<u>Revised</u> Design Development Report (DDR)

(Revised per Dominic Weatherill comments from October 27, 2008)

Chris Mote's Pumping Service

RECEIVED

NOV 14 2008

P.O. Box 3110
Cleveland, Georgia 30528

Septage and Grease Trap Waste LAS

November 11, 2008

GEORGIA REGISTERED No. 10751 PROFESSIONAL ENGINEER BRIAN A. RINDT
11-11-08

prepared by

RMA

Rindt-McDuff Associates, Inc. • 334 Cherokee Street, Marietta, GA 30060 • t: (770) 427-8123 • f: (770) 425-8930
www.rindt-mcduff.com • e-mail: info@rindt-mcduff.com

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RMA Rindt-McDuff Associates, Inc.
Engineering and Environmental Consulting

November 11, 2008

Mr. Dominic Weatherill, Manager
Industrial Wastewater Unit
Georgia Environmental Protection Division
4220 International Pkwy., Suite 101
Atlanta, GA 30354

Re: Revised Design Development Report (DDR)
Chris Mote's Pumping Service LAS
15,000 gpd
White County, Georgia

Dear Dominic:

Please find enclosed herewith two copies of the Design Development Report for Chris Mote's Pumping Service LAS revised in accordance with you review comments of October 27, 2008. I have included revised versions of the DDR with the exception of the Appendices which remain the same, except for Bob Kendall Soils Report which has been in the revised DDR document.

Comment No. 1: An irrigation flow meter with totalizer will be installed on the irrigation line. An accurate log will be maintained with regard to the daily quantity of treated wastewater that will be sprayed applied to each irrigation zone. See DDR revised Figure 2.

Comment No. 2: The locations of the requested monitoring wells are shown on DDR revised Figure 5.

Comment No. 3: Sludge will be sent to a landfill.

Comments Nos. 4 and 5: These comments related to the nitrogen balance shown as Table 6 in the Bob Kendall Soils Report. This spread sheet has been revised by Mr. Kendall, as follows: (a) Ammonia Volatilization @ 5%; (b) Denitrification @ 20%; and (c) Plant uptake and storage @ 200 lb/ac-yr. (Note: the EPD "Guidelines" allow 303 lb/ac-yr for "Mixed Hardwoods." Table 6 has been revised to reflect these new values. As can be seen, the "Nitrate-Nitrogen in Percolate" is predicted to be 6.79 mg/l.

Comment No. 6: The design application rate (as shown in the original DDR) is 0.59 in/wk (See sections 4.0 and 5.1.) 35,000 gal/wk x 3 zones = 105,000 gal/wk total. 105,000 gal/wk over 6.6 acres is equal 0.59 in/wk.

Comment No. 7: All required buffer zones will be observed. Disinfection with hypochlorite will be provided in the treated effluent holding tank.

Comment No. 8: Please find attached the completed LAS permit application.

Comment No. 9: An O&M Manual will be prepared as requested.

Please let me know if you have any questions.

Very truly yours,

RINDT-MCDUFF ASSOCIATES, INC.

Brian A. Rindt. P.E.
Principal

Atts:

C: Chris Mote

Georgia Department of Natural Resources
Environmental Protection Division, Watershed Protection Branch
4220 International Parkway, Suite 101, Atlanta, Georgia 30354
Permitting, Compliance and Enforcement Program
404/362-2680
FAX: 404/362-2691

October 27, 2008

Mr. Brian A. Rindt, P.E.
Rindt-McDuff Associates, Inc.
334 Cherokee Street
Mariette, Georgia 33360

RE: Chris Mote's Pumping Service LAS.
Design Development Report
Cleveland, White County

Dear Mr. Rindt:

We are in the process of reviewing the Design Development Report (DDR) submitted for the above referenced facility in White County. Comments generated during our review appear in the attachment. Within 60 days, please address all of the comments in the attachment by revising the DDR and the submittal of a permit application. If you have any questions, please contact me at (404) 362-2680.

Sincerely,

D. Weatherill

Dominic Weatherill, Manager
Industrial Wastewater Unit
Permitting Compliance and Enforcement Program

DJW/jrkm

CC:

ATTACHMENT
Design Development Report
Chris Mote's Pumping Service, Inc.

1. Rather than relying on pump run times, a flow totalizing recorder needs to be installed at the irrigation pump station to accurately measure the volume of wastewater applied to each ofthe spray fields.

2. The location of the groundwater monitoring wells need to be finalized. One well upgradient, outside of the influence of the land treatment site, must be installed. One well within the wetted field area and, at a minimum, two wells downgradient of the wetted field area must also be installed. The downgradient wells should be "boundary" wells.

3. The LAS permit will not allow composting of sludge on site. A solid waste permit will be needed or the material must be sent to a landfill.

4. On Table 6, page 17, Nitrogen Balance, an ammonia loss of 50 percent was used in the calculations. We generally assume losses to ammonia volatization should not exceed 5%. Using a 5% ammonia loss the estimated nitrogen percolate is increased to approximately 10 mg/l, thereby putting in doubt the feasiblilty of installing a land application system. Please review calculation and revise the table accordingly.

5. On Table 6, denitrification is projected to be 10% of Total Nitrogen Applied. This is some what conservative, as we have generally allowed 20% for mixed hardwoods. Is the more conservative designed value to be used?

6. The DDR indicates that average design application rate is 0.25 in/wk. and only 35,000 gallons per week, per spray zone will be applied. How does the facility intend to operate the land application system so that this rate is not exceeded. What will be the instantaneous wastewater application rate (inches/hr.)

7. Because of the proximity of residences in the area, the buffer zone requirements present in the DDR are to be strictly enforced. In addition, we will require disinfection to achieve a fecal coliform limit of 200 MPN/100ml.

8. Enclosed is an LAS permit application that needs to be completed and submitted.

9. An Operations Manual (OM) will need to be developed and submitted before operations begin.

APPLICATION FOR PERMIT TO DISCHARGE TO A LAND DISPOSAL OR LAND TREATMENT SYSTEM

APPLICATION NUMBER ____________

DATE RECEIVED ____________

To be filed only by land disposal facility/owner

FOR DIVISION USE

YEAR MO. DAY

Please read the accompanying instructions.

Please print or type

1. Name of organization responsible for facility
   Chris Mote's Pumping Service, Inc.

2. Address, location, and telephone number of all pretreatment facilities

   A. Mailing address:
      1. Street address P.O. Box 3110 (Paradise Valley Rd.)
      2. City Cleveland 3. County White
      4. State Georgia 5. Zip 30528

   B. Location: Attach detailed location map
      1. Street Paradise Valley Rd.
      2. City Cleveland 3. County White
      4. State Georgia

   C. Telephone No. 706-865-5526
      Area Code mobile: 706-530-2034

3. Specify the pretreatment units for each discharge to the land disposal site(s):

   screen, 30,000 gallon holding, chemical feed (caustic, coagulant, polymer), phase separator, 60,000 gallon activated sludge tank, blower, 30,000 gallon treated water holding tank, spray pumping, effluent flow metering.

4. Design flow (average daily) of facility 15,000 gpd.

5. Number of separate land disposal sites. one site – three zones
A.1 B.2 C.3 D.4 E.5 F.6 or more

6. Number of separate holding ~~ponds~~ tanks 3 and the capacity of each:
A. 30,000 gallons B. 60,000 gallons C. 30,000 gallons

7. Design hydraulic loading rate for each site: A. 0.59 inches/week
B. 0.59 inches/week C. 0.59 inches/week D. ______ inches/week
E. ______ inches/week

8. Design application rate for each site: A. 0.13 inches/hour,
B. 0.13 inches/hour, C. 0.13 inches/hour, D. ______ inches/hour
E. ______ inches/hour.

9. Attach map that includes numerical identification of all groundwater monitoring wells and location and defines the boundaries of the site(s). Groundwater monitoring wells should be identified by the following symbols: Background wells B1, B2, B3, etc; On site wells O1, O2, O3, etc; Perimeter wells P1, P2, P3, etc.
General Description: see attached Figure 5. MW-B1 (background placed west of LAS site upgradient); MW-P1 and MW-P2 placed downgradient of spray zones; MW-O1 placed within zone 3

10. Description of groundwater monitoring wells: see #9, above.

11. List types of industrial wastewaters in the system including S.I.C. codes and volume of wastewater discharged.
Septic Tank pump out (67%); Grease trap pump out (33%)

12. Type of collection sewer system: Hauled wastes

_____ A. Separate sanitary

_____ B. Combined sanitary and storm

_____ C. Both separate and combined sewer systems

I certify that I am familiar with the information contained in the application and that to the best of my knowledge and belief such information is true, complete, and accurate.

Chris Mote

Printed Name of Person Signing

Owner

Title

11-11-08

Date Application Signed

Chris Mote

Signature of Applicant

False Statements

Any person who knowingly makes any false statements, representation or certification on this application may be punished by a fine of not more than $10,000 or by imprisonment for not more that six months, or both. Georgia Water Quality Control Act, Section 22, Penalty for Violation of Act. (Acts 1964, pp. 416,433; 1974, pp. 599, 607.)

Introduction

This Revised Design Development Report (DDR) is submitted with regard to a proposed Land Application System (LAS) for the treatment and disposal of hauled septic tank and grease trap wastes by Chris Mote's Pumping Service ("Chris Mote") in White County, Georgia.

Chris Mote owns and operates a septic tank and grease trap pumping service located in White County, Georgia. In recent years, access to disposal facilities for septic tank and grease trap wastes has become problematic in the White County area. Chris Mote owns 25.09 acres of land approximately 4 miles northwest of Cleveland, Georgia. Chris Mote desires to locate an LAS system on this land capable of treating 15,000 gallons per day (gpd) of hauled septic tank and grease trap wastes.

This DDR was reviewed by EPD with nine comments provided on October 27, 2008. This Revised DDR incorporates the responses to the EPD comments. The EPD comments and responses have been summarized in the cover letter at the front of this report.

1.0 Site Description

The Site utilized for spray irrigation is located on the southeastern portion of the Chris Mote property as shown on Figure 5.

1.1 Location

The Site location map is shown as Figure 1. (See Section B.1.1 of the attached soils report from Kendall & Associates, Inc.)

1.2 Climate

(See Section B.1.2 of the attached soils report from Kendall & Associates, Inc.)

1.3 Geology and Groundwater

(See Section B.1.3 of the attached soils report from Kendall & Associates, Inc.)

1.4 Topography

(See Section B.1.4 of the attached soils report from Kendall & Associates, Inc.)

1.5 Access

(See Section B.1.5 of the attached soils report from Kendall & Associates, Inc.)

1.6 Water supply wells

(See Section B.1.6 of the attached soils report from Kendall & Associates, Inc.)

2.0 **Drawings** (See attached drawings, Figures 2, 3, 4 and 5)

2.1 Preapplication Treatment Facility

The proposed pretreatment facility is shown in schematic form in Figure 2, in site plan form in Figure 3, and in mass balance form in Figure 4.

The proposed spray irrigation field is shown on a 2 foot contour survey prepared by TerraMark Land Surveying shown as Figure 5. The soil boring and proposed monitoring well locations are shown on Figure 5, herein. The soil boring locations are also shown on Figure 6 in the Kendall& Associates soils report.

3.0 **Design Wastewater Characteristics**

Figure 4 shows the constituent mass balance for the treatment system.

3.1 Average and Peak Daily Flows

The system design will be for 15,000 gallons per day of hauled septic tank and grease trap wastes. It is anticipated that the 15,000 gallons per day will consist of 10,000 gpd of septic tank wastes and 5,000 gpd of grease trap wastes. These flow rates will be controlled by the delivery of the wastewater such that the design flow rate of 15,000 gpd will never be exceeded.

1. Biochemical Oxygen Demand (BOD)

The BOD from grease trap wastes is 75,000 mg/l, and the BOD from septic tank wastes is 5,000 mg/l. As can be seen from Figure 4, the aggregate influent BOD is 28,333 mg/l. However, 75% of the BOD at this point may be attributed to the suspended solids. Once the suspended have been removed in the phase separator, the BOD is projected to be 7,833 mg/l, or, at 14,000 gpd, 827 lb/day. The BOD will be treated by activated sludge in a 60,000 gallon above-ground, steel tank. At a working volume of 58,000 gallons, the hydraulic retention time (HRT) in the activated sludge tank will be 99 hours or 4.1 days. The unit BOD loading will be 107 lb/1,000 cu ft. Projected MCRT is 14.5 days. The estimated air requirement is 574 cfm. The BOD following activated sludge treatment will be less than 50 mg/l.

2. Total Suspended Solids (TSS)

The TSS from grease trap wastes is 100,000 mg/l, and the TSS from septic tank wastes is 15,000 mg/l. As can be seen from Figure 4, the aggregate influent TSS is 43,333 mg/l. However, 95% of the TSS will be removed by the phase separator. Once the suspended have been removed in the phase separator, the TSS is projected to be 2,167 mg/l, or, at 14,000 gpd, 253 lb/day.

3.4 Ammonia Nitrogen, Total Kjeldahl Nitrogen , Nitrate and Nitrite

Figure 6 shows actual ammonia measurements on eight loads of Chris Mote's hauled wastes. The average ammonia value is 53.3 mg/l, say 55 mg/l. Based on the influent TSS being 0.2% nitrogen, the influent TKN is estimated to be 55 + (43,333 x 0.002) = 142 mg/l. Nitrates and nitrites will be less than 1 mg/l.

Once the TSS have been removed by the phase separator, the TKN will drop to 60 mg/l, and the ammonia will remain at 55 mg/l.

During the activated sludge treatment process, ammonia will be reduced by air purging of NH_3^{o} and some amount of nitrification. For purposes of analysis, we have assumed 23 mg/l of ammonia nitrification and no evaporation of ammonia. Nitrification can be controlled by controlling alkalinity and dissolved oxygen.

The project TKN loading following activated sludge treatment is projected to be 30 mg/l (30 mg/l ammonia and 1 mg/l organic nitrogen) and 23 mg/l nitrates/nitrites, for a total nitrogen loading to the spray field of 54 mg/l, or 7 lb/day.

Table 6 in the Kendall & Associates soils report predicts, at the above nitrogen loading, that the nitrates in the down-gradient groundwater will be 6.79 mg/l (less than 10 mg/l). However, it is important to note that Mr. Kendall used a conservative uptake rate of 200 lb/acre/year. Table 3.8-2 in the EPD LAS guidelines (EPA Table 4-12) indicates that the nitrogen uptake rate for "mixed hardwoods" should be 303 lb/acre/year. Therefore, according to the EPD guidance, this proposed LAS system is over-designed.

3.5 Total Phosphorus

Total phosphorus in the influent is expected to be 300 mg/l. After phase separation, the phosphorus is expected to decrease to 30 mg/l. After activated sludge treatment, the phosphorus concentration is expected to further decline to 15 mg/l, or 2 lb/day, or 685 lb/year. Assuming a spray field of 6.6 acres, the phosphorus loading rate will be 104 lb/acre/year. Mr. Kendall indicated in the soils report that the soil phosphorus adsorption capacity for these soils typically is in the range of 500-800 lb/acre.

Phosphorus is not expected to be an issue regarding this treatment system. If needed, phosphorus removal can be enhanced by increasing the coagulant feed (aluminum or ferric) to the phase separator.

3.6 Chloride

Chlorides are not expected to be an issue regarding this treatment system.

3.7 Sodium Adsorption Ratio

The Sodium Adsorption Ratio (SAR) not expected to be an issue regarding this treatment system.

3.8 Electrical Conductivity

Electrical Conductivity is not expected to be an issue regarding this treatment system.

3.9 Metals/Priority Pollutants

Metals/Priority Pollutants are not expected to be an issue regarding this treatment system.

4.0 Water Balance

The spray application rates will be dictated by the nitrogen loading rates Hydraulic loading rates as shown below will be well below the maximum allowable rates due to nitrogen loading. This land application system is designed for a maximum overall irrigation capacity of 15,000 gallons per day (gpd).

The spray field as shown in Figure 5 has been divided into three roughly equal sized zones, Zones 1, 2 and 3. Zone 1 is the highest irrigation zone with elevations ranging from 1650 to 1669. Zone 2 is the second highest irrigation zone with elevations ranging from 1630 to 1650. Zone 3 is the lowest of the three irrigation zones with elevations ranging from 1610 to 1630. All slopes within all three zones are less than 30%, as allowed for forested spray fields.

A hydraulic loading of 1.13 in/week has been recommended by Mr. Kendall in his soils report. Each irrigation zone is roughly 2.2 acres of mixed hardwoods. An application rate of 15,000 gpd would be equivalent to 105,000 gal/week, or, 35,000 gal/week/zone.

The weekly hydraulic loading can therefore be calculated as:

$$\frac{35{,}000 \times 12}{7.48 \times 2.2 \times 43{,}560} = 0.59 \text{ in/week} < 1.13 \text{ in/week}$$

4.1 Irrigation Operating Criteria

Irrigation will be allowed so long as the following criteria are met:

1. There is no current precipitation.
2. There has been no precipitation within the previous 12 hours.
3. No surface runoff
4. No irrigation during high winds

4.2 Storage/holding

Storage is provided in the 30,000 gallon influent holding tank and the 30,000 gallon effluent holding tank. It is anticipated that at any given time there will be approximately 30,000 gallons of available holding capacity in these two tanks. Therefore, at a design flow rate of 15,000 gpd, there will be two days holding capacity.

Two days should be sufficient holding capacity for normal operations. For periods of prolonged rainfall, hurricane winds or icing conditions during which irrigation must be curtailed, then the pumping out of grease traps and septic tanks will also be curtailed accordingly.

5.0 Nitrogen Balance

5.1 Design Loading Rates

The spray application rates will be dictated by the nitrogen loading rates This land application system is designed for a maximum overall irrigation capacity of 15,000 gallons per day (gpd) at a nitrogen loading of 54 mg/l. At this nitrogen loading rate, Mr. Kendall has recommended a hydraulic loading rate of 0.59 in/week to avoid excessive nitrates in the ground water.

The spray field as shown in Figure 5 has been divided into three roughly equal sized zones, Zones 1, 2 and 3. Zone 1 is the highest irrigation zone with elevations ranging from 1650 to 1669. Zone 2 is the second highest irrigation zone with elevations ranging from 1630 to 1650. Zone 3 is the lowest of the three irrigation zones with elevations ranging from 1610 to 1630. All slopes within all three zones are less than 30%, as allowed for forested spray fields.

A hydraulic loading of 1.13 in/week has been recommended by Mr. Kendall in his soils report. Each irrigation zone is roughly 2.2 acres of mixed hardwoods. An application rate of 15,000 gpd would be equivalent to 105,000 gal/week, or, 35,000 gal/week/zone.

The weekly hydraulic loading can therefore be calculated as:

$$\frac{35{,}000 \times 12}{7.48 \times 2.2 \times 43{,}560} = 0.59 \text{ in/week}$$

6.0 Groundwater Samples

Ground water samples will be collected from four monitoring wells (as shown in Figure 5) and tested for nitrate concentrations twice per year.

7.0 Phosphorus Loading Rate

Other than nitrogen, the wastewater constituent loading that could be of potential concern is phosphorus.

7.1 Phosphorus

The irrigation wastewater is projected to have a total phosphorus concentration of 15 mg/L. Assuming an average daily irrigation rate of 15,000 gpd (7 days per week), then the annual phosphorus loading would be:

P = (0.015 MGD x 365 x 15 mg/L x 8.34) / 6.6 acres
P = 104 lb/ acre/year (as P)

This loading rate is not considered to be excessive and will be adsorbed in the soil or taken up to support the vegetative growth.

8.0 Wetted Field Area and Storage Volumes

The wetted field area as shown in Figure 5 is 6.6 acres. The irrigation will be divided into three irrigation zones as follows:

Zone No. 1: 2.2 acres
Zone No. 2: 2.2 acres
Zone No. 3: 2.2 acres

Total 6.6 +/- acres

Note: The individual zone acreages may vary due to detailed design needs; however, the total amount (6.6 acres) is not expected to change.

Storage will be provided as described above in section 4.2.

9.0 Process Control of the Preapplication Treatment Facility

The preapplication treatment facility will operate as described above and as depicted graphically in Figures 2, 3 and 4.

In general the following operating procedures will apply"

1. The dewatered sludge in the phase separator will be emptied into the sludge management area at an estimated 12% solids, or greater. This dewatered sludge will be delivered to a landfill. Sludge production is estimated to be 746 cu ft per day at 12% solids at the design capacity of 15,000 gpd. Assuming that the sludge generated cannot be dewatered at the rate projected, then a second phase separator will be obtained,

2. When a truck arrives with a load of grease trap wastes or septic tank pumpage, the contents will be discharged from the truck, through a screen, into an influent sump with pump. The sump contents will then be pumped from the sump into the 30,000 gallon influent holding tank, T1. Septic wastes will be combined with grease trap wastes in T1.

3. In general, T1 will not be mixed or aerated to reduce odor potential. However, the capability will be provided to aerate T1 (if necessary) and to break up floating scum layers by recirculation utilizing a flexible hose.

4. The aeration to the activated sludge basin will be shut off and the solids will be allowed to settle. MLSS concentrations will be periodically checked. When the solids have settled, the supernatant will be decanted to the 30,000 gallon effluent holding tank, T3.

Suspended solids will be removed from T2 and pumped to T1 as needed to maintain the desired MLSS concentration (estimated at this time to be 4,000 mg/l).

5. Wastewater from the influent holding tank, T1, will be pumped through the phase separator at an estimated amount of 15,000 gpd. The wastewater from T1 will be fed coagulant and polymer as necessary to achieve efficient and effective dewatering. Bench tests will be performed as necessary. It is anticipated that within approximately 20 hours, dewatering will be completed sufficient to achieve a dewatered sludge that will pass the "paint filter" test. Then, go to Step 1.

6. The filtrate from the phase separator will be pumped to the activated sludge tank, T2. The wastewater will be aerated in the activated sludge tank until the following day at which time, Step 4 will be repeated.

7. Treated and clarified effluent will be pumped to the 30,000 gallon effluent holding tank. Disinfection will be provided in the effluent holding tank using hypochlorite. During favorable weather conditions, daily irrigation will be achieved. The irrigation rate to each individual zone will be at a rate of approximately 130 gpm. It is anticipated that 15,000 to 25,000 gpd will be irrigated each favorable day, depending on weather conditions. Each zone will receive 35,000 gallons per week at design flow conditions. This irrigation may be conducted, for example, as follows:

day	Amount in T3 before irrigation (gallons)	Amount in T3 after irrigation (gallons)	Zone 1 (gallons)	Zone 2 (gallons)	Zone 3 (gallons)	TOTAL (gallons)
1	23,000	3,000	20,000			20,000
2	18,000	3,000		15,000		15,000
3	25,000	3,000			22,000	22,000
4	13,000	13,000	rain	rain	rain	
5	28,000	28,000	rain	rain	rain	
6	28,000	2,000	15,000	11,000		26,000
7	26,000	4,000		9,000	13,000	22,000
TOTAL			35,000	35,000	35,000	105,000

It should be noted that one hour of spray irrigation at 130 gpm will deliver 7,800 gallons. Therefore, to irrigate 20,000 gallons, the irrigation pump will need to operate for 2 hours and 34 minutes. An effluent flow meter will be used to measure the daily quantity of treated effluent that is irrigated on each zone. Detailed records of hydraulic loading by zone will be maintained.

10.0 Detailed Soils Investigation Report

The Kendall & Associates Soils Report is presented in Appendix A.

M:\2008\R2008-008 (Mote)\DDR Report.doc

FIGURES

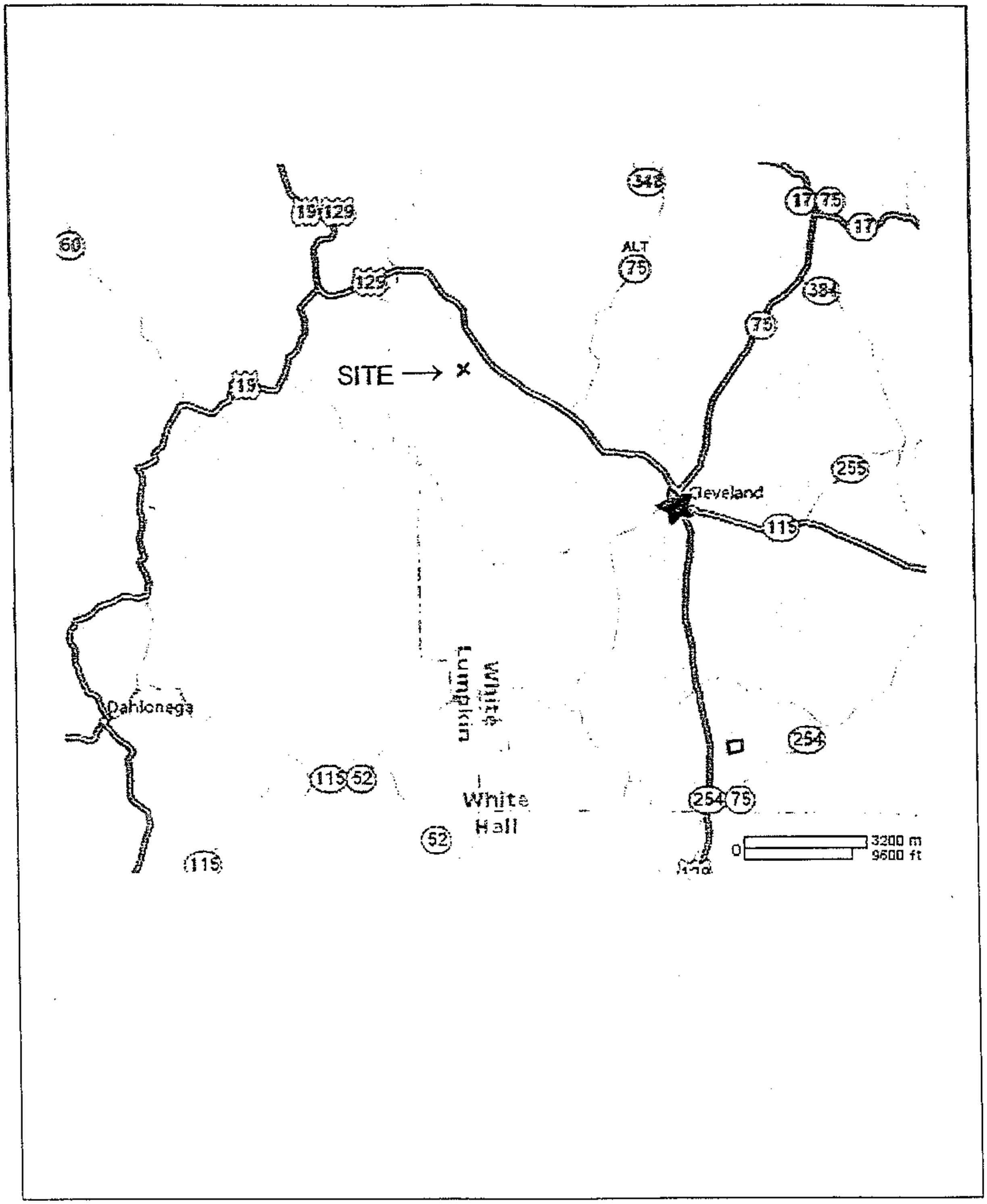


Figure 1
Location Map

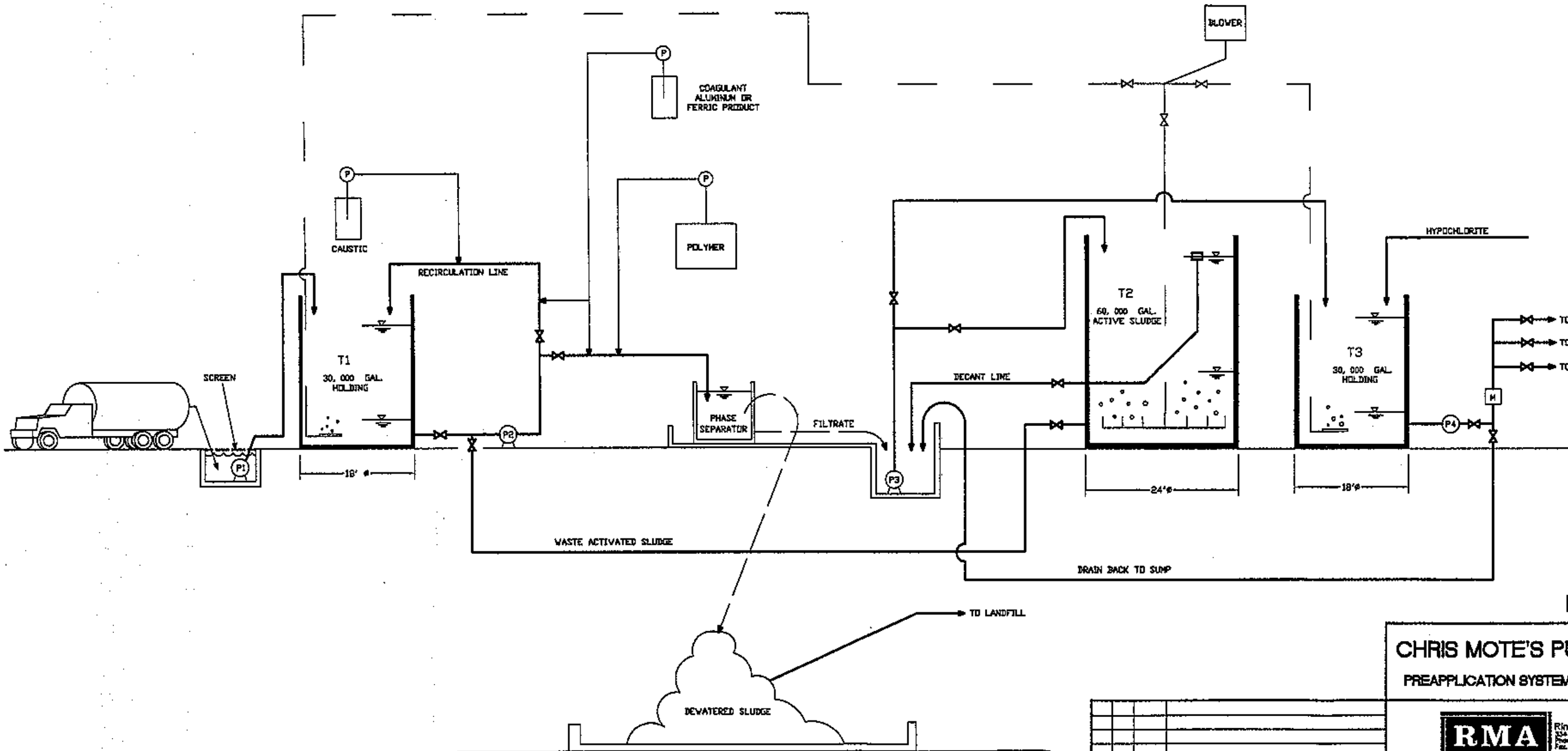


FIGURE 2

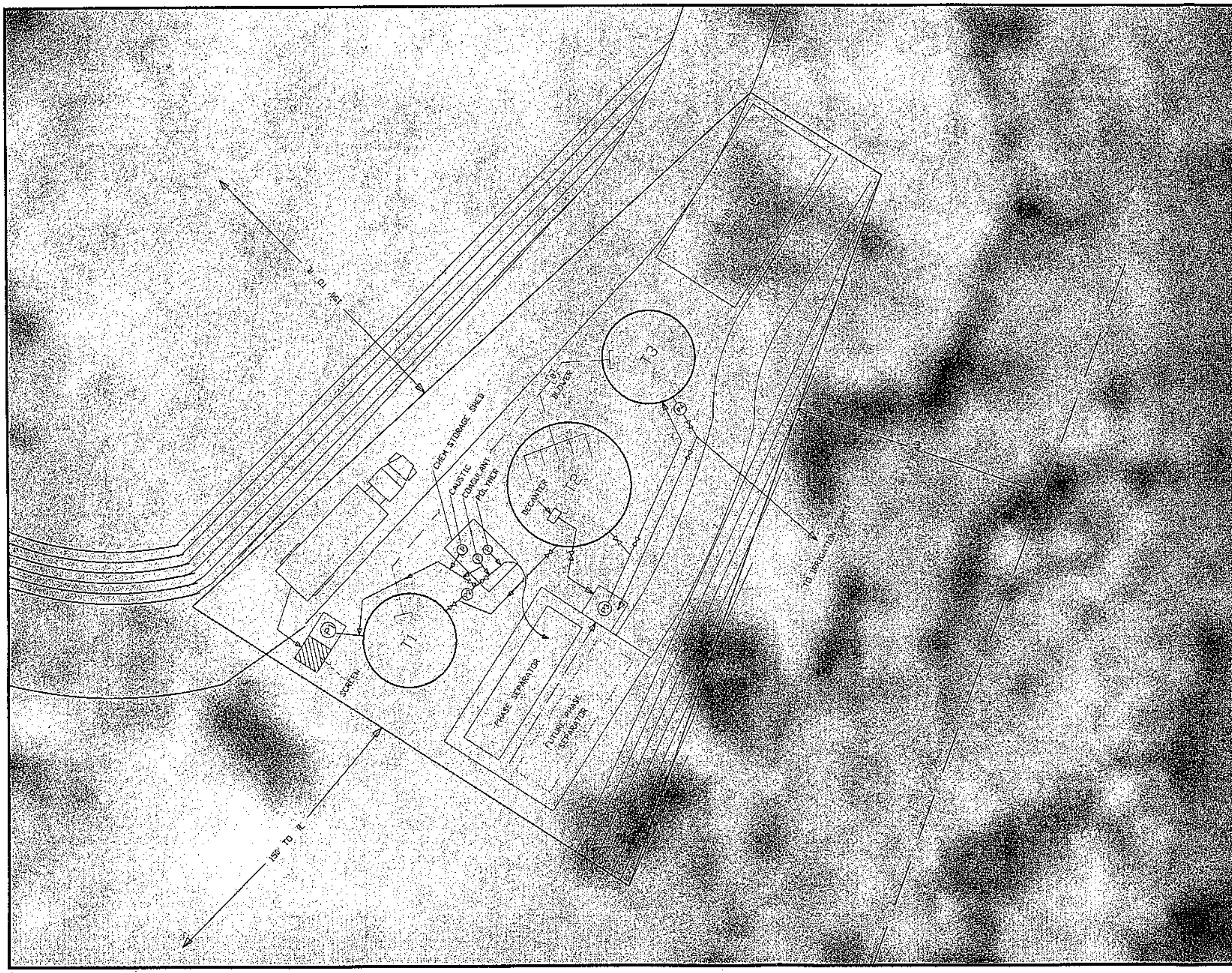
CHRIS MOTE'S PUMPING SERV.

PREAPPLICATION SYSTEM FLOW SCHEMATIC

RMA Rindt-McDuff Associates, Inc.
334 Cherokee Street – Marietta, GA 30060
Phone No. (770) 427-8123
Fax No. (770) 425-8930

Date: 07/22/08 Land Lot: LL District: DISTRICT
County: WHITE Scale: NTS Sheet No.
Proj. Manager: BR Drawn By: WKR Reviewed By:
Job Number: R2008-008 File Name: FLOW SCH 1 of 1

No.	By	Date	Revision



No.	By	Date	Revision

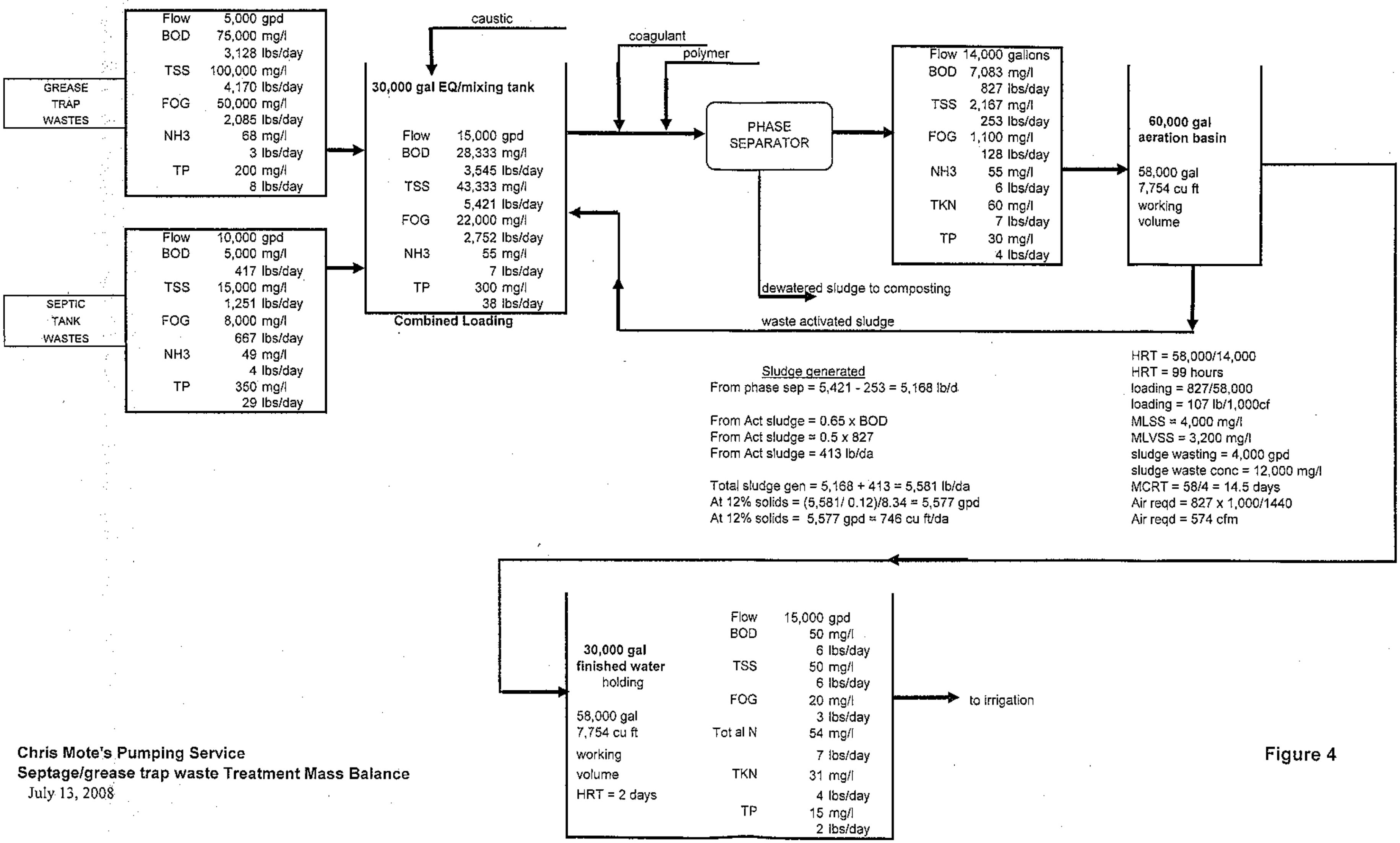
FIGURE 3

CHRIS MOTE'S PUMPING SERV.

PREAPPLICATION SYSTEM LAYOUT PLAN

RMA Rindt–McDuff Associates, Inc.
334 Cherokee Street – Marietta, GA 30060
Phone No. (770) 427-8123
Fax. No. (770) 425-8930

Date: 07/23/08 Land Lot: LL	District: DISTRICT	
County: WHITE	Scale: 1" = 30'	Sheet No.
Proj. Manager: BR Drawn By: WKR	Reviewed By: RB	
Job Number: R2008-008	File Name: LAYOUT	1 of 1



Chris Mote's Pumping Service
Septage/grease trap waste Treatment Mass Balance
July 13, 2008

Figure 4

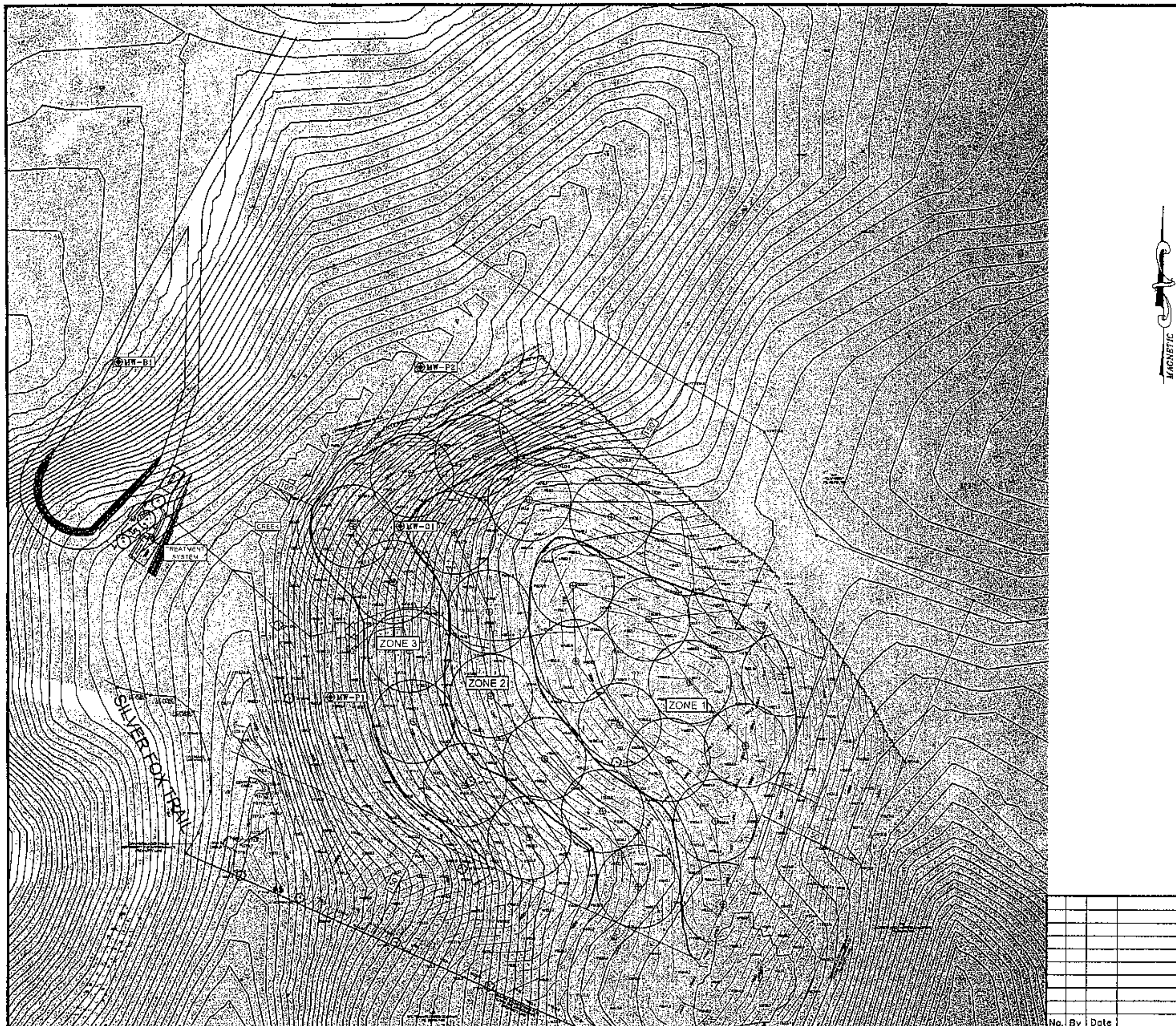


FIGURE 5

CHRIS MOTE'S PUMPING SERV.
SPRAY IRRIGATION ZONES

RMA Rindt-McDuff Associates, Inc.
334 Cherokee Street - Marietta, GA. 30060
Phone No. (770) 427-8123
Fax. No. (770) 425-8930

Date: JULY, 2008 Land Lot:	District:	
County: WHITE	Scale: N.T.S.	Sheet No.
Proj. Manager: BR Drawn By: MJR	Reviewed By: BR	
Job Number: R2008-008 File Name:		of

No.	By	Date	Revision

CHRIS MOTE'S PUMPING SERVICE, LLC

Serving North Georgia Since 1987

P.O. Box 3110
Cleveland, Georgia 30528
(706) 865-5526
Toll Free 1-877-250-7867

February 15, 2008

To Whom It May Concern:

The following are the ammonia test results for jobs pumped by Chris Mote's Pumping Service LLC., Cleveland Georgia.

Originator	Type	Test Results
Vend Inc.	Septic	34
El Campesino	Grease	105
Almark	Comm. Waste	45
Mr. Langford	Residential septic	22
Mrs. Stewart	Residential septic	40
Lanier Park Hospital	Commercial grease	30
Mr. Webb	Residential septic	90
Reid's Café	Septic	60

Septic : 49.2 (65%)
Grease : 67.5 (30%)
comm waste 45 (5%)

49.2(.65) + 67.5(0.3) + 45(.05)
= 54.48

If you have any questions please feel free to call me @ cell- 770-530-2034 or my office number 706-865-5526.

Sincerely,

Chris Mote

Chris Mote
Chris Mote's Pumping Service LLC

FIGURE 6

APPENDIX A

Kendall & Associates Soils Report

KENDALL &
ASSOCIATES, INC.
Soil and Ecological Consultants

DETAILED SOIL INVESTIGATION AND CONCEPT DESIGN REPORT LAND APPLICATION SYSTEM MOTE'S PUMPING SERVICE WHITE COUNTY, GEORGIA

By:

J. Brandon Stuart
Soil Scientist

and

Robert L. Kendall, RPSS
President

July 15, 2008

2443 Powder Springs Road Marietta, Georgia 30064 (770) 439-8824 FAX (770) 439-0131

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**DETAILED SOIL INVESTIGATION AND
CONCEPT DESIGN REPORT
LAND APPLICATION SYSTEM
CHRIS MOTE'S PUMPING SERVICE
PARADISE VALLEY ROAD
WHITE COUNTY, GEORGIA**

A. BACKGROUND

Chris Mote's Pumping Service pumps septic tanks and grease traps and hauls the waste material to the City of Gainesville municipal wastewater treatment plant or to an existing septage land application site in White County. As an alternative to hauling to these locations, Chris Mote plans to construct a private wastewater treatment plant and land apply the treated liquid waste to an approximate 7-acre spray field on the company's property. The projected design wastewater flow for the project is 15,000 gpd.

Kendall & Associates was retained to perform the Detailed Soil Investigation and develop the land-based design criteria for the slow-rate land treatment system. The Georgia EPD Guidelines for Slow-Rate Land Treatment of Wastewater (2006) was used as the basis for the investigation.

B. SITE DESCRIPTION

1.1 Location

The 25-acre Project Site is located at 669 Paradise Valley Road (see Figure 1). The Study Area consists of 11 acres of forested land in the southern section of the property. Area topography is shown on Figure 2, taken from the USGS 7.5 minute quadrangle map of Cowrock, Georgia.

1.2 Climate

Precipitation, temperature and evapotranspiration data from the National Weather Service station at Helen, Georgia are presented in Table 1. These data were compiled to aid in calculating a water balance for the spray irrigation system.

1.3 Geology and Groundwater

White County lies within the Blue Ridge Physiographic Province. The Project Site is underlain by unnamed rock units consisting primarily of biotite gneiss. (Lawton et al. 1976) The weathering of these metamorphic crystalline rocks produces a soil profile consisting of upper layers of clay loam and clay which transition into loamy sand and sandy loam. With depth, these soils generally become of higher consistency. The overburden soils are separated from the unaltered parent rock by a transition zone of saprolite that is composed of alternating layers of high consistency soil and rock. The saprolite typically becomes more firm and dense and less porous with depth.

FIGURE 1
SITE LOCATION MAP
MOTE'S SEPTIC PUMPING LAS
WHITE COUNTY, GEORGIA

KENDALL & ASSOCIATES, INC.
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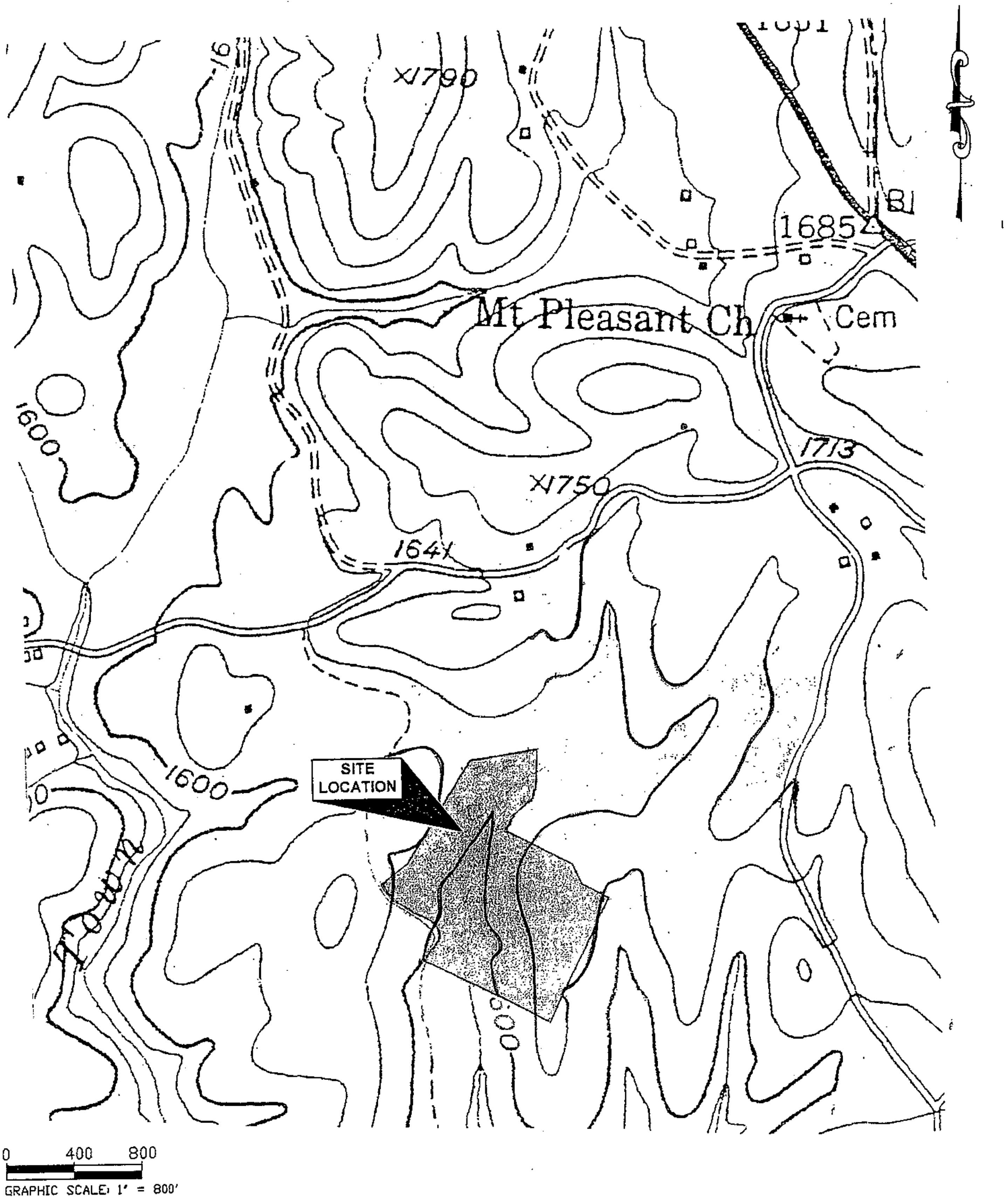

FIGURE 2
USGS TOPOGRAPHIC MAP
MOTE'S SEPTIC PUMPING LAS
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Table 1. Climatic data for Chris Mote's Pumping Service LAS project, White County, Georgia.[1]

Month	Average Precipitation (in/mo)	Design Precipitation (in/mo)	Average Temperature (°F)	Potential Evapotranspiration (in/mo)
January	6.74	8.87	41.4	0.38
February	5.71	8.06	44.6	0.52
March	7.03	10.11	51.4	1.37
April	4.69	6.78	58.8	2.31
May	6.03	8.65	65.8	3.82
June	5.56	8.03	72.5	4.90
July	5.75	8.66	76.2	5.92
August	5.83	8.93	75.2	5.39
September	5.78	8.57	69.4	3.72
October	4.45	6.57	59.4	2.23
November	5.92	7.72	50.5	1.04
December	6.03	7.87	42.8	0.46
Total	69.53	---	---	32.04

[1] From National Weather Service Station at Helen, GA 1972-1977, 1984-2007.

The actual weathering processes that form the residual soil materials are quite erratic, being dependent upon such factors as rock mineralogy, surface topography, ground water conditions and the specific geologic history of the area. These factors result in a poorly defined boundary between the fully weathered and unaltered parent rock, an extremely irregular rock surface and the occasional presence of rock layers or boulders within an otherwise fully weathered soil profile.

The water bearing units of this area are of two main types: the unconsolidated highly weathered rock (saprolite) at the surface and the unaltered bedrock at depth. The saprolite and bedrock are different but hydraulically connected aquifers. Ground water is typically found within the soil profile and shallow saprolite zones at lower elevations near streams and within rock fracture zones at higher landscape positions. The Project Site is not found in a "significant ground water recharge area" according to Hydrologic Atlas 18 published by the Georgia Geologic Survey (see Figure 3).

Wastewater applied to sloping forested sites infiltrates through the soil surface and travels laterally downslope, mainly through the upper three to four feet of the soil profile. (Kendall, 1979). The underlying saprolite layer typically contributes little to the movement of water through the soil on sloping sites. Most soil water under these conditions recharges the water table aquifer at the foot of slope near intermittent and perennial streams. Because of the low permeability of the saprolite and low porosity of the underlying bedrock most of the shallow ground water discharges into the adjoining stream channels rather than entering the bedrock aquifer.

FIGURE 3
GROUNDWATER RECHARGE AREA MAP
MOTE'S SEPTIC PUMPING LAS
WHITE COUNTY, GEORGIA

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We did not observe any evidence of either a perched or apparent water table in any of the soil borings within the Study Area. Backhoe pits dug in the Study Area to a depth of 10 feet did not encounter evidence of a water table at any of the five locations examined.

1.4 Topography and Drainage

Figure 2 is reproduced from the USGS 7.5-minute quadrangle sheet of Cowrock, Georgia. Site topography from a field-run topographic survey is shown on the Site-Specific Soil Maps (Figure 6). The LAS study area is located on moderately sloping upland (6 to 25 percent slopes) at elevations ranging from 1570 ft to 1668 ft, msl. An unnamed perennial stream that is a tributary of Town Creek borders the Study Area on the western side.

1.5 Access

Access into the LAS site will be from internal roads and from a private gravel road off of Paradise Valley Road. The LAS site boundaries will be posted.

1.6 Water Supply Wells

Chris Mote and his family live in the house in the northern part of the 25-acre Project Site and obtain drinking water from a well near the house. The well is 6 inches in diameter and 280 feet deep with 260 feet of casing. The casing length represents the thickness of the saprolite and partially weathered rock above solid bedrock. The well is located on the opposite (west) side of the perennial stream from the proposed spray field at a distance of approximately 450 feet.

There are approximately 100 residences within 2,500 feet of the proposed spray field (see Figure 4). House locations shown on Figure 4 were obtained from a 2007 aerial photo published by Google Maps. Only 19 of the house sites are located within 1,000 feet of the proposed spray field.

Since public water is not available we assume that all homes in the area obtain drinking water from individual private wells. There are no wells located downslope of the proposed spray field. Fourteen of the 19 homes within 1,000 feet of the site are located west of the perennial stream that runs through the Project Site. Three of the homes east of this stream are at higher elevation than the Project Site. One home to the southeast of the Project Site is separated by an intermittent stream. One home is located south of the Project Site at a distance of 1,000 feet.

C. DETAILED SOIL INVESTIGATION

Characterization of the physical properties of the soil is the most important component of the land application system design process. Evaluation of the soils on the site included soil profile descriptions from hand auger borings and backhoe observation pits, *in situ* hydraulic conductivity measurements and soil chemical analyses.

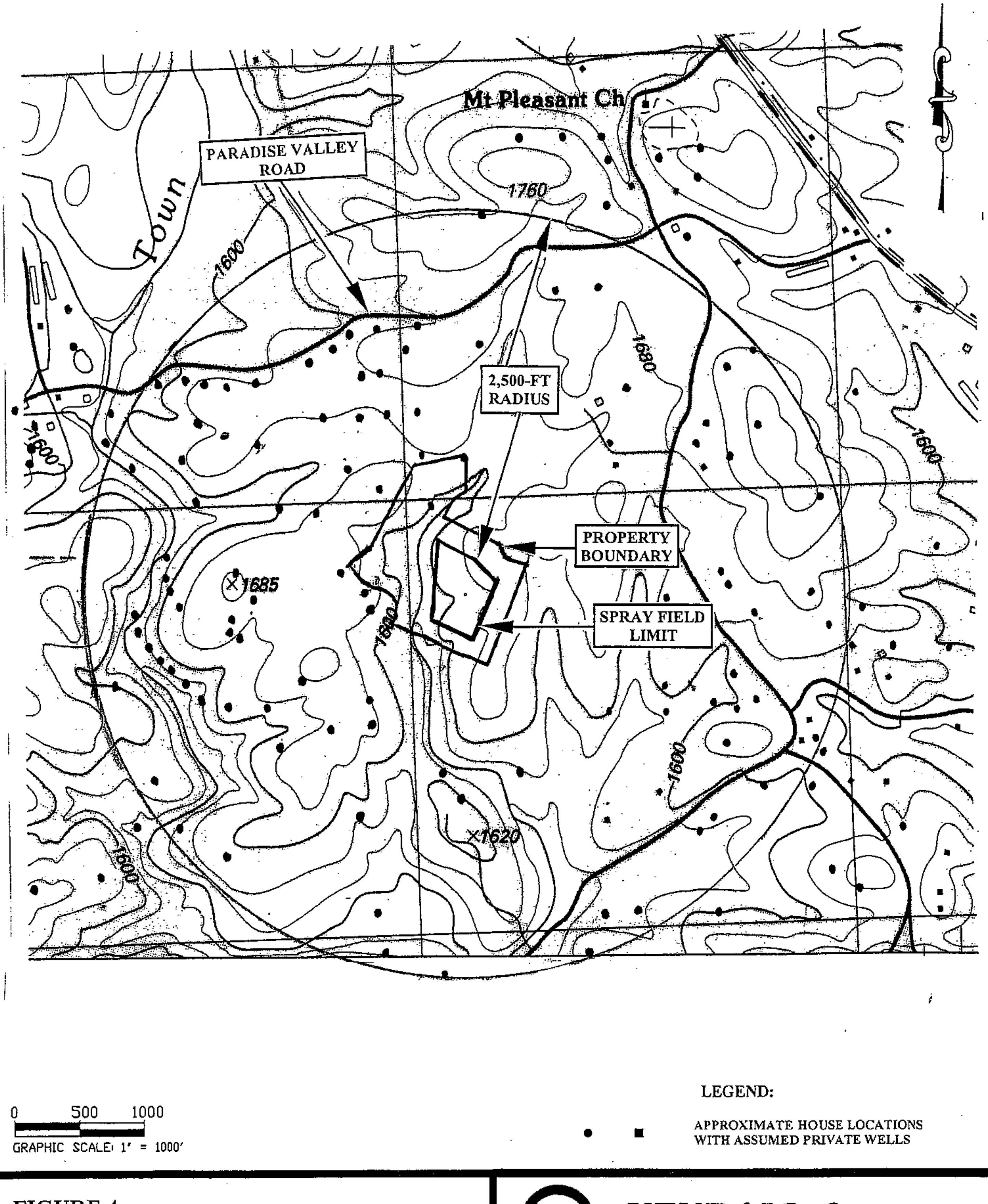

FIGURE 4
WELL LOCATION MAP
MOTE'S SEPTIC PUMPING LAS
WHITE COUNTY, GEORGIA

KENDALL & ASSOCIATES, INC.

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1.0 Site Description

1.1 Site Location Map

See Figure 1

1.2 Topographic Map

See Figure 2

1.3 Soil Survey Map

Figure 5 shows the NRCS soil map for the project site reproduced from the Soil Survey of Dawson, Lumpkin and White Counties (1972). The NRCS classified the soils in the Study Area as the Hayesville soil series.

1.4 Site-Specific Soil Map

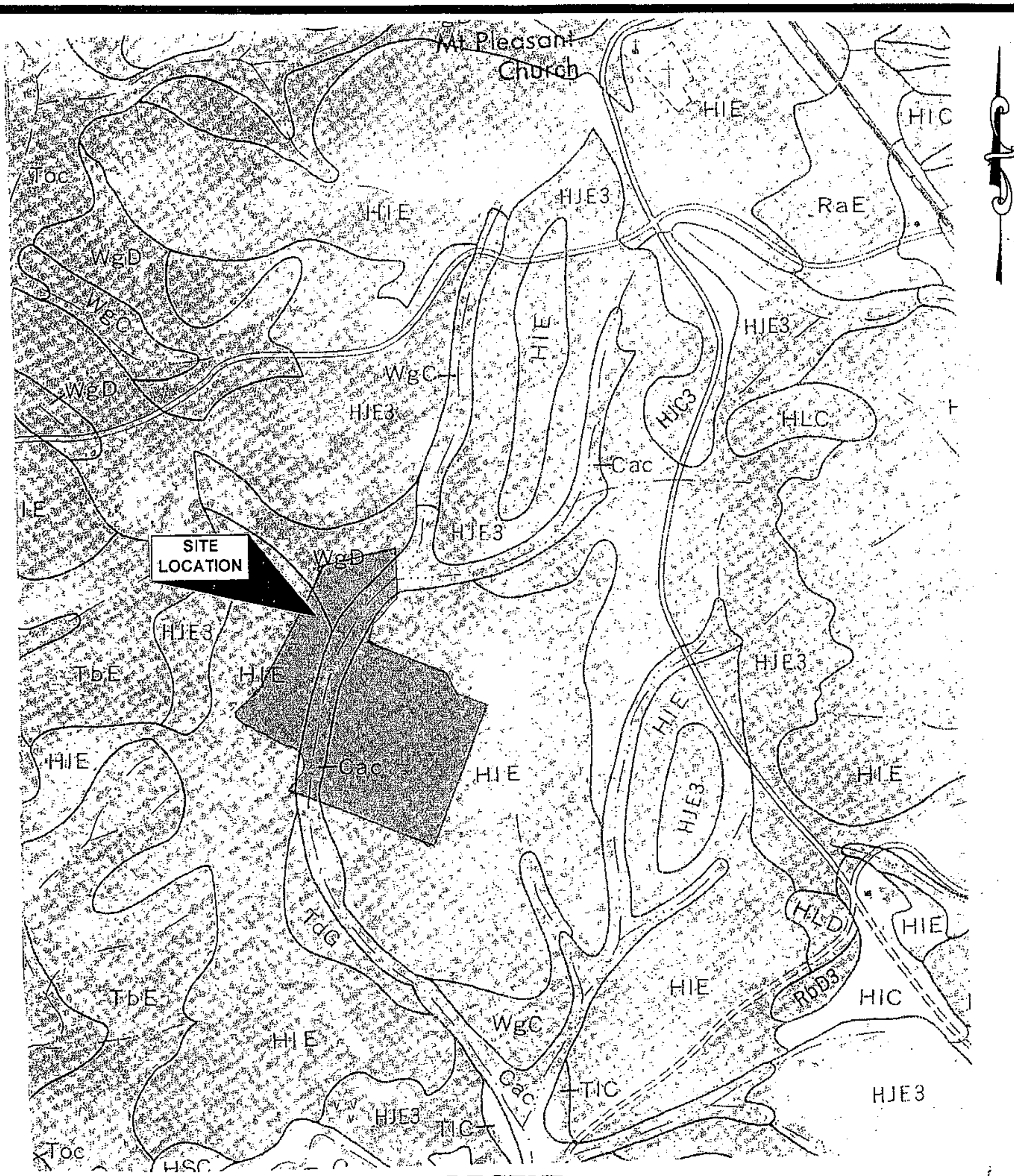
A total of 41 hand auger borings and five backhoe pits were advanced in the Study Area at spacings of 100 feet or less. Boring and pit locations are shown on Figure 6. Soil profile descriptions from the borings are enclosed in Appendix A of this report. We classified the soils within the Study Area as the Hayesville, Tallapoosa, and Starr series. Official Series Descriptions for the three soil series as published by the NRCS are presented in Appendix A.

2.0 Soil Series Description

The Hayesville series is a member of the fine, kaolinitic, mesic family of Typic Kanhapludults. This series consists of very deep, well drained soils on gently sloping to very steep ridges and side slopes of the Southern Appalachian Mountains. They most commonly formed in residuum weathered from igneous and high-grade metamorphic rocks such as granite, granodiorite, mica gneiss and schist; but in some places formed from thickly bedded metagraywacke and metasandstone. Slopes range from 2 to 60 percent.

The Starr series is a member of the fine-loamy, mixed, semiactive, thermic family of Fluventic Dystrudepts. This series consists of very deep, well-drained, moderately permeable soils in slight depressions, around drain heads and on terraces, fans, and foot slopes. They formed in colluvium weathered from felsic to mafic high-grade metamorphic rocks. Slopes range from 0 to 8 percent.

The Tallapoosa series is a member of the loamy, mixed, semiactive, thermic family of shallow Typic Hapludults. This series consists of shallow, well-drained, moderately permeable soils that formed in residuum weathered from mica schist. These soils are on narrow ridges and sideslopes with slopes ranging from 5 to 80 percent.



LEGEND:

Cac	Cartecay complex
HIE	Hayesville sandy loam, 10 to 25 percent slopes
WgD	Wickham fine sandy loam, 10 to 25 percent slopes

0 400 800
GRAPHIC SCALE: 1" = 800'

FIGURE 5
NRCS SOIL MAP
MOTE'S SEPTIC PUMPING LAS
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2.1 Soil Physical Properties

The most critical properties of soil for land application are those affecting the downward and lateral percolation of water. The water transmitting capacity of the soil is frequently the limiting factor that controls the amount of land area required. Table 2 presents the soil physical properties of the Hayesville, Starr and Tallapoosa soil series.

3.0 Soil Characteristics

3.1 Soil Profile Descriptions

The Starr soils consist of colluvial material over residual soils. The landscape position in the area of the Starr soils is not favorable for wastewater application due to convergent soil water drainage and stormwater drainage patterns.

The surface horizon in the Hayesville soil at the Project Site is 3 to 8 inches thick and has a sandy loam to sandy clay loam texture with few rock fragments. The most restrictive layer in the subsoil or B horizon is clay in texture. The B horizon extends to an average depth of 40 inches below ground surface. The underlying C horizon consists of sandy loam to sandy clay loam saprolite (highly weathered parent material).

The surface horizon in the Tallapoosa soil at the Project Site is 3 to 10 inches thick and has a sandy loam to sandy clay loam texture with few rock fragments. The most restrictive layer in the subsoil or B horizon is clay in texture. The B horizon extends to an average depth of 31 inches below ground surface. The underlying Cr horizon consists of soft weathered rock derived from highly weathered mica schist. Depth to hard bedrock is greater than six feet.

3.2 Unified Soil Classification

Soils have been described using the USDA system rather than the Unified Soil Classification System. Wastewater storage will be provided by tanks rather than a holding lagoon.

3.3 Soil Permeability

Field permeability tests were performed at a depth of 18-24 inches in the restrictive soil horizon to obtain site-specific information for designing the land application system. A constant head permeameter device (Amoozegar, 1989) was used to measure the vertical permeability of the Hayesville and Tallapoosa soils at the project site. Four permeability tests were performed in each soil series at the locations shown on Figure 6. Test results are reported in Table 3.

The geometric mean permeability values from the field tests for the Study Area are 0.55 in/hr for the Hayesville soils and 0.37 in/hr for the Tallapoosa soils. The calculated mean value for both soils is lower than the predicted permeability range of 0.6-2.0 in/hr published by the NRCS but consistent with field tests that we have performed in these soils at other LAS sites. The geometric mean values for these two soils will be used to calculate Design Percolation rates, discussed later in this report.

Table 2. Physical properties of soils (from NRCS) at Mote's Pumping Service LAS site.

Soil Series	Depth (in)	USDA Texture	Permeability (in/hr)	Water Table (ft)	Bedrock (ft)
Hayesville	0-9	SL	2.0-6.0	>6	>6
	9-31	SCL, C	0.6-2.0		
	31-48	SCL	0.6-2.0		
Tallapoosa	0-5	FSL	2.0-6.0	>6	>6
	5-18	SCL	0.6-2.0		
	18-72	FSL (SWR)	2.0-6.0		
Starr	0-12	FSL, L	2.0-6.0	>6	>6
	6-34	SCL	2.0-6.0		
	34-60	FSL	2.0-6.0		

Textural Key:
FSL – Fine Sandy Loam
SCL – Sandy Clay Loam
SC – Sandy Clay
SL – Sandy Loam
CL – Clay Loam
L – Loam
LS – Loamy Sand
C – Clay
SWR – Soft Weathered Rock

Table 3. Permeability test results from Mote's Pumping Service LAS site.

Test No.	Soil Series	Depth (inches)	Texture	Permeability (in/hr)
PT1	Hayesville	20	SCL	0.50
PT5	Hayesville	18	SL	0.45
PT7	Hayesville	24	SCL	2.42
PT8	Hayesville	18	SCL	0.18
Geometric Mean	Hayesville			0.55
PT2	Tallapoosa	20	SCL	0.56
PT3	Tallapoosa	24	SCL	1.17
PT6	Tallapoosa	20	SCL	0.31
PT9	Tallapoosa	20	SCL	0.09
Geometric Mean	Tallapoosa			0.37

3.4 Soil Chemistry

Samples were collected from the subsoil throughout the Hayesville and Tallapoosa soils. Samples were taken near the top of the B horizon where the soils exhibit the greatest chemical reactivity and are within reach of active plant roots. One composite sample was made up for each soil series from at least four individual subsamples. Test results are summarized in Table 4. Laboratory data reports are included in Appendix B of this report.

Table 4. Soil chemical characteristics for Motes Pumping Service LAS site.

Parameter	Units	Hayesville	Tallapoosa
pH	S.U.	4.9	4.7
CEC	meq/100cm^3	2.2	2.1
Calcium	lbs/acre	180	36
Magnesium	lbs/acre	34	21
Potassium	lbs/acre	58	50
Nitrogen	lbs/acre	5	5
Phosphorus	lbs/acre	8	8
Zinc	lbs/acre	1.4	1.4
Iron	lbs/acre	1281	1675
Acid Saturation	%	68	85
Base Saturation	%	32	15

Cation exchange capacity (CEC) is at moderate levels. The CEC reflects the ability of the soil to adsorb cations such as ammonium, calcium, sodium and metals. Adsorption of ammonium minimizes the mobility of nitrogen in the soil and increases retention time, which allows plants to take up a significant portion of the nitrogen that is applied with the wastewater.

3.5 Engineering Properties of Soils for Pond Construction

Not Applicable

4.0 Adverse Subsurface Conditions

The Starr soils in the LAS study area are unsuitable for land application due to convergent subsurface drainage limitations.

5.0 Delineation of Suitable and Unsuitable Areas

The Hayesville and Tallapoosa soils are suitable for land application by spray irrigation. The Hayesville mapping unit shown on Figure 6 contains 4.8 acres and the Tallapoosa unit contains 5.6 acres. After allowance for a 150-ft buffer around the perimeter of the property the total area suitable for land application is approximately 7.5 acres.

6.0 Design Percolation

As reported in Table 3, the geometric mean permeability values for the tests performed at the Project Site are 0.55 in/hr for the Hayesville soils and 0.37 in/hr for the Tallapoosa soils. We recommend using the more limiting permeability value for the Tallapoosa series to calculate a single Design Percolation value for both soils mapped at the Project Site. This eliminates the need to separate the site into different zones based on soil series. We recommend using a design safety factor of 5 percent for the Tallapoosa soil. Using this factor, the Design Percolation value for the site is 0.44 in/day.

D. SITE ASSIMILATIVE CAPACITY

The assimilative capacity of a land application site is the amount of waste considered on a constituent-by-constituent basis that can be safely applied to the soil. Wastewater volume (hydraulic loading) and nitrogen concentration are evaluated to assure that these components of the wastewater can be assimilated by the proposed site. The following sections discuss the basis for the determination of the assimilative capacity of the site for hydraulic and nitrogen loadings given the physical, chemical and biological characteristics of the site.

1.0 Hydrologic Balance

The hydraulic assimilative capacity of a land application site is determined in large degree by the texture, structure and permeability of the soil. The thickness, continuity and permeability of both surface and restrictive horizons in the soil determine the amount of vertical and lateral drainage. As permeability in the vertical direction decreases there is an increase in lateral flow through the overlying layers in the soil. Lateral flow becomes a greater proportion of total drainage as slope increases due to an increase in the hydraulic gradient.

The normal approach to determining the hydraulic assimilative capacity of a land application site is to calculate a hydrologic balance. A value for percolation of water through the soil profile is calculated using soil permeability data. Percolation is assumed to occur in a vertical direction and is controlled by the vertical permeability of the most restrictive soil horizon. Under actual field conditions subsurface drainage is much more complex because of the heterogeneous nature of the soil and the lateral component of flow. The percolation value in the hydrologic balance calculation actually represents an approximation of the combined components of vertical and lateral flow through the soil.

A hydrologic balance is calculated to determine the assimilative capacity of the site for wastewater and to assure that wastewater application will not result in negative impacts on groundwater or surface water. Land application systems are designed and operated so that there is no surface runoff of the wastewater from the site. The only pathways for assimilating the effluent are through transpiration by plants or by percolation through the soil profile, after which the effluent eventually reaches the ground water.

The average monthly hydrologic balance for a land application system is formulated as:

$$Pd + W = Pet + S$$

where the inputs, design precipitation (Pd) and wastewater (W) equal the outputs, potential evapotranspiration (PEt) and percolation (S).

Evapotranspiration and design precipitation have been calculated based on an analysis of 30 years of monthly precipitation data from the U.S. Weather Service station in Helen, Georgia. The design precipitation is the mean monthly precipitation with a 5-year return period, which implies that there is a 20 percent chance that the design precipitation will be equaled or exceeded in any given year.

The design percolation (S) rate represents the optimum water transmitting capacity of the soil. Soils with a high percolation rate have a low residence time for wastewater and are more amenable to chemical migration to ground water. On the other hand, soils with a low percolation rate are more prone to over-saturation and runoff to surface water.

The solution to the hydrologic balance for the site based on the more limiting Tallapoosa soil is presented in Table 5. The month with the lowest weekly loading for the project site is March with a hydraulic limit of 1.13 in/wk. In order to eliminate water balance storage and to provide an additional safety factor we recommend not exceeding this hydraulic loading limit during any month of the year.

2.0 Nitrogen Balance

Control of nitrate leaching is one of the principal objectives of land application system design and operation when nitrogen is a major waste constituent. Nitrogen leaching must be maintained at a level such that the concentration of nitrate-nitrogen in ground water does not exceed the drinking water quality standard of 10 mg/l. The concentration of total nitrogen in the effluent from the aerobic treatment tanks is projected to be 54.5 mg/l and the ammonia concentration is projected to be 30 mg/l.

The greatest contribution to nitrogen removal from applied wastewater is through vegetative uptake. Experience with land application systems receiving wastewater by spray irrigation has shown that a vegetation system consisting of mature hardwoods with a natural understory is effective in nitrogen uptake. EPD (2006) and EPA (1981) guidance estimate the nitrogen uptake rate for this type of vegetation is in the range of 300 lb/ac-yr. Experience monitoring forest land application systems suggests that a more reasonable rate is 150 lb/ac-yr. We recommend using this lower rate for nitrogen balance calculations.

Denitrification contributes to significant nitrogen removal at land application sites when conditions are favorable. Because of the strength of the wastewater, organic carbon will be readily available and anoxic conditions followed by aerobic conditions should occur relatively frequently, which will promote denitrification. A denitrification rate of 10 percent of applied nitrogen is estimated for the site.

Table 5. Water balance calculations for Tallapoosa Soil, Mote's Pumping Service LAS.

AVERAGE HYDRAULIC CONDUCTIVITY (in/hr):	0.37
DESIGN SAFETY FACTOR (0.04 - 0.12):	0.05
DESIGN PERCOLATION (in/day):	0.44

MONTH	DESIGN PRECIPITATION (in/mo)	POTENTIAL EVAPOTRANS. (in/mo)	DESIGN PERCOLATION (in/mo)	WASTEWATER (in/mo)	LOADING (in/wk)
January	8.87	0.38	13.76	5.27	1.19
February	8.06	0.52	12.43	4.89	1.22
March	10.11	1.37	13.76	5.02	1.13
April	6.78	2.31	13.32	8.84	2.06
May	8.65	3.82	13.76	8.93	2.02
June	8.03	4.90	13.32	10.19	2.38
July	8.66	5.92	13.76	11.00	2.48
August	8.93	5.39	13.76	10.23	2.31
September	8.57	3.72	13.32	8.46	1.97
October	6.57	2.23	13.76	9.43	2.13
November	7.72	1.04	13.32	6.63	1.55
December	7.87	0.46	13.76	6.35	1.43

Volatilization of ammonia is an important assimilative pathway in above-ground applications and under aerobic soil conditions. The estimated volatilization rate for the proposed spray field is 50 percent

The amount of residual nitrogen remaining after plant uptake, denitrification and volatilization are accounted for will be available to migrate to the ground water as the nitrate ion in the leachate. The nitrate concentration of the leachate is a function of the mass of nitrate available for leaching and the volume of water percolating to the ground water. The nitrate concentration in the ground water must be maintained below 10 mg/l, which is the drinking water standard.

The nitrogen balance for the Project Site is presented in Table 6. We recommend establishing the hydraulic loading for the application site to maintain nitrate leaching below 7.0 mg/l, which provides a margin of safety below the primary drinking water limit of 10 mg/l. Applying the design wastewater flow of 15,000 gpd to the 6.5 acres of suitable soil results in a hydraulic loading of 0.59 in/wk and a nitrate concentration in the leachate of 6.13 mg/l.

Table 6. Nitrogen balance for Motes Pumping Service land application system.

PARAMETER	INPUT DATA	
Average Daily Flow:	15,000	gpd
Wetted Field Area:	6.5	acres
Total Wastewater Nitrogen:	54.5	mg/l
Total Wastewater Ammonia:	30	mg/l
Net Plant Uptake:	200	lbs/ac-yr
Precipitation:	69.5	in/yr
Average Design Wastewater Loading:	0.59	in/wk

PATHWAY	AMOUNT	
Nitrogen Input From Wastewater	382	lb/ac-yr
Nitrogen Input From Rainfall and Fixation	5	lb/ac-yr
Total Nitrogen Input	387	lb/ac-yr
Ammonia Volatilization @ 5%	11	lb/ac-yr
Denitrification @ 20% of Total Nitrogen Applied	77	lb/ac-yr
Net Plant Uptake and Storage	200	lb/ac-yr
Nitrogen Leached by Percolate	99	lb/ac-yr
Precipitation	69.5	in/yr
Wastewater Applied	30.9	in/yr
Potential Evapotranspiration	36	in/yr
Percolate	64.5	in/yr
Nitrate-Nitrogen in Percolate	6.79	mg/l

3.0 Phosphorus and Other Constituent Loadings

The standard analysis includes phosphorus concentration in the soil but not phosphorus adsorption capacity of the soil. The Hayesville and Tallapoosa soils at the Project Site have high clay content in the subsoil and a high capacity for adsorbing phosphorus in applied effluent. The phosphorus adsorption capacity of these soils typically is in the range of 500-800 lb/ac. Forest vegetation can take up about 30 lb/ac of phosphorus each year. Phosphorus assimilation is rarely if ever a land limiting issue for wastewater that is applied to clayey soils. There typically are no other constituents in the effluent from residential developments that impact land area requirements for spray irrigation systems.

4.0 Ground Water Impacts

The nitrogen balance calculates the nitrate concentration in the percolate, not in the receiving ground water. Mixing of the percolate with ground water down gradient from the land application site reduces the nitrate concentration by an additional factor that is often difficult to quantify. The nitrogen balance indicates that application of wastewater to the soils will yield a nitrate concentration in the percolate of 6.38 mg/l, which is safely below the drinking water standard of 10 mg/l. Mixing with ground water is estimated to reduce the percolate concentration by half.

Sources at the Georgia EPD Drinking Water Program indicate that the Project Site is not located within the inner management zone of any existing well-head protection area (Personal Communication, Sandra Jo Robertson). The private drinking water well on the Mote property is approximately 450 feet from the northwestern edge of the proposed spray irrigation field. There are no other private wells within 500 feet of the proposed spray field.

Movement of soil water from the spray field area is expected to be toward the west where it will recharge the perennial tributary of Town Creek that runs through the Project Site. Nitrate nitrogen migrating from the spray field is projected to be well within drinking water standards. Therefore, there should be no negative impact to any private wells located in the general vicinity of the Project Site.

Based on the literature review, site investigation and water and nitrogen balance calculations, the proposed spray irrigation system does not endanger an underground source of drinking water.

E. LAND APPLICATION DESIGN CRITERIA

1.0 Design Wastewater Loading

The design flow 15,000 gpd applied to 6.5 acres represents a loading of 0.59 in/wk or 30.7 in/yr. At this rate there should be no measurable impact on ground water quality from nitrate leaching.

2.0 Wetted Field Area

The normal approach to calculating wetted field area is to start with the land area required for applying the average daily flow then add additional area for reduction of stored wastewater from operational, wet-weather/emergency and water balance storage. Based on water balance calculations the soils at the Project Site have a hydraulic limit of 1.13 in/wk. However, wastewater application for this project is limited by nitrogen loading to a rate of 0.59 in/wk. Therefore, there is excess hydraulic capacity that is not being utilized for application of the average daily flow. This excess capacity can be utilized for application of stored wastewater without having to provide additional land area for this purpose.

3.0 Vegetation Management

The site currently consists of mixed hardwoods. Minor clearing of construction lanes will be required for installation of the distribution headers and laterals. No harvesting or planting should be required provided disease or storm activity does not diminish the vitality of growth in this stand.

4.0 Monitoring

The proposed monitoring program for the land application system includes two down-gradient wells, one interior well and one background well. Sampling of wastewater from the holding tank is also required. Considering the small size of the project, the assumed ground water flow directions on the site and the method of application, four wells should provide an adequate means of monitoring the performance of the system. Two wells are recommended near the eastern boundary of the spray field to monitor ground water quality between the field and the perennial stream. All wells should be set in the water table aquifer. The down-gradient wells will detect changes in groundwater conditions due to the land application system operation while the background well will provide samples unaffected by the system.

Water quality samples should be taken from all monitoring wells on at least one occasion before system operation begins. This must be done in order to log data reflective of native groundwater quality prior to any percolation of wastewater. Wells should be developed as described in procedures approved by EPD before the first sampling is done.

F. SUMMARY AND CONCLUSIONS

An evaluation of site conditions and waste characteristics has been performed for Mote's Pumping Service in White County, Georgia to develop design criteria for the proposed spray irrigation land application system. The evaluation followed guidelines established by the Georgia Environmental Protection Division for the design of spray irrigation land application systems. As a result of this evaluation the suitability of the proposed site for wastewater application has been established. The pertinent design criteria are summarized below.

1. The design flow for the system is of 15,000 gpd. Aerobic treatment will be provided prior to land application.
2. A total of 10.4 acres of suitable land were identified for wastewater application. Nitrogen balance calculations indicate that 6.5 acres are required to safely maintain ground water quality below the target concentration of 7 mg/l for nitrate nitrogen in leachate from the system.
3. Wastewater will be applied with a solid-set irrigation system. Vegetation will consist of mature hardwood forest.
4. A monitoring system with two down-gradient wells, one interior well and one background well is recommended for the site. Composite wastewater sampling will be conducted at the central dosing tank.

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APPENDIX A

SOIL PROFILE DESCRIPTIONS

AND

OFFICIAL SOIL SERIES DESCRIPTIONS

SOIL PROFILE DESCRIPTIONS
MOTE'S PUMPING SERVICE LAS
WHITE COUNTY, GEORGIA

Boring No.	Depth (Inches)	Description
B1	Tallapoosa Series	
	0-6	Brown Sandy Loam
	6-32	Red Clay Loam
	32-38	Red Clay Loam, Few Fine Distinct Yellowish Brown Mottles
	38	Auger Refusal on Solid Rock
B2	Tallapoosa Series	
	0-4	Brown Sandy Loam
	4-36	Red Sandy Clay Loam, Few Fine Mica Flakes, Few Fine Seams of Black and Reddish Yellow Sandy Loam
	36	Auger Refusal on Solid Rock
B3	Tallapoosa Series	
	0-6	Strong Brown Sandy Clay Loam
	6-27	Yellowish Red Clay, Common Medium Mica Flakes, Few Medium Seams of Yellowish Brown, Strong Brown and Black Soft Weathered Rock
	27-120	Strong Brown, Black, White and Gray Soft Weathered Rock, Crushes to Coarse Sand
B4	Hayesville Series	
	0-4	Brown Sandy Loam
	4-20	Red Sandy Clay Loam
	20-28	Red Sandy Clay Loam, Few Fine Faint Yellowish Brown Mottles, Few Fine Mica Flakes
	28-38	Red Sandy Clay Loam, Few Medium Seams of Black, Yellow and Reddish Yellow Sandy Loam Saprolite
	38-58	Red Sandy Loam, Common Medium Seams of Reddish Yellow, Yellow and Red Sandy Loam Saprolite, Few Fine Seams of Reddish Yellow and Yellowish Brown Hard Weathered Parent Material, Few Medium Seams of Red Sandy Clay Loam, Many Fine Mica Flakes
	58-72	Variegated Red, Brown, White and Yellow Sandy Loam Saprolite, Many Fine Mica Flakes
B5	Hayesville Series	
	0-6	Reddish Brown Sandy Loam
	6-18	Red Sandy Loam, Many Medium Seams of Red Sandy Clay Loam, Few Medium Seams of Brown Sandy Loam
	18-48	Red Sandy Loam, Many Medium Seams of Red Sandy Clay Loam, Few Medium Seams of Red, Dusky Red and Black Sandy Loam Saprolite, Many Fine Mica Flakes
	48-72	Variegated Black, Red, Dusky Red and White Sandy Loam Saprolite, Many Fine Mica Flakes

SOIL PROFILE DESCRIPTIONS
MOTE'S PUMPING SERVICE LAS
WHITE COUNTY, GEORGIA

Boring No.	Depth (Inches)	Description
B6	Hayesville Series	
	0-3	Brown Sandy Loam
	3-28	Red Sandy Clay Loam, Few Fine Mica Flakes
	28-36	Red Sandy Clay Loam, Few Fine Seams of Reddish Yellow Sandy Loam, Many Coarse Mica Flakes
	36-40	Red Sandy Loam, Many Medium Seams of Reddish Yellow Sandy Loam Saprolite, Many Coarse Mica Flakes
	40-72	Red Sandy Loam, Many Fine Mica Flakes, Many Medium Seams of Black, Reddish Yellow and White Sandy Loam Saprolite, Few Fine Seams of Quartz Fragments, Few Fine Seams of Reddish Yellow and White Hard Weathered Parent Material
B7	Tallapoosa Series	
	0-7	Brown Sandy Loam
	7-38	Red Sandy Clay Loam, Few Fine Mica Flakes
	38-53	Red Sandy Clay Loam, Few Fine Mica Flakes, Few Fine Seams of Dusky Red Hard Weathered Parent Material, Few Fine Seams of Yellow and Yellowish Brown Sandy Loam Saprolite
	53	Auger Refusal on Solid Rock
B8	Tallapoosa Series	
	0-6	Brown Sandy Loam
	6-72	Strong Brown Sandy Clay Loam, Few Fine Mica Flakes
B9	Tallapoosa Series	
	0-6	Strong Brown Sandy Loam
	6-18	Red Sandy Clay Loam, Many Fine Mica Flakes
	18-28	Red Sandy Clay Loam, Many Fine Mica Flakes, Few Medium Seams of Black and Red Sandy Loam Saprolite
	28-42	Variegated Red, Black, Yellow and Brownish Yellow Sandy Loam Saprolite, Many Fine Mica Flakes
	42-61	Variegated Red, Black, Yellow and Brownish Yellow Sandy Loam Saprolite, Many Fine Mica Flakes, Few Fine Seams of Quartz and Yellowish Brown and Black Hard Weathered Parent Material
	61	Auger Refusal on Solid Rock
B10	Hayesville Series	
	0-8	Brown Sandy Loam
	8-28	Reddish Yellow Sandy Clay Loam, Few Fine Mica Flakes
	28-36	Reddish Yellow Sandy Loam, Many Fine Mica Flakes, Few Medium Seams of Black and Yellowish Brown Sandy Loam Saprolite
	36-54	Reddish Yellow Sandy Loam, Few Fine Seams of Red Sandy Clay Loam, Few Fine Seams of Dusky Red, Black and Yellowish Brown Hard Weathered Parent Material, Crushes to Sandy Loam
	54-72	Variegated Red, Black, Dusky Red, White and Yellow Sandy Loam Saprolite

SOIL PROFILE DESCRIPTIONS
MOTE'S PUMPING SERVICE LAS
WHITE COUNTY, GEORGIA

Boring No.	Depth (Inches)	Description
B11	Hayesville Series	
	0-5	Strong Brown Sandy Loam
	5-28	Yellowish Red Sandy Clay Loam, Common Medium Mica Flakes
	28-40	Light Red Sandy Clay Loam, Common Medium Mica Flakes
	40-53	Light Red and Pale Yellow Coarse Sandy Loam, Common Medium Mica Flakes
	53-72	Yellow, Yellowish Red and Pale Yellow Coarse Sandy Loam Saprolite, Few Medium Prominent Yellowish Red and Light Red Sandy Clay Loam Saprolite, Few Medium Prominent Yellowish Red and Light Red Sandy Clay Loam Saprolite, Common Medium Mica Flakes.
B12	Tallapoosa Series	
	0-4	Brown Sandy Loam
	4-17	Red Sandy Clay Loam, Few Fine Mica Flakes, Few Medium Seams of Yellow, Yellowish Brown and Black Sandy Loam Saprolite
	17-24	Variegated Red, Brown, Yellow and Yellowish Brown Sandy Loam Saprolite, Many Fine Mica Flakes
	24-54	Variegated Black, Yellow, White and Red Hard Weathered Parent Material, Few Fine Seams of Red Sandy Loam
	54	Boring Terminated Due to Hard Weathered Parent Material
B13	Tallapoosa Series	
	0-4	Strong Brown Sandy Clay Loam
	4-18	Yellowish Red Sandy Clay Loam, Few Fine Mica Flakes
	18-26	Yellowish Red Sandy Clay Loam, Common Fine Mica Flakes, Common Medium Seams of Black and Strong Brown Soft Weathered Rock
	26-60	Strong Brown and Black Soft Weathered Rock, Yellowish Red and Strong Brown Sandy Clay Loam, Common Fine Mica Flakes
B14	Hayesville Series	
	0-3	Brown Sandy Loam
	3-28	Red Sandy Clay Loam, Few Fine Mica Flakes
	28-34	Red Sandy Clay Loam, Many Fine Mica Flakes, Few Fine Seams of Black and Red Sandy Loam
	34-72	Variegated Red, Black, White, Yellow and Brownish Yellow Sandy Loam Saprolite, Many Fine Mica Flakes
B15	Hayesville Series	
	0-8	Brown Sandy Loam
	8-42	Strong Brown Sandy Clay Loam, Few Fine Mica Flakes
	42-50	Yellowish Red Sandy Clay Loam, Few Fine Mica Flakes
	50	Auger Refusal on Solid Rock

SOIL PROFILE DESCRIPTIONS
MOTE'S PUMPING SERVICE LAS
WHITE COUNTY, GEORGIA

Boring No.	Depth (Inches)	Description
B16	Hayesville Series	
	0-7	Brown and Reddish Brown Sandy Clay Loam
	7-16	Yellowish Red Sandy Clay Loam
	16-38	Light Red Sandy Clay Loam, Few Medium Mica Flakes
	38-72	Light Red and Yellowish Red Sandy Clay Loam Saprolite, Common Fine Mica Flakes, Few Medium Seams of Yellow and Yellowish Red Sandy Loam Saprolite
B17	Hayesville Series	
	0-4	Brown Sandy Loam
	4-16	Strong Brown Sandy Clay Loam
	16-28	Red Sandy Clay Loam, Few Fine Mica Flakes
	28-60	Red Sandy Clay loam, Many Fine Mica Flakes, Many Medium Seams of Black, Yellow, Brownish Yellow and Red Sandy Loam Saprolite
	60-72	Variegated Black, Yellow, White and Red Hard Weathered Parent Material, Augers to Sandy Loam, Many Fine Mica Flakes
B18	Tallapoosa Series	
	0-3	Brown Sandy Loam
	3-20	Red Sandy Clay Loam, Many Fine Mica Flakes
	20-41	Variegated Black, Yellow, White and Red Sandy Loam Saprolite, Many Fine Mica Flakes, Few Fine Seams of Red Sandy Clay Loam
	41-72	Variegated Black, Yellow, White and Red Hard Weathered Parent Material, Few Fine Seams of Red Sandy Clay Loam
B19	Tallapoosa Series	
	0-4	Brown Sandy Loam
	4-28	Red Sandy Clay Loam, Many Fine Mica Flakes
	28-40	Red Sandy Loam, Many Fine Mica Flakes, Few Medium Seams of Dusky Red, Black and Yellow Sandy Loam Saprolite, Few Medium Seams of Red Sandy Clay Loam
	40-72	Variegated Black, Dusky Red, Red, Yellow and White Sandy Loam Saprolite, Many Fine Mica Flakes
B20	Tallapoosa Series	
	0-4	Brown Sandy Loam
	4-22	Red Sandy Clay Loam, Many Fine Mica Flakes
	22-32	Red Sandy Clay Loam, Many Large Mica Flakes, Few Fine Seams of Black Sandy Loam Saprolite
	32-41	Red Sandy Loam, Many Coarse Mica Flakes, Few Medium Seams of Black, Yellowish Brown and Reddish Yellow Sandy Loam Saprolite, Few Fine Seams of Reddish Yellow and black Hard Weathered Parent Material
	41	Auger Refusal on Hard Weathered Parent Material

SOIL PROFILE DESCRIPTIONS
MOTE'S PUMPING SERVICE LAS
WHITE COUNTY, GEORGIA

Boring No.	Depth (Inches)	Description
B21	Tallapoosa Series	
	0-6	Brown Sandy Loam
	6-38	Red Sandy Clay Loam, Many Fine Mica Flakes
	38-48	Red Sandy Clay Loam, Many Fine Mica Flakes, Few Fine Seams of Red, Dusky Red, Black and Yellowish Brown Sandy Loam Saprolite
	48-57	Red Sandy Loam, Few Medium Seams of Black, Red, Dusky Red and Yellowish Brown Saprolite
	57	Auger Refusal on Hard Rock
B22	Starr Series	
	0-3	Brown and Strong Brown Sandy Clay Loam
	3-32	Strong Brown Sandy Clay Loam
	32-54	Yellowish Red and Red Sandy Clay Loam
	54-60	Red and Light Red Sandy Clay Loam, Common Medium Seams of Black and Reddish Yellow Soft Weathered Rock, Few Fine Seams of Reddish Yellow and Black Hard Weathered Rock Material
	60	Auger Refusal on Hard Weathered Rock
B23	Tallapoosa Series	
	0-3	Brown and Dark Brown Sandy Loam
	3-18	Yellowish Red Sandy Clay Loam, Few Fine Seams of Yellow, Reddish Yellow and Black Soft Weathered Rock
	18-33	Reddish Yellow, Yellow, Light Red and Black Soft Weathered Rock, Crushes to Sandy Loam, Common Medium Mica Flakes
	33-46	Reddish Yellow, Yellow, Light Red and Black Soft Weathered Rock, Crushes to Sandy Loam, Common Medium Mica Flakes, Few Fine Prominent Light Red Sandy Clay Loam
	46-60	Strong Brown, Reddish Yellow, Yellow and Black Soft Weathered Rock, Crushes to Coarse Sand
	60	Boring Terminated
B24	Tallapoosa Series	
	0-3	Black and Dark Brown Organic Material
	3-7	Red and Reddish Brown Sandy Clay Loam
	7-22	Red Clay
	22-30	Red Sandy Clay Loam
	30-40	Light Red Sandy Loam, Few Fine Mica Flakes
	40-72	Light Reddish Yellow Sandy Loam Saprolite, Few Fine Mica Flakes, Yellow and Black Soft Weathered Rock, Crushes to Coarse Sand

SOIL PROFILE DESCRIPTIONS
MOTE'S PUMPING SERVICE LAS
WHITE COUNTY, GEORGIA

Boring No.	Depth (Inches)	Description
B25	Tallapoosa Series	
	0-3	Reddish Brown Sandy Clay Loam
	3-27	Red Clay
	27-38	Yellowish Red Sandy Clay Loam, Few Fine Mica Flakes
	38-48	Dusky Red Sandy Clay Loam Saprolite, Few Fine Mica Flakes, Few Fine Quartz Seams
	48-55	Dusky Red, Brown and Strong Brown Sandy Loam Saprolite, Few Fine Seams of Yellowish Red Sandy Clay Loam Saprolite, Common Fine Mica Flakes
	55-72	Yellow, Pale Yellow, White and Dusky Red Sandy Loam Saprolite, Common Fine Seams of Reddish Yellow, Yellow and Black Soft Weathered Rock, Common Fine Mica Flakes
B27	Tallapoosa Series	
	0-4	Reddish Brown Sandy Loam
	4-14	Red Sandy Clay Loam
	14-42	Red Sandy Clay Loam, Few Medium Seams of Reddish Yellow Soft Weathered Rock
	42-60	Red and Dark Red Soft Weathered Rock, Crushes to Sand, Few Medium Seams of Reddish Yellow Dense Hard Weathered Rock, Few Medium Prominent Yellowish Red Sandy Clay Loam Saprolite
B28	Hayesville Series	
	0-8	Brown Sandy Loam
	5-16	Yellowish Red Sandy Clay Loam
	16-49	Red Sandy Clay Loam, Common Fine Mica Flakes
	49-72	Dusky Red Sandy Loam Saprolite, Few Fine Mica Flakes
B29	Hayesville Series	
	0-2	Brown Sandy Loam
	2-22	Yellowish Red Sandy Clay Loam
	22-37	Yellowish Red and Light Red Sandy Clay Loam Saprolite
	37-66	Yellowish Brown and Strong Brown Sandy Loam Saprolite, Few Fine Mica Flakes
	66	Auger Refusal on Loose Quartz
B30	Hayesville Series	
	0-7	Brown and Light Red Sandy Clay Loam
	7-30	Yellowish Red Sandy Clay Loam
	30-44	Strong Brown Sandy Clay Loam, Few Fine Mica Flakes
	44-72	Yellowish Brown Sandy Loam, Common Fine Distinct White Mottles (Quartz), Few Fine Mica Flakes