models

AX100

Physical Specifications

Approximate Dimensions**

Filter Basin Length	191 in.
Width	94.5 in.
Height	42.5 in.
Area (footprint)	128 sq. ft.
Filter Dry Weight	1,650 lbs.

*** See AdvanTex Treatment System drawings for exact dimensions.*

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ATD-ATX-AX-3
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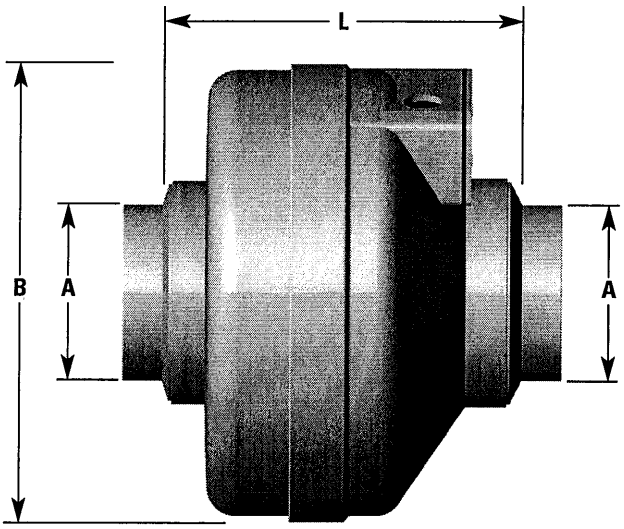
Ventilation Fan

Submittal
Data Sheet

Orenco Systems®
Incorporated
1-800-348-9843

Applications

Orenco Ventilation Fans are used in some larger AdvanTex™ Treatment Systems to gently push air through the textile media, ensuring adequate oxygen is available for biological treatment.



General

Orenco Ventilation Fans feature a UL recognized and UV protected resin housing, allowing the fan to be mounted in outdoor and wet locations, with air temperatures up to 140° F. The fans are caulked at the motor screws, wiring cables, and along the seams of the fan to prevent moisture from entering the housing. The wiring box features a water-proof gasket.

Standard Models

FR100, FR150, FR225, FR250

Specifications

Dimensions

	Model FR100	Model FR150	Model FR225	Model FR250
A - Inlet/Outlet Diameter (in.)	3.875	5.875	7.75	9.75
B - Overall Housing Diameter (in.)	9.5	11.75	13.25	13.25
L - Fan Body Length (in.)	9.125	8.375	12.5	9

Performance Data

	Model FR100	Model FR150	Model FR225	Model FR250
Watts	19	90	137	225
Volts	115	115	115	115
Power Costs Per Month ($)*	$1.09	$5.16	$7.89	$12.96
CFM at 0" H_2O Static Pressure	108	243	429	563
CFM at .4" H_2O Static Pressure	72	196	366	493
CFM at .8" H_2O Static Pressure	19	142	297	419
CFM at 1.5" H_2O Static Pressure	na	18	168	294

** approximate for continuously running fan, at national average power cost of $.08/kWhr*

Materials of Construction:

Ventilation fan Housing: Thermoplastic resin (Noryl)

Recirculating Splitter Valves

Submittal Data Sheet

Orenco Systems®
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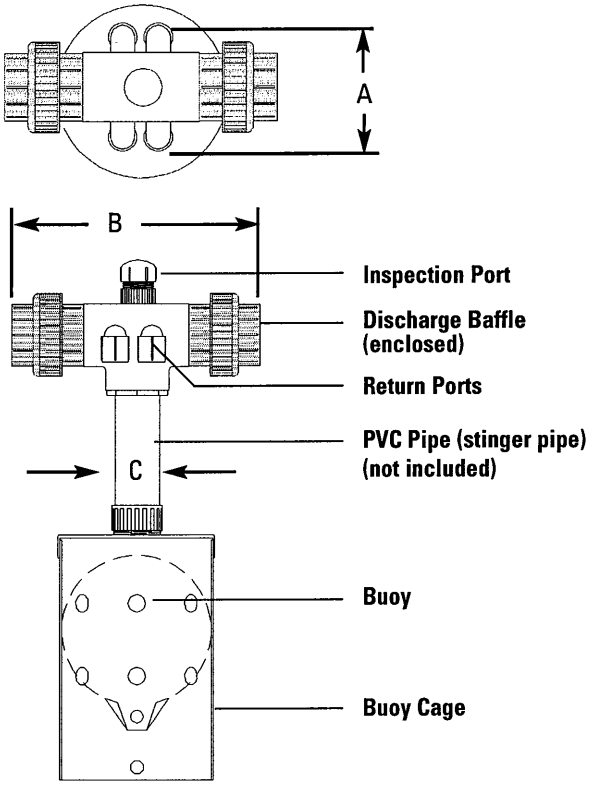
1-800-348-9843

Applications

Orenco Recirculating Splitter Valves provide a guaranteed flow split for accurate recirculation in onsite septic systems.



General

Orenco Recirculating Splitter Valves (RSVs; US Patent #5,480,561) are constructed of PVC and rubber components for corrosion resistance. The RSV redirects 100% of the incoming flow to the recirculation tank during periods in which the buoy is not seated, and 80% when the buoy is seated. An inspection port is provided for routine maintenance.

Standard Models

RSV2U, RSV3U, RSV4U.

Nomenclature

RSV X U

- U: Unions included with product.
- X: Indicates inlet and exit pipe size (inches).

Specifications

Model	RSV2U	RSV3U	RSV4U
A (in)	5 1/2	7 1/2	9 1/2
B (in)	16 1/4	18 1/2	20 3/4
C (in)	2	3	3
Cage Diameter (in.)	13	13	13
Cage Height (in.)	19 1/4	19 1/4	19 1/4
Buoy Dia. (in)	11 1/2	11 1/2	11 1/2
Return Port Size (in)	3/4	1	1 1/4
Maximum Flow (gpm)†	60	100	150

† Inlet flow performance based on an inlet head pressure of three feet.

Materials of Construction:

All Pipe & Fittings:	PVC Sch. 40 per ASTM specification
Buoy:	Rubber

NSU-SF-RSV-2
Rev. 2.1, © 9/99

Pump Basins

Submittal
Data Sheet

Orenco Systems®
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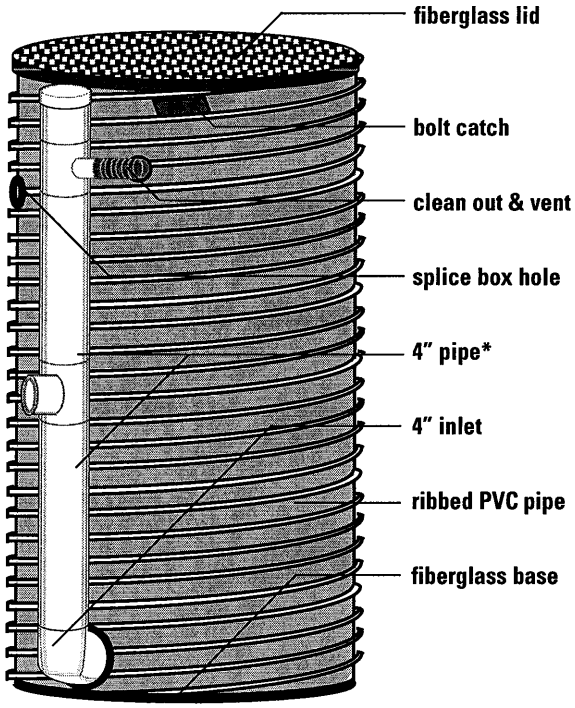
1-800-348-9843

Applications

Orenco Pump Basins serve as secondary pump chambers and lift stations in septic systems.



*4" pipe not supplied by Orenco

General

Orenco Pump Basins are constructed of PVC pipe in 21", 24", and 30" diameters. Bases are fiberglass attached with epoxy. Lids are textured fiberglass with stainless steel fastening bolts. A 4" inlet elbow and holes to accomodate splice boxes and discharge piping are located and sized to specific need. Optional equipment includes grommets for plumbing and electrical discharge holes, float stem holders, splice boxes, and clean out & vent assemblies.

Standard Models

PB2154, PB2454, PB3054
(Custom basins are available for specific configurations.)

Nomenclature

PB XX XX
- PB
- XX — Indicates diameter (inches)
- XX — Indicates height (inches)

Specifications

Dimensions

	Model PB21XX	Model PB24XX	Model PB30XX
Basin Diameter (in.)	21	24	30
I.D. of Basin (in.)	20.75	23.5	29.5
Liquid Capacity (gal./in.)	1.46	1.88	2.96

Materials of Construction:

Ribbed PVC Pipe:	PVC Perma-Loc
Fiberglass Lid & Base:	Molded fiberglass
Grommet(s):	EPDM

Appendix D

Pump Repair Manual

Servicing Orenco Systems®
4" Submersible Pumps

Orenco Systems®
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1-800-348-9843

Equipment:

- 1/2 – inch Wrench - to remove liquid end from motor
- 3/4 – inch Wrench - to remove and replace motor lead
- $5/16$ – inch Wrench - to remove cap screw at top of shaft
- Phillips head screwdriver - to remove screen from pump
- Standard head screwdriver
- Vise
- 10" to 12" Channel Locks
- Pipe Wrench

- Pressure Gauge (0-100 psi)
- Multimeter Tester- volt-ammeter-ohmmeter
- Wire strippers/cutters
- Wire crimpers

Other Supplies:

- Trisodiumphosphate (TSP)
- Rags (lots)
- Five gallon bucket
- Test basin (e.g. 55 gallon drum)
- Rubber gloves
- Anti-bacterial soap

Testing Procedures:

First, determine that the pump voltage is correct. The control panel should have a sticker that correctly states the voltage of the control panel. There should also be a sticker in the control panel or access riser above the pump vault that states the pump motor information (it is quite often located on the splice box lid). Verify that these correspond. If there is no sticker in the access riser, the pump may be pulled and the pertinent information can be found on the pump motor (the bottom portion of the unit). The motor and panel stickers should look like the following:

diameter. The screened vault is designed to ensure this. However, during power outages the level in the tank may rise so that the scum mat breaches the top of the vault. In this case, scum particles are pulled into the pump and the pump may clog. Partial plugging may also occur when the system is improperly designed or *underdesigned*, as it is often referred to. Underdesigned systems often are a result of lack of information regarding water usage or a lack of foresight regarding peak flows, especially in commercial installations such as restaurants or laundromats. Other causes include system abuse (disposing of solid wastes, excessive grease or hair, etc.) and leaky fixtures causing excessive flows.

Generator Testing:

When testing on-site with a generator, it is important to make sure that the generator selected is sufficient for the pump being tested. ORENCO pumps incorporate two-wire motors. Instead of a separate start capacitor as used with three-wire motors, all starting components are built into the unit. Because of this, generally a 50% increase in generator capacity is needed over that required with a three-wire motor.

Below is a table listing recommended generator sizes for Orenco two-wire motors. It is recommended that the generator manufacturer be consulted whenever possible.

Minimum Rating of Generator

	Externally Regulated		Internally Regulated	
Motor Horsepower	KW	KVA	KW	KVA
1/3	2.25	2.85	1.80	2.25
1/2	3.00	3.75	2.25	2.85
3/4	4.50	5.70	3.00	3.75
1	6.00	7.50	3.75	4.70
1 1/2	7.50	9.38	4.50	5.70

There are two types of generators available, externally and internally regulated. Most are externally regulated. They use an external mounted voltage regulator that senses the output voltage. As the voltage dips at motor start up, the regulator increases the output voltage of the generator. Internally regulated generators have an extra winding in the generator stator and are also called self excited. The extra winding senses the output current to automatically increase the output voltage.

Always start the generator before the motor is started, and always stop the motor before the generator is shut down. The motor thrust bearing may be damaged when generators are allowed to coast down with the motor connected. This same condition occurs when generators are allowed to run out of fuel.

More About The Motor:

As mentioned previously, Orenco 4-inch submersible effluent pumps incorporate the use of two-wire Franklin Electric motors. It is important that we briefly discuss the operation and controls of this motor. The Franklin Electric two-wire motor contains a special Biac switch for starting. When power is supplied to the two motor leads the bi-metal switch contacts are closed, allowing a triac relay to pass

Inspect the discharge connection for damage. It's unlikely that this portion of the pump would ever have to be replaced except in the case of an extended run dry condition.

Once the discharge connection is removed the stack and suction cap can be removed from the stainless steel pump shell. Simply remove the E-ring with a pair of needle nose pliers and the stages are ready to be examined. The models have a simple single piece diffuser/spacer component. Between each stage is a small thrust pad and a suction cap at the suction connection. Finally there is a retainer ring located below the bottom stage.

If the impellers and diffusers are clogged with grease or scum, then it may be possible to break down the solids particles using a chemical such as trisodiumphosphate (TSP). The clogged parts can be placed in a five gallon bucket of water with approximately 1/2-cup of TSP and soaked for 2 hours. The parts should be rinsed with water on removal and brushed clean. Some particles are more difficult than others and some impellers and diffusers may have to be replaced.

These model pumps have shown incredible run dry capabilities in bench tests and should not exhibit problems from this occurrence. However, running dry is not covered by any warranty and the pump should not operate under this condition.

Repairing the pump end is simple. First, place a suction cap into the shell; it's marked to show which side is oriented up. Next, place the first impeller (the white component) onto the shaft. Follow this with a diffuser/spacer (the clear component). Next comes another suction cap followed by a thrust pad. Be sure that the thrust pad is inserted with the brown side facing up toward the discharge. Repeat this process until the correct number of stages (impeller-diffuser/spacer combinations) have been built. The suction cap and thrust pad are only necessary preceding an impeller, so do not include one above the top diffuser/spacer unit. Lastly, snap the E-ring back into the slot on the shaft, place this unit into the shell and replace the discharge connection.

Also available for these models are complete replacement stacks. A stack can be changed in a matter of minutes. Please refer to the enclosed page entitled *"Replacement Stack Instructions for Orenco 4" Submersible Effluent Pumps"*.

ALWAYS WEAR RUBBER GLOVES WHEN HANDLING EQUIPMENT USED IN EFFLUENT. BE SURE TO USE ANTIBACTERIAL SOAP FOR WASHING UP AFTERWARDS.

Pump Performance Test - Procedure

The purpose of this test is to verify that the pump is consistently operating on a point of its characteristic curve. The verification is very simple; with a stopwatch and bucket, the displaced water is measured in terms of gallons displaced in a certain amount of time.

By manipulating the ball valve, different dynamic heads can be simulated to produce various flow rates to gather enough data points to verify a pump curve. This restriction in the ball valve causes an unknown amount of head loss, so a pressure gauge is installed just upstream of the ball valve to measure the pressure being delivered by the pump. The head loss induced by the discharge assembly and flow controller can be calculated by using the formulas on the previous page and below, and the static difference can be physically measured. After we derive all the variables in the total dynamic head, we can plot points.

The calculations can most easily be done by organizing the data in a chart, as shown below. Since the static difference should not change during the test, it is best to place that column towards the beginning of the chart. The orifice and discharge head loss equations once again are:

Head Loss Through Orifice: $h_{orifice} = 0.0065\ Q^2/d^4$

Head Loss Through Discharge Assembly:
$h_{disch} = 0.023\ Q^2$ (for Orenco's 1" discharge assembly)
$h_{disch} = 0.005\ Q^2$ (for Orenco's 1 1/4" discharge assembly)
$h_{disch} = 0.003\ Q^2$ (for Orenco's 1 1/2" discharge assembly)
$h_{disch} = 0.002\ Q^2$ (for Orenco's 2" discharge assembly)

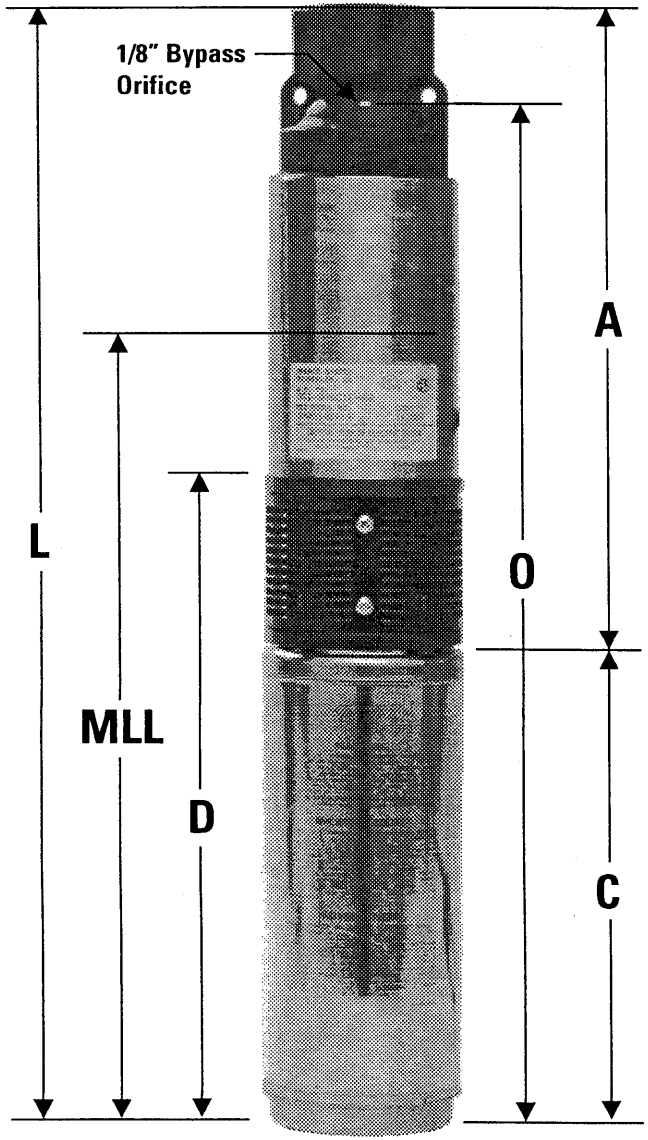
For example:
A five gallon bucket is filled in one minute (5gpm), the head loss through the orifice approximately equals 41.6 feet (18 psi), the head loss through the hose and valve assembly is minimal at low flows, at 5 gpm it is approximately 0.6 feet (0.25 psi).

At zero flow (valve shut off) there is no head loss through the flow controller, so the pressure difference from the gauge to the liquid level in the tank (3 to 6 feet or 1.3 to 2.6 psi) is the total dynamic shut off head.

Flow Table

Q (gpm)	h_{static}	$h_{orifice}$	h_{disch}	Gauge Press. (ft)	TDH (ft)
0.0	6.0	0.0	0.0	238±	244±
3.0	6.0	15.0	0.2	202±	223±
5.0	6.0	41.6	0.6	156±	204±

Orenco Submersible Pump Dimensions



Pump Model	A	C	D	L	O	DS	MLL	Check Valve
P100311/P100312	10-1/2	8-1/2	11-1/2	19	17-1/4	1-1/4	18	N
P100511/P100512	12-3/4	9-1/2	12-1/4	22-1/4	20-5/8	1-1/4	20	N
P100712	14-3/4	10-1/2	13-1/4	25-1/4	23-5/8	1-1/4	22	N
P101012	19	11-1/2	14-1/4	30-3/4	26-3/8	1-1/4	24	N
PJ120511	11	9-1/2	11-5/8	20-1/2	18-1/2	1-1/4	20	Y
PJ180511	9-1/2	9-1/2	11-5/8	19	17	1-1/4	20	Y
P200511/P200512	13-1/4	9-1/2	12-1/4	22-3/4	21	1-1/4	20	N
P200712	13-1/4	10-1/2	13-1/4	23-3/4	22-1/4	1-1/4	22	N
P201012	15-1/2	11-1/2	14-1/4	27	25-1/2	1-1/4	25	N
P201512	17-3/4	15	17-3/4	32-3/4	31-1/8	1-1/4	28	N
P300511/P300512	12	9-1/2	12-1/4	21-1/4	19-3/4	1-1/4	22	N
P300712	13-1/2	10-1/2	13-1/4	24	22-1/4	1-1/4	24	N
P301012	14-3/4	11-1/2	14-1/4	26-1/2	24-7/8	1-1/4	27	N
P301512	17-3/4	15	17-3/4	32-3/4	31	1-1/4	29	N
P500511/P500512	11-1/4	9-1/2	11-1/4	20-5/8	18-3/4	2	22	N
P500712	13-1/4	10-1/2	12-3/8	23-3/4	22-1/2	2	24	N
P501012	15-1/4	11-1/2	13-1/2	26-7/8	25	2	27	N
P501512	17-1/4	15	16-7/8	32-1/4	30-3/8	2	29	N

A = liquid end height
C = motor height
D = intake height
MLL = minimum liquid level

L = overall pump height
O = bypass orifice height
DS = discharge size

All measurements are in inches.

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ETD-PU-PU-2
Rev 2.0 1/01

Orenco Pump Information (continued)

Model	Horsepower	Cable Type	Cable Size	Cable Length	Listings	FLA	Disch. Size	Discharge Height	Pump Height	MLL	Run Dry?	Solids	Overload?
Grundfos PEF4021	4/10	SJOW-A	16/3	20'	UL/ULc	14.5	1 1/2"	2 11/16"	11 1/2"	3"	No	3/4"	Yes
Grundfos PEF3311	1/3	SJOW-A	16/3	20'	UL/ULc	8.4	2"	4 5/8"	15 1/8"	5"	No	3/4"	Yes
Grundfos PEF3312	1/3	SJOW-A	16/3	20'	UL/ULc	3.9	2"	4 5/8"	15 1/8"	5"	No	3/4"	Yes
Grundfos PEF5011	1/2	SJOW-A	16/3	20'	UL/ULc	11.5	2"	4 5/8"	16 3/4"	5"	No	3/4"	Yes
Grundfos PEF5012	1/2	SJOW-A	16/3	20'	UL/ULc	5.4	2"	4 5/8"	16 3/4"	5"	No	3/4"	Yes
Grundfos PEF7512	3/4	SJOW-A	16/3	20'	UL/ULc	7.6	2"	4 5/8"	16 3/4"	5"	No	3/4"	Yes
Grundfos PEF10012	1	SJOW-A	16/3	20'	UL/ULc	10.1	2"	4 5/8"	16 3/4"	5"	No	3/4"	Yes
Grundfos PEF15012	1 1/2	SJOW-A	16/3	20'	UL/ULc	13.1	2"	4 5/8"	16 3/4"	5"	No	3/4"	Yes
Grundfos PSE4011	4/10	SJOW-A	16/3	20'	UL/ULc	9.7	2"	6 13/16"	16 3/16"	5"	No	2"	Yes
Grundfos PSE4012	4/10	SJOW-A	16/3	20'	UL/ULc	3.9	2"	6 13/16"	16 3/16"	5"	No	2"	Yes
Grundfos PSE5011	1/2	SJOW-A	16/3	20'	UL/ULc	11.2	2"	6 13/16"	17 3/4"	5"	No	2"	Yes
Grundfos PSE5012	1/2	SJOW-A	16/3	20'	UL/ULc	5.2	2"	6 13/16"	17 3/4"	5"	No	2"	Yes
Grundfos PSE7512	3/4	SJOW-A	16/3	20'	UL/ULc	9.7	2"	6 13/16"	17 3/4"	5"	No	2"	Yes
Grundfos PSE10012	1	SJOW-A	16/3	20'	UL/ULc	10.3	2"	6 13/16"	17 3/4"	5"	No	2"	Yes
Grundfos PSE15012	1 1/2	SJOW-A	16/3	20'	UL/ULc	13.1	2"	6 13/16"	17 3/4"	5"	No	2"	Yes
Myers PMG200	2	SJOW	14/3	20'	UL/CSA	15.0	1 1/4"	4 1/2"	17 1/2"	2"	No	——	Yes

Power Usage and Electrical Costs

Orenco Systems®
Incorporated

814 AIRWAY AVENUE
SUTHERLIN, OREGON
97479

TOLL FREE:
(800) 348-9846

TELEPHONE:
(541) 459-4449

FACSIMILE:
(541) 459-2884

WEB SITE:
www.orenco.com

INPUT:

$P_{in} = v\ i\ PF$ (Watts)

where:
v = Volts AC
i = Amperes
*PF = Power Factor

$$BHP = \frac{P_{in}}{745.7}\ hp$$

***NOTE:** Residential and small commercial users will purchase power at the apparent rate of energy used per hour of usage (kWh); this is a product of voltage, amperage, and hours. Correcting for the actual power used is generally not significant enough for residential users to request utility adjustment. This reduces the power usage equation to:

OUTPUT:

$$P_{out} = \frac{QH}{3956}\left(745.7\ \frac{Watts}{hp}\right),\ Watts$$

Q = Discharge (gpm)
H = Pressure head at discharge (feet)

EFFICIENCY:

$$e = \frac{P_{out}}{P_{in}}$$

ELECTRICAL COSTS:

$$R.T.\ (Run\ Time) = \frac{\left(\frac{Daily\ Flow\ (gpd)}{(Pump\ Flow\ Rate\ (gpm))}\right)}{60\ Minutes\ per\ Hour} = hrs/day$$

P.U. (Power Usage) = (kVA) (PF) (R.T.) = kWh/day

Cost per day = (P.U. (kWH/day)) (Cost/kWh)

$$P.U.\ (Power\ Usage) = \frac{(v)\ (i)\ (R.T.)}{1000\ W/kW} = kWh/day$$

EXAMPLE:

A model P100511, 1/2 hp, 115VAC pump operating at 5 gpm.
From the amperage curve, (i) = 11.2 amps.
Flow is 150 gallons per day.

$$R.T.\ (Run\ Time) = \frac{\left(\frac{150\ (gpd)}{5\ (gpm)}\right)}{60\ Minutes\ per\ Hour} = 0.5\ hrs/day$$

$$P.U.\ (Power\ Usage) = \frac{(115V)\ (11.2A)\ (0.5\ hrs/day)}{1000\ W/kW} = 0.644\ kWh/day$$

Cost per day = (0.644 kWh/day) ($0.08/kWh) = $0.052/day

Appendix E

Automatic Distributing Valve Manual & Booklet

Orenco Automatic Distributing Valve Assemblies

Orenco Systems®
Incorporated
1-800-348-9843

For Wastewater Effluent Systems

Introduction

Orenco's automatic distributing valve assemblies, pressurized with small high-head effluent pumps, are useful for distributing effluent to multiple zones. These zones can be segments of sand filter manifolds, drainfields, or other effluent distribution systems. Distributing valve assemblies can substantially simplify the design and installation of a distribution system and reduce installation costs. This is particularly true where a distributing valve assembly is used instead of multiple pumps and/or electrically operated valves. Additionally, a reduction in long term operation and maintenance costs is realized due to a reduced size and/or number of pumps. More even distribution can be achieved on sloping sites by zoning laterals at equal elevations. This eliminates drainback to lower lines and the unequal distribution of effluent that occurs at the beginning of a cycle.

Valve Operation

The valve itself has only a few moving parts, requires no electricity, and alternates automatically each cycle. Refer to Figure 1 for the following valve operation description. The flow of the incoming effluent forces the rubber flap disk ❶ to seat against the valve bottom ❷. The opening ❸ in the rubber flap disk aligns with an opening in the valve bottom to allow flow to only one valve outlet. The stem ❹ houses a stainless steel spring which pushes the rubber flap disk away from the valve bottom after the flow of effluent stops. The stem acts as a cam follower and rotates the rubber flap disk as the stem is raised and lowered through the cam ❺. The force from the flow of effluent pushes the stem down through the cam and the stainless steel spring pushes the stem back up through the cam when the flow of effluent stops. Each linear motion of the stem allows the rubber flap disk to rotate half the distance necessary to reach the next outlet. When there is no flow, the rubber flap disk is in the "up" position and is not seated against the valve bottom.

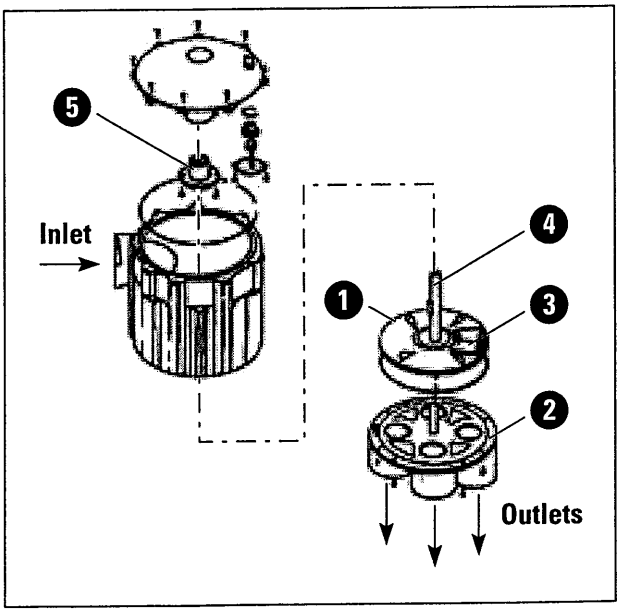

Figure 1:
6000 Series Valve

Table 1. Automatic Distributing Valve Assembly Headloss Equations

Model Series	Equation	Operating Range (gpm)
V4400A	$H_L = 0.085 \times Q^{1.45}$	10 - 40
V4600A	$H_L = 0.085 \times Q^{1.58}$	10 - 25
V6400A	$H_L = 0.0045 \times Q^2 + 3.5 \times (1 - e^{-0.06Q})$	15 - 70
V6600A	$H_L = 0.0049 \times Q^2 + 5.5 \times (1 - e^{-0.1Q})$	15 - 70

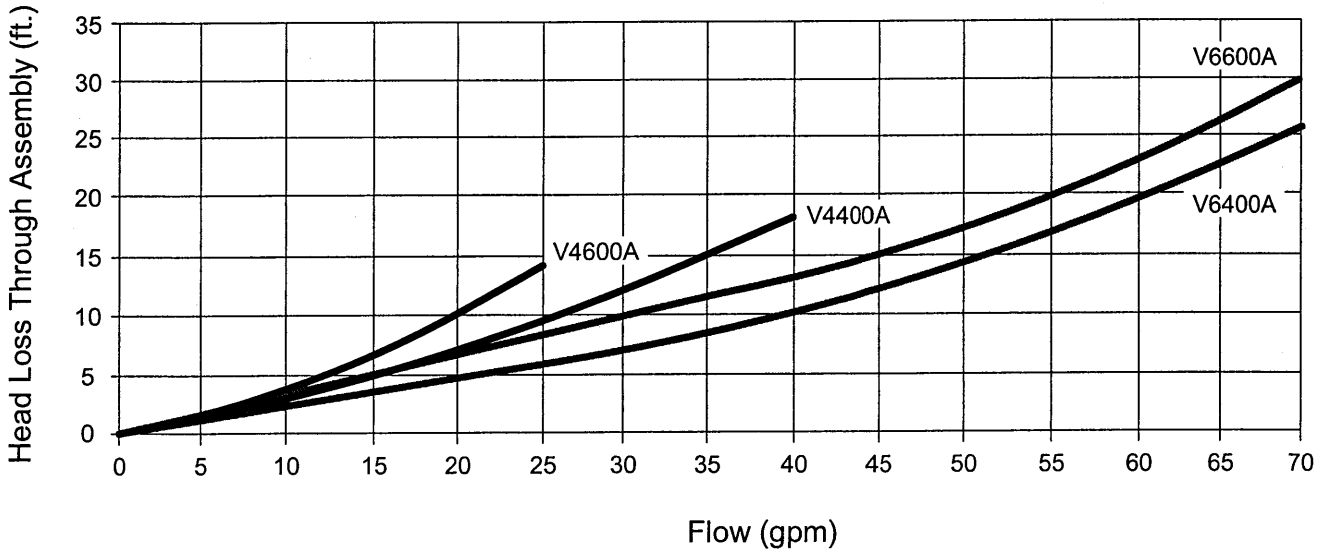

Figure 3:
Automatic distributing valve assembly headloss curves

The Pumping System

Although the distributing valve was designed for the irrigation industry, it has started to gain fairly wide acceptance in the effluent pumping industry. However, because of the mechanical movements of the valve, it is necessary to take steps to prevent solids from reaching the distributing valve that may impede the operation of the valve. Orenco Biotube® Pump Vaults — when properly sized and installed — provide the necessary protection to prevent valve malfunction. The Biotube® pump vault accepts effluent only from the clear zone between a tank's scum and sludge layers and then filters this effluent through a very large surface area screen cartridge. Without this protection in effluent systems, the valve has very little chance of reliable long-term operation.

System Startup

Refer to the Hydrotek Valve booklet that is provided with the distributing valve assembly for the sequencing of the valve outlets. The transport line should always be flushed with clean water before installing the valve. Any sand, gravel, or other foreign objects that may have been in the pipe during installation can easily become lodged in the distributing valve, causing malfunction.

With the pump running, alternately close and open the ball valve on the distributing valve assembly to check proper rotation of the valve. (Note: If check valves are used on the lines after the distributing valve, the pump may need to be turned on and off to allow the pressure to be released from the valve.) If visual operation of which zone is operating is not possible, watch the clear pipe on each line for indication of which zone is operating.

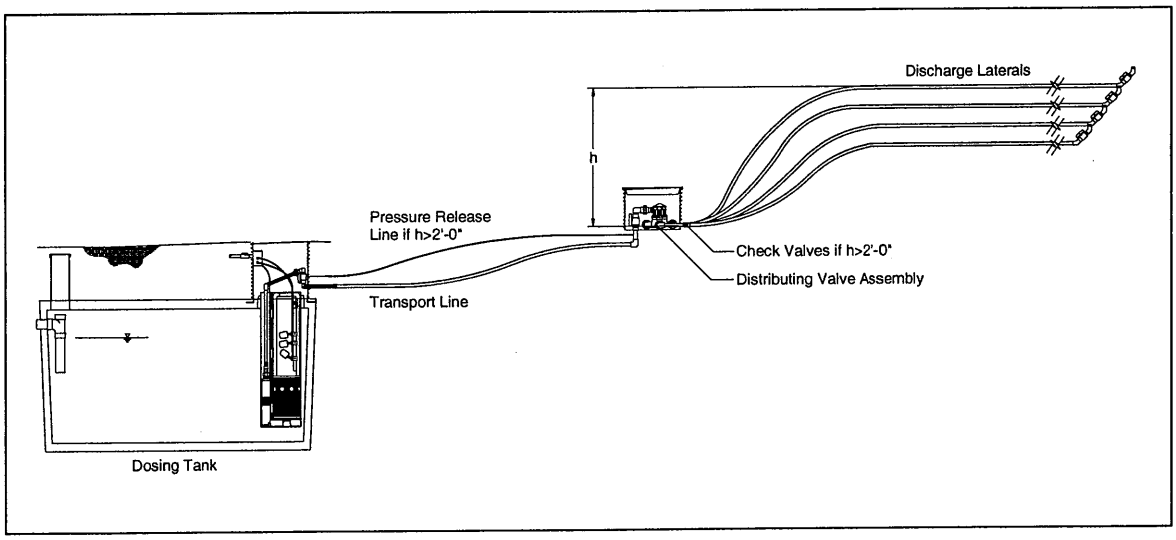

Figure 5:
Valve assembly below final discharge point

Maintenance

Annually check for proper operation by following procedures listed in the Hydrotek Valve booklet and system startup procedures listed above.

Troubleshooting

1. PROBLEM: Valve does not change or cycle to next zone or outlet

CAUSE: The stem and disk assembly is not rotating when water flow is turned off and then back on.

SOLUTION 1: Ensure that there is no debris inside the cam. Clean and carefully reinstall the cam.
SOLUTION 2: If fewer than the maximum number of outlets are being used, check the installation of the cam. Ensure that the stem and disk assembly is not being held down by an improperly installed cam. Refer to the cam replacement instructions.

6000

HYDROTEK® VALVE

Printed in USA

08 - 11/93

INTRODUCTION

The HYDROTEK® 6000 Series Distributing Valve is a water flow operated valve which acts as a manifold. The valve cycles from zone to zone in a clockwise fashion each time the water flow is stopped and started.

With its metal die cast body, the HYDROTEK® 6000 Series Valve is capable of handling high pressure applications. The 6000 Series Valves are recommended to be used on pump fed systems and can also be used on higher flow pressurized city water systems.

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CAM REPLACEMENT INSTRUCTIONS 4
VALVE APPLICATIONS 5
VALVE INSTALLATION ..... 6 - 7
VALVE PARTS DIAGRAM AND PARTS LIST ..... 8 - 9
TROUBLESHOOTING ..... 10 - 11
TECHNICAL SPECIFICATIONS 12
WARRANTY AND DEALER INFORMATION 13

VALVE OPTIONS

The HYDROTEK® 6000 Series Valve is available with the following outlet and cam combinations:

HYDROTEK® Model No.	Description	Check Your Model
6402	Two zone valve with four outlet bottom	( )
6403	Three zone valve with four outlet bottom	(➡)
6404	Four zone valve with four outlet bottom	( )
6605	Five zone valve with six outlet bottom	( )
6606	Six zone valve with six outlet bottom	( )

6400 Series four outlet valves have interchangeable cams for two, three or four zone operation.

6600 Series six outlet valves have interchangeable cams for five or six zone operation.

VALVE INSTALLATION

Prior to installation of HYDROTEK® 6000 Series Valve, make sure that the system is designed using adequate pipe sizes and control valves to ensure maximum performance of the valve.

For installation with large terrain elevations, or applications with high lift requirements such as overhead systems in greenhouses, the valve should be installed at the highest point in the system, or check-valves should be installed near the valve in the elevated lines to prevent the back-flow of water from the higher locations to the lower zones.

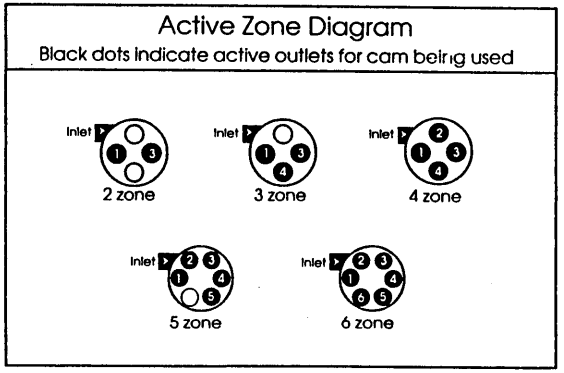
When connecting the lines to the valve outlets, ensure that the correct cam is installed. See diagram for proper zone hookup of outlets.

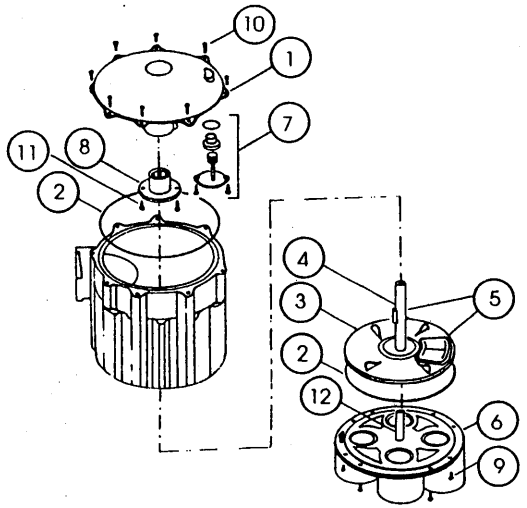
Do NOT turn the valve upside down when gluing the lines into the valve outlets. Glue may run down into the valve and interfere with valve operation. Allow glue to dry for at least two hours before operating or testing the valve. For best results, use a multi-purpose glue which is compatible with ABS plastic.

VALVE INSTALLATION (continued)

To seal off any unused outlets, install a piece of PVC pipe at least six inches in length to the outlet and cap the pipe. This will allow additional zones to be added easily at a later time. Make sure proper cam is installed for number of zones to be used.

In regions of the country where winter temperatures may cause damage to exterior pipes, the HYDROTEK® 6000 Series Valve should be winterized. To protect the control valve and other irrigation components from damage, the entire system should be drained or cleared using compressed air. Contact your K-Rain dealer for information on the winterization requirements in your area.





HYDROTEK® 6000 SERIES VALVE PARTS

1	4 Outlet valve top	8002804
	6 Outlet valve top	8002806
2	Valve body seal	8600000
3	Rubber flap disk	8003000
4	Stem with .032 spring	8004002
	Stem with .028 spring	8004003
5	Stem/disk assy. with .032 spring	8003050
	Stem/disk assy. with .028 spring	8003051
6	4 Outlet valve bottom	8002704
	6 Outlet valve bottom	8002706
7	Vacuum breaker assy.	8005001
8	Two zone, 4 outlet cam	8002902
	Three zone, 4 outlet cam	8002903
	Four zone, 4 outlet cam	8002904
	Five zone, 6 outlet cam	8002905
	Six zone, 6 outlet cam	8002906
9	Valve bottom screws (6) (10-24 x 3/4 Phil Pan SS)	8004410
10	Valve top screws (8) (10-24 x 5/8 Slt. phst. SS)	8004412
11	Cam retaining screws (2) (6 x 1/2 Phil Pan SS)	8004414
12	Valve bottom S.S. Pin (1/4" dia.)	8600001

Appendix F

Control Panel

Installation Manual

Orenco Systems®
Incorporated

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Bethel Heights Phase I & II
TCOM-TDAX/DAX2 PTROCS Drip (Phase I)
TDAX/DAX2 PTROCS Drip (Phase II)
Manual# EIN-CP-MISC-520
Order# 273079

This Manual Contains:

Description	Document Number
1. Installation Instructions	EIN-CP-GEN-1
2. Panel Wiring Diagram	EDW-CD-TCOM-52
3. TCOM Setting Instructions (Phase I)	EIN-CP-SET-684
3. TCOM Setting Instructions (Phase II)	EIN-CP-SET-685
4. Custom TCOM Control Panel & HyperTerminal Access	EIN-CP-TCOM-3

EIN-CP-MISC-520
Rev 1.0 © 10/26/03

Panel Installation

Orenco Systems®
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Before Installing Panel

1. *Read all instructions before proceeding with the installation. Improper installation may void warranties.*

2. Inspect your order for completeness and inspect each component for shipment damage. If something is missing or damaged, you will need to contact your supplier to obtain replacements.

3. Check to be sure the instructions and items supplied comply with state and local regulations.

4. A qualified electrician must be employed to install and service the panel and ancillary wiring. The equipment must be installed in compliance with the National Electric Code, as well as state and local codes.

Placement of the Control Panel

5. Install the electrical control or alarm panel within view of the tank. The panel should be attached to a post or an exterior wall. Panels that contain motor contactors should not be mounted to an exterior wall unless the mounting method includes sound deadening. If possible, position the panel in the shade to protect it from weather. Extreme temperatures can cause inconsistent performance of the electrical components. Locate the panel at a convenient height (usually about five feet above the ground) and where it will be accessible for maintenance.

Install Floats and Pumps

6. Install the electrical splice box(es) for the floats and pump(s) before installing the actual floats and pumping equipment. The splice box(es) are installed in the grommet(s) provided near the top of the riser.

7. Install the floats. Thread the float and pump cords through the cord grips into the PVC splice box, leaving adequate lengths of electrical cord coiled inside the riser to allow easy removal of the pump and float assembly. Do not remove the colored markers or the paper tags from the float cords, and do not try to thread the markers and tag through the cord grip. These should be left on the float cord, outside the splice box. Tighten the cord grips by hand, not by tool, then check the tightness of the cord grips by tugging on each cord. A cord is secure and the connection watertight when the cord grip is tight enough to prevent slippage. Adequate lengths of cord should be left within the splice box to allow for easy removal for future disconnecting and re-splicing.

8. Run the wires from the control panel to the splice box. The wires can be brought through a conduit, or can be buried using suitable direct-burial wire. Conduit that enters the splice box must be sealed with a conduit seal. A conduit seal should be used, even if the wires are direct-buried, to prevent the infiltration of water into the splice box. The number of wires required depends on the control panel and the number of floats and pumps used. This can be determined by consulting the Splice Box Wiring diagram appropriate for the control panel and float arrangement being used.

Wire should be sized at 14 AWG for the float. Refer to Figure 1 to determine the proper size for the pump wires. When calculating wire size, you need to take the length and size of your branch circuit wires from the service entrance panel to the pump control

= Factory Wire
= Field Wire

Control Panel Wiring Diagram
TCOM-(2)TDAX/DAX2 PTROCS/PTROCS

Quote# 061803L1 Custom# 273079

From Main Power Panel
230/115 VAC, 1 Phase, 60 Hz.
Main disconnect
provided by others.

Motors must have
Internal Overload Protection

Ground Wire
L1
L2
N
DISTRIBUTION BLOCK (3) FSPDB2A

CB 20A	M1	CT1 COIL	12	13	Recirc. 1	1	PUMP 230 VAC 1Ø 3/4HP
CB 20A	M2	CT2 COIL	14	15	Recirc. 1	2	PUMP 230 VAC 1Ø 3/4HP
CB 20A	M3	CT3 COIL	16	17	Recirc. 1	3	PUMP 230 VAC 1Ø 3/4HP
CB 20A	M4	CT4 COIL	18	19	Recirc. 1	4	PUMP 230 VAC 1Ø 3/4HP
CB 20A	M5	CT5 COIL	20	21	Recirc. 1	5	PUMP 230 VAC 1Ø 3/4HP
CB 20A	M6	CT6 COIL	22	23	Recirc. 1	6	PUMP 230 VAC 1Ø 3/4HP
CB 20A	M7	CT7 COIL	24	25	Dose 1	7	PUMP 230 VAC 1Ø 1/2HP
CB 20A	M8	CT8 COIL	26	27	Dose 1	8	PUMP 230 VAC 1Ø 1/2HP
CB 20A	M9	CT9 COIL	72	73	Recirc. 2	9	PUMP 230 VAC 1Ø 3/4HP
CB 20A	M10	CT10 COIL	74	75	Recirc. 2	10	PUMP 230 VAC 1Ø 3/4HP
CB 20A	M11	CT11 COIL	76	77	Recirc. 2	11	PUMP 230 VAC 1Ø 3/4HP
CB 20A	M12	CT12 COIL	78	79	Recirc. 2	12	PUMP 230 VAC 1Ø 3/4HP
CB 20A	M13	CT13 COIL	80	81	Recirc. 2	13	PUMP 230 VAC 1Ø 3/4HP
CB 20A	M14	CT14 COIL	82	83	Recirc. 2	14	PUMP 230 VAC 1Ø 3/4HP
CB 20A	M15	CT15 COIL	84	85	Dose 2	15	PUMP 230 VAC 1Ø 3/4HP
CB 20A	M16	CT16 COIL	86	87	Dose 2	16	PUMP 230 VAC 1Ø 1/2HP

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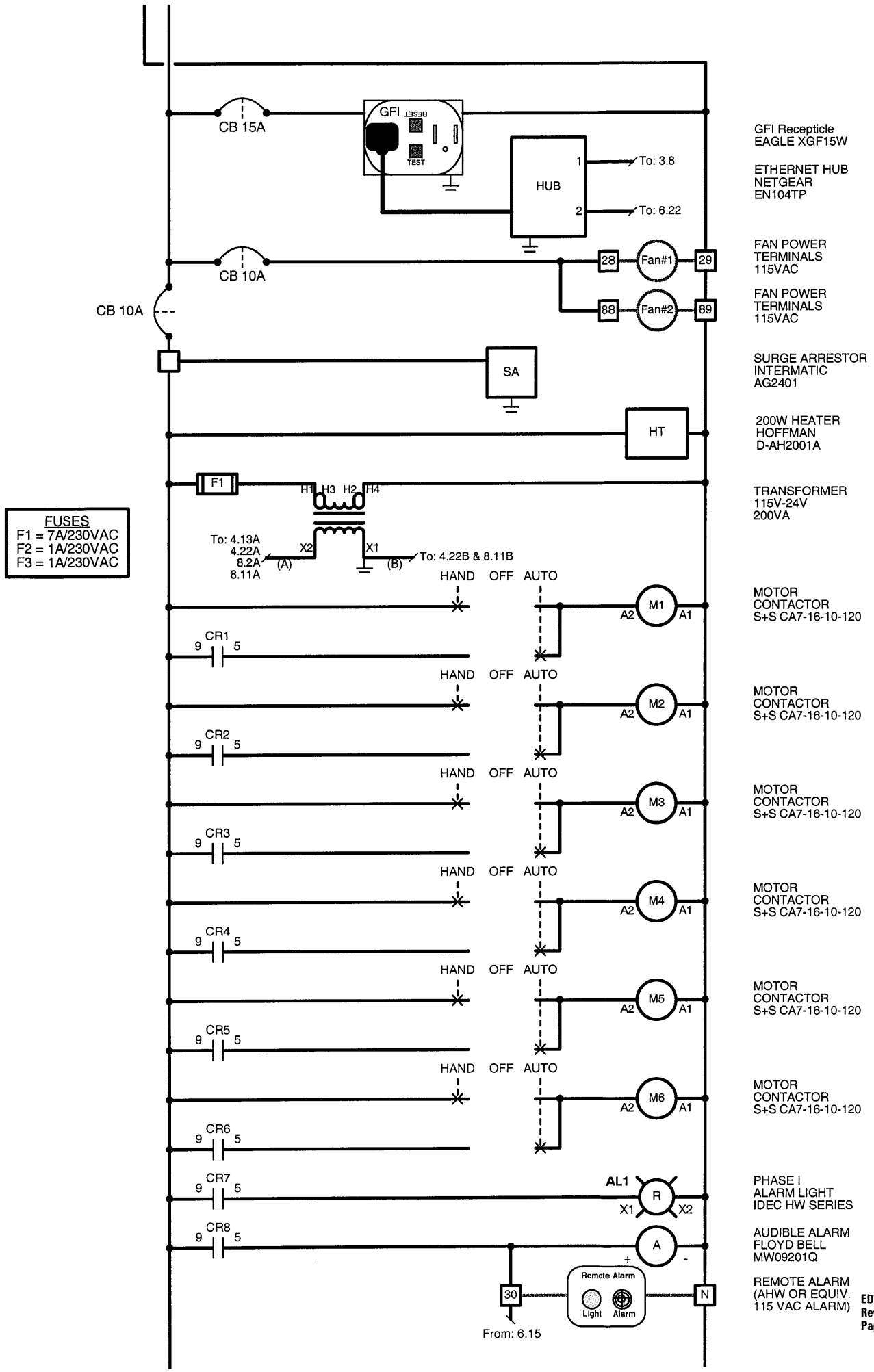
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2.
2.16
2.17
2.18
2.19
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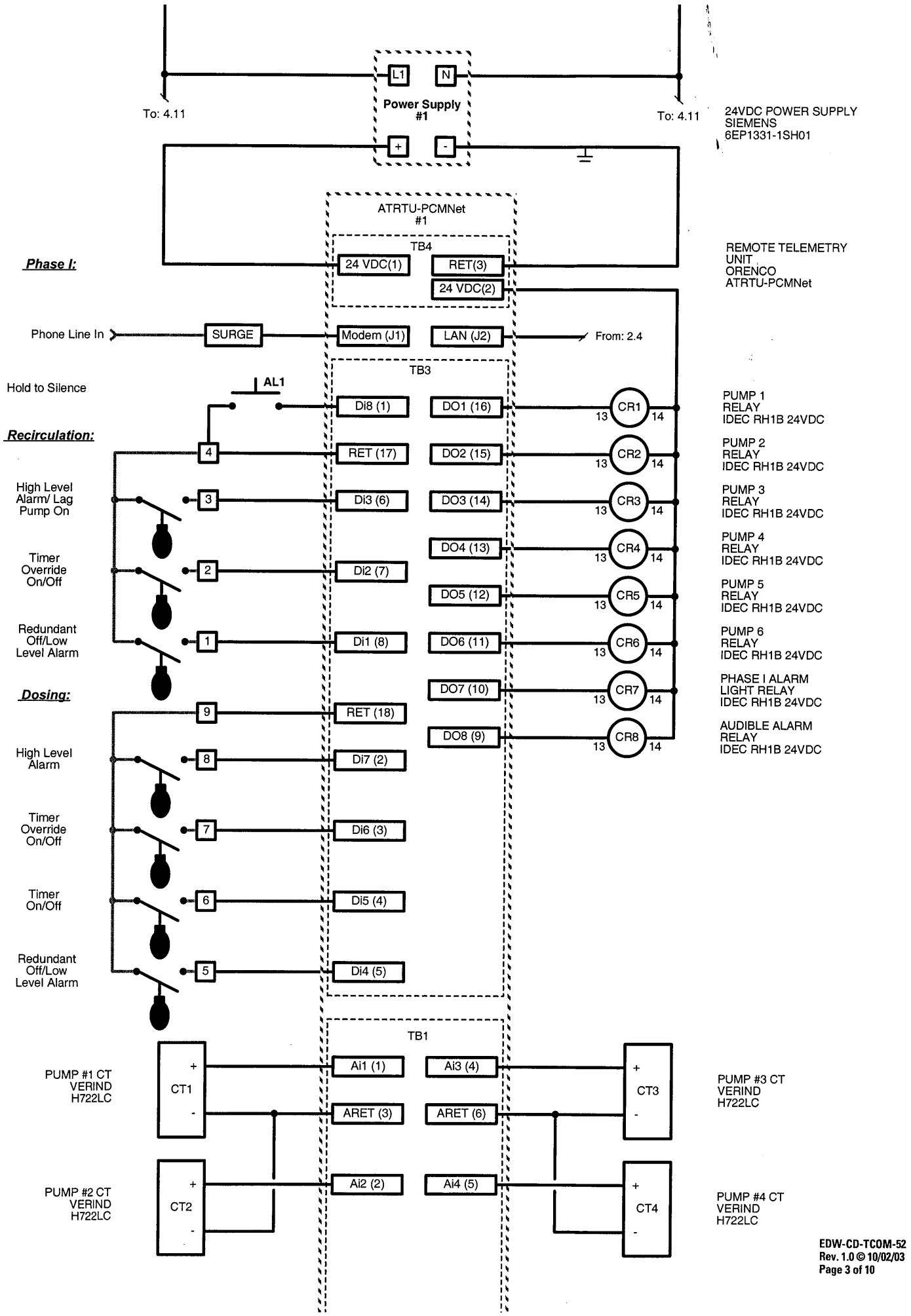
2.21
2.22
2.23
2.24
2.25
2.26
2.27
CB 15A
GFI
RESET
TEST
HUB
1
2
To: 3.8
To: 6.22
CB 10A
28
Fan#1
29
88
Fan#2
89
CB 10A
SA
HT
F1
H1 H3 H2 H4
X2
X1
(A)
(B)
To: 4.13A
4.22A
8.2A
8.11A
To: 4.22B & 8.11B
HAND OFF AUTO
M1
A2
A1
CR1
9
5
M2
CR2
M3
CR3
M4
CR4
M5
CR5
M6
CR6
CR7
AL1
R
X1
X2
CR8
A
+
-
Remote Alarm
Light
Alarm
30
N
From: 6.15
FUSES
F1 = 7A/230VAC
F2 = 1A/230VAC
F3 = 1A/230VAC
GFI Recepticle
EAGLE XGF15W
ETHERNET HUB
NETGEAR
EN104TP
FAN POWER
TERMINALS
115VAC
FAN POWER
TERMINALS
115VAC
SURGE ARRESTOR
INTERMATIC
AG2401
200W HEATER
HOFFMAN
D-AH2001A
TRANSFORMER
115V-24V
200VA
MOTOR
CONTACTOR
S+S CA7-16-10-120
MOTOR
CONTACTOR
S+S CA7-16-10-120
MOTOR
CONTACTOR
S+S CA7-16-10-120
MOTOR
CONTACTOR
S+S CA7-16-10-120
MOTOR
CONTACTOR
S+S CA7-16-10-120
MOTOR
CONTACTOR
S+S CA7-16-10-120
PHASE I
ALARM LIGHT
IDEC HW SERIES
AUDIBLE ALARM
FLOYD BELL
MW09201Q
REMOTE ALARM
(AHW OR EQUIV.
115 VAC ALARM)


To: 4.11
L1
N
Power Supply #1
+
-
To: 4.11
24VDC POWER SUPPLY
SIEMENS
6EP1331-1SH01
ATRTU-PCMNet #1
TB4
Phase I:
24 VDC(1)
RET(3)
24 VDC(2)
REMOTE TELEMETRY UNIT
ORENCO
ATRTU-PCMNet
Phone Line In
SURGE
Modem (J1)
LAN (J2)
From: 2.4
TB3
Hold to Silence
AL1
Recirculation:
Di8 (1)
DO1 (16)
CR1
13
14
PUMP 1 RELAY
IDEC RH1B 24VDC
4
RET (17)
DO2 (15)
CR2
PUMP 2 RELAY
IDEC RH1B 24VDC
High Level Alarm/ Lag Pump On
3
Di3 (6)
DO3 (14)
CR3
PUMP 3 RELAY
IDEC RH1B 24VDC
DO4 (13)
CR4
PUMP 4 RELAY
IDEC RH1B 24VDC
Timer Override On/Off
2
Di2 (7)
DO5 (12)
CR5
PUMP 5 RELAY
IDEC RH1B 24VDC
Redundant Off/Low Level Alarm
1
Di1 (8)
DO6 (11)
CR6
PUMP 6 RELAY
IDEC RH1B 24VDC
Dosing:
DO7 (10)
CR7
PHASE I ALARM LIGHT RELAY
IDEC RH1B 24VDC
9
RET (18)
DO8 (9)
CR8
AUDIBLE ALARM RELAY
IDEC RH1B 24VDC
High Level Alarm
8
Di7 (2)
Timer Override On/Off
7
Di6 (3)
Timer On/Off
6
Di5 (4)
Redundant Off/Low Level Alarm
5
Di4 (5)
TB1
PUMP #1 CT
VERIND
H722LC
CT1
Ai1 (1)
Ai3 (4)
CT3
PUMP #3 CT
VERIND
H722LC
ARET (3)
ARET (6)
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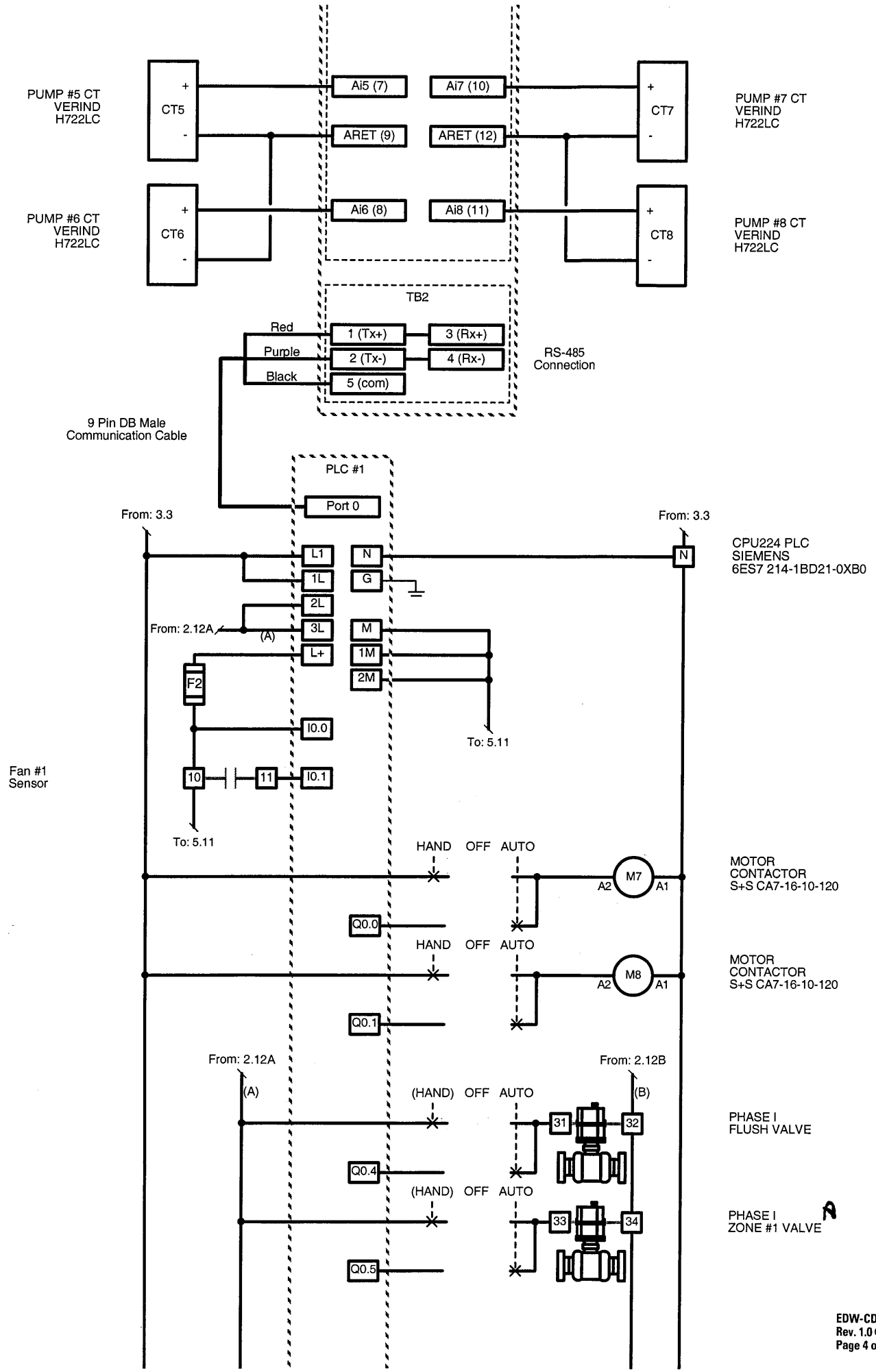
VERIND
H722LC
CT2
Ai2 (2)
Ai4 (5)
CT4
PUMP #4 CT
VERIND
H722LC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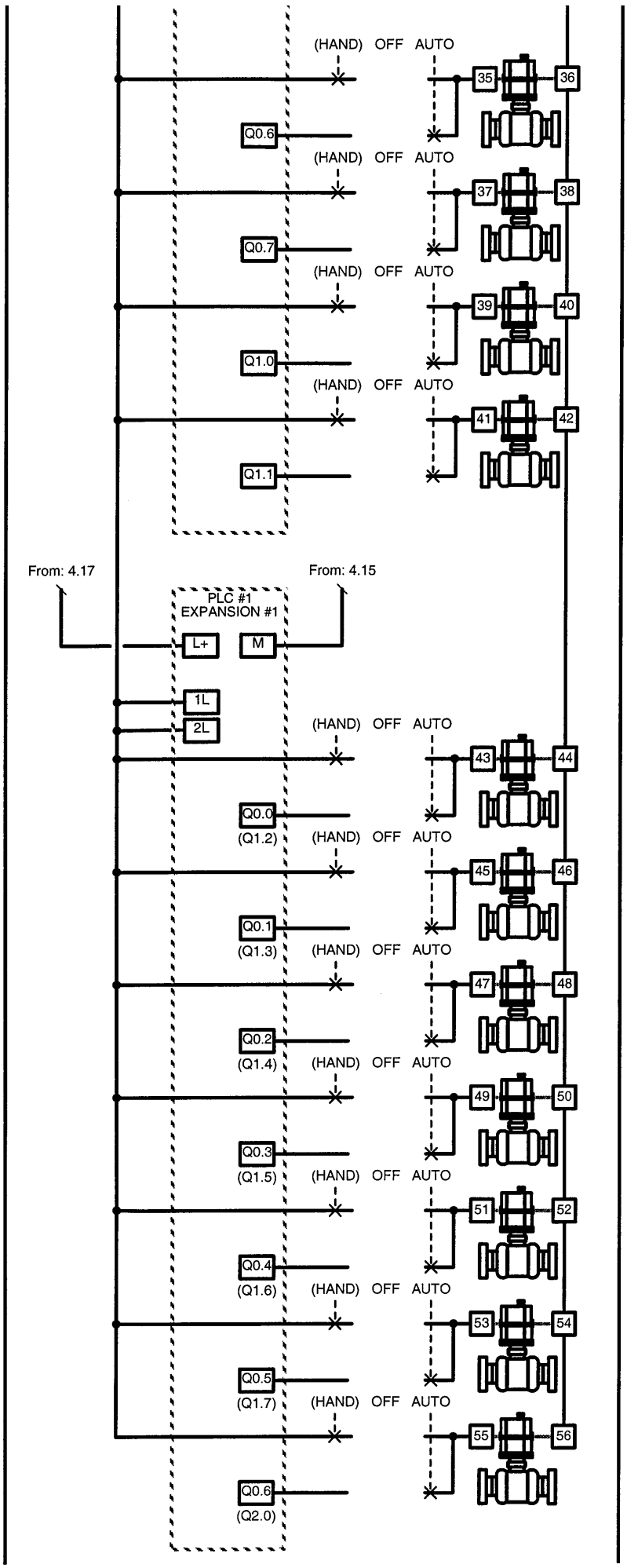
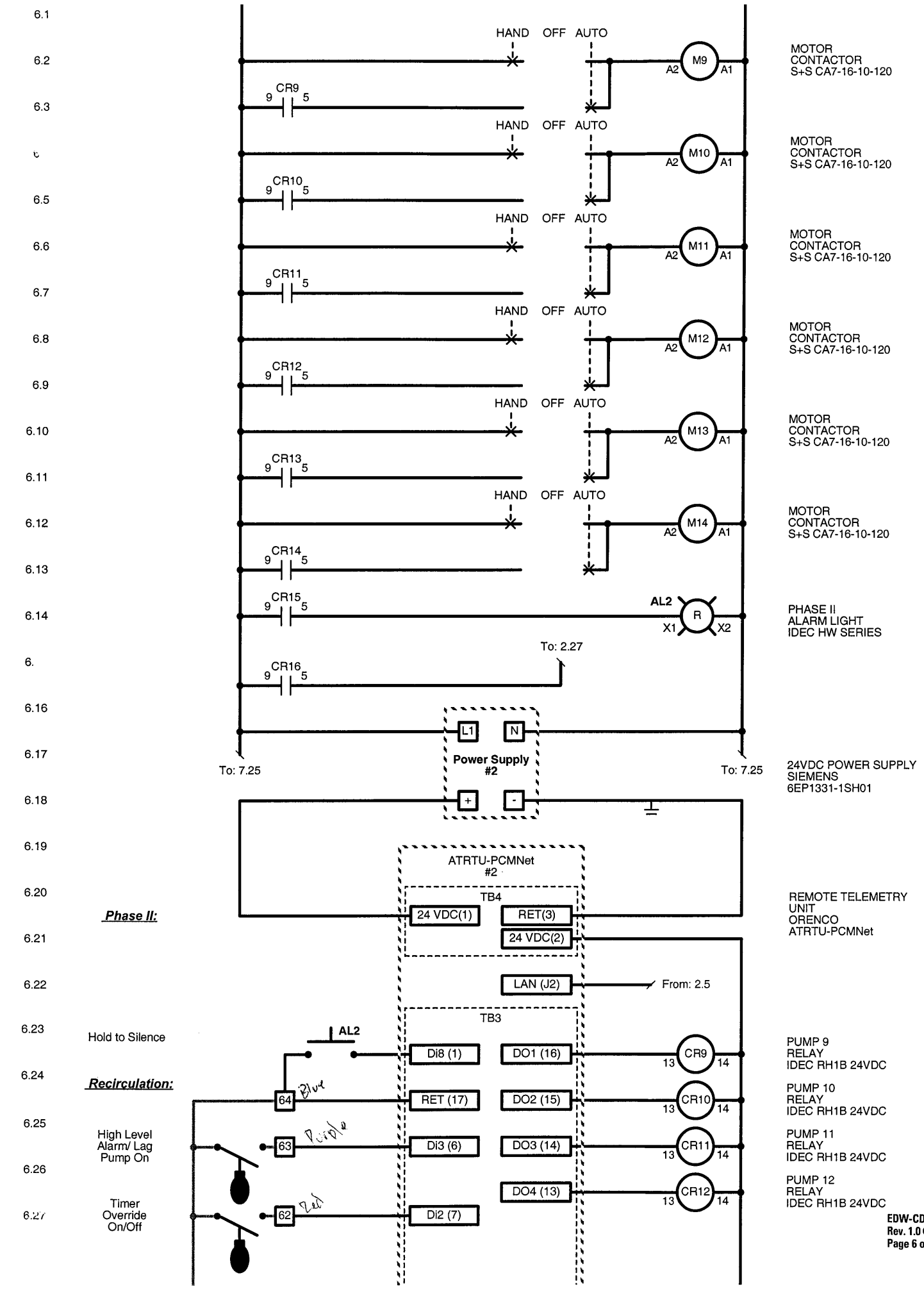
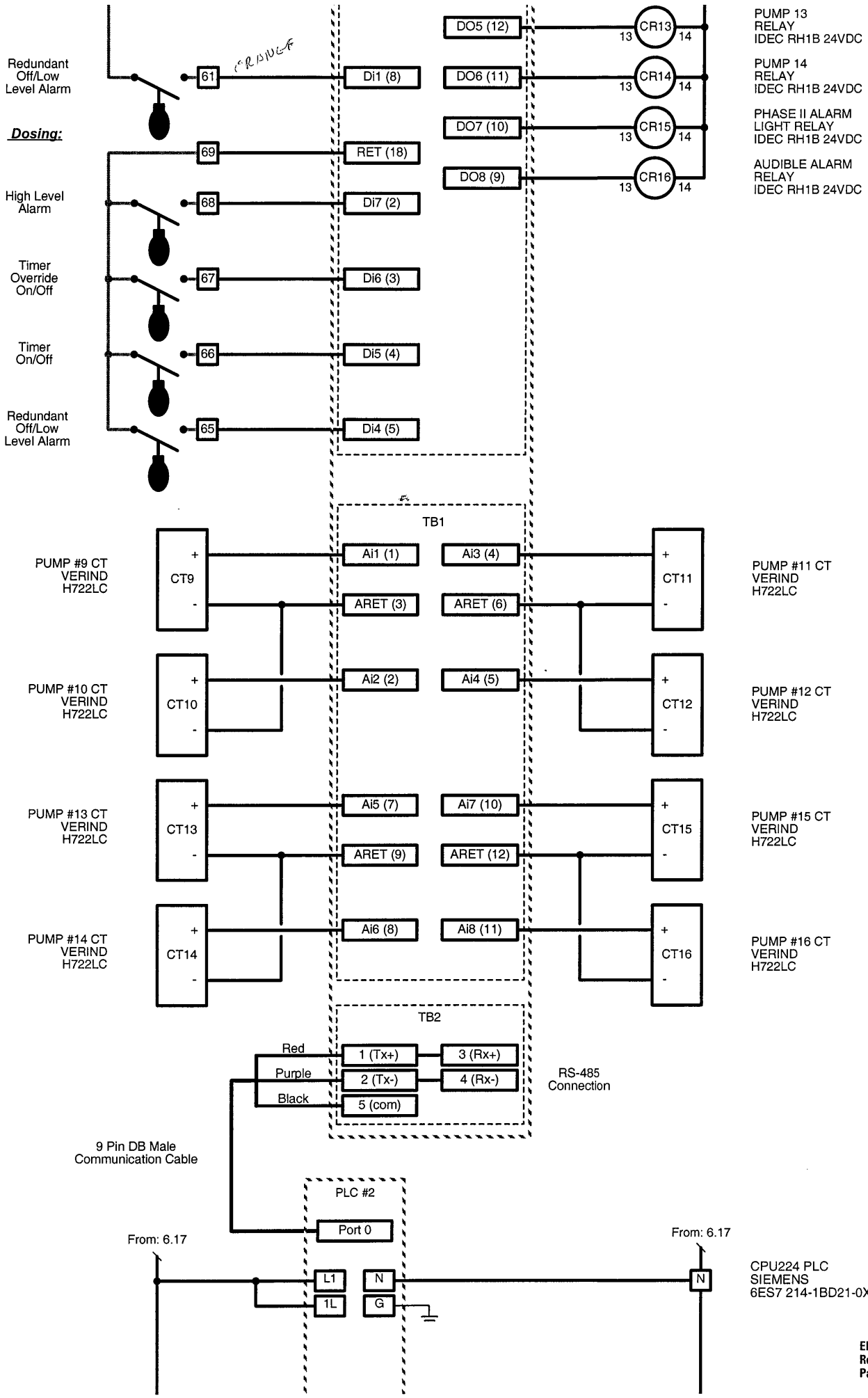
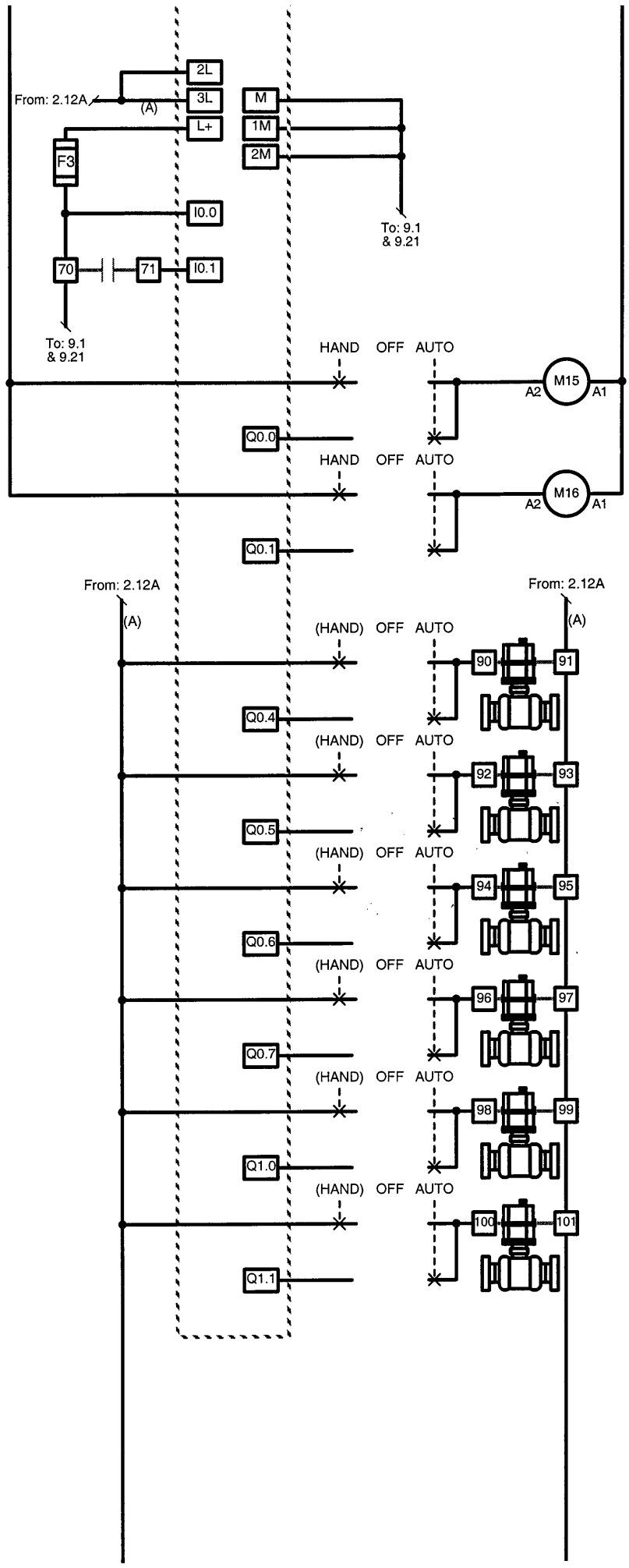
VERIND
H722LC
CT5
Ai5 (7)
Ai7 (10)
ARET (9)
ARET (12)
CT7
PUMP #7 CT
VERIND
H722LC
PUMP #6 CT
VERIND
H722LC
CT6
Ai6 (8)
Ai8 (11)
CT8
PUMP #8 CT
VERIND
H722LC
TB2
Red
Purple
Black
1 (Tx+)
2 (Tx-)
5 (com)
3 (Rx+)
4 (Rx-)
RS-485
Connection
9 Pin DB Male
Communication Cable
PLC #1
Port 0
From: 3.3
From: 3.3
CPU224 PLC
SIEMENS
6ES7 214-1BD21-0XB0
L1
1L
2L
3L
L+
N
G
M
1M
2M
From: 2.12A
(A)
F2
I0.0
To: 5.11
Fan #1
Sensor
10
11
I0.1
To: 5.11
HAND OFF AUTO
M7
A2
A1
MOTOR
CONTACTOR
S+S CA7-16-10-120
Q0.0
HAND OFF AUTO
M8
MOTOR
CONTACTOR
S+S CA7-16-10-120
Q0.1
From: 2.12A
(A)
From: 2.12B
(B)
(HAND) OFF AUTO
31
32
PHASE I
FLUSH VALVE
Q0.4
(HAND) OFF AUTO
33
34
PHASE I
ZONE #1 VALVE
Q0.5

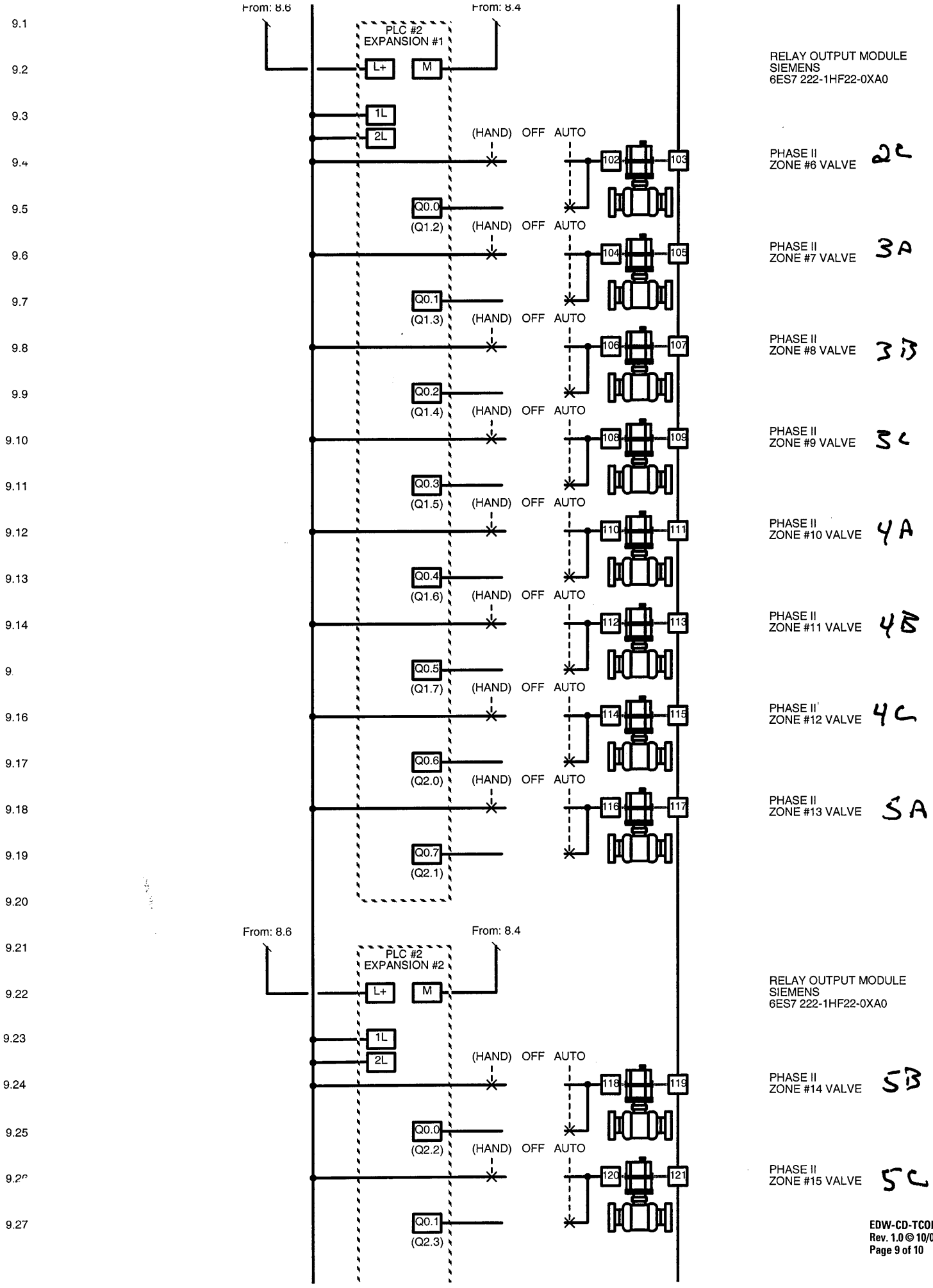

(HAND) OFF AUTO
35
36
PHASE I
ZONE #2 VALVE
1B
Q0.6
(HAND) OFF AUTO
37
38
PHASE I
ZONE #3 VALVE
1C
Q0.7
(HAND) OFF AUTO
39
40
PHASE I
ZONE #4 VALVE
2A
Q1.0
(HAND) OFF AUTO
41
42
PHASE I
ZONE #5 VALVE
2B
Q1.1
From: 4.17
From: 4.15
PLC #1
EXPANSION #1
L+
M
RELAY OUTPUT MODULE
SIEMENS
6ES7 222-1HF22-0XA0
1L
2L
(HAND) OFF AUTO
43
44
PHASE I
ZONE #6 VALVE
2C
Q0.0
(Q1.2)
(HAND) OFF AUTO
45
46
PHASE I
ZONE #7 VALVE
3A
Q0.1
(Q1.3)
(HAND) OFF AUTO
47
48
PHASE I
ZONE #8 VALVE
3B
Q0.2
(Q1.4)
(HAND) OFF AUTO
49
50
PHASE I
ZONE #9 VALVE
3C
Q0.3
(Q1.5)
(HAND) OFF AUTO
51
52
PHASE I
ZONE #10 VALVE
4A
Q0.4
(Q1.6)
(HAND) OFF AUTO
53
54
PHASE I
ZONE #11 VALVE
4B
Q0.5
(Q1.7)
(HAND) OFF AUTO
55
56
PHASE I
ZONE #12 VALVE
4C
Q0.6
(Q2.0)


HAND OFF AUTO
M9
A2 A1
MOTOR CONTACTOR S+S CA7-16-10-120
CR9
9 5
HAND OFF AUTO
M10
A2 A1
MOTOR CONTACTOR S+S CA7-16-10-120
CR10
9 5
HAND OFF AUTO
M11
A2 A1
MOTOR CONTACTOR S+S CA7-16-10-120
CR11
9 5
HAND OFF AUTO
M12
A2 A1
MOTOR CONTACTOR S+S CA7-16-10-120
CR12
9 5
HAND OFF AUTO
M13
A2 A1
MOTOR CONTACTOR S+S CA7-16-10-120
CR13
9 5
HAND OFF AUTO
M14
A2 A1
MOTOR CONTACTOR S+S CA7-16-10-120
CR14
9 5
CR15
9 5
AL2
R
X1 X2
PHASE II ALARM LIGHT IDEC HW SERIES
To: 2.27
CR16
9 5
L1
N
Power Supply #2
+
-
To: 7.25
To: 7.25
24VDC POWER SUPPLY SIEMENS 6EP1331-1SH01
ATRTU-PCMNet #2
TB4
24 VDC(1)
RET(3)
24 VDC(2)
LAN (J2)
From: 2.5
REMOTE TELEMETRY UNIT ORENCO ATRTU-PCMNet
Phase II:
TB3
Hold to Silence
AL2
Di8 (1)
DO1 (16)
CR9
13 14
PUMP 9 RELAY IDEC RH1B 24VDC
Recirculation:
64
Blue
RET (17)
DO2 (15)
CR10
13 14
PUMP 10 RELAY IDEC RH1B 24VDC
High Level Alarm/ Lag Pump On
63
Purple
Di3 (6)
DO3 (14)
CR11
13 14
PUMP 11 RELAY IDEC RH1B 24VDC
DO4 (13)
CR12
13 14
PUMP 12 RELAY IDEC RH1B 24VDC
Timer Override On/Off
62
Red
Di2 (7)


Redundant Off/Low Level Alarm
61
Di1 (8)
Dosing:
69
RET (18)
High Level Alarm
68
Di7 (2)
Timer Override On/Off
67
Di6 (3)
Timer On/Off
66
Di5 (4)
Redundant Off/Low Level Alarm
65
Di4 (5)
DO5 (12)
DO6 (11)
DO7 (10)
DO8 (9)
CR13
CR14
CR15
CR16
13
14
PUMP 13 RELAY IDEC RH1B 24VDC
PUMP 14 RELAY IDEC RH1B 24VDC
PHASE II ALARM LIGHT RELAY IDEC RH1B 24VDC
AUDIBLE ALARM RELAY IDEC RH1B 24VDC
TB1
PUMP #9 CT VERIND H722LC
CT9
Ai1 (1)
ARET (3)
Ai3 (4)
ARET (6)
CT11
PUMP #11 CT VERIND H722LC
PUMP #10 CT VERIND H722LC
CT10
Ai2 (2)
Ai4 (5)
CT12
PUMP #12 CT VERIND H722LC
PUMP #13 CT VERIND H722LC
CT13
Ai5 (7)
ARET (9)
Ai7 (10)
ARET (12)
CT15
PUMP #15 CT VERIND H722LC
PUMP #14 CT VERIND H722LC
CT14
Ai6 (8)
Ai8 (11)
CT16
PUMP #16 CT VERIND H722LC
TB2
Red
Purple
Black
1 (Tx+)
2 (Tx-)
5 (com)
3 (Rx+)
4 (Rx-)
RS-485 Connection
9 Pin DB Male Communication Cable
PLC #2
Port 0
From: 6.17
From: 6.17
L1
1L
N
G
N
CPU224 PLC SIEMENS 6ES7 214-1BD21-0XB0


From: 2.12A
(A)
2L
3L
L+
F3
M
1M
2M
I0.0
To: 9.1
& 9.21
70
71
I0.1
To: 9.1
& 9.21
HAND OFF AUTO
M15
A2
A1
MOTOR
CONTACTOR
S+S CA7-16-10-120
Q0.0
HAND OFF AUTO
M16
A2
A1
MOTOR
CONTACTOR
S+S CA7-16-10-120
Q0.1
From: 2.12A
(A)
From: 2.12A
(A)
(HAND) OFF AUTO
90
91
PHASE II
FLUSH VALVE
Q0.4
(HAND) OFF AUTO
92
93
PHASE II
ZONE #1 VALVE
1A
Q0.5
(HAND) OFF AUTO
94
95
PHASE II
ZONE #2 VALVE
1B
Q0.6
(HAND) OFF AUTO
96
97
PHASE II
ZONE #3 VALVE
1C
Q0.7
(HAND) OFF AUTO
98
99
PHASE II
ZONE #4 VALVE
2A
Q1.0
(HAND) OFF AUTO
100
101
PHASE II
ZONE #5 VALVE
2B
Q1.1

Fan #2
Sensor



RELAY OUTPUT MODULE
SIEMENS
6ES7 222-1HF22-0XA0

PHASE II
ZONE #6 VALVE 2C

PHASE II
ZONE #7 VALVE 3A

PHASE II
ZONE #8 VALVE 3B

PHASE II
ZONE #9 VALVE 3C

PHASE II
ZONE #10 VALVE 4A

PHASE II
ZONE #11 VALVE 4B

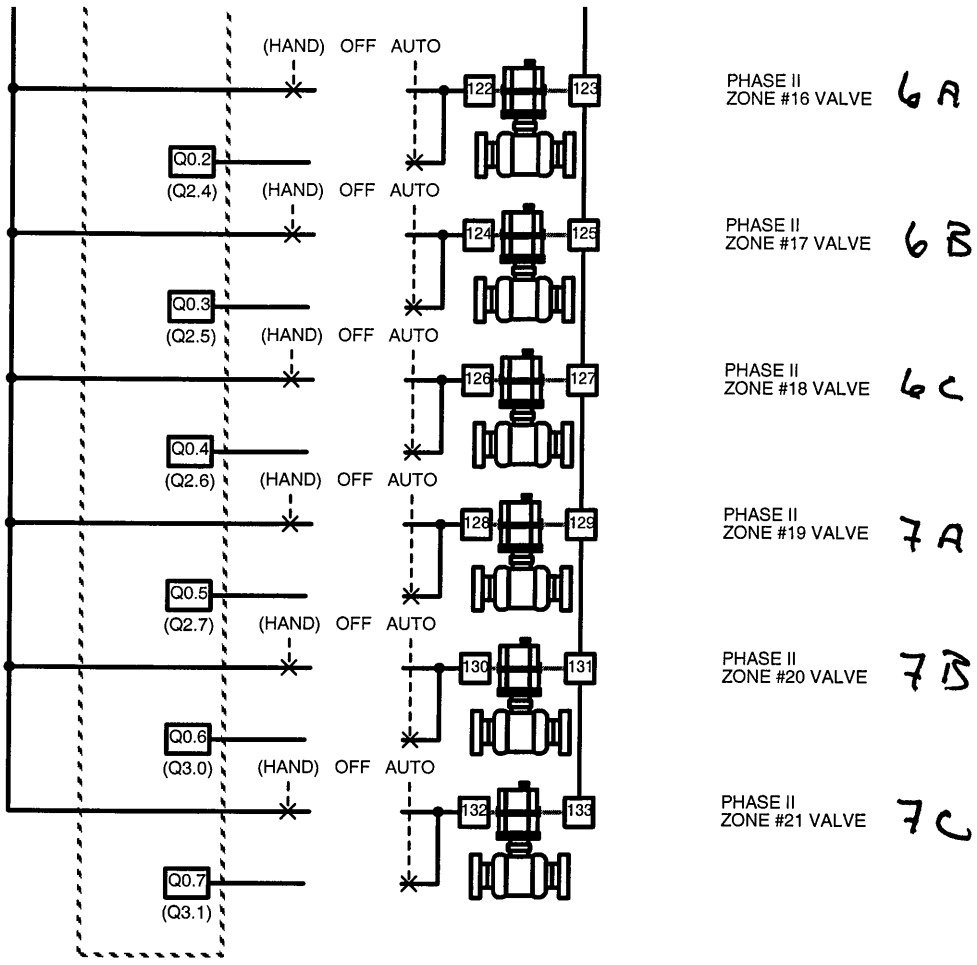
PHASE II
ZONE #12 VALVE 4C

PHASE II
ZONE #13 VALVE 5A

RELAY OUTPUT MODULE
SIEMENS
6ES7 222-1HF22-0XA0

PHASE II
ZONE #14 VALVE 5B

PHASE II
ZONE #15 VALVE 5C


(HAND) OFF AUTO
122
123
PHASE II
ZONE #16 VALVE
6A
Q0.2
(Q2.4)
(HAND) OFF AUTO
124
125
PHASE II
ZONE #17 VALVE
6B
Q0.3
(Q2.5)
(HAND) OFF AUTO
126
127
PHASE II
ZONE #18 VALVE
6C
Q0.4
(Q2.6)
(HAND) OFF AUTO
128
129
PHASE II
ZONE #19 VALVE
7A
Q0.5
(Q2.7)
(HAND) OFF AUTO
130
131
PHASE II
ZONE #20 VALVE
7B
Q0.6
(Q3.0)
(HAND) OFF AUTO
132
133
PHASE II
ZONE #21 VALVE
7C
Q0.7
(Q3.1)

TCOM Setting Instructions

Orenco Systems®
Incorporated

814 AIRWAY AVENUE
SUTHERLIN, OREGON
97479-9012

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FACSIMILE:
(541) 459-2884

Orenco's Custom TCOM Control Panels includes a number a number of user adjustable parameters that may need to be set to something other than the factory default. If your Custom TCOM Control Panel uses a ATRTU 100 Board see document EIN-CP-TCOM-1 for how to access and change you user adjustable parameters. If your Custom TCOM Control Panel uses a ATRTU 400 or 1600 Board see document EIN-CP-TCOM-2 for how to access and change you user adjustable parameters. If your Custom TCOM Control Panel uses a ATRTU PCMNet Board see document EIN-CP-TCOM-3 for how to access and change you user adjustable parameters.

This TCOM unit uses point Numbers (PT#) to identify the various program functions. The following point numbers are adjustable by the system operator:

Phase I:

Pt#	Description	Value (Factory Default)
Page E: Recirc Settings		
65	RecNml Off Time	1.42 Min
66	RecNml On Time	99 Sec
68	RecOVR Off Time	0.42 Min
69	RecOVR On Time	106.8 Sec
71	P1 LowAmpLimit	6.0 Amp
72	P1 HighAmpLimit	14.0 Amp
74	P2 LowAmpLimit	6.0 Amp
75	P2 HighAmpLimit	14.0 Amp
77	P3 LowAmpLimit	6.0 Amp
78	P3 HighAmpLimit	14.0 Amp
Page F: Recirc Settings Cont.		
81	P4 LowAmpLimit	6.0 Amp
82	P4 HighAmpLimit	14.0 Amp
84	P5 LowAmpLimit	6.0 Amp
85	P5 HighAmpLimit	14.0 Amp
87	P6 LowAmpLimit	6.0 Amp
88	P6 HighAmpLimit	14.0 Amp
91	Pump 1 GPM	50.0 GPM
92	Pump 2 GPM	50.0 GPM
93	Pump 3 GPM	50.0 GPM
94	Pump 4 GPM	50.0 GPM
95	Pump 5 GPM	50.0 GPM
96	Pump 6 GPM	50.0 GPM
Page G: Dose Settings		
97	DosNml Off Time	60.0 Min
98	DosNml On Time	300 Sec
100	DosOVR Off Time	30.0 Min
101	DosOVR On Time	300 Sec
103	Number of Zones	12.0 1-12 (zones)
105	EnableZoneFlsh?	Y YorN
106	ZoneFlshIntervl	12.0 Cycl
107	ZoneFlshTime	5.0 Min
108	ZoneRotateTime	8.0 Sec

Page H: Dose Settings Cont.

113 P7 LowAmpLimit	**6.0 Amp**
114 P7 HighAmpLimit	**14.0 Amp**
116 P8 LowAmpLimit	**6.0 Amp**
117 P8 HighAmpLimit	**14.0 Amp**
119 Pump 7 GPM	**50.0 GPM**
120 Pump 8 GPM	**50.0 GPM**

Page I: General Settings

129 Audible Delay	**120.0 Min**
130 Aud React Delay	**480.0 Min**
132 Pager Interval	**30.0 Min**
134 CS Delay	**25.0 Sec**

For Instructions on how to override a numeric point valvue see page 14 of document EIN-CP-TCOM-1 (for ATRTU 100 Boards), page 14 of document EIN-CP-TCOM-2 (for ATRTU 400 or 1600 Boards), pr page 14 of document EIN-CP-TCOM-3 (for PCMNet Boards).

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This TCOM unit uses point Numbers (PT#) to identify the various program functions. The following point numbers are adjustable by the system operator:

Phase II:

Pt#	Description	Value (Factory Default)
Page A: Phase II Status		
1	**Enable PhaseII?**	**OFF (this point must be turned ON to enable Phase II alarm activations**
Page E: Recirc Settings		
65	**RecNml Off Time**	**1.42 Min**
66	**RecNml On Time**	**99 Sec**
68	**RecOVR Off Time**	**0.42 Min**
69	**RecOVR On Time**	**106.8 Sec**
71	**P9 LowAmpLimit**	**6.0 Amp**
72	**P9 HighAmpLimit**	**14.0 Amp**
74	**P10LowAmpLimit**	**6.0 Amp**
75	**P10HighAmpLimit**	**14.0 Amp**
77	**P11LowAmpLimit**	**6.0 Amp**
78	**P11HighAmpLimit**	**14.0 Amp**
Page F: Recirc Settings Cont.		
81	**P12LowAmpLimit**	**6.0 Amp**
82	**P12HighAmpLimit**	**14.0 Amp**
84	**P13LowAmpLimit**	**6.0 Amp**
85	**P13HighAmpLimit**	**14.0 Amp**
87	**P14LowAmpLimit**	**6.0 Amp**
88	**P14HighAmpLimit**	**14.0 Amp**
91	**Pump9 GPM**	**50.0 GPM**
92	**Pump10 GPM**	**50.0 GPM**
93	**Pump11 GPM**	**50.0 GPM**
94	**Pump12 GPM**	**50.0 GPM**
95	**Pump13 GPM**	**50.0 GPM**
96	**Pump14 GPM**	**50.0 GPM**
Page G: Dose Settings		
97	**DosNml Off Time**	**60.0 Min**
98	**DosNml On Time**	**300 Sec**
100	**DosOVR Off Time**	**30.0 Min**
101	**DosOVR On Time**	**300 Sec**
103	**Number of Zones**	**21.0 1-21 (zones)**
105	**EnableZoneFlsh?**	**Y YorN**
106	**ZoneFlshIntervl**	**21.0 Cycl**
107	**ZoneFlshTime**	**5.0 Min**
108	**ZoneRotateTime**	**8.0 Sec**

Page H: Dose Settings Cont.

113 P15LowAmpLimit	**6.0 Amp**
114 P15HighAmpLimit	**14.0 Amp**
116 P16LowAmpLimit	**6.0 Amp**
117 P16HighAmpLimit	**14.0 Amp**
119 Pump15 GPM	**50.0 GPM**
120 Pump16 GPM	**50.0 GPM**

Page I: General Settings

129 Audible Delay	**120.0 Min**
130 Aud React Delay	**480.0 Min**
132 Pager Interval	**30.0 Min**
134 CS Delay	**25.0 Sec**

For Instructions on how to override a numeric point valvue see page 14 of document EIN-CP-TCOM-1 (for ATRTU 100 Boards), page 14 of document EIN-CP-TCOM-2 (for ATRTU 400 or 1600 Boards), pr page 14 of document EIN-CP-TCOM-3 (for PCMNet Boards).

Custom TCOM Control Panels

and HyperTerminal Access

ATRTU PCMNet Board

EIN-CP-TCOM-3
Rev. 1.0 © 10/22/2003

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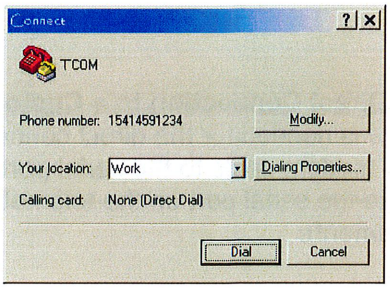
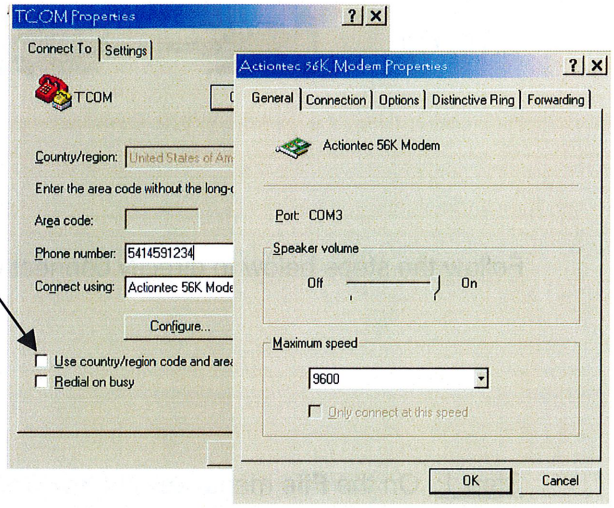
Step 3: Click the **Modify** button.



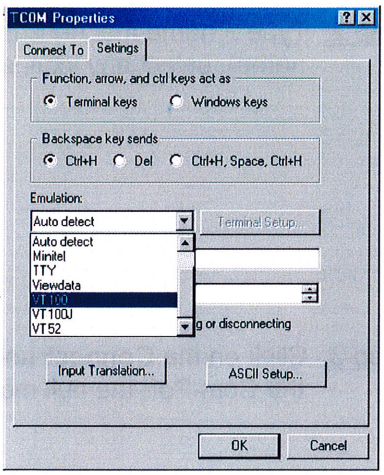
Step 4: Be sure the **Use country/region code and area code** box is NOT checked.

Step 5: Click the **Configure** button.

Step 6: Change the maximum speed to 9600 and click the **OK** button.



Step 7: Click on the **Settings** tab and change the emulation to VT100 and click the **OK** button.



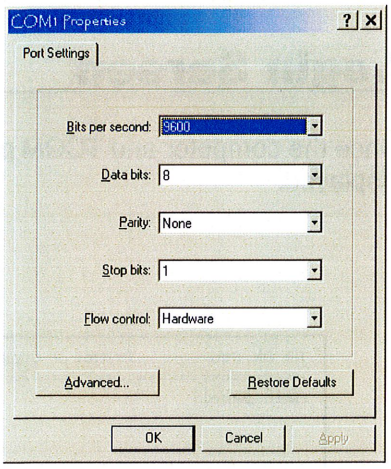
Step 8: Click the **Cancel** button until all of the windows are gone. The HyperTerminal window is now available.

Step 9: On the **File** menu, select **Save**.

Step 10: On the **Call** menu, select **Call,** then click the **Dial** button.

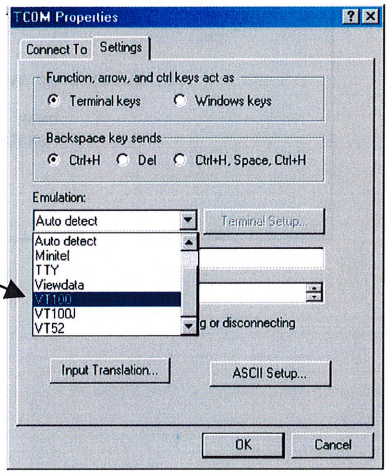
The computer will now establish a connection with the panel. If the login screen does not appear, press the **ESC** key to refresh the screen. (Skip to page 8 of this document.)

Step 4: Click on the **Configure** box and select 9600 bits per second.



Step 5: Click the **OK** button.

Step 6: Click on the **Settings** tab, and change the emulation to VT100 and click the **OK** button.



Step 7: Click the **Cancel** button until all of the windows are gone. The HyperTerminal window is now available.

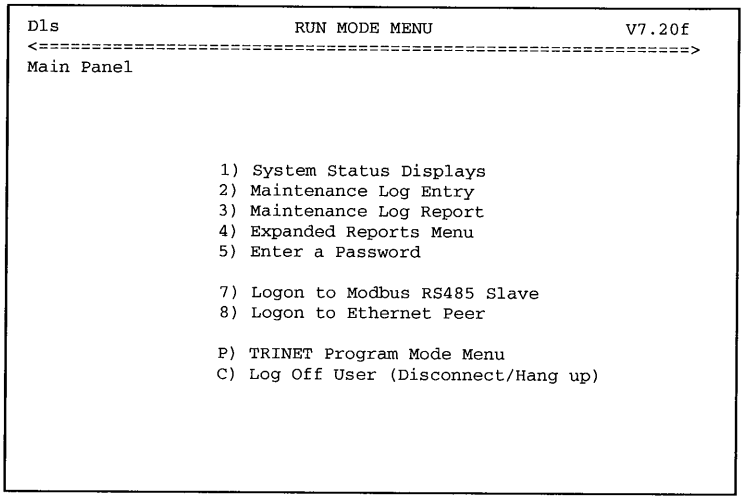
Step 8: On the **File** menu, select **Save**.

Step 9: On the **Call** menu, select **Call**.

The computer will now establish a connection with the panel. If the login screen does not appear, press the **ESC** key to refresh the screen.

Run Mode Menu

This main menu is displayed after a successful login. The name of the current page being displayed will be labeled. The following options are available by pressing the number or letter that corresponds to the desired mode.



Note ◆

- To select a menu option, press the corresponding letter or number next to the desired page (e.g., press the **1** key for the System Status Displays page).
- Access to the Run Mode Menu options depends on the password level.
- The TRINET Program Mode Menu is for Orenco Systems' engineers or advanced users.
- Logging onto a Modbus Slave or Ethernet Peer only applicable with a networked based system.

System Status Displays (1)

Current displays of the panel's activities can be viewed. Viewing and adjusting parameters will be done here.

Maintenance Log Entry (2,3)

Any changes or adjustments to the system can be manually logged for future reference.

Expanded Reports Menu (4)

Activity, Alarm, and User Logs can be viewed, downloaded, and converted to Excel files.

Enter a Password (5)

Logs you off of the current session, so a new User Name and Password can be used to log on.

Logon to Modbus RS485 Slave (7)

Allows access to a Modbus slave.

Logon to Ethernet Peer (8)

Allows access to an Ethernet peer.

TRINET Program Mode Menu (P)

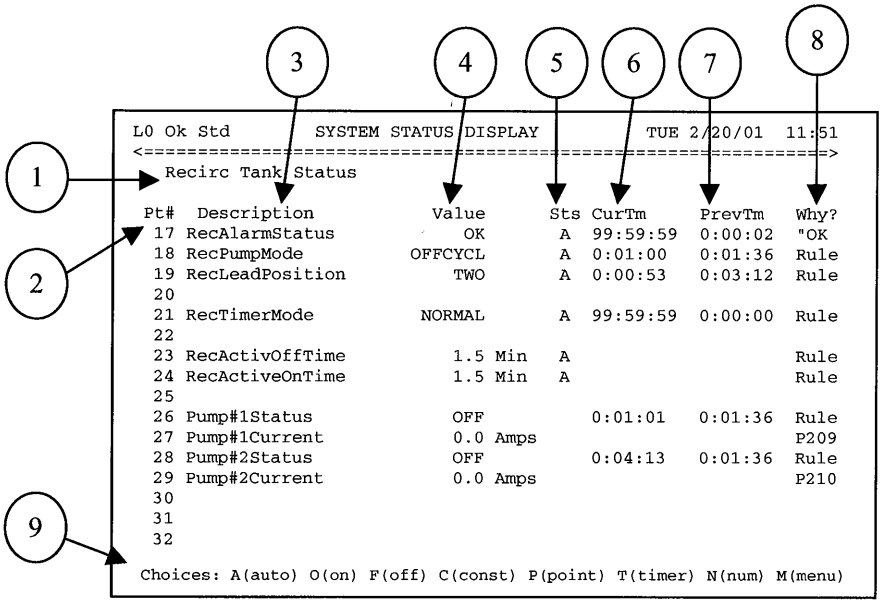
This is where the point rules are created and stored. Changes made in the programming mode by non-authorized operators can void your system warranty and affect the operation of your system.

Log Off User (Disconnect/Hang up) (C)

Disconnects the current session with the controller. Also returns you back to the main panel if logged onto a networked board (see page 24).

Page Definition & Layout

All of the pages under System Status Display have the same appearance. Each of the pages contains the following nine fields:



Note ◆

- The point numbers can be toggled on/off by pressing the letter **N** and the **Enter** key.
- To see a specific point, press **P** and the **Enter** key. Then enter the point number and press the **Enter** key.

The following tips apply to all screens within the TCOM System.

- **ESC** key exits the current page.
- **CTRL** & **Z** keys scroll 16 points backward.
- **CTRL** & **W** keys scroll 16 points forward.
- **Tab** Φ moves cursor in sequence between control fields.
- ↵ **Enter** key executes desired command

Page Description (1)
Identifies which page is being viewed (e.g., Recirc. Tank Status).

PT# (2)
Identifies the program point number. Each page includes sixteen programming points. If the point numbers are not displayed, see NOTE.

Description (3)
Describes each program point used.

Value (4)
Displays the current value of the point. This can be displayed as a label (e.g., OK, HiLevel, OFF, OnCycle, etc.), a unit of measurement (e.g., min, gal, amps, etc.), a digital value (e.g., on or off), a date, or time.

Sts (5)
If this column contains a variable, the point can be changed or adjusted.

CurTm (6)
Provides the elapsed time for the current value.

PrevTime (7)
Provides the total elapsed time for the previous point value.

Why? (8)
Defines the reason for the value if available (e.g., rules, inputs, default value, etc.).

Choices (9)
These options are available under the **Sts** column.

```
L0 Ok Std        SYSTEM STATUS DISPLAY          TUE 2/20/01  12:14
<=============================================================>
   Digital Outputs

 Pt#  Description          Value      Sts CurTm     PrevTm   Why?
 241 RecircTankPump1         on        A  0:00:08   0:04:48  Rule
 242 RecircTankPump2        off        A  0:01:45   0:01:36  OFF
 243 DoseTankPump3          off        A  2:19:27   0:04:07  Rule
 244 DoseTankPump4          off        A  0:47:20   0:03:49  Rule
 245 AlarmLight             off        A  99:59:59  0:00:04  OFF
 246 AudibleAlarm           off        F  0:02:31   0:00:00  Ovr/Const
 247
 248
 249
 250
 251
 252
 253
 254
 255
 256

 Choices: A(auto) O(on) F(off) C(const) P(point) T(timer) N(num) M(menu)
```

WARNING ▲

- Changes to parameters must be made between screen updates or they will not be saved. (This can be avoided by pressing the **Enter** key immediately after a letter is entered in the **Sts** column.)
- Overriding point values can severely effect the operation of your onsite system and will not allow the TriNet Logic to control a particular point.

Note ◆

- If a mistake is made while changing a parameter, press the **ESC** key.
- The point numbers can be toggled on/off by pressing the letter **N** and the **Enter** key.
- To see a specific point, press **P** and the **Enter** key. Then enter the point number and press the **Enter** key.

To Force a Digital Point Off

When a point is forced off, the logic for that point is overridden. The point will no longer use the TriNet Logic to determine its state. The point will continue to stay off until it is returned to Auto(A) state.

1. Using the **Tab** key or Arrow keys, move the cursor in the **Sts** column to select the point to be overriden.
2. Type **F** and immediately press the **Enter** key.

In this example, point #246, "AudibleAlarm", will be manually turned off. The audible alarm on the panel will stay off until an **A** is entered at point #246.

```
L0 Ok Std          SYSTEM STATUS DISPLAY          TUE 2/20/01  12:36
<=================================================================>
   Digital Outputs

 Pt#  Description          Value      Sts CurTm     PrevTm    Why?
 241 RecircTankPump1         off       T  0:01:03   0:00:38   Rule
 242 RecircTankPump2         off       A  0:04:15   0:01:36   Rule
 243 DoseTankPump3           off       A  2:41:10   0:04:07   Rule
 244 DoseTankPump4           off       A  1:09:03   0:03:49   Rule
 245 AlarmLight              off       A  0:21:25   0:00:11   OFF
 246 AudibleAlarm            off       A  0:24:14   0:00:00   Rule
 247
 248
 249
 250
 251
 252
 253
 254
 255
 256

 Enter Override Time (hh:mm or xxx secs):  120
 Choices: A(auto) O(on) F(off) C(const) P(point) T(timer) N(num) M(menu)
```

WARNING ▲

- Changes to parameters must be made between screen updates or they will not be saved. (This can be avoided by pressing the **Enter** key immediately after a letter is entered in the **Sts** column.)

Note ◆

- If factory default settings need severe adjustments, the operator needs to contact Orenco Systems, Inc. to implement changes.
- If a mistake is made while changing a parameter, press the **ESC** key.
- The point numbers can be toggled on/off by pressing the letter **N** and the **Enter** key.
- To see a specific point, press **P** and the **Enter** key. Then enter the point number and press the **Enter** key.

To Override a Point for a Specified Time

This procedure overrides the logic and changes the value of a point for a specified period of time and then returns it to the previous value. This can be used for both digital and numeric values.

1. Using the **Tab** key or Arrow keys, move the cursor in the **Sts** column to select the point to be overriden.
2. Type **T** and immediately press the **Enter** key.
3. Type **O** (on), **F** (off), the desired numeric value or the label, and press the **Enter** key.
4. Enter the length of Time (if seconds are needed, enter the number of seconds, such as, 120); if minutes or hours are needed, enter value with a colon, (such as, HH:MM); then press the **Enter** key.

In this example, point #241, the "RecircTankPump1", will be turned on for 120 seconds; then it will revert back to its auto value.

Explain the Point Value (A)

This option will describe the program logic that is currently responsible for the point's value. All other value possibilities are listed.

```
POINT VALUE EXPLANATION
=======================

THU 3/1/01   11:34 Std

Point# 1 (AlarmStatusRec) is now:       LowLvl
 DUE TO Rule 119



Logic that exists for this point:
                              Rule Changes Point
                                 Used by Rule
                          Point Definition Default




                          Press any key to continue
```

Note ◆

- If no data is available, a message of "No Data to Report" will be displayed.
- Pressing the **ESC** key at anytime will return to the previous screen.

Rule Display (F)

The rules for the point can be displayed. The rule controlling the point will be displayed first. The other rules that apply to the point can be displayed by repeatedly pressing the **Enter** key.

```
L0 Ok Std                      CONTROL RULE SUMMARY
<=====================================================================
===========>
POINT:  1 (AlarmStatusRec) {LowLvl  }   RULE: 119 {true}
 -- IS --
  "LowLvl
 -- IF --
  P35     (BottomFloat) {OK}    =  "OK
 -- AND --
  P179    (RO) {off}    =  OFF









LIST RULE # (1-256): 0
```

Note ◆

- If no rules are controlling a point, a message of "No Rule Applies!" will be displayed.
- Pressing the **ESC** key at anytime will return to the previous screen.

Logs (Q,S,U)

These pages will display the activity log, alarm log, or user log.

The activity log will report input or output activity with a date and time stamp. To view an activity log, the cursor must be on the digital input/output to be monitored before entering the System Status Menu.

The alarm log will report any PC board failures (e.g., low battery, power failures).

The user log is where the programming data is reported (e.g., level alarms, daily pump run times). The user logs will be separated into individual pages. This menu is where user log numbers can be determined and viewed before downloading.

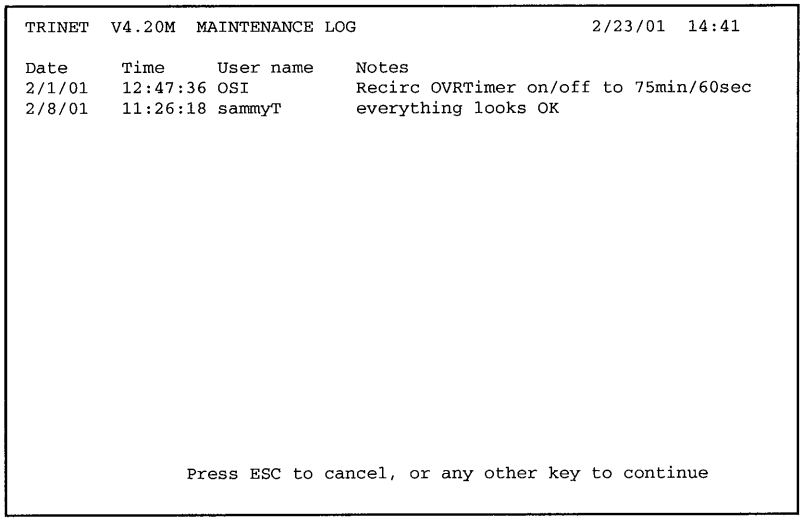
```
TRINET  V4.16E  ACTIVITY LOG REPORT                  2/20/01  16:53

                    POINT 245 (AlarmLight) ACTIVITY DATA

ACTIVITY logged:                    Start   Start    End      End
Cause of Activity     Item  Value   Date    Time     Date     Time
PT-ON    ,AlarmLight  245     on  2/20/01 12:14:40 2/20/01 12:14:51

          Press ESC to cancel, or any other key to continue
```

Note ◆

- If no data is available to report from the logs, a message of "No Data to Report" will be displayed.
- Pressing the **ESC** key at anytime will return to the previous screen.

Viewing the Maintenance Log Report

1. Press **3** from the Run Mode Menu.
2. Select **A** for Report Format.
3. Select **A** for Transmission Format.
4. Press the **Enter** key.
5. Type **Y** to pause after each screen.
6. Press the **Enter** key to generate report.



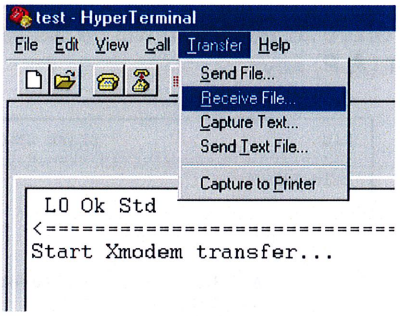
```
L0 Ok Dls                    ACTIVITY LOG REPORT
<=====================================================================>



     Report for which point (1-480 or 0 for all)? 1

          Report format (A for ASCII, D for DIF)? D

Transmission format (A for ASCII, X for X-Modem)? X
```

Note

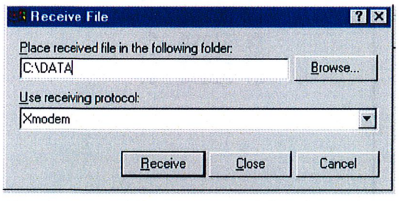
* **The file will be downloaded to the specified path with the specified file name.**
* **If the file is saved in a .txt format, then it can be easily accessed with any text editor (e.g., MS Word, WordPad, etc.).**
* **If the file is saved as a .dif format, it can be easily accessed in Excel.**
* **Once the "Start X-modem Transfer" prompt appears, the system allows the user 1 minute to click on the Receive File.**

3. Type the point/log number, press the **Tab** key.
4. Type **A** for an ASCII report format (for text editor)* or **D** for a DIF report format (for excel file)*; then press the **Tab** key.
5. Type **X** for X-Modem transmission format.
6. Press **Enter** key.

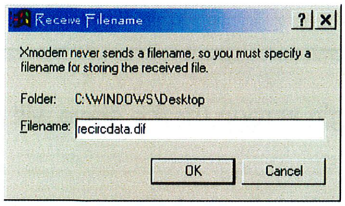
You will be prompted to start the transfer.



7. On the **Transfer** menu, click on **Receive File***.



8. **Enter a path** on your local drive to receive the report (e.g., C:\Data).
9. Select **Xmodem** from the receiving protocol option.
10. Click on the **Receive** button.



11. **Enter a file name** (e.g., recircdata.dif)*.
12. Click on the **OK** button.

Logon to Ethernet Peer (8)

When two or more boards are networked using Ethernet, these boards are referred to as peers. To access other peers press **8** from the Run Mode Menu.

The Ethernet Peer Select Menu will be displayed; select the peer to access by pressing the corresponding letter (**A-P**) key.

```
Dls                ETHERNET PEER SELECT MENU
<============================================================>
Main Panel



        A) Peer  1:  Main Panel       I) Peer  9:
        B) Peer  2:  Sub Panel        J) Peer 10:
        C) Peer  3:                   K) Peer 11:
        D) Peer  4:                   L) Peer 12:
        E) Peer  5:                   M) Peer 13:
        F) Peer  6:                   N) Peer 14:
        G) Peer  7:                   O) Peer 15:
        H) Peer  8:                   P) Peer 16:
```

Note ◆

- After a peer panel is accessed the screens will be similar to those discussed throughout this document.
- Another peer can be accessed by selecting Log Off User option on the slave Run Mode Menu.

A new login screen for the peer will appear (see page 3).

Appendix G

Material Specifications

AdvanTex® Treatment Systems

Material Specifications

Bethel Heights – Phase I & II
Bethel Heights, AR

Material Specifications

Orenco Systems®
Incorporated
1-800-348-9843

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Foreword

Throughout this document you will find the term "or approved equal". For this project this term "approved equal" shall mean equal in the judgment of the engineer.

Should the bidder seek approval of a product other than the brand or brands named in the specifications, the bidder shall furnish written evidence that such product conforms in all respects to the specified requirements, and that it has been used successfully elsewhere under similar conditions. Where the specified requirements involve conformance to recognized codes or standards the bidder shall furnish evidence of such conformance in the form of test or inspection reports, prepared by a recognized agency, and bearing an authorized signature.

Manufacturer's standard data and catalog cut sheets will not be considered sufficient in themselves, and the engineer will not be responsible for seeking further data from the manufacturer, or for otherwise researching the product. Failure to provide complete data will be cause for rejection of the product. The submission shall include any impacts that could be expected from the alternative product and shall also indicate any product that would require a license or royalty, the actual fees, and a note that these fees would be handled by the bidder.

The bidder shall provide submissions, meeting the above parameters no less than 96 hours prior to bid opening for review by the engineer.

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Primary and Secondary Tanks

General

The manufacturer shall provide the structural design and certification to the engineer for review. The design shall be in accordance with accepted engineering practice. Precast concrete or fiberglass tanks shall have been designed by a registered engineer and approved by state or local regulatory agencies, or authorities.

a. Loading Criteria:

- There shall be 140 pcf for minimum weight of saturated backfill, or 127 pcf for unsaturated backfill (500 psf minimum).
- Minimum lateral loading shall be 62.4 pcf. Lateral loading shall be determined from ground surface.
- The tank shall also support a concentrated wheel load of 2500 lbs.

b. Tanks requiring deep burial (>48") or subject to truck or heavy traffic loading require special consideration. (A minimum soil cover of 12" shall be used, unless specified otherwise by manufacturer.)

c. *All tanks shall be structurally sound and watertight* and shall be guaranteed in writing by the tank manufacturer for a period of two years from the date of final acceptance. Manufacturer's signed guarantee shall accompany bids. The tank guarantee/warranty shall be furnished at the time of submittal. Tank warranty shall not be limited liability to replacement cost of the tanks. The septic tank shall be capable of withstanding long-term hydrostatic loading, in addition to the soil loading, due to a water table maintained at ground surface.

d. Tanks shall be manufactured and furnished with a minimum access opening of 20 inches in diameter and of the configuration shown on the manufacturer's drawings. Modification of completed tanks will not be permitted.

e. Inlet plumbing shall include an inlet tee which penetrates 18 inches into the liquid from the inlet flow line. The inlet plumbing shall allow for natural ventilation back through the building sewer and vent stack.

f. Tanks shall be capable of successfully withstanding an aboveground static hydraulic test and shall be individually tested.

g. Tanks shall be installed in strict accordance with the manufacturer's recommended installation instructions.

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e. Performance testing will be evaluated by a Registered Professional Engineer (P.E.). The Engineer will have the sole responsibility to determine the maximum external loading on any of the tank models.

f. The tank shall be constructed with a glass fiber and resin content specified by the manufacturer and with no exposed glass fibers. Any permanent metal part shall be 300 series stainless steel.

g. Inspections may be made by the engineer in the supplier's yard, within the plant, upon delivery and again after installation. The minimum wall thickness shall be 3/16". If the wall thickness is suspected to be less than 3/16" or if delamination is suspected within any portion of the tank, the engineer may drill a 1/4" diameter hole through the tank wall for inspection purposes. If the required minimum 3/16" thickness is not found, repair if feasible shall be the responsibility of the contractor. If repair is judged not feasible, the tank shall be rejected. If twenty percent (20%) or more of the tanks are rejected for any of the aforementioned reasons, each tank under this bid will become suspect of substandard quality and subject to rejection by the engineer. If the required minimum 3/16" thickness is found and no delamination is present, the repair of the inspection holes shall be the responsibility of the engineer.

h. The engineer shall specify the minimum weight of each tank model that will be allowed. The manufacturer will permanently mark the weight of each tank on the top near the access hole.

i. The minimum tank weight shall be specified by the manufacturer's engineer (i.e., 330 lbs for 1000 gallon tanks ...450 lbs for 1500 gallon tanks; add 30lbs for internal baffle).

j. Holes specified for the tank shall be provided by the manufacturer. Resin shall be properly applied to all cut or ground edges so that no glass fibers are exposed and all voids are filled.

k. Orenco Systems®, Inc. EPDM gaskets, or approved equal, shall be used at the inlet to join the tank wall and the inlet piping. ABS or Schedule 40 PVC pipe and fittings shall be used at the inlets.

l. Inlet plumbing shall include an inlet tee that penetrates 18" into the liquid from the inlet flow line. (The depth may vary depending on the tank's height; in all cases, though, the inlet should extend to a level below the bottom of the maximum scum depth). The inlet plumbing shall allow for natural ventilation back through the building sewer and vent stack.

m. Water testing shall be performed on each tank and shall be witnessed by the engineer. Every tank shall be filled with water to the brim of the access opening for a minimum of two (2) hours. The tank shall show no leakage from section seams, pin-holes or other imperfections. Any leakage is cause for rejection.

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Collection

Blend Tanks

All blend tank components shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for wastewater treatment systems. References must be available on request from the engineer. Equipment shall be Orenco Systems®, Inc. or approved equal consisting of the following:

1. **Risers:**

   Risers shall be required for access to internal vaults and access into the blend tanks for septage pumping. All risers shall be constructed watertight. The risers shall be attached to the tanks such that a watertight seal is provided. Risers shall extend three inches (3") above original grade to allow for settlement and to ensure positive drainage away from the access. Risers for inspection ports shall be a minimum of 18 inches in nominal diameter. Risers shall be a minimum of 30 inches in nominal diameter when the depth of bury is 36 inches or greater. All other risers shall be a minimum of 24 inches in nominal diameter and shall vary in height depending on the depth of bury on the various tanks. Adhesive required to adhere the PVC or fiberglass risers to either fiberglass or ABS tank adapter shall be either a two-part epoxy, Model MA320 or approved equal, or a single component adhesive Model ADH100 or approved equal. To ensure product compatibility, risers, lids, and attachment components shall be supplied by a single manufacturer.

2. **Inlet and Cleanout Risers:**

   Risers shall be ribbed PVC as manufactured by Orenco Systems®, Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2 an inch. Risers shall extend to 3 inches above the ground surface to allow for settlement. Risers shall be at least 12 inches tall with a nominal diameter of 30 inches. See section 3 below for adhesive requirements.

3. **Outlet Risers:**

   Risers shall be ribbed PVC as manufactured by Orenco Systems®, Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2 an inch. Risers shall extend

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Treatment

Recirculation Tank Pumping Assemblies

All pumping systems shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for wastewater treatment systems. References must be available on request from the engineer. Systems shall be Orenco Systems®, Inc. High-Head Pumping Assemblies or approved equal, composed of:

1. **Risers:**

   Risers shall be required for access to internal vaults and access into the recirculation tanks for inspection, maintenance, or septage removal. All risers shall be constructed watertight. The risers shall be attached to the tanks such that a watertight seal is provided. Risers shall extend three inches (3") above original grade to allow for settlement and to ensure a positive drainage away from the access. Risers for inspection ports shall be a minimum of 18 inches in nominal diameter. Risers containing pumping assemblies or electrical splice boxes shall be a minimum of 30 inches in diameter and shall be of sufficient diameter to allow removal of internal vaults without removing splice boxes, etc. Risers shall be a minimum of 30 inches in nominal diameter when the depth of bury is 36 inches or greater. All other risers shall be a minimum of 24 inches in nominal diameter and shall vary in height depending on the depth of bury on the various tanks. Adhesive required to adhere the PVC or fiberglass risers to either fiberglass or ABS tank adapter shall be either a two-part epoxy, Model MA320, a single component adhesive Model ADH100 or approved equal.

2. **Inlet and RSV Riser:**

   Risers shall be ribbed PVC as manufactured by Orenco Systems®, Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2 an inch. Risers shall extend to 3 inches above the ground surface to allow for settlement. Risers shall be at least 12 inches tall with a nominal diameter of 30 inches. See section 3b below for adhesive requirements. The RSV riser shall be equipped with the following:

   - Inlet & Outlet Grommets: EPDM grommets shall be installed to assure a watertight seal.

Optional Components

- Traffic bearing lid: The traffic bearing lid shall be a cast iron frame and cover, part number 6024, 3060, 4036, as manufactured by Sather Manufacturing Co., Inc., or approved equal, which will fit over a standard lid. The cover shall have the word SEWER cast into it.

5. **Riser Installation:**

   Riser installation shall be accomplished according to the manufacturer's instructions.

6. **Pump Vaults:**

   Orenco Systems®, Inc. Model PVU95-3630-L, Universal Biotube® Pump Vault or engineer-approved equal, installed in conformance with the engineer's plans. The filter shall have a minimum effective screen area of no less than 20.6 square feet. The Biotube Pump Vault shall consist of a 12-inch diameter, 95-inch deep HDPE vault with eight (8) 2-inch diameter holes evenly spaced around the perimeter, located 30 inches from the base of the pump vault. Housed inside the polyethylene vault shall be the Biotube assembly consisting of 1/8" mesh polypropylene tubes. Attached to the vault is a flow inducer to accept one or two high-head effluent pumps.

7. **Discharge Hose and Valve Assembly:**

   Orenco Systems®, Inc. Model HV200BCX, 2-inch diameter, 150 psi PVC ball valve, 150 psi PVC check valve, PVC flex hose with working pressure rating of 64 psi, and Schedule 40 PVC pipe.

8. **Float Switch Assembly:**

   Orenco Systems®, Inc. Model MF3A-YP,G,W-48V with three switch floats mounted on a PVC stem attached to the filter cartridge. The floats must be adjustable and must be removable without removing the pump vault. The high/lag enable- and low-level alarms and override enable function shall be preset as shown in the engineer's plans. Each float lead shall be secured with a nylon strain relief bushing at the splice box. The floats shall be UL or CSA listed and shall be rated for a minimum of 5.0A @ 120 VAC.

9. **High-Head Effluent Pumps:**

   Pump must be approved for use in pump vault described above. Pump shall be Orenco Systems®, Inc. Model P500712, 3/4 hp, 230 VAC, single phase, 60 Hz, two-wire motor, with 10-foot long extra heavy duty (SO) electrical cord with ground. Each pump shall be capable of providing a nominal flow rate of 50 gpm at a head of 57 feet. Pump shall be UL and CSA listed as an effluent pump. Pump shall be provided with a non-prorated five-year warranty.

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detection of trends)

e. Schedule functions to control digital "Points" based on date or day of week/time.

f. Automatic daylight savings time adjustment.

g. Automatic call-out to pagers during alarm conditions when panel detects trends that could lead to system failure.

In addition, the unit shall have the capability of real-time direct connection to the panel via laptop serial port, to allow the operator real-time access to detailed logged data and the ability to change point values.

Standard Components:

h. Motor-Start Contactor: 230 VAC: 16 FLA, 3 hp, 60 Hz; 2.5 million cycles at FLA (10 million at 50% FLA).

i. Toggle Switch: Single-pole switch, automatic On, with spring-loaded, momentary, manual On. 20 amps, 1 hp.

j. Controls Circuit Breaker: 10 amps, OFF/ON switch. Single-pole 115 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

k. Pump Circuit Breaker: 20 amps, OFF/ON switch. Double-pole 230 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

l. Audio Alarm: 80 dB at 24", warble-tone sound.

m. Visual Alarm: 7/8" diameter red lens, "Push-to-silence." NEMA 4, 1-watt bulb, 115 VAC

n. Panel Enclosure: NEMA 4 rated. Constructed of steel; hinges and latch are stainless steel. Conduit couplings provided.

o. Remote Telemetry Unit: ATRTU-400; 24 VDC (center tap transformer), 8 digital inputs, 6 analog inputs, 8 digital outputs, on-board modem (9600 baud), and battery backup.

Optional Components:

p. Current Sensor: 115 VAC with adjustable high & low alarm set points.

green non-skid finish, 2-inches insulation and provided with stainless steel bolts, and wrench. The riser and lid combination shall be sealed for watertightness and able to support a 2500 lb. wheel load. (Note: This is not to imply that PVC risers are intended for traffic areas.) All fasteners shall be made of corrosion resistant stainless steel.

c. Rigid closed-cell foam insulation of 2-inch thickness shall be mechanically attached to the underside of the lid. All fasteners shall be made of corrosion resistant stainless steel. The insulation shall have an R-value of no less than 10 per 2-inch increment.

2. **AdvanTex® Treatment System:**

Orenco Systems®, Inc. AX100 AdvanTex® Treatment System installed in conformance with the engineer's plans. The AX100 is a packed bed filter consisting of a proprietary textile media. The media has been specifically engineered for wastewater applications.

3. **Transport Piping / Fittings:**

a. All transport piping and fittings from the recirculation tanks shall meet a minimum pressure rating of Schedule 40.

b. The AdvanTex® pod return lines shall be 4" diameter, Class 125 or higher pressure. All fittings shall be Schedule 40.

4. **Installation**

All AdvanTex® components shall be installed in accordance with the manufacturer's recommendations, the engineer's plans, and all state and local regulations. See Appendix B.

AdvanTex® Ventilation System

1. **Vent Fan:**

The vent fan shall be Orenco Systems®, Inc. FR150 or approved equal capable of meeting the following requirements:

a. The fan shall be UL Listed for use in wet locations and in conditioned air streams of up to 140°F

b. The fan shall be rated at 142 cfm at 0.8-inches of H_2O static pressure.

c. The fan shall be 100% speed controllable.

d. The fan shall have an external wiring box with a waterproof gasket.

6. **Transport Piping / Fittings:**

   a. All transport piping and fittings from the recirculations tank shall meet a minimum pressure rating of Schedule 40.

   b. The air return lines shall be 4-inch diameter, Class 125 or higher pressure. All fittings shall be Schedule 40.

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Disposal

Dosing Tank Pumping Assemblies

All pumping systems shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for effluent sewers. References must be available on request from the engineer. Systems shall be Orenco Systems®, Inc. High-Head Pumping Assemblies or approved equal, composed of:

1. **Risers:**

   Risers shall be required for access to internal vaults and access into the drainfield dosing tanks for inspection, maintenance, or septage removal. All risers shall be constructed watertight. The risers shall be attached to the tanks such that a watertight seal is provided. Risers shall extend three inches (3") above original grade to allow for settlement and to ensure a positive drainage away from the access. Risers for inspection ports shall be a minimum of 18 inches in nominal diameter. Risers containing pumping assemblies or electrical splice boxes shall be a minimum of 30 inches in diameter and shall be of sufficient diameter to allow removal of internal vaults without removing splice boxes, etc. Risers shall be a minimum of 30 inches in nominal diameter when the depth of bury is 36 inches or greater. All other risers shall be a minimum of 24 inches in nominal diameter and shall vary in height depending on the depth of bury on the various tanks. Adhesive required to adhere the PVC or fiberglass risers to either fiberglass or ABS tank adapter shall be either a two-part epoxy, Model MA320, a single component adhesive Model ADH100 or approved equal.

2. **Inlet and Cleanout Risers:**

   Risers shall be ribbed PVC as manufactured by Orenco Systems®, Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2 an inch. Risers shall extend to 3 inches above the ground surface to allow for settlement. Risers shall be at least 12 inches tall with a nominal diameter of 30 inches. See section 3b below for adhesive requirements.

3. **Outlet Risers:**

   Outlet risers shall be ribbed PVC as manufactured by Orenco Systems®, Inc. or engineer-approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to

© 11/03, Orenco Systems®, Inc.

5. **Riser Installation:**

   Riser installation shall be accomplished according to the manufacturer's instructions.

6. **Pump Vaults:**

   Orenco Systems®, Inc. Model PVU95-2419-L, Universal Biotube® Pump Vault or engineer-approved equal, installed in conformance with the engineer's plans. The filter shall have a minimum effective screen area of no less than 20.6 square feet. The Biotube Pump Vault shall consist of a 12-inch diameter, 95-inch deep HDPE vault with eight (8) 2-inch diameter holes evenly spaced around the perimeter, located 19 inches from the base of the pump vault. Housed inside the polyethylene vault shall be the Biotube assembly consisting of 1/8" mesh polypropylene tubes. Attached to the vault is a flow inducer to accept one or two high-head effluent pumps.

7. **Discharge Hose and Valve Assembly:**

   Orenco Systems®, Inc. Model HV125BCX, 1-1/4-inch diameter, 150 psi PVC ball valve, 150 psi PVC check valve, PVC flex hose with working pressure rating of 80 psi, and Schedule 40 PVC pipe.

8. **Float Switch Assembly:**

   Orenco Systems®, Inc. Model MF4A-YP,G,R,W-60FS with four mercury switch floats mounted on a PVC stem attached to the filter cartridge. The floats must be adjustable and must be removable without removing the pump vault. The high/lag- and low-level alarms, override enable function and timer on/off floats shall be preset as shown in the engineer's plans. Each float lead shall be secured with a nylon strain relief bushing at the splice box. The floats shall be UL or CSA listed and shall be rated for a minimum of 5.0A @ 120 VAC.

9. **High-Head Effluent Pumps:**

   Pump must be approved for use in pump vault described above. Pump shall be Orenco Systems®, Inc. Model P200512, 1/2 hp, 230 VAC, single phase, 60 Hz, two-wire motor, with 10-foot long extra heavy duty (SO) electrical cord with ground. Each pump shall be capable of providing a nominal flow rate of 20 gpm against a head of 107 feet. Pump shall be UL and CSA listed as an effluent pump. Pump shall be provided with a non-prorated five-year warranty.

10. **Electrical Splice Box:**

    Electrical splice box shall be Orenco Systems®, Inc. Model SB6, UL approved for wet locations, equipped with one electrical cord grip and a 1-inch outlet fitting. Also included shall be UL listed waterproof butt splice connectors.

Appendix E: Phase I Record Drawings

Phase 1 Sanitary Sewer Improvements

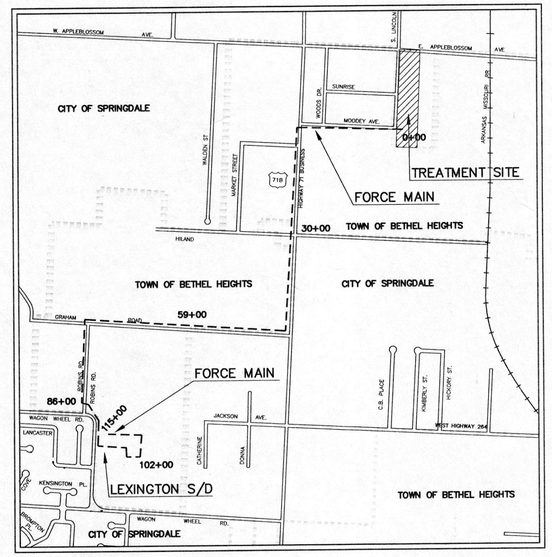
for the

City of Bethel Heights, Arkansas

EDA Project No. 0656

December, 2003

"As-Built" Plans



Vicinity

1" = 1000'

GENERAL NOTES:

1) THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO AVOID DAMAGE TO ADJACENT PROPERTIES DURING THE CONSTRUCTION OF THE PROJECT. THE CONTRACTOR SHALL BE HELD SOLELY RESPONSIBLE FOR ANY DAMAGES THAT MAY RESULT.

2) THE LOCATIONS OF EXISTING UTILITIES SHOWN ON THE PLANS ARE GENERAL IN NATURE AND ARE BASED ON INFORMATION PROVIDED BY THE UTILITY COMPANIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING THE EXACT LOCATION OF ALL UTILITIES BEFORE PROCEEDING WITH THE CONSTRUCTION.

3) OTHER CONTRACTORS, LABORERS, WORKMEN, UTILITY COMPANIES, ETC., MAY BE WORKING WITHIN OR AROUND THE PROJECT SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING HIS WORK WITH OTHERS TO MINIMIZE ANY CONFLICTS THAT ARISE.

4) IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, THE CONTRACTOR WILL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS OF THE JOB SITE INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THIS REQUIREMENT WILL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. THE DUTY OF THE ENGINEER TO CONDUCT CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES, IN OR NEAR THE CONSTRUCTION SITE.

5) CONTRACTOR SHALL PROVIDE ADEQUATE MEANS OF EROSION CONTROL THROUGHOUT THE CONSTRUCTION OF THE PROJECT.

6) ALL CONSTRUCTION METHODS AND MATERIALS SHALL MEET OR EXCEED THE MINIMUM STANDARD AS SPECIFIED BY THE ARKANSAS STATE HIGHWAY AND TRANSPORATION DEPARTMENT AND THE CITY OF SPRINGDALE, ARKANSAS.

7) THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING, PAYING AND POSTING FOR ALL PAYMENT, PERFORMANCE, AND MAINTENANCE BONDS NECESSARY FOR THE CONSTRUCTION OF THIS PROJECT.

8) ALL CONSTRUCTION WORK AND UTILITY WORK OUTSIDE OF PROPERTY BOUNDARIES SHALL BE PERFORMED IN COOPERATION WITH AND IN ACCORDANCE WITH REGULATIONS OF THE AUTHORITIES CONCERNED. THE CONTRACTOR SHALL PROVIDE ADEQUATE CONSTRUCTION SIGNAGE AND OTHER TRAFFIC CONTROL DEVICES WHEN WORKING IN ANY RIGHT-OF-WAY. SIGNAGE AND OTHER TRAFFIC CONTROL DEVICES SHALL CONFORM TO ALL FEDERAL, STATE AND LOCAL GUIDELINES AND REGULATIONS.

9) THE CONTRACTOR SHALL CONDUCT THE WORK IN A MANNER THAT WILL INSURE, AS FAR AS PRACTICABLE, THE LEAST OBSTRUCTION TO TRAFFIC AND SHALL PROVIDE FOR THE CONVENIENCE AND SAFETY OF THE GENERAL PUBLIC AND RESIDENTS ALONG AND ADJACENT TO HIGHWAYS IN THE CONSTRUCTION AREA IN AN ADEQUATE AND SATISFACTORY MANNER IN ACCORDANCE WITH THE ARKANSAS DEPARTMENT OF TRANSPORTATION STANDARDS.

10) CONTRACTOR SHALL BE RESPONSIBLE FOR ALL NECESSARY MEASURES TO PROVIDE ADEQUATE TRENCH SAFETY, AND ALL OTHER ITEMS NECESSARY TO SATISFY ACT 291-1993 OF THE STATE OF ARKANSAS.

11) THE CONTRACTOR SHALL VERIFY WITH THE ENGINEER BEFORE BEGINNING CONSTRUCTION, THE PROCUREMENT AND LOCATION OF ALL EASEMENTS, TEMPORARY AND PERMANENT, NECESSARY TO CARRY OUT THE WORK OUTLINED WITHIN THESE DRAWINGS AND RELATED CONTRACT DOCUMENTS.

SEWER SYSTEM NOTES:

1) SEWER FORCE MAIN PIPE SHALL BE INSTALLED WITH 24" MIN. COVER WITH THE INDICATED TYPE AND SIZE OF PIPE AS SHOWN ON THE PLANS AND DETAILS.

2) ALL 2-INCH AND LARGER PVC SEWER MAIN SHALL HAVE A MINIMUM WALL THICKNESS CLASSIFICATION OF SDR-26.

3) ALL SERVICE LINE AND FITTINGS SHALL BE PVC SDR-26 SERVICES SHALL BE CONSTRUCTED IN THE LOCATION AS INDICATED ON THE PLANS AND TERMINATE TO A SUITABLE GRADE.

4) THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING AND PAYING FOR ALL NECESSARY STREET CUT PERMITS OR FEES. ALL STREET CUTS SHALL BE CONSTRUCTED IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL LAWS OR REGULATIONS.

5) EACH RESIDENTIAL LOT WITHIN LEXINGTON SUBDIVISION WILL CONTAIN ONE 1,500 GALLON ORENCO SEPTIC TANK WITH BIOTUBE PUMP VAULT. TANKS WILL BE INSTALLED AT THE TIME OF THE BUILDING PERMIT AND ARE NOT A PART OF THIS CONTRACT.

EDA

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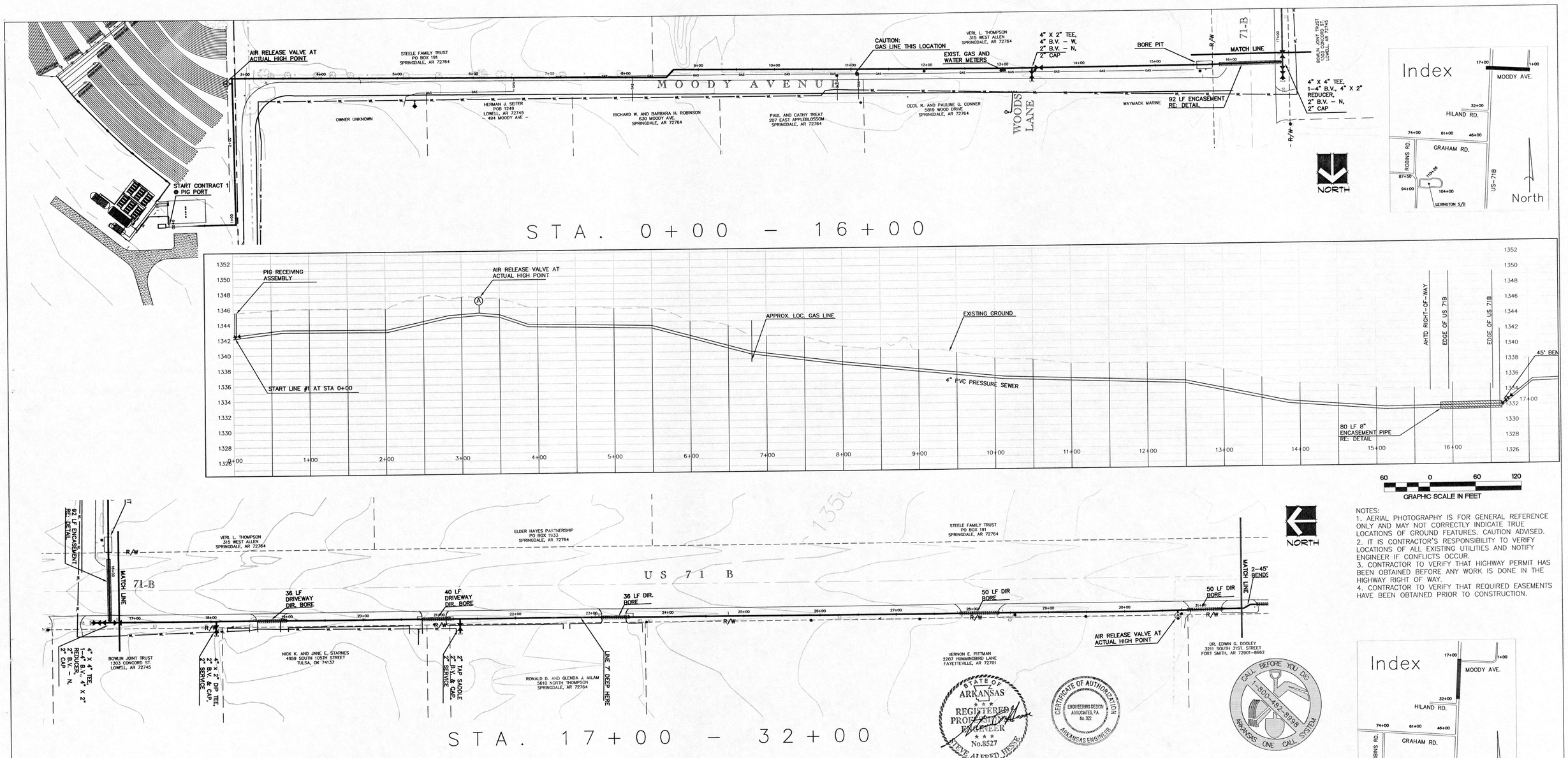
Bethel Heights Sanitary Sewer - 0656



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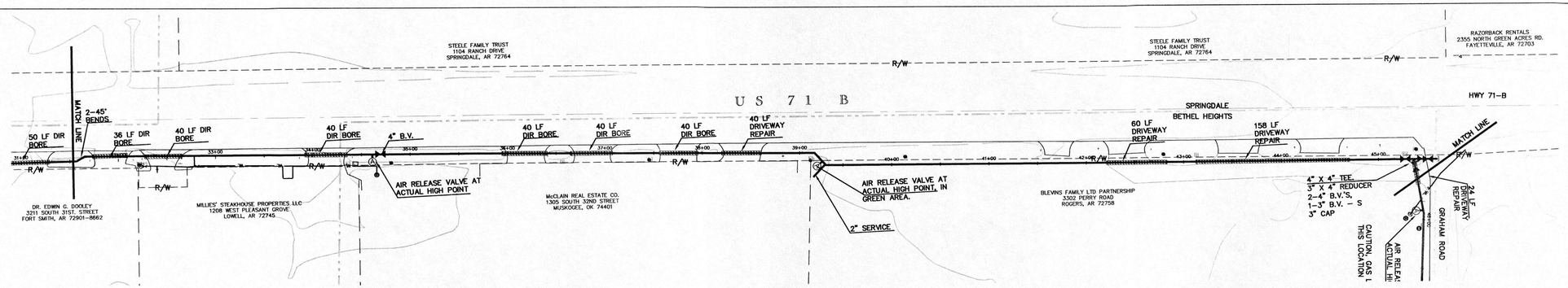

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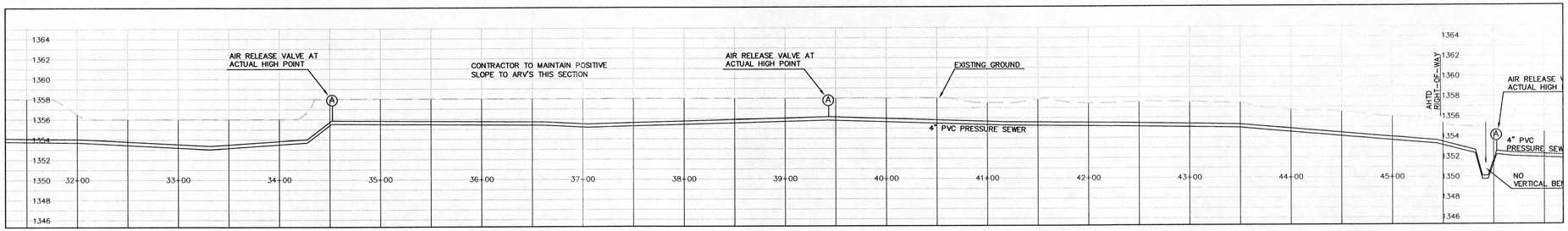

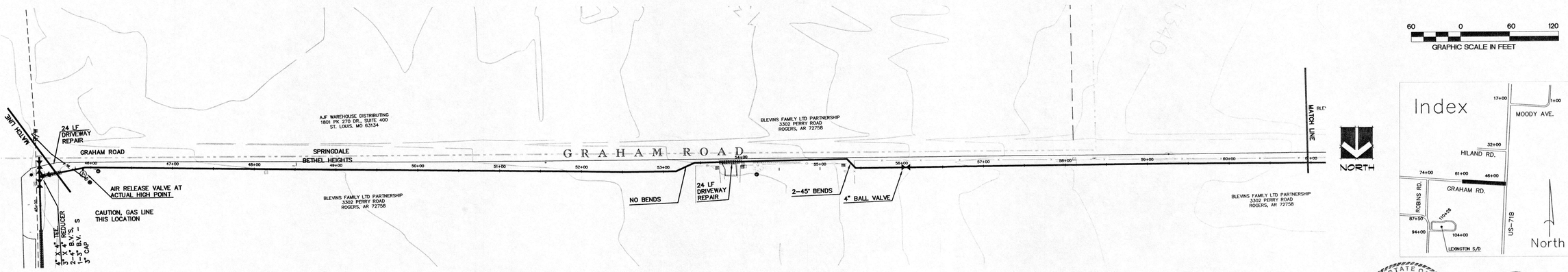

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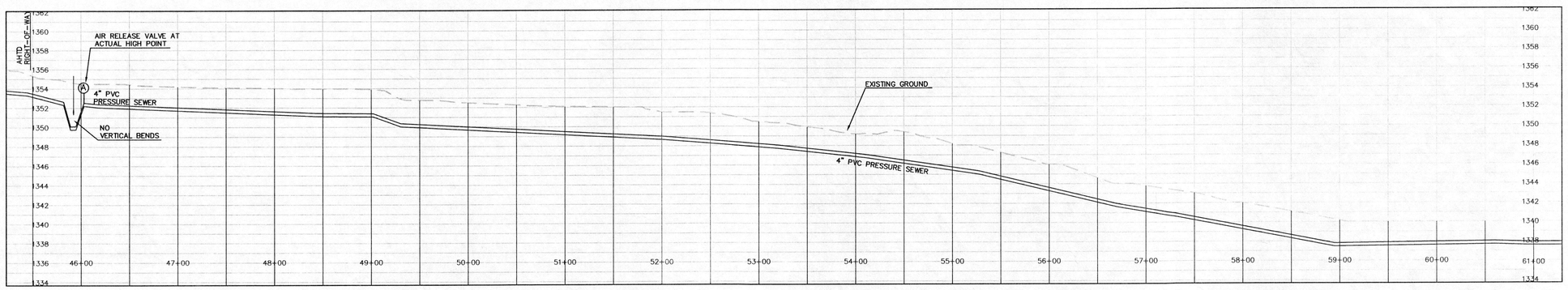

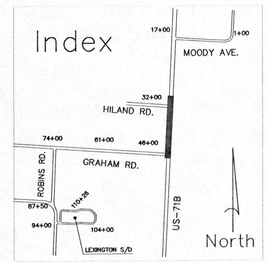

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4. CONTRACTOR TO VERIFY THAT REQUIRED EASEMENTS HAVE BEEN OBTAINED PRIOR TO CONSTRUCTION.

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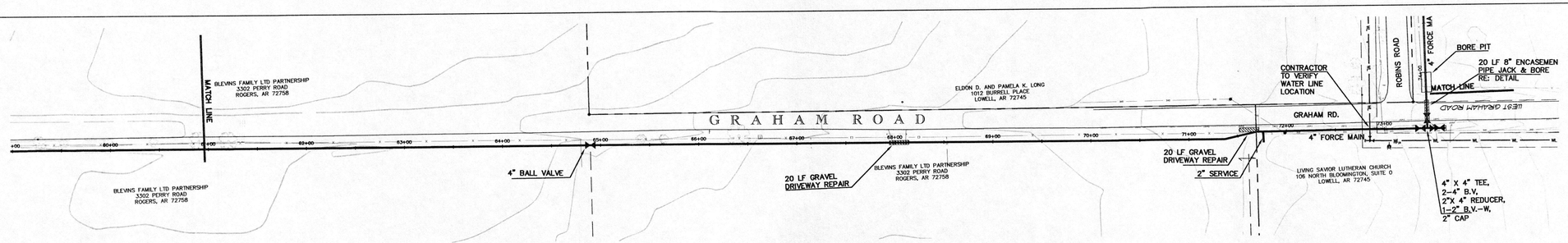

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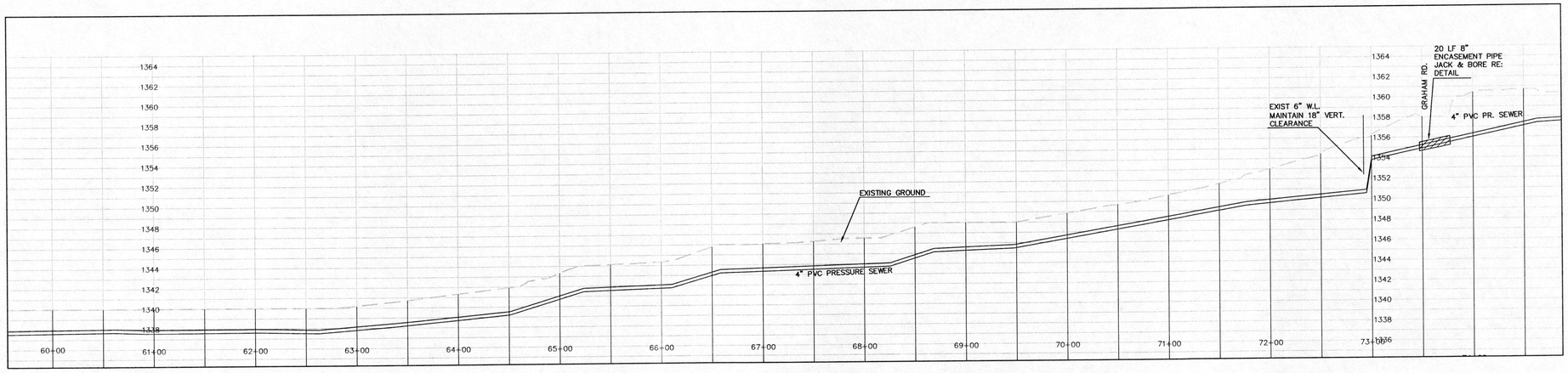

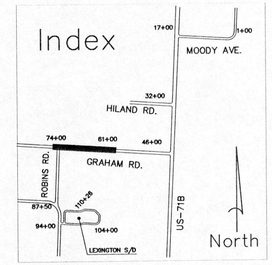

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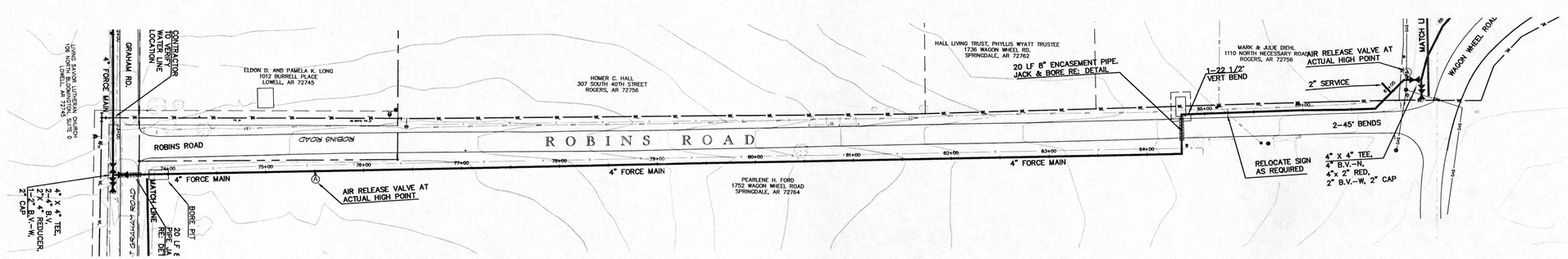

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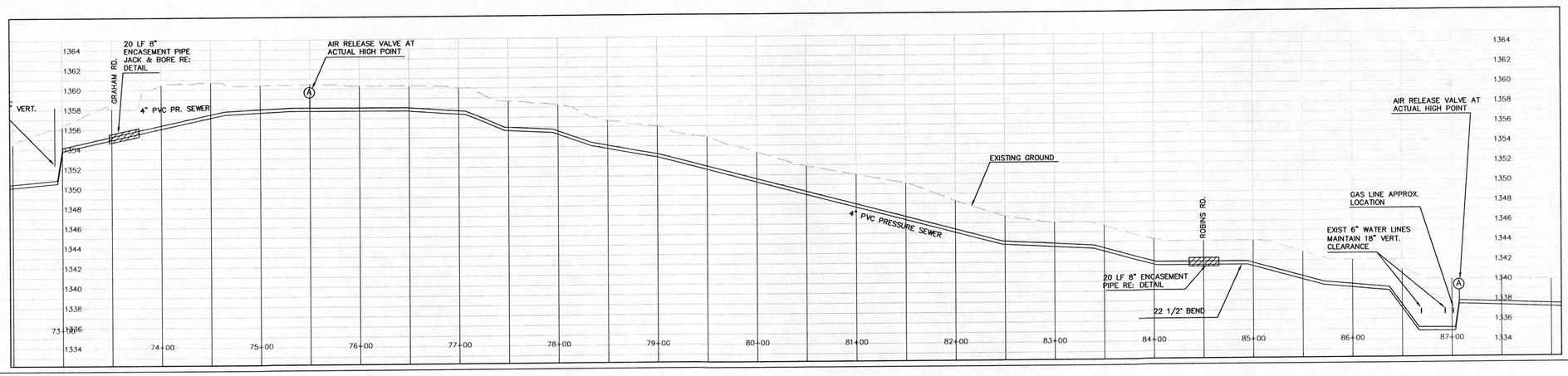

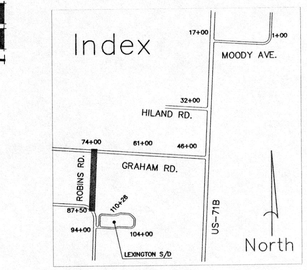

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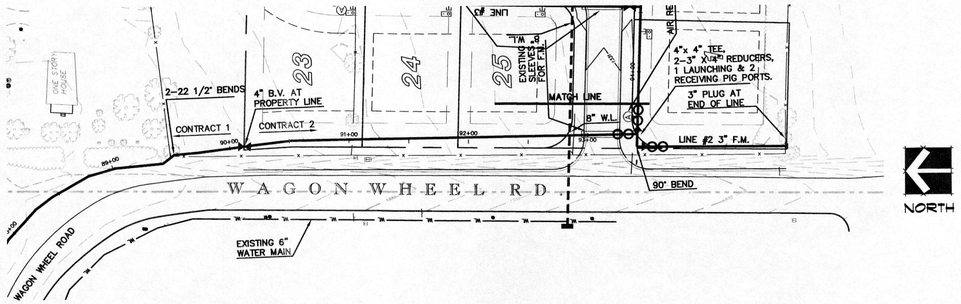

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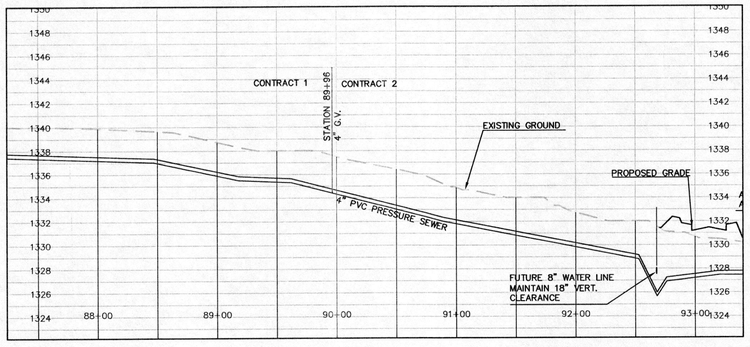

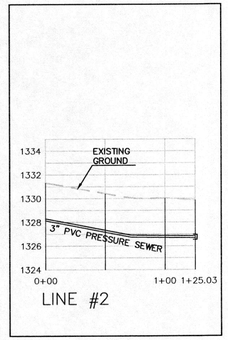

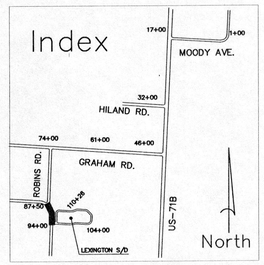

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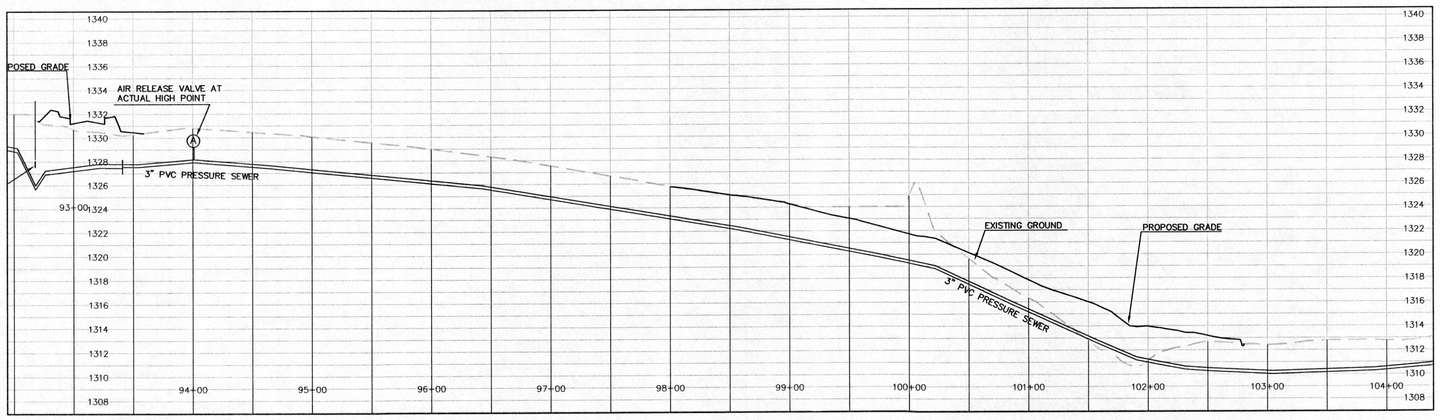

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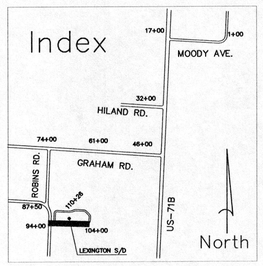

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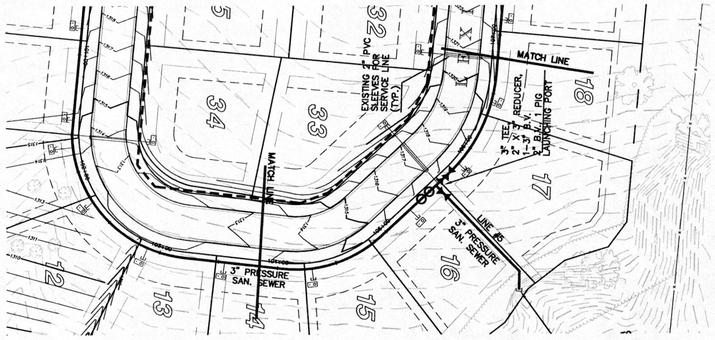

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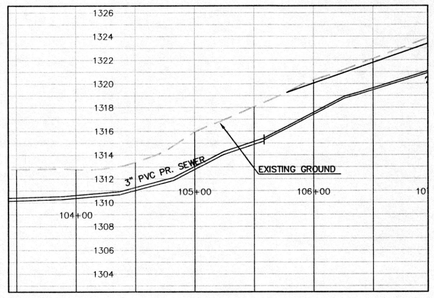

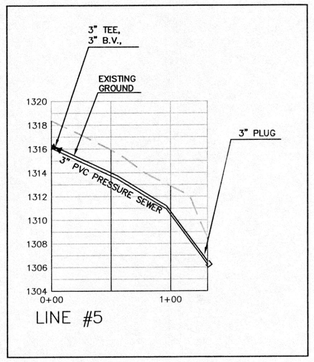

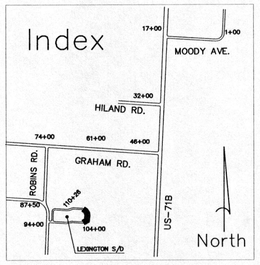

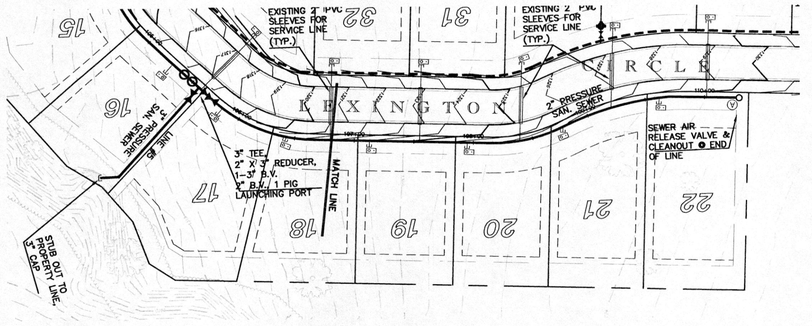

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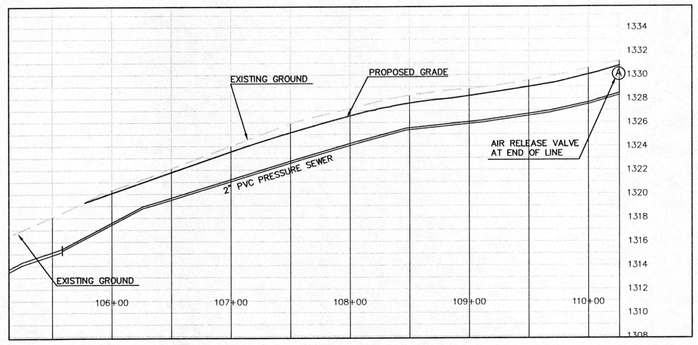

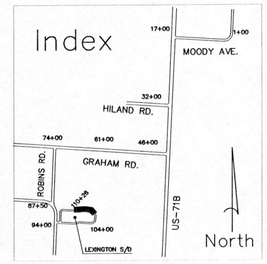

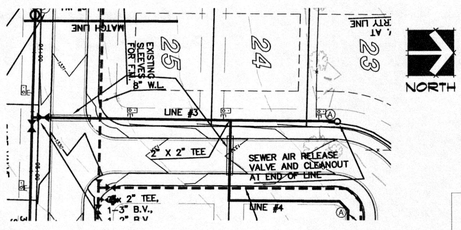

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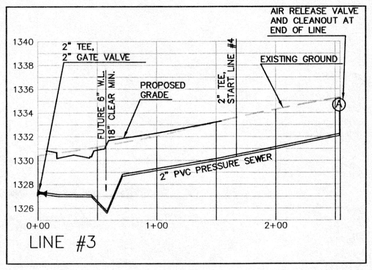
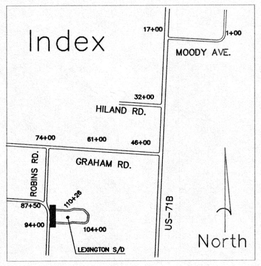
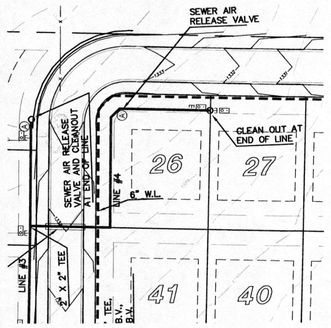
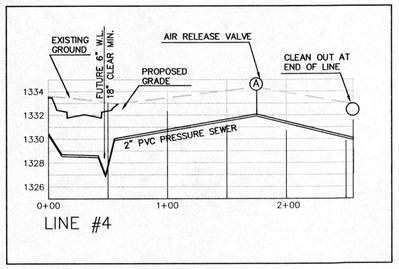
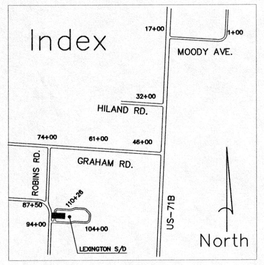






LINE "4"











NOTES:
1. AERIAL PHOTOGRAPHY IS FOR GENERAL REFERENCE ONLY AND MAY NOT CORRECTLY INDICATE TRUE LOCATIONS OF GROUND FEATURES. CAUTION ADVISED.
2. IT IS CONTRACTOR'S RESPONSIBILITY TO VERIFY LOCATIONS OF ALL EXISTING UTILITIES AND NOTIFY ENGINEER IF CONFLICTS OCCUR.
3. CONTRACTOR TO VERIFY THAT HIGHWAY PERMIT HAS BEEN OBTAINED BEFORE ANY WORK IS DONE IN THE HIGHWAY RIGHT OF WAY.
4. CONTRACTOR TO VERIFY THAT REQUIRED EASEMENTS HAVE BEEN OBTAINED PRIOR TO CONSTRUCTION.

"AS-BUILT"

60 0 60 120
GRAPHIC SCALE IN FEET

FORCE MAIN PLAN & PROFILE STATION 104+00 – 110+26

PHASE 1 SANITARY SEWER IMPROVEMENTS

BETHEL HEIGHTS, ARKANSAS

EDA Consulting Engineering Landscape Architecture Land Surveying
Engineering Design Associates, P.A.
134 West Emma Avenue (479) 756-1266
Springdale, Arkansas 72764 Fax: (479) 756-2129

DRAWN BY: AWF	CHECKED BY: SAH
DATE: 8-30-02	
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FILE NAME: 0656FORCE.DWG	
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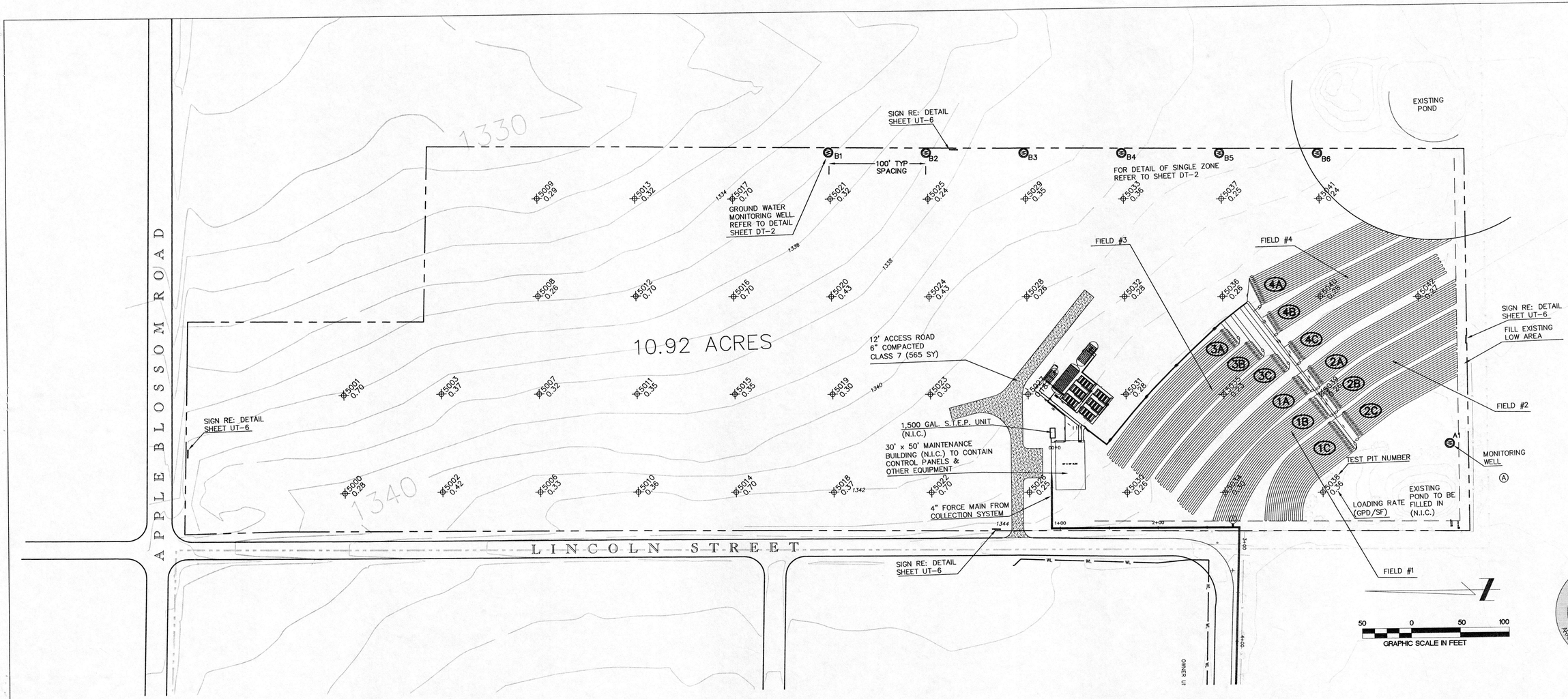
\\Survey\e\LAND PROJECTS EDA\0656\dwg\0656 as built.dwg 12/22/2003 12:07:19 PM CST



CALL BEFORE YOU DIG 1-800-482-5998 ARKANSAS ONE CALL SYSTEM

STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No.8527 STEVE ALBRED

CERTIFICATE OF AUTHORIZATION ENGINEERING DESIGN ASSOCIATES, P.A. No. 322 ARKANSAS ENGINEER

12-29-03

"AS-BUILT"

TREATMENT AREA SYSTEM LAYOUT

PHASE 1 SANITARY SEWER IMPROVEMENTS

BETHEL HEIGHTS, ARKANSAS

EDA Consulting Engineering Landscape Architecture Land Surveying
Engineering Design Associates, P.A.
134 West Emma Avenue (479) 756-1066
Springdale, Arkansas 72764 Fax: (479) 756-2129

DRAWN BY: AWF	CHECKED BY: CLP
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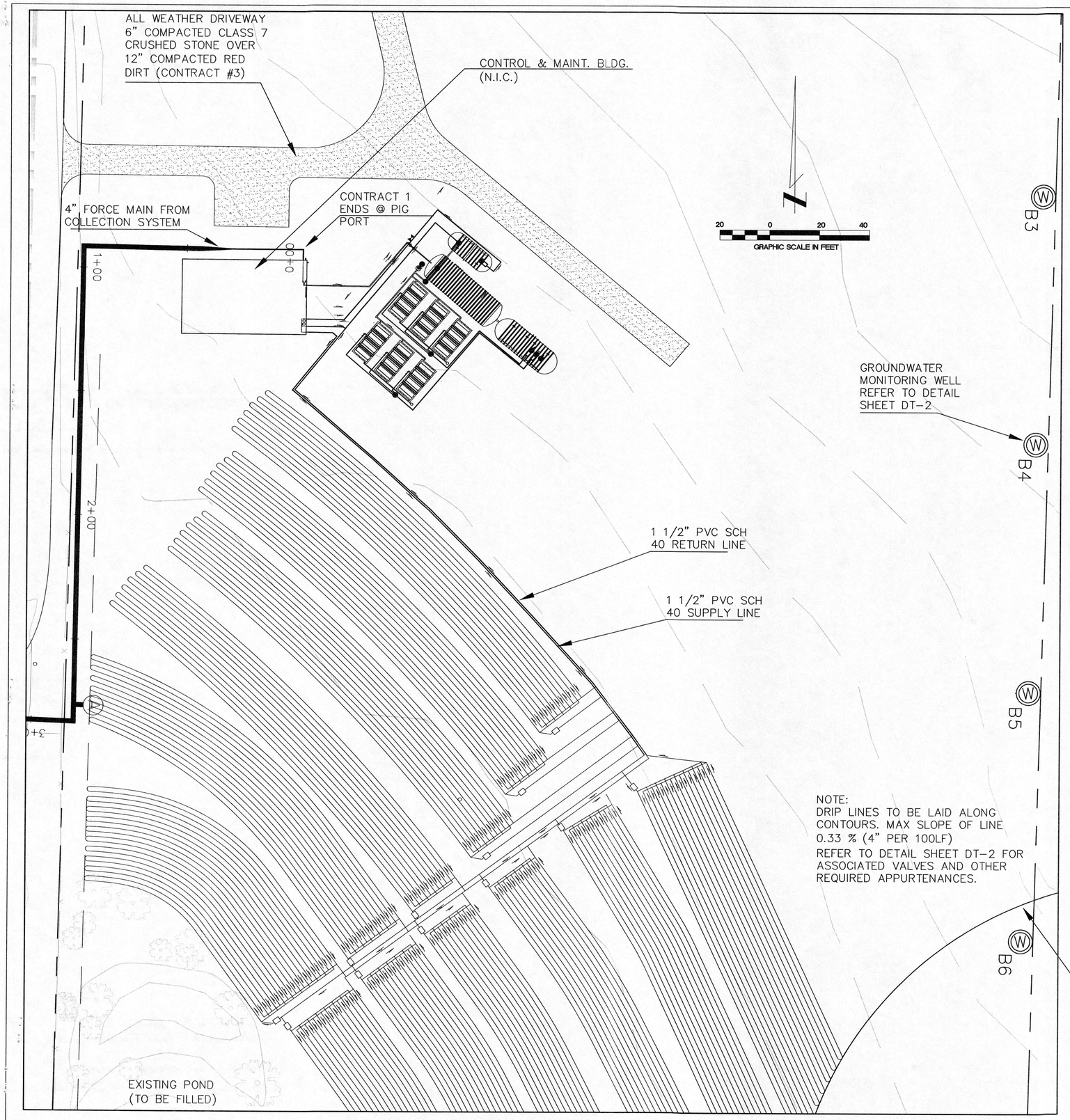
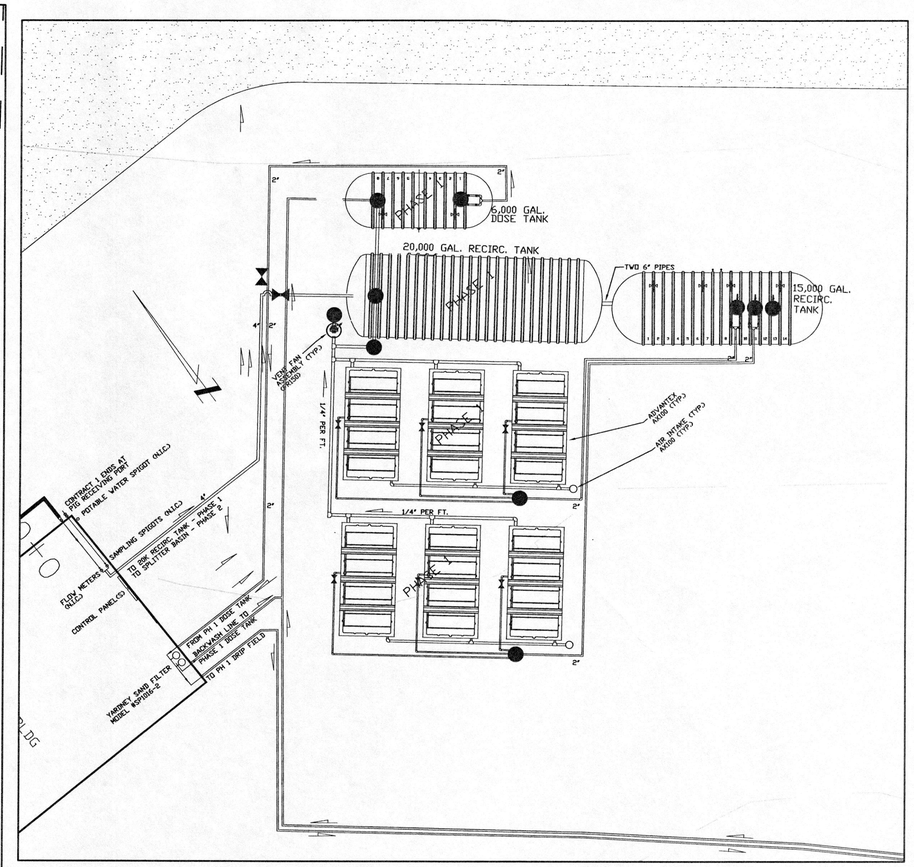


NOTE:
DRIP LINES TO BE LAID ALONG CONTOURS. MAX SLOPE OF LINE 0.33 % (4" PER 100LF)
REFER TO DETAIL SHEET DT-2 FOR ASSOCIATED VALVES AND OTHER REQUIRED APPURTENANCES.



ROUTING DETAIL

10 0 10 20
GRAPHIC SCALE IN FEET

NOTES:
1) CONTRACTOR TO PROVIDE A MINIMUM OF 12" OF FALL FROM THE BOTTOM OF THE AX-100 TREATMENT PODS TO THE TOP OF THE RECIRCULATION TANK.
2) PROVIDE A MIN. OF 9" FALL FROM THE BASE OF THE AX100 PODS TO THE SPLITTER VALVE BODY.
3) INSTALL ALL FILTRATE RETURN LINES AT 1/4" PER FOOT.

"AS-BUILT"

CERTIFICATE OF AUTHORIZATION
ENGINEERING DESIGN ASSOCIATES, P.A.
No. 322
ARKANSAS ENGINEER

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No.8527
STEVE ALFRED HESS
12-29-03

TREATMENT & DRIP DISPERSAL LARGE SCALE DRAWINGS

PHASE 1 SANITARY SEWER IMPROVEMENTS

BETHEL HEIGHTS, ARKANSAS

EDA
Consulting Engineering
Landscape Architecture
Land Surveying
Engineering Design Associates, P.A.
134 West Emma Avenue (479) 756-1266
Springdale, Arkansas 72764 Fax: (479) 756-2129

DRAWN BY: AWF CHECKED BY: SAH
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DESCRIPTION:

SHEET UT-7

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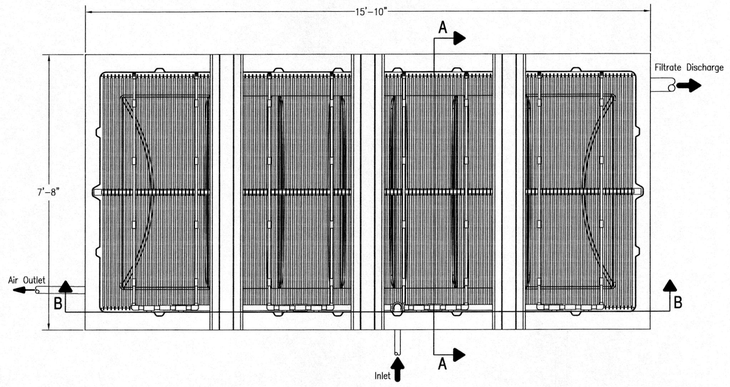
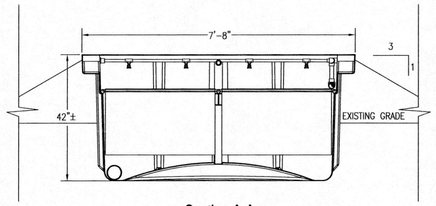
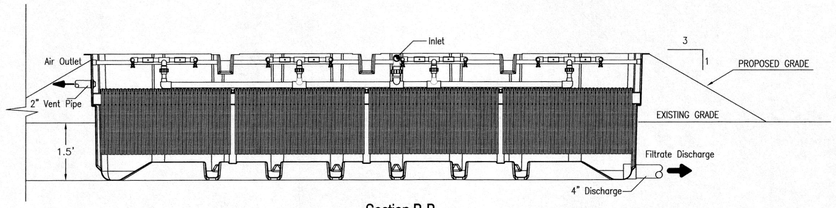


Top View
Scale: 1" = 2'-0"



Section A-A
Scale: 1" = 2'-0"

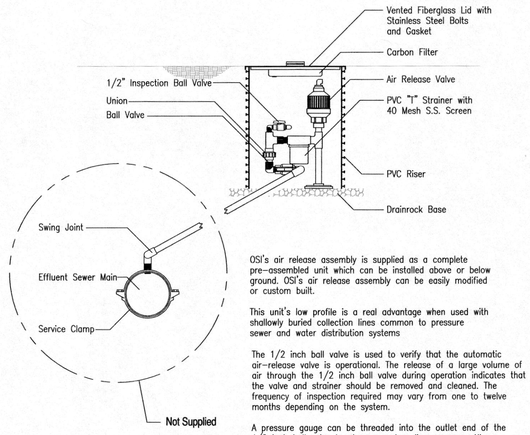


Section B-B
Scale: 1" = 2'-0"

AdvanTex 100 System

(ALSO REFER TO MANUFACTURER'S INSTALLATION MANUAL FOR OTHER INFORMATION)

Air Release Assembly

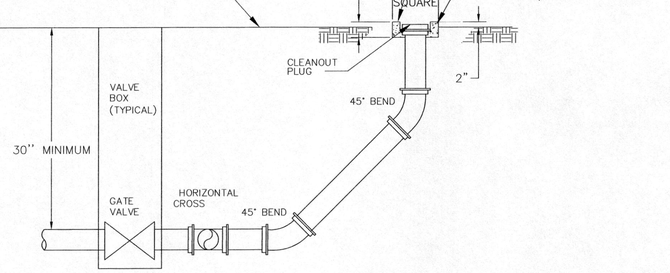


OSI's air release assembly is supplied as a complete pre-assembled unit which can be installed above or below ground. OSI's air release assembly can be easily modified or custom built.

This unit's low profile is a real advantage when used with shallowly buried collection lines common to pressure sewer and water distribution systems

The 1/2 inch ball valve is used to verify that the automatic air-release valve is operational. The release of a large volume of air through the 1/2 inch ball valve during operation indicates that the valve and strainer should be removed and cleaned. The frequency of inspection required may vary from one to twelve months depending on the system.

A pressure gauge can be threaded into the outlet end of the 1/2 inch ball valve to observe system line pressure. All components are rated for a 150 psi working pressure.

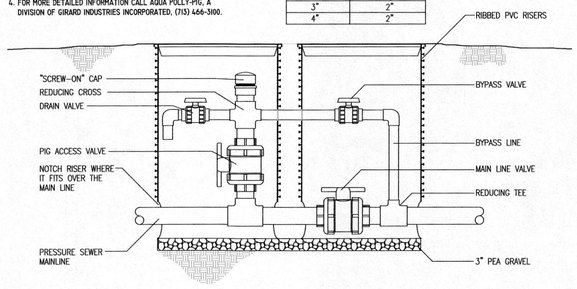


SINGLE CLEANOUT ASSEMBLY
N.T.S.

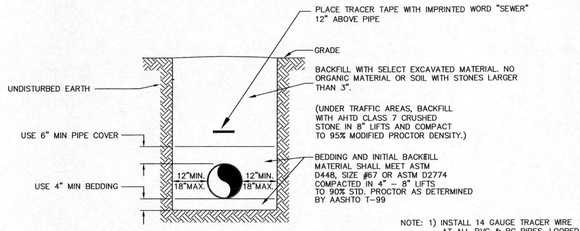
NOTES:
1. PROTECT THE MAIN LINE FROM BEING SHEARED BECAUSE OF TRAFFIC LOADS ON THE RISER BY INSURING THE RISER IS PLACED ON A STABLE BASE AND THAT THE NOTCH IS CUT HIGH ENOUGH TO ALLOW ADEQUATE CLEARANCE BETWEEN THE BOTTOM OF THE NOTCH AND THE TOP OF THE PVC LINE.
2. LAUNCHING AND RECEIVING PORTS ARE CONSTRUCTED IN A SIMILAR FASHION.
3. WHEN RECEIVING THE PIG, OPERATE DRAIN VALVE TO RELIEVE PRESSURE. CAPTURE ALL EFFLUENT AND DISPOSE OF PROPERLY.
4. FOR MORE DETAILED INFORMATION CALL AQUA POLLY-PIG, A DIVISION OF GIRARD INDUSTRIES INCORPORATED, (713) 466-3100.

BYPASS LINE

MAINLINE SIZE	BYPASS LINE SIZE
2"	1 1/2"
3"	2"
4"	2"

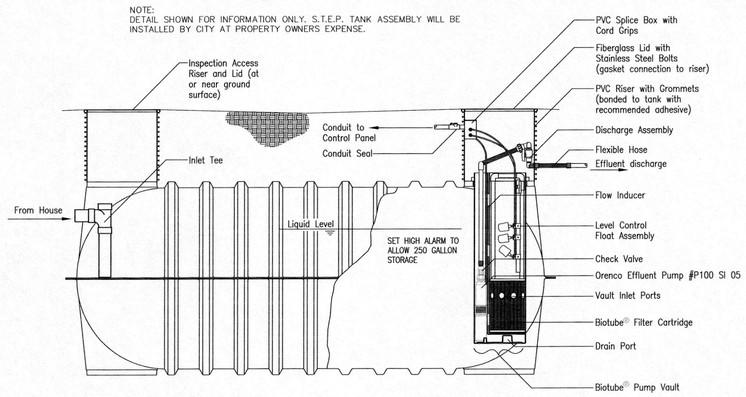


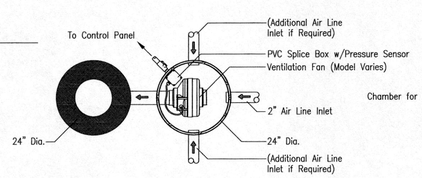
PIG LAUNCHING & RECEIVING DETAIL
N.T.S.



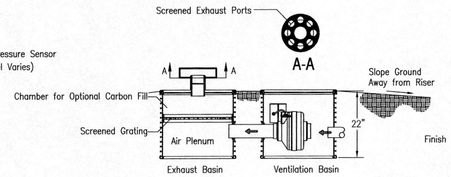
TYPICAL BACKFILL FOR DI, PVC AND RC PIPES
N.T.S.

1500 Gallon Single Compartment Drawdown Fiberglass Tank

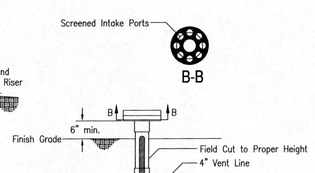




Top View

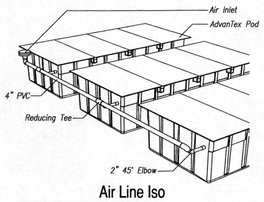


Side View

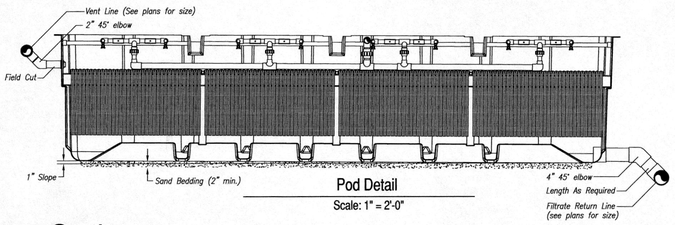


Air Inlet Detail
Scale: 1" = 2'-0"

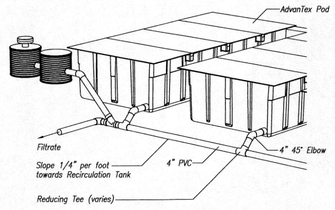
Ventilation Fan Detail
Scale: 1" = 2'-0"



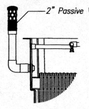
Air Line Iso
NTS



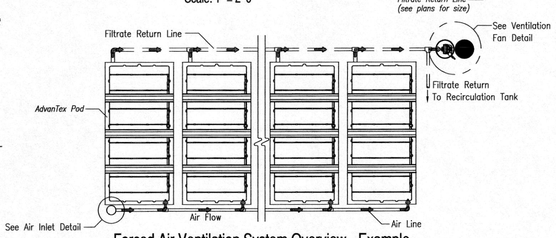
Pod Detail
Scale: 1" = 2'-0"



Filtrate Return Line Iso
NTS



Passive Vent Option
NTS



Forced Air Ventilation System Overview - Example
Scale: 1" = 8'-0"

Orenco Systems®
Incorporated

814 AIRWAY AVENUE
SUTHERLIN, OREGON
97479-9012

TELEPHONE:
(541) 459-4449
(800) 348-9843

CERTIFICATE OF AUTHORIZATION — ENGINEERING DESIGN ASSOCIATES, P.A. No. 822 — ARKANSAS ENGINEER

STATE OF ARKANSAS — REGISTERED PROFESSIONAL ENGINEER — No. 8527 — STEVE ALFRED HESSE — 9-24-03

CALL BEFORE YOU DIG — 1-800-482-8998 — ARKANSAS ONE CALL SYSTEM

MISCELLANEOUS DETAILS
PHASE 1 SANITARY SEWER IMPROVEMENTS
BETHEL HEIGHTS, ARKANSAS

EDA
Consulting Engineering
Landscape Architecture
Land Surveying
Engineering Design Associates, P.A.
134 West Emma Avenue (479) 756-1266
Springdale, Arkansas 72764 Fax: (479) 756-2129

DRAWN BY: CHECKED BY: SAH
DATE: 9-23-02
SCALE: NONE
JOB NUMBER: 0656
FILE NAME: 0656DETAILS.DWG

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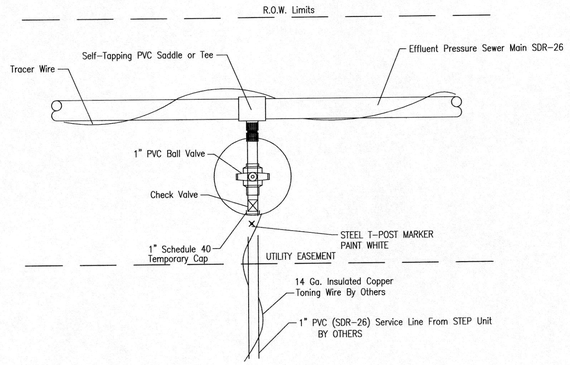
SHEET DT-1

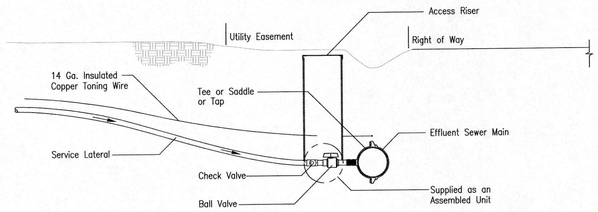


NOTE:
1. All Service Laterals From the Effluent Sewer Main to the Property Line shall be Pressure Tested Prior to any Back filling.

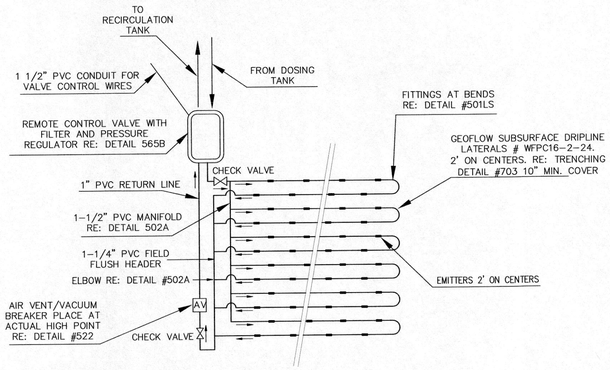
2. Place marker tape imprinted with the word "SEWER" 12" above top of pipe.

PRESSURE SEWER SERVICE DETAIL
scale: NONE

Effluent Sewer Service Connection

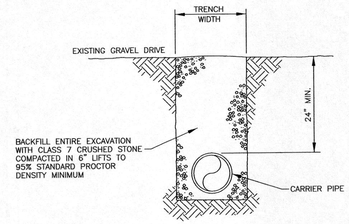


All service line connections shall be solvent welded. The only acceptable solvents and cements are those that are recommended by the pipe manufacturer. All service laterals from the effluent sewer main to the property line shall be pressure tested prior to any backfilling.

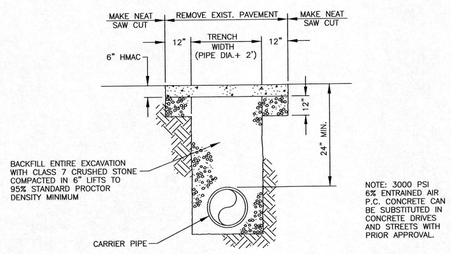


GEOFLOW TYPICAL LAYOUT FOR SINGLE ZONE
WASTEFLOW PC DRIPLINE
NOT TO SCALE
REFER TO PLANS FOR ACTUAL DIMENSIONS

NOTE:
1). ALL PVC LINE TO BE SCHEDULE 40
2). MAXIMUM SLOPE NOT TO EXCEED 4" PER 100 FEET

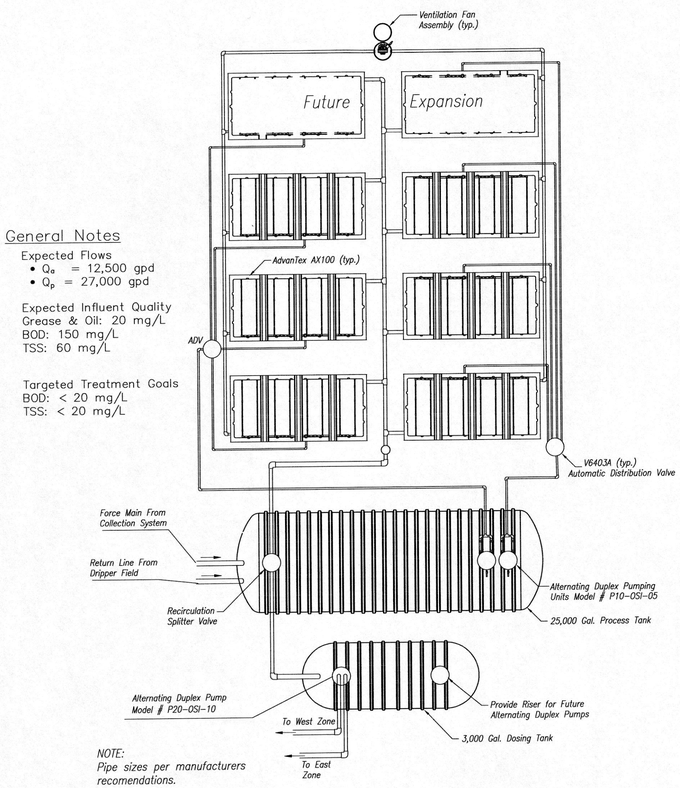


GRAVEL DRIVE CROSSING REPAIR
N.T.S.



NOTE: 3000 PSI 6% ENTRAINED AIR P.C. CONCRETE CAN BE SUBSTITUTED IN CONCRETE DRIVES AND STREETS WITH PRIOR APPROVAL.

PAVED DRIVE/STREET CROSSING REPAIR
N.T.S.



NOTE:
Pipe sizes per manufacturers recomendations.

General Notes

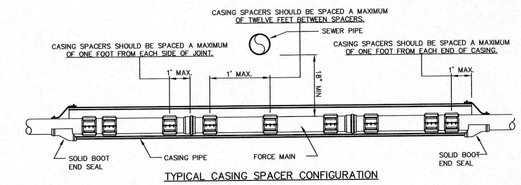
Expected Flows
- Q_a = 12,500 gpd
- Q_p = 27,000 gpd

Expected Influent Quality
Grease & Oil: 20 mg/L
BOD: 150 mg/L
TSS: 60 mg/L

Targeted Treatment Goals
BOD: < 20 mg/L
TSS: < 20 mg/L

AdvanTex® - AX100 System for Q_{ave} = 12,500 gpd

GENERAL SYSTEM LAYOUT – DO NOT USE FOR CONSTRUCTION

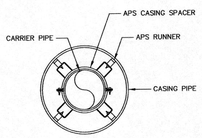


TYPICAL CASING SPACER CONFIGURATION

NOTES:

1. SPACERS SHALL BE MANUFACTURED BY "ADVANCE PRODUCTS & SYSTEMS" AS SPECIFIED.
2. QUANTITY OF RUNNERS SHALL BE IN ACCORDANCE WITH CARRIER PIPE SIZE AS FOLLOWS:
   - TO 14" DIAMETER – 4 RUNNERS
   - 16" TO 36" DIAMETER – 6 RUNNERS
   - 38" TO 48" DIAMETER – 8 RUNNERS
3. DIMENSIONS BETWEEN SPACERS SHALL BE AS FOLLOW:
   - STAINLESS STEEL – 8 TO 12 FEET.
   - CARBON STEEL – 8 TO 12 FEET.
4. WIDTH OF SPACERS SHALL BE IN ACCORDANCE WITH CARRIER PIPE SIZE AS FOLLOWS:
   - TO 14" DIAMETER – 8" WIDTH
   - 16" AND LARGER DIAMETER – 12" WIDTH
5. A MINIMUM OF THREE SPACERS PER FULL JOINT OF PIPE.
6. WATER LINES SHALL BE "CENTERED" IN CASING.
7. ALL D.I. CARRIER PIPE MUST HAVE FIELD LOCK GASKETS INSTALLED WITHIN THE CASING PIPE.
8. CONTRACTOR TO VERIFY THAT ENCASEMENT PIPE IS LARGE ENOUGH TO CONTAIN THE CARRIER PIPE.
9. MAINTAIN 18" MINIMUM BETWEEN WATER AND SEWER MAINS.

ENCASEMENT / CARRIER PIPE SIZING CHART

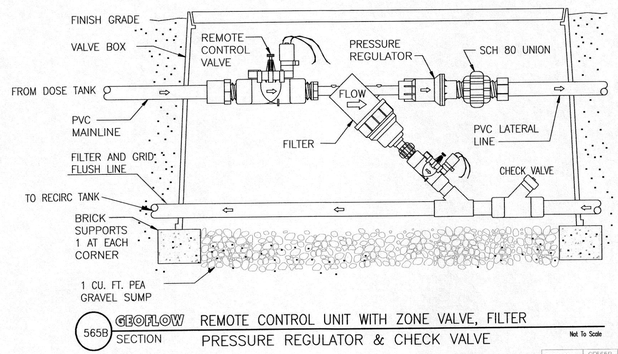


TYPICAL END VIEW

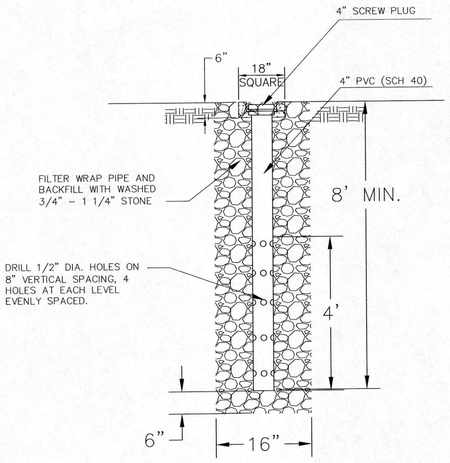
MAIN SIZE NOMINAL SIZE	ENCASEMENT PIPE NOMINAL SIZE
4"	8"
6"	12"
8"	16"
12"	20"
16"	24"
24"	36"

ALL ENCASEMENT PIPE SHALL BE NEW STEEL & HAVE A MINIMUM WALL THICKNESS OF .25

FORCE MAIN ENCASEMENT DETAILS



565B SECTION — GEOFLOW REMOTE CONTROL UNIT WITH ZONE VALVE, FILTER PRESSURE REGULATOR & CHECK VALVE
Not To Scale
3-08-99 GF565B

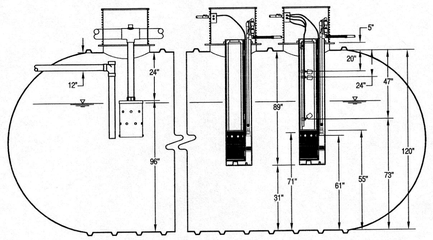


GROUNDWATER MONITORING WELL
N.T.S.

RSV & Float Setting For 10'Ø Xerxes Fiberglass Tank

Scale: 1" = 4'-0"

Tank Volume: 25,000 gal.
Pump(s) model: P5007
Pump MLL: 24"
Pump Vault model: PVU96-3630



NOTE: CONTRACTOR TO VERIFY ALL FLOAT SETTINGS FROM MANUFACTURER.

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Appendix F: Phase I Construction Drawings (latest dated set discovered)

Phase 1 Sanitary Sewer Improvements

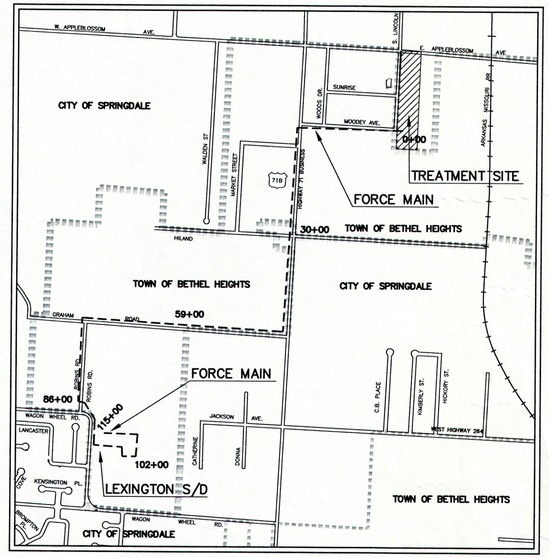
for the

City of Bethel Heights, Arkansas

EDA Project No. 0656

September 25, 2003

Construction Plans



V i c i n i t y

1" = 1000'

CONSTRUCTION DRAWINGS

GENERAL NOTES:

1) THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO AVOID DAMAGE TO ADJACENT PROPERTIES DURING THE CONSTRUCTION OF THE PROJECT. THE CONTRACTOR SHALL BE HELD SOLELY RESPONSIBLE FOR ANY DAMAGES THAT MAY RESULT.

2) THE LOCATIONS OF EXISTING UTILITIES SHOWN ON THE PLANS ARE GENERAL IN NATURE AND ARE BASED ON INFORMATION PROVIDED BY THE UTILITY COMPANIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING THE EXACT LOCATION OF ALL UTILITIES BEFORE PROCEEDING WITH THE CONSTRUCTION.

3) OTHER CONTRACTORS, LABORERS, WORKMEN, UTILITY COMPANIES, ETC., MAY BE WORKING WITHIN OR AROUND THE PROJECT SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING HIS WORK WITH OTHERS TO MINIMIZE ANY CONFLICTS THAT ARISE.

4) IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, THE CONTRACTOR WILL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS OF THE JOB SITE INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THIS REQUIREMENT WILL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. THE DUTY OF THE ENGINEER TO CONDUCT CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES, IN OR NEAR THE CONSTRUCTION SITE.

5) CONTRACTOR SHALL PROVIDE ADEQUATE MEANS OF EROSION CONTROL THROUGHOUT THE CONSTRUCTION OF THE PROJECT.

6) ALL CONSTRUCTION METHODS AND MATERIALS SHALL MEET OR EXCEED THE MINIMUM STANDARD AS SPECIFIED BY THE ARKANSAS STATE HIGHWAY AND TRANSPORATION DEPARTMENT AND THE CITY OF SPRINGDALE, ARKANSAS.

7) THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING, PAYING AND POSTING FOR ALL PAYMENT, PERFORMANCE, AND MAINTENANCE BONDS NECESSARY FOR THE CONSTRUCTION OF THIS PROJECT.

8) ALL CONSTRUCTION WORK AND UTILITY WORK OUTSIDE OF PROPERTY BOUNDARIES SHALL BE PERFORMED IN COOPERATION WITH AND IN ACCORDANCE WITH REGULATIONS OF THE AUTHORITIES CONCERNED. THE CONTRACTOR SHALL PROVIDE ADEQUATE CONSTRUCTION SIGNAGE AND OTHER TRAFFIC CONTROL DEVICES WHEN WORKING IN ANY RIGHT-OF-WAY. SIGNAGE AND OTHER TRAFFIC CONTROL DEVICES SHALL CONFORM TO ALL FEDERAL, STATE AND LOCAL GUIDELINES AND REGULATIONS.

9) THE CONTRACTOR SHALL CONDUCT THE WORK IN A MANNER THAT WILL INSURE, AS FAR AS PRACTICABLE, THE LEAST OBSTRUCTION TO TRAFFIC AND SHALL PROVIDE FOR THE CONVENIENCE AND SAFETY OF THE GENERAL PUBLIC AND RESIDENTS ALONG AND ADJACENT TO HIGHWAYS IN THE CONSTRUCTION AREA IN AN ADEQUATE AND SATISFACTORY MANNER IN ACCORDANCE WITH THE ARKANSAS DEPARTMENT OF TRANSPORTATION STANDARDS.

10) CONTRACTOR SHALL BE RESPONSIBLE FOR ALL NECESSARY MEASURES TO PROVIDE ADEQUATE TRENCH SAFETY, AND ALL OTHER ITEMS NECESSARY TO SATISFY ACT 291-1993 OF THE STATE OF ARKANSAS.

11) THE CONTRACTOR SHALL VERIFY WITH THE ENGINEER BEFORE BEGINNING CONSTRUCTION, THE PROCUREMENT AND LOCATION OF ALL EASEMENTS, TEMPORARY AND PERMANENT, NECESSARY TO CARRY OUT THE WORK OUTLINED WITHIN THESE DRAWINGS AND RELATED CONTRACT DOCUMENTS.

SEWER SYSTEM NOTES:

1) SEWER FORCE MAIN PIPE SHALL BE INSTALLED WITH 24" MIN. COVER WITH THE INDICATED TYPE AND SIZE OF PIPE AS SHOWN ON THE PLANS AND DETAILS.

2) ALL 2-INCH AND LARGER PVC SEWER MAIN SHALL HAVE A MINIMUM WALL THICKNESS CLASSIFICATION OF SDR-26.

3) ALL SERVICE LINE AND FITTINGS SHALL BE PVC SDR-26 SERVICES SHALL BE CONSTRUCTED IN THE LOCATION AS INDICATED ON THE PLANS AND TERMINATE TO A SUITABLE GRADE.

4) THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING AND PAYING FOR ALL NECESSARY STREET CUT PERMITS OR FEES. ALL STREET CUTS SHALL BE CONSTRUCTED IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL LAWS OR REGULATIONS.

5) EACH RESIDENTIAL LOT WITHIN LEXINGTON SUBDIVISION WILL CONTAIN ONE 1,500 GALLON ORENCO SEPTIC TANK WITH BIOTUBE PUMP VAULT. TANKS WILL BE INSTALLED AT THE TIME OF THE BUILDING PERMIT AND ARE NOT A PART OF THIS CONTRACT.

SPECIAL NOTES:

1) THIS PLAN SET IS BASED UPON THE EXPECTED FLOWS AND WASTE STRENGTHS PROVIDED IN TABLE BELOW FOR THE PURPOSE OF SERVING THE CITY OF BETHEL HEIGHTS. ANY CHANGE IN USAGE THAT WOULD EFFECT FLOWS OR WASTE STRENGTH REQUIRES A REVIEW BY THE DESIGNER.

CONSTITUENT	AVERAGE	WEEKLY PEAK	RARELY EXCEED
BOD5	150 MG/L	250 MG/L	500 MG/L
TSS	40 MG/L	75 MG/L	150 MG/L
TKN	65 MG/L	75 MG/L	150 MG/L
G&O	20 MG/L	25 MG/L	30 MG/L

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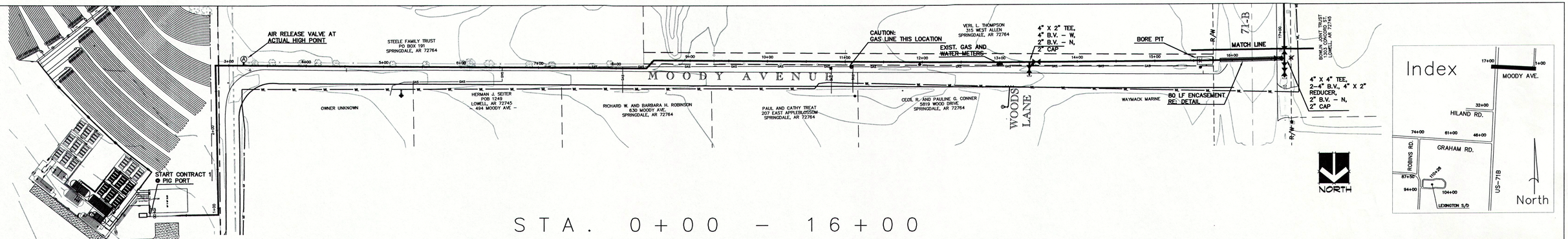
Bethel Heights Sanitary Sewer - 0656



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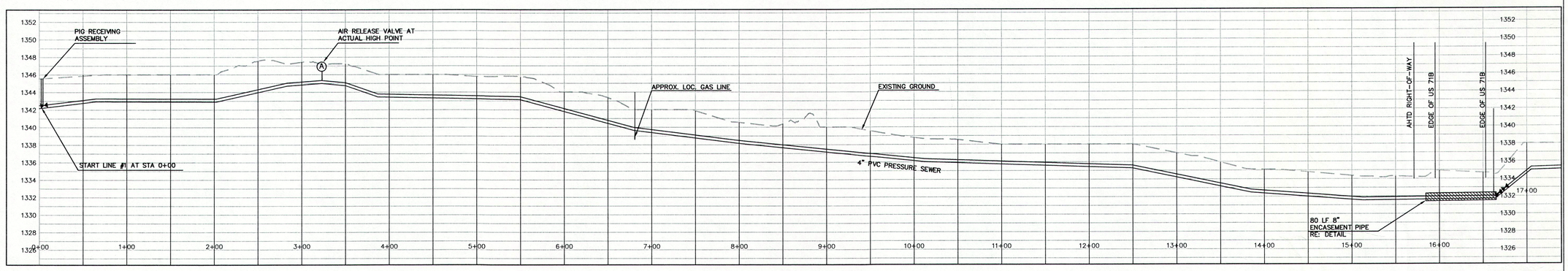

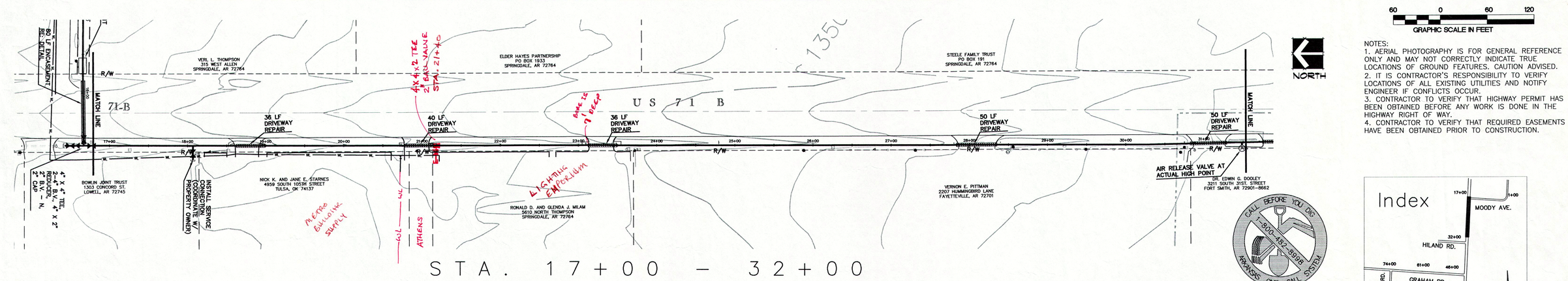

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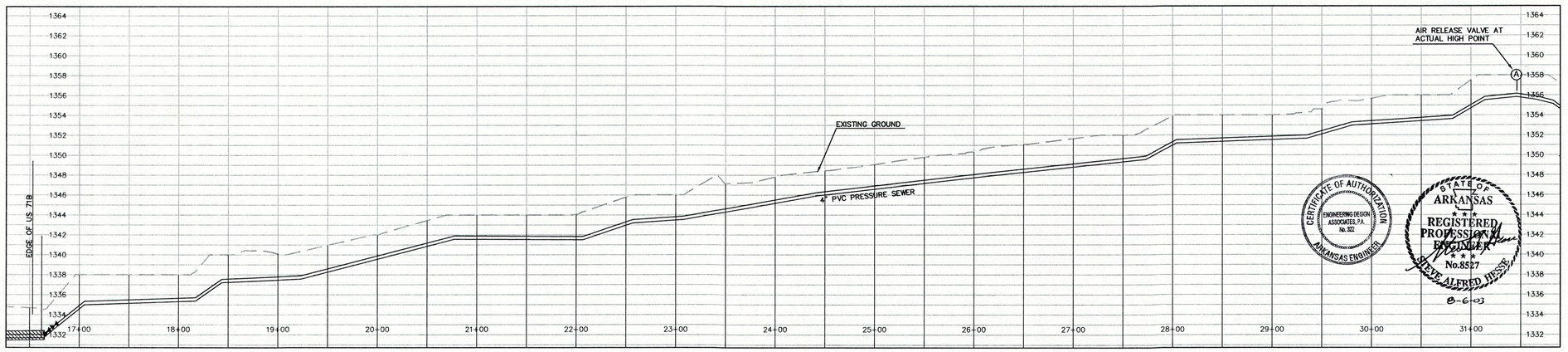

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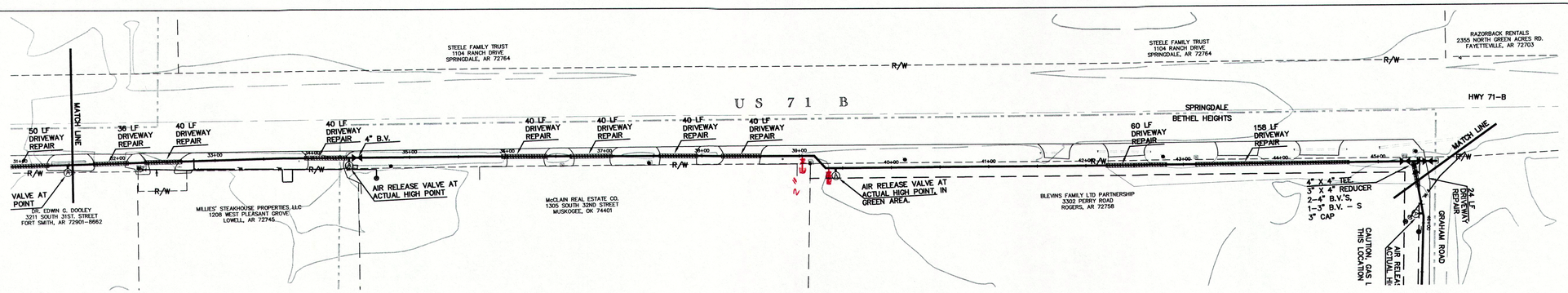

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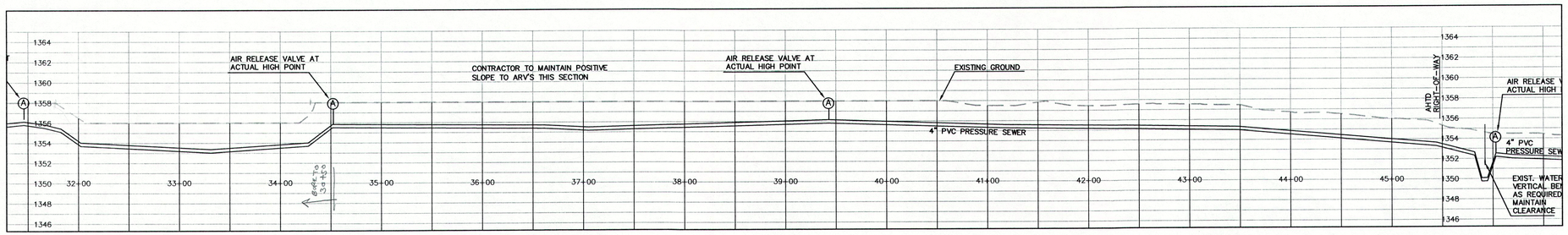

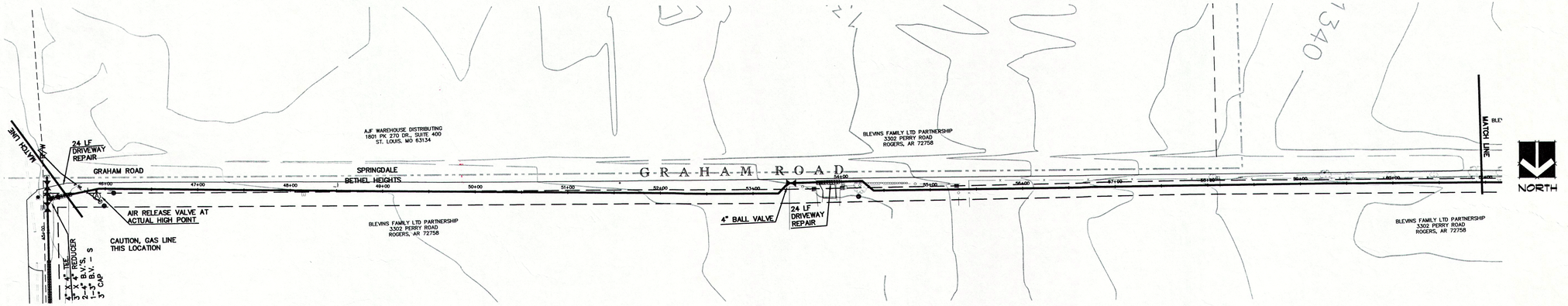

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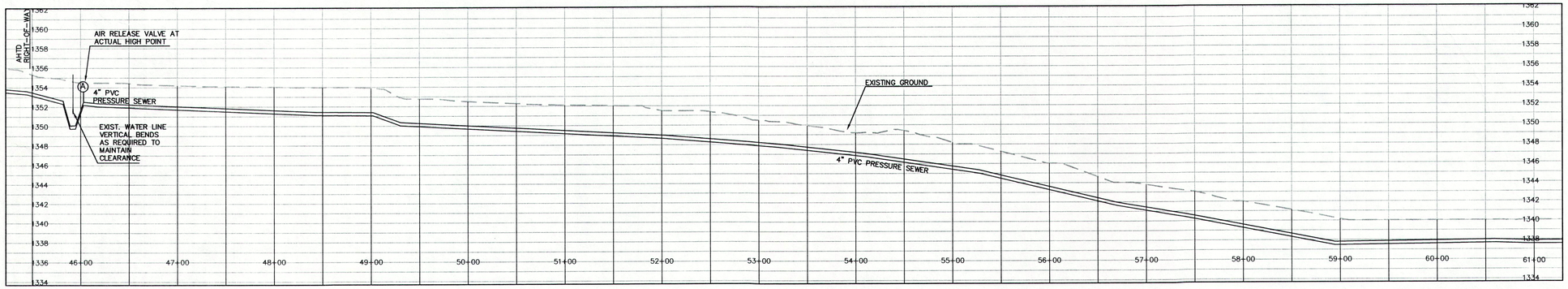

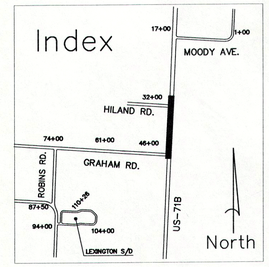

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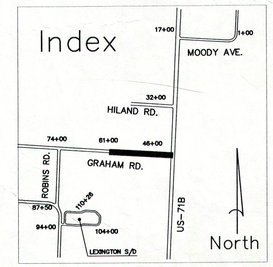

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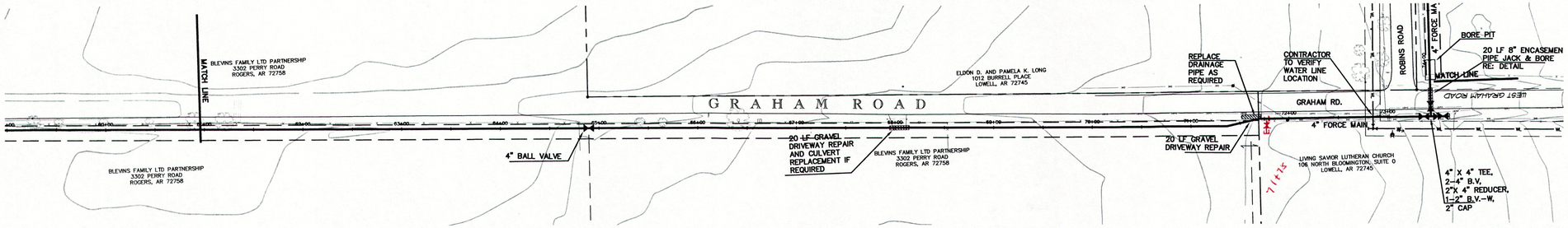

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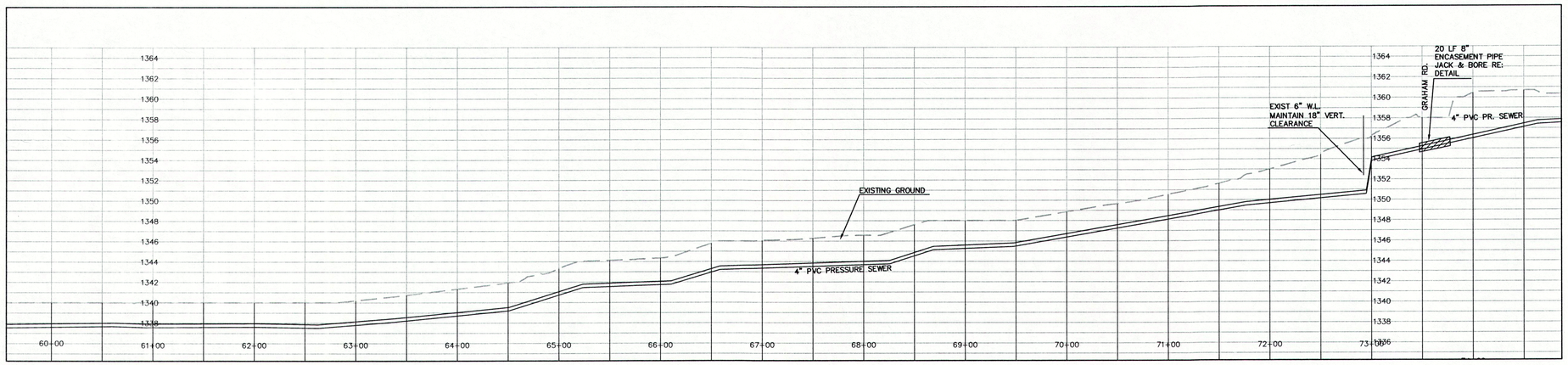

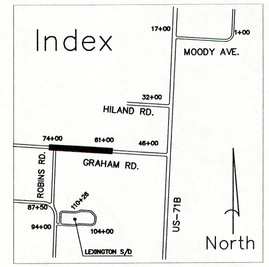

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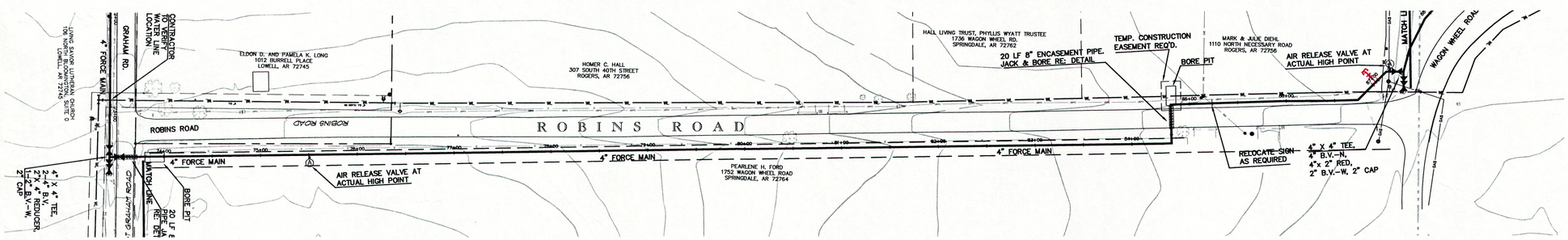

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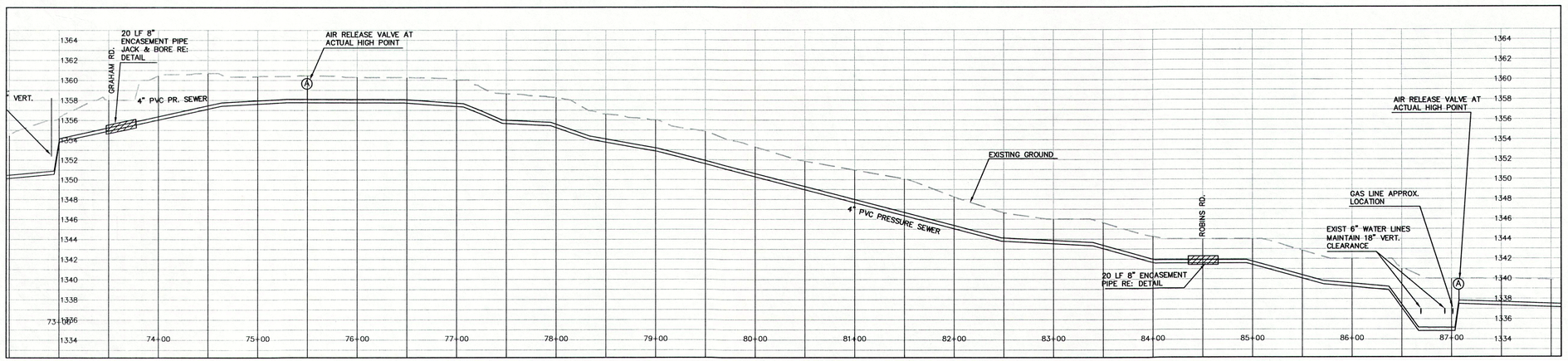

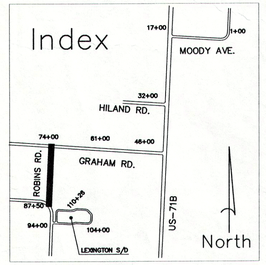

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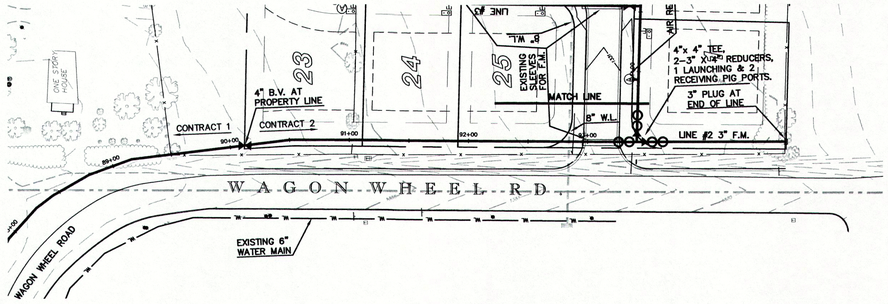

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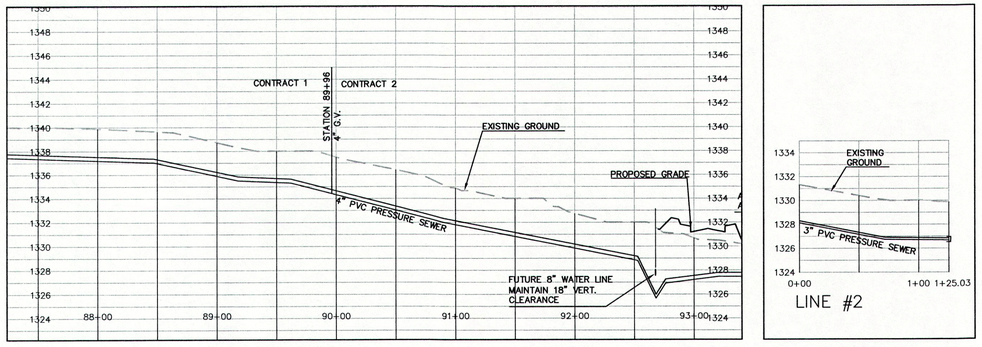

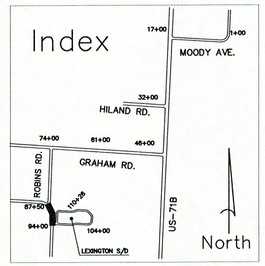

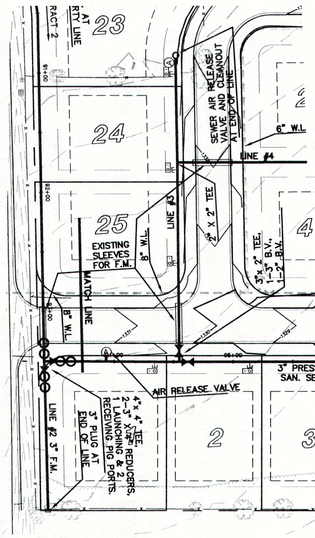

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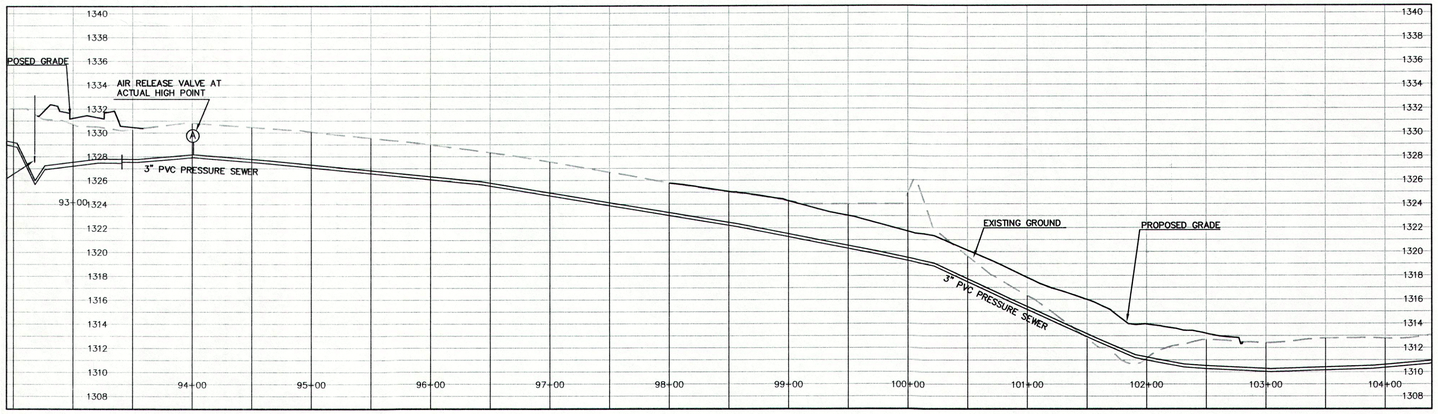

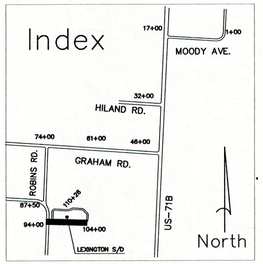

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SHEET UT-4

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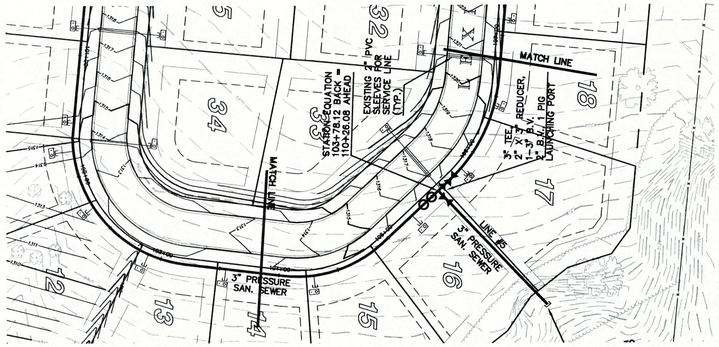
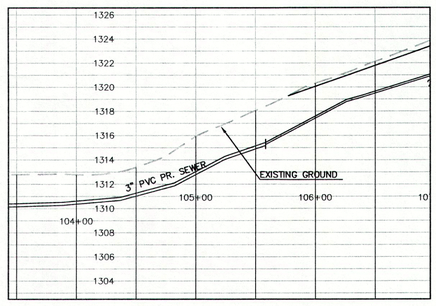
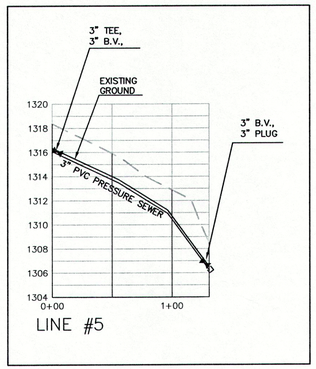
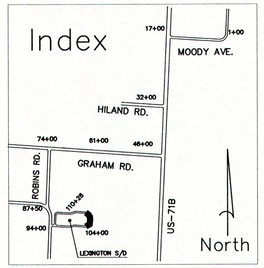


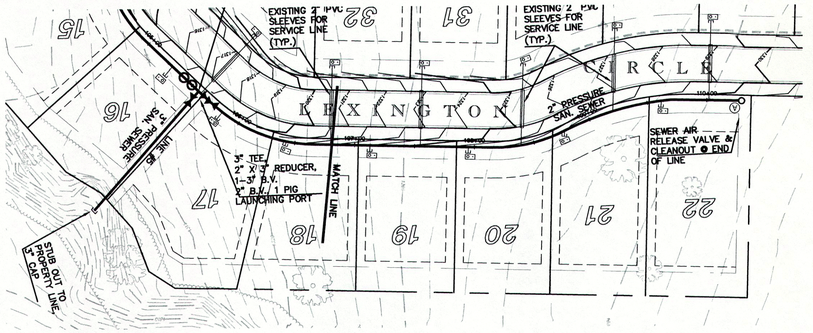
STA. 104+00 – 106+00



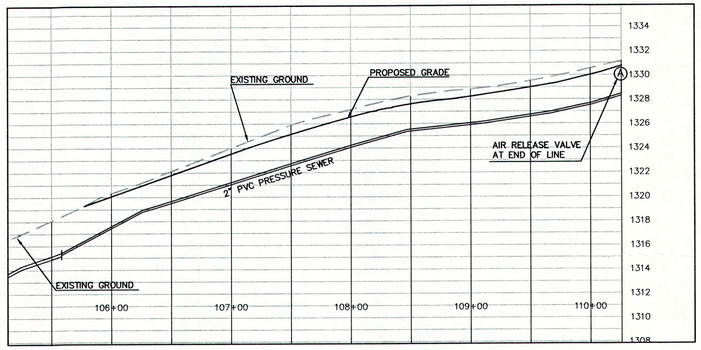
LINE "5"

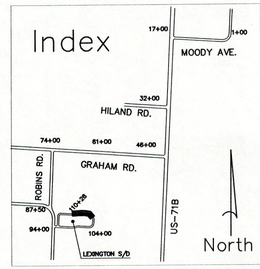


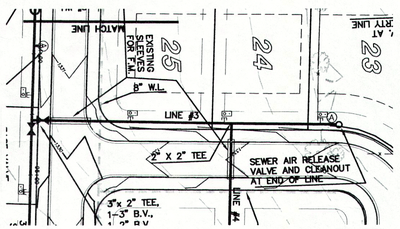




STA. 106+00 – 110+26







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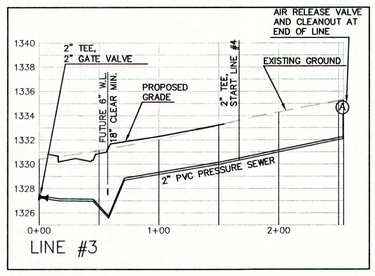

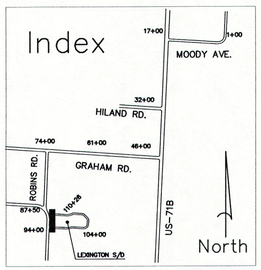

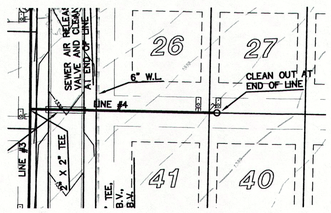

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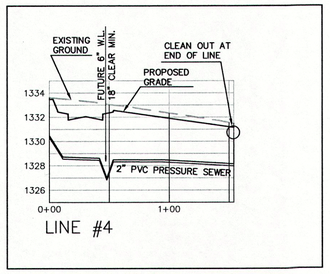

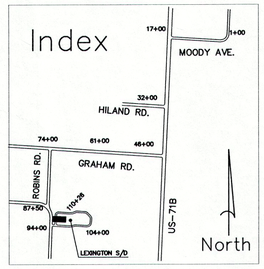

60 0 60 120

GRAPHIC SCALE IN FEET

CERTIFICATE OF AUTHORIZATION ENGINEERING DESIGN ASSOCIATES, P.A. No. 322 ARKANSAS ENGINEER

STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No.8527 STEVE ALFRED HESSE

8-6-03

NOTES:
1. AERIAL PHOTOGRAPHY IS FOR GENERAL REFERENCE ONLY AND MAY NOT CORRECTLY INDICATE TRUE LOCATIONS OF GROUND FEATURES. CAUTION ADVISED.
2. IT IS CONTRACTOR'S RESPONSIBILITY TO VERIFY LOCATIONS OF ALL EXISTING UTILITIES AND NOTIFY ENGINEER IF CONFLICTS OCCUR.
3. CONTRACTOR TO VERIFY THAT HIGHWAY PERMIT HAS BEEN OBTAINED BEFORE ANY WORK IS DONE IN THE HIGHWAY RIGHT OF WAY.
4. CONTRACTOR TO VERIFY THAT REQUIRED EASEMENTS HAVE BEEN OBTAINED PRIOR TO CONSTRUCTION.

CALL BEFORE YOU DIG 1-800-482-8998 ARKANSAS ONE CALL SYSTEM

FORCE MAIN PLAN & PROFILE STATION 104+00 – 110+26

PHASE 1 SANITARY SEWER IMPROVEMENTS

BETHEL HEIGHTS, ARKANSAS

EDA Consulting Engineering Landscape Architecture Land Surveying
Engineering Design Associates, P.A.
134 West Emma Avenue (479) 756-1266
Springdale, Arkansas 72764 Fax: (479) 756-2129

DRAWN BY: AWF CHECKED BY: SAH
DATE: 8-30-02
SCALE:1"=60' HORZ. 1"=6' VERT.
JOB NUMBER: 0656
FILE NAME: 0656FORCE.DWG

DESCRIPTION:

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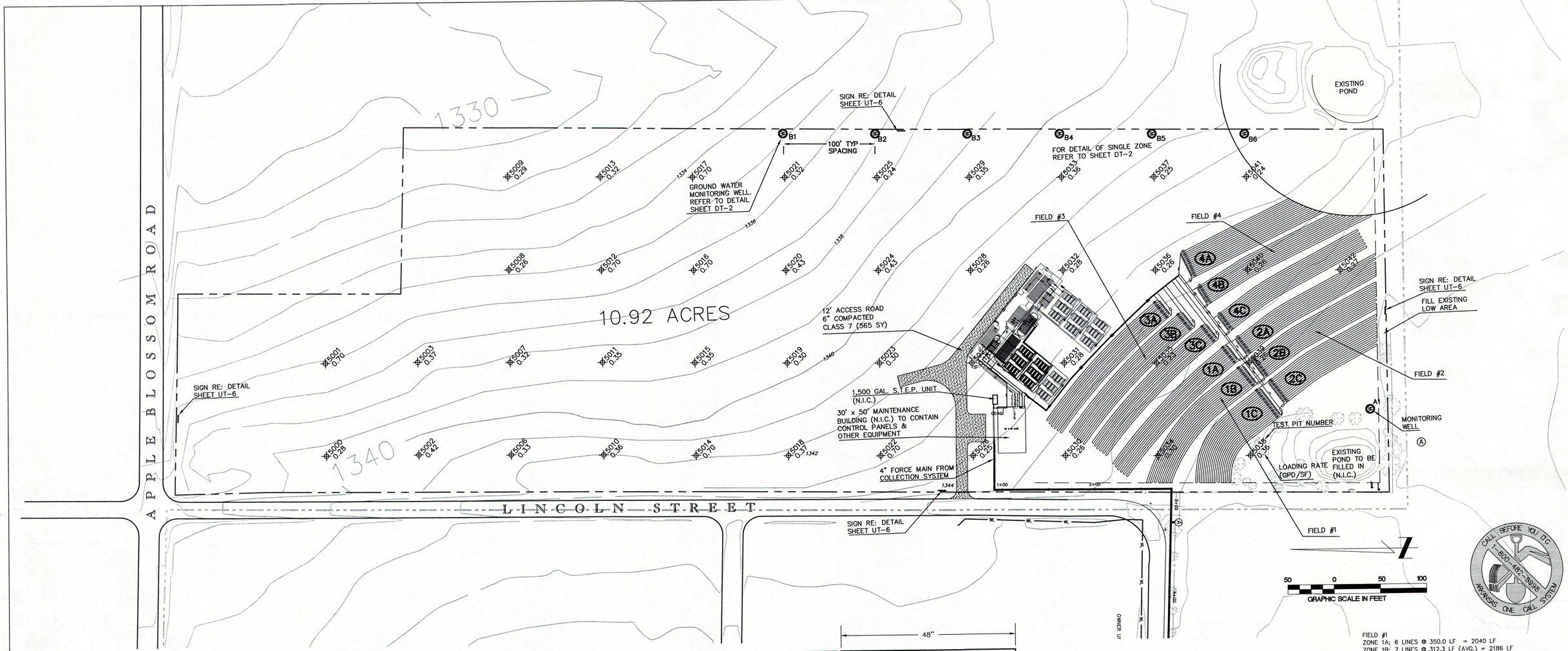
SHEET UT-5



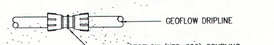
FIELD #1
ZONE 1A; 6 LINES @ 350.0 LF = 2040 LF
ZONE 1B; 7 LINES @ 312.3 LF (AVG.) = 2186 LF
ZONE 1C; 10 LINES @ 227.4 LF (AVG.) = 2274 LF
6500 LF @ 2' SPACING = 13000 SF

FIELD #2
ZONE 2A; 6 LINES @ 342.5 LF (AVG.) = 2055 LF
ZONE 2B; 7 LINES @ 303.1 LF (AVG.) = 2122 LF
ZONE 2C; 8 LINES @ 258.3 LF (AVG.) = 2066 LF
6243 LF @ 2' SPACING = 12486 SF

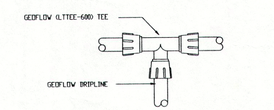
FIELD #3
ZONE 3A; 6 LINES @ 350.0 LF = 2040 LF
ZONE 3B; 6 LINES @ 350.0 LF = 2040 LF
ZONE 3C; 6 LINES @ 350.0 LF = 2040 LF
6120 LF @ 2' SPACING = 12240 SF

FIELD #4
ZONE 4A; 8 LINES @ 287.4 LF (AVG.) = 2299 LF
ZONE 4B; 6 LINES @ 365.3 LF (AVG.) = 2192 LF
ZONE 4C; 6 LINES @ 350.0 LF = 2040 LF
6531 LF @ 2' SPACING = 13062 SF

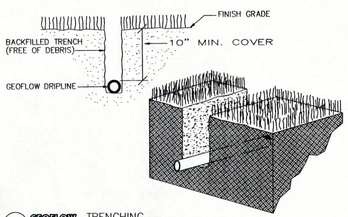
TOTAL (ALL FIELDS) = 25394 LF, 50788 SF



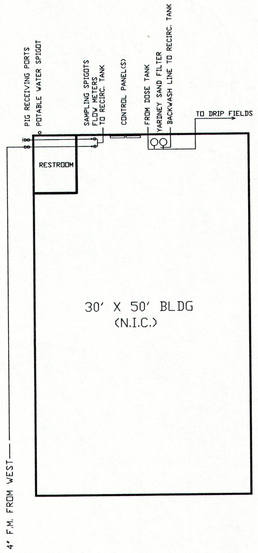
501LS GEOFLOW LOCKSLIP COUPLING (LTC-600) SECTION

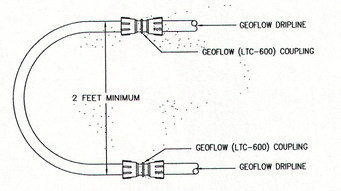


503LS GEOFLOW LOCKSLIP TEE (LTTEE-600) SECTION

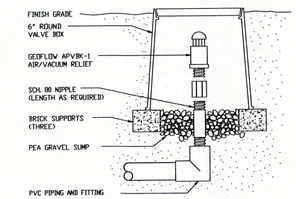


703 GEOFLOW TRENCHING INSTALLATION

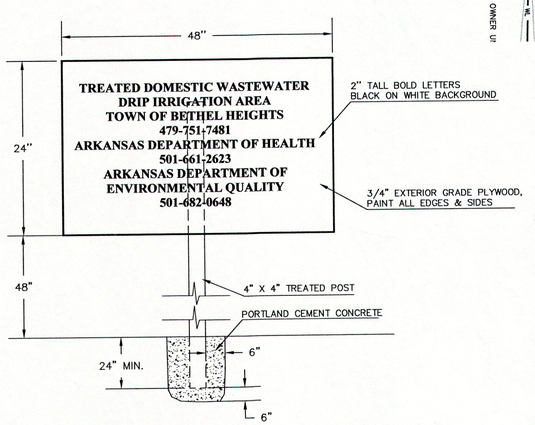




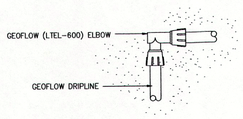
501LS A GEOFLOW LOCKSLIP COUPLING (LTC-600) SECTION



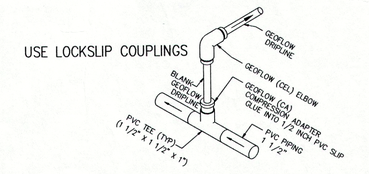
522 GEOFLOW 1" AIR/VACUUM RELIEF SECTION (PLUMBED TO PVC)



SIGN DETAIL
N.T.S.



502LS GEOFLOW LOCKSLIP ELBOW (LTEL-600) SECTION



505A GEOFLOW MANIFOLD / FLUSH HEADER CONNECTION (PVC TO ELBOW) SECTION

CERTIFICATE OF AUTHORIZATION ENGINEERING DESIGN ASSOCIATES, P.A. No. 322 ARKANSAS ENGINEER

STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No.8527 STEVE ALFRED HESSE

9-24-03

TREATMENT AREA SYSTEM LAYOUT

PHASE 1 SANITARY SEWER IMPROVEMENTS

BETHEL HEIGHTS, ARKANSAS

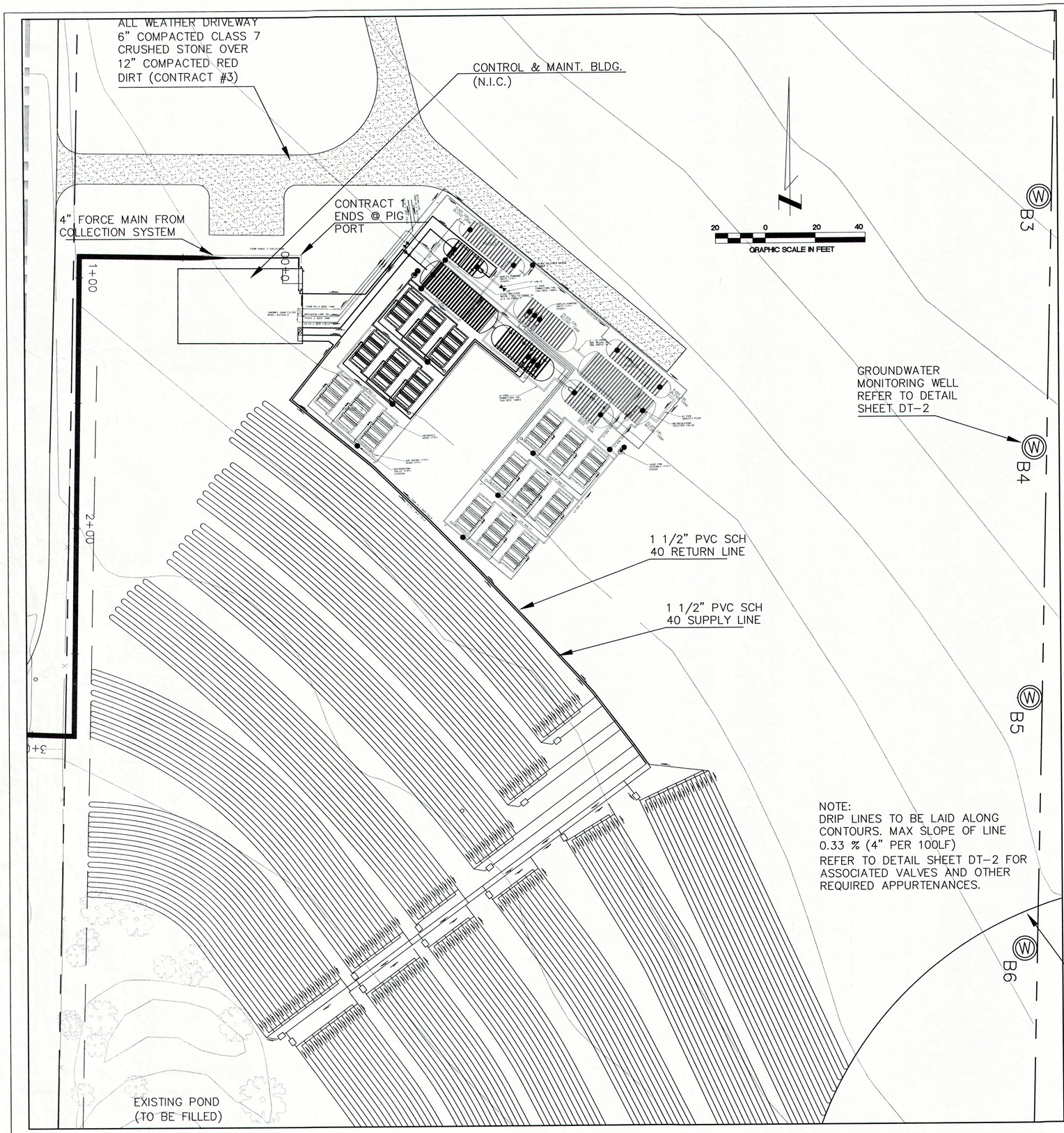
EDA
Consulting Engineering
Landscape Architecture
Land Surveying
Engineering Design Associates, P.A.
134 West Emma Avenue (479) 756-1266
Springdale, Arkansas 72764 Fax: (479) 756-2129

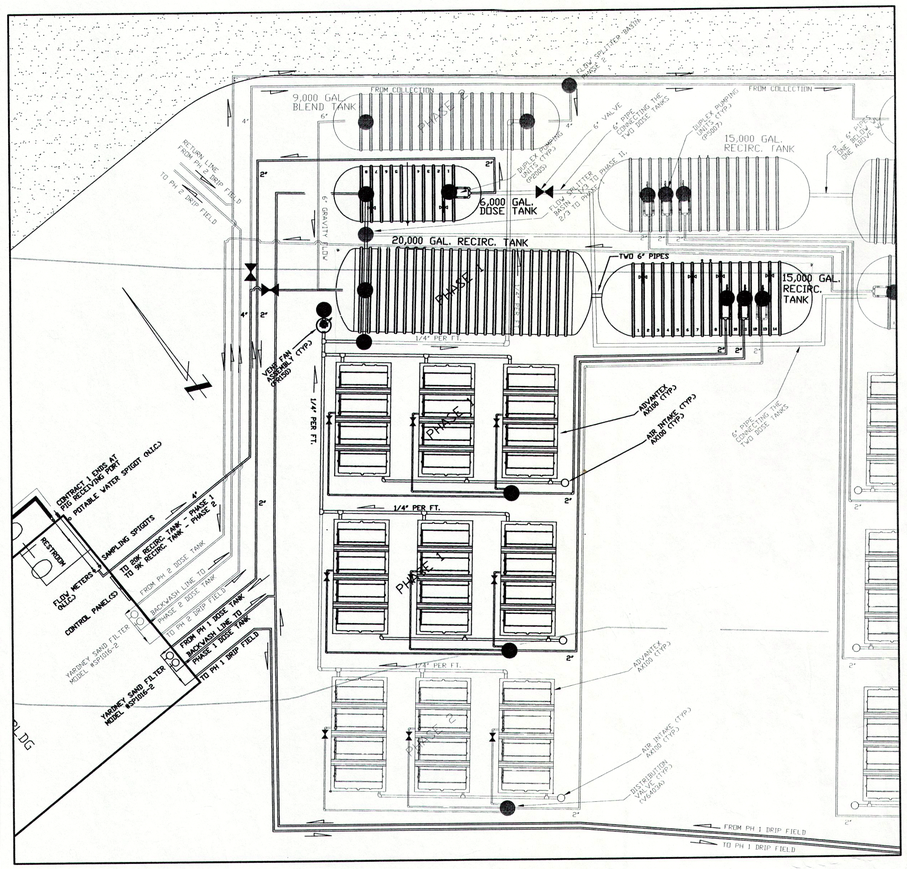
DRAWN BY: AWF CHECKED BY: CLP
DATE: 9-6-02
SCALE: 1" = 50'
JOB NUMBER: 0656
FILE NAME: 0656UTIL.DWG

DESCRIPTION:

C:\Land Projects - SAH\0656\dwg\0656UTIL.dwg 9/24/2003 2:23:25 PM CST

SHEET UT-6





ROUTING DETAIL

10 0 10 20
GRAPHIC SCALE IN FEET

NOTES:
1) CONTRACTOR TO PROVIDE A MINIMUM OF 12" OF FALL FROM THE BOTTOM OF THE AX-100 TREATMENT PODS TO THE TOP OF THE RECIRCULATION TANK.
2) PROVIDE A MIN. OF 9" FALL FROM THE BASE OF THE AX100 PODS TO THE SPLITTER VALVE BODY.
3) INSTALL ALL FILTRATE RETURN LINES AT 1/4" PER FOOT.

CERTIFICATE OF AUTHORIZATION
ENGINEERING DESIGN ASSOCIATES, P.A.
No. 323
ARKANSAS ENGINEER

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No.8527
STEVE ALFRED HESS
9-24-03

TREATMENT & DRIP DISPERSAL LARGE SCALE DRAWINGS

PHASE 1 SANITARY SEWER IMPROVEMENTS

BETHEL HEIGHTS, ARKANSAS

EDA
Consulting Engineering
Landscape Architecture
Land Surveying
Engineering Design Associates, P.A.
134 West Emma Avenue (479) 756-1266
Springdale, Arkansas 72764 Fax: (479) 756-2129

DRAWN BY: AWF	CHECKED BY: SAH
DATE: 9-6-02	
SCALE: 1" = 20'	
JOB NUMBER: 0656	
FILE NAME: 0656UTIL.DWG	
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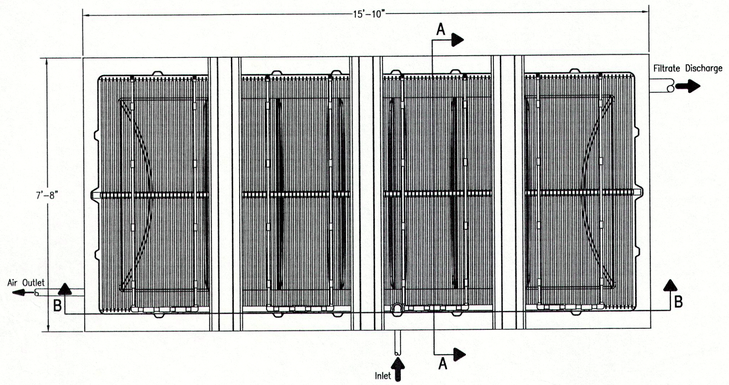
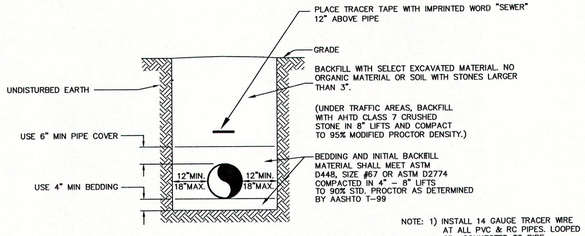


Top View

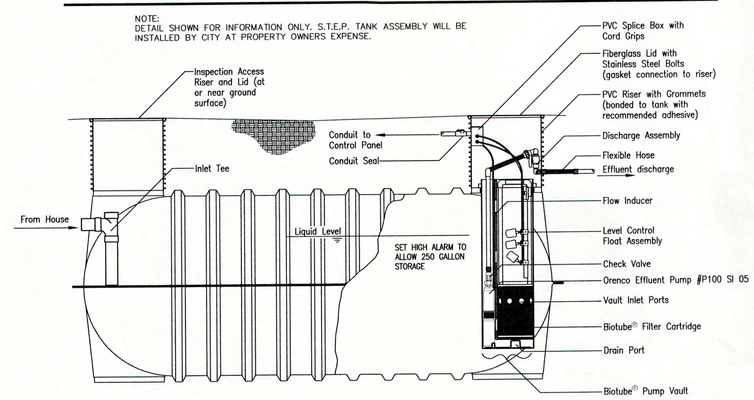
Scale: 1" = 2'-0"

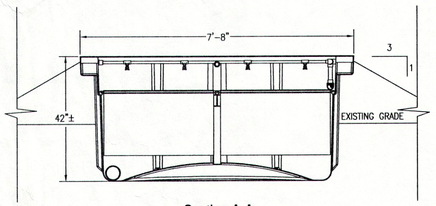


TYPICAL BACKFILL
FOR DI, PVC AND RC PIPES

N.T.S.

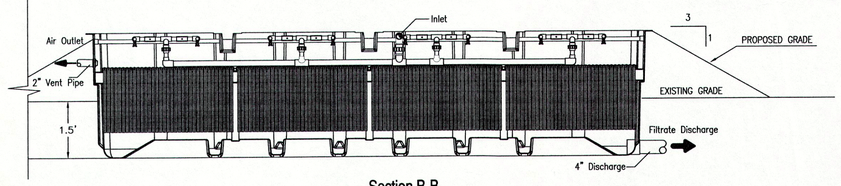
1500 Gallon Single Compartment Drawdown Fiberglass Tank





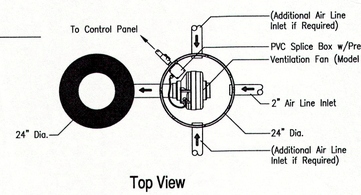
Section A-A

Scale: 1" = 2'-0"

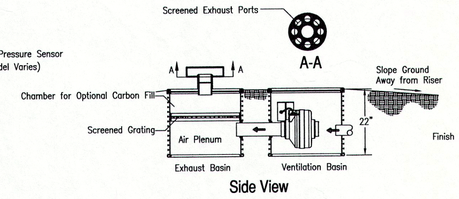


Section B-B

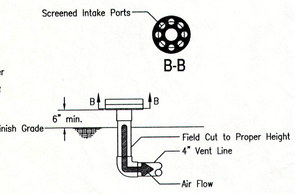
Scale: 1" = 2'-0"



Top View



Side View

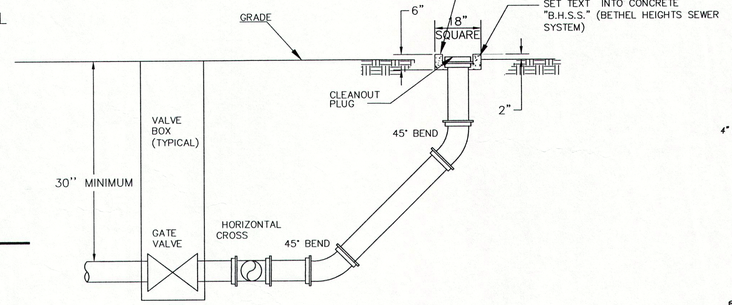


Air Inlet Detail

Scale: 1" = 2'-0"

AdvanTex 100 System

(ALSO REFER TO MANUFACTUER'S INSTALLATION MANUAL FOR OTHER INFORMATION)



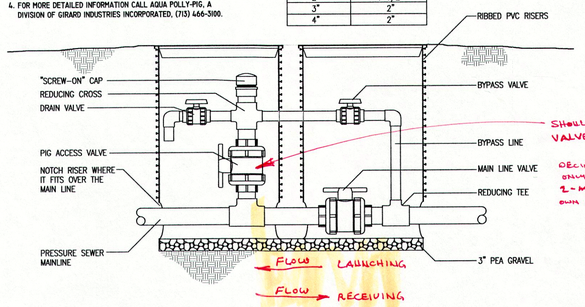
SINGLE CLEANOUT ASSEMBLY

N.T.S.

NOTES:

1. PROTECT THE MAIN LINE FROM BEING SHEARED BECAUSE OF TRAFFIC LOADS ON THE RISER BY INSURING THE RISER IS PLACED ON A STABLE BASE AND THAT THE NOTCH IS CUT HIGH ENOUGH TO ALLOW ADEQUATE CLEARANCE BETWEEN THE BOTTOM OF THE NOTCH AND THE TOP OF THE PVC LINE.
2. LAUNCHING AND RECEIVING PORTS ARE CONSTRUCTED IN A SIMILAR FASHION.
3. WHEN RECEIVING THE PIG, OPERATE DRAIN VALVE TO RELIEVE PRESSURE. CAPTURE ALL EFFLUENT AND DISPOSE OF PROPERLY.
4. FOR MORE DETAILED INFORMATION CALL AQUA POLLY-PIG, A DIVISION OF GIRARD INDUSTRIES INCORPORATED, (713) 466-3100.

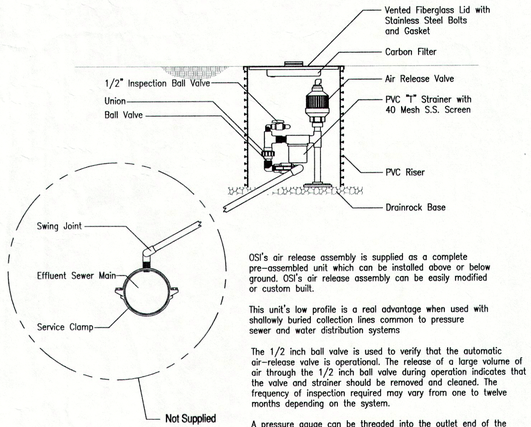
BYPASS LINE	
MAINLINE SIZE	BYPASS LINE SIZE
2"	1 1/2"
3"	2"
4"	2"



PIG LAUNCHING & RECEIVING DETAIL

N.T.S.

Air Release Assembly



OSI's air release assembly is supplied as a complete pre-assembled unit which can be installed above or below ground. OSI's air release assembly can be easily modified or custom built.

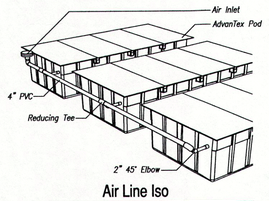
This unit's low profile is a real advantage when used with shallowly buried collection lines common to pressure sewer and water distribution systems

The 1/2 inch ball valve is used to verify that the automatic air-release valve is operational. The release of a large volume of air through the 1/2 inch ball valve during operation indicates that the valve and strainer should be removed and cleaned. The frequency of inspection required may vary from one to twelve months depending on the system.

A pressure gauge can be threaded into the outlet end of the 1/2 inch ball valve to observe system line pressure. All components are rated for a 150 psi working pressure.

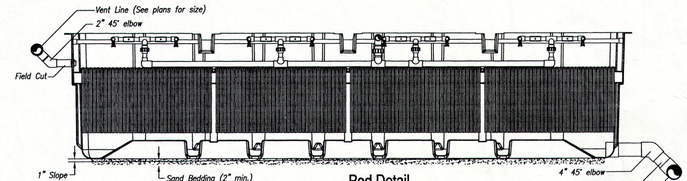
Ventilation Fan Detail

Scale: 1" = 2'-0"



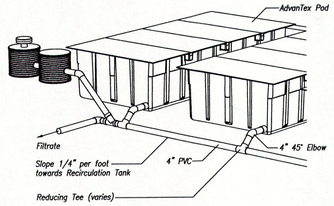
Air Line Iso

NTS



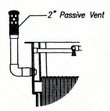
Pod Detail

Scale: 1" = 2'-0"



Filtrate Return Line Iso

NTS



Passive Vent Option

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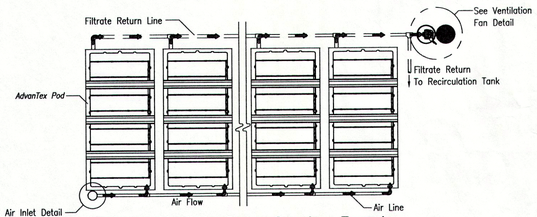

Forced Air Ventilation System Overview - Example

Scale: 1" = 8'-0"

Orenco Systems®
Incorporated
814 AIRWAY AVENUE
SUTHERLIN, OREGON
97479-9012
TELEPHONE:
(541) 459-4449
(800) 348-9843

CERTIFICATE OF AUTHORIZATION — ENGINEERING DESIGN ASSOCIATES, P.A. No. 922 — ARKANSAS ENGINEER

STATE OF ARKANSAS — REGISTERED PROFESSIONAL ENGINEER — No.8527 — STEVE ALFRED HESSE — 9-24-03

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MISCELLANEOUS DETAILS

PHASE 1 SANITARY SEWER IMPROVEMENTS

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Engineering Design Associates, P.A.
Consulting Engineering
Landscape Architecture
Land Surveying
134 West Emma Avenue
Springdale, Arkansas 72764
(479) 756-1266
Fax: (479) 756-2129

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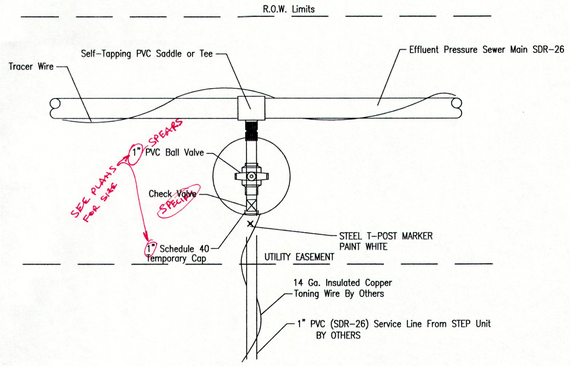
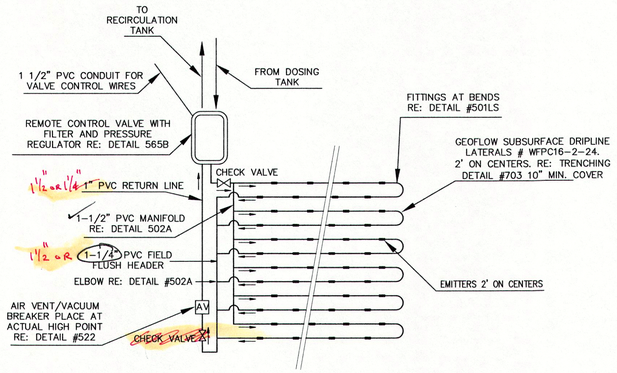


NOTE:
1. All Service Laterals From the Effluent Sewer Main to the Property Line shall be Pressure Tested Prior to any Back filling.

2. Place marker tape imprinted with the word "SEWER" 12" above top of pipe.

PRESSURE SEWER SERVICE DETAIL
scale: NONE



GEOFLOW TYPICAL LAYOUT FOR SINGLE ZONE WASTEFLOW PC DRIPLINE

NOT TO SCALE
REFER TO PLANS FOR ACTUAL DIMENSIONS

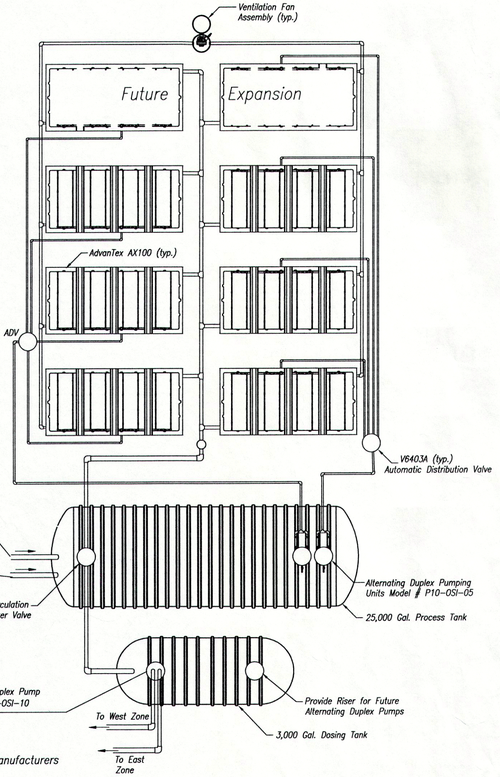
NOTE:
1). ALL PVC LINE TO BE SCHEDULE 40
2). MAXIMUM SLOPE NOT TO EXCEED 4" PER 100 FEET

General Notes

Expected Flows
- Q_a = 12,500 gpd
- Q_p = 27,000 gpd

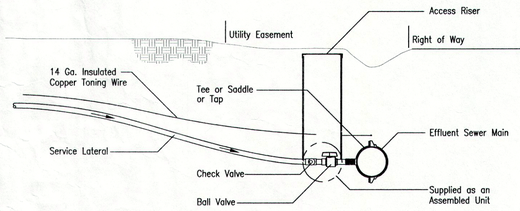
Expected Influent Quality
Grease & Oil: 20 mg/L
BOD: 150 mg/L
TSS: 60 mg/L

Targeted Treatment Goals
BOD: < 20 mg/L
TSS: < 20 mg/L

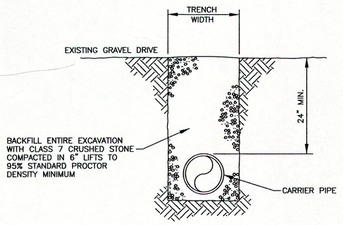


NOTE: Pipe sizes per manufacturers recomendations.

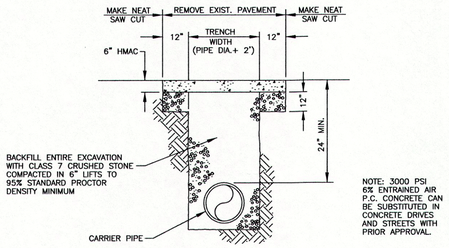
Effluent Sewer Service Connection



All service line connections shall be solvent welded. The only acceptable solvents and cements are those that are recommended by the pipe manufacturer. All service laterals from the effluent sewer main to the property line shall be pressure tested prior to any backfilling.

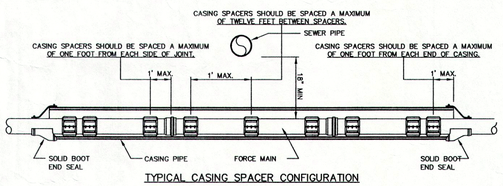


GRAVEL DRIVE CROSSING REPAIR
N.T.S.



NOTE: 3000 PSI 6% ENTRAINED AIR P.C. CONCRETE CAN BE SUBSTITUTED IN CONCRETE DRIVES AND STREETS WITH PRIOR APPROVAL.

PAVED DRIVE/STREET CROSSING REPAIR
N.T.S.

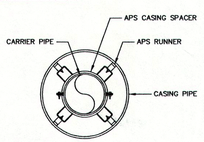


TYPICAL CASING SPACER CONFIGURATION

NOTES:

1. SPACERS SHALL BE MANUFACTURED BY "ADVANCE PRODUCTS & SYSTEMS" AS SPECIFIED.
2. QUANTITY OF RUNNERS SHALL BE IN ACCORDANCE WITH CARRIER PIPE SIZE AS FOLLOWS:
   - TO 14" DIAMETER – 4 RUNNERS
   - 16" TO 36" DIAMETER – 6 RUNNERS
   - 38" TO 48" DIAMETER – 8 RUNNERS
3. DIMENSIONS BETWEEN SPACERS SHALL BE AS FOLLOW:
   - STAINLESS STEEL – 8 TO 12 FEET.
   - CARBON STEEL – 8 TO 12 FEET.
4. WIDTH OF SPACERS SHALL BE IN ACCORDANCE WITH CARRIER PIPE SIZE AS FOLLOWS:
   - TO 14" DIAMETER – 8" WIDTH
   - 16" AND LARGER DIAMETER – 12" WIDTH
5. A MINIMUM OF THREE SPACERS PER FULL JOINT OF PIPE.
6. WATER LINES SHALL BE "CENTERED" IN CASING.
7. ALL D.I. CARRIER PIPE MUST HAVE FIELD LOCK GASKETS INSTALLED WITHIN THE CASING PIPE.
8. CONTRACTOR TO VERIFY THAT ENCASEMENT PIPE IS LARGE ENOUGH TO CONTAIN THE CARRIER PIPE.
9. MAINTAIN 18" MINIMUM BETWEEN WATER AND SEWER MAINS.

ENCASEMENT / CARRIER PIPE SIZING CHART

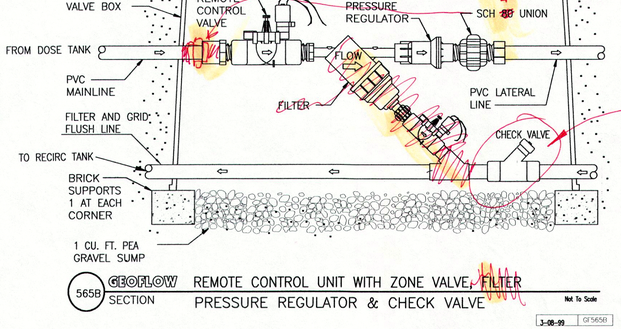


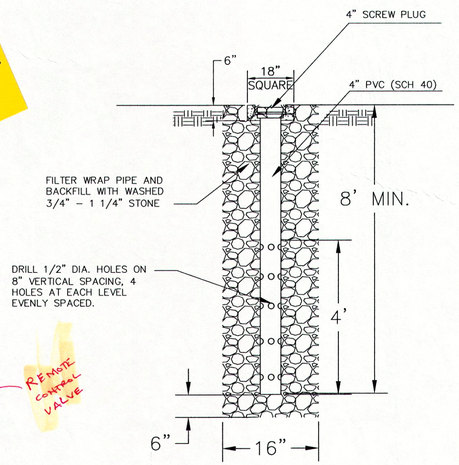
TYPICAL END VIEW

MAIN SIZE	ENCASEMENT PIPE
NOMINAL SIZE	NOMINAL SIZE
4"	8"
6"	12"
8"	16"
12"	20"
16"	24"
24"	36"

ALL ENCASEMENT PIPE SHALL BE NEW STEEL & HAVE A MINIMUM WALL THICKNESS OF .25

FORCE MAIN ENCASEMENT DETAILS





GROUNDWATER MONITORING WELL
N.T.S.

AdvanTex® - AX100 System for Q_{ave} = 12,500 gpd

GENERAL SYSTEM LAYOUT – DO NOT USE FOR CONSTRUCTION

RSV & Float Setting For 10'Ø Xerxes Fiberglass Tank

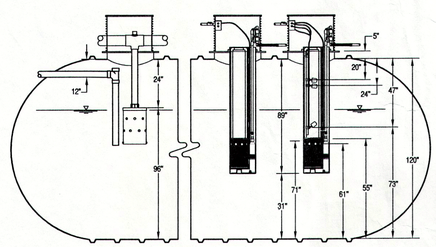
Scale: 1" = 4'-0"

Tank Volume: 25,000 gal.

Pump(s) model: P5007

Pump MLL: 24"

Pump Vault model: PVU96-3630



NOTE: CONTRACTOR TO VERIFY ALL FLOAT SETTINGS FROM MANUFACTURER.

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(479) 756-1266 Fax: (479) 756-2129

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SHEET DT-2

Appendix G: Phase 2 Construction Drawings (latest set discovered)

Phase 2 Sanitary Sewer Improvements

for the

City of Bethel Heights, Arkansas

EDA Project No. 0656.4

December 15, 2003

Construction Plans

GENERAL NOTES:

1) THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO AVOID DAMAGE TO ADJACENT PROPERTIES DURING THE CONSTRUCTION OF THE PROJECT. THE CONTRACTOR SHALL BE HELD SOLELY RESPONSIBLE FOR ANY DAMAGES THAT MAY RESULT.

2) THE LOCATIONS OF EXISTING UTILITIES SHOWN ON THE PLANS ARE GENERAL IN NATURE AND ARE BASED ON INFORMATION PROVIDED BY THE UTILITY COMPANIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING THE EXACT LOCATION OF ALL UTILITIES BEFORE PROCEEDING WITH THE CONSTRUCTION.

3) OTHER CONTRACTORS, LABORERS, WORKMEN, UTILITY COMPANIES, ETC., MAY BE WORKING WITHIN OR AROUND THE PROJECT SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING HIS WORK WITH OTHERS TO MINIMIZE ANY CONFLICTS THAT ARISE.

4) IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, THE CONTRACTOR WILL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS OF THE JOB SITE INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THIS REQUIREMENT WILL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. THE DUTY OF THE ENGINEER TO CONDUCT CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES, IN OR NEAR THE CONSTRUCTION SITE.

5) CONTRACTOR SHALL PROVIDE ADEQUATE MEANS OF EROSION CONTROL THROUGHOUT THE CONSTRUCTION OF THE PROJECT.

6) ALL CONSTRUCTION METHODS AND MATERIALS SHALL MEET OR EXCEED THE MINIMUM STANDARD AS SPECIFIED BY THE ARKANSAS STATE HIGHWAY AND TRANSPORATION DEPARTMENT AND THE CITY OF SPRINGDALE, ARKANSAS.

7) THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING, PAYING AND POSTING FOR ALL PAYMENT, PERFORMANCE, AND MAINTENANCE BONDS NECESSARY FOR THE CONSTRUCTION OF THIS PROJECT.

8) ALL CONSTRUCTION WORK AND UTILITY WORK OUTSIDE OF PROPERTY BOUNDARIES SHALL BE PERFORMED IN COOPERATION WITH AND IN ACCORDANCE WITH REGULATIONS OF THE AUTHORITIES CONCERNED. THE CONTRACTOR SHALL PROVIDE ADEQUATE CONSTRUCTION SIGNAGE AND OTHER TRAFFIC CONTROL DEVICES WHEN WORKING IN ANY RIGHT-OF-WAY. SIGNAGE AND OTHER TRAFFIC CONTROL DEVICES SHALL CONFORM TO ALL FEDERAL, STATE AND LOCAL GUIDELINES AND REGULATIONS.

9) THE CONTRACTOR SHALL CONDUCT THE WORK IN A MANNER THAT WILL INSURE, AS FAR AS PRACTICABLE, THE LEAST OBSTRUCTION TO TRAFFIC AND SHALL PROVIDE FOR THE CONVENIENCE AND SAFETY OF THE GENERAL PUBLIC AND RESIDENTS ALONG AND ADJACENT TO HIGHWAYS IN THE CONSTRUCTION AREA IN AN ADEQUATE AND SATISFACTORY MANNER IN ACCORDANCE WITH THE ARKANSAS DEPARTMENT OF TRANSPORTATION STANDARDS.

10) CONTRACTOR SHALL BE RESPONSIBLE FOR ALL NECESSARY MEASURES TO PROVIDE ADEQUATE TRENCH SAFETY, AND ALL OTHER ITEMS NECESSARY TO SATISFY ACT 291-1993 OF THE STATE OF ARKANSAS.

11) THE CONTRACTOR SHALL VERIFY WITH THE ENGINEER BEFORE BEGINNING CONSTRUCTION, THE PROCUREMENT AND LOCATION OF ALL EASEMENTS, TEMPORARY AND PERMANENT, NECESSARY TO CARRY OUT THE WORK OUTLINED WITHIN THESE DRAWINGS AND RELATED CONTRACT DOCUMENTS.

12) IT IS THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE ENGINEER OF ANY UTILITY CONFLICTS BEFORE BEGINNING CONSTRUCTION.

SEWER SYSTEM NOTES:

1) SEWER FORCE MAIN PIPE SHALL BE INSTALLED WITH 24" MIN. COVER WITH THE INDICATED TYPE AND SIZE OF PIPE AS SHOWN ON THE PLANS AND DETAILS.

2) ALL 2-INCH AND LARGER PVC SEWER MAIN SHALL HAVE A MINIMUM WALL THICKNESS CLASSIFICATION OF SDR-26.

3) ALL SERVICE LINE AND FITTINGS SHALL BE PVC SDR-26 SERVICES SHALL BE CONSTRUCTED IN THE LOCATION AS INDICATED ON THE PLANS AND TERMINATE TO A SUITABLE GRADE.

4) THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING AND PAYING FOR ALL NECESSARY STREET CUT PERMITS OR FEES. ALL STREET CUTS SHALL BE CONSTRUCTED IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL LAWS OR REGULATIONS.

5) EACH RESIDENTIAL LOT WITHIN LEXINGTON SUBDIVISION WILL CONTAIN ONE 1,500 GALLON ORENCO SEPTIC TANK WITH BIOTUBE PUMP VAULT. TANKS WILL BE INSTALLED AT THE TIME OF THE BUILDING PERMIT AND ARE NOT A PART OF THIS CONTRACT.

SPECIAL NOTES:

1) THIS PLAN SET IS BASED UPON THE EXPECTED FLOWS AND WASTE STRENGTHS PROVIDED IN TABLE BELOW FOR THE PURPOSE OF SERVING THE CITY OF BETHEL HEIGHTS. ANY CHANGE IN USAGE THAT WOULD EFFECT FLOWS OR WASTE STRENGTH REQUIRES A REVIEW BY THE DESIGNER.

CONSTITUENT	AVERAGE	WEEKLY PEAK	RARELY EXCEED
BOD5	150 MG/L	250 MG/L	500 MG/L
TSS	40 MG/L	75 MG/L	150 MG/L
TKN	65 MG/L	75 MG/L	150 MG/L
G&O	20 MG/L	25 MG/L	30 MG/L

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Springdale, Arkansas 72764

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STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No.8527
STEVE ALFRED HESSE
12-15-03

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ENGINEERING DESIGN ASSOCIATES, P.A.
No. 322
ARKANSAS ENGINEER

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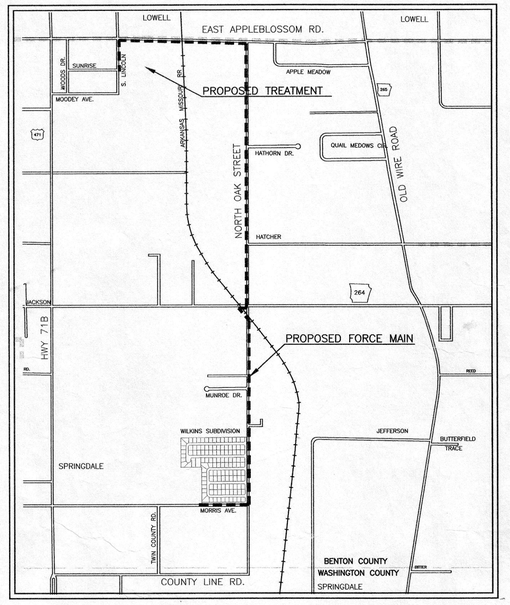

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Force Main Plan & Profile Sta. 27+00 – 60+00	UT-2
Force Main Plan & Profile Sta. 60+00 – 94+00	UT-3
Force Main Plan & Profile Sta. 94+00 – 127+00	UT-4
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Large Scale Treatment Area Plan	UT-7
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Misc. Details	DT-2
Misc. Details	DT-3

PHASE 2 - 0656 - CONST. PLANS

Bethel Heights Sanitary Sewer – 0656.4

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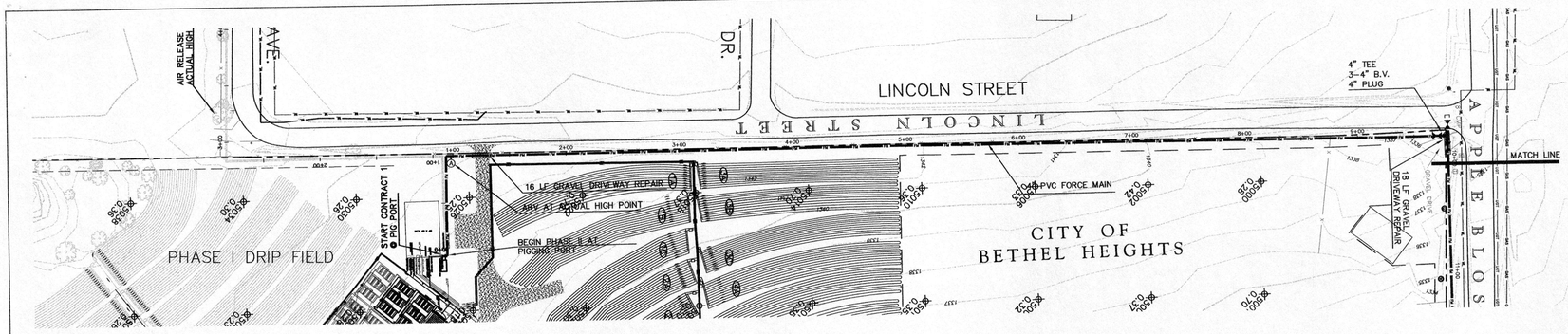

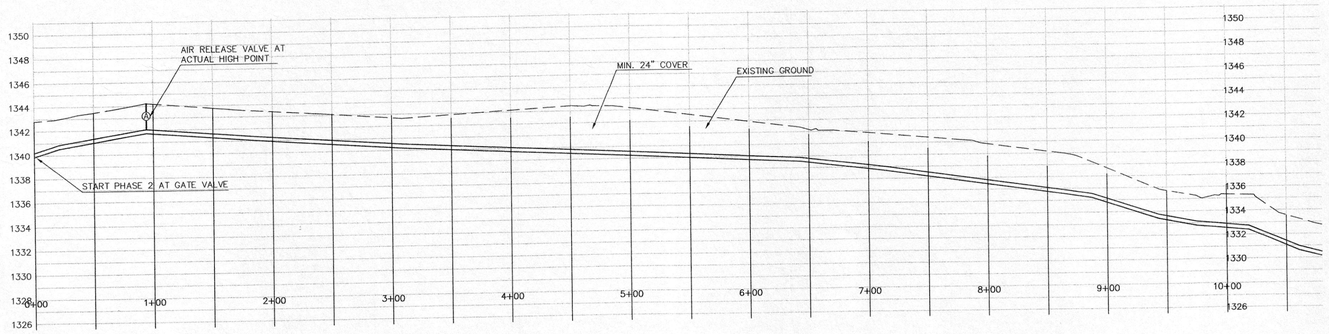

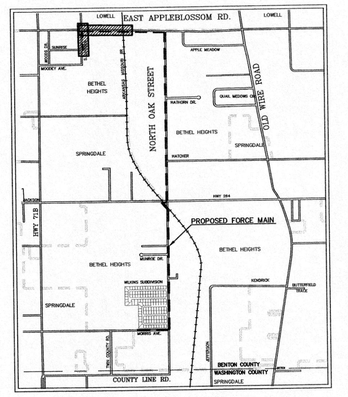

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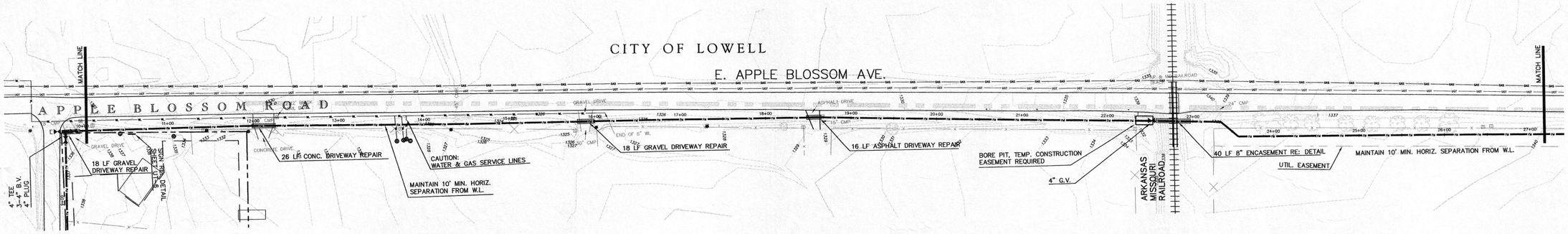

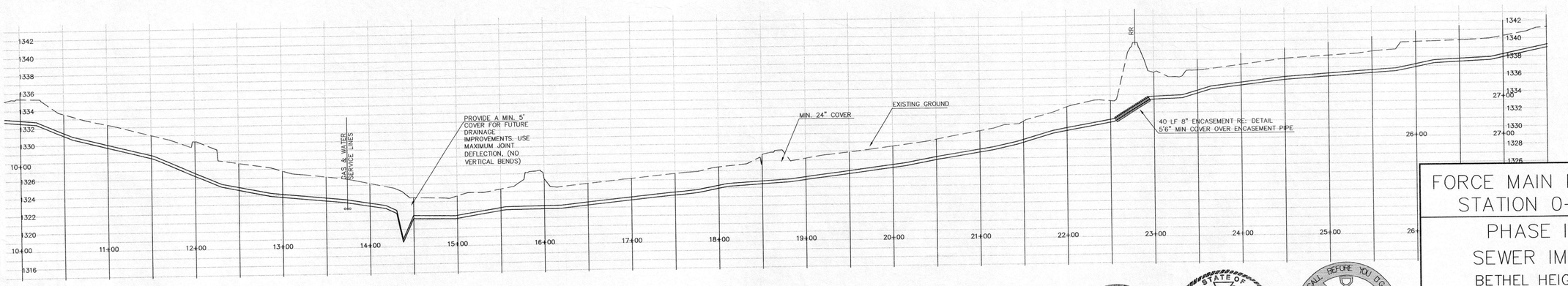

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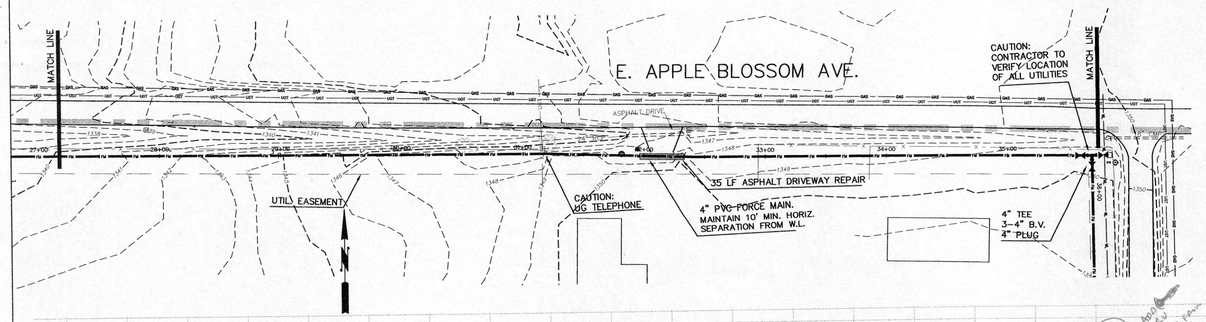

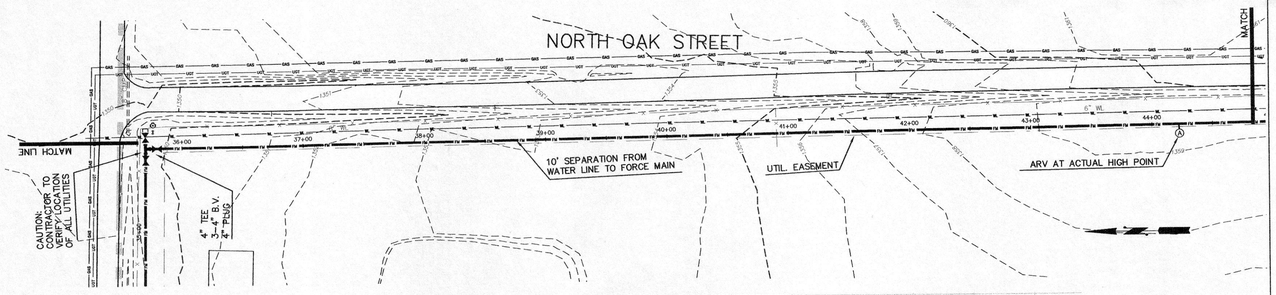

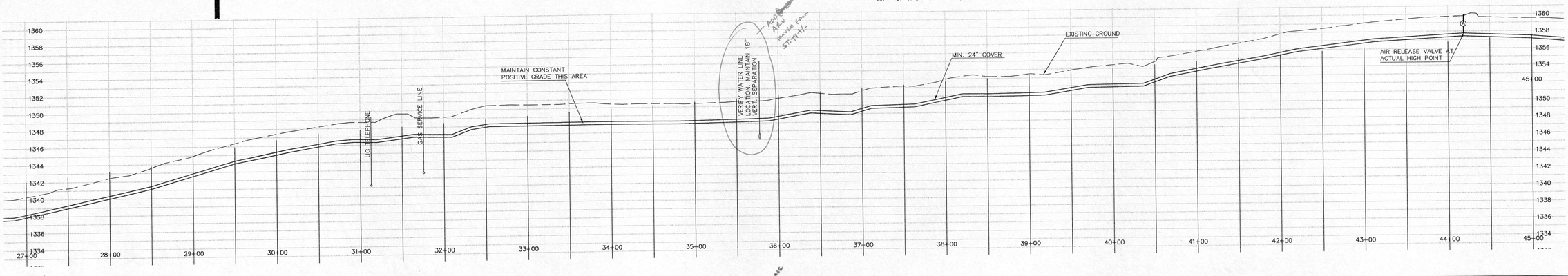

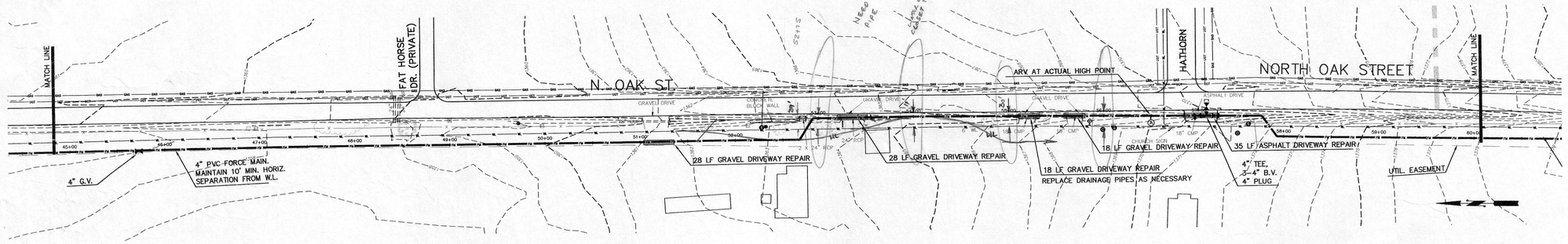

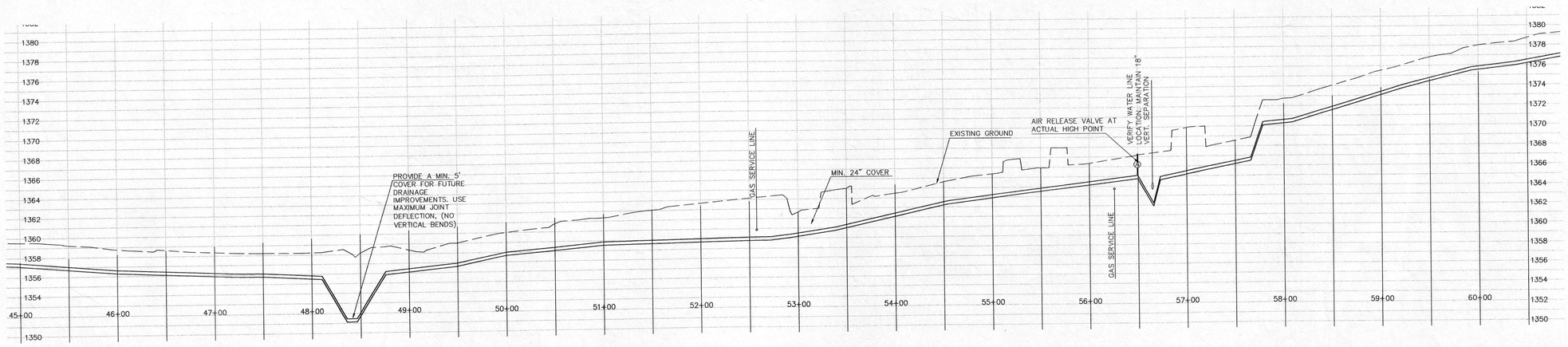

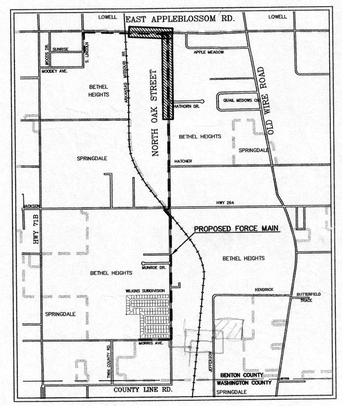

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12-11-03

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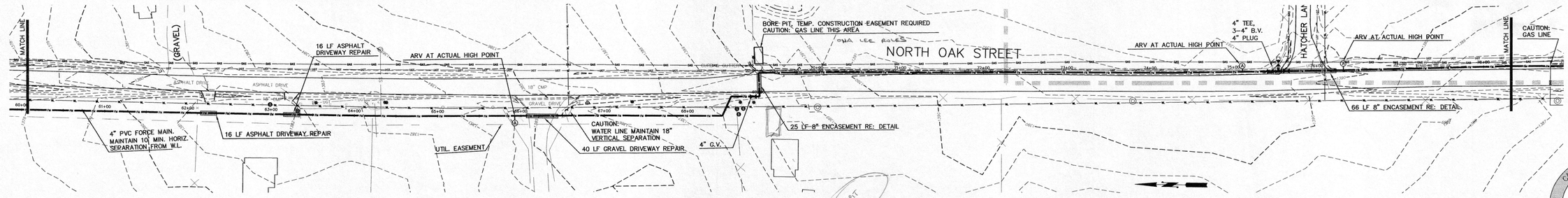

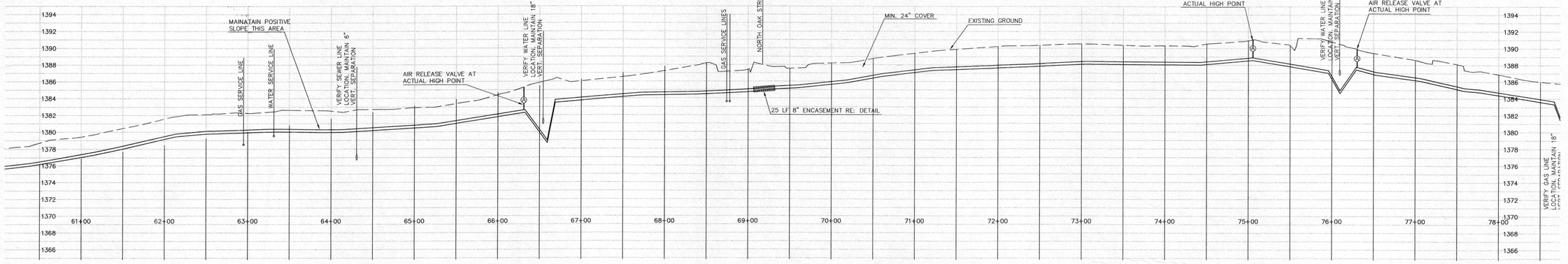

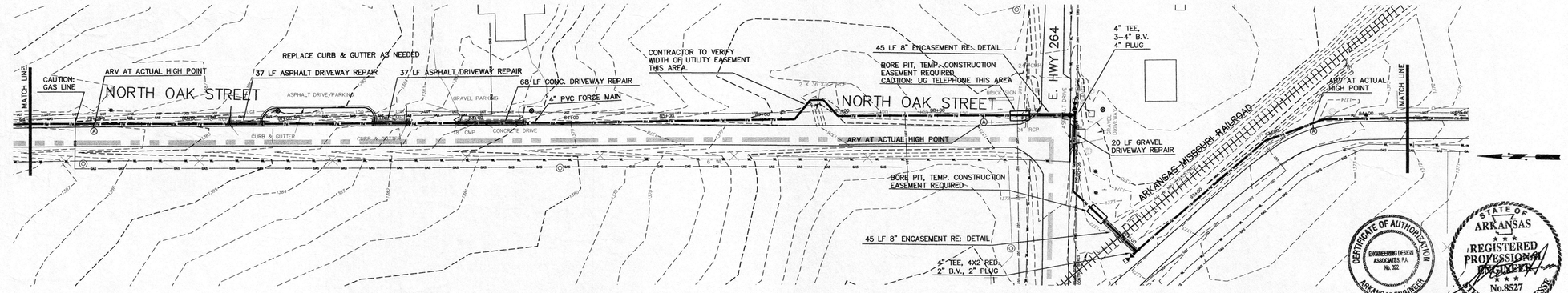

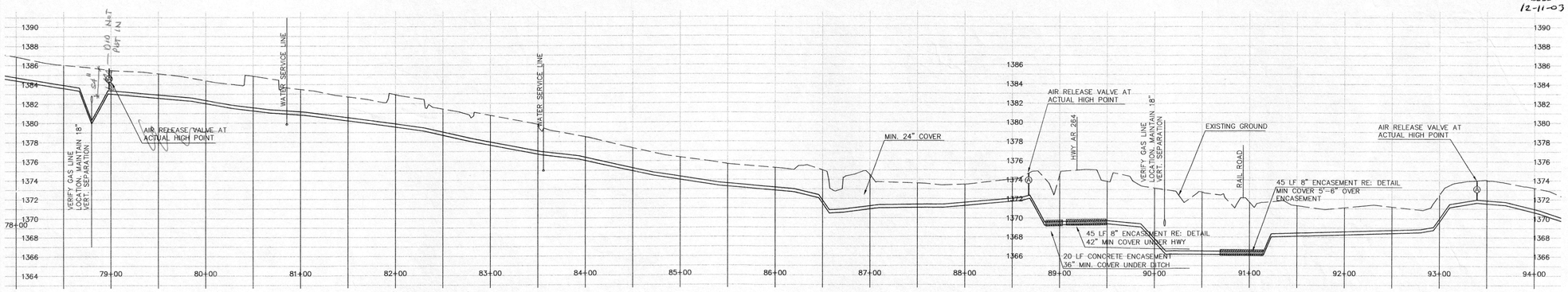

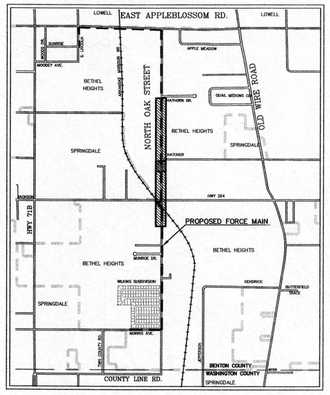

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STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No.8527 STEVE ALFRED HESSE 12-1-03

FORCE MAIN PLAN & PROFILE STATION 60+00 – 94+00

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EDA Consulting Engineering Landscape Architecture Land Surveying
Engineering Design Associates, P.A.
134 West Emma Avenue (479) 756-1266
Springdale, Arkansas 72764 Fax: (479) 756-2129

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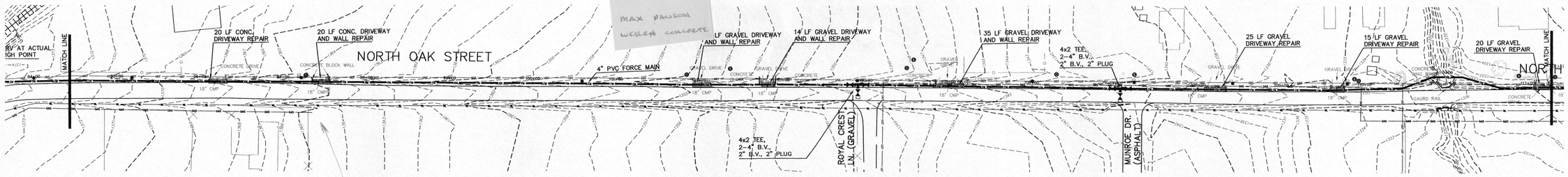
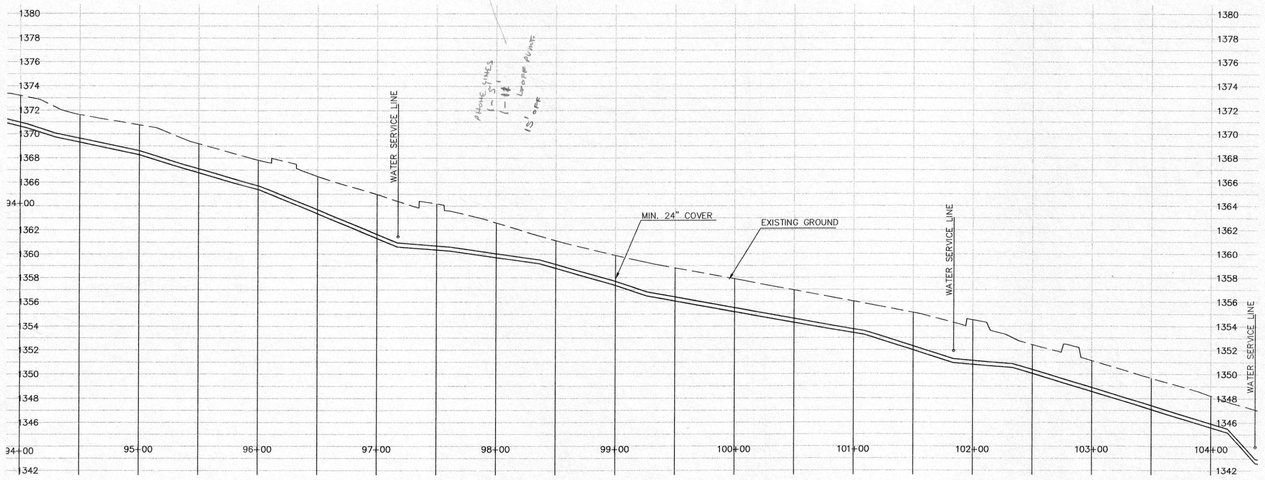
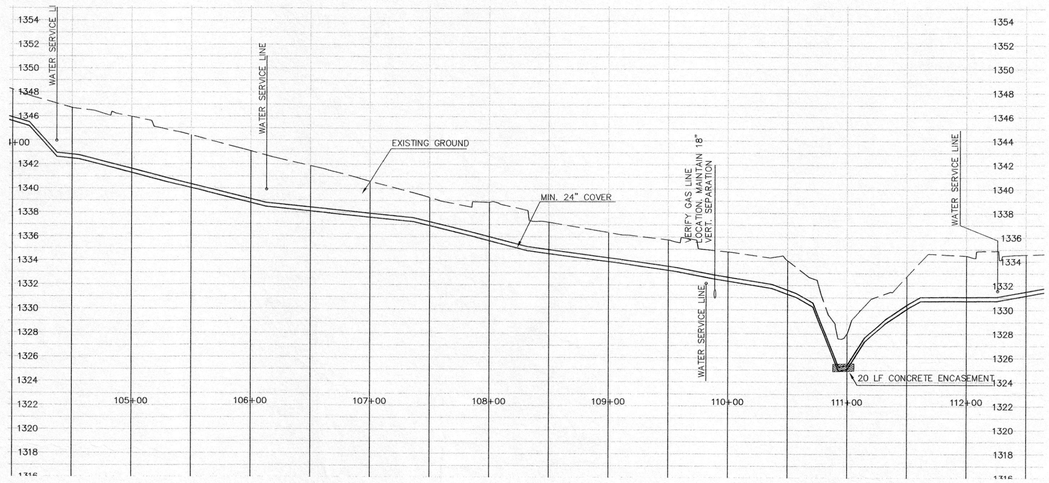
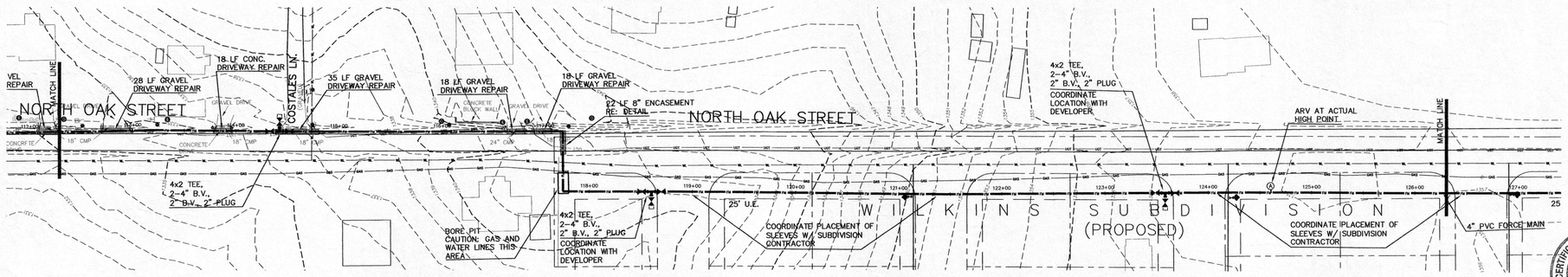
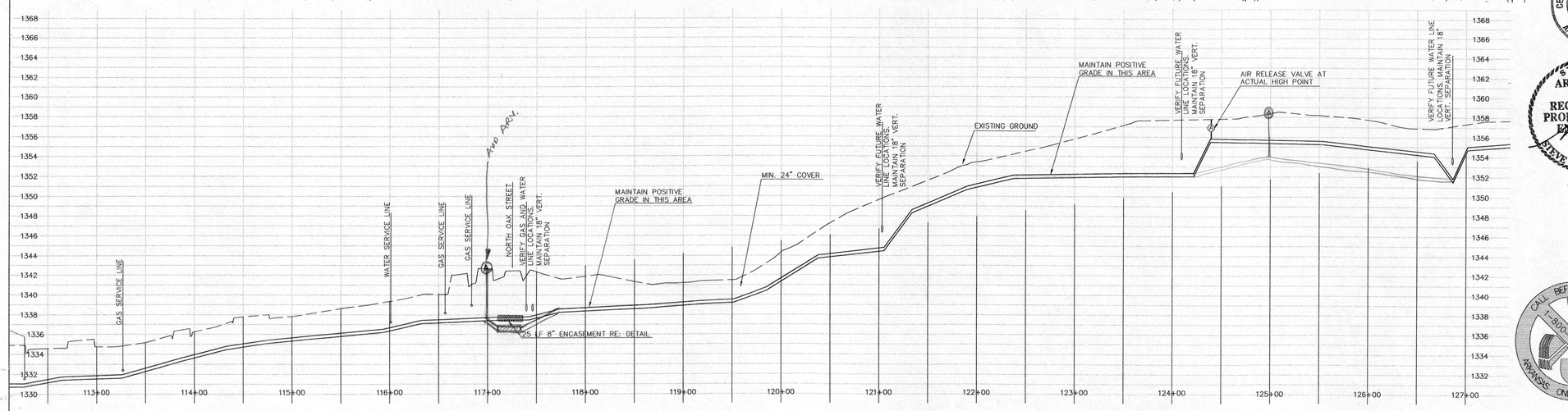
Jimmy Mathews
Max Dawson
Weblen Concrete

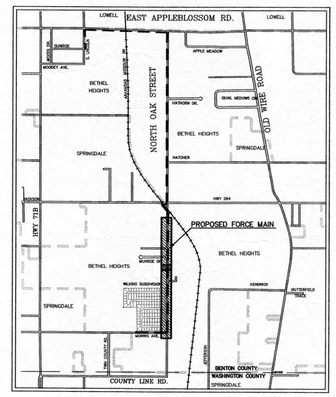












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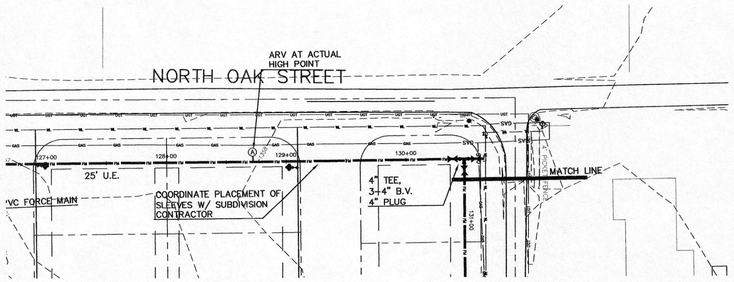

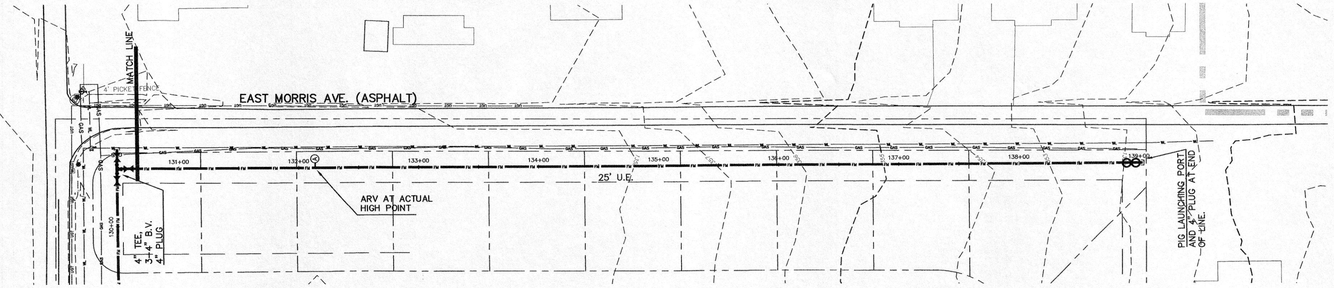

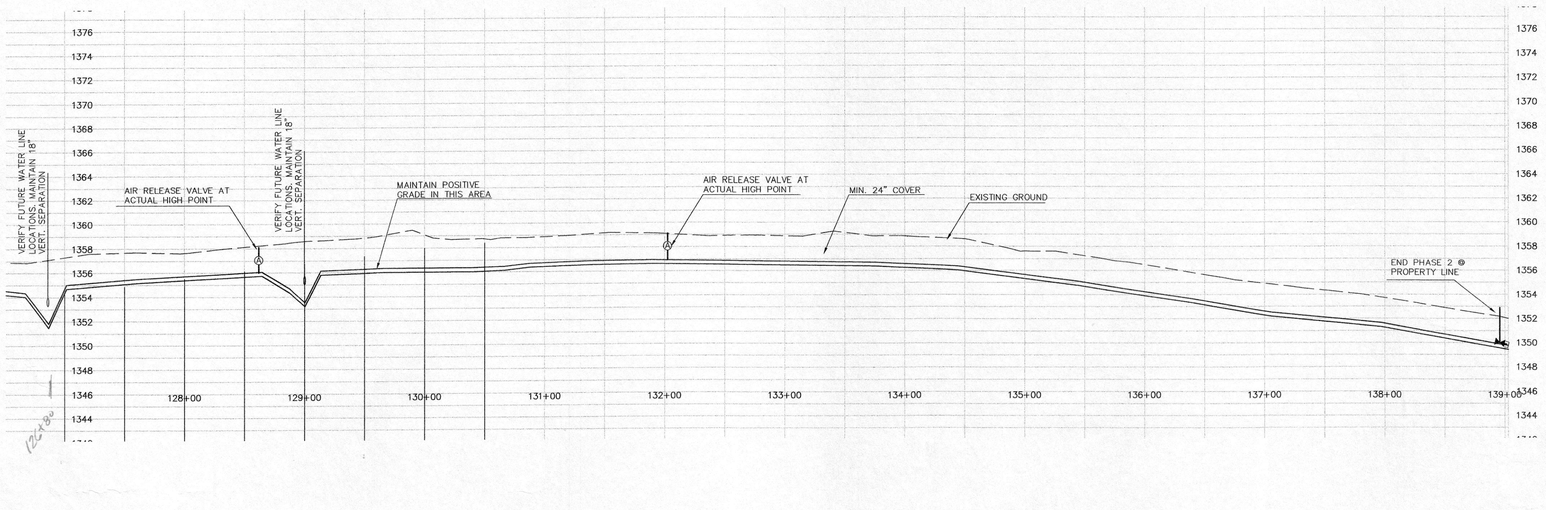

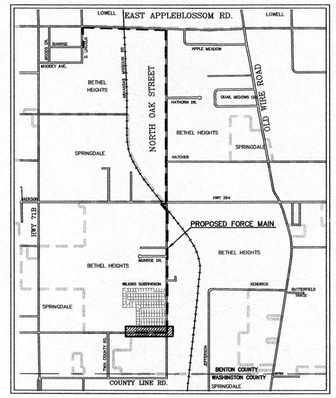

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CERTIFICATE OF AUTHORIZATION
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No.8527
STEVE ALFRED HESSE
12-11-03

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Springdale, Arkansas 72764 Fax: (479) 756-2129

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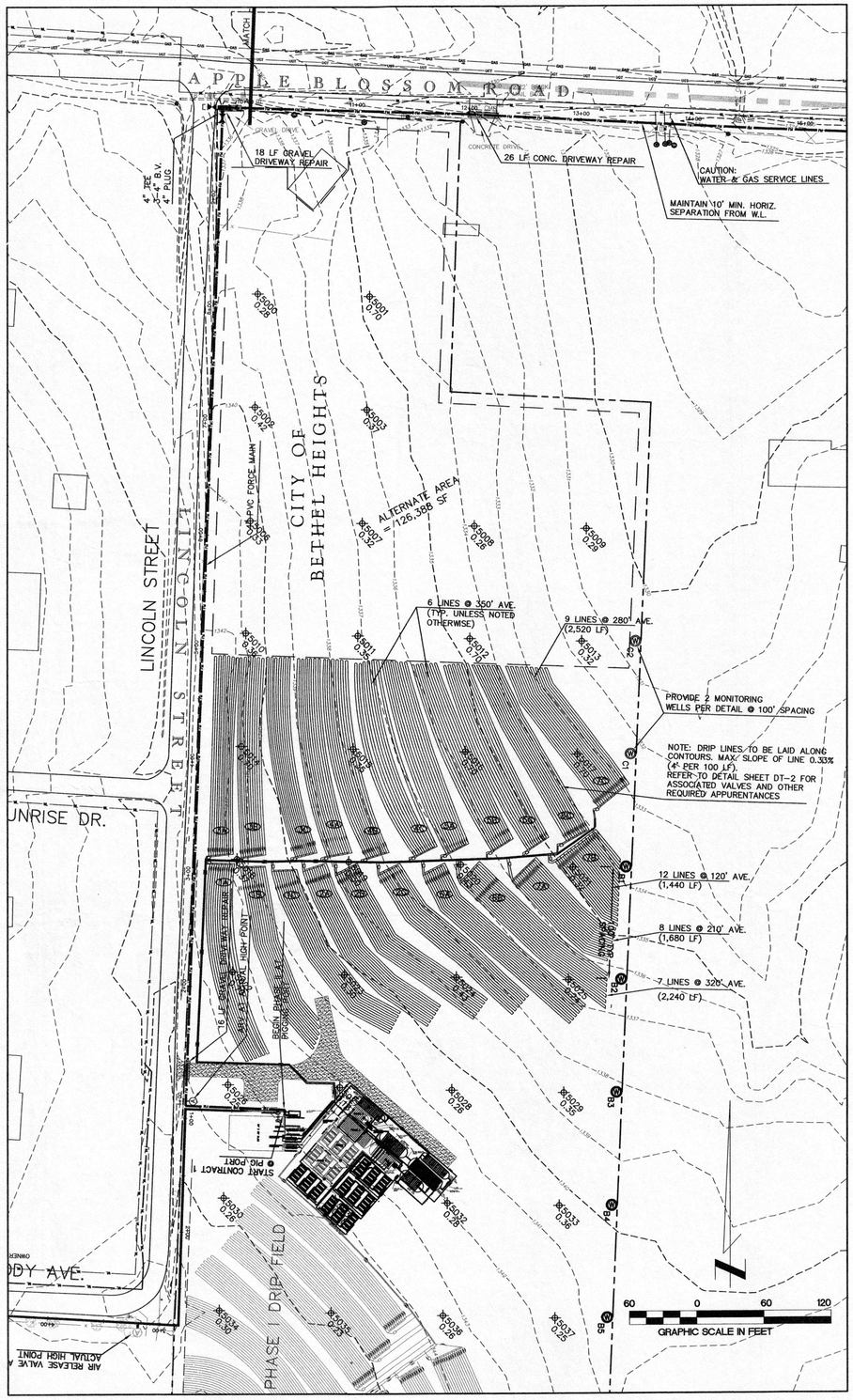

OVERALL PLAN



DRIP DISPERSAL LAYOUT

Field #1:
Zone 1A – 6 lines @ 350 LF = 2100 LF
Zone 1B – 6 lines @ 350 LF = 2100 LF
Zone 1C – 6 lines @ 350 LF = 2100 LF
Total: 6300 LF (12,600 SF)

Field #2:
Zone 2A – 6 lines @ 350 LF = 2100 LF
Zone 2B – 6 lines @ 350 LF = 2100 LF
Zone 2C – 6 lines @ 350 LF = 2100 LF
Total: 6300 LF (12,600 SF)

Field #3:
Zone 3A – 6 lines @ 350 LF = 2100 LF
Zone 3B – 6 lines @ 350 LF = 2100 LF
Zone 3C – 6 lines @ 350 LF = 2100 LF
Total: 6300 LF (12,600 SF)

Field #4:
Zone 4A – 6 lines @ 350 LF = 2100 LF
Zone 4B – 6 lines @ 350 LF = 2100 LF
Zone 4C – 6 lines @ 350 LF = 2100 LF
Total: 6300 LF (12,600 SF)

Field #5:
Zone 5A – 6 lines @ 350 LF = 2100 LF
Zone 5B – 6 lines @ 350 LF = 2100 LF
Zone 5C – 6 lines @ 350 LF = 2100 LF
Total: 6300 LF (12,600 SF)

Field #6:
Zone 6A – 6 lines @ 350 LF = 2100 LF
Zone 6B – 7 lines @ 320 LF = 2240 LF
Zone 6C – 6 lines @ 350 LF = 2100 LF
Total: 6440 LF (12,880 SF)

Field #7:
Zone 7A – 8 lines @ 210 LF = 1680 LF
Zone 7B – 12 lines @ 120 LF = 1440 LF
Zone 7C – 9 lines @ 280 LF = 2520 LF
Total: 5640 LF (11,280 SF)

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STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No.8527 STEVE ALFRED HESSE

12-11-03

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TREATMENT AREA

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Landscape Architecture
Land Surveying
134 West Emma Avenue Springdale, Arkansas 72764
(479) 756-1266 Fax: (479) 756-2129

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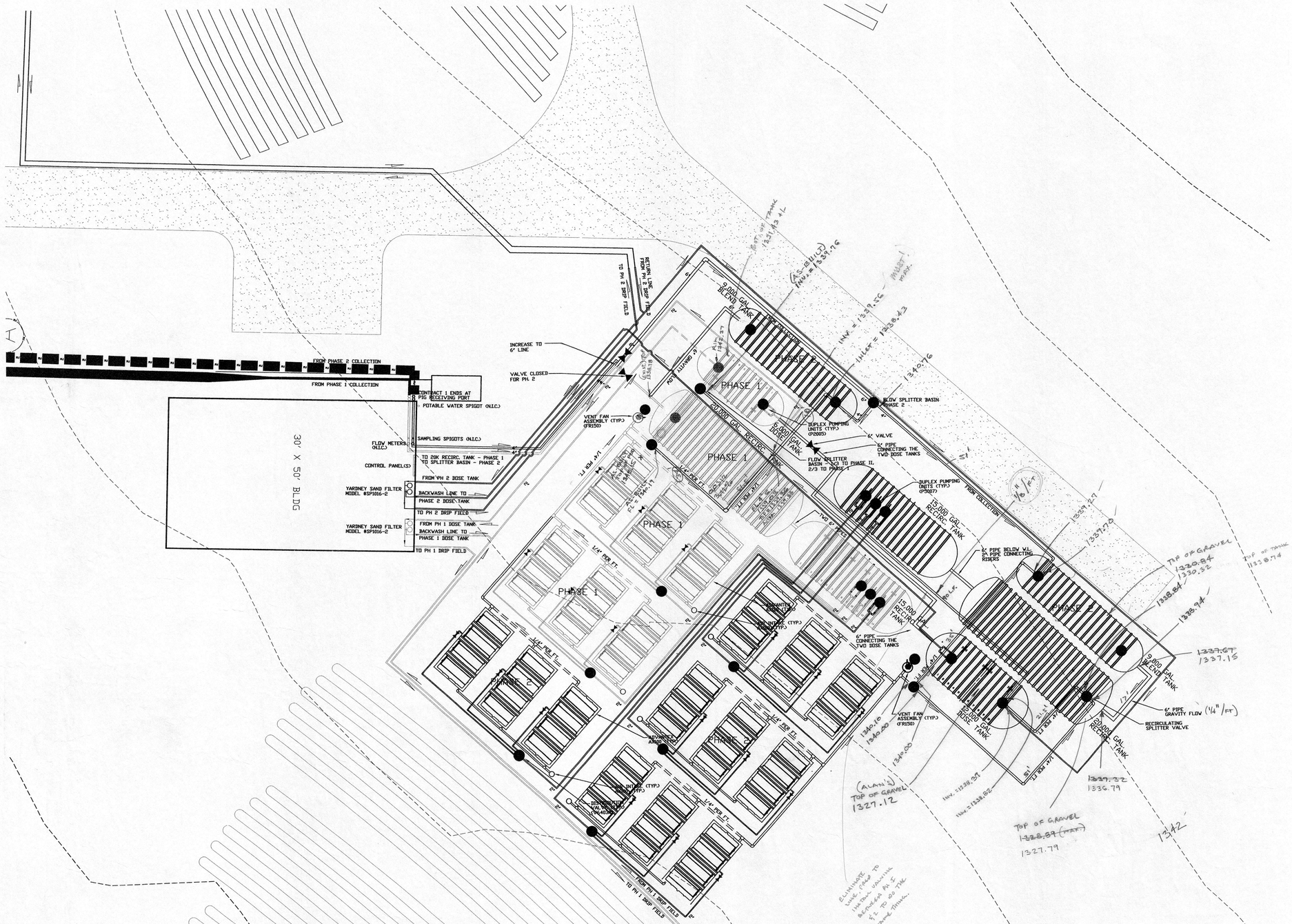

ALL ELEVATIONS ARE TO BE FIELD VERIFIED BY CONTRACTOR. NOTIFY ENGINEER IF CONFLICT EXISTS.

LARGE SCALE TREAMENT AREA DETAIL

CERTIFICATE OF AUTHORIZATION ENGINEERING DESIGN ASSOCIATES, P.A. No. 322 ARKANSAS ENGINEER

STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER STEVE ALFRED HESSE No. 8527

12-15-03

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LARGE SCALE TREATMENT AREA PLAN

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Engineering Design Associates, P.A.

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Springdale, Arkansas 72764 Fax: (479) 756-2129

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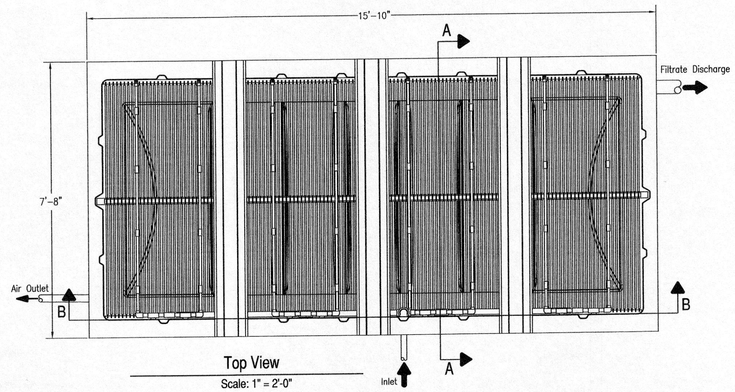
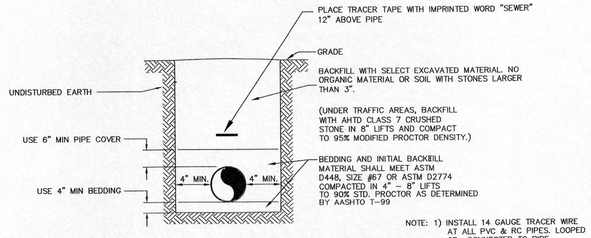


Top View

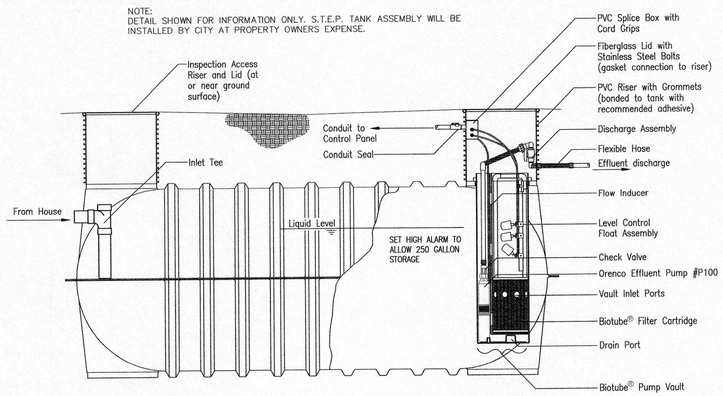
Scale: 1" = 2'-0"

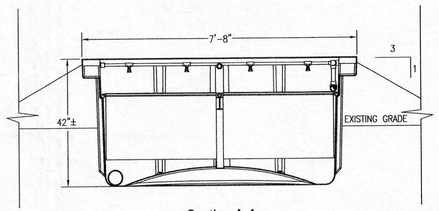


TYPICAL BACKFILL
FOR DI, PVC AND RC PIPES

N.T.S.

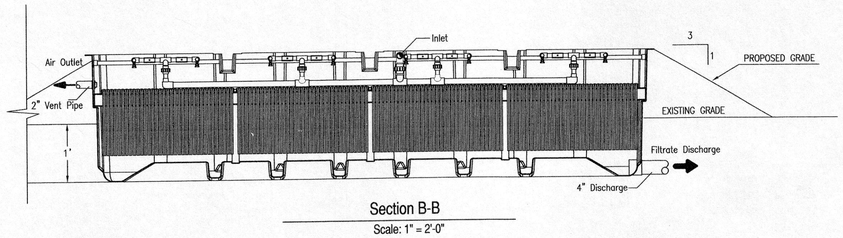
1500 Gallon Single Compartment Drawdown Fiberglass Tank





Section A-A

Scale: 1" = 2'-0"

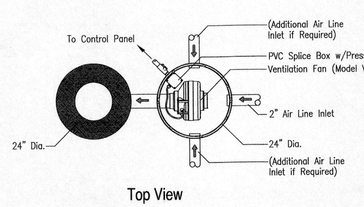


Section B-B

Scale: 1" = 2'-0"

AdvanTex 100 System

(ALSO REFER TO MANUFACTURER'S INSTALLATION MANUAL FOR OTHER INFORMATION)



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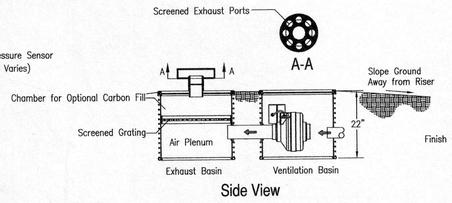
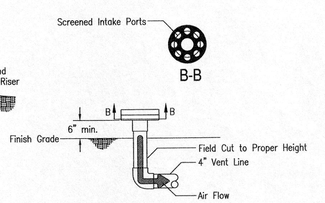


Side View

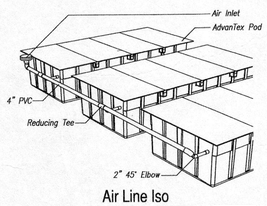


Air Inlet Detail

Scale: 1" = 2'-0"

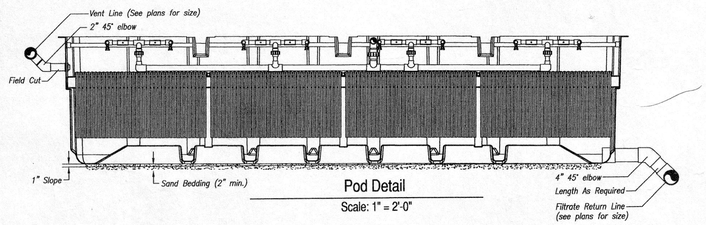
Ventilation Fan Detail

Scale: 1" = 2'-0"



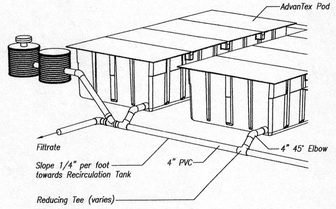
Air Line Iso

NTS



Pod Detail

Scale: 1" = 2'-0"



Filtrate Return Line Iso

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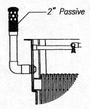
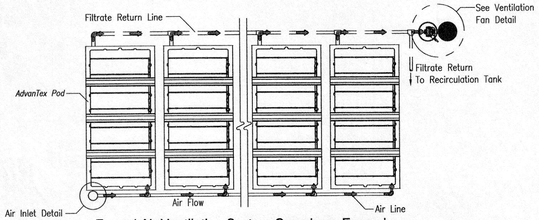


Passive Vent Option

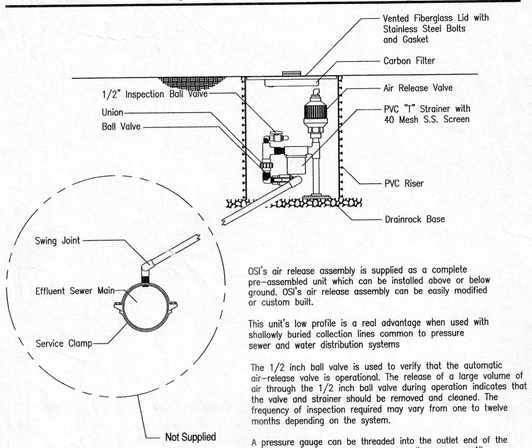
NTS



Forced Air Ventilation System Overview - Example

Scale: 1" = 8'-0"

Air Release Assembly



OSI's air release assembly is supplied as a complete pre-assembled unit which can be installed above or below ground. OSI's air release assembly can be easily modified or custom built.

This unit's low profile is a real advantage when used with shallowly buried collection lines common to pressure sewer and water distribution systems

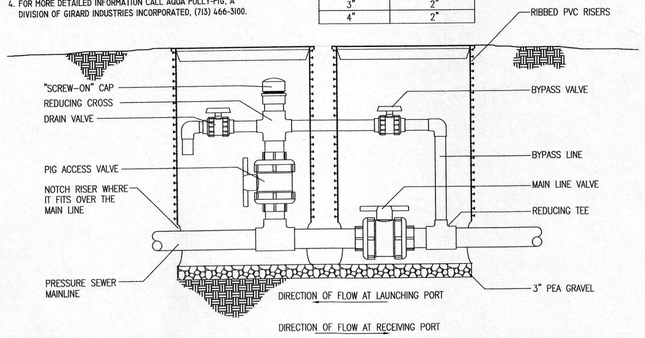
The 1/2 inch ball valve is used to verify that the automatic air-release valve is operational. The release of a large volume of air through the 1/2 inch ball valve during operation indicates that the valve and strainer should be removed and cleaned. The frequency of inspection required may vary from one to twelve months depending on the system.

A pressure gauge can be threaded into the outlet end of the 1/2 inch ball valve to observe system line pressure. All components are rated for a 150 psi working pressure.

NOTES:

1. PROTECT THE MAIN LINE FROM BEING SHEARED BECAUSE OF TRAFFIC LOADS ON THE RISER BY INSURING THE RISER IS PLACED ON A STABLE BASE AND THAT THE NOTCH IS CUT HIGH ENOUGH TO ALLOW ADEQUATE CLEARANCE BETWEEN THE BOTTOM OF THE NOTCH AND THE TOP OF THE PVC LINE.
2. LAUNCHING AND RECEIVING PORTS ARE CONSTRUCTED IN A SIMILAR FASHION.
3. WHEN RECEIVING THE PIG, OPERATE DRAIN VALVE TO RELIEVE PRESSURE. CAPTURE ALL EFFUENT AND DISPOSE OF PROPERLY.
4. FOR MORE DETAILED INFORMATION CALL AQUA POLLY-PIG, A DIVISION OF GIRARD INDUSTRIES INCORPORATED, (713) 466-3100.

BYPASS LINE	
MAINLINE SIZE	BYPASS LINE SIZE
2"	1 1/2"
3"	2"
4"	2"



PIG LAUNCHING & RECEIVING DETAIL

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ARKANSAS ENGINEER

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12-11-03

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97479-9012

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MISCELLANEOUS DETAILS

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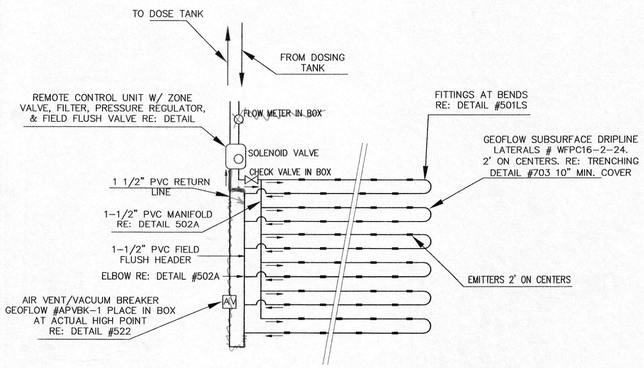
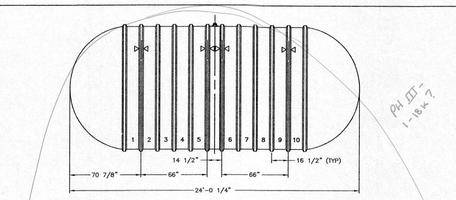


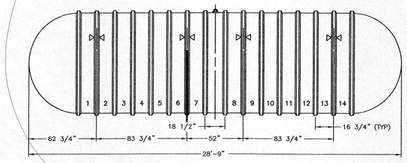
GEOFLOW TYPICAL LAYOUT FOR SINGLE ZONE WASTEFLOW PC DRIPLINE

NOT TO SCALE
REFER TO PLANS FOR ACTUAL DIMENSIONS

NOTE:
1). ALL PVC LINE TO BE SCHEDULE 40
2). MAXIMUM SLOPE NOT TO EXCEED 4" PER 100 FEET

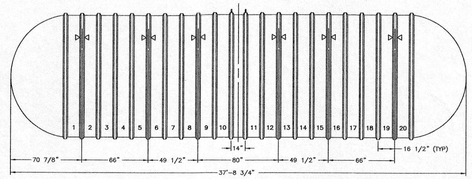


SINGLE WALL TANK
10' DIAMETER
12,000 GALLON

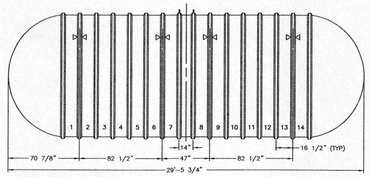


SINGLE WALL TANK
8' DIAMETER
9,000 GALLON

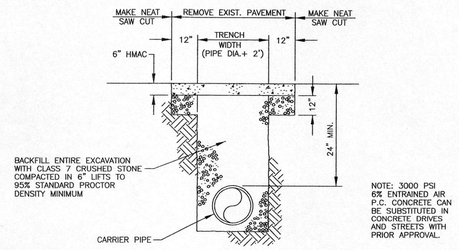
XERXES CORPORATION
510-876



SINGLE WALL TANK
10' DIAMETER
20,000 GALLON

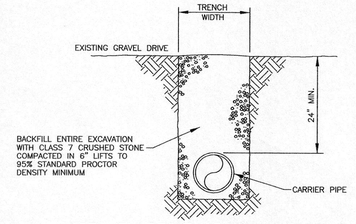


SINGLE WALL TANK
10' DIAMETER
15,000 GALLON

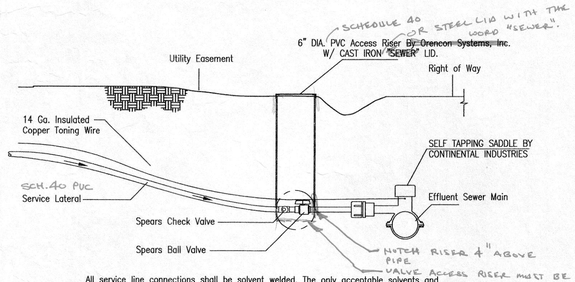


NOTE: 3000 PSI 6% ENTRAINED AIR P.C. CONCRETE CAN BE SUBSTITUTED IN CONCRETE DRIVES AND STREETS WITH PRIOR APPROVAL.

PAVED DRIVE/STREET CROSSING REPAIR
N.T.S.

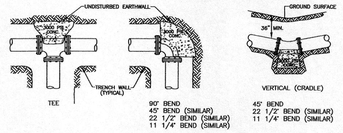


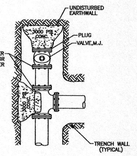
GRAVEL DRIVE CROSSING REPAIR
N.T.S.



All service line connections shall be solvent welded. The only acceptable solvents and cements are those that are recommended by the pipe manufacturer. All service laterals from the effluent sewer main to the property line shall be pressure tested prior to any backfilling.

1" Effluent Sewer Service Connection





TEE WITH PLUG

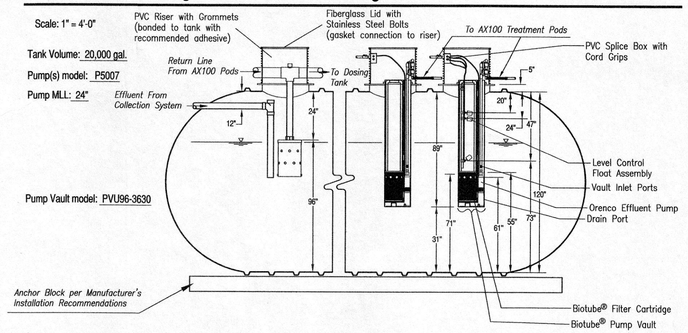
NOTES:
1. All fittings shall be mechanical joint.
2. Do not cover bells or flanges with concrete.
3. Wrap all fittings with visqueen.
4. Back all tees according to size of branch.
5. Backing future line extensions shall be such that later removal is possible.
6. All bends where fittings are used, both horizontal and vertical, shall be backed.
7. Reaction backing table is based on 150 p.s.i. and soil bearing pressure of 2,500 lb./sq. ft. Additional backing may be required in some areas as directed by engineer.

REACTION BACKING TABLE
REQUIRED SQ. FT. OF UNDISTURBED EARTHWALL FOR REACTION BACKING

SIZE	TYPE OF FITTINGS				
	TEE OR PLUG/CAP	90°	45°	22 1/2°	11 1/4°
4"	1	1	1	1	1
6"	1	1	1	1	1
8"	2	2	1	1	1
12"	3	3	2	1	1
16"	4	4	3	2	2
24"	10	10	5	3	2

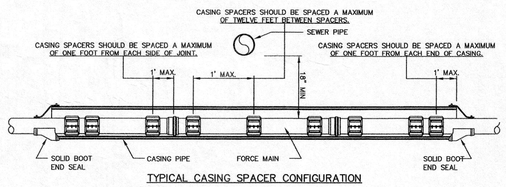
SEWER FORCE MAIN THRUST BLOCKING DETAIL
N.T.S.

RSV & Float Setting For 10'Ø Xerxes Fiberglass Tank



Orenco Systems®
Incorporated
814 AIRWAY AVENUE
SUTHERLIN, OREGON
97479-9012
TELEPHONE:
(541) 459-4449
(800) 348-9843

NOTE: CONTRACTOR TO VERIFY ALL FLOAT SETTINGS WITH MANUFACTURER.

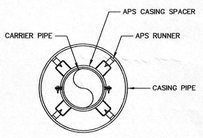


TYPICAL CASING SPACER CONFIGURATION

NOTES:

1. SPACERS SHALL BE MANUFACTURED BY "ADVANCE PRODUCTS & SYSTEMS" AS SPECIFIED.
2. QUANTITY OF RUNNERS SHALL BE IN ACCORDANCE WITH CARRIER PIPE SIZE AS FOLLOWS:
   - TO 14" DIAMETER – 4 RUNNERS
   - 16" TO 36" DIAMETER – 6 RUNNERS
   - 38" TO 48" DIAMETER – 8 RUNNERS
3. DIMENSIONS BETWEEN SPACERS SHALL BE AS FOLLOW:
   - STAINLESS STEEL – 8 TO 12 FEET.
   - CARBON STEEL – 8 TO 12 FEET.
4. WIDTH OF SPACERS SHALL BE IN ACCORDANCE WITH CARRIER PIPE SIZE AS FOLLOWS:
   - TO 14" DIAMETER – 8" WIDTH
   - 16" AND LARGER DIAMETER – 12" WIDTH
5. A MINIMUM OF THREE SPACERS PER FULL JOINT OF PIPE.
6. WATER LINES SHALL BE "CENTERED" IN CASING.
7. ALL D.I. CARRIER PIPE MUST HAVE FIELD LOCK GASKETS INSTALLED WITHIN THE CASING PIPE.
8. CONTRACTOR TO VERIFY THAT ENCASEMENT PIPE IS LARGE ENOUGH TO CONTAIN THE CARRIER PIPE.
9. MAINTAIN 18" MINIMUM BETWEEN WATER AND SEWER MAINS.

ENCASEMENT / CARRIER PIPE SIZING CHART

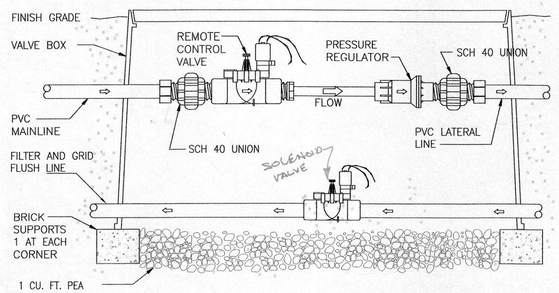


TYPICAL END VIEW

MAIN SIZE	ENCASEMENT PIPE NOMINAL SIZE
4"	8"
6"	12"
8"	16"
12"	20"
16"	24"
24"	36"

ALL ENCASEMENT PIPE SHALL BE NEW STEEL & HAVE A MINIMUM WALL THICKNESS OF .25

FORCE MAIN ENCASEMENT DETAILS



565B GEOFLOW SECTION — REMOTE CONTROL UNIT WITH ZONE VALVE, PRESSURE REGULATOR & FIELD FLUSH VALVE

Not To Scale

CERTIFICATE OF AUTHORIZATION — ENGINEERING DESIGN ASSOCIATES, P.A. No. 322 — ARKANSAS ENGINEER

STATE OF ARKANSAS — REGISTERED PROFESSIONAL ENGINEER — No.8527 — STEVE ALFRED HESS

12-11-03

MISCELLANEOUS DETAILS

PHASE 2 SANITARY SEWER IMPROVEMENTS

BETHEL HEIGHTS, ARKANSAS

EDA Engineering Design Associates, P.A.
Consulting Engineering
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134 West Emma Avenue
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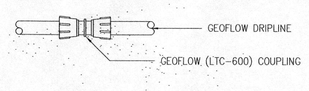
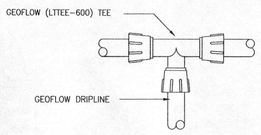


501LS GEOFLOW LOCKSLIP COUPLING (LTC-600)
SECTION

Not To Scale

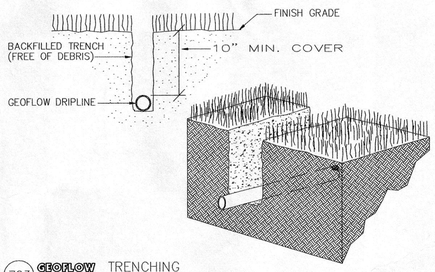
4-15-99 GF501LS



503LS GEOFLOW LOCKSLIP TEE (LTTEE-600)
SECTION

Not To Scale

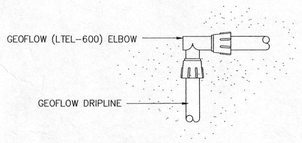
3-9-99 GF503LS



703 GEOFLOW TRENCHING
INSTALLATION

Not To Scale

4-15-99 GF703



502LS GEOFLOW LOCKSLIP ELBOW (LTEL-600)
SECTION

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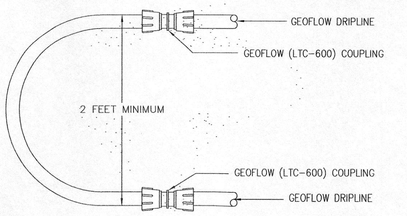
4-15-99 GF502LS



501LS A GEOFLOW LOCKSLIP COUPLING (LTC-600)
SECTION

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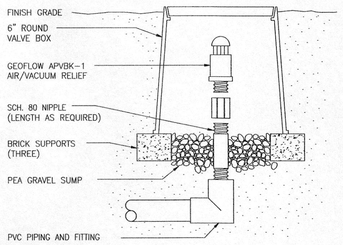
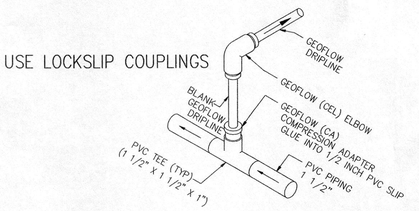
4-15-99 GF501LSA



522 GEOFLOW 1" AIR/VACUUM RELIEF
SECTION (PLUMBED TO PVC)

Not To Scale

5-28-99 GF522



505A GEOFLOW MANIFOLD / FLUSH HEADER CONNECTION (PVC TO ELBOW)
SECTION

Not To Scale

4-15-99 GF505A

CERTIFICATE OF AUTHORIZATION
ENGINEERING DESIGN ASSOCIATES, P.A.
No. 322
ARKANSAS ENGINEER

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 8527
STEVE ALFRED HESSE

12-11-03

MISCELLANEOUS DETAILS

PHASE 2 SANITARY SEWER IMPROVEMENTS

BETHEL HEIGHTS, ARKANSAS

EDA
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SHEET DT-3

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Appendix H: Phase 3 Construction Drawings (latest set discovered)

Phase III Sanitary Sewer Improvements

for the

Town of Bethel Heights, Arkansas

EDA Project No. 0656.6

August 15, 2004

GENERAL NOTES:

1) THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO AVOID DAMAGE TO ADJACENT PROPERTIES DURING THE CONSTRUCTION OF THE PROJECT. THE CONTRACTOR SHALL BE HELD SOLELY RESPONSIBLE FOR ANY DAMAGES THAT MAY RESULT.

2) THE LOCATIONS OF EXISTING UTILITIES SHOWN ON THE PLANS ARE GENERAL IN NATURE AND ARE BASED ON INFORMATION PROVIDED BY THE UTILITY COMPANIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING THE EXACT LOCATION OF ALL UTILITIES BEFORE PROCEEDING WITH THE CONSTRUCTION.

3) OTHER CONTRACTORS, LABORERS, WORKMEN, UTILITY COMPANIES, ETC., MAY BE WORKING WITHIN OR AROUND THE PROJECT SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING HIS WORK WITH OTHERS TO MINIMIZE ANY CONFLICTS THAT ARISE.

4) IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, THE CONTRACTOR WILL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS OF THE JOB SITE INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THIS REQUIREMENT WILL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. THE DUTY OF THE ENGINEER TO CONDUCT CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES, IN OR NEAR THE CONSTRUCTION SITE.

5) CONTRACTOR SHALL PROVIDE ADEQUATE MEANS OF EROSION CONTROL THROUGHOUT THE CONSTRUCTION OF THE PROJECT.

6) ALL CONSTRUCTION METHODS AND MATERIALS SHALL MEET OR EXCEED THE MINIMUM STANDARD AS SPECIFIED BY THE ARKANSAS STATE HIGHWAY AND TRANSPORATION DEPARTMENT AND THE CITY OF SPRINGDALE, ARKANSAS.

7) THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING, PAYING AND POSTING FOR ALL PAYMENT, PERFORMANCE, AND MAINTENANCE BONDS NECESSARY FOR THE CONSTRUCTION OF THIS PROJECT.

8) ALL CONSTRUCTION WORK AND UTILITY WORK OUTSIDE OF PROPERTY BOUNDARIES SHALL BE PERFORMED IN COOPERATION WITH AND IN ACCORDANCE WITH REGULATIONS OF THE AUTHORITIES CONCERNED. THE CONTRACTOR SHALL PROVIDE ADEQUATE CONSTRUCTION SIGNAGE AND OTHER TRAFFIC CONTROL DEVICES WHEN WORKING IN ANY RIGHT-OF-WAY. SIGNAGE AND OTHER TRAFFIC CONTROL DEVICES SHALL CONFORM TO ALL FEDERAL, STATE AND LOCAL GUIDELINES AND REGULATIONS.

9) THE CONTRACTOR SHALL CONDUCT THE WORK IN A MANNER THAT WILL INSURE, AS FAR AS PRACTICABLE, THE LEAST OBSTRUCTION TO TRAFFIC AND SHALL PROVIDE FOR THE CONVENIENCE AND SAFETY OF THE GENERAL PUBLIC AND RESIDENTS ALONG AND ADJACENT TO HIGHWAYS IN THE CONSTRUCTION AREA IN AN ADEQUATE AND SATISFACTORY MANNER IN ACCORDANCE WITH THE ARKANSAS DEPARTMENT OF TRANSPORTATION STANDARDS.

10) CONTRACTOR SHALL BE RESPONSIBLE FOR ALL NECESSARY MEASURES TO PROVIDE ADEQUATE TRENCH SAFETY, AND ALL OTHER ITEMS NECESSARY TO SATISFY ACT 291-1993 OF THE STATE OF ARKANSAS.

11) THE CONTRACTOR SHALL VERIFY WITH THE ENGINEER BEFORE BEGINNING CONSTRUCTION, THE PROCUREMENT AND LOCATION OF ALL EASEMENTS, TEMPORARY AND PERMANENT, NECESSARY TO CARRY OUT THE WORK OUTLINED WITHIN THESE DRAWINGS AND RELATED CONTRACT DOCUMENTS.

SEWER SYSTEM NOTES:

1) SEWER FORCE MAIN PIPE SHALL BE INSTALLED WITH 24" MIN. COVER WITH THE INDICATED TYPE AND SIZE OF PIPE AS SPECIFIED

2) ALL 3-INCH AND LARGER PVC SEWER MAIN SHALL HAVE A MINIMUM WALL THICKNESS CLASSIFICATION OF SDR-26.

3) ALL SEWER PIPE SMALLER THAN 3-INCH SHALL BE SCHEDULE 40.

4) THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING AND PAYING FOR ALL NECESSARY STREET CUT PERMITS OR FEES. ALL STREET CUTS SHALL BE CONSTRUCTED IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL LAWS OR REGULATIONS.

EDA

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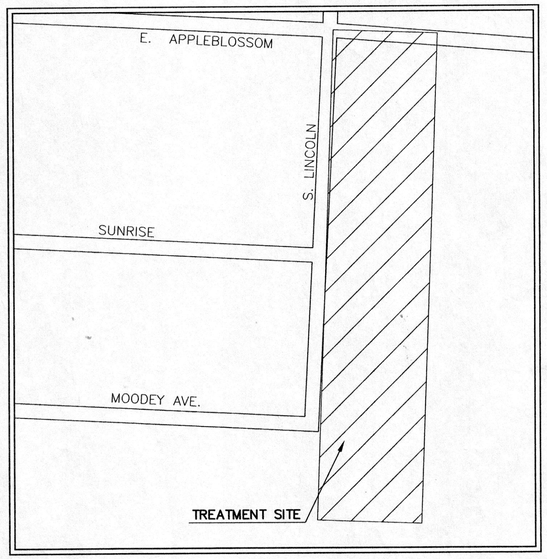

V i c i n i t y

1" = 200'

CONSTRUCTION DRAWINGS

INDEX

	SHEET
Treatment Area Site Plan	UT-1
Large Scale Treatment Area Plan	UT-2
Miscellaneous Details	DT-1
Miscellaneous Details	DT-2

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CERTIFICATE OF AUTHORIZATION ENGINEERING DESIGN ASSOCIATES, P.A. No. 322 ARKANSAS ENGINEER

STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No. 8527 STEVE ALFRED HESSE

8-15-04

Bethel Heights Sanitary Sewer - Phase III - 0656.6



OVERALL PLAN



DRIP DISPERSAL LAYOUT

Field #12:
Zone 12A – 6 lines @ 350 LF = 2100 LF
Zone 12B – 6 lines @ 350 LF = 2100 LF
Zone 12C – 6 lines @ 350 LF = 2100 LF
Total: 6300 LF (12,600 SF)

Field #13:
Zone 13A – 6 lines @ 350 LF = 2100 LF
Zone 13B – 6 lines @ 350 LF = 2100 LF
Zone 13C – 6 lines @ 350 LF = 2100 LF
Total: 6300 LF (12,600 SF)

Field #14:
Zone 14A – 6 lines @ 350 LF = 2100 LF
Zone 14B – 6 lines @ 350 LF = 2100 LF
Zone 14C – 6 lines @ 350 LF = 2100 LF
Total: 6300 LF (12,600 SF)

Field #15:
Zone 15A – 6 lines @ 350 LF = 2100 LF
Zone 15B – 6 lines @ 350 LF = 2100 LF
Zone 15C – 6 lines @ 350 LF = 2100 LF
Total: 6300 LF (12,600 SF)

Field #16:
Zone 16A – 6 lines @ 350 LF = 2100 LF
Zone 16B – 6 lines @ 250 LF = 1500 LF
1 line @ 240 LF = 240 LF
1 line @ 200 LF = 200 LF
1 line @ 160 LF = 160 LF
Zone 16C – 6 lines @ 350 LF = 2100 LF
Total: 6300 LF (12,600 SF)

Field #17:
Zone 17A – 6 lines @ 350 LF = 2100 LF
Zone 17B – 6 lines @ 350 LF = 2100 LF
Zone 17C – 6 lines @ 350 LF = 2100 LF
Total: 6300 LF (12,600 SF)

Field #18:
Zone 18A – 6 lines @ 350 LF = 2100 LF
Zone 18B – 6 lines @ 350 LF = 2100 LF
Zone 18C – 7 lines @ 154 LF = 1080 LF
– 14 lines @ 80 LF = 1120 LF
Total: 6400 LF (12,800 SF)

NOTE: DRIP DISPERSAL FIELDS WILL BE INSTALLED BY THE CITY OF BETHEL HEIGHTS AND ARE NOT A PART OF THIS CONTRACT.

CONSTRUCTION DRAWINGS

CERTIFICATE OF AUTHORIZATION ENGINEERING DESIGN ASSOCIATES, P.A. No. 922 ARKANSAS ENGINEER

STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No.8527 STEVE ALFRED HESSE

8-15-04

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TREATMENT AREA

PHASE 3A SANITARY SEWER IMPROVEMENTS

BETHEL HEIGHTS, ARKANSAS

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JOB NUMBER: 0656.6
FILE NAME: PHASE 3 TREATMENT PLAN.DWG

DESCRIPTION:

SHEET UT-1

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LARGE SCALE TREAMENT AREA DETAIL

CONSTRUCTION DRAWINGS

CERTIFICATE OF AUTHORIZATION ENGINEERING DESIGN ASSOCIATES, P.A. No. 322 ARKANSAS

STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No.8527 STEVE ALFRED HESSE

8-15-04

NOTE:
ALL ELEVATIONS ARE TO BE FIELD VERIFIED BY CONTACTOR. NOTIFY ENGINEER IF CONFLICTS EXIST.

CALL BEFORE YOU DIG 1-800-482-8998 ARKANSAS ONE CALL SYSTEM

LARGE SCALE TREATMENT AREA PLAN

PHASE 3A SANITARY SEWER IMPROVEMENTS

BETHEL HEIGHTS, ARKANSAS

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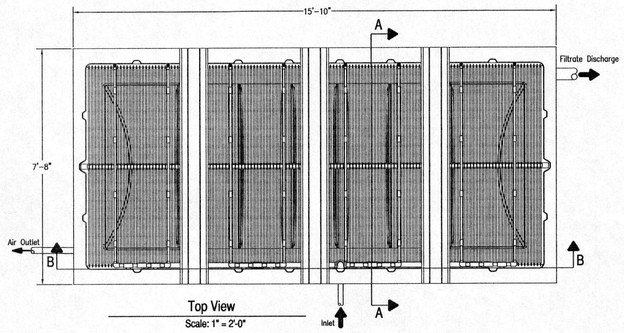

Top View
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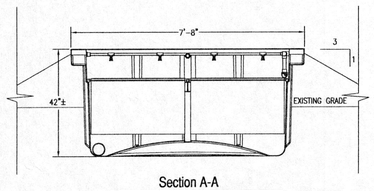

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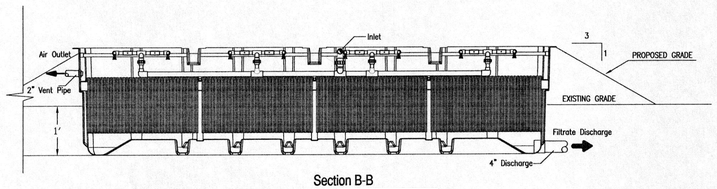
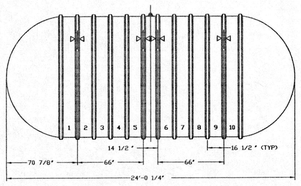


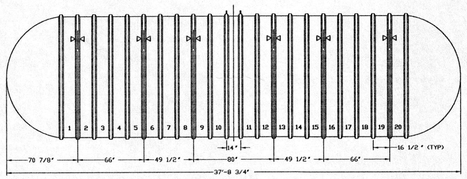
Section B-B
Scale: 1" = 2'-0"

AdvanTex 100 System

(ALSO REFER TO MANUFACTURER'S INSTALLATION MANUAL FOR OTHER INFORMATION)

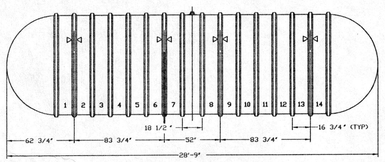


SINGLE WALL TANK
10' DIAMETER
12,000 GALLON

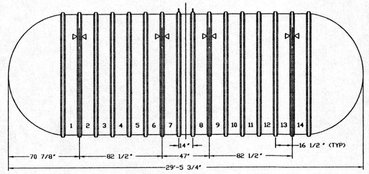


SINGLE WALL TANK
10' DIAMETER
20,000 GALLON

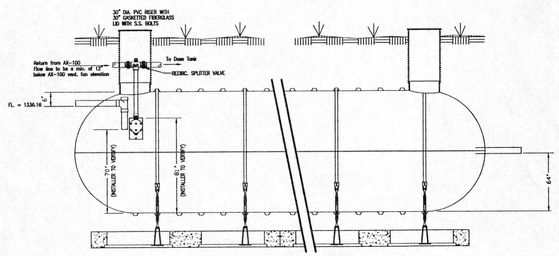
XERXES CORPORATION
S10-876



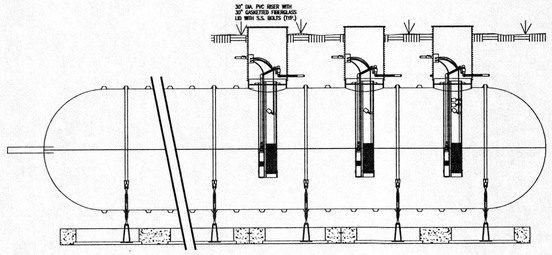
SINGLE WALL TANK
8' DIAMETER
9,000 GALLON



SINGLE WALL TANK
10' DIAMETER
15,000 GALLON



RECIRCULATION TANK
10' DIAMETER
20,000 GALLON



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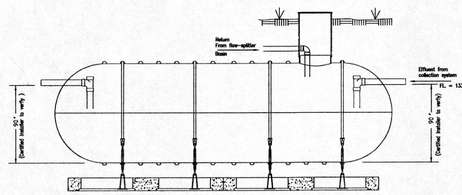
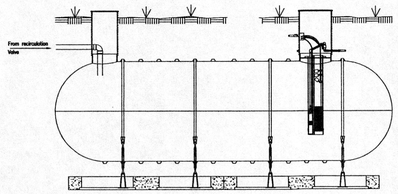
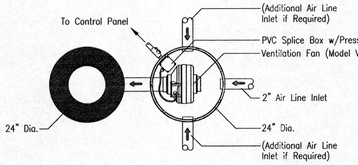
15,000 GALLON



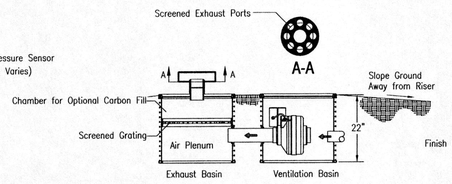
BLEND TANK
8' DIAMETER
9,000 GALLON



DOSE TANK
8' DIAMETER
9,000 GALLON



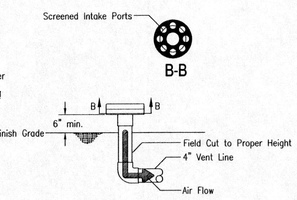
Top View



Side View

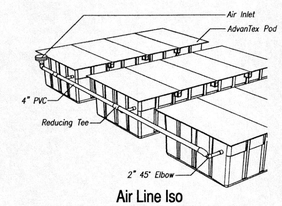
Ventilation Fan Detail

Scale: 1" = 2'-0"

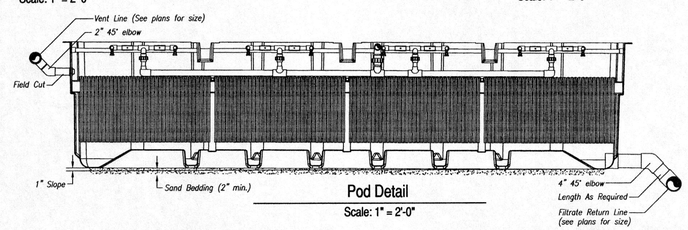


Air Inlet Detail

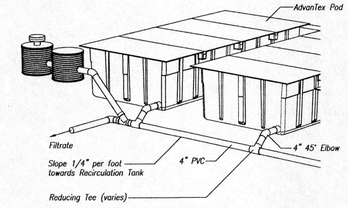
Scale: 1" = 2'-0"



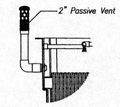
Air Line Iso
NTS



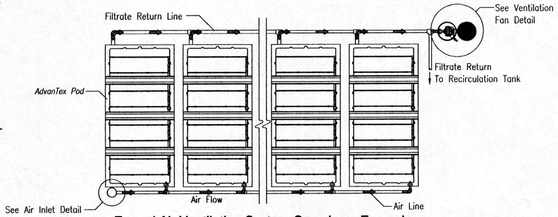
Pod Detail
Scale: 1" = 2'-0"



Filtrate Return Line Iso
NTS

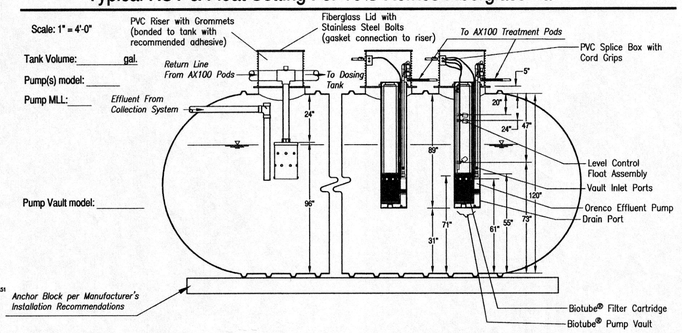


Passive Vent Option
NTS



Forced Air Ventilation System Overview - Example
Scale: 1" = 8'-0"

Typical RSV & Float Setting For 10'Ø Xerxes Fiberglass Tank



NOTE: CONTRACTOR TO VERIFY ALL FLOAT SETTINGS WITH MANUFACTURER.

CONSTRUCTION DRAWINGS

CERTIFICATE OF AUTHORIZATION ENGINEERING DESIGN ASSOCIATES, P.A. No. 322 ARKANSAS ENGINEER

STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No.8527 STEVE ALFRED HESSE
8-15-04

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SUTHERLIN, OREGON
97479-9012
TELEPHONE:
(541) 459-4449
(800) 348-9843

MISCELLANEOUS DETAILS

PHASE 3A SANITARY SEWER IMPROVEMENTS

BETHEL HEIGHTS, ARKANSAS

EDA
Consulting Engineering
Landscape Architecture
Land Surveying
Engineering Design Associates, P.A.
134 West Emma Avenue (479) 756-1266
Springdale, Arkansas 72764 Fax: (479) 756-2129

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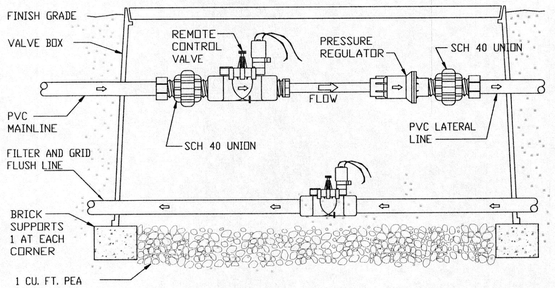
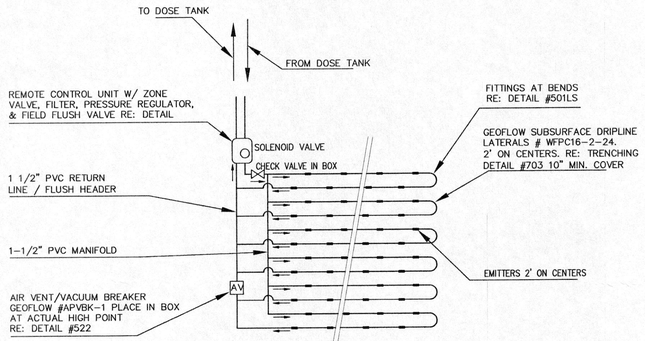


565B GEOFLOW SECTION — REMOTE CONTROL UNIT WITH ZONE VALVE, PRESSURE REGULATOR & FIELD FLUSH VALVE

Not To Scale

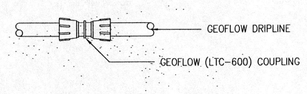


GEOFLOW TYPICAL LAYOUT FOR SINGLE ZONE
WASTEFLOW PC DRIPLINE

NOT TO SCALE

REFER TO PLANS FOR ACTUAL DIMENSIONS

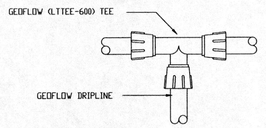
NOTES:
1). ALL PVC LINE TO BE SCHEDULE 40
2). MAXIMUM SLOPE NOT TO EXCEED 4" PER 100 FEET



501LS GEOFLOW SECTION — LOCKSLIP COUPLING (LTC-600)

Not To Scale

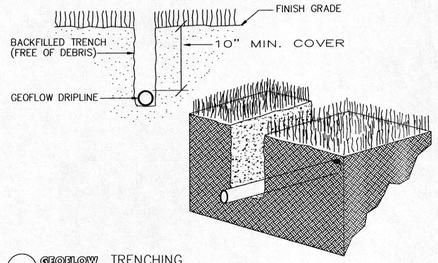
4-15-99 GF501LS



503LS GEOFLOW SECTION — LOCKSLIP TEE (LTTEE-600)

Not To Scale

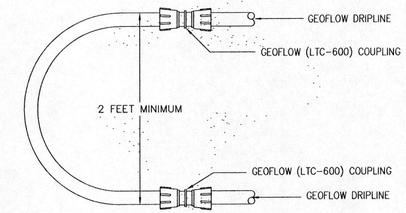
3-9-99 GF503LS



703 GEOFLOW INSTALLATION — TRENCHING

Not To Scale

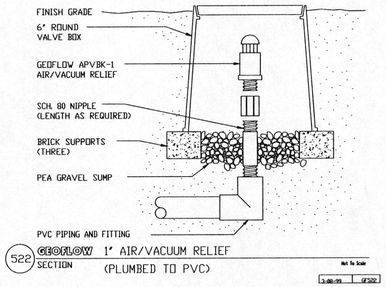
4-15-99 GF703



501LS A GEOFLOW SECTION — LOCKSLIP COUPLING (LTC-600)

Not To Scale

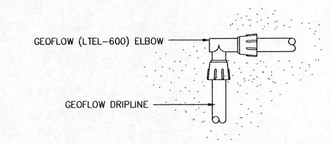
4-15-99 GF501LSA



522 GEOFLOW SECTION — 1" AIR/VACUUM RELIEF (PLUMBED TO PVC)

Not To Scale

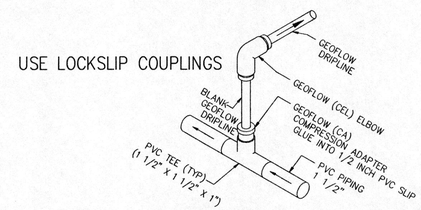
3-30-99 GF522



502LS GEOFLOW SECTION — LOCKSLIP ELBOW (LTEL-600)

Not To Scale

4-15-99 GF502LS

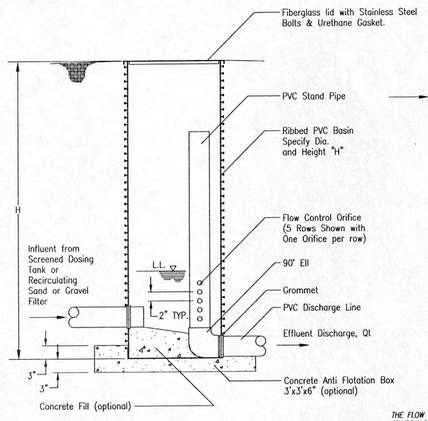


505A GEOFLOW SECTION — MANIFOLD / FLUSH HEADER CONNECTION (PVC TO ELBOW)

Not To Scale

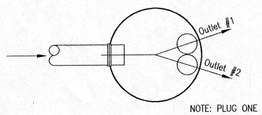
4-15-99 GF505A

Flow Splitter Basin for Gravity Flow Effluent



SIDE VIEW - FLOW SPLITTER BASIN

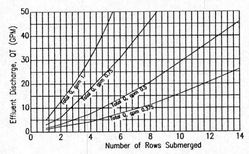
scale: 3/4" = 1'-0"



NOTE: PLUG ONE OUTLET FOR FUTURE PHASE

TOP VIEW - FLOW SPLITTER BASIN

SCALE: NTS



THE FLOW RATE IS BASED ON A LIQUID LEVEL THAT IS 2" ABOVE ANY ORIFICE OR ROW OF ORIFICES. THE TOTAL FLOW (Qt) PER DISCHARGE PIPE IS CALCULATED BY MULTIPLYING THE NUMBER OF ORIFICES PER ROW TIMES THE DISCHARGE RATE FROM THE GRAPH. EXAMPLE: Assume that there are 5 rows high as shown in the drawing. If all five rows are submerged the discharge rate obtained from the curve for one 1" orifice per row is 42 gpm. If there were four 1" diameter orifices per row the total discharge flow would be Qt=rQ=4(42gpm)=168gpm

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CONSTRUCTION DRAWINGS

CERTIFICATE OF AUTHORIZATION — ENGINEERING DESIGN ASSOCIATES, P.A. — No. 922 — ARKANSAS ENGINEER

STATE OF ARKANSAS — REGISTERED PROFESSIONAL ENGINEER — No.8527 — STEVE ALFRED HESSE

8-15-04

MISCELLANEOUS DETAILS

PHASE 3A SANITARY SEWER IMPROVEMENTS

BETHEL HEIGHTS, ARKANSAS

EDA — Engineering Design Associates, P.A.
Consulting Engineering
Landscape Architecture
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134 West Emma Avenue
Springdale, Arkansas 72764
(479) 756-1266
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DRAWN BY: CHECKED BY: SAH
DATE: 2-1-04
SCALE: NONE
JOB NUMBER: 0656.6
FILE NAME: 0656 PH 3 DETAILS.DWG
DESCRIPTION:
SHEET DT-2

Appendix I: Phase 4 Construction Drawings (latest set discovered)

Phase 4 Sanitary Sewer Improvements

for the

Town of Bethel Heights, Arkansas

EDA Project No. 0950.2

Construction Plans

September 2006

GENERAL NOTES:

1) THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO AVOID DAMAGE TO ADJACENT PROPERTIES DURING THE CONSTRUCTION OF THE PROJECT. THE CONTRACTOR SHALL BE HELD SOLELY RESPONSIBLE FOR ANY DAMAGES THAT MAY RESULT.

2) THE LOCATIONS OF EXISTING UTILITIES SHOWN ON THE PLANS ARE GENERAL IN NATURE AND ARE BASED ON INFORMATION PROVIDED BY THE UTILITY COMPANIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING THE EXACT LOCATION OF ALL UTILITIES BEFORE PROCEEDING WITH THE CONSTRUCTION.

3) OTHER CONTRACTORS, LABORERS, WORKMEN, UTILITY COMPANIES, ETC., MAY BE WORKING WITHIN OR AROUND THE PROJECT SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING HIS WORK WITH OTHERS TO MINIMIZE ANY CONFLICTS THAT ARISE.

4) IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, THE CONTRACTOR WILL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS OF THE JOB SITE INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THIS REQUIREMENT WILL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. THE DUTY OF THE ENGINEER TO CONDUCT CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES, IN OR NEAR THE CONSTRUCTION SITE.

5) CONTRACTOR SHALL PROVIDE ADEQUATE MEANS OF EROSION CONTROL THROUGHOUT THE CONSTRUCTION OF THE PROJECT.

6) ALL CONSTRUCTION METHODS AND MATERIALS SHALL MEET OR EXCEED THE MINIMUM STANDARD AS SPECIFIED BY THE ARKANSAS STATE HIGHWAY AND TRANSPORATION DEPARTMENT AND THE CITY OF SPRINGDALE, ARKANSAS.

7) THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING, PAYING AND POSTING FOR ALL PAYMENT, PERFORMANCE, AND MAINTENANCE BONDS NECESSARY FOR THE CONSTRUCTION OF THIS PROJECT.

8) ALL CONSTRUCTION WORK AND UTILITY WORK OUTSIDE OF PROPERTY BOUNDARIES SHALL BE PERFORMED IN COOPERATION WITH AND IN ACCORDANCE WITH REGULATIONS OF THE AUTHORITIES CONCERNED. THE CONTRACTOR SHALL PROVIDE ADEQUATE CONSTRUCTION SIGNAGE AND OTHER TRAFFIC CONTROL DEVICES WHEN WORKING IN ANY RIGHT-OF-WAY. SIGNAGE AND OTHER TRAFFIC CONTROL DEVICES SHALL CONFORM TO ALL FEDERAL, STATE AND LOCAL GUIDELINES AND REGULATIONS.

9) THE CONTRACTOR SHALL CONDUCT THE WORK IN A MANNER THAT WILL INSURE, AS FAR AS PRACTICABLE, THE LEAST OBSTRUCTION TO TRAFFIC AND SHALL PROVIDE FOR THE CONVENIENCE AND SAFETY OF THE GENERAL PUBLIC AND RESIDENTS ALONG AND ADJACENT TO HIGHWAYS IN THE CONSTRUCTION AREA IN AN ADEQUATE AND SATISFACTORY MANNER IN ACCORDANCE WITH THE ARKANSAS DEPARTMENT OF TRANSPORTATION STANDARDS.

10) CONTRACTOR SHALL BE RESPONSIBLE FOR ALL NECESSARY MEASURES TO PROVIDE ADEQUATE TRENCH SAFETY, AND ALL OTHER ITEMS NECESSARY TO SATISFY ACT 291-1993 OF THE STATE OF ARKANSAS.

11) THE CONTRACTOR SHALL VERIFY WITH THE ENGINEER BEFORE BEGINNING CONSTRUCTION, THE PROCUREMENT AND LOCATION OF ALL EASEMENTS, TEMPORARY AND PERMANENT, NECESSARY TO CARRY OUT THE WORK OUTLINED WITHIN THESE DRAWINGS AND RELATED CONTRACT DOCUMENTS.

SEWER SYSTEM NOTES:

1) SEWER FORCE MAIN PIPE SHALL BE INSTALLED WITH 24" MIN. COVER WITH THE INDICATED TYPE AND SIZE OF PIPE AS SPECIFIED

2) ALL 3-INCH AND LARGER PVC SEWER MAIN SHALL HAVE A MINIMUM WALL THICKNESS CLASSIFICATION OF SDR-26.

3) ALL SEWER PIPE SMALLER THAN 3-INCH SHALL BE SCHEDULE 40.

4) THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING AND PAYING FOR ALL NECESSARY STREET CUT PERMITS OR FEES. ALL STREET CUTS SHALL BE CONSTRUCTED IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL LAWS OR REGULATIONS.

EDA

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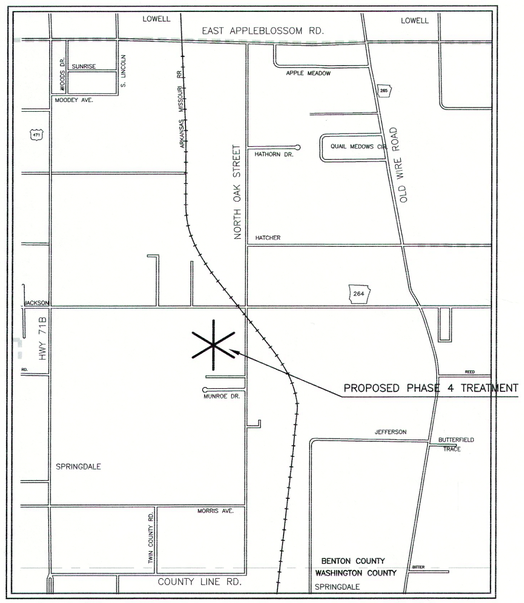

Vicinity

NTS

INDEX	SHEET
Overall Site Plan	UT-1
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Drip Field "B"	UT-3
Drip Field "A"	UT-4
Phase 4 Calculations	UT-5
Erosion Control Plan	EC-1
Miscellaneous Details	DT-1
Miscellaneous Details	DT-2

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CERTIFICATE OF AUTHORIZATION ENGINEERING DESIGN ASSOCIATES, P.A. No. 322 ARKANSAS ENGINEER

STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No. 8527 STEVE ALFRED HESSE

6-18-07

Bethel Heights Sanitary Sewer - Phase 4 - 0950.2
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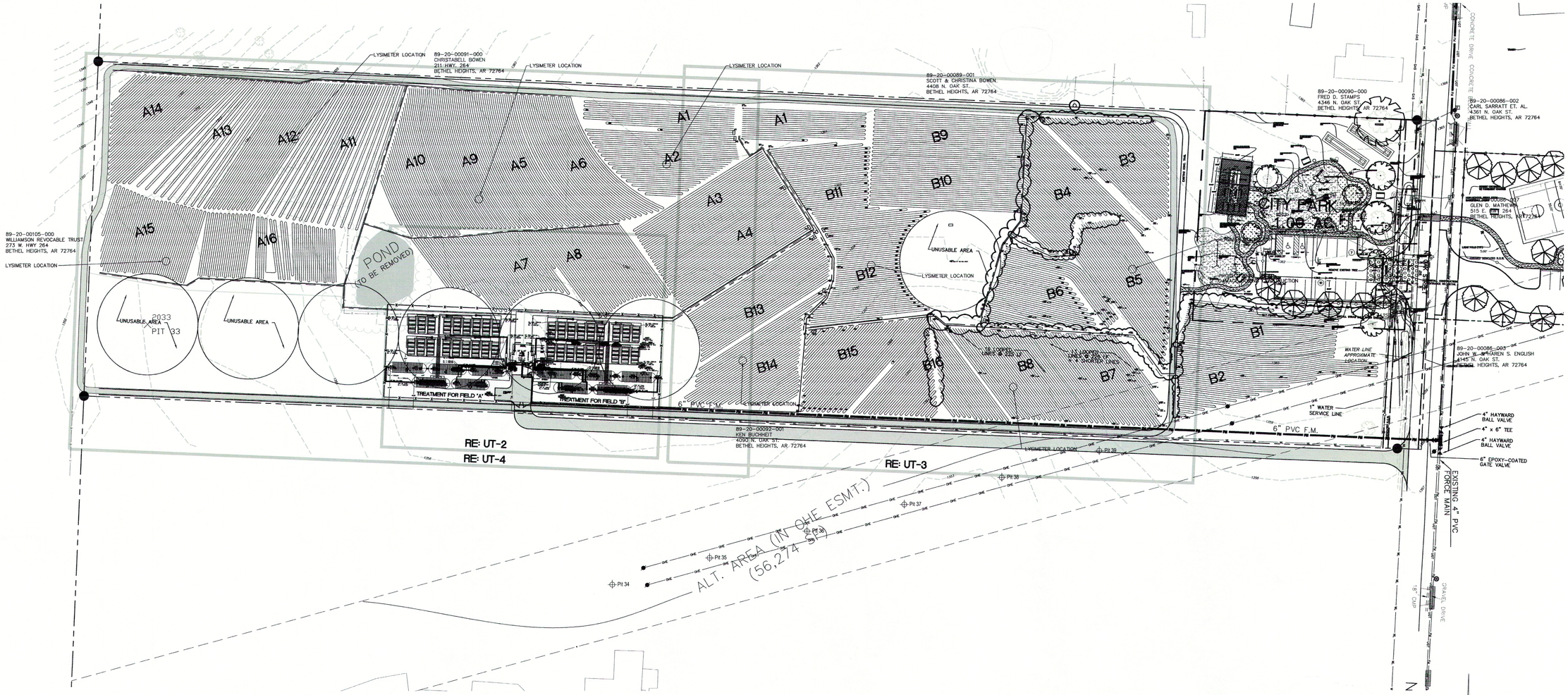

PRIMARY TREATMENT AREA REQUIRED: 225,000 SF
ALTERNATE AREA REQUIRED (25%): 56,250 SF
TOTAL AREA REQUIRED: 281,250 SF

Field A1:
Zone A1 – 3,600 LF
Zone A2 – 3,600 LF
Zone A3 – 3,600 LF
Zone A4 – 3,600 LF
Zone A5 – 3,600 LF
Zone A6 – 3,600 LF
Zone A7 – 3,600 LF
Zone A8 – 3,600 LF
Field A2:
Zone A9 – 3,600 LF
Zone A10 – 3,600 LF
Zone A11 – 3,600 LF
Zone A12 – 3,600 LF
Zone A13 – 3,600 LF
Zone A14 – 3,600 LF
Zone A15 – 3,600 LF
Zone A16 – 3,600 LF
Total: 57,600 LF (115,200 SF)

Field B1:
Zone B1 – 3,600 LF
Zone B2 – 3,600 LF
Zone B3 – 3,600 LF
Zone B4 – 3,600 LF
Zone B5 – 3,600 LF
Zone B6 – 3,600 LF
Zone B7 – 3,600 LF
Zone B8 – 3,600 LF
Field B2:
Zone B9 – 3,600 LF
Zone B10 – 3,600 LF
Zone B11 – 3,600 LF
Zone B12 – 3,600 LF
Zone B13 – 3,600 LF
Zone B14 – 3,600 LF
Zone B15 – 3,600 LF
Zone B16 – 3,600 LF
Total: 57,600 LF (115,200 SF)

PRIMARY DRIP AREA PROVIDED: 230,400 SF
ALTERATE DRIP AREA PROVIDED: 56,274 SF
TOTAL AREA PROVIDED: 286,674 SF

Legend

- FOUND IRON PIN
- PROPERTY LINE
- EASEMENT LINE
- BALL VALVE
- EXISTING CONTOUR
- 1 1/2" DRIP SUPPLY LINE
- 2" DRIP SUPPLY LINE
- 3" DRIP SUPPLY LINE
- 3" DRIP RETURN LINE

CERTIFICATE OF AUTHORIZATION ENGINEERING DESIGN ASSOCIATES, P.A. No. 322 ARKANSAS ENGINEER

STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No.8527 STEVE ALFRED HESSE

6-18-07

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OVERALL SITE PLAN
PHASE 4 TREATMENT
BETHEL HEIGHTS, ARKANSAS

EDA Consulting Engineering Landscape Architecture
Engineering Design Associates, P.A.
134 West Emma Avenue (479) 756-1266
Springdale, Arkansas 72764 Fax: (479) 756-2129

DRAWN BY: BLW CHECKED BY: SAH
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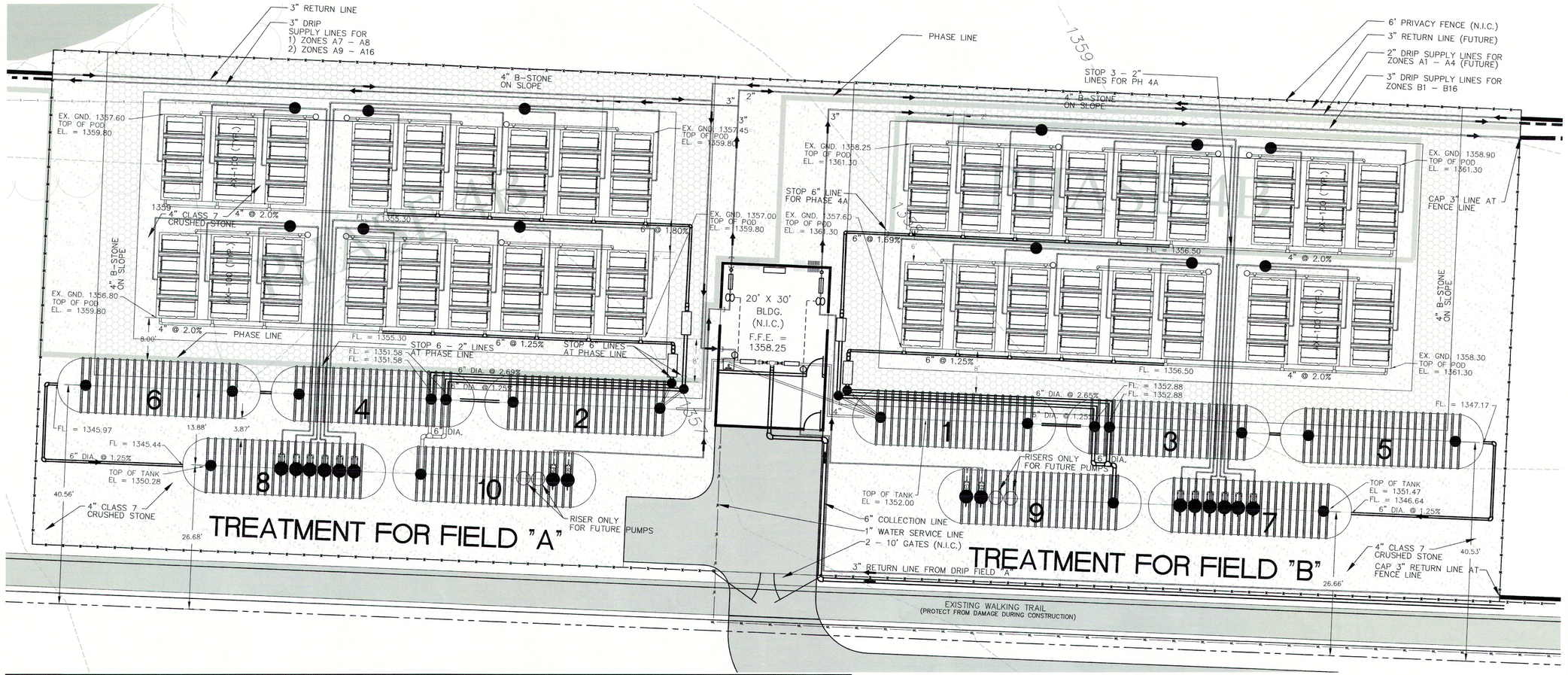

BUILDING BLOWUP
1" = 5'

GENERAL NOTES:

1) CONTRACTOR TO STRIP TOP SOIL FROM ALL AREAS TO BE EXCAVATED. STOCK PILE TOP SOIL MATERIAL ON SITE FOR USE LATER IN DRESSING UP SITE AND FOR SEEDED AREAS.

2) CONTRACTOR TO REMOVE ALL OTHER EXCESS SOIL MATERIAL FROM SITE.

3) CONTRACTOR TO CONSTRUCT EARTHEN PAD FOR BUILDING. BUILDING PAD TO BE A MINIMUM OF 24" OF SELECT CHERTY MATERIAL (HILL–SIDE). AREA UNDER BUILDING TO BE SCARIFIED TO A DEPTH OF 8 INCHES AND FILLED IN 8 INCH LIFTS AND COMPACTED TO 95% STANDARD PROCTOR DENSITY. COMPACTION OR TESTS MAY BE REQUIRED.

4) OFFSITE ACCESS ROAD IS TEMPORARY AND IS TO BE REMOVED AND RESTORED TO OWNER'S SATISFACTION ONCE CONSTRUCTION IS COMPLETE.

5) CONTRACTOR TO INSTALL 9 – 2" CONDUITS FROM EACH AX–100 UNIT TO THE BUILDING FOR FUTURE PRESSURE GAUGES (GAUGES BY CITY).

6) STUB OUT ALL PIPES FOR PHASE B INTO BUILDING. FLOW METERS, SAMPLING PORT, AND VORTEX FILTERS FOR PHASE B WILL NOT BE INSTALLED UNDER THIS CONTRACT.

CERTIFICATE OF AUTHORIZATION
ENGINEERING DESIGN ASSOCIATES, P.A.
No. 322
ARKANSAS ENGINEER

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 8527
STEVE ALFRED HESSE
6-18-07

10 0 10 20
GRAPHIC SCALE IN FEET

CALL BEFORE YOU DIG
1-800-482-8998
ARKANSAS ONE CALL SYSTEM

LARGE SCALE TREATMENT PLAN
PHASE 4 TREATMENT
BETHEL HEIGHTS, ARKANSAS

EDA Consulting Engineering Landscape Architecture
Engineering Design Associates, P.A.
134 West Emma Avenue (479) 756-1266
Springdale, Arkansas 72764 Fax: (479) 756-2129

DRAWN BY: BLW	CHECKED BY: SAH
DATE: 7–6–05	
SCALE: 1"= 10'	
JOB NUMBER: 0950.2	
FILE NAME: TREAMTENT PLAN.DWG	
DESCRIPTION:	SHEET UT–2

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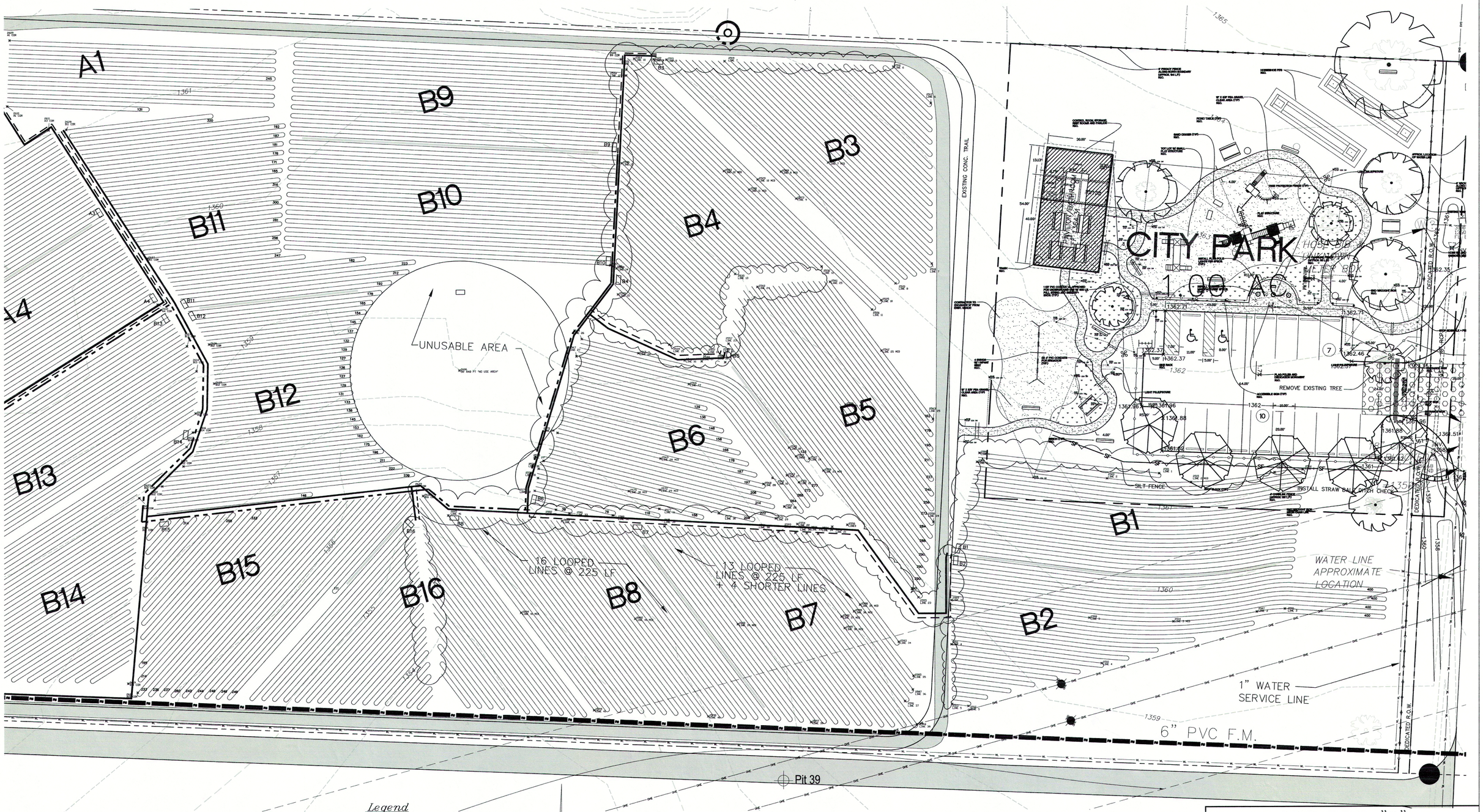

Legend

●	FOUND IRON PIN
	PROPERTY LINE
	EASEMENT LINE
⋈	BALL VALVE
	EXISTING CONTOUR
	1 1/2" DRIP SUPPLY LINE
	2" DRIP SUPPLY LINE
	3" DRIP SUPPLY LINE
	3" DRIP RETURN LINE

CALL BEFORE YOU DIG 1-800-482-8998 ARKANSAS ONE CALL SYSTEM

10 0 10 20
GRAPHIC SCALE IN FEET

NOTES:
1) HEADER PIPES ARE NOT SHOWN FOR CLARITY.
2) HEADER PIPE SUPPLY AND RETURN LINE SIZES SHALL BE THE SAME AS THE MAIN SUPPLY AND RETURN LINES.
3) SUPPLY LINE SIZING IS BASED ON LOADING UP TO 2 ZONES FROM EITHER "A" OR "B" AT ONE TIME, BUT MUST BE ONE FROM FIELD A1 AND ONE FROM A2, FOR EXAMPLE. NOT LOADING 2 ZONES FROM A1–A8, A9–A16, ETC.
4) RETURN LINE SIZING IS BASED ON FLUSHING ONLY ONE ZONE FROM EITHER "A" OR "B" AT ONE TIME.

CERTIFICATE OF AUTHORIZATION ENGINEERING DESIGN ASSOCIATES, P.A. No. 322 ARKANSAS ENGINEER

STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No.8527 STEVE ALFRED HESSE
6-18-07

DRIP FIELD "B"

PHASE 4 TREATMENT

BETHEL HEIGHTS, ARKANSAS

EDA Consulting Engineering Landscape Architecture
Engineering Design Associates, P.A.
134 West Emma Avenue (479) 756-1266
Springdale, Arkansas 72764 Fax: (479) 756-2129

DRAWN BY: BLW CHECKED BY: SAH
DATE: 7-6-05
SCALE: 1"= 20'
JOB NUMBER: 0950.2
FILE NAME: TREAMTENT PLAN.DWG
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SHEET UT-3

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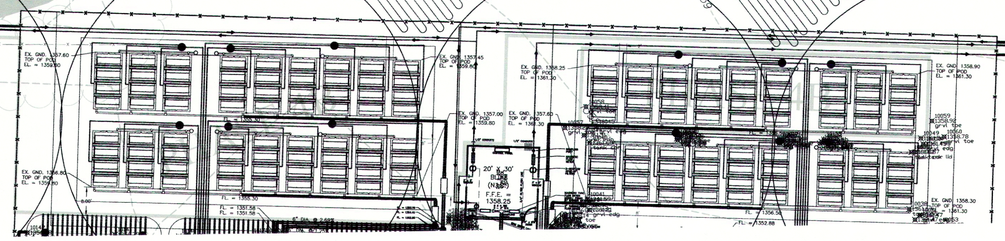
POND (TO BE REMOVED)

2033 PIT 33



CALL BEFORE YOU DIG 1-800-482-8998 ARKANSAS ONE CALL SYSTEM

Legend

- FOUND IRON PIN
- PROPERTY LINE
- EASEMENT LINE
- BALL VALVE
- EXISTING CONTOUR
- 1 1/2" DRIP SUPPLY LINE
- 2" DRIP SUPPLY LINE
- 3" DRIP SUPPLY LINE
- 3" DRIP RETURN LINE

10 0 10 20

GRAPHIC SCALE IN FEET

NOTES:
1) HEADER PIPES ARE NOT SHOWN FOR CLARITY.
2) HEADER PIPE SUPPLY AND RETURN LINE SIZES SHALL BE THE SAME AS THE MAIN SUPPLY AND RETURN LINES.
3) SUPPLY LINE SIZING IS BASED ON LOADING UP TO 2 ZONES FROM EITHER "A" OR "B" AT ONE TIME, BUT MUST BE ONE FROM FIELD A1 AND ONE FROM A2, FOR EXAMPLE. NOT LOADING 2 ZONES FROM A1–A8, A9–A16, ETC.
4) RETURN LINE SIZING IS BASED ON FLUSHING ONLY ONE ZONE FROM EITHER "A" OR "B" AT ONE TIME.

CERTIFICATE OF AUTHORIZATION ENGINEERING DESIGN ASSOCIATES, P.A. No. 322 ARKANSAS ENGINEER

STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No.8527 STEVE ALFRED HESSE

6-18-07

DRIP FIELD "~~B~~ A"

PHASE 4 TREATMENT
BETHEL HEIGHTS, ARKANSAS

EDA Consulting Engineering Landscape Architecture
Engineering Design Associates, P.A.
134 West Emma Avenue (479) 756-1266
Springdale, Arkansas 72764 Fax: (479) 756-2129

DRAWN BY: BLW CHECKED BY: SAH
DATE: 7-6-05
SCALE: 1"= 20'
JOB NUMBER: 0950.2
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SHEET UT-4

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FIELD 1

Geoflow Subsurface Dripline Dispersal: Field Calculation

Job Description:	Bethel Heights Phase IV
	Field A1-A8
Prepared by:	Lance Jobe
Date:	5/31/2006

Please fill in the shaded areas and drop down menus below:

Note. This worksheet can be found in Geoflow's Design and Installation Manual

Worksheet - Field Design

		Dispersal Field as Single Zone	Dispersal Field as Multiple Zones	
Number of Zones		1	8	zone(s)
A)	Quantity of effluent to be disposed per day	22,500	2,813	gallons / day
B)	Hydraulic loading rate	0.4	0.4	gallons / sq.ft. / day
C)	Determine total area required	56,250	7,031	square ft.
D)	Choose spacing between WASTEFLOW lines	2	2	ft.
D)	Choose spacing between WASTEFLOW emitters	2 ft.	2	ft.
E)	Total linear ft.	28,125	3,600	each
F)	Total number of emitters	14,063	1,800	each
G)	Select Wasteflow dripline	Wasteflow PC - 1 gph	Wasteflow PC 1 gph	dripline
H)	Pressure at the beginning of the dripfield	20 psi	20	psi
I)	Feet of Head at the beginning of the dripfield	46.2	46.2	ft.
J)	What is the flow rate per emitter in gph?	1.02	1.02	gallons per hour
K)	Total flow for the area (gph)	14,344	1,836	gallons per hour
	Total flow for the area (gpm)	239.06	30.60	gallons per minute
L)	Select pipe diameters for manifolds and submains	Refer to a PVC chart	2	inch
M)	Select Filter	Consult Factory	Two x AP4E-1F (1in.)	
N)	Maximum length of each WASTEFLOW line. For additional technical flow, pressure and flushin data please refer to Geoflow's Design Manual and WASTEFLOW hydraulics worksheet.	265	265	ft.

Check below to choose quantity and length of daily doses

Dosing		
Number of doses per day/zone:	1	12
Pump run time per dose/zone (minutes):	94.12	7.66 minutes
Pump run time per day/zone (hours):	1.57	1.53 hours / day
Pump run time per day/all zones (hours):	1.57	12.25 hours
Time between doses (hours):	22.43	0.98 hours

Dripline Volume

Geoflow Subsurface Dispersal: Pump Size Calculation

Job Description:	Bethel Heights Phase IV
	Field A1-A8
Prepared by:	Lance Jobe
Date:	5/31/2006

Please fill in the shaded areas below:

Information automatically inserted is from the multiple zone column in 'Worksheet 1-Field

Note. This worksheet can be found in Geoflow's Design and Installation Manual

Worksheet - Pump Sizing

O)	Minimum pump capacity	30.60 gpm		
P)	Header pipe size	2 inch		
Q)	Pressure loss in 100 ft. of pipe	0.32 psi		
R)	Friction head in 100 ft. of pipe	0.74 ft.		
S)	Static head			
	i) Height from pump to tank outlet	5.7 ft.		
	ii) Elevation increase or decrease	11 ft.		
T)	Total static head	**16.7 *ft.***		
U)	Friction head			
	i) Equivalent length of fittings	100 ft.		
	ii) Distance from pump to field	1039 ft.		
	iii) Total equivalent length of pipe	1139 ft.		
	iv) Total effective feet	8.42 ft.		
	v) Head required at dripfield	46.2 ft.		
	vi) Headloss through filter or Headwork	18.48 ft.	8	psi
	vii) Head loss through zone valves	5.313 ft.	2.3	psi
V)	Total friction Head	**78.41** ft.		
W)	**Total dynamic head**	**95.11 ft.**		
X)	**Dosing pump capacity**	**30.60 gpm**		
Y)	Flushing Flow	1 ft/sec * 0.75 gpm/line * 35 lines	26.25	gpm
	Minimum pump capacity*	**56.85 gpm**		

*Duplex pumps to be run simultaneously for flushing flow.

FIELD 4

Geoflow Subsurface Dripline Dispersal: Field Calculation

Job Description:	Bethel Heights Phase IV
	Field B9-B16
Prepared by:	Lance Jobe
Date:	5/31/2006

Please fill in the shaded areas and drop down menus below:

Note. This worksheet can be found in Geoflow's Design and Installation Manual

Worksheet - Field Design

		Dispersal Field as Single Zone	Dispersal Field as Multiple Zones	
Number of Zones		1	8	zone(s)
A)	Quantity of effluent to be disposed per day	22,500	2,813	gallons / day
B)	Hydraulic loading rate	0.4	0.4	gallons / sq.ft. / day
C)	Determine total area required	56,250	7,031	square ft.
D)	Choose spacing between WASTEFLOW lines	2	2	ft.
D)	Choose spacing between WASTEFLOW emitters	2 ft.	2	ft.
E)	Total linear ft.	28,125	3,600	each
F)	Total number of emitters	14,063	1,800	each
G)	Select Wasteflow dripline	Wasteflow PC - 1 gph	Wasteflow PC 1 gph	dripline
H)	Pressure at the beginning of the dripfield	20 psi	20	psi
I)	Feet of Head at the beginning of the dripfield	46.2	46.2	ft.
J)	What is the flow rate per emitter in gph?	1.02	1.02	gallons per hour
K)	Total flow for the area (gph)	14,344	1,836	gallons per hour
	Total flow for the area (gpm)	239.06	30.60	gallons per minute
L)	Select pipe diameters for manifolds and submains	Refer to a PVC chart	2	inch
M)	Select Vortex Filter (item no.)	Consult Factory	Two x AP4E-1F (1in.)	
N)	Maximum length of each WASTEFLOW line. For additional technical flow, pressure and flushin data please refer to Geoflow's Design Manual and WASTEFLOW hydraulics worksheet.	265	265	ft.

Check below to choose quantity and length of daily doses

Dosing		
Number of doses per day/zone:	1	12
Pump run time per dose/zone (minutes):	94.12	7.66 minutes
Pump run time per day/zone (hours):	1.57	1.53 hours / day
Pump run time per day/all zones (hours):	1.57	12.25 hours
Time between doses (hours):	22.43	0.98

Dripline Volume

Geoflow Subsurface Dispersal: Pump Size Calculation

Job Description:	Bethel Heights Phase IV
	Field B9-B16
Prepared by:	Lance Jobe
Date:	5/31/2006

Please fill in the shaded areas below:

Information automatically inserted is from the multiple zone column in 'Worksheet 1-Field

Note. This worksheet can be found in Geoflow's Design and Installation Manual

Worksheet - Pump Sizing

O)	Minimum pump capacity	30.60 gpm		
P)	Header pipe size	2 inch		
Q)	Pressure loss in 100 ft. of pipe	0.32 psi		
R)	Friction head in 100 ft. of pipe	0.74 ft.		
S)	Static head			
	i) Height from pump to tank outlet	5.7 ft.		
	ii) Elevation increase or decrease	12.7 ft.		
T)	Total static head	**18.4 *ft.***		
U)	Friction head			
	i) Equivalent length of fittings	100 ft.		
	ii) Distance from pump to field	2902 ft.		
	iii) Total equivalent length of pipe	3002 ft.		
	iv) Total effective feet	22.190784 ft.		
	v) Head required at dripfield	46.2 ft.		
	vi) Headloss through filter or Headwork	9.24 ft.	4	psi
	vii) Head loss through zone valves	5.313 ft.	2.3	psi
V)	Total friction Head	**82.94** ft.		
W)	**Total dynamic head**	**101.34 ft.**		
X)	**Dosing pump capacity**	**30.60 gpm**		
Y)	Flushing Flow	1 ft/sec * 0.75 gpm/line * 28 lines	21	gpm
	Minimum pump capacity	**51.60 gpm**		

FIELD 2

Geoflow Subsurface Dripline Dispersal: Field Calculation

Job Description:	Bethel Heights Phase IV
	Field A9-A16
Prepared by:	Lance Jobe
Date:	5/31/2006

Please fill in the shaded areas and drop down menus below:

Note. This worksheet can be found in Geoflow's Design and Installation Manual

Worksheet - Field Design

		Dispersal Field as Single Zone	Dispersal Field as Multiple Zones	
Number of Zones		1	8	zone(s)
A)	Quantity of effluent to be disposed per day	22,500	2,813	gallons / day
B)	Hydraulic loading rate	0.4	0.4	gallons / sq.ft. / day
C)	Determine total area required	56,250	7,031	square ft.
D)	Choose spacing between WASTEFLOW lines	2	2	ft.
D)	Choose spacing between WASTEFLOW emitters	2 ft.	2	ft.
E)	Total linear ft.	28,125	3,600	each
F)	Total number of emitters	14,063	1,800	each
G)	Select Wasteflow dripline	Wasteflow PC - 1 gph	Wasteflow PC 1 gph	dripline
H)	Pressure at the beginning of the dripfield	20 psi	20	psi
I)	Feet of Head at the beginning of the dripfield	46.2	46.2	ft.
J)	What is the flow rate per emitter in gph?	1.02	1.02	gallons per hour
K)	Total flow for the area (gph)	14,344	1,836	gallons per hour
	Total flow for the area (gpm)	239.06	30.60	gallons per minute
L)	Select pipe diameters for manifolds and submains	Refer to a PVC chart	2	inch
M)	Select Vortex Filter (item no.)	Consult Factory	Two x AP4E-1F (1in.)	
N)	Maximum length of each WASTEFLOW line. For additional technical flow, pressure and flushin data please refer to Geoflow's Design Manual and WASTEFLOW hydraulics worksheet.	265	265	ft.

Check below to choose quantity and length of daily doses

Dosing		
Number of doses per day/zone:	1	12
Pump run time per dose/zone (minutes):	94.12	7.66 minutes
Pump run time per day/zone (hours):	1.57	1.53 hours / day
Pump run time per day/all zones (hours):	1.57	12.25 hours
Time between doses (hours):	22.43	0.98 hours

Dripline Volume inches

Geoflow Subsurface Dispersal: Pump Size Calculation

Job Description:	Bethel Heights Phase IV
	Field A9-A16
Prepared by:	Lance Jobe
Date:	5/31/2006

Please fill in the shaded areas below:

Information automatically inserted is from the multiple zone column in 'Worksheet 1-Field

Note. This worksheet can be found in Geoflow's Design and Installation Manual

Worksheet - Pump Sizing

O)	Minimum pump capacity	30.60 gpm		
P)	Header pipe size	2 inch		
Q)	Pressure loss in 100 ft. of pipe	0.32 psi		
R)	Friction head in 100 ft. of pipe	0.74 ft.		
S)	Static head			
	i) Height from pump to tank outlet	5.7 ft.		
	ii) Elevation increase or decrease	9.2 ft.		
T)	Total static head	**14.9 *ft.***		
U)	Friction head			
	i) Equivalent length of fittings	100 ft.		
	ii) Distance from pump to field	1860 ft.		
	iii) Total equivalent length of pipe	1960 ft.		
	iv) Total effective feet	14.48832 ft.		
	v) Head required at dripfield	46.2 ft.		
	vi) Headloss through filter or Headwork	9.24 ft.	4	psi
	vii) Head loss through zone valves	5.313 ft.	2.3	psi
V)	Total friction Head	**75.24** ft.		
W)	**Total dynamic head**	**90.14 ft.**		
X)	**Dosing pump capacity**	**30.60 gpm**		
Y)	Flushing Flow	1 ft/sec * 0.75 gpm/line * 39 lines	29.25	gpm
	Minimum pump capacity	**59.85 gpm**		

FIELD 3

Geoflow Subsurface Dripline Dispersal: Field Calculation

Job Description:	Bethel Heights Phase IV
	Field B1-B8
Prepared by:	Lance Jobe
Date:	5/31/2006

Please fill in the shaded areas and drop down menus below:

Note. This worksheet can be found in Geoflow's Design and Installation Manual

Worksheet - Field Design

		Dispersal Field as Single Zone	Dispersal Field as Multiple Zones	
Number of Zones		1	8	zone(s)
A)	Quantity of effluent to be disposed per day	22,500	2,813	gallons / day
B)	Hydraulic loading rate	0.4	0.4	gallons / sq.ft. / day
C)	Determine total area required	56,250	7,031	square ft.
D)	Choose spacing between WASTEFLOW lines	2	2	ft.
D)	Choose spacing between WASTEFLOW emitters	2 ft.	2	ft.
E)	Total linear ft.	28,125	3,600	each
F)	Total number of emitters	14,063	1,800	each
G)	Select Wasteflow dripline	Wasteflow PC - 1 gph	Wasteflow PC 1 gph	dripline
H)	Pressure at the beginning of the dripfield	20 psi	20	psi
I)	Feet of Head at the beginning of the dripfield	46.2	46.2	ft.
J)	What is the flow rate per emitter in gph?	1.02	1.02	gallons per hour
K)	Total flow for the area (gph)	14,344	1,836	gallons per hour
	Total flow for the area (gpm)	239.06	30.60	gallons per minute
L)	Select pipe diameters for manifolds and submains	Refer to a PVC chart	2	inch
M)	Select Vortex Filter (item no.)	Consult Factory	Two x AP4E-1F (1in.)	
N)	Maximum length of each WASTEFLOW line. For additional technical flow, pressure and flushin data please refer to Geoflow's Design Manual and WASTEFLOW hydraulics worksheet.	265	265	ft.

Check below to choose quantity and length of daily doses

Dosing		
Number of doses per day/zone:	1	12
Pump run time per dose/zone (minutes):	94.12	7.66 minutes
Pump run time per day/zone (hours):	1.57	1.53 hours / day
Pump run time per day/all zones (hours):	1.57	12.25 hours
Time between doses (hours):	22.43	0.98

Dripline Volume

Geoflow Subsurface Dispersal: Pump Size Calculation

Job Description:	Bethel Heights Phase IV
	Field B1-B8
Prepared by:	Lance Jobe
Date:	5/31/2006

Please fill in the shaded areas below:

Information automatically inserted is from the multiple zone column in 'Worksheet 1-Field

Note. This worksheet can be found in Geoflow's Design and Installation Manual

Worksheet - Pump Sizing

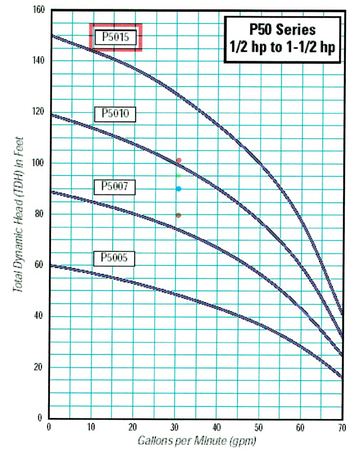
O)	Minimum pump capacity	30.60 gpm		
P)	Header pipe size	2 inch		
Q)	Pressure loss in 100 ft. of pipe	0.32 psi		
R)	Friction head in 100 ft. of pipe	0.74 ft.		
S)	Static head			
	i) Height from pump to tank outlet	5.7 ft.		
	ii) Elevation increase or decrease	5.25 ft.		
T)	Total static head	**10.95 *ft.***		
U)	Friction head			
	i) Equivalent length of fittings	100 ft.		
	ii) Distance from pump to field	997.5 ft.		
	iii) Total equivalent length of pipe	1097.5 ft.		
	iv) Total effective feet	8.11272 ft.		
	v) Head required at dripfield	46.2 ft.		
	vi) Headloss through filter or Headwork	9.24 ft.	4	psi
	vii) Head loss through zone valves	5.313 ft.	2.3	psi
V)	Total friction Head	**68.87** ft.		
W)	**Total dynamic head**	**79.82 ft.**		
X)	**Dosing pump capacity**	**30.60 gpm**		
Y)	Flushing Flow	1 ft/sec * 0.75 gpm/line * 41 lines	23.06	gpm
	Minimum pump capacity	**53.66 gpm**		

CERTIFICATE OF AUTHORIZATION — ENGINEERING DESIGN ASSOCIATES, P.A. No. 322 — ARKANSAS ENGINEER

STATE OF ARKANSAS — REGISTERED PROFESSIONAL ENGINEER — No.8527 — STEVE ALFRED HESSE

6-23-06

ORENCO PUMP CURVE



EACH FIELD WILL BE DOSED BY DUPLEXED P5015 PUMPS RUNNING INDIVIDUALLY. BOTH PUMPS IN THE DUPLEX WILL RUN DURING FLUSHING.

– FIELD 1
– FIELD 2
– FIELD 3
– FIELD 4

PH 4 CALCULATIONS

PHASE 4 TREATMENT
BETHEL HEIGHTS, ARKANSAS

EDA — Consulting Engineering, Landscape Architecture
Engineering Design Associates, P.A.
134 West Emma Avenue, Springdale, Arkansas 72764
(479) 756-1266 Fax: (479) 756-2129

DRAWN BY: LDJ CHECKED BY: SAH
DATE: 4-26-06
SCALE: NONE
JOB NUMBER: 0950.2
FILE NAME: 0950 Calculation Sheet
DESCRIPTION:
SHEET UT-5

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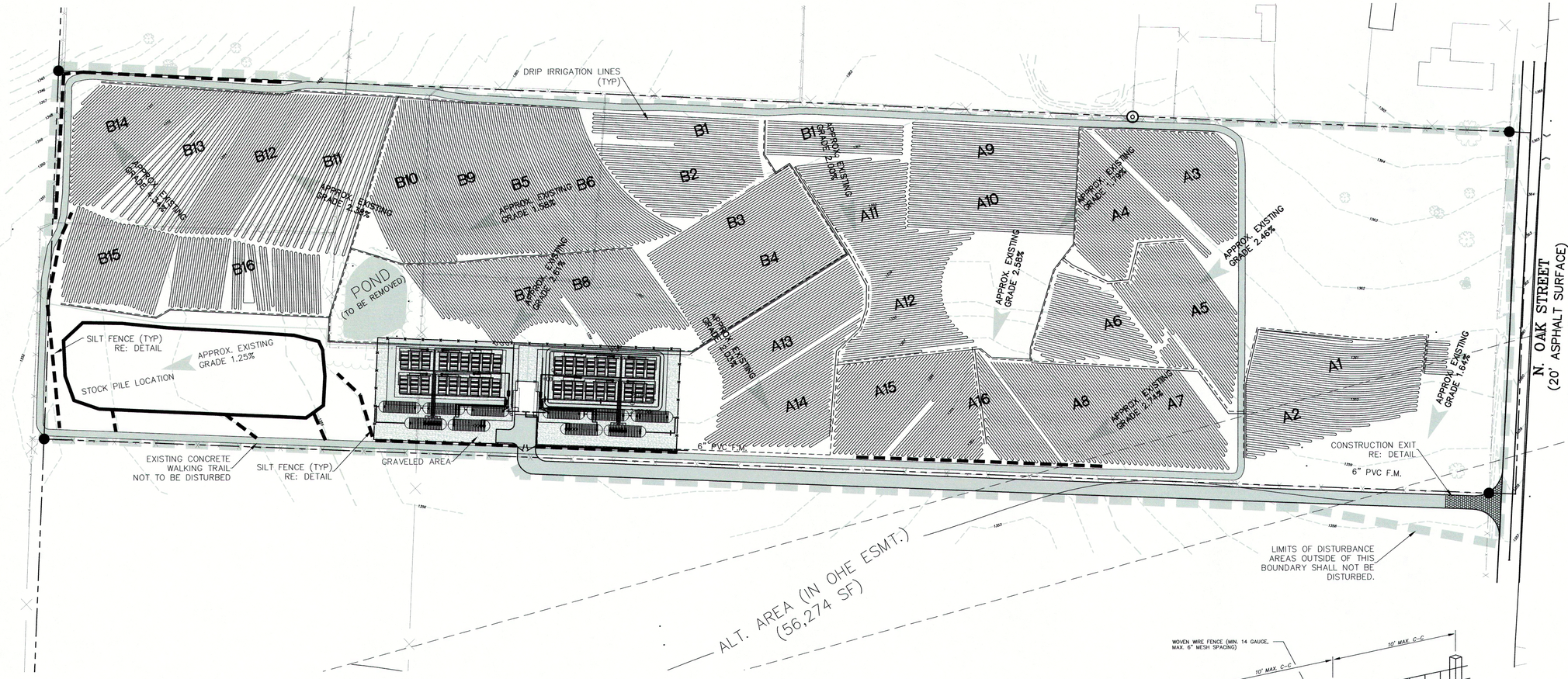


GRADING NOTES:

1) THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL REMOVAL AND PROPER DISPOSAL OF DEBRIS, CLEARING, GRUBBING, AND STRIPPING OF TOPSOIL AND ORGANIC MATTER AS NECESSARY FOR THE CONSTRUCTION OF THIS PROJECT. TOPSOIL MAY BE STOCKPILED ON SITE, AS DIRECTED BY THE ENGINEER. THE BURNING OF TIMBER AND DEBRIS WILL NOT BE PERMITTED UNLESS APPROVAL IS GAINED FROM THE OWNER, ENGINEER, AND GOVERNING OFFICIALS. THE CONTRACTOR IS RESPONSIBLE FOR ALL PERMITS, FEES, ETC. REQUIRED.

2) BUILDING SETBACK AREAS TO RECEIVE FILL MATERIAL SHALL BE SCARIFIED TO A DEPTH OF 8-INCH DEPTH AND PROPERLY COMPACTED TO 95% STANDARD PROCTOR DENSITY. ANY UNSUITABLE AREAS SHALL BE FURTHER UNDEROUT AND REPLACED WITH SUITABLE MATERIAL, AS DIRECTED BY THE ENGINEER.

3) OFF-SITE FILL MATERIAL SHALL HAVE A PLASTICITY INDEX OF 20 OR LESS, A LIQUID LIMIT OF 50 OR LESS, AND CONTAIN NO ROCK LARGER THAN FOUR INCHES. OFF SITE FILL MATERIAL SHALL BE APPROVED BY THE ENGINEER.

4) AREAS THAT ARE TO BE CUT TO SUB-GRADE LEVELS SHALL BE PROOF-ROLLED WITH A LOADED TANDEM AXLE DUMP TRUCK OR SIMILAR APPROVED CONSTRUCTION EQUIPMENT TO DETECT UNSUITABLE SOIL CONDITIONS. CUT AREAS ARE TO BE SCARIFIED AND RE-COMPACTED TO 95% STANDARD PROCTOR AND TESTED BY A GEOTECHNICAL ENGINEER PRIOR TO PLACEMENT OF BASE MATERIAL.

5) THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CONTROL OF DUST AND DIRT RISING AND SCATTERING IN THE AIR DURING CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE WATER SPRINKLING TRUCKS OR OTHER MEANS SUITABLE OF CONTROL OF DUST. THE CONTRACTOR SHALL COMPLY WITH ALL GOVERNING REGULATIONS PERTAINING TO ENVIRONMENTAL PROTECTION.

6) THE DEVELOPER SHALL PROVIDE AN INDEPENDENT TESTING LABORATORY TO PERFORM CONSTRUCTION TESTING OF THE SUB-GRADE FOR COMPLIANCE WITH THE MINIMUM REQUIREMENTS OF SUB-GRADE DENSITIES. THE CONTRACTOR SHALL PROVIDE 48 HOURS ADVANCED NOTIFICATION SO THE DEVELOPER CAN SCHEDULE TESTING.

7) THE CONTRACTOR SHALL MAINTAIN ALL SLOPES 3:1 OR FLATTER UNLESS OTHERWISE INDICATED ON THE PLANS. ALL SLOPES EXCEEDING 3:1, BUT LESS THAN 2:1 SHALL BE SODDED.

8) CONTRACTOR SHALL CONTROLL EROSION ALONG THE EDGE OF THE PROPERTY INCLUDING BOTTOM OF SLOPE LOCATIONS AND ALONG DITCHES LINES. THE CONTRACTOR SHALL TAKE ALL NECESSARY MEANS TO PREVENT MUD AND DEBRIS FROM FLOWING ONTO ADJACENT PROPERTY.

9) ALL SLOPES AND AREAS DISTURBED BY CONSTRUCTION SHALL BE GRADED SMOOTH AND FOUR-INCHES OF TOPSOIL APPLIED. IF ADEQUATE TOP-SOIL IS NOT AVAILABLE ON-SITE, THE CONTRACTOR SHALL PROVIDE TOPSOIL, APPROVED BY THE OWNER, AS NEEDED. THE AREA SHALL THEN BE SEEDED, FERTILIZED, MULCHED, WATERED AND MAINTAINED UNTIL 70% GRASS COVER IS ESTABLISHED IN ALL AREAS. ANY AREAS DISTURBED FOR ANY REASON PRIOR TO FINAL ACCEPTANCE OF THE PROJECT SHALL BE CORRECTED BY THE CONTRACTOR.

REVEGETATION REQUIREMENTS:

1. 0% TO 10% EXISTING GRADE: REVEGETATION SHALL BE A MINIMUM OF SEEDING AND MULCHING, SAID SEEDING SHALL PROVIDE COMPLETE AND UNIFORM COVERAGE THAT MINIMIZES EROSION AND RUN-OFF IN NO MORE THAN TWO GROWING SEASONS.

2. 10% TO 25% EXISTING GRADE: REVEGETATION SHALL BE A MINIMUM OF HYDROSEEDING WITH MULCH AND FERTILIZER, STAKED SOD AND / OR GROUND COVER, SAID PLANTINGS SHALL PROVIDE COMPLETE AND UNIFORM COVER IN NO MORE THAN TWO GROWING SEASONS.

3. 25% TO 33% FINISH GRADE: THE SLOPE SHALL BE COVERED WITH LANDSCAPE FABRIC AND PLANTED WITH GROUND COVER (PER CITY STANDARDS) OR COVERED WITH RIP-RAP. IF RIP-RAP IS USED, THE SLOPE'S STABILITY AND ERODABILITY MUST BE EQUIVALENT TO OR BETTER THAN IT'S PREDEVELOPED STATE.

4. MORE THAN 33% FINISH GRADE: ANY FINISH GRADE OVER 33% REQUIRES LANDSCAPE FABRIC AND STABILIZATION.

EROSION CONTROL NOTES:

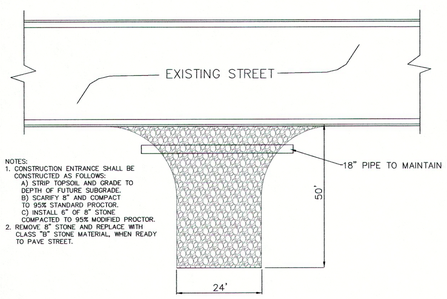
1) ALL WASH WATER SHALL BE DISPOSED OF IN A MANNER THAT PREVENTS CONTACT BETWEEN THESE MATERIALS AND STORM WATER THAT IS DISCHARGED FROM THE SITE.

2) CONTRACTOR SHALL MAINTAIN ON THE SITE OR HAVE READILY AVAILABLE SUFFICIENT OIL AND GREASE ABSORBING MATERIALS AND FLOTATION BOOMS TO CONTAIN AND CLEAN-UP FUEL OR CHEMICAL SPILLS AND LEAKS.

3) OFF-SITE VEHICLE TRACKING OF SEDIMENTS SHALL BE MINIMIZED. PRIOR TO ANY OTHER CONSTRUCTION, A STABILIZED CONSTRUCTION ENTRANCE SHALL BE CONSTRUCTED AT EACH POINT OF ENTRY TO OR EXIT FROM THE SITE. THE CONTRACTOR SHALL APPLY ADDITIONAL STONE TO THE TOP OF THE CONSTRUCTION ENTRANCE AS NECESSARY TO PREVENT TRACKING OF MUD ONTO PUBLIC RIGHT-OF-WAY. MATERIALS SPILLED , TRACKED, DROPPED, OR WASHED ONTO PUBLIC RIGHT-OF-WAY SHALL BE REMOVED IMMEDIATELY.

4) ALL SEEDED AREAS SHALL BE CHECKED REGULARLY TO CONFIRM THAT A GOOD STAND IS MAINTAINED. AREAS SHALL BE FERTILIZED, IRRIGATED AND RESEEDED AS REQUIRED.

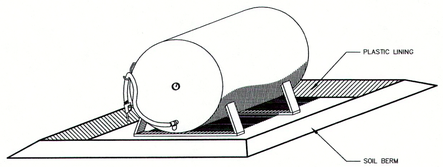
5) A MINIMUM VEGETATIVE BUFFER OF 25 FEET SHALL BE PROVIDED BETWEEN CONSTRUCTION OPERATIONS AND WETLANDS AND ORDINARY HIGH WATER MARKS OF RIVERS AND STREAMS.



NOTES:
1. CONSTRUCTION ENTRANCE SHALL BE CONSTRUCTED AS FOLLOWS:
   A) STRIP TOPSOIL AND GRADE TO DEPTH OF FUTURE SUBGRADE.
   B) SCARIFY 8" AND COMPACT TO 95% STANDARD PROCTOR.
   C) INSTALL 6" OF 8" STONE COMPACTED TO 95% MODIFIED PROCTOR.
2. REMOVE 8" STONE AND REPLACE WITH CLASS "B" STONE MATERIAL, WHEN READY TO PAVE STREET.

CONSTRUCTION ENTRANCE

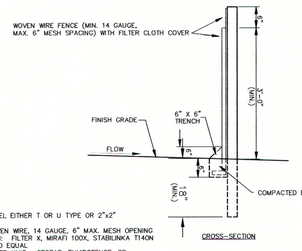
N.T.S.



BERM SHALL BE HIGH ENOUGH TO CONTAIN THE TOTAL VOLUME PLUS 10% OF THE FUEL HELD BY THE STORAGE TANK.

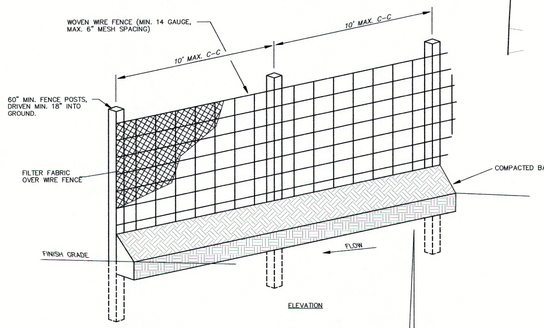
FUEL STORAGE DETAIL

N.T.S.



CROSS-SECTION

POSTS: STEEL EITHER T OR U TYPE OR 2"x2" HARDWOOD
FENCE: WOVEN WIRE, 14 GAUGE, 6" MAX. MESH OPENING
FILTER CLOTH: FILTER X, MIRAFI 100X, STABILINKA T140N OR APPROVED EQUAL
PREFABRICATED UNIT: GEOFAB, ENVIROFENCE, OR APPROVED EQUAL.



ELEVATION

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES.
2. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH EACH OTHER THEY SHALL BE OVERLAPPED BY SIX INCHES AND FOLDED.
4. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.

SILT FENCE

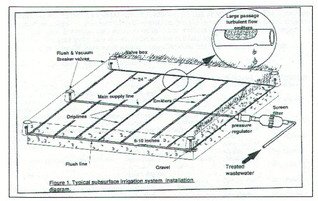
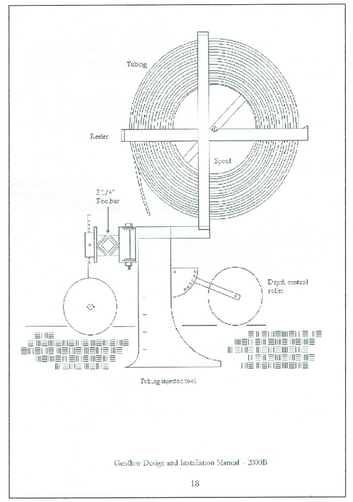


Figure 1. Typical subsurface irrigation system installation. (Ogletree)



Geoflow Design and Installation Manual - 2000B

18

Legend

- Property Line
- Existing Contours (1270)
- Silt Fence
- Flow Direction Arrow
- Construction Entrance

NOTES:

1. ALL BEST MANAGEMENT PRACTICES, SEDIMENT AND EROSION CONTROL DEVICES SHALL BE INSTALLED AND MAINTAINED THROUGHOUT THE PROJECT ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.
2. THE CONSTRUCTION EXIT SHALL BE INSTALLED PRIOR TO CONSTRUCTION BEGINNING.
3. ALL DISTURBED AREAS SHALL BE SEEDED OR SODDED.
4. THE STOCKPILED SOIL SHALL BE RINGED WITH SILT FENCE AND TEMPORARILY SEEDED.
5. REFER TO THE REVEGETATION REQUIREMENTS NOTES 1 THROUGH 4 FOR STABILIZATION PRACTICES FOR ALL DISTURBED AREAS. IF CONSTRUCTION IS NOT EXPECTED TO RESUME WITHIN 3 WEEKS ON AN UNFINISHED AREA, IT SHALL BE TEMPORARILY STABILIZED WITHIN 2 WEEKS.
6. THIS PLAN WAS CREATED AS A GUIDE FOR THE CONTRACTOR IN THE FIELD BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME. THE CONTRACTOR WILL BE REQUIRED TO ADJUST AND/OR ADD EROSION AND SEDIMENT CONTROL PRACTICES AS DEEMED NECESSARY IN THE FIELD. THESE CHANGES MUST BE DOCUMENTED ON THIS PLAN AS THEY ARE MADE IN THE FIELD WITH A REASON STATED FOR THE CHANGE, THE DATE, AND A SIGNATURE BY WHOM THE CHANGE WAS MADE. A CURRENT COPY OF THIS PLAN MUST BE KEPT ON SITE AT ALL TIMES.
7. THE EXISTING SURFACE WATERS ON THIS SITE CONSIST OF A POND THAT IS TO BE REMOVED.
8. DRIP IRRIGATION LINES ARE TO BE PLOWED INTO THE SOIL. THIS IS ACCOMPLISHED BY A PLOW THAT SPREADS THE SOIL, PLACES THE DRIP IRRIGATION LINE, AND PRESSES THE SOIL BACK TOGETHER. VERY LITTLE OF THE GRASS ROOTS ARE CUT AND THERE IS ALMOST NO SOIL DISTURBANCE, CONSEQUENTLY, THE SITE'S GRASS COVER WILL BE MAINTAINED DURING DRIP LINE INSTALLATION. THIS CONSTRUCTION PRACTICE WILL EFFECTIVELY LEAVE A VEGETATIVE BUFFER ACROSS THE SITE. SEE EXAMPLE PICTURE. THE SUPPLY LINES FOR THE DRIP IRRIGATION LINES WILL BE PLACED BY CONVENTIONAL TRENCHING METHODS; HOWEVER, BY MAINTAINING THE VEGETATIVE COVER, THIS WILL PROVIDE A NATURAL FILTER IN ADDITION TO THE PERIMETER EROSION CONTROL DEVICES AT THE DOWN SLOPE AND SIDE SLOPE BOUNDARIES.
9. DUE TO THE FACT THAT THIS SITE IS RELATIVELY FLAT AS SHOWN BY THE GRADES IN THE PLAN ABOVE AND NO STORM DRAINAGE SYSTEM IS BEING INSTALLED, THE SITE DOES NOT HAVE A SINGLE, CONCENTRATED POINT OF DISCHARGE. THIS SITE DRAINS BY SHEET FLOW ACROSS AND OFF THE SITE ON THE SOUTH AND WEST PROPERTY LINES. NO EROSIVE CONDITIONS ARE EXPECTED.
10. AS THE DISTURBED AREA FOR THIS PROJECT IS LESS THAN 10 ACRES AND SINCE THERE IS NO COMMON DRAINAGE LOCATION THAT SERVES 10 OR MORE DISTURBED ACRES ON THIS SITE, A TEMPORARY SEDIMENT BASIN IS NOT REQUIRED. SEDIMENT CONTROLS HAVE BEEN SHOWN AT ALL SIDE SLOPE AND DOWN SLOPE BOUNDARIES AS REQUIRED.
11. THE STOCKPILE AREA SHALL BE FINAL SEEDED FOLLOWING THE DISBURSEMENT OF THE STOCKPILED SOIL. THE MANNER OF INSTALLATION OF THE DRIP IRRIGATION LINES WILL MAINTAIN THE EXISTING SOIL STABILIZATION. THE TREATMENT AREA WILL BE STABILIZED WITH GRAVEL TO PREVENT EROSION AND INCREASE INFILTRATION. NO OTHER STABILIZATION MEASURES ARE ANTICIPATED TO BE NECESSARY. THE GRAVEL AND VEGETATION ON THE SITE WILL BE THE ONLY POST-CONSTRUCTION STORMWATER PRACTICES FOR THIS SITE.
12. THE POND SHALL BE DEWATERED PRIOR TO ANY OTHER EXCAVATION. AS THIS IS AN EXISTING STOCK POND WITH NO STOCK HAVING ACCESS TO IT FOR AT LEAST THE PAST YEAR, THE SOLID PARTICLES HAVE SETTLED. THEREFORE, THE WATER SHALL BE PUMPED OUT ONTO THE EXISTING GRASS SO THAT IT WILL SHEET FLOW ACROSS THE VEGETATED BUFFER BEFORE INFILTRATING OR FLOWING OFF THE SITE.

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STATE OF ARKANSAS — REGISTERED PROFESSIONAL ENGINEER — No. 11965 — LANCE D. JOBE — 9-1-06

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EROSION CONTROL PLAN
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EDA — Engineering Design Associates, P.A. — Consulting Engineering, Landscape Architecture
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Springdale, Arkansas 72764 Fax: (479) 756-2129

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DATE: 7-19-06
SCALE: 1"= 50'
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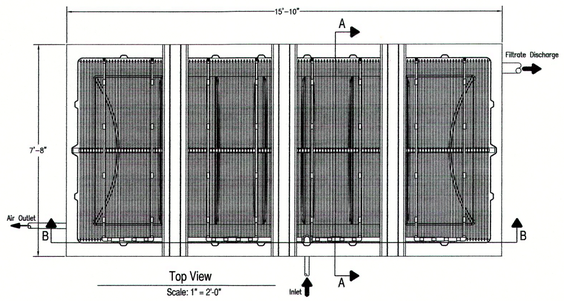
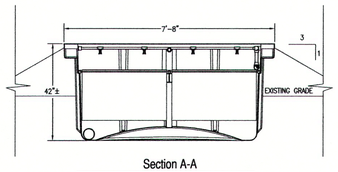
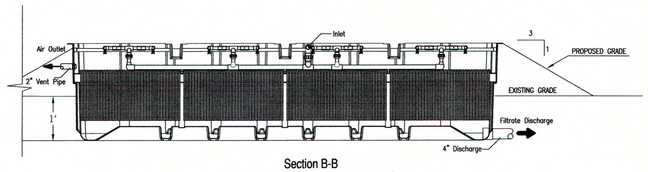


Top View
Scale: 1" = 2'-0"



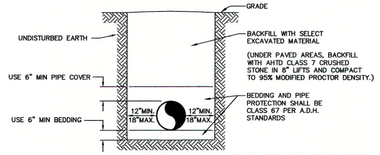
Section A-A
Scale: 1" = 2'-0"



Section B-B
Scale: 1" = 2'-0"

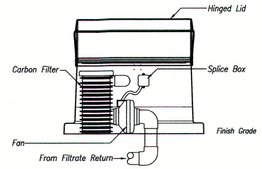
AdvanTex 100 System

(ALSO REFER TO MANUFACTURER'S INSTALLATION MANUAL FOR OTHER INFORMATION)

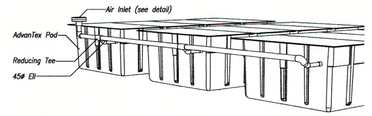


NOTE: 1) INSTALL 14 GAUGE TRACER WIRE AT ALL PVC & RC PIPES.

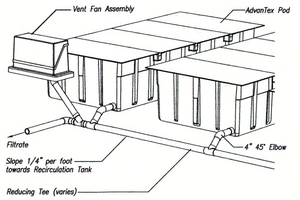
TRENCH/PIPE BEDDING DETAIL
N.T.S.



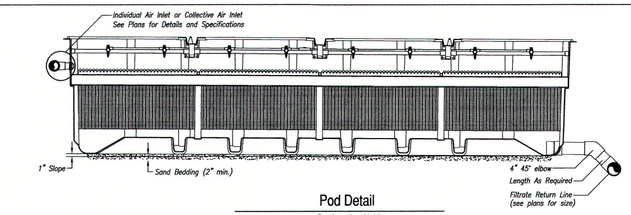
Above Ground Fan Assembly
Scale: 1" = 24"



Collective Air Inlet Option
Scale: NTS



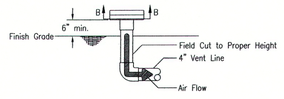
Filtrate Return Line Iso
NTS



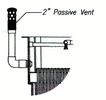
Pod Detail
Scale: 1" = 2'-0"



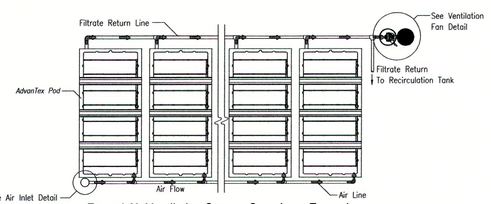
B-B



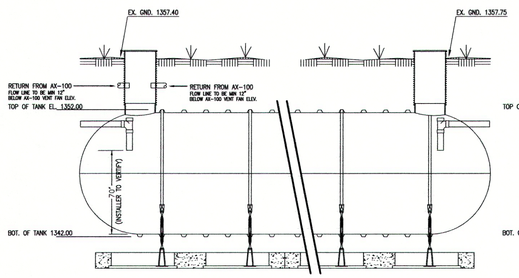
Air Inlet Detail
Scale: 1" = 2'-0"



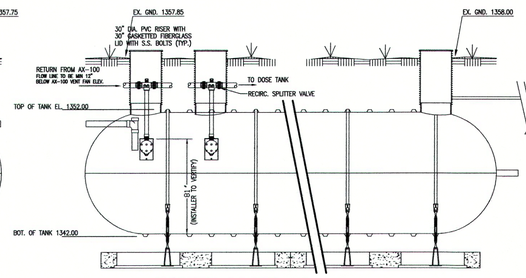
Passive Vent Option
NTS



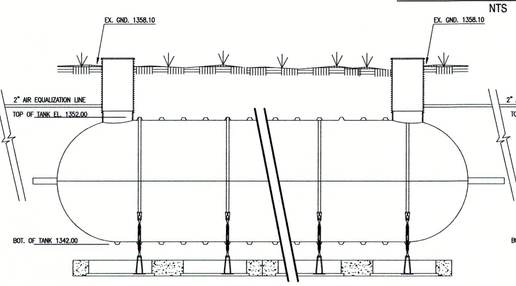
Forced Air Ventilation System Overview - Example
Scale: 1" = 8'-0"



BLEND TANK #1
10' DIAMETER
20,000 GALLON



RECIRCULATION TANK #3
10' DIAMETER
20,000 GALLON



RECIRCULATION TANK #5
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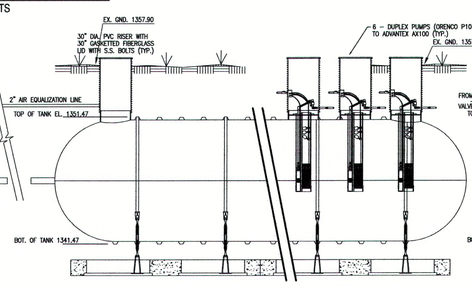
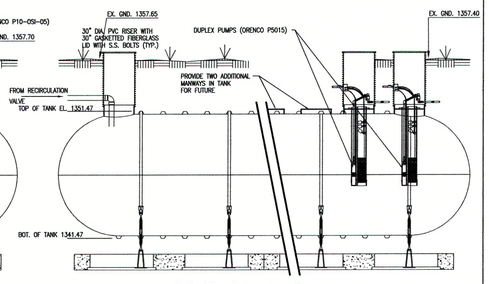
20,000 GALLON



ADVANTEX PUMP TANK #7
10' DIAMETER
20,000 GALLON



DOSE TANK #9
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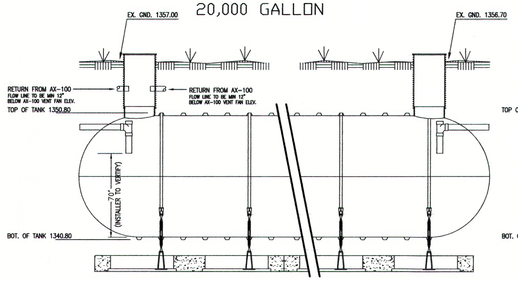

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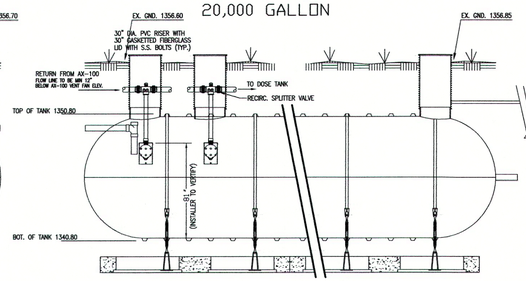

RECIRCULATION TANK #4
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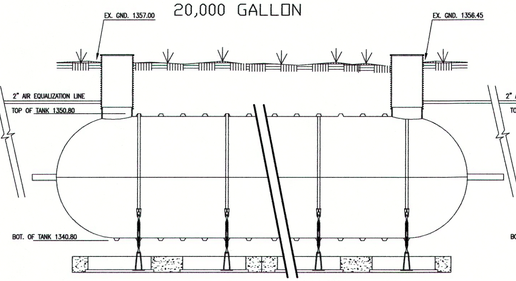

RECIRCULATION TANK #6
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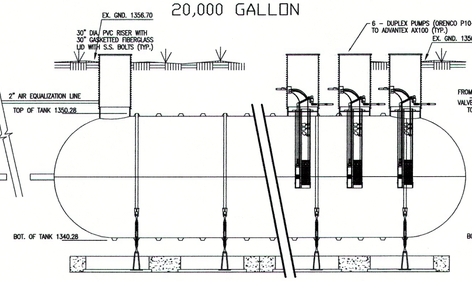

ADVANTEX PUMP TANK #8
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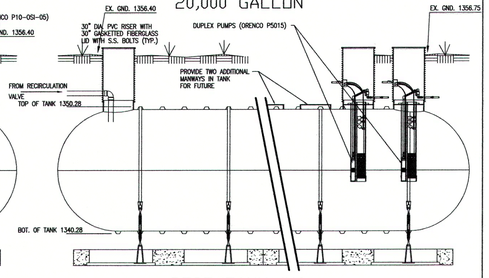
20,000 GALLON



DOSE TANK #10
10' DIAMETER
20,000 GALLON

FLOW TRAIN

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STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No. 8527 STEVE ALFRED HESSE

9-20-06

MISCELLANEOUS DETAILS

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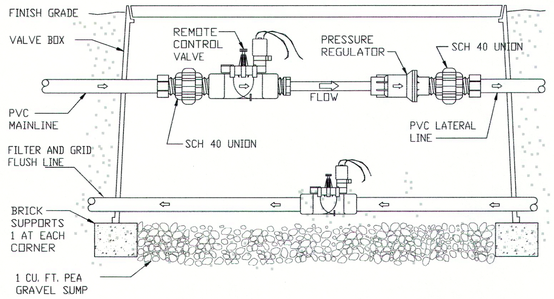
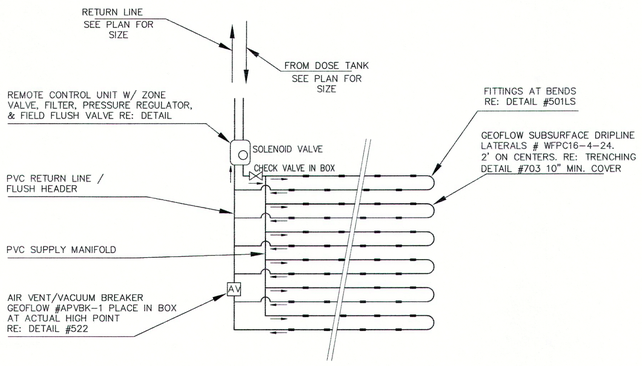


565B GEOFLOW SECTION — REMOTE CONTROL UNIT WITH ZONE VALVE, PRESSURE REGULATOR & FIELD FLUSH VALVE

Not To Scale

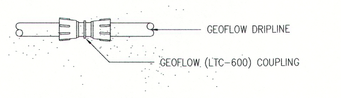


GEOFLOW TYPICAL LAYOUT FOR SINGLE ZONE WASTEFLOW PC DRIPLINE

NOT TO SCALE

REFER TO PLANS FOR ACTUAL DIMENSIONS

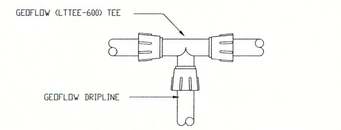
NOTES:
1). ALL PVC LINE TO BE SCHEDULE 40
2). MAXIMUM SLOPE NOT TO EXCEED 4" PER 100 FEET.
3) CONTRACTOR TO PROVIDE ALL WIRING REQUIRED FOR SOLENOID VALVES.



501LS GEOFLOW SECTION — LOCKSLIP COUPLING (LTC-600)

Not To Scale

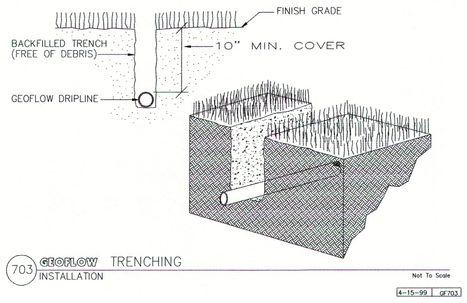
4-15-99 GF501LS



503LS GEOFLOW SECTION — LOCKSLIP TEE (LTTEE-600)

Not To Scale

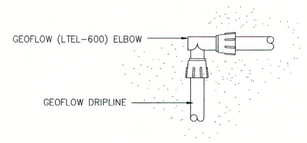
3-9-99 GF503LS



703 GEOFLOW INSTALLATION — TRENCHING

Not To Scale

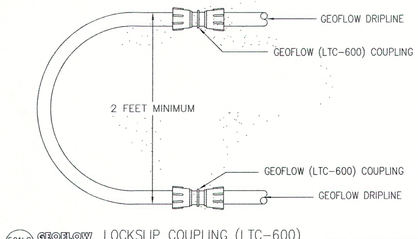
4-15-99 GF703



502LS GEOFLOW SECTION — LOCKSLIP ELBOW (LTEL-600)

Not To Scale

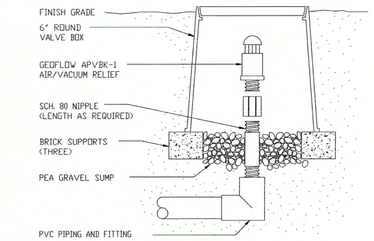
4-15-99 GF502LS



501LS A GEOFLOW SECTION — LOCKSLIP COUPLING (LTC-600)

Not To Scale

4-15-99 GF501LSA

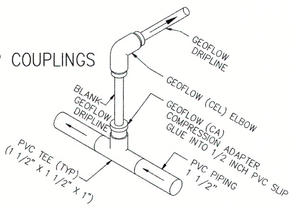


522 GEOFLOW SECTION — 1" AIR/VACUUM RELIEF (PLUMBED TO PVC)

Not To Scale

3-99-99 GF522

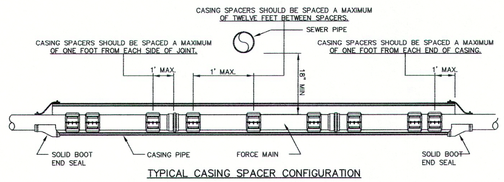
USE LOCKSLIP COUPLINGS



505 GEOFLOW SECTION — MANIFOLD / FLUSH HEADER CONNECTION (PVC TO ELBOW)

Not To Scale

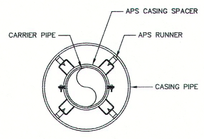
4-15-99 GF505A



TYPICAL CASING SPACER CONFIGURATION

NOTES:

1. SPACERS SHALL BE MANUFACTURED BY "ADVANCE PRODUCTS & SYSTEMS" AS SPECIFIED.
2. QUANTITY OF RUNNERS SHALL BE IN ACCORDANCE WITH CARRIER PIPE SIZE AS FOLLOWS:
   - TO 14" DIAMETER – 4 RUNNERS
   - 16" TO 36" DIAMETER – 6 RUNNERS
   - 38" TO 48" DIAMETER – 8 RUNNERS
3. DIMENSIONS BETWEEN SPACERS SHALL BE AS FOLLOW:
   - STAINLESS STEEL – 8 TO 12 FEET.
   - CARBON STEEL – 8 TO 12 FEET.
4. WIDTH OF SPACERS SHALL BE IN ACCORDANCE WITH CARRIER PIPE SIZE AS FOLLOWS:
   - TO 14" DIAMETER – 8" WIDTH
   - 18" AND LARGER DIAMETER – 12" WIDTH
5. A MINIMUM OF THREE SPACERS PER FULL JOINT OF PIPE.
6. WATER LINES SHALL BE "CENTERED" IN CASING.
7. ALL D.I. CARRIER PIPE MUST HAVE FIELD LOCK GASKETS INSTALLED WITHIN THE CASING PIPE.
8. CONTRACTOR TO VERIFY THAT ENCASEMENT PIPE IS LARGE ENOUGH TO CONTAIN THE CARRIER PIPE.
9. MAINTAIN 18" MINIMUM BETWEEN WATER AND SEWER MAINS.



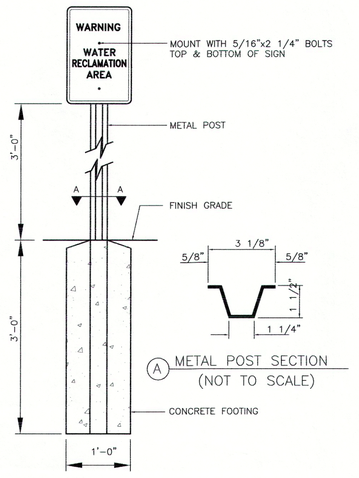
TYPICAL END VIEW

ENCASEMENT / CARRIER PIPE SIZING CHART

MAIN SIZE	ENCASEMENT PIPE
NOMINAL SIZE	NOMINAL SIZE
4"	8"
6"	12"
8"	16"
12"	20"
16"	24"
24"	36"

ALL ENCASEMENT PIPE SHALL BE NEW STEEL & HAVE A MINIMUM WALL THICKNESS OF .25

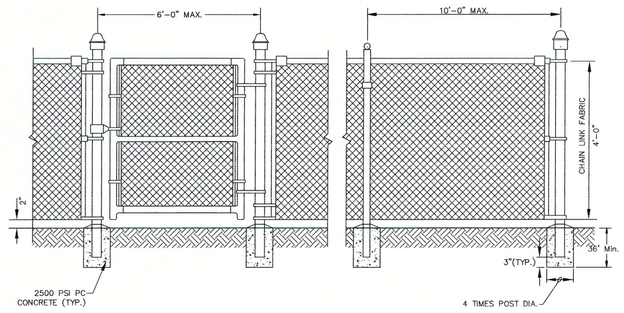
FORCE MAIN ENCASEMENT DETAILS



A METAL POST SECTION (NOT TO SCALE)

WARNING SIGN DETAIL

N.T.S.



SECURITY FENCE W/ GATE

N.T.S.

CERTIFICATE OF AUTHORIZATION — ENGINEERING DESIGN ASSOCIATES, P.A. No. 322 — ARKANSAS ENGINEER

STATE OF ARKANSAS — REGISTERED PROFESSIONAL ENGINEER — No. 8527 — STEVE ALFRED HESSE

6-18-07

MISCELLANEOUS DETAILS

PHASE 4 TREATMENT

BETHEL HEIGHTS, ARKANSAS

EDA Consulting Engineering Landscape Architecture
Engineering Design Associates, P.A.
134 West Emma Avenue (479) 756-1266
Springdale, Arkansas 72764 Fax: (479) 756-2129

DRAWN BY: BLW CHECKED BY: SAH

DATE: 7-6-05

SCALE: NONE

JOB NUMBER: 0950.2

FILE NAME: 0950 PH 4 DETAILS.DWG

DESCRIPTION:

SHEET DT-2

\\Server\Public\projects\0950_2\dwg\0950 PH 4 DETAILS.dwg 6/18/2007 8:44:37 AM CDT

Appendix J: Revised Drip Field Soil Loading Rates, Phase 1, 2, & 3

Revised Drip Field Soil Loading Rates

Phase 1			
Zone ID	*Zone Area (ft^2)	Loading Rate (gpd/ft^2)	Maximum Capacity (gpd)
1A	3894	0.26	1012.44
1B	4372	0.26	1136.72
1C	4548	0.26	1182.48
2A	4110	0.26	1068.6
2B	4244	0.26	1103.44
2C	4080	0.26	1060.8
3A	4080	0.26	1060.8
3B	4080	0.26	1060.8
3C	4524	0.26	1176.24
4A	4598	0.26	1195.48
4B	4178	0.26	1086.28
4C	4080	0.26	1060.8
	50,788.00		**13,205**

Phase 2				
Zone ID	Previous Zone ID	*Zone Area (ft^2)	Loading Rate (gpd/ft^2)	Maximum Capacity (gpd)
5A	1A	4200	0.46	1932
5B	1B	4200	0.46	1932
5C	1C	4200	0.46	1932
6A	2A	4200	0.46	1932
6B	2B	4200	0.46	1932
6C	2C	4200	0.46	1932
7A	3A	4200	0.46	1932
7B	3B	4200	0.46	1932
7C	3C	4200	0.46	1932
8A	4A	4200	0.46	1932
8B	4B	4200	0.46	1932
8C	4C	4200	0.46	1932
9A	5A	4200	0.46	1932
9B	5B	4200	0.46	1932
9C	5C	4200	0.46	1932
10A	6A	4200	0.46	1932
10B	6B	4480	0.46	2060.8
10C	6C	4200	0.46	1932
11A	7A	3360	0.46	1545.6
11B	7B	2880	0.46	1324.8
11C	7C	5040	0.46	2318.4
		87,160.00		**40,094**

Phase 3			
Zone ID	*Zone Area (ft^2)	Loading Rate (gpd/ft^2)	Maximum Capacity (gpd)
12A	4200	0.217	911.4
12B	4200	0.217	911.4
12C	4200	0.217	911.4
13A	4200	0.217	911.4
13B	4200	0.217	911.4
13C	4200	0.217	911.4
14A	4200	0.217	911.4
14B	4200	0.217	911.4
14C	4200	0.217	911.4
15A	4200	0.217	911.4
15B	4200	0.217	911.4
15C	4200	0.217	911.4
16A	4200	0.217	911.4
16B	4200	0.217	911.4
16C	4200	0.217	911.4
17A	4200	0.217	911.4
17B	4200	0.217	911.4
17C	4200	0.217	911.4
18A	4200	0.217	911.4
18B	4200	0.217	911.4
18C	4400	0.217	954.8
	88,400.00		**19,183**

Plant 1 - Phase 1,2 and 3 Total Dispersal = 72,481 gpd

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

Appendix K: Revised Drip Field Soil Loading Rates, Phase 4

Revised Drip Field Soil Loading Rates

Phase 4A					Phase 4B				
Zone ID	**Previous Zone ID	*Zone Area (ft^2)	Loading Rate (gpd/ft^2)	Maximum Capacity (gpd)	Zone ID	**Previous Zone ID	*Zone Area (ft^2)	Loading Rate (gpd/ft^2)	Maximum Capacity (gpd)
A1	1A	7200	0.4	2880	B1	3A	7200	0.4	2880
A2	*1A*	7200	0.4	2880	B2	*3A*	7200	0.4	2880
A3	1B	7200	0.4	2880	B3	3B	7200	0.4	2880
A4	*1B*	7200	0.4	2880	B4	*3B*	7200	0.4	2880
A5	1C	7200	0.4	2880	B5	3C	7200	0.4	2880
A6	*1C*	7200	0.4	2880	B6	*3C*	7200	0.4	2880
A7	1D	7200	0.4	2880	B7	3D	7200	0.4	2880
A8	*1D*	7200	0.4	2880	B8	*3D*	7200	0.4	2880
A9	2A	7200	0.4	2880	B9	4A	7200	0.4	2880
A10	*2A*	7200	0.4	2880	B10	*4A*	7200	0.4	2880
A11	2B	7200	0.4	2880	B11	4B	7200	0.4	2880
A12	*2B*	7200	0.4	2880	B12	*4B*	7200	0.4	2880
A13	2C	7200	0.4	2880	B13	4C	7200	0.4	2880
A14	*2C*	7200	0.4	2880	B14	*4C*	7200	0.4	2880
A15	2D	7200	0.4	2880	B15	4D	7200	0.4	2880
A16	*2D*	7200	0.4	2880	B16	*4D*	7200	0.4	2880
		115,200.00		**46,080.00**			**115,200.00**		**46,080.00**

Plant 2 - Phase 4A and 4B Total Dispersal = 92,160 gpd

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

** *Italicized* zones were previously combined with there unitalicized counterpart, overall area remains unchanged

Appendix L: Bethel Heights Treatment Plants: Record Plans

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:

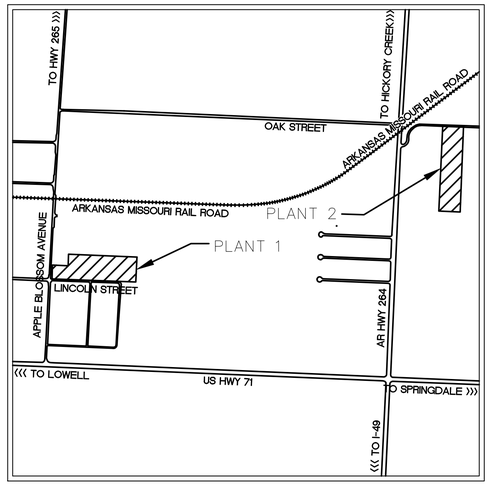
CITY HALL
530 SUNRISE DRIVE
BETHEL HEIGHTS, AR 72764
479-751-7481

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



Vicinity Map

Not to Scale

INDEX	SHEET
Overall Site	C101
Plant 1 Drip Fields	C102
Plant 2 Drip Fields	C103
Plant 1	C104
Plant 2	C105

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.

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

RECORD DRAWING

DRAWN BY:	CLP	CHECKED BY:	JRG	DATE	#	REVISION DESC.
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JOB NUMBER:			2114			

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COVER

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

COVER



PLANT 1 AND 2

300 0 300 600
300 SCALE GRAPHIC SCALE IN FEET

RECORD DRAWING

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OVERALL SITE

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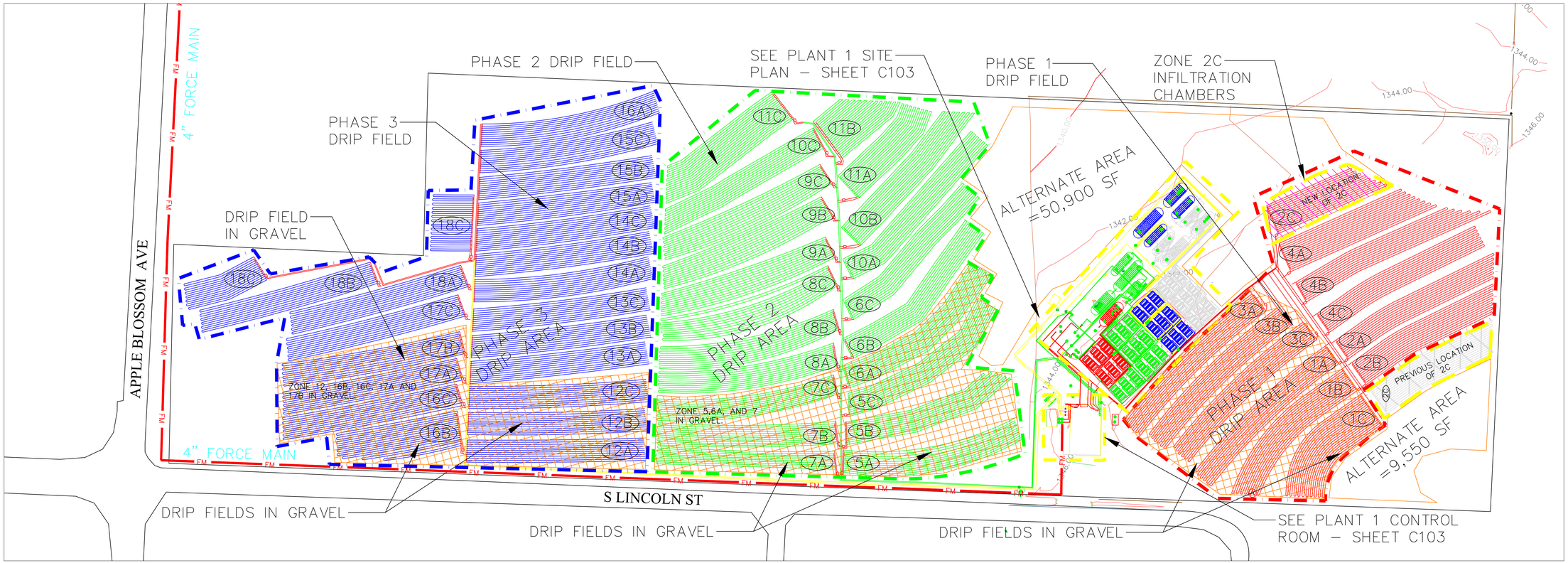
BETHEL HEIGHTS, AR

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

C101



PLANT 1 DRIP FIELDS

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

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
1342.00	Contours
	Phase 1 Drip Field
	Phase 2 Drip Field
	Phase 3 Drip Field
	Drip Field in Chambers
	Graveled Drip Field

Notes:

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50 0 50 100
50 SCALE GRAPHIC SCALE IN FEET

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

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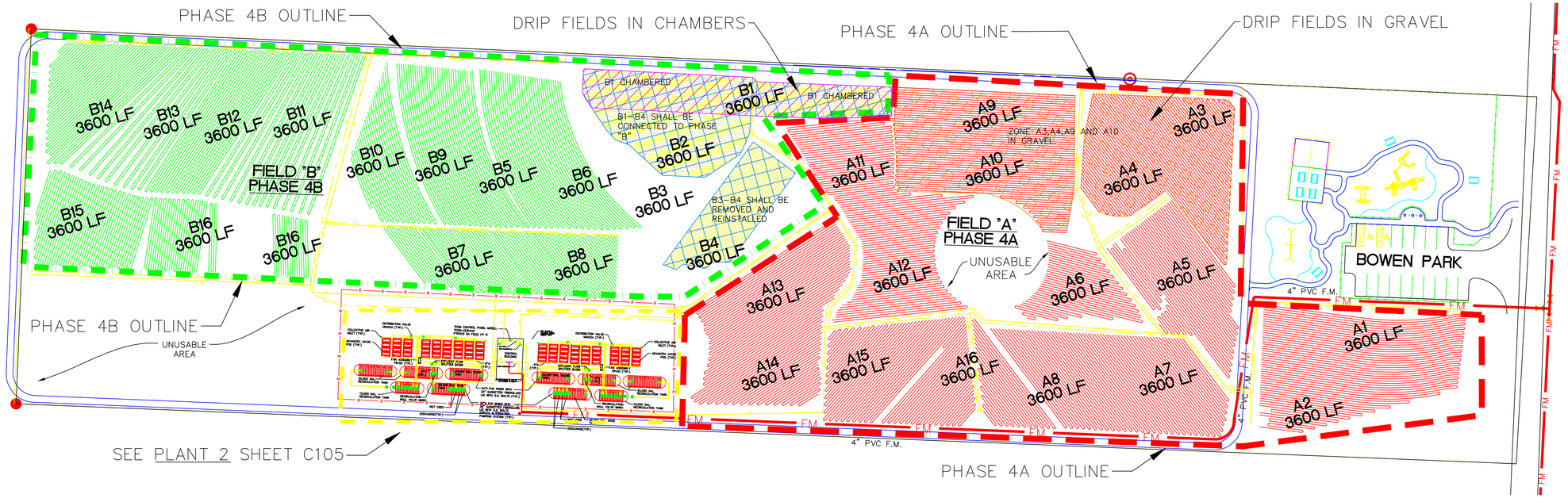
C102



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:

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50 0 50 100
50 SCALE GRAPHIC SCALE IN FEET

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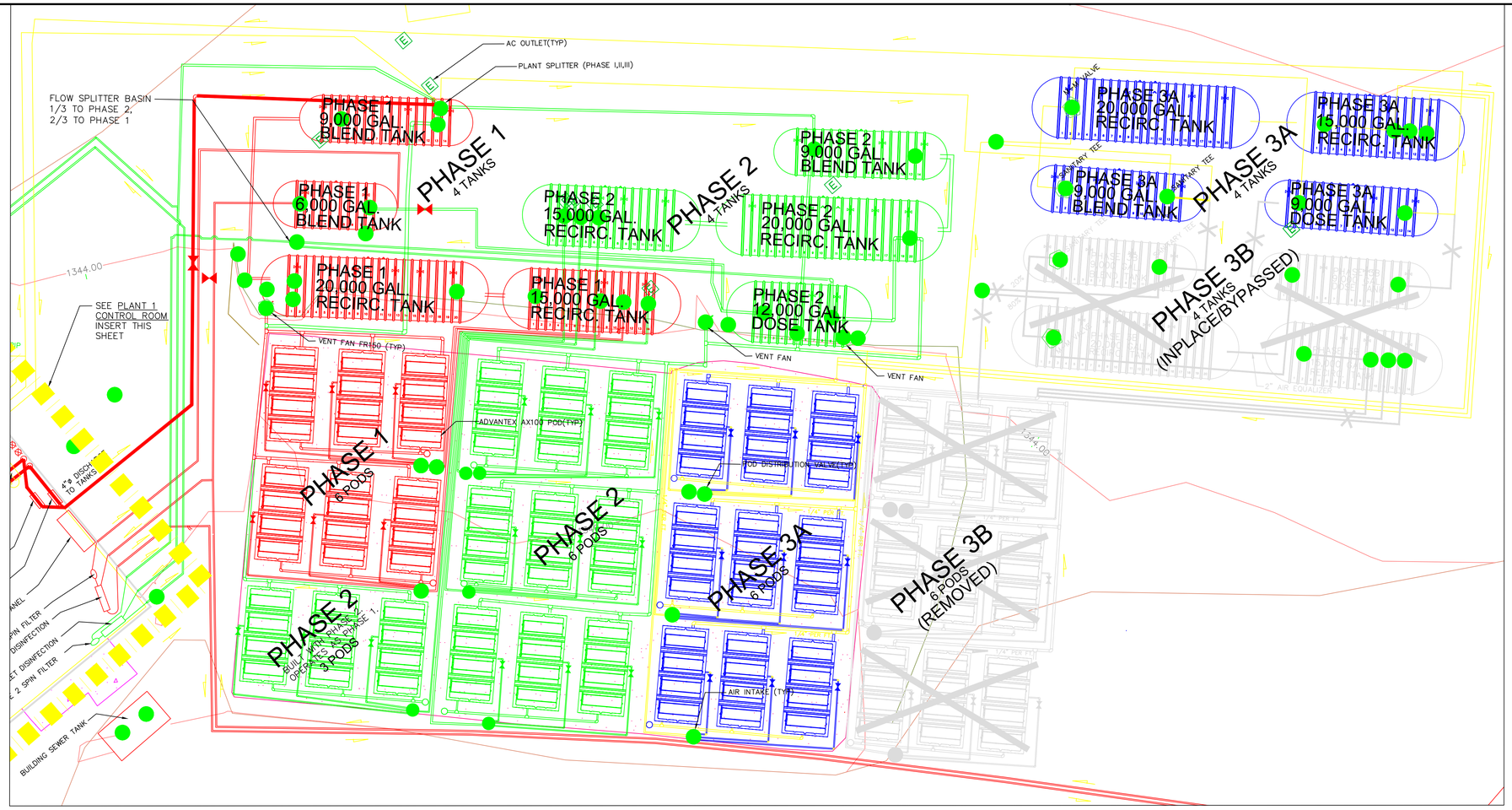
No. 322
ARKANSAS ENGINEER

PHASE 4A AND 4B 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

C103

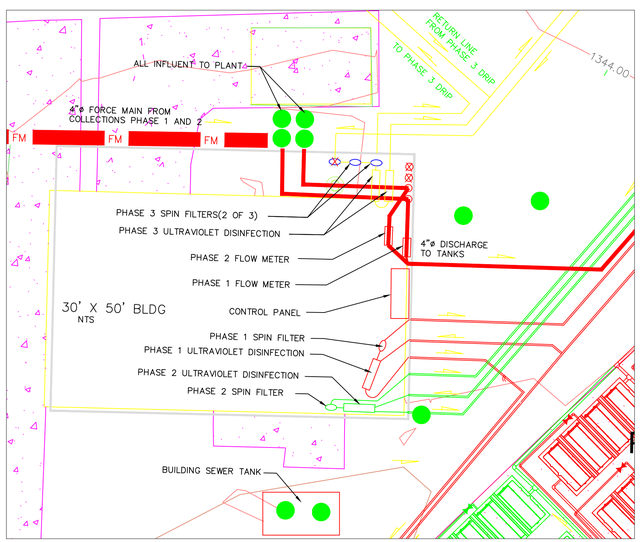


PLANT 1 TANKS AND PODS

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

Legend

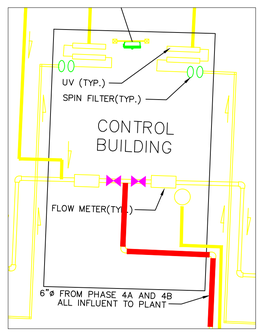
- Flow Direction
- Access Lid
- Electric Outlet Riser
- Valve
- Contours (1342.00)
- See Insert Outline
- Collections Phase 1 and 2 Raw Discharge From Control Room To Tanks
- FM — Force Main Phase 1 and 2 From Collections to Plant
- Phase 1 Pipe and Structures
- Phase 2 Pipe and Structures
- Phase 3A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



PLANT 1 - CONTROL ROOM

Legend

- Flow Direction
- Access Lid
- Abandon Influent Conduit
- Phase 1 and 2 Influent Conduit through Floor
- Contours (1342.00)
- Phase 1 Pipe
- Phase 2 Pipe
- Phase 3 Pipe
- Phase 3B (Removed or Bypassed)
- FM — 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.

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JOB NUMBER:	2114		

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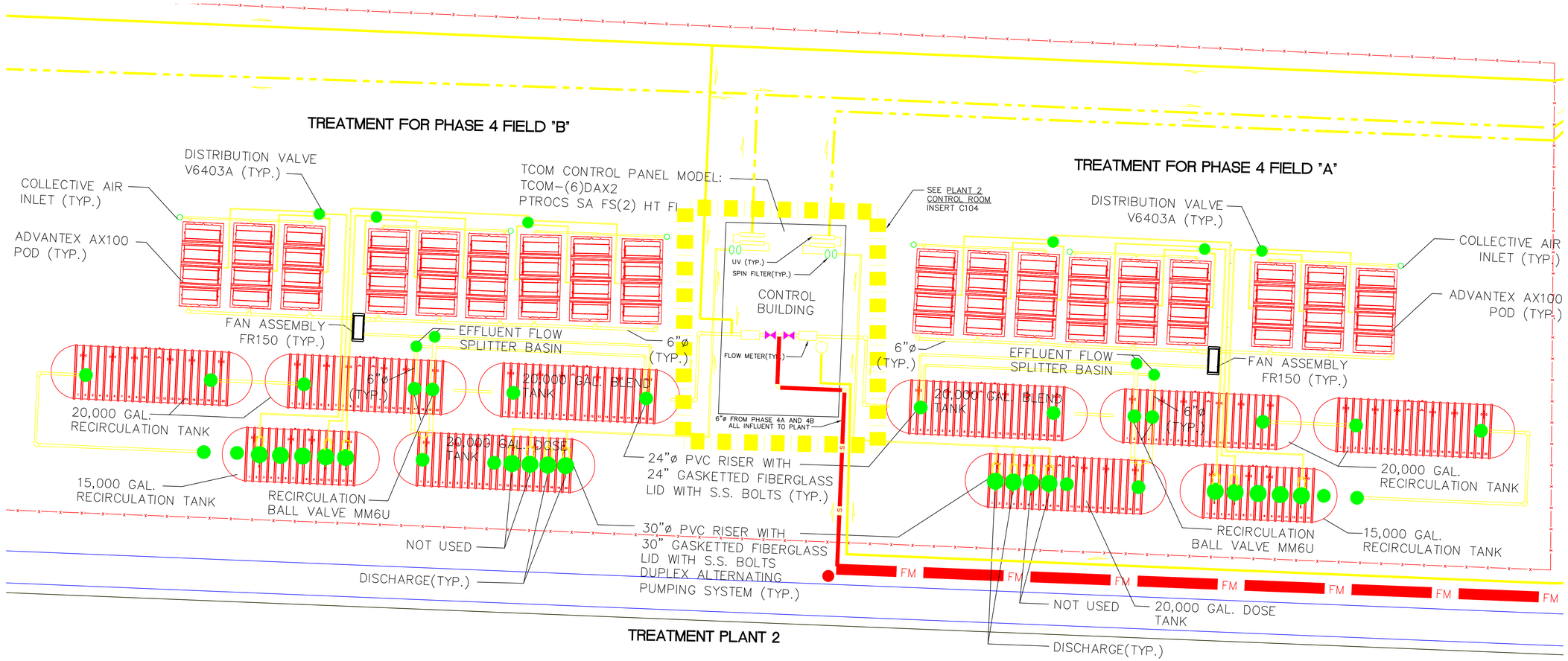
EARTHPLAN DESIGN ALTERNATIVES, P.A.
No. 322
ARKANSAS ENGINEER

PLANT 1
TREATMENT FACILITIES
BETHEL HEIGHTS, AR

Earthplan Design Alternatives, PA
Civil Engineering / Landscape Architecture
(479) 756-1266
(479) 756-1270
Fax: (479) 750-2070
www.edpa.com
134 West Emma Avenue
Springdale, Arkansas 72764

C104



PLANT 2 TANKS AND PODS

5576 N OAK ST
BETHEL HEIGHTS, AR

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)

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.

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10 SCALE GRAPHIC SCALE IN FEET

RECORD DRAWING

DATE	#	REVISION DESC.

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PLANT 2
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Appendix M: Bethel Heights Treatment Plants: Interim Operating Plans

BETHEL HEIGHTS TREATMENT PLANTS

Waste Water Treament Facilities Interim Operations Plan

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
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479-439-9929
PLS 1845
matt@jsnwa.com

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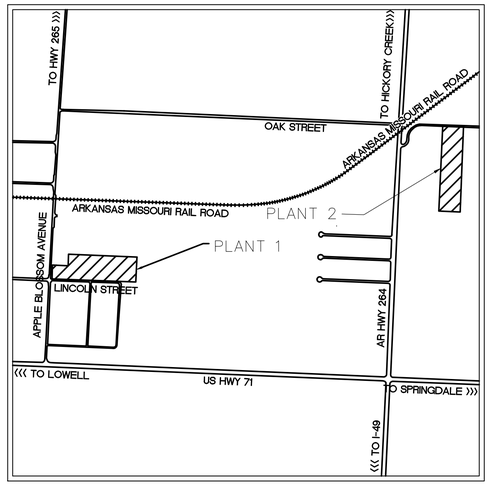

Vicinity Map

Not to Scale

INDEX

	SHEET
Phase 1,2 and 3 Drip Fields	IOP1
Phase 4A and 4B Drip Fields	IOP2

INTERIM OPERATING PLAN

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

#	REVISION DESC.	DATE

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COVER

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IOP COVER

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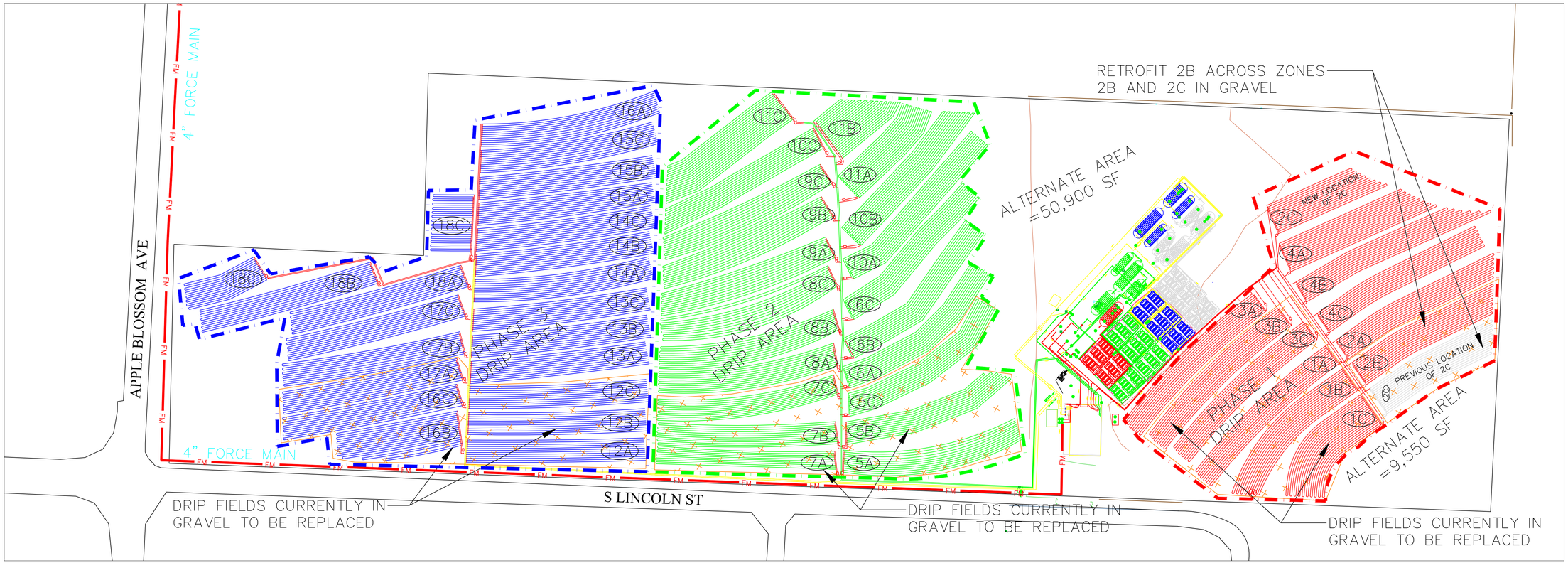

PLANT 1 DRIP FIELDS

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

Revised Drip Field Soil Loading Rates

Phase 1				Phase 2					Phase 3			
Zone ID	*Zone Area (ft^2)	Loading Rate (gpd/ft^2)	Maximum Capacity (gpd)	Zone ID	Previous Zone ID	*Zone Area (ft^2)	Loading Rate (gpd/ft^2)	Maximum Capacity (gpd)	Zone ID	*Zone Area (ft^2)	Loading Rate (gpd/ft^2)	Maximum Capacity (gpd)
1A	3894	0.26	1012.44	5A	1A	4200	0.46	1932	12A	4200	0.217	911.4
1B	4372	0.26	1136.72	5B	1B	4200	0.46	1932	12B	4200	0.217	911.4
1C	4548	0.26	1182.48	5C	1C	4200	0.46	1932	12C	4200	0.217	911.4
2A	4110	0.26	1068.6	6A	2A	4200	0.46	1932	13A	4200	0.217	911.4
2B	4244	0.26	1103.44	6B	2B	4200	0.46	1932	13B	4200	0.217	911.4
2C	4080	0.26	1060.8	6C	2C	4200	0.46	1932	13C	4200	0.217	911.4
3A	4080	0.26	1060.8	7A	3A	4200	0.46	1932	14A	4200	0.217	911.4
3B	4080	0.26	1060.8	7B	3B	4200	0.46	1932	14B	4200	0.217	911.4
3C	4524	0.26	1176.24	7C	3C	4200	0.46	1932	14C	4200	0.217	911.4
4A	4598	0.26	1195.48	8A	4A	4200	0.46	1932	15A	4200	0.217	911.4
4B	4178	0.26	1086.28	8B	4B	4200	0.46	1932	15B	4200	0.217	911.4
4C	4080	0.26	1060.8	8C	4C	4200	0.46	1932	15C	4200	0.217	911.4
	50,788.00		**13,205**	9A	5A	4200	0.46	1932	16A	4200	0.217	911.4
				9B	5B	4200	0.46	1932	16B	4200	0.217	911.4
				9C	5C	4200	0.46	1932	16C	4200	0.217	911.4
				10A	6A	4200	0.46	1932	17A	4200	0.217	911.4
				10B	6B	4480	0.46	2060.8	17B	4200	0.217	911.4
				10C	6C	4200	0.46	1932	17C	4200	0.217	911.4
				11A	7A	3360	0.46	1545.6	18A	4200	0.217	911.4
				11B	7B	2880	0.46	1324.8	18B	4200	0.217	911.4
				11C	7C	5040	0.46	2318.4	18C	4400	0.217	954.8
						87,160.00		**40,094**		**88,400.00**		**19,183**

Plant 1 - Phase 1,2 and 3 Total Dispersal = 72,481 gpd

* 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:

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INTERIM OPERATING PLAN

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

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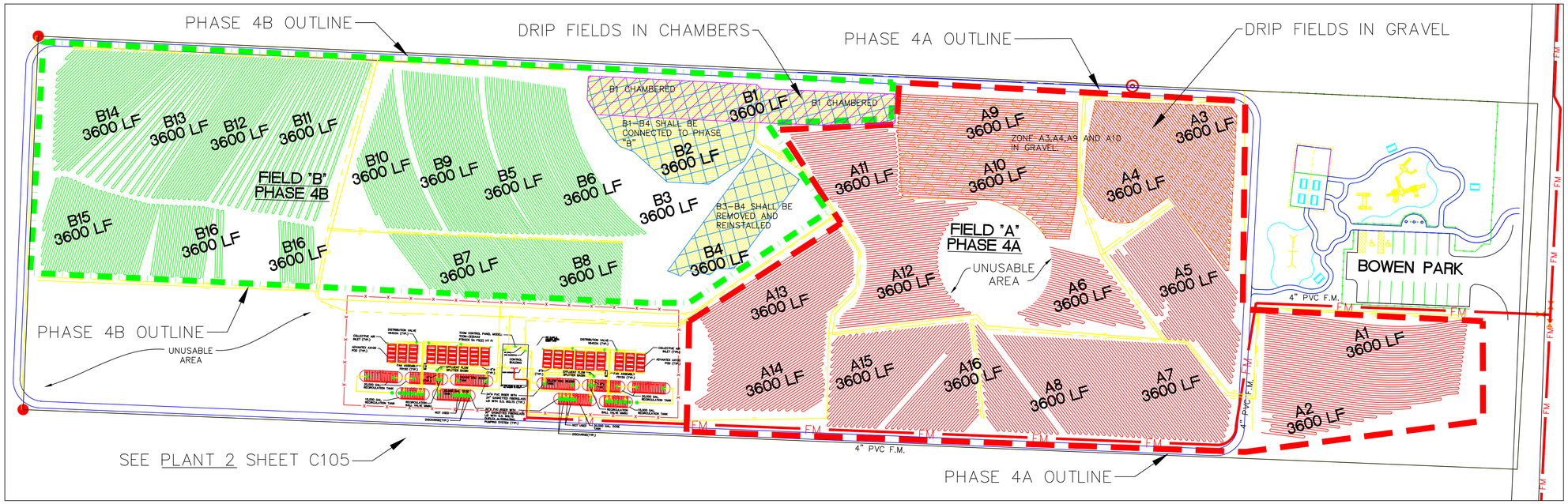

PLANT 2 DRIP FIELDS

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

Revised Drip Field Soil Loading Rates

Phase 4A					Phase 4B				
Zone ID	**Previous Zone ID	*Zone Area (ft^2)	Loading Rate (gpd/ft^2)	Maximum Capacity (gpd)	Zone ID	**Previous Zone ID	*Zone Area (ft^2)	Loading Rate (gpd/ft^2)	Maximum Capacity (gpd)
A1	1A	7200	0.4	2880	B1	3A	7200	0.4	2880
A2	*1A*	7200	0.4	2880	B2	*3A*	7200	0.4	2880
A3	1B	7200	0.4	2880	B3	3B	7200	0.4	2880
A4	*1B*	7200	0.4	2880	B4	*3B*	7200	0.4	2880
A5	1C	7200	0.4	2880	B5	3C	7200	0.4	2880
A6	*1C*	7200	0.4	2880	B6	*3C*	7200	0.4	2880
A7	1D	7200	0.4	2880	B7	3D	7200	0.4	2880
A8	*1D*	7200	0.4	2880	B8	*3D*	7200	0.4	2880
A9	2A	7200	0.4	2880	B9	4A	7200	0.4	2880
A10	*2A*	7200	0.4	2880	B10	*4A*	7200	0.4	2880
A11	2B	7200	0.4	2880	B11	4B	7200	0.4	2880
A12	*2B*	7200	0.4	2880	B12	*4B*	7200	0.4	2880
A13	2C	7200	0.4	2880	B13	4C	7200	0.4	2880
A14	*2C*	7200	0.4	2880	B14	*4C*	7200	0.4	2880
A15	2D	7200	0.4	2880	B15	4D	7200	0.4	2880
A16	*2D*	7200	0.4	2880	B16	*4D*	7200	0.4	2880
		115,200.00		**46,080.00**			**115,200.00**		**46,080.00**

Plant 2 - Phase 4A and 4B Total Dispersal = 92,160 gpd

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

** *Italicized* zones were previously combined with there 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

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