Capitol City Plume - Documents (1 of 4)

Stephen Smith to: gary.gengel@lw.com 07/26/2011 03:14 PM

Attached are discussed documents:

CC Plume - SI.pdf

Stephen P. Smith
U.S. Environmental Protection Agency, Region 4
Office of Environmental Accountability
61 Forsyth Street, S.W.
Atlanta, Georgia 30303
Ph: (404) 562-9554
Fax: (404) 562-9486
smith.stephen@epa.gov

Site Investigation Ref. #6330
Capitol City Plume
Montgomery, Montgomery Co., Alabama
ALD 0001058056

Date: March 7, 1996
Prepared by: Chris Smith
Alabama Department of Environmental Management
Site: Capitol City Plume
EPA ID: ALD001058056
Ref #: 6330

SITE: Capitol City Plume
BREAK: 1.9
OTHER: v.1

Further Action Approved
6/29/96
BJ

1.0 INTRODUCTION

Under authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA) the Alabama Department of Environmental Management (ADEM), Field Operations Division, conducted a Site Inspection (SI) on the Capitol City Plume site located in downtown Montgomery, Montgomery County, Alabama. The Purpose of this investigation was to assess the threat to human health and the environment the site may pose. This included reviewing existing information and evaluating the site under the Hazard Ranking System (HRS).

2.0 SITE DESCRIPTION

2.1 Location

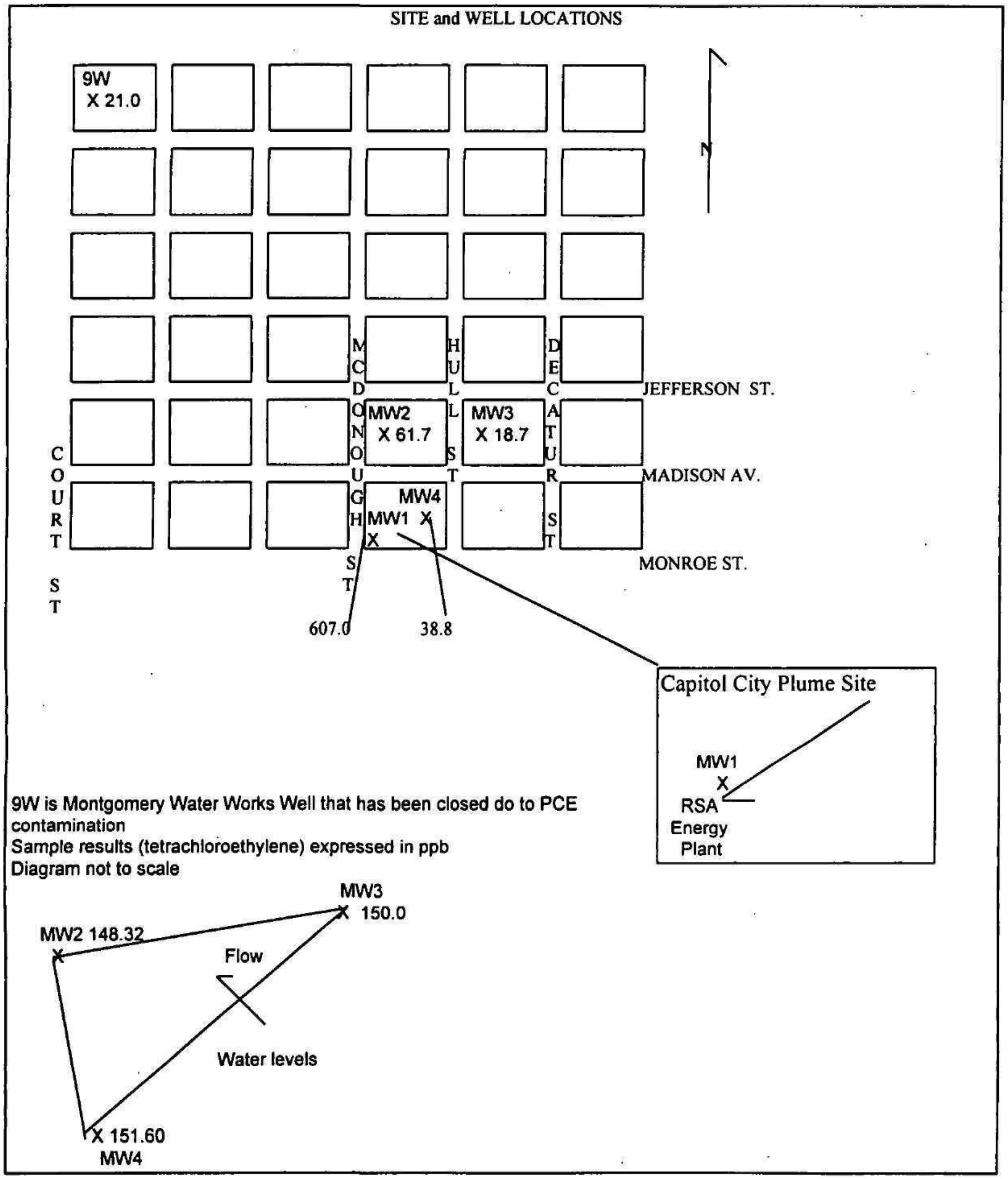
The Capitol City Plume site is located in downtown Montgomery, Montgomery County, Alabama. The original or first location contamination was discovered was the Retirement Systems of Alabama (RSA) Energy Plant. The RSA Energy plant is located in the Southwest 1/4 of Section 7; Township 16 North; Range 18 East. [1,2]

Since the initial discovery of contamination, investigations conducted by ADEM's Special Projects has indicated that there is an extensive groundwater plume. Current data suggest the Capitol City Plume to be located within a several block area that is bound on the north by Pollard St., on the east by Decatur St., on the south by Dexter Ave., and on the west by Court St. [4,5]

2.2 Operational History

At this time a source of contamination has not been identified. Therefore little can be written about operational history, ownership, waste generation and treatment; however, it is suspected that past dry cleaning, auto repair, and/or printing operations are the source of contamination. Several of these facilities have operated within the site area over the years.

The site was initially discovered during the construction of the RSA Energy Plant. It began with an area of contaminated soil and has grown into the discovery of a groundwater plume that has caused the closing of one public drinking water well. [4]


SITE and WELL LOCATIONS

9W is Montgomery Water Works Well that has been closed do to PCE contamination
Sample results (tetrachloroethylene) expressed in ppb
Diagram not to scale

After the report of contaminated soil by RSA officials ADEM's Special Projects under the Alabama Hazardous Substance Cleanup Fund (AHSCF) authority began investigating in September of 1993. In ADEM's Phase I investigation Special Projects focused on the RSA Energy plant area. The Phase II investigation which began in November 1993 consisted of subsurface soil sampling, installation and sampling of 2 groundwater monitoring wells, sampling other wells located within the study area and in cooperation with the Northeast Research Institute (NERI) conducting a PETREX soil gas survey. The soil gas survey suggests that the source of groundwater contamination is not the RSA Energy Plant location. Data collected to date has also not identified a surface source; however, investigations are still being conducted. [3,4]

3.0 WASTE SOURCE

As already mentioned a source of contamination has not been identified, so as per 40 CFR Part 300 HRS the groundwater plume that has been identified through sampling and the soil gas survey will be the source used for generating a HRS score for the site. To generate a Hazardous Waste Quantity the area within the monitoring wells was used to obtain a volume. The area between MW1, MW2 and MW3 contained 95,815,328.7722 cubic feet. The area consisting of MW1, MW3 and 9W contained 1,057,159,393.06 cubic feet. It should be noted that the total volume of the aquifer was not calculated. If the total volume was calculated the numbers would be higher. I used the area within MW1, MW2, and MW3 as the groundwater plume (see diagram on page 2).

3.1 Waste Source Sampling

Samples collected during the Phase I investigation revealed levels of tetrachloroethylene at 7843 ppm in the soil and 607 ppb in groundwater. Phase II groundwater analysis ranged from 9.7 ppb to 113.0 ppb tetrachloroethylene. It was also discovered during this investigation that Montgomery Public Water Well 9W had to be closed due to the presence of tetrachloroethylene. Well 9W is located 3/8 of a mile NW of the RSA site. It had concentrations of tetrachloroethylene of 7.1 ppb on 4/4/91 and 21.0 ppb on 5/14/92. The groundwater samples and the results of the soil gas survey indicated that there was a groundwater plume and that the contamination appeared to come from an off site source. [3,4]

The contaminated soil that was originally discovered was removed and properly disposed by the RSA.

4.0 GROUNDWATER PATHWAY

4.1 Hyrogeology

The site is located within the Red, High Stream Terraces physiograhic subdivision of the Alluvial Deltaic Plain District of the East Gulf Coastal Plain physiographic section. The prominent features of the Alluvial-Deltaic Plain District are broad, well developed, flat flood plains and terraces. These flood plains and terraces consist of gravel, sand silt, and clay sediments that have been deposited by the meandering Alabama River, Tallapoosa River and their large ancestral streams. The alluvial deposits are as much as 80 feet thick, but are typically 30 to 50 feet thick. The Eutaw formation underlies the alluvial aquifer and consists of marine sand separated by a zone of clay. Some municipal wells are screened in the alluvial aquifer, but the majority are screened in the underlying Eutaw. The two aquifers are hydraulically connected and susceptible to surface contamination. [6]

4.2 Groundwater Targets

The site area is served by the Montgomery Water Works (MWW). Twenty eight of MWW's forty nine wells are located within the site target distance limit. MWW obtains 34% of their water from drinking water wells. All 49 are used equally. Montgomery Water works serves 220,002 people. Other utilities in the Montgomery vicinity purchase a percentage of their water from MWW. MWW provides 40% of the Pintlala Water and Fire Protection Authority and 75% of the Hunter Walk Manufactured Home Community water. Pintlala serves 3,819 and Hunter Walk serves 597. [1,6,7]

4.3 Groundwater Conclusions

Sampling mentioned earlier has revealed an observed release and a MWW well has been closed due to the same contamination, therefore it appears there is an observed release with an actual contamination target. Also with Montgomery being a large city there are a considerable number of residence potentially threatened. After reviewing the Preliminary Assessment and evaluating the information and data with the HRS it appears that the Capitol City Plume site does pose a threat. ADEM's Special Projects is still working within the area attempting to identify a source of contamination. They have recently began another soil gas survey that encompasses a larger area of downtown Montgomery.

5.0 SURFACE WATER PATHWAY

5.1 Hydrology

The site overland drainage flows into stormwater drainage paths located in downtown Montgomery. The stormwater system was constructed prior to 1860, so there is very little information available about the exact route water travels prior to discharge; however, the Montgomery Water Works and Sanitary Sewer Board said the drainage systems discharge all stormwater into the Alabama River. The Alabama River is located less than .75 miles west northwest form the RSA site.[1]

Once the drainage enters the Alabama River it is carried by the river for the entire 15 mile target distance limit. The Alabama River has a 2-year 7-day low flow of 6980 cubic feet per second (cfs). [1]

The majority of the source (groundwater plume) is outside the 500 year flood plain, but the northwest portion of the plume is located within the 100 year flood plain. [1]

5.2 Surface Water Targets

There are no drinking water intakes located within the target distance limit; however, approximately .76 miles of wetland frontage has the potential of being influenced by site drainage. Also the Alabama Sturgeon a proposed federally threatened species is known to inhabit the Alabama River within the target distance limit.

5.3 Surface Water Conclusions

Even though the site has some surface water targets associated with the pathway, when considering the source and the flow of the Alabama River it is unlikely the site poses a threat to the surface water.

6.0 SOIL EXPOSURE AND AIR PATHWAYS

There is no observed surface contamination. The source is a groundwater plume with no identified surface source. With this in mind the Soil and Air pathways will not be evaluated.

7.0 CONCLUSIONS

An observed release with actual contamination has been established in the groundwater pathway. Considering the information in SI, PA and SI worksheet it is recommended that the Capitol City Plume site be considered as a candidate for the NPL.

References:

1. Preliminary Assessment

2. U.S.G.S. 7.5 minute series Topographic Map

3. Special Projects Phase I Report

4. Special Projects Phase II Report

5. Soil Gas Survey, PETREX Information, Report and Maps

6. Geology

7. Montgomery Water Works well distribution and Population served

REFERENCE 1

PRELIMINARY ASSESSMENT

The PA should already be on file, so the entire PA was not included in this report

REFERENCE 1

PRELIMINARY ASSESSMENT
CAPITOL CITY PLUME
MONTGOMERY, MONTGOMERY COUNTY, ALABAMA
EPA ID No.: AL0001058056
CERCLIS SITE REF. No.: 6330

Prepared By
Jerremy Stamps
Alabama Department of Environmental Management
Special Projects

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ATTACHMENTS
PLATES

Date: *February 1995*

Prepared by: *Jerremy Stamps (Site Investigator)*
Site Assessment Unit
ADEM - Special Projects

Site: *Capitol City Plume*
Montgomery, Montgomery County, Alabama 36110

EPA ID No.: *AL0001058056*

CERCLIS No.: *6330*

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1. INTRODUCTION

Under authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA) and a cooperative agreement between the U. S. Environmental Protection Agency and the Alabama Department of Environmental Management (ADEM), a Preliminary Assessment (PA) was conducted at the Capitol City Plume Site in Montgomery, Montgomery County, Alabama. The purpose of this investigation was to collect information concerning conditions at the site sufficient to assess the threat posed to human health and the environment and to determine the need for additional investigation under CERCLA/SARA or other action. The scopes of the investigation included a review of available file information, a comprehensive target survey, a site reconnaissance and a limited ground water, soil, and soil gas study.

2. SITE DESCRIPTION, SITE HISTORY, AND WASTE CHARACTERISTICS

2.1 Location

The "Capitol City Plume" Site is located in downtown Montgomery, Alabama (Figure 1). Tetrachloroethene (PCE) was initially discovered as soil and ground water contamination in a 30 foot deep excavation that was dug during the construction of the Retirement Systems of Alabama (RSA) Energy Plant located in the Southwest 1/4 of Section 7; Township 16 North; Range 18 East (Figure 1).

Montgomery has a humid subtropical climate with moderate precipitation throughout all seasons. Statistically, Montgomery County receives the most precipitation, 6.50 inches, during the month of March and the least precipitation, 2.36 inches, during the month of October. The normal annual total precipitation for Montgomery County is 53.66 inches. Runoff in the northwest portion of the county is less than 18 inches per year and the mean annual lake evaporation is approximately 43 inches. (Reference 3)

The mean annual temperature for Montgomery County is approximately 65.4° F. On a monthly average, January is the coldest and July is the warmest. January has an average temperature of 49.2° F and an absolute minimum temperature of 5° F. July has an average temperature of 81.2° F and an absolute maximum temperature of 107° F. (Reference 3)

2.2 Site Description

In an area of downtown Montgomery that is bound on the north by Pollard Street; on the east by Decatur Street; on the south by Dexter Avenue and on the west by Court Street, a soil gas survey was conducted by the Alabama Department of Environmental Management. The survey detected 6 tetrachloroethene (PCE) and 6 benzene, toluene, ethylbenzene, and xylene (BTEX) plumes (Figure 1; Appendix C).

Five (5) of the 12 contaminated ground water plumes identified by the soil gas survey extended beyond the study area. Therefore, for the purposes of this assessment, the Capitol City Plume Site has been estimated to consist of all properties within an 1/2 mile radius of the original location where PCE contamination was first discovered. The geographic coordinates where PCE contaminated soil and ground water were initially discovered are 32° 22' 44.90" North Latitude and 86° 18' 15.70" West Longitude (Reference 1; Reference 2).

2.3 Waste Characteristics and Site History

In September of 1993 the Special Projects branch of the Alabama Department of Environmental Management (ADEM) began investigating a report of PCE soil contamination at the RSA Energy Plant site at the corner of Monroe Street and McDonough Street (Appendix A). After 17 months of investigative work, ADEM came to the conclusion that there are a minimum of 12 ground water plumes contaminated with either PCE or BTEX within a 30 city block area of downtown Montgomery (Appendix B; Appendix C).

The substances benzene, toluene, ethylbenzene, and xylene (BTEX) are constituents found in automobile fuel as well as many other petroleum derived fuels and solvents. Due to the common use of these substances, the possible sources of all the ground water plumes contaminated with BTEX in the study area were not extensively researched, but the sources of at least two of the BTEX plumes are thought to be leaking underground storage tanks.

Tetrachloroethene (PCE) is a man made substance mainly used for dry cleaning fabrics and textiles. Some other uses for the chlorinated hydrocarbon solvent are as a metal cleaning agent, as an additive in printing inks, adhesives, glues, sealant and polishes, and as a chemical intermediate in the process of other man made chemicals. Other names that may be used for tetrachloroethene include PCE, tetrachloroethylene, perchloroethylene, perc, perclene, and perchlor. At normal temperatures tetrachloroethene is a liquid, but some of the liquid can be expected to evaporate into the air producing an ether-like odor.

Since the major use for PCE is as a dry cleaning agent, research using city directories ranging in age from 1905 to 1985 were used to determine approximately how many possible sources from that one type of industry has existed within the study area of the Capitol City Plume Site. The following table contains the names and addresses of all the cleaners that were found to exist within the study area:

Year of Directory	Address	Name
1905	105 Monroe	Kruger George
1905	110-112 N Perry	Montgomery Steam Laundry
1907	1-2 Monroe	Jackson G. W.
1913	24 N Perry	Bachelor Tailoring & French Dry Cleaning
1913	201-203 Dexter	Montgomery French Dry Cleaning Co.
1913	4 Dexter	Paris Dry Cleaning Co.
1915	213 Dexter	Paris Dry Cleaning Co.
1915	507 N Decatur	Crim Clifford
1915	126 N Perry	H. B. Pressing Club
1915	607 Pollard	Jordan Lewis
1915	121 Dexter	Solomon Piha
1915	N Court	Williams Frank
1916	310 Dexter	Burke D. T.
1916	705 N Decatur	Harris
1916	421 Dexter	Home Industrial Cleaners
1916	18 N Perry	Howard G. C.

1937	400 Madison	Madison Avenue Dry Cleaners
1941	118 N Perry	Imperial Dry Cleaners
1941	403-405 Dexter	Strait Cleaners & Dyers
1946	217-237 Dexter	Loo Sing Laundry
1946	10 Lawerence	City Cleaners
1949	110 N Court	Caffey Dry Cleaners
1949	320 Madison	Madison Avenue Dry Cleaners
1949	317 Dexter	Paramount Cleaners
1949	525 Decatur	Wright Cleaners
1951	629-637 Madison	Jim Massey Cleaners
1955	124 N Court	Caffey Dry Cleaners
1955	330 Madison	Madison Avenue Dry Cleaners
1955	213 Madison	Parkers Snow White Laundry
1955	110 N Perry	Right Way Cleaners
1955	527 N Decatur	Wright Cleaners
1955	341 Dexter	Paramount Cleaners
1970	527 N Decatur	Sun-Moon Cleaners & Launders
1980	330 Madison	Davis One Hour Cleaners & Laundry
1980	14 Perry Ct	Kelly's Cleaners
1985	432 Madison	Davis One Hour Cleaners

3. GROUND WATER PATHWAY

3.1 Hydrogeologic Setting

The Capitol City Plume Site is located within the Red, High Stream Terraces physiographic subdivision of the Alluvial-Deltaic Plain District of the East Gulf Coastal Plain physiographic section. The prominent features of the Alluvial-Deltaic Plain District are broad, well developed, flat flood plains and terraces. These flood plains and terrace consist of gravel, sand, silt and clay sediments that have been deposited by the meandering Alabama River, Tallapoosa River and their large ancestral streams. The alluvial deposits are as much as 80 feet thick, but are usually only 30 to 50 feet thick. The parent material of these Quaternary alluvial deposits are residuum soils that have been washed in from as far away as the Piedmont physiographic district of Alabama. (Reference 3; Reference 5)

In the flood plains of the Alabama, Coosa and Tallapoosa Rivers, the alluvial deposits are a potential source for large public water supplies. A few municipal wells in the Montgomery North Well Field utilize the alluvial aquifer, but most are screened within the underlying Eutaw Formation. The Eutaw Formation consists of marine sand separated by a zone of clay. Because the Eutaw aquifer is hydraulically connected with the highly permeable alluvial sand and gravel deposits, it as well as the alluvial aquifer is susceptible to surface contamination. (Reference 3; Reference 4)

3.2 Ground Water Targets

Twenty-eight (28) of the 49 public water wells in the Montgomery North and West Well Fields are within the four-mile target radius. Montgomery Water Works (MWW) gets 34 percent of its total water supply from these equally contributing wells. The remaining 66 percent of their water supply comes from an intake located on the Tallapoosa River. The water from the 49 wells and the surface water intake make up a blended system that directly supplies 220,002 people. Pintlala Water and Fire Protection Authority serve a population of 3,819 and purchases 40 percent of its drinking water from MWW. Hunter Walk Manufactured Home Community serves a population of 597 and purchases 75 percent of its drinking water from MWW. (Reference 4; Reference 5)

3.3 Ground Water Conclusions

The installation of 4 monitoring wells on the Capitol City Plume Site has verified the presence of PCE in ground water (Appendix A; Appendix B). The soil gas survey conducted at the site suggest that PCE and BTEX contamination are widespread and may pose a serious threat to much of Montgomery's North Well Field. In the North Well Field municipal well number 9W has already had to be taken out of commission due to the presence of PCE contamination.

4. SURFACE WATER PATHWAY

4.1 Geomorphologic Setting

The maximum high elevation for the Capitol City Plume Site is approximately 288 feet above mean sea level in the southern part of the site, and the minimum low elevation for the site is approximately 160 feet above mean sea level, along the northwest border of the site near the Alabama River (Figure 1). Most of the Capitol City Plume Site lies outside of the 500 year flood plain of the Alabama Basin, but the northwest portion of the site that lies below approximately 170 feet above mean sea level lies within the 100 year flood plain (Reference 6). The portion of the site that lies below approximately 175 feet above mean sea level is also within the 500 year flood plain (Reference 6).

Overland drainage from the site flows into the city's storm water sewers and is discharged into the Alabama River. The city of Montgomery's storm water sewers system is believed to have been installed prior to the Civil War. No records are available that show the flow paths of the system, but according to the Montgomery Water Works and Sanitary Sewer Board, the system is know to discharge all collected storm water at various points along the Alabama River.

Once the overland drainage from the Capitol City Plume Site enters into the Alabama River it will travel southwestward down the Alabama River for the entire targeted 15-mile downstream surface water pathway. In the 15-mile surface water pathway, the Alabama River has a 7-day average flow of 3,710 cubic feet per second (cfs). The lowest flow to which the Alabama River will decline during 7 consecutive days on an average of once every 2 years of normal flow (7-day Q2) is estimated to be 6980 cfs. (Reference 11)

4.2 Surface Water Targets

The 15-mile downstream surface water pathway (SWP) begins and end on the Alabama River (Plate 1). There are no known drinking water intakes located within the targeted SWP (Reference 5). Along the entire targeted overland drainage and surface water pathway there is approximately 0.76 linear miles of wetlands that could come in contact with water from the Capitol City Plume Site. The land along the banks of the Alabama River and its intermittent tributaries might be critical to the support of many threatened and endangered species (see list of species in Section 5.2).

4.3 Surface Water Conclusion

Within the 15-mile downstream surface water pathway, the Alabama River is classified as a fish and wildlife area, and a water contact sport area (Reference 12). There are no drinking water intakes, no listed endangered or threatened aquatic wildlife and only a few small stretches of wetland that come in direct contact with the banks of the river. No information was discovered that would indicate that contaminants know to exist in the soils and ground waters at the Capitol City Plume Site have migrated into the surface water pathway.

5. SOIL EXPOSURE AND AIR PATHWAY

5.1 Physical Conditions

The USDA Soil Survey, indicates that the site is underlain by Sandy Alluvial Land soils of the Amite and Cahaba Soil Series. These soils consist of mixed alluvium that has been washed in from the Coastal Plain Upland. The soils of this land type are well drained, and have a moderate to moderately rapid permeability in the subsoil. Runoff over this land type is moderately rapid. (Reference 3)

5.2 Soil and Air Targets

There are several thousand workers that work on the Capitol City Plume Site and approximately 955 people living on the site. There are two schools, St. Mary of Loretta School and Baldwin School, located on the site (Figure 1; Reference 7). In the area of Montgomery that makes up the Capitol City Plume Site, no daycare facilities were listed in the South Central Bell 1994-95 Montgomery, Alabama Phone Book and none were seen during the site reconnaissance.

According to the Alabama 1990 census records (Reference 8), the average number of people living in homes located in Montgomery County is 2.61 residents per household. In the following table, the total population within the target area has been broken down into sub-populations that live within each specified distance radius from the site:

DISTANCE FROM SITE	*POPULATION*
ONSITE	954.6
0 TO 1/4 MILE	1,193.3
>1/4 TO 1/2 MILE	1,670.6
>1/2 TO 1 MILE	4,773.1
>1 TO 2 MILES	15,274.0
>2 TO 3 MILES	22,910.9
>3 TO 4 MILES	30,547.9
TOTAL POPULATION	77,324.4

None of the Capitol City Plume Site or the area within the 4-mile target area is considered to be a wetland environment. Within the 15-mile surface water pathway are a few small patches of wetland areas. The nearest wetland is approximately 5 miles northwest of the site or 6.2 miles downstream from the probable point of entry (PPE) for contaminants coming from the site via the surface water migration pathway (Reference 1).

It is not know if the Capitol City Plume Site is a critical habitat for federally designated endangered or threatened species. The table below is a list of the native species that may utilize the land and surface waters located within the 4-mile radius and 15-mile target areas:

Common Name	***Listing***	***Distribution in Alabama***
Red Wolf	Endangered	Statewide
Backman's Warbler	Endangered	Statewide
Eskimo Curlew	Endangered	Statewide
American Peregrine Falcon	Endangered	Statewide
American Burying Beetle	Endangered	Statewide
Florida Panther	Endangered	Statewide
Ivory-billed Woodpecker	Endangered	South, West-central
Red-cockaded woodpecker	Endangered	Statewide
Wood Stork	Endangered	Statewide
Bald Eagle	Endangered	Statewide
Arctic Peregrine Falcon	Threatened	Statewide
Alabama Canebrake Pitcher-plant	Endangered	Central

(Reference 9; Reference 10)

5.3 Soil Exposure and Air Pathway Conclusion

The air and soil exposure pathways do not appear to pose more than a minimal threat to human health and the environment. In all the soil and air studies done on the Capitol City Plume Site, none of the surficial soil or ambient air samples showed PCE contamination in any detectable quantity. The only documented exposure to the contaminants found at the Capital City Plume site by direct contact with contaminated soil or air took place during construction work in a 30 foot deep excavation at the Retirement Systems of Alabama Energy Plant.

6. SUMMARY AND CONCLUSIONS

In September of 1993 the Special Projects branch of the Alabama Department of Environmental Management (ADEM) began investigating a report of PCE soil contamination at the RSA Energy Plant site at the corner of Monroe Street and McDonough Street. After 17 months of investigative work, ADEM has discovered 6 ground water plumes contaminated with PCE and 6 other plumes of ground water contaminated with BTEX within a 30 city block area of downtown Montgomery. The installation of 4 monitoring wells on the Capitol City Plume Site combined with a soil gas survey suggest that PCE and BTEX contamination are widespread and may pose a serious threat to much of Montgomery's North Well Field. In the North Well Field municipal well number 9W has already had to be taken out of commission due to the presence of PCE contamination.

Because of the presence of PCE and BTEX contaminated ground water plumes near the Montgomery North and West Well Fields, and the large drawdown which is caused by the pumping of these well fields, there is a possibility that many of the drinking water supply wells screened in the Eutaw and the alluvial aquifers could become contaminated. Since these two well fields are responsible for 34 percent of Montgomery's water supply, ADEM recommends that this site be further evaluated under the authority of CERCLA and SARA.

7. REFERENCES

1. U.S.G.S. 7.5 Minute Series Topographic Quadrangle Maps of Alabama: Montgomery North 1981; Montgomery South 1981; Willow Springs 1987; Barachias 1987; Prattville 1987. Scale 1:24,000.

2. U.S. Environmental Protection Agency, Standard Operating Procedure to Determine Site Latitude and Longitude Coordinates, 1991. Calculation worksheet for the Capitol City Plume Site.

3. Burgess, Leland H., et al., United States Department of Agriculture Soil Conservation Service and Forest Service in cooperation with Alabama Department of Agriculture and Industries and Alabama Agricultural Experiment Station, 1960, Soil Survey of Montgomery County, Alabama.

4. Alabama Department of Environmental Management, Federal Reporting Data System (FRDS-II), Public Water Supply Summary.

5. Scott, John C., Cobb, Riley H. and Castleberry, Rick D., 1987, Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama; Area 8: U.S. Geological Survey Water-Resources Investigations Report 86-4360.

6. Federal Emergency Management Agency, Flood Insurance Rate Maps, Montgomery County; Montgomery, Alabama. Panel Numbers 01101C0000 and 01101C0065 F.

7. State of Alabama-Department of Education, LEA Personnel System (EDLP471), 1992, Total Number of Pupils and Faculty by School and County.

8. Alabama State Data Center, Center for Business and Economic Research, College of Commerce and Business Administration, The University of Alabama. 1990 CENSUS Alabama Counties and Cities By Race.

9. Teem, David H., et al., Alabama Agricultural Experiment Station, 1986, Vertebrate Animals of Alabama in Need of Special Attention.

10. Department of Conservation and Natural Resources, 1991 Federally Listed Endangered/Threatened Species.

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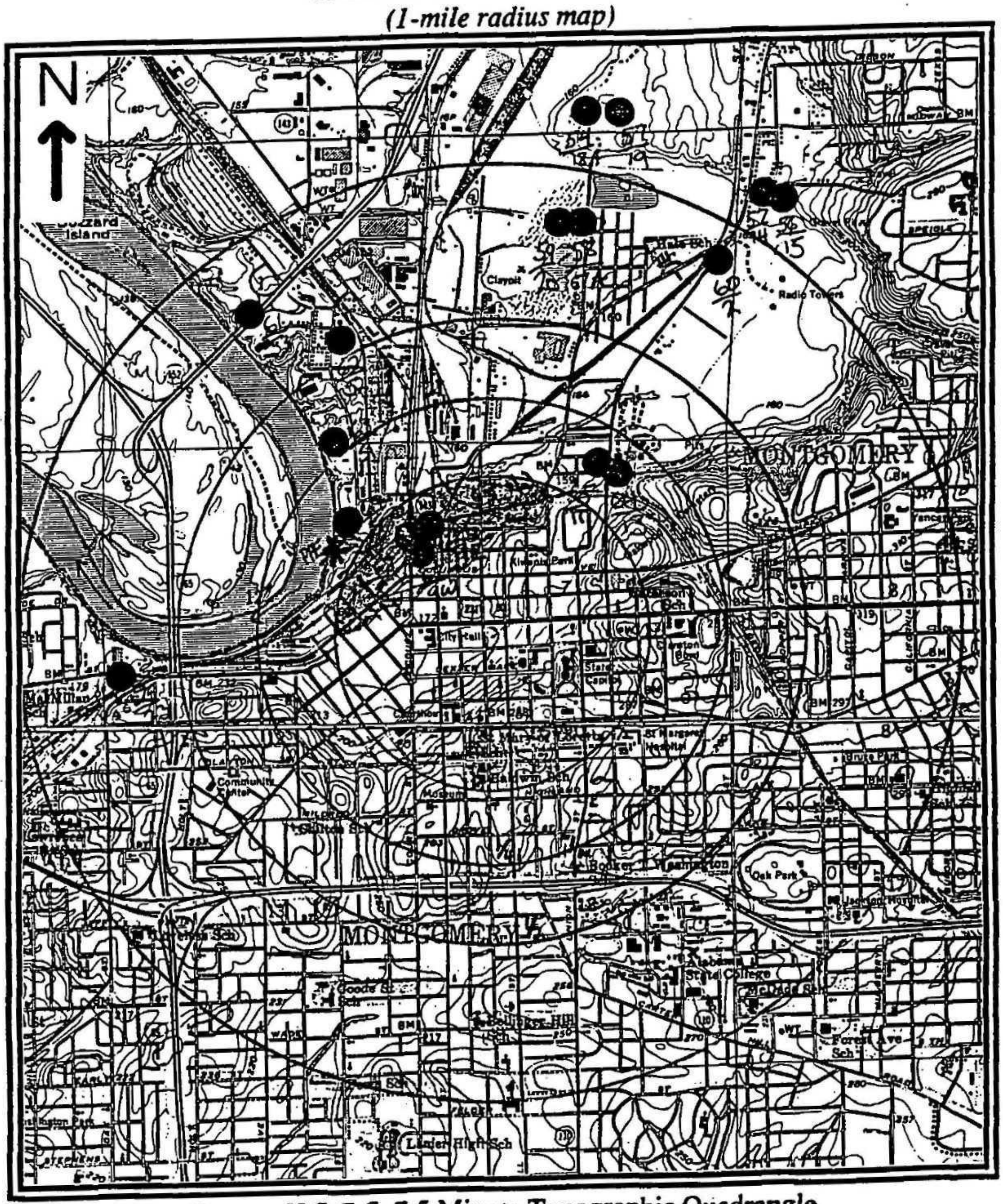
11. Hayes, Eugene C., United States Geological Survey in cooperation with the Geological Survey of Alabama, 1978, 7-Day Low Flows and Flow Duration of Alabama Streams Through 1973.

12. Alabama Department of Environmental Management; Water Division - Water Quality Program, 1993, Water Use Classification for Interstate and Intrastate Waters, Chapter 335-6-11.

FIGURES

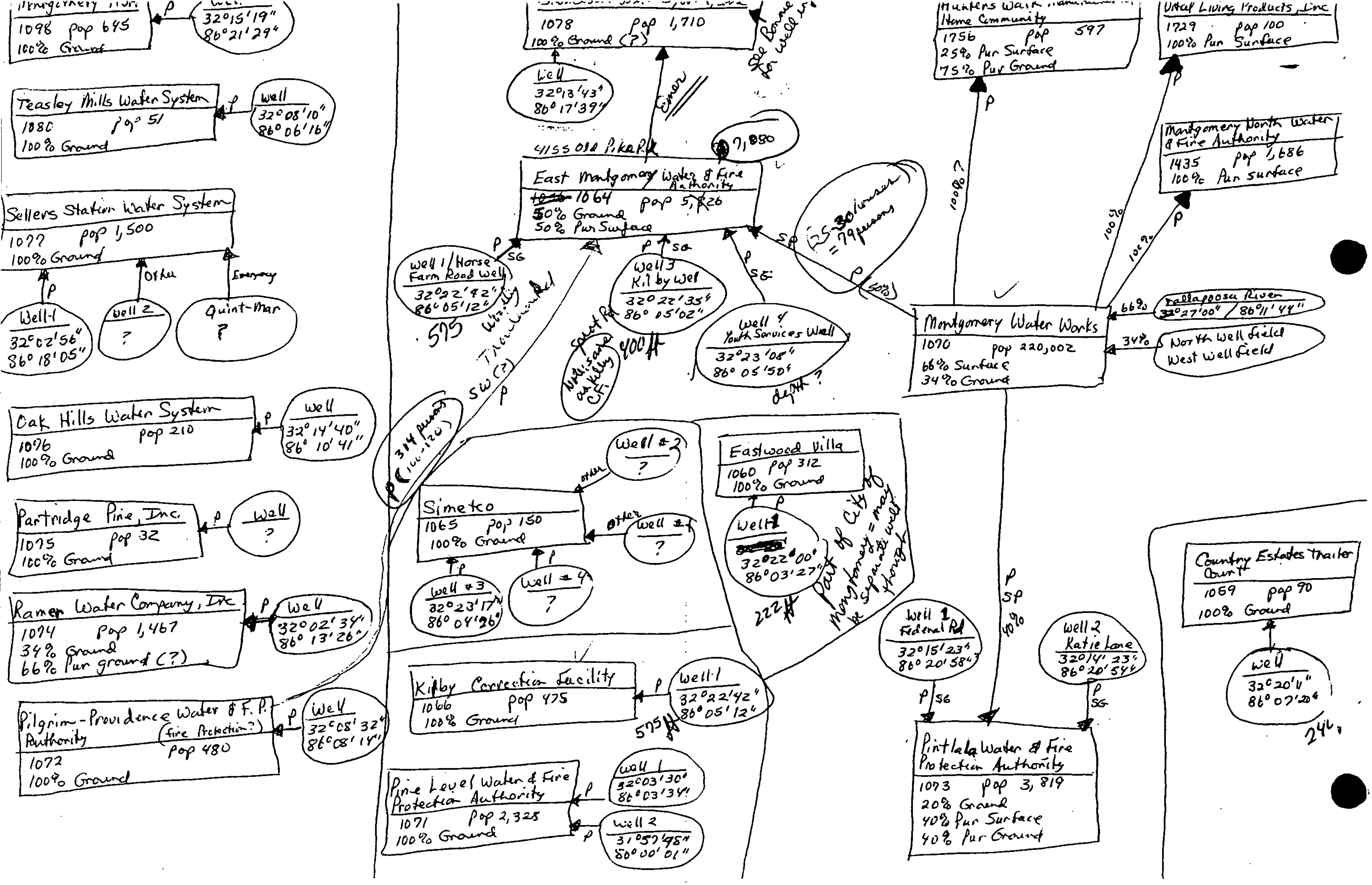
FIGURE 1

FIGURE 1
CAPITOL CITY PLUME SITE
(1-mile radius map)



Source: U.S.G.S. 7.5 Minute Topographic Quadrangle

REFERENCE 4


1098 pop 645
100% Ground
P
32°15'19"
86°21'29"
Teasley Mills Water System
1080 pop 51
100% Ground
P
Well
32°08'10"
86°06'16"
Sellers Station Water System
1077 pop 1,500
100% Ground
P
Other
Emergency
Well-1
32°02'56"
86°18'05"
Well 2
?
Quint-Mar
?
Oak Hills Water System
1076 pop 210
100% Ground
P
Well
32°14'40"
86°10'41"
Partridge Pine, Inc.
1075 pop 32
100% Ground
P
Well
?
Ramer Water Company, Inc
1074 Pop 1,467
34% Ground
66% Pur ground (?)
P
Well
32°02'34"
86°13'26"
Pilgrim-Providence Water & F.P. Authority
(fire Protection?)
1072 pop 480
100% Ground
P
Well
32°08'32"
86°08'14"
1078 pop 1,710
100% Ground (?)
Well
32°13'43"
86°17'39"
Emer
See Bonnie for well in
4155 Old Pike Rd
7,080
East Montgomery Water & Fire Authority
1064 pop 5,826
50% Ground
50% Pur Surface
P
SG
Well 1/Horse Farm Road Well
32°22'42"
86°05'12"
575
Wasily
Trowbridge Rd
SW (?)
P
314 persons (100-120)
P
P
SG
Well 3
Kilby Well
32°22'35"
86°05'02"
400 ft
Sprott Rd
Not same as Kilby CF
P
SG
Well 4
Youth Services Well
32°23'08"
86°05'50"
depth?
SP
(25-30 houses = 79 persons
P
(50%)
Hunters Walk
Home Community
1756 pop 597
25% Pur Surface
75% Pur Ground
P
100%?
Vital Living Products, Inc
1729 pop 100
100% Pur Surface
P
100%
Montgomery North Water & Fire Authority
1435 pop 1,686
100% Pur surface
P
100%
Montgomery Water Works
1070 pop 220,002
66% Surface
34% Ground
66%
Tallapoosa River
32°27'00" / 86°11'44"
34%
North Well field
West Well field
Simetco
1065 pop 150
100% Ground
Other
Well #2
?
Other
Well #1
?
P
Well #3
32°23'17"
86°04'26"
P
Well #4
?
Eastwood Villa
1060 pop 312
100% Ground
P
Well 1
32°22'00"
86°03'27"
222 ft
Part of City of Montgomery = may be separate well though
Kilby Correction Facility
1066 pop 475
100% Ground
P
Well 1
32°22'42"
86°05'12"
575 ft
Pine Level Water & Fire Protection Authority
1071 Pop 2,328
100% Ground
P
Well 1
32°03'30"
86°03'34"
P
Well 2
31°57'48"
86°00'01"
P
SP
40%
Well 1
Federal Rd
32°15'23"
86°20'58"
P
SG
Well 2
Katie Lane
32°14'23"
86°20'54"
P
SG
Pintlala Water & Fire Protection Authority
1073 pop 3,819
20% Ground
40% Pur Surface
40% Pur Ground
Country Estates Trailer Court
1059 pop 90
100% Ground
Well
32°20'4"
86°07'20"
246

The Water Works and Sanitary Sewer Board
of the City of Montgomery
P.O. BOX 1631
MONTGOMERY, ALABAMA 36102-1631

THOMAS R. MORGAN
GENERAL MANAGER
JAMES P. HENRY, II
GENERAL MANAGER, OPERATIONS
ROY D. HOLMBERG
ASSISTANT GENERAL MANAGER
PHONE (205) 240-1607
FAX (205) 240-1616

FAX TRANSMISSION

DATE: 8/20/93

TIME: 3:45 pm

SENT TO: Bonnie Temple

COMPANY: ADEM

FAX NUMBER: 260-2795

SENT FROM: Engineering Department

PHONE NUMBER: 240-1626

RETURN FAX NUMBER: 205/261-3448

[illegible]
West Well Field
[illegible]

This is page 1 of 3 pages.

SENT BY: Barry Dees

Tallapoosa River (Surface Water) = 66%

WEST WELL FIELD
WELLS CURRENTLY IN OPERATION

Well Number	Plat Sheet	Map Legend Reference	Motor Horsepower	Well Depth (ft)	Year Drilled	Year Reworked	Aquifer	Reported Capacity (gpm) Original	1962	1970	1983	1989
21	24	I-10	40	155	1941	1980	E	457	467	488	393	659
22	25	I-10	40	181	1953	1980	E	350	495	495	517	329
23	22	I-10	40	164	1941		E	349	438	439	465	535
26	33-A	I-9	50	1010	1985		E,G,C	800	—	—	—	556
27	33-B	J-8	50	876	1953	1990	G,C	383	393	448	361	363
28	33-B	J-8	50	820	1984		E,G,C	500	—	—	—	404
29	33-B	J-8	50	755	1953		G,C	541	503	485	560	545
30	28-D	J-8	50	615	1949	1992	G,C	650	566	598	560	373
31	28-D	J-8	60	622	1949	1978	G,C	503	510	503	644	485
32	28-D	J-8	50	635	1949	1992	E,G,C	580	518	584	503	305
33	64	J-7	50	621	1949		E,G,C	524	526	620	572	431
34	64	J-7	50	618	1949		E,G,C	517	495	560	361	305
36	64-A	J-7	50	629	1950		E,G,C	530	578	503	644	431
38	64-C	J-7	75	618	1985		E,G,C	750	—	—	—	687
39	64-B	J-7	75	668	1952		E,G,C	703	703	430	656	590
40	64-B	K-6	60	275	1952		E	457	548	524	596	431
41	90	K-6	50	296	1953	1988	E	460	430	393	247	384
*42	—	K-6	50	462	1953		E,G	372	328	372	*	*
43	91-W	K-5	75	704	1953	1987	E,G,C	572	524	548	448	474
*44	91-D	K-5	50	740	1953		E,G,C	439	402	328	383	**
45	91-D	K-5	50	786	1953	1988	E,G	700	503	465	488	670
46	91-G	K-4	60	700	1955	1993	E,G,C	1,000	596	560	632	570
47	91-T	K-4	75	702	1955	1989	E,G,C	1,000	863	810	777	556
48	91-T	K-4	60	700	1955	1978	E,G,C	1,012	560	305	WEST	384
49	91-S	K-4	60	704	1955		E,G,C	1,000	737	WE	692	543
50	91-S	L-3	75	716	1955		E,G,C	1,000	908	880	974	777
54	31-D	K-8	60	605	1985		G,C	450	—	—	—	440
55	32-H	L-7	75	1015	1985		G,C	700	—	—	—	550
56	67-B	L-7	75	695	1985		E,G,C	700	—	—	—	687
57	91-X	K-5	75	720	1985		E,G,C	700	—	—	—	528
58	91-W	K-5	75	750	1985		E,G,C	700	—	—	—	528
TOTAL CAPACITY (gpm)								19,100	12,582	11,848	12,150	14,520
(mgd)								(27.5)	(18.1)	(17.2)	(17.5)	(21.0)

* Removed from service.

** Flow not measurable

— Information not available. Assume capacity is the same as previous test.

T Terrace
E Eutaw
G Gordo
C Coker

29 wells in operation - 21%

NORTH WELL FIELD
WELLS CURRENTLY IN OPERATION

Well Number	Plat Sheet	Map Legend Reference	Motor Horsepower	Well Depth (ft)	Year Drilled	Year Reworked	Aquifer	Reported Capacity (gpm) Original	1962	1969	1976	1983	1989
2	118	G-12	20	70	1957		T	524	503	339	517	457	354
5A	6	H-11	60	699	1957		G,C	596	597	795	654	---	772
7	118	G-12	50	645	1957		G,C	416	416	465	837	630	472
8	102	H-11	50	695	1957		G,C	620	620	743	---	810	777
9E	102	H-11	25	74	1962		T	---	---	---	658	644	816
9W	102	H-11	25	79	1962		T	---	---	---	720	732	731
11	117	H-12	40	270	1959		G	600	600	457	568	820	621
13	117	H-12	60	755	1959		C	600	600	795	915	372	797
14	122	G-13	50	644	1937		G	316	316	480	530	383	357
15	122	G-13	25	73	1957	1988	E	407	405	316	200	820	216
18	118	G-12	20	72	1957	1988	T	407	361	372	430	---	341
19	118	G-12	50	610	1937		C	271	271	280	316	350	221
20	118	G-12	20	74	1957		T	473	473	430	503	---	416
51	6	H-11	50	600	1956		G,C	510	429	548	656	596	521
52	4	G-11	50	600	1956		G,C	657	335	536	620	608	557
53	4	G-11	50	600	1956		G,C	566	437	572	524	180	543
		TOTAL CAPACITY (gpm)						8,238	7,738	8,504	9,287	8,269	8,211
		(mgd)						(11.9)	(11.1)	(12.2)	(13.4)	(11.9)	(11.8)

---

* Removed from service.

** Flow not measurable

-- Information not available. Assume capacity is the same as previous test.

T Terrace

E Eutaw

G Gordo

C Coker

16 wells in operation [illegible]

TOPOGRAPHIC MAP

U.S.G.S 7.5 MINUTE

U.S. EPA REGION IV

SDMS

Unscannable Material Target Sheet

DocID: 10449683 Site ID: AL0001058056

Site Name: Capital City Plume

Nature of Material:

Map:	✓	Computer Disks:	
Photos:		CD-ROM:	
Blueprints:		Oversized Report:	
Slides:		Log Book:	

Other (describe): 5 mile radius map

Amount of material:

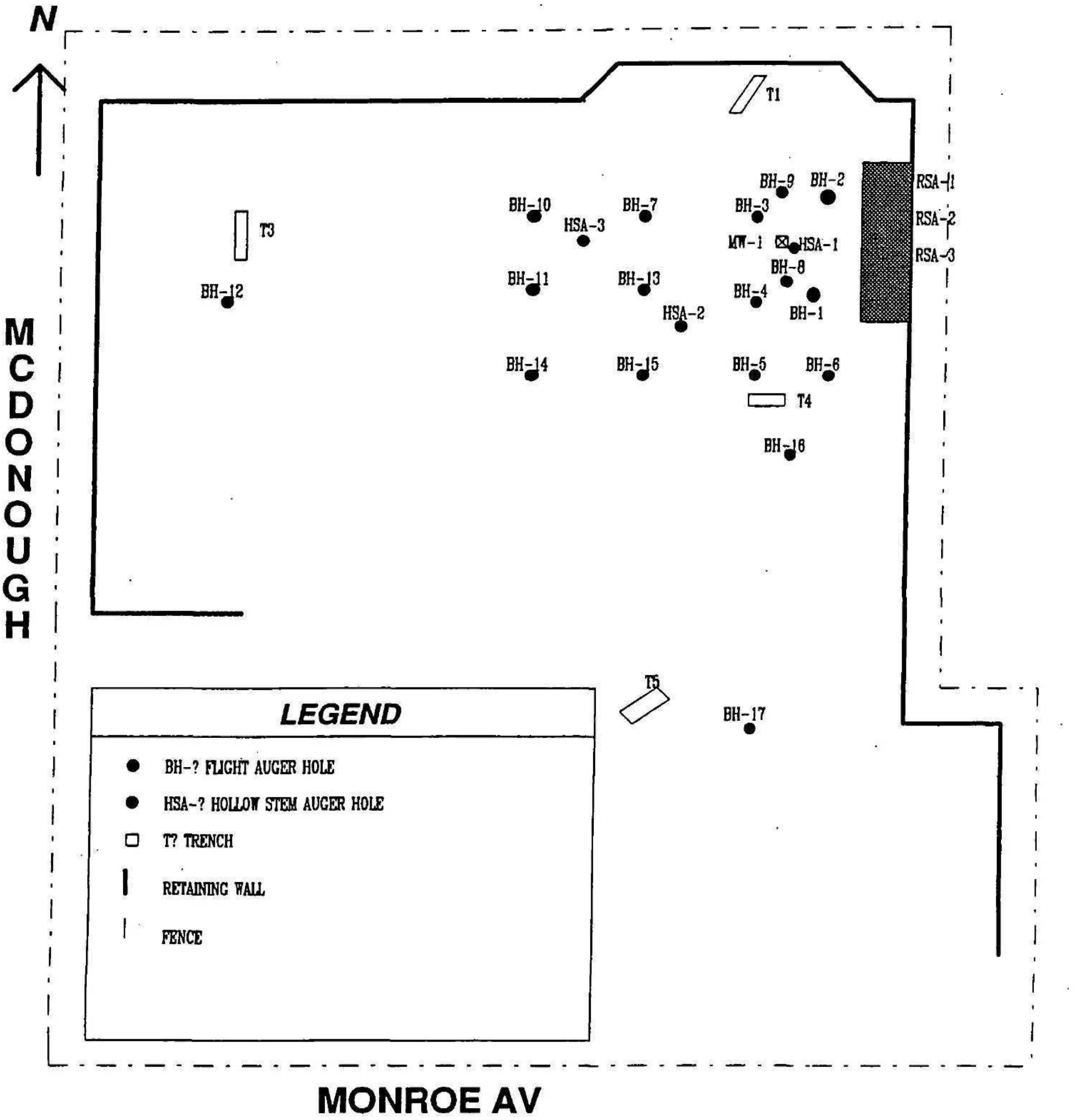
Please contact the appropriate Records Center to view the material.

SPECIAL PROJECTS PHASE I REPORT

RSA PHASE I
CHILLER PLANT SITE
SOIL AND WATER
SAMPLE RESULTS

SAMPLE ID	SAMPLE LOCATION	SAMPLE DATE	SAMPLER	SAMPLE DEPTH	TEST RESULTS
RSA-1	HOT SPOT	9-14-93	MAURER	NA	3989 ppm
RSA-2	HOT SPOT	9-14-93	MAURER	NA	7268 ppm
RSA-3	HOT SPOT	9-14-93	MAURER	NA	7843 ppm
H-4A	HOLE 4X	10-7-93	STAMPS	1.5'-4'	BDL
H-1A	HOLE 1X	10-7-93	STAMPS	1.5'-4'	BDL
H-1B	HOLE 1X	10-7-93	STAMPS	4'-6.5'	BDL
RSA-1	BH-1	10-11-93	STAMPS	1.5'-4'	BDL
RSA-2	BH-1	10-11-93	STAMPS	4'-6.5'	BDL
TR-5	T4	10-15-93	STAMPS	0'-4'	0.06 ppm
TR-6	T4	10-15-93	STAMPS	0'-4'	0.13 ppm
HSA-1A	HSA-1	10-18-93	STAMPS	1.5'-4'	BDL
HSA-1B	HSA-1	10-18-93	STAMPS	4'-6.5'	0.09 ppm
HSA-2A	HSA-2	10-18-93	STAMPS	1.5'-4'	BDL
HSA-2B	HSA-2	10-18-93	STAMPS	4'-6.5'	BDL
SP-2C	HSA-2	10-18-93	STAMPS	6.5'-8'	BDL
HSA-3A	HSA-3	10-18-93	STAMPS	1.5'-4'	BDL
HSA-3B	HSA-3	10-18-93	STAMPS	4'-6.5'	BDL
AM	BH-15	10-22-93	STAMPS	BOH	0.02 ppm
AN	BH-1	10-22-93	STAMPS	BOH	0.01 ppm
AO	BH-5	10-22-93	STAMPS	BOH	0.02 ppm
WS-2	MW-1	10-15-93	STAMPS	G.WATER	536 ppb
WS-3	MW-1	10-15-93	STAMPS	G.WATER	607 ppb

RSA CHILLER PLANT SIT



SAMPLES CONTAINING SIGNIFICANT AMOUNTS OF TETRACHLORETHYLENE
FROM
RSA CHILLER PLANT SITE

SAMPLE ID	SAMPLE SOURCE & DATE	SOIL OR WATER	AMOUNT OF TETRACHLORETHYLENE
RSA-1	HOT SPOT 9-14-93	SOIL	3989 ppm
RSA-2	HOT SPOT 9-14-93	SOIL	7268 ppm
RSA-3	HOT SPOT 9-14-93	SOIL	7843 ppm
WS-2	MW-1 10-15-93	WATER	536 ppb
WS-3	MW-1 10-15-93	WATER	607 ppb

MCL for drinking water is 5 ppb

REFERENCE 4

SPECIAL PROJECTS PHASE II REPORT

REFERENCE 4

ADEM

ALABAMA
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Leigh Pegues, Director

Jim Folsom
Governor

Mailing Address:
PO BOX 301463
MONTGOMERY AL
36130-1463

Physical Address:
1751 Cong. W. L.
Dickinson Drive
Montgomery, AL
36109-2608

(205) 271-7700
FAX 271-7950
270-5612

Field Offices:

110 Vulcan Road
Birmingham, AL
35209-4702
) 942-6168
FAX 941-1603

400 Well Street
P.O. Box 953
Decatur, AL
35602-0953
(205) 353-1713
FAX 340-9359

2204 Perimeter Road
Mobile, AL
36615-1131
(205) 450-3400
FAX 479-2593

OCTOBER 28, 1993

MEMORANDUM

TO: Jymalyn E. Redmond, Chief
Site Assessment Unit
Special Projects

FROM: Jerremy H. Stamps
Site Assessment Unit
Special Projects

SUBJECT: RSA TOWERS DRAFT PHASE II STUDY PLAN
AHSCF SITE NUMBER 9074

INTRODUCTION

Perchlorethylene contaminated soil and groundwater has been found at the Retirement System of Alabama (RSA) Chiller Plant at the corner of Monroe Street and McDonough Street in Montgomery Alabama. The Alabama Department of Environmental Management (ADEM) conducted a study at this site and determined that contamination extended beyond the RSA Chiller Plant excavation.

OBJECTIVES

In order to determine the extent and possibly the source of contamination ADEM will hire an environmental testing firm to drill and sample five borings, two of which will be converted into groundwater monitoring wells. ADEM will collect 25 shelby tube soil samples and 8 groundwater samples for volatile compound analysis at ADEM's Montgomery Laboratory. The air column within each boring will be analyzed on two consecutive days using a mobile gas chromatograph.

SCOPE

In this phase of the assessment, the study area will be limited to a six city block area bound on the north by Jefferson Street, on the south by Dexter Avenue, on the west by McDonough Street, on the east by Decature Street (see boring location map).

METHODOLOGY

A) Test Hole Boring

Hollow stem augers shall be used when boring test holes in order to eliminate potential caving and cross contamination.

B) Soil Sampling

Split spoons with removable liners and/or shelby tubes shall be used for sampling devices. These samples will be taken from test holes every 5 feet,with the first sample starting at 5 feet below the surface, and the last sample starting at 25 feet (5 samples per test hole).

In order to limit exposure to the atmosphere, the ends of the liners or shelby tubes shall be covered with aluminum foil,duck tape and plastic caps prior to being preserved with ice.

C) Groundwater Sampling

Two of the test hole borings shall be converted into 2 inch diameter, 50 to 60 foot deep PVC monitoring wells. After installation, the two monitoring wells shall be developed to remove fines in the vicinity of the screen. Approximately 24 hours after the wells have been developed four water samples shall be collected from each well. Two of the samples will be taken prior to purging and two shall be removed after 5 well volumes have been purged.

D) Air Sampling

All test holes shall be covered with a steel plate and allowed to equilibrate for 24 hours. ADEM's Air Division will then analyze the air in the holes to determine the amount of vapor phase tetrachlorethylene escaping from the soil.

E) Sample Preservation

All soil and water samples ,while in custody of field personnel, shall be kept on ice. At the end of each work day all samples shall be relinquished to ADEM's Montgomery Laboratory.

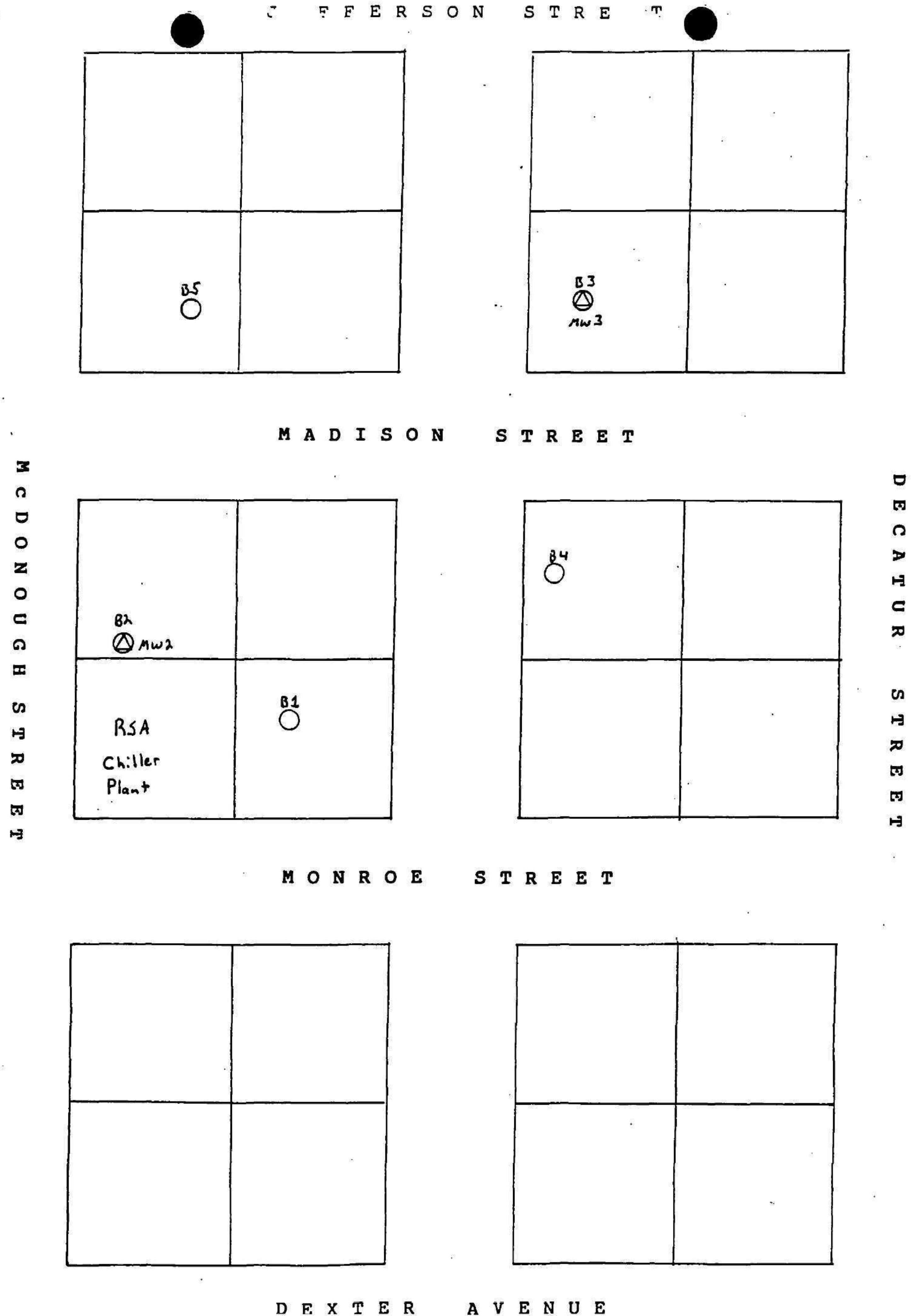
F) Generated Waste

All excess soil, water and other waste shall be contained in drums. The drummed waste will then be transported to ADEM's Montgomery Field Operations, where the material will be characterized and disposed of in the required manner following applicable state and federal guidelines.

CONCLUSION

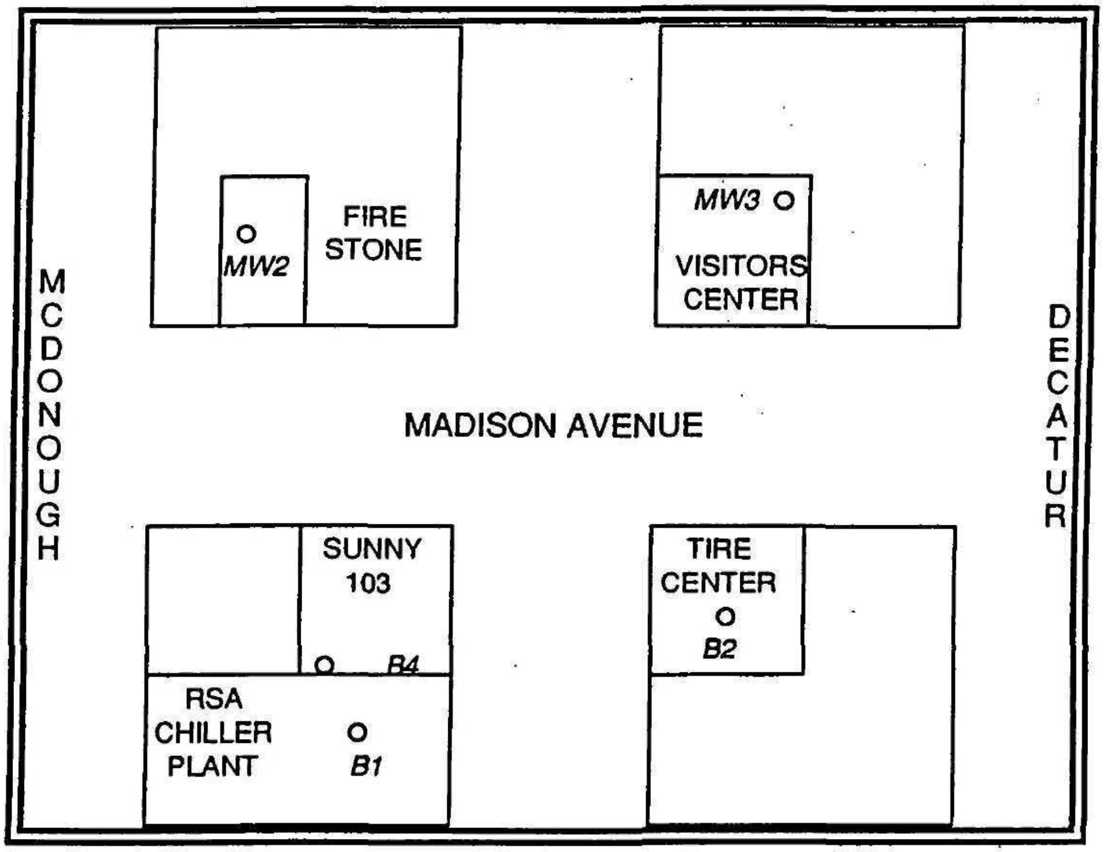
Following all applicable guidelines from ADEM'S Standard Operation Procedures Manual, the RSA Towers Site Number 9074 Phase II Study will consist of soil, groundwater, and air sampling in a 4 to 6 city block area around a site found to be contaminated with tetrachlorethylene.

This phase of the study will give ADEM the information needed to determine how extensive the contamination is and what the source of contamination may be, so that a clean-up plan can be initiated.


FFERSON STRE T
B5
B3
MW3
MADISON STREET
MCDONOUGH STREET
DECATUR STREET
B4
B2
MW2
B1
RSA
Chiller
Plant
MONROE STREET
DEXTER AVENUE

JERREMY STAMPS
FIELD NOTES
FOR
RSA TOWER AHSCF #9044
PHASE I STUDY

Map 1.



RSA PHASE II SITE MAP

SITE NAME: RSA TOWER
AHSCF NUMBER: 9074
DATE: 11-29-93

COMMENTS: DRILLING STARTED AT 9:05 A.M.

BORING #	SAMPLE I D	SAMPLE TIME	SAMPLE DEPTH	LOGGER	TYPE CONT.	TYPE PRESERVATIVE
MW2	MW2-1	0930	4'-6'	J. S.	SHELBY	ICE
MW2	MW2-2	0938	11'-13'	J. S.	SHELBY	ICE
MW2	MW2-3	0955	18'20'	J. S.	SHELBY	ICE
MW2	MW2-4	1005	25'-27'	J. S.	SHELBY	ICE
MW2	MW2-5	1012	32'-34'	J. S.	SHELBY	ICE

SITE NAME: RSA TOWERS
AHSCF NUMBER: 9074
DATE: 11-30-93

COMMENTS: GRAY CLAY SEAM AT 35' TO 40' DEEP
SAND AND GRAVEL AT 59' DEEP

BORING #	SAMPLE I D	SAMPLE TIME	SAMPLE DEPTH	LOGGER	TYPE CONT.	TYPE PRESER VATIVE
MW3	MW3-1	0840	4'-6'	J. S.	SHELBY	ICE
MW3	MW3-2	0846	11'-13'	J. S.	SHELBY	ICE
MW3	MW3-3	0850	18'-20'	J. S.	SHELBY	ICE
MW3	MW3-4	0910	25'-27'	J. S.	SHELBY	ICE
MW3	MW3-5	0930	32'-34'	J. S.	SHELBY	ICE

SITE NAME: RSA TOWER
AHSCF NUMBER: 9074
DATE: 11-30-93

COMMENTS: BORING ON RSA PROPERTY

BORING #	SAMPLE I D	SAMPLE TIME	SAMPLE DEPTH	LOGGER	TYPE CONT.	TYPE PRESER VATIVE
B1	B1-A	1350	4'-6'	J. S.	SHELBY	ICE
B1	B1-B	1354	11'-13'	J. S.	SHELBY	ICE
B1	B1-C	1357	18'-20'	J. S.	SHELBY	ICE.
B1	B1-D	1405	25'-27'	J. S.	SHELBY	ICE
B1	B1-E	1415	32'-34'	J. S.	SHELBY	ICE

SITE NAME: RSA TOWER
AHSCF NUMBER: 9074
DATE: 12-1-93

COMMENTS: TIRE CENTER PROPERTY

BORING #	SAMPLE ID	SAMPLE TIME	SAMPLE DEPTH	LOGGER	TYPE CONT.	TYPE PRESERVATIVE
B2	B2-A	0900	4'-6'	J. S.	SHELBY	ICE
B2	B2-B	0907	11'-13'	J. S.	SHELBY	ICE
B2	B2-C	0914	18'-20'	J. S.	SHELBY	ICE
B2	B2-D	0921	25'-27'	J. S.	SHELBY	ICE
B2	B2-E	0936	32'-34'	J. S.	SHELBY	ICE

SITE NAME: RSA TOWER
AHSCF NUMBER: 9074
DATE: 12-1-93

COMMENTS: SUNNY 103 PARKING LOT
REPLACES PROPOSED BORING AT MADISON PARKING LOT

BORING NUMBER	SAMPLE I D	SAMPLE TIME	SAMPLE DEPTH	LOGGER	TYPE CONT.	TYPE PRESERVATIVE
B4	B4-A	1035	4'-6'	J. S.	SHELBY	ICE
B4	B4-B	1040	11'-13'	J. S.	SHELBY	ICE
B4	B4-C	1045	18'-20'	J. S.	SHELBY	ICE
B4	B4-D	1051	25'-27'	J. S.	SHELBY	ICE
B4	B4-E	1100	32'-34'	J. S.	SHELBY	ICE

WELL INSTALLATION LOG
RSA TOWER
AHSCF 9074

	WELL # MW2	WELL # MW3
FEET OF SCREEN	20'	20'
FEET OF RISER	40'	40'
AMOUNT OF SAND	23' = 5 BAGS + CAVE IN	23' = 4 BAGS + CAVE IN
AMOUNT OF CLAY	2' = 1/2 BUCKET	2' = 1/2 BUCKET
AMOUNT OF CEMENT	27 BAGS = ~35'	27 BAGS =~35'
BAGS OF CONCRETE	1	1
FEET OF WATER	12'	4'

At completion the wells were secured with "J" plugs with locks and flush mount well covers.

InterOffice Memo

To: Jymalyn Redmond

From: Jerremy Stamps

Date: December 29, 1993

Subject: Results of Drilling at RSA Tower Site on 11-29-93 to 12-1-93

Attached you will find a copy of the soil sample logs that list the sample I D, sample time, sample depth, location I D and results of each soil sample and groundwater sample taken during the second phase of study at the RSA Site in downtown Montgomery.

JHS

attachments

TABLE I: RSA PHASE II SOIL SAMPLES AND TEST RESULTS

BORING #	SAMPLE I D	SAMPLE DEPTH	SAMPLE DATE	SAMPLE TIME	TETRACHLORETHYLENE RESULTS
MW2	MW2-1	4'-6'	11-29-93	0930	BDL
MW2	MW2-2	11'-13'	11-29-93	0938	BDL
MW2	MW2-3	18'-20'	11-29-93	0955	BDL
MW2	MW2-4	25'-27'	11-29-93	1005	BDL
MW2	MW2-5	32'-34'	11-29-93	1012	BDL
MW3	MW3-1	4'-6'	11-30-93	0840	BDL
MW3	MW3-2	11'-13'	11-30-93	0846	BDL
MW3	MW3-3	18'-20'	11-30-93	0850	BDL
MW3	MW3-4	25'-27'	11-30-93	0910	BDL
MW3	MW3-5	32'-34'	11-30-93	0930	BDL
B1	B1-A	4'-6'	11-30-93	1350	BDL
B1	B1-B	11'-13'	11-30-93	1354	BDL
B1	B1-C	18'-20'	11-30-93	1357	BDL
B1	B1-D	25'-27'	11-30-93	1405	BDL
B1	B1-E	32'-34'	11-30-93	1415	BDL
B2	B2-A	4'-6'	12-1-93	0900	BDL
B2	B2-B	11"-13'	12-1-93	0907	BDL
B2	B2-C	18'-20'	12-1-93	0914	BDL
B2	B2-D	25'-27'	12-1-93	0921	BDL
B2	B2-E	32'-34'	12-1-93	0936	BDL
B4	B4-A	4'-6'	12-1-93	1035	BDL
B4	B4-B	11'-13'	12-1-93	1040	BDL
B4	B4-C	18'-20'	12-1-93	1045	BDL
B4	B4-D	25'-27'	12-1-93	1051	BDL
B4	B4-E	32'-34'	12-1-93	1100	BDL

TABLE II: RSA PHASE II WATER SAMPLES AND TEST RESULTS

WELL #	SAMPLE ID	SAMPLE DATE	SAMPLE TIME	DEPTH TO WATER	DEPTH TO SCREEN	BOTTOM OF WELL	FEET OF WATER	TETRACHLORETHYLENE RESULTS
MW2	MW2-UPA	12-6-93	1240	38.78'	39.87'	59.87'	21.09'	61.7 ppb
MW3	MW3-UPA	12-6-93	1210	54.46'	39.32'	59.32'	4.86'	18.7 ppb

NOTES:

1. ALL MEASUREMENTS ARE TAKEN WITH RESPECT TO TOP OF WELL RISER
2. MCL FOR TETRACHLORETHYLENE IN DRINKING WATER IS *5.0 ppb*
3. WATER SAMPLE WS-3 TAKEN FROM MW-1 AT THE RSA CHILLER PLANT SITE ON 10-15-93 CONTAINED 607.0 ppb TETRACHLORETHYLENE

RSA PHASE II STUDY CONCLUSIONS

In the downtown area, 25 soil samples were taken from five different borings (see attached map for approximate location of each boring). Shelby tube soil samples were taken at five foot intervals with the first sample starting at four feet and the last sample ending at approximately 34 feet below surface level (see table I). The soil samples were then tested for the presence of tertachlorethylene and other volatile organic compounds. All 25 soil samples exhibited below detection limit results for all constituents analyzed (see attached laboratory analysis reports).

Two of the five borings were drilled to a depth of approximately 60 feet. Monitoring wells were then installed and completed. After the wells had been developed, water samples were collected and tested for the presence of volatile organic compounds. With the exception of tetrachlorethylene, both water sample results tested less than the instrument's detection limit for all other volatile organic compounds (see attached laboratory analysis reports). Groundwater sample MW2-UPA from well number MW2 contained 61.7 parts per billion tetrachlorethylene, and groundwater sample MW3-UPA from well number MW3 contained 18.7 parts per billion tetrachlorethylene (see table II).

During our study it was also discovered that Montgomery public water well number 9W had to be closed due to the presence of tetrachlorethylene. Montgomery public water well number 9W, located approximately 3/8 of a mile northwest of the RSA Chiller Plant site, contained 7.1 parts per billion Tetrachlorethylene on 04/04/91 and 21.0 parts per billion tetrachlorethylene on 05/14/92.

The data from this study combined with the data collected at the RSA Chiller Plant site indicates that the contamination has extensively spread from the source. Since the only soil samples found to contain tetrachlorethylene, and the highest groundwater contamination of 607.0 parts per billion tetrachlorethylene came from the RSA Chiller Plant site, all data collected as of 01/03/94 suggest that the source of contamination is coming from the RSA Chiller Plant site or possibly the adjacent property to the east.

TABLE I: RSA PHASE II SOIL SAMPLES AND TEST RESULTS

BORING #	SAMPLE I D	SAMPLE DEPTH	SAMPLE DATE	SAMPLE TIME	TETRACHLORETHYLENE RESULTS
MW2	MW2-1	4'-6'	11-29-93	0930	BDL
MW2	MW2-2	11'-13'	11-29-93	0938	BDL
MW2	MW2-3	18'-20'	11-29-93	0955	BDL
MW2	MW2-4	25'-27'	11-29-93	1005	BDL
MW2	MW2-5	32'-34'	11-29-93	1012	BDL
MW3	MW3-1	4'-6'	11-30-93	0840	BDL
MW3	MW3-2	11'-13'	11-30-93	0846	BDL
MW3	MW3-3	18'-20'	11-30-93	0850	BDL
MW3	MW3-4	25'-27'	11-30-93	0910	BDL
MW3	MW3-5	32'-34'	11-30-93	0930	BDL
B1	B1-A	4'-6'	11-30-93	1350	BDL
B1	B1-B	11'-13'	11-30-93	1354	BDL
B1	B1-C	18'-20'	11-30-93	1357	BDL
B1	B1-D	25'-27'	11-30-93	1405	BDL
B1	B1-E	32'-34'	11-30-93	1415	BDL
B2	B2-A	4'-6'	12-1-93	0900	BDL
B2	B2-B	11"-13'	12-1-93	0907	BDL
B2	B2-C	18'-20'	12-1-93	0914	BDL
B2	B2-D	25'-27'	12-1-93	0921	BDL
B2	B2-E	32'-34'	12-1-93	0936	BDL
B4	B4-A	4'-6'	12-1-93	1035	BDL
B4	B4-B	11'-13'	12-1-93	1040	BDL
B4	B4-C	18'-20'	12-1-93	1045	BDL
B4	B4-D	25'-27'	12-1-93	1051	BDL
B4	B4-E	32'-34'	12-1-93	1100	BDL

BDL=BELOW DETECTION LIMITS

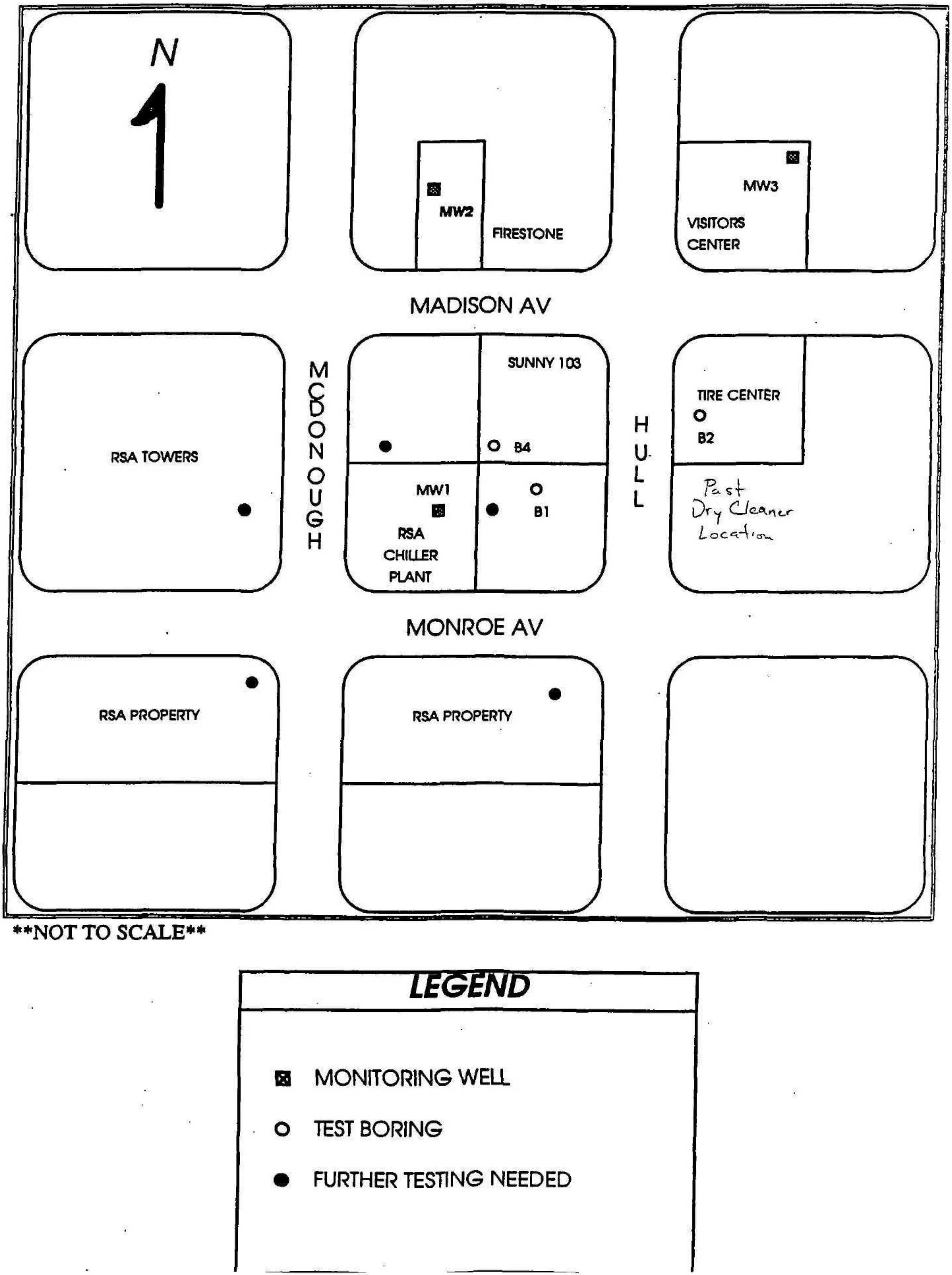
TABLE II: RSA PHASE II WATER SAMPLES AND TEST RESULTS

WELL #	SAMPLE ID	SAMPLE DATE	SAMPLE TIME	DEPTH TO WATER	DEPTH TO SCREEN	BOTTOM OF WELL	FEET OF WATER	TETRACHLORETHYLENE RESULTS
MW2	MW2-UPA	12-6-93	1240	38.78'	39.87'	59.87'	21.09'	61.7 ppb
MW3	MW3-UPA	12-6-93	1210	54.46'	39.32'	59.32'	4.86'	18.7 ppb

NOTES:

1. ALL MEASUREMENTS ARE TAKEN WITH RESPECT TO TOP OF WELL RISER
2. MCL FOR TETRACHLORETHYLENE IN DRINKING WATER IS ***5.0 ppb***
3. WATER SAMPLE WS-3 TAKEN FROM MW-1 AT THE RSA CHILLER PLANT SITE ON 10-15-93 CONTAINED 607.0 ppb TETRACHLORETHYLENE

RSA SITE MAP



NOT TO SCALE

MONITORING WELL
WATER LEVEL DATA

WELL	DATE	TOP OF WATER (- meters)	TOP OF WATER (- feet)	TOP OF WATER (feet above MSL)	TOP OF WELL CASING (feet above MSL)
MW-2	12-6-93	11.82	38.78	147.22	185.92
MW-2	2-28-94	11.69	38.35	147.57	185.92
MW-2	3-4-94	11.69	38.35	147.57	185.92
MW-2	6-13-94	11.60	38.06	147.86	185.92
MW-3	12-6-93	16.59	54.46	149.06	203.52
MW-3	2-28-94	16.50	54.13	149.39	203.52
MW-3	3-4-94	16.48	54.07	149.45	203.52
MW-3	6-13-94	16.49	54.10	149.42	203.52
MW-4	12-6-93	----	----	----	----
MW-4	2-28-94	14.80	48.56	151.10	199.66
MW-4	3-4-94	14.78	48.49	151.17	199.66
MW-4	6-13-94	14.77	48.45	151.21	199.66

NOTES: MSL = MEAN SEA LEVEL

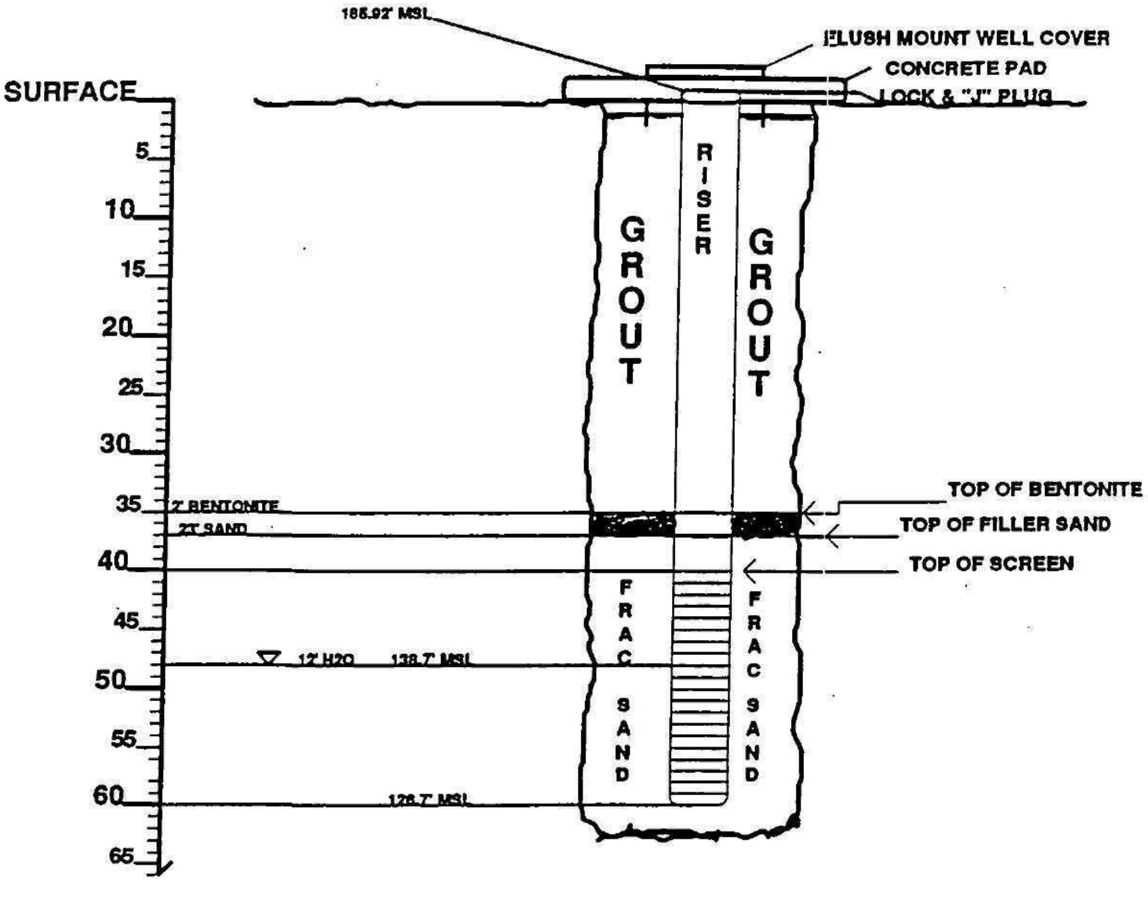
WATER SAMPLE
TETRACHLOROETHYLENE
RESULTS
AS OF
6-13-94

SAMPLE ID	SAMPLE LOCATION	SAMPLE DATE	TEST RESULTS (ppb)
WS-2	MW-1	10-15-93	536.0
WS-3	MW-1	10-15-93	607.0
MW3-UPA	MW-3	12-6-93	18.7
MW2-UPA	MW-2	12-6-93	61.7
AMW4-UP	MW-4	3-4-94	9.7
AMW4-P	MW-4	3-4-94	38.8
AMW3- UP	MW-3	3-4-94	65.0
AMW3-P	MW-3	3-4-94	41.9
AMW2-UP	MW-2	3-4-94	86.0
AMW2-P	MW-2	3-4-94	93.0
9W	PWSW#9W	6-13-94	BDL
MW-3C	MW-3	6-13-94	17.2
MW-2	MW-2	6-13-94	113.0
MW-4	MW-4	6-13-94	3.7

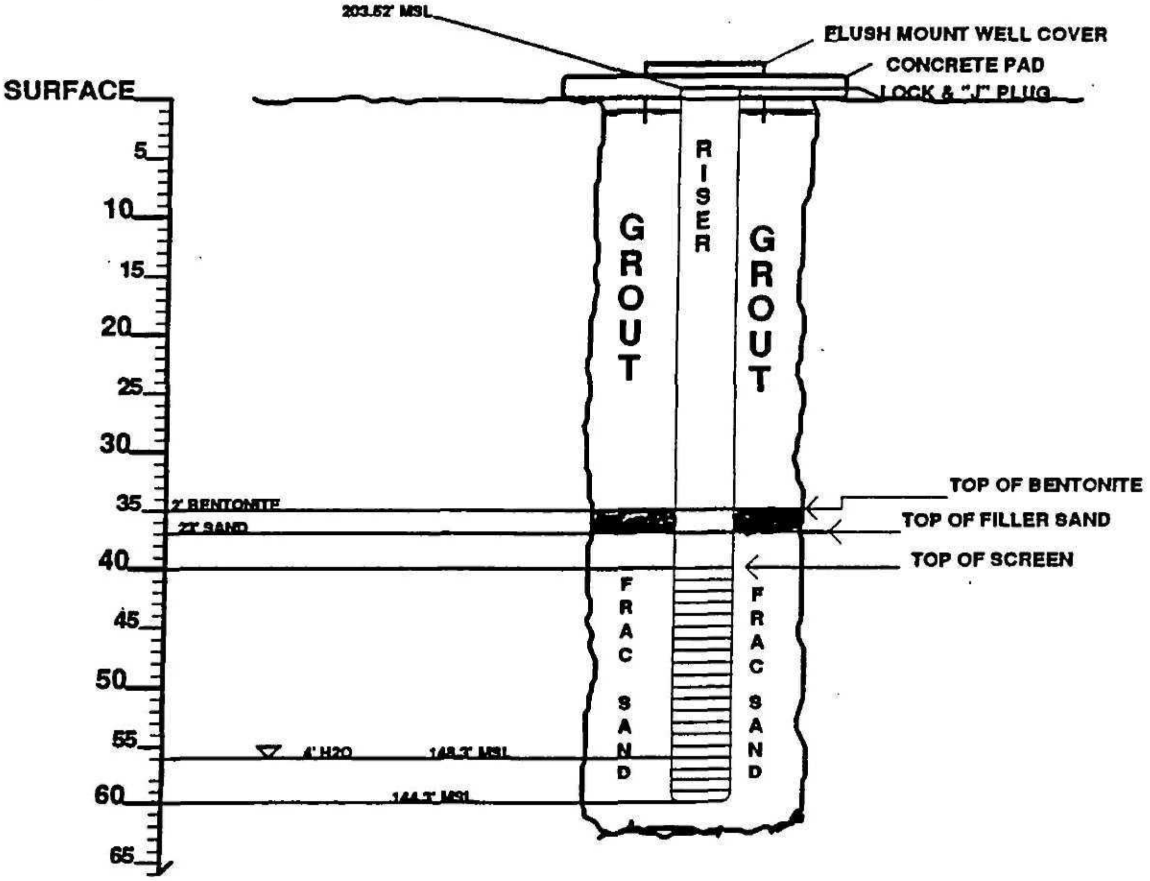
WELL #	SAMPLE ID	SAMPLE DATE	SAMPLE TIME	DEPTH TO WATER	FEET OF WATER	TETRACHLORETHYLENE CONCENTRATIONS
MW1	WS-2 P	10/15/93	2:05	22.4'	24.6'	536.0 ppb
MW1	WS-3 P	10/15/93	2:05	22.4'	24.6'	607.0 ppb
MW2	MW2-UPA	12/6/93	12:40	38.78'	21.09'	61.7 ppb
MW3	MW3-UPA	12/6/93	12:10	54.46'	4.86'	18.7 ppb
MW2	AMW2-UP	3/4/94	3:22	38.25'	21.49'	86.0 ppb
MW3	AMW3-UP	3/4/94	2:03	54.07'	5.05'	65.0 ppb
MW4	AMW4-UP	3/4/94	10:45	48.49'	19.42'	9.7 ppb
MW2	AMW2-P	3/4/94	4:15	38.25'	21.49	93.0 ppb
MW3	AMW3-P	3/4/94	2:30	54.07'	5.05'	41.9 ppb
MW4	AMW4-P	3/4/94	12:20	48.49'	19.42'	38.8 ppb
9W	9W	6-13-94	9:00	???	???	BDL
MW3	MW-3C	6-13-94	11:00	54.10'	5.05'	17.2 ppb
MW2	MW-2	6-13-94	11:10	38.05'	21.03'	113.0 ppb
MW4	MW-4	6-13-94	11:20	48.76'	14.2'	3.7 ppb

NOTES: UP= UNPURGED WELL SAMPLE
P= PURGED 3 WELL VOLUMES PRIOR TO SAMPLING

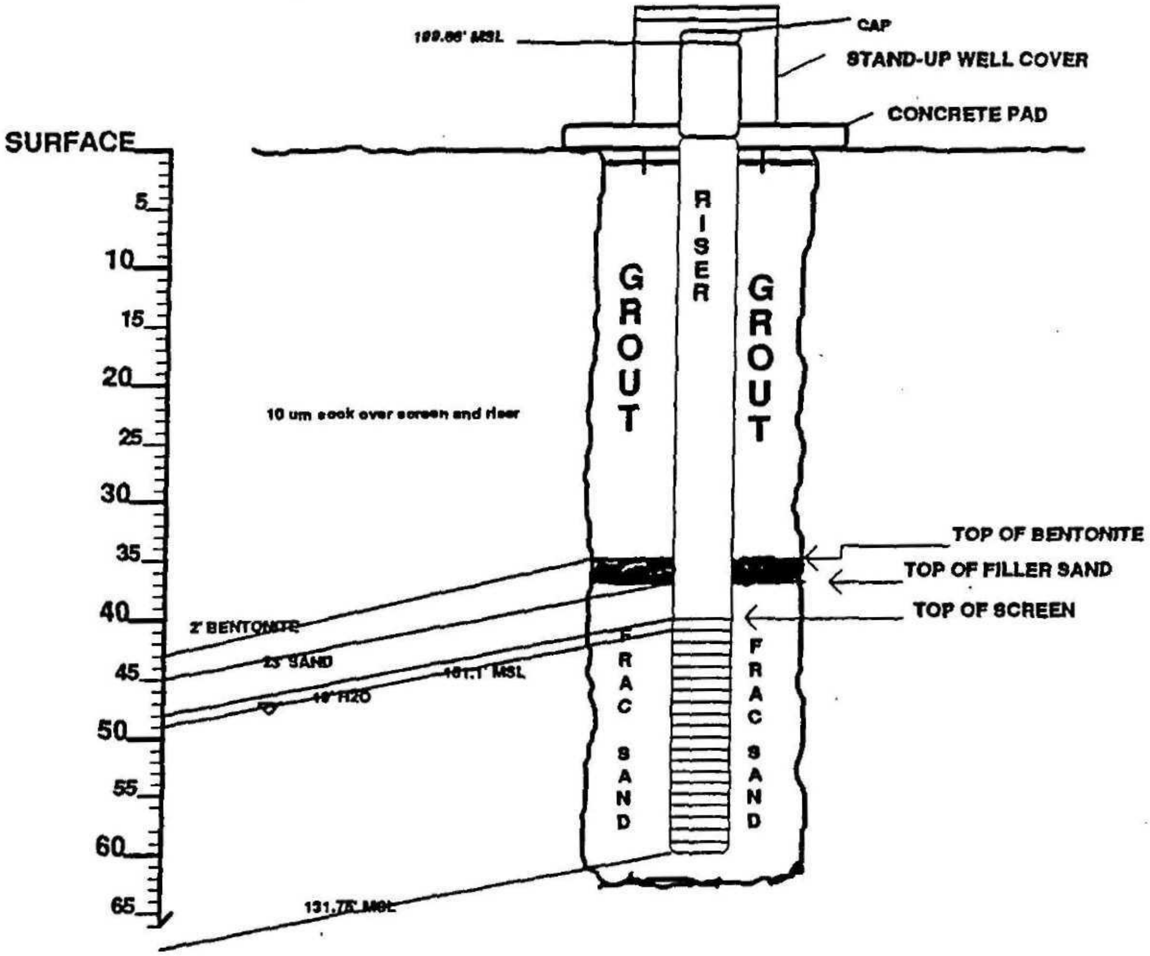
WELL SCHEMATIC
FOR
MONITOR WELL
MW-2



WELL SCHEMATIC
FOR
MONITOR WELL
MW-3



WELL SCHEMATIC
FOR
MONITOR WELL
MW-4



MONITORING WELL # 4
DRILLING LOG

0'	Black to gray sand with silt
5'	Reddish tan silt with fine sand
10'	Tan fine sand
15'	Moist tan fine sand with some silt and clay
20'	Moist tan fine sand with some silt and clay
25'	Moist reddish tan silt and clay with sand
30'	Moist tan silt and clay with sand
35'	Moist grayish tan clay
40'	Moist grayish tan clay
45'	Reddish tan sandy silt (not as moist as above)
50'	Reddish tan sandy silt

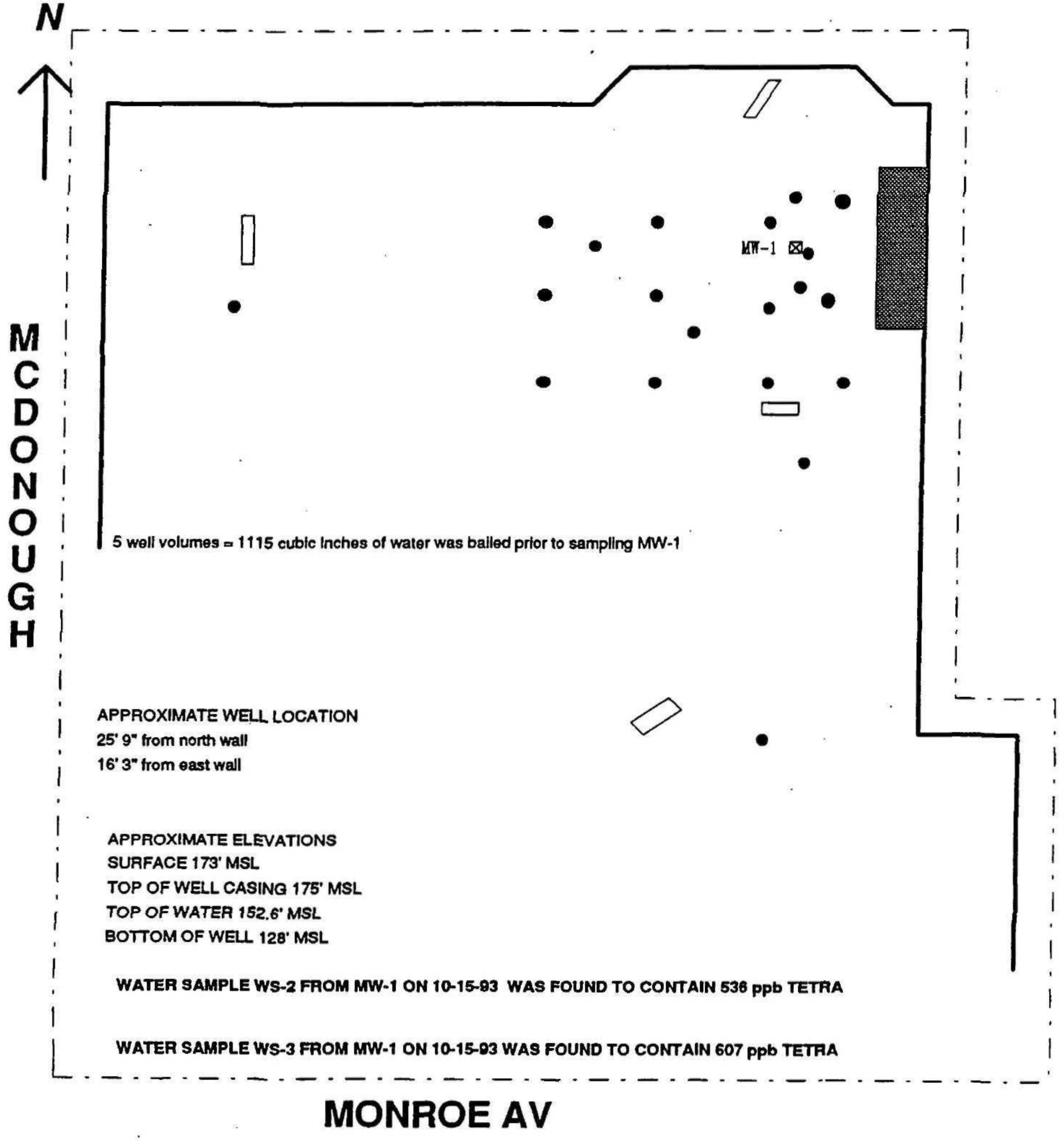
TABLE II: RSA PHASE II WATER SAMPLES AND TEST RESULTS

WELL #	SAMPLE ID	SAMPLE DATE	SAMPLE TIME	DEPTH TO WATER	DEPTH TO SCREEN	BOTTOM OF WELL	FEET OF WATER	TETRACHLORETHYLENE RESULTS
MW2	MW2-UPA	12-6-93	1240	38.78'	39.87'	59.87'	21.09'	61.7 ppb
MW3	MW3-UPA	12-6-93	1210	54.46'	39.32'	59.32'	4.86'	18.7 ppb

NOTES:

1. ALL MEASUREMENTS ARE TAKEN WITH RESPECT TO TOP OF WELL RISER
2. MCL FOR TETRACHLORETHYLENE IN DRINKING WATER IS ***5.0 ppb***
3. WATER SAMPLE WS-3 TAKEN FROM MW-1 AT THE RSA CHILLER PLANT SITE ON 10-15-93 CONTAINED 607.0 ppb TETRACHLORETHYLENE

RSA CHILLER PLANT SIT
TETRACHOLRETHYLENE
CONCENTRATIONS
IN MONITORING WELL MW-1



5 well volumes = 1115 cubic inches of water was bailed prior to sampling MW-1

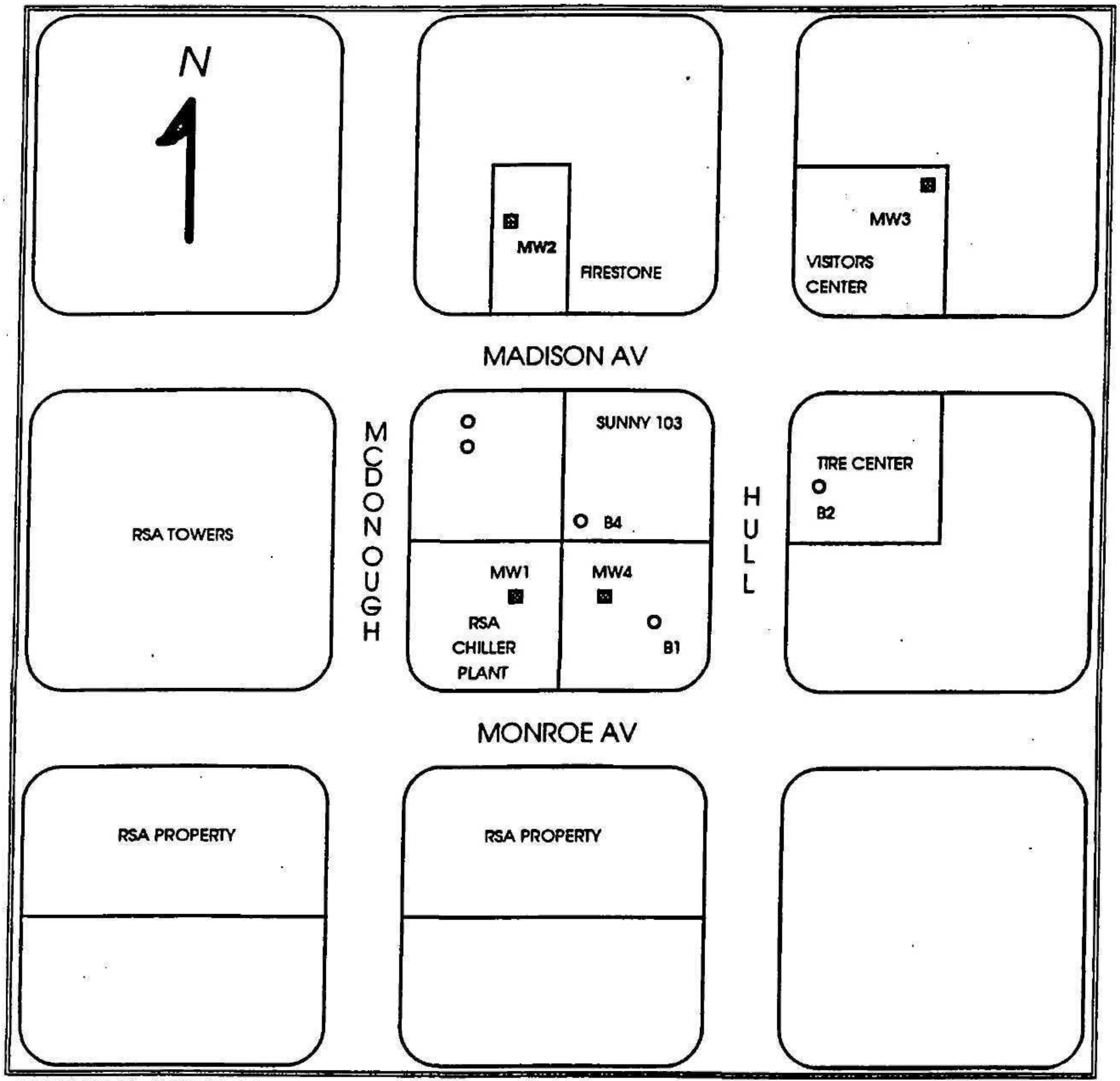
APPROXIMATE WELL LOCATION
25' 9" from north wall
16' 3" from east wall

APPROXIMATE ELEVATIONS
SURFACE 173' MSL
TOP OF WELL CASING 175' MSL
TOP OF WATER 152.6' MSL
BOTTOM OF WELL 128' MSL

WATER SAMPLE WS-2 FROM MW-1 ON 10-15-93 WAS FOUND TO CONTAIN 536 ppb TETRA

WATER SAMPLE WS-3 FROM MW-1 ON 10-15-93 WAS FOUND TO CONTAIN 607 ppb TETRA

RSA SITE MAP



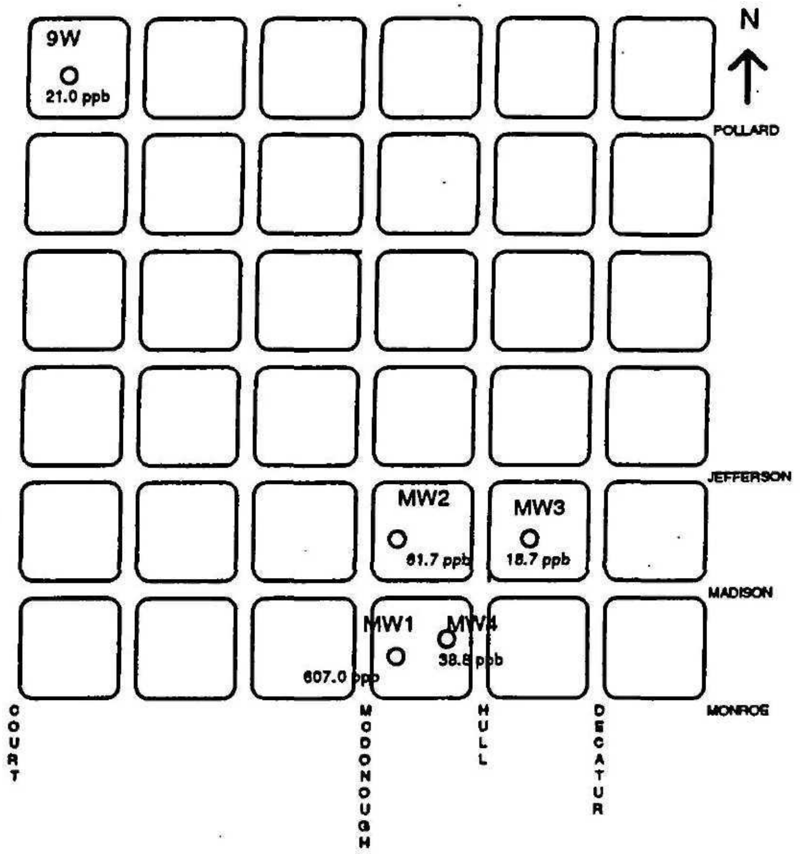
NOT TO SCALE

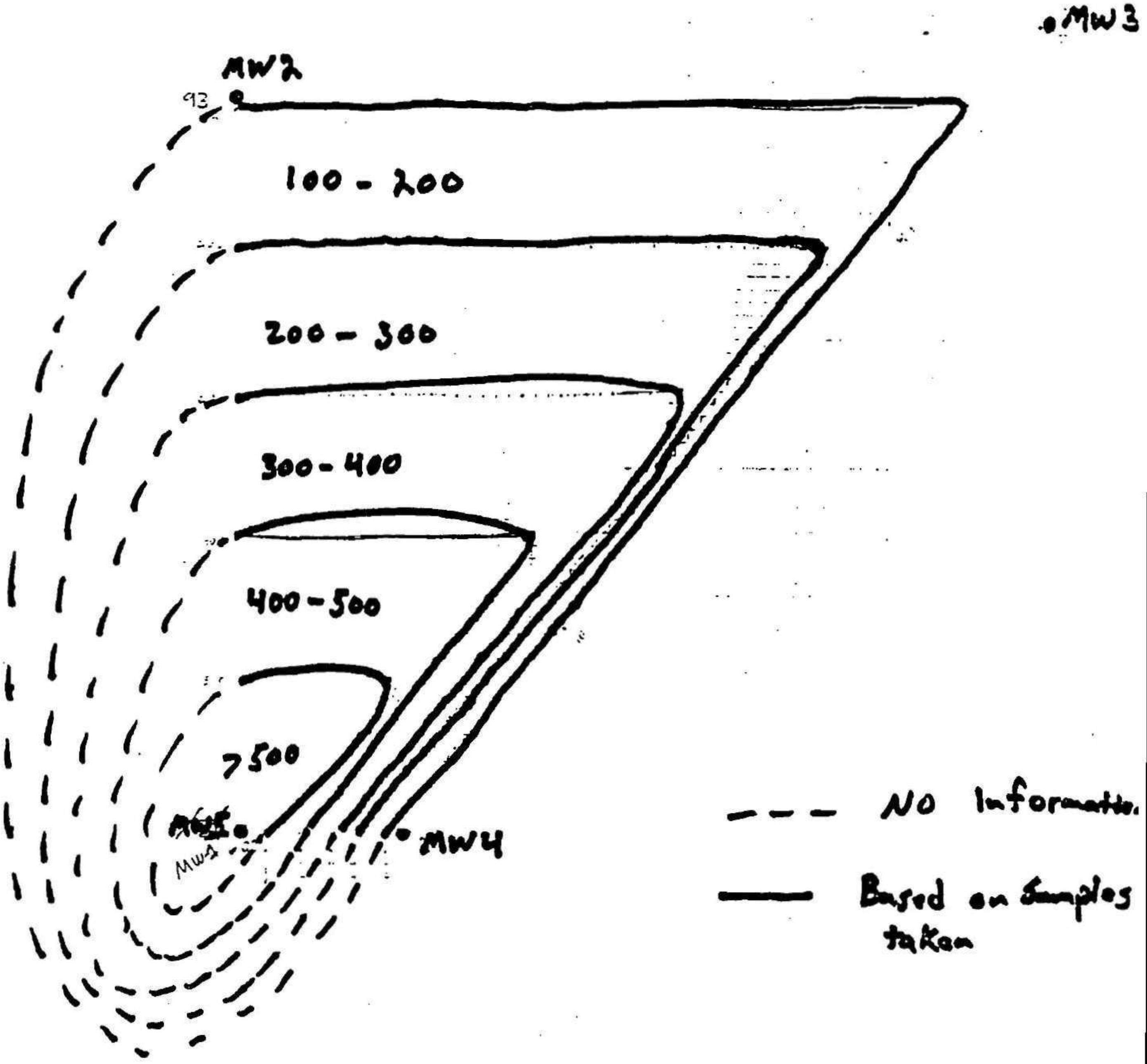
LEGEND

☒ MONITORING WELL

○ TEST BORING

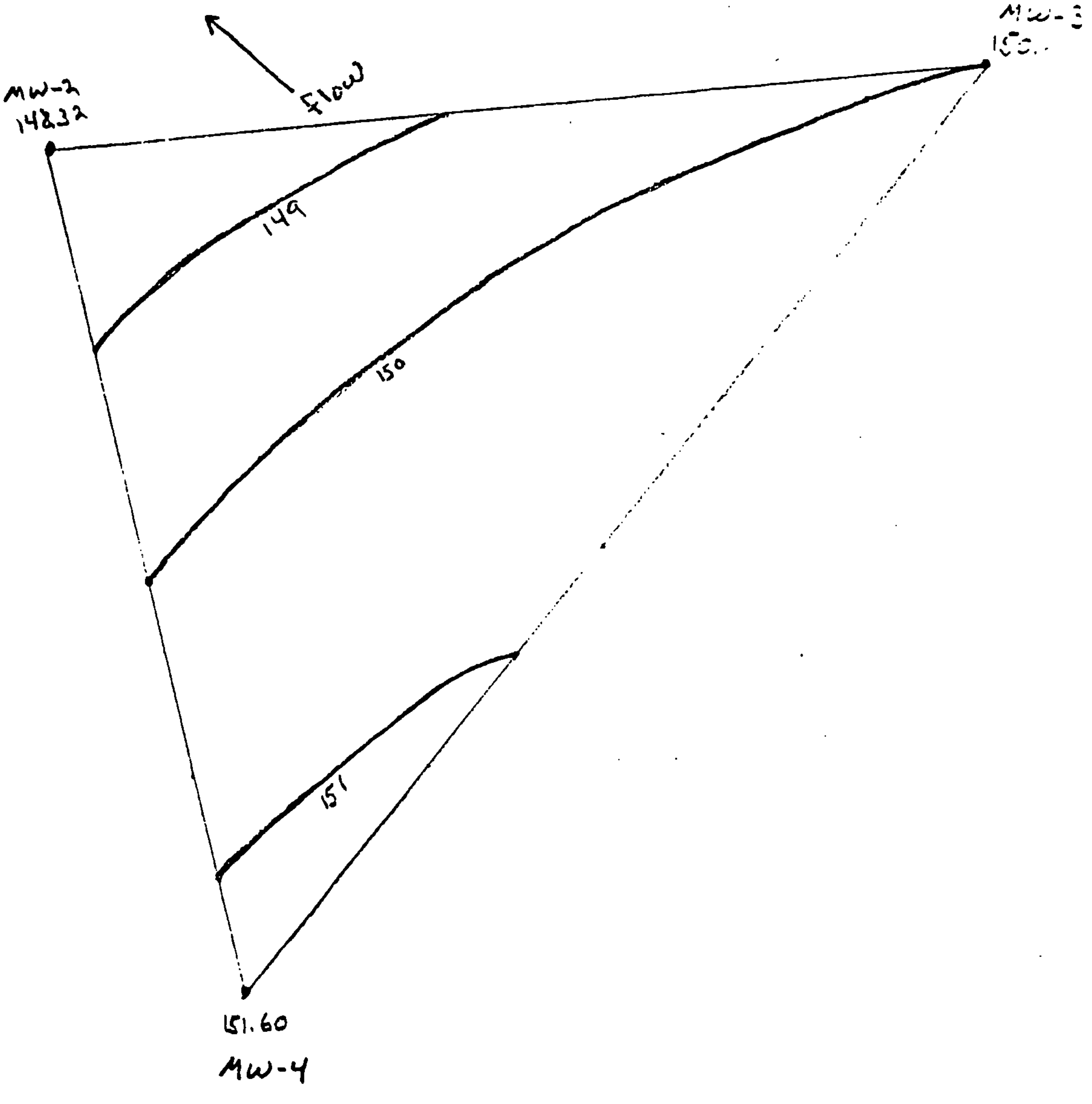
WELL LOCATIONS




MW3
MW2
93
100 - 200
200 - 300
300 - 400
400 - 500
>500
MW1
MW4
- - - NO Informatio
Based on Samples taken

RSA Plume

RSA



RSA Wells

348-9074

	Depth to H_2O	Total Depth of Well
MW-1	14.65 ft.	19.10 ft. ? bailer to bottom
MW-2	11.46 ft.	18.05 ft.
MW-3	16.31 ft.	18.04 ft.

packers

Heigth to top of casing as compaired to 200' contor

MW-1 -5.98' +5.64' = -.34' +200' = 199.66'
MW-2 -19.72' + 5.64' = -14.08' +200' = 185.92'
MW-3 -2.12' + 5.64' = + 3.52' +200' = 203.52'

Elevations at Casings

w# 14.65 meters $\times \frac{100\text{ cm}}{\text{meter}} \frac{1\text{ inch}}{2.54\text{ cm}} \frac{1\text{ foot}}{12\text{ inches}}$ = 48.064 feet

w2 11.46 meters = 37.598 feet

w3 16.31 meters = 53.510 feet

199.66 − 48.064 = 151.596′ MW 4

185.92 − 37.598 = 148.322 MW 2

203.52 − 53.510 = 150.01 MW 3

RSA 9074

6-13-94

RSA 9W	pH	COND	TEMP
900	5.76	80	20.8

RSA MW3-C 0930 purge
DEPTH TO WATER 16.49 meters
TOTAL DEPTH 18.03 meters

pH	Cond	Temp
5.48	180 ~~[illegible]~~	22.3 ~~[illegible]~~
5.35	200	22.2
5.27	200	21.8
5.22	200	21.8

RSA MW-2 0950 purge
water 11.60 meter
tal 17.99 meter

pH	Cond	Temp
5.41	270	22.5 ~~[illegible]~~
5.32	260	22.1
5.42	250	22.3
5.38	250	22.2

RSA MW-4 1050 purge
water 14.77 meters
e Depth 19.10 meters

pH	Cond	Temp
5.83	250	22.2
5.66	230	22.2
5.88	250	22.2
5.66	240	22.0

RSA 9074

6-13-94

RSA 9W	pH	COND	TEMP
900	5.76	80	20.8

SA MW3-C 0930 purge

DEPTH TO WATER 16.49 meters

TOTAL DEPTH 18.03 meters

pH	Cond	Temp
5.48	180 ~~[illegible]~~	22.3 ~~[illegible]~~
5.35	200	22.2
5.27	200	21.8
5.22	200	21.8

SA MW-2 0950 purge

a water 11.60 meter

ttl. 17.99 meter

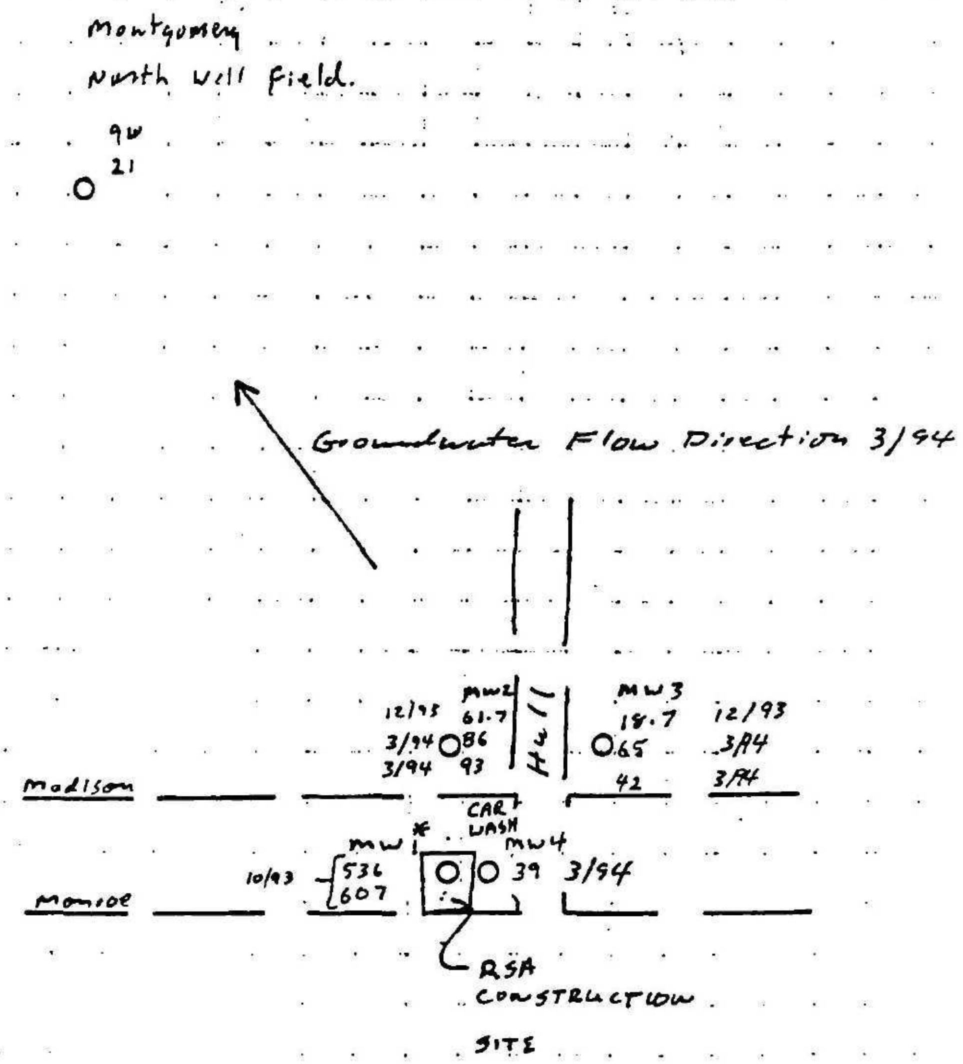
pH	Cond	Temp
5.41	270	22.5 ~~[illegible]~~
5.32	260	22.1
5.42	250	22.3
5.38	250	22.2

SA MW-4 1050 purge

water 14.77 meters

Depth 19.10 meters

pH	Cond	Temp
5.83	250	22.2
5.66	230	22.2
5.88	250	22.2
5.66	240	22.0

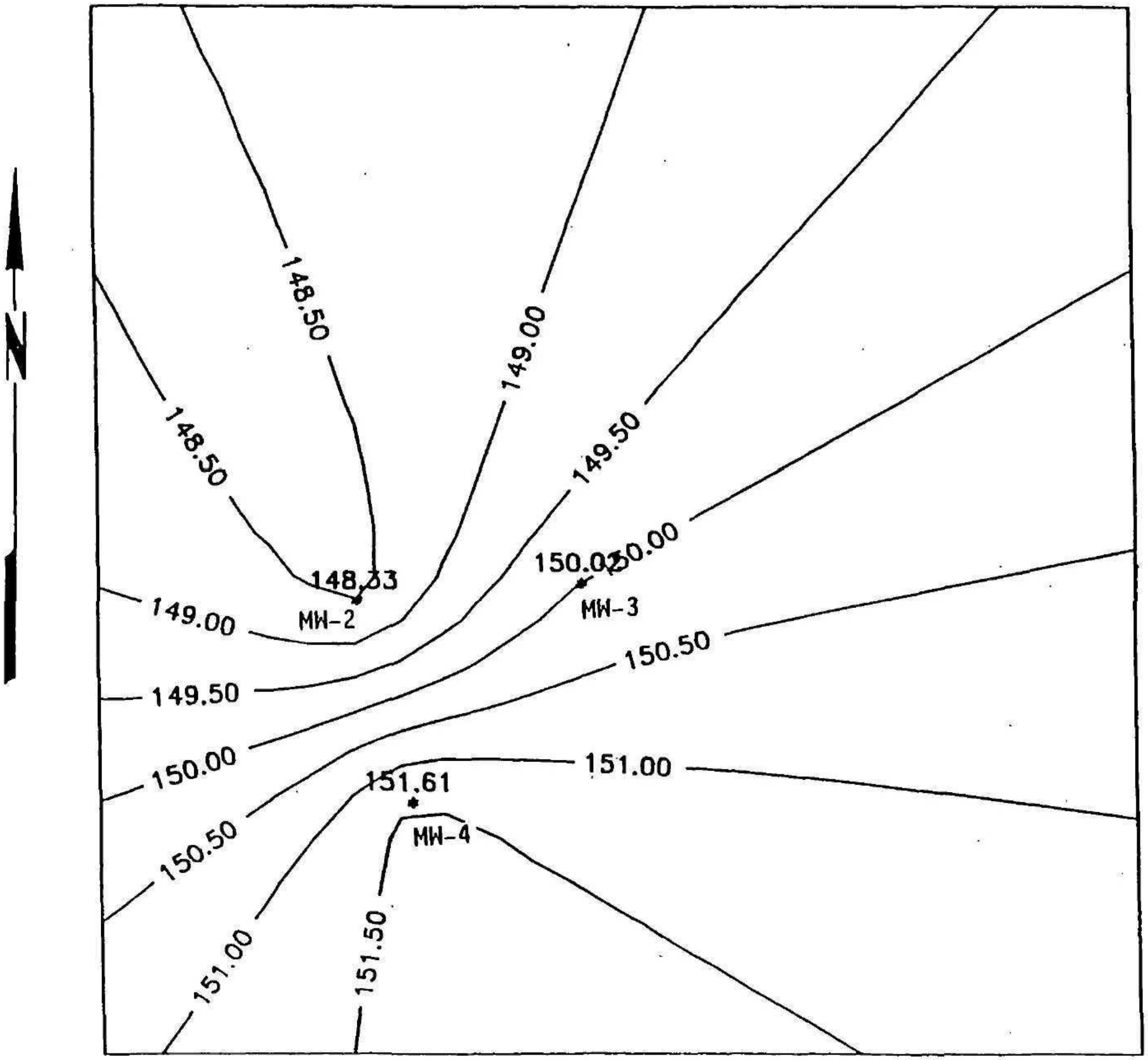


Legend

- o Monitoring well #
- 607 parts per billion tetrachlorethylene

* MW 1 Sampled twice and abandoned.

GROUNDWATER FLOW–RSA PHYSICAL PLANT SITE



REFERENCE 5

SOIL GAS SURVEY
PETREX Information and Report

REFERENCE 5

RSA PETREX SURVEY
FIELD NOTES

AHSCF # 9074
NERI PROJECT # 2224

12/14/94
Location: Montgomery, Alabama
Temperature: Approximately 55° F
Weather: Dry, bright, wind blowing from East at less than 5 mph

BAG 1

TUBE 2: 1-11-95 9:42am

10:20 AM ... hole through bare ground into coarse red sand ... black coarse material at bottom ... roots nearby and in top of hole...parking lot ... hole approx. 4 paces South of tree ... approx. 25' South of Pollard St. ... approx. 25' East of drive way ... brick and concrete on surfaces ... debris all around.

TUBE 1: 1-11-95 9:51

10:30 AM ... hole through turf and dark brown sand and gravel into brown moist silty sand ... approx. 10' South of Pollard St. ... approx. 5 1/2' North of front steps of Nichol's Auto ... storm drain 8' to Northeast ... public water wells approx. 150' to the north ... hole beneath brick ... UST approx. 35' west of hole.

TUBE 4: 1-11-95 10:22

10:40 AM ... hole through turf into brown peat and sand ... approx. 1 1/4' South of Capital Trailways Bus parking ... approx. 8' North of Randolph St. ... in side walk ... approx. 3' West of 6th fence post from East.

TUBE 5: 1-11-95 10:26

10:50 AM ... hole through turf into moist light brown coarse sand into black coarse sand at bottom ... approx. 3' West of building ... approx. 2 1/2 ' East of RR tracks ... 15' South of Randolph St. ... Budwiser Facility to West and South ... approx. 7' North of mimosa tree ... used red ribbon flagging.

TUBE 6: 1/11/95 10:37

hole through turf into brown coarse sand into gray moist medium sand with silt ... approx. 10' North of fence ... approx. 6' East of utility pole ... approx. 8' East of old drive way ... approx. 2 1/2' East of fence post with flagging ... red ribbon.

TUBE 7: 1/11/95 10:28

hole through turf into moist light brown medium sand ... approx. 18" North of iron fence ... approx. 2 1/2' East of 6th section of fence from West ... approx. 25' South of Randolph St. ... approx. 35' East of old walkway ... installed with core shovel.

TUBE 3: 1/11/95 10:32

11:25 AM ... hole through turf into moist brown medium sand ... approx. 1' North of Randolph St. ... 1' South of bus parking sign post ... approx. 5' West of Hull St. ... sidewalk approx. 4' to the North ... at Southeast corner of Lawson Construction company.

BREAK FOR LUNCH AT 11:35 AM

RETURNED TO WORK AT 12:35 PM

1/11/95 10:44 am

TUBE 10: 12:35 PM ... hole through asphalt into red coarse sand fill material ... approx. 15' South of block wall ... approx. 3 1/2' South of dirt and old logs ... approx. 25' South of Columbus St. ... approx. 28' East of building.

1/11/95 10:53

TUBE 8: hole through bare soil, brick and concrete rubble into miost brown fine sand ... approx. 2' North of 1st fence post from building ... approx. 8' West of building ... approx. 20' North of Jefferson St.

tube neck broke - transferred wires to new tube

1/11/95 11:03

TUBE 12: 1:22 PM ... hole through turf into brown clayey sand ... 1 1/4' North of iron fence ... approx. 20' South of road ... approx. 8' East of water line

1/11/95 11:05

TUBE 14: hole through turf in corner of sidewalk into brown clayey sand with some black coarse sand at bottom ... approx. 10' South of Jefferson St. ... approx. 14' West of Lawrence St.

1/11/95 11:08

TUBE 9: hole through turf into dark moist clayey sand ... approx. 3 1/2' North of Jefferson St. ... approx. 30' West of Lawrence St. ... approx. 60' Northwest of tube 14 ... approx. 4 1/2' from no right turn sign and drive way.

broke at 11:[illegible]am lunch - start back 1:30 pm

1/11/95 1:40 pm

TUBE 13: 2:03 PM ... hole through turf in sidewalk margin into moist brown silty sand ... approx. 6' South of roadway ... approx. 10' North of power transformer facility ... approx. 16' West of large power line tower ... approx. 8' East of water and sewer line.

1/11/95 1:45 pm

TUBE 11: hole through turf into red brown moist sand ... approx. 2' South of sidewalk ... approx. 6' North of Jefferson St. ... approx. 8' east of historic district sign ... approx. 35' West of street corner ... installed with core shovel.

1/11/95 1:48 pm

TUBE 23: hole through turf into moist brown sand ... approx. 15' East of tree ... approx. 4' South of Jefferson St. ... approx. 11' South of building ... approx. 60' East of street corner.

- possible car emissions - car running

1/11/95 1:50 pm

TUBE 24: hole through turf into dark brown sand ... approx. 1 1/2' South of sidewalk ... approx. 2 1/2' East of sidewalk.

1/11/95 1:52 pm

TUBE 25: 2:50 PM ... hole through thin layer of moss into dark brown sand ... approx. 5' west of Decatur St. ... approx. 6" east of sign post.

1/11/95 1:55

TUBE 26: hole through turf into dark brown and red brown sand with concrete debris ... approx. 6' North of Madison Av. in center of square of turf ... installed with core shovel.

1/11/95 1:57

TUBE 51: Through turf into brown moist medium sand ... approx. 18" south of driveway ... approx. 55' East of Street ... approx. 60' West of MW-3 ... installed with auger.

1/11/95 1:58pm **TUBE 20:** hole through turf into moist sandy soil ... approx. 4' South of driveway ... approx. 4' East of sidewalk ... approx. 4 1/2' West of road.

1/11/95 2:01 pm **TUBE 19:** 3:16 PM ... hole through turf into coarse brown sand into red mottled clay ... approx. 10" West of street sign post ... approx. 5' West of road and sewer grate ... approx. 2' North of sewer line.

1/11/95 2:05 pm **TUBE 21:** hole through turf into dark sandy soil into red brown sand ... approx. 1 1/2' West of stop sign ... approx. 17' North of Madison Av. ... approx. 6 1/2' East of sidewalk.

1/11/95 2:06 pm **TUBE 18:** hole through turf into brown sand with some pebbles ... approx. 6' North of Madison St. .... approx. 4' east of sewer line ... approx. 20' West of utility pole ... installed with auger.

1/11/95 2:10 pm **TUBE 22:** hole through asphalt into dark sandy soil ... approx. 20' South of storm drain ... approx. 20' east of curb ... approx. 60' South of MW-2 ... TIME TEST LOCATION 2 TIME TEST TUBES ARE WEST OF TRUE SAMPLE TUBE.

inished 2:15 pm

3:50 PM END INSTALLATION FOR WEDNESDAY 12/14/94

12/15/94 9:15 AM BEGIN INSTALLATION
Temperature: 50° F
Weather: humid with overcast sky, wind less than 5 mph from Northeast

1-12-95

2:00 **TUBE 41:** hole through turf into brown sand with pebbles ... approx. 10' East of fence that borders car wash ... approx. 8' North of old building pad ... approx. 70' West of Hull St. ... approx. 22' West of MW-4.

START BAG 2

10:47 **TUBE 44:** hole through 6" of concrete into red brown moist silty sand ... approx. 13' North of Monroe St. ... Approx. 8' east of light post ... TIME TEST TUBES LOCATED WEST OF TRUE SAMPLE TUBE

1:50 **TUBE 38:** hole through turf into brown sandy soil ... approx. 5 1/2' West of Hull St. ... approx. 6' South of small tree ... approx. 10' East of Northwest Finance ... approx. 5' west of parking meter.

1:56 **TUBE 50:** hole through grass in median between sidewalk and street ... through dirt then concrete block then into brown sand ... approx. 12' East of curb ... approx. 8' North of utility pole ... approx. 7' South of driveway to B F Goodrich.

1:55 **TUBE 39:** hole through sparse grass and gravel into red brown moist sand ... approx. 18" north of fence ... approx. 10 ' East of low fence ... approx. 18' East of 8' drive down to car wash.

TUBE 40: 1:52
10:12 AM ... hole through gravel and bare soil into red brown sand ... approx. 20" West of sidewalk ... approx. 2 1/2' North of fence ... approx. 2' southwest of unauthorized vehicle parking sign.

TUBE 42: 11:03
hole through asphalt into silty brown sand ... approx. 6" east of fence ... approx. 15' West of Hull St. ... approx. 5' West of concrete sidewalk ... approx. 11' North of no trespassing sign ... in center of painted square.

TUBE 43: 10:56
hole through asphalt on north edge of Monroe street into concrete and soft brown sandy soil ... Approx. 4' West of sidewalk ... approx. 12" Southwest of temporary fence post.

TUBE 48: 10:44
hole through asphalt in Monroe St. ... Approx. 8' South of Yellow line on white line path ... approx. 10' East of storm drain in corner area ... into yellow sandy soil ... approx. 25' East of Mc Donough St.

TUBE 55: 10:38
11:10 AM ... hole through asphalt in Monroe St. ... Approx. 25' West of Mc Donough St. ... Approx. 8' South of yellow line ... into tight brown sand ... approx. 3 1/2' West of white walkway line.

TUBE 54: 10:30
hole through asphalt in Monroe St. ... approx. 6 1/2' South of yellow line ... approx. 5' East of white walkway line ... approx. 20' East of Lawrence St. ... into coarse sand subgrade material.

BREAK FOR LUNCH ANT 11:30 AM
START BACK AT 1:21 PM

1-2-95

TUBE 15: 9:45
hole through asphalt into brown sand with gravel ... approx. 3' South of air conditioning units ... approx. 12' West of building ... approx. 30' North of Monitoring well, air stripping unit approx. 15' to Southeast ... TIME TEST TUBES LOCATED WEST OF TRUE SAMPLE TUBE.

TUBE 46: 950
2:00 PM ... hole through asphalt in parking area into red brown sandy soil ... approx. 3' East of brick wall ... approx. 30' North of Jefferson St. ... between yellow lines of parking boundaries.

TUBE 45: 9:54
hole through grass into red brown organic sand into red brown sand with clay ... approx. 15' West of Lawrence St. ... approx. 2 1/2' South of asphalt .... approx. 10' North of Jefferson St.

TUBE 17: 10:00
hole through turf into gray brown poorly sorted sand with silt ... approx. 2' West of sidewalk ... approx. 12' North of Parking lot ... approx. 14' West of Lawrence St. in center of painted square.

TUBE 16: 10:05
2:30 PM ... hole through turf into soft red and yellow sand ... in center of painted square ... approx. 10' North of Madison St. ... approx. 14' West of Lawrence St.

10:16 TUBE 30: hole through bark and soil in flower bed ... approx. 8' South of sidewalk ... approx. 8 1/2' South of Madison St. curb ... approx. 1 1/2' West of joint in sidewalk ... into yellow brown clayey sand.

TUBE 29: hole through turf into gravely sand with some asphalt ... approx. 1 1/2' East of brick wall ... approx. 16' West of Lawrence St. ... TIME TEST SAMPLES TO THE SOUTH OF THE TRUE TEST TUBE.
10:10

TUBE 27: 2:55 PM ... hole through turf into dark brown sandy soil ... approx. 14" Northwest of curve in sidewalk ... approx. 9' West of Lawrence St. ... approx. 12' North of Monroe St.
10:26

TUBE 28: hole through bare soil in edge of border ... approx. 6" South of brick wall ... approx. 8' West of Lawrence St.. approx. 63' North of #27 ... approx. 75' North of Monroe St.
10:22

PAUL LEFT AT 3:10 PM

TUBE 53: hole through humus material and red silty clay soil ....near Madison hotel ...
??? 10:33

3:15 PM END INSTALLATION FOR THURSDAY 12/15/94

12/16/94 9:30 AM BEGIN INSTALLATION
Temperature: 65° F
Weather: humid with cloudy sky, wind less than 5 mph from Northeast

wind 5-10 mph
SE

13 JAN 95

0925 TUBE 31: 9:36 AM ... hole through asphalt into red silty fill material ... first parking space next to brick wall.

0928 TUBE 36: 9:45 AM ... hole through asphalt in red silty fill material ... last parking space six paces from from MW-3 ... 3' from brick wall.

1032 TUBE 37: 10:07 AM ... soil in brown humus topsoil with worms ... 4" from short brick wall ... 2' from wooden wall of dumpster.

1030 TUBE 32: 10:40 AM ... hole in brown soil ... 3' from curb in dirt ... 9' from wrong way sign.

START BAG 3

1028 TUBE 33: 10:25 AM ... under oak ... sandy loam, mottled red and brown soil ... approx. 4' from tree ... approx. 4' from roadside.

1025 TUBE 34: 10:35 AM ... loose manila sand ... something solid at bottom of hole ... 3-4' from small palm tree ... 6' from meter.

1020 TUBE 35: 10:45 AM ... red sand to brown sand and gravel ... 6' Southeast of corner of yellow building ... 8' from corner of concrete drive.

1001 TUBE 58: 11:00 AM ... across from law office ... 4' from curb

1005 TUBE 56: 11:10 AM ... area smelled of pesticide ... inside churches chain link fence nest to second concrete car curb ... 3' from fence.

1010 TUBE 47: 11:20 AM ... hole through concrete in red clay ... 6" North of chain link fence on Monroe St. ... 4' east of curb.

TUBE 52: 11:35 AM ... brown loam with pea gravel ... at corner of Davis Dry Cleaners ... 6 paces north of Southeast corner of building ... 1 1/2' from wall of building.
0943

Mr power dug hole in

LOST → TUBE 59: 11:45 AM ... brown rich loam ... 2' from street sign ... center of painted square. Lost

0948 TUBE 57: 11:53 AM ... hole through asphalt and brown sandy fill ... 1' South of wooden fence ... 4' East of chain fence. Lost

collapsed in

Tube Broken

TUBE 60: 12:04 PM ... sandy loam with some roots ... nest to Ala. State Bar Asso. ... 15' North of telephone pole on corner of Dexter and Hull.
0959

TUBE 49: 12:15 PM ... hole through asphalt into fill material ... between Charlies Produce and red brick wall 48' Northeast of MW-2.
0933

FINISHED AT 12:15 PM

END OF NOTES

RSA AHSCF 9074

NERI Jo[illegible]#22 04

3 triplicates

53 [illegible]plicates + 2 lost in fiel

8 Time test

BAG NUMBER ________ FIELD BLANK NUMBER ________

HANDS SHOULD BE CLEAN OF DIRT AND ODOR BEFORE HANDLING TUBES

1. Remove the cap. If the black liner has stuck to tube lip, remove it and immediately place sampler (vertically with open end down) into sample location hole. The sampler must be at least 2 inches below ground surface. Immediately cover sampler with soil.

2. Replace black liner in cap and return clean bag. Retrieval: Tube must be sealed with liner in cap asap upon removal from sample hole.

3. Note tubes which have been dug up by animals, cracked, broken, placed near R.R. tracks, asphalt, power poles, or exposed to exhaust or gas fumes, etc.

Sample #	Date In/Out	Retrieval: Check line if black liner is in cap	#3) Notations
2	12-14-94 / 1-11-95	✓	29 Days
1	/		
4	/		
5	/		
6	/		
7	/		
3	/		
10	/		
8	/		
12	/		
14	/		
9	/		
13	/		
11	/		
23	/		
24	/		
25	/		
26	/		
51	/		
20	/		
19	/		
21	/		
18	/		
22	/		
	/		
	/		
	/		
	/		

2224

BAG NUMBER __________ FIELD BLANK NUMBER __________

HANDS SHOULD BE CLEAN OF DIRT AND ODOR BEFORE HANDLING TUBES

1. Remove the cap. If the black liner has stuck to tube lip, remove it and immediately place sampler (vertically with open end down) into sample location hole. The sampler must be at least 2 inches below ground surface. Immediately cover sampler with soil.
2. Replace black liner in cap and return clean bag. Retrieval: Tube must be sealed with liner in cap asap upon removal from sample hole.
3. Note tubes which have been dug up by animals, cracked, broken, placed near R.R. tracks, asphalt, power poles, or exposed to exhaust or gas fumes, etc.

Sample #	Date In/Out	Retrieval: Check line if black liner is in cap	#3) Notations
41	12-15-94 / 1-12-95	✓	29 Days
44	12-15-94 / 1-12-95		
38	/		
50	/		
39	/		
40	/		
42	/		
43	/		
48	/		
55	/		
54	/		
15	/		
46	/		
45	/		
17	/		
16	/		
30	/		
29	/		
27	/		
28	/		
53	↓ / ↓	↓	↓
	/		
	/		
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	/		

2224

BAG NUMBER ________ FIELD BLANK NUMBER ________

HANDS SHOULD BE CLEAN OF DIRT AND ODOR BEFORE HANDLING TUBES

1. Remove the cap. If the black liner has stuck to tube lip, remove it and immediately place sampler (vertically with open end down) into sample location hole. The sampler must be at least 2 inches below ground surface. Immediately cover sampler with soil.
2. Replace black liner in cap and return clean bag. Retrieval: Tube must be sealed with liner in cap asap upon removal from sample hole.
3. Note tubes which have been dug up by animals, cracked, broken, placed near R.R. tracks, asphalt, power poles, or exposed to exhaust or gas fumes, etc.

Sample #	Date In/Out	Retrieval: Check line if black liner is in cap	#3) Notations
31	12-16-94 / 1-13-95	✓	29 Days
36	/		
37	/		
32	/		
33	/		
34	/		
35	/		
58	/		
56	/		
47	/		
52	/		
[illegible]	/ X	X	Ala. Power Dug tube up :
[illegible]	/ X	X	hole Collapsed [illegible] — Could not find wires
60	/		
49	/		
	/		
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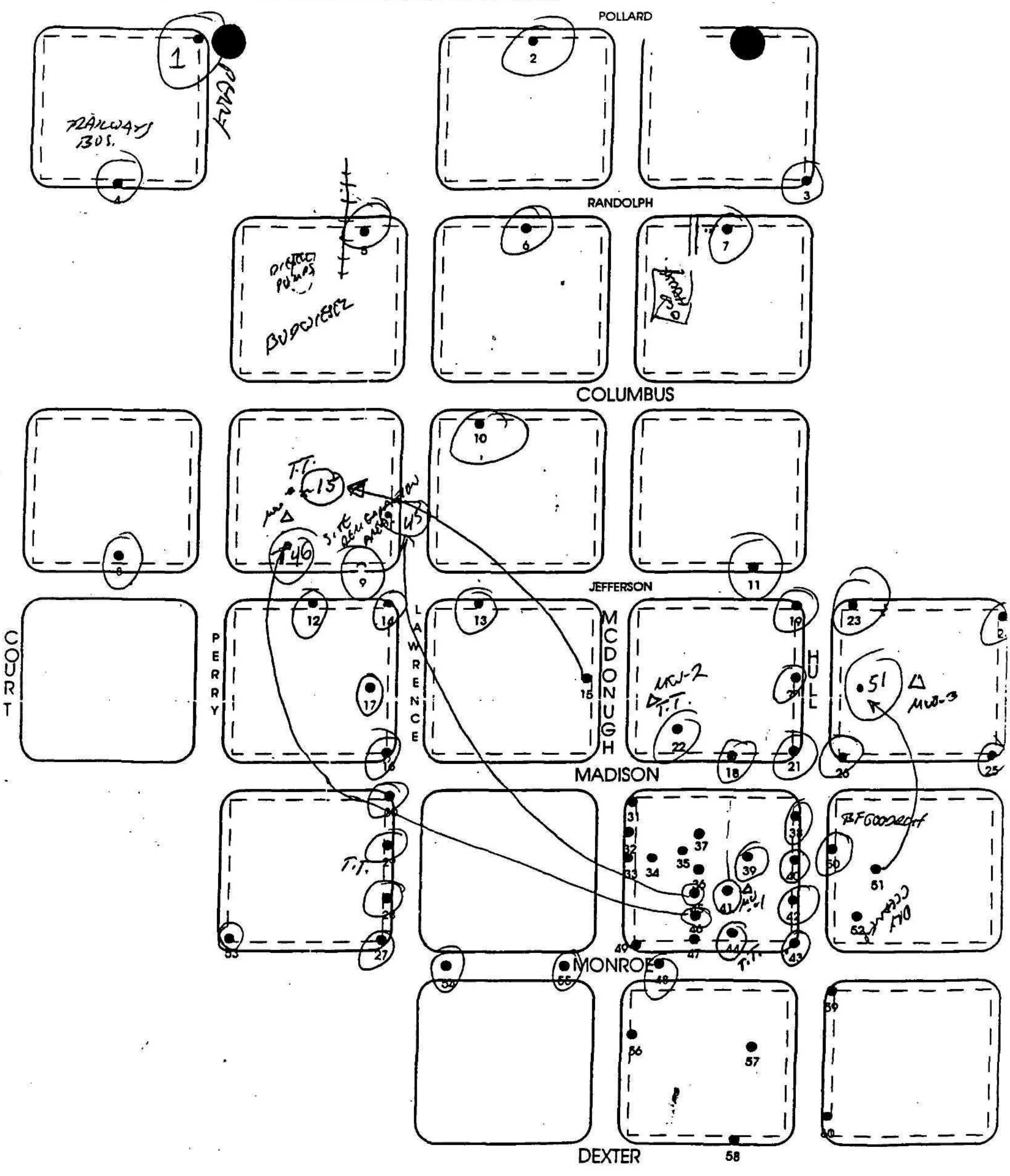

POLLARD
RANDOLPH
COLUMBUS
JEFFERSON
MADISON
MONROE
DEXTER
COURT
PERRY
LAWRENCE
MCDONOUGH
HULL
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59
60
TRAILWAYS BUS.
DISTRICT PUMPS
BUDWEISER
T.T.
15
MW
Site remediation area
45
46
MW-2
T.T.
51
MW-3
MW-1
T.T.
BFGOODRICH
OLD CREEK
T.T.

NERI
Northeast Research Institute LLC

605 Parfet Street • Suite 10
[illegible]ewood, Colorado 80215-551
[illegible]03-238-0090 • 800-845-513
Fax 303-238-252

January 26, 1995

Mr. Jeremy Stamps
Alabama Department of Environmental Management
Site Assessment Unit
Special Projects
P.O. Box 30463
Montgomery, Alabama

Phone: (205) 271-7700
Fax : (205) 270-5612

Dear Mr. Stamps:

Enclosed please find the preliminary report of the findings of the PETREX Soil Gas investigation performed at the Downtown Montgomery Site located in Montgomery, Alabama.

If you have any questions concerning the enclosed, please do not hesitate to call. We will await your comments prior to issuing our final report.

Respectfully Submitted,
NORTHEAST RESEARCH INSTITUTE LLC

Julia Olney Gullett

Julia Olney Gullett
Senior Geologist

JAN 1995
ADEM
SPECIAL PROJECTS

encl
/JOG

D2224JG/01.25.95

NER
Northeast Research Institute LLC

[illegible]05 Parfet Street • Suite 100
Lakewood, Colorado 80215-5518
303-238-0090 • 800-845-5137
Fax 303-238-2522

REPORT ON THE FINDINGS OF THE PETREX SOIL GAS SURVEY PERFORMED AT THE DOWNTOWN MONTGOMERY SITE

PREPARED FOR:
THE ALABAMA DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT

PREPARED BY: DATE:

Julia Olney Gullett 1/26/95
Julia Olney Gullett, Senior Geologist

APPROVED BY: DATE:

1/26/95
Paul A. Harrington, Operations Manager

NORTHEAST RESEARCH INSTITUTE
605 PARFET STREET, SUITE 100
LAKEWOOD, COLORADO 80215
(303) 238-0090

1294-2224E

JAN 1995
ADEM
SPECIAL PROJECTS

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APPENDICES

A. Results of the Pilot PETREX Soil Gas Investigation
B. PETREX Protocol
C. Tabular Data
D. Sample Mass Spectra
E. Histograms

Plates 1 - 3, provided separately

1.0 EXECUTIVE SUMMARY

Northeast Research Institute (NERI) and the Alabama Department of Environmental Management (ADEM) recently performed PETREX Soil Gas sampling at the Downtown Montgomery Site located in Montgomery, Alabama. Tetrachloroethene (PCE) has been discovered in groundwater production wells in the vicinity. The purpose of the PETREX Soil Gas survey was to map the distribution of PCE as detected in soil gas, to help determine potential source areas, preferential migration pathways and the areal extent of chemical migration.

Tetrachloroethene (PCE) and the petroleum hydrocarbon compounds benzene, toluene, ethylbenzene/xylene(s) (BTEX) were detected in the soil gas. The distribution of the compound occurrences has been mapped and potential source areas and preferential migration pathways appear to have been identified. Potential source areas for PCE were identified in the vicinity of the city blocks bounded by Monroe Street to the south, McDonough Street to the west, Decatur Street to the east and on the north and south sides of Madison Avenue. The primary potential source area of BTEX release appears to be located in the vicinity of the city block bounded by Dexter Street to the south, Lawrence Street to the west, McDonough Street to the east and Monroe Street to the north. The areal extent of PCE migration appears to be limited, and confined to the study area; the areal extent of BTEX migration extends beyond the survey limits to the south and southeast, and was not defined.

2.0 INTRODUCTION

Northeast Research Institute (NERI) and the Alabama Department of Environmental Management (ADEM) recently performed PETREX Soil Gas sampling at the Downtown Montgomery Site located in Montgomery, Alabama. Tetrachloroethene (PCE) has been discovered in groundwater production wells in the vicinity.

In August 1993, NERI provided ADEM with three PETREX passive soil gas samplers as part of a pilot test to determine the effectiveness of the PETREX technique in detecting the known contaminant. PCE was detected at all locations sampled in the pilot investigation and a follow up investigation was initiated. For additional discussions on the results of the pilot investigation, please refer to Appendix A.

The purpose of the PETREX Soil Gas survey was to map the distribution of PCE as detected in soil gas, to help determine potential source areas, preferential migration pathways and the areal extent of chemical migration.

3.0 OVERVIEW OF THE PETREX TECHNIQUE

Each PETREX soil gas sampler consists of two or three activated charcoal adsorption elements (collectors) housed in a resealable glass container in an inert atmosphere.

Soil gas sample collection is performed by unsealing the sampler and exposing the collector to the soil gas of the subsurface environment at the base of a shallow borehole. Sample collection proceeds via free vapor diffusion through the opening of the uncapped sampler container. Following a controlled period of time, the sampler is retrieved from the borehole, resealed, and submitted for analysis.

One collector from each soil gas sampler is analyzed by Thermal Desorption/Mass Spectrometry (TD-MS). Selected second collectors may be analyzed by Thermal Desorption-Gas Chromatography/Mass Spectrometry (TD-GC/MS) for compound confirmation. At least ten percent of samplers used in any project are three collector samplers. The third collector is used for setting instrument sensitivity prior to analysis.

Compounds are identified by comparison to standard reference spectra run on the same instrument. The mass spectral ion count of the appropriate indicator peak(s) for each compound or group of compounds is then plotted as relative response on a map and contoured using a variety of standard geostatistical analyses.

For a more detailed and technical discussion of the method, please refer to Appendix A, PETREX Protocol.

4.0 OBJECTIVES

The purposes of the PETREX Soil Gas Survey were to:

1. Identify PCE in soil gas;
2. Map the distribution of PCE occurrences to aid in defining potential source areas, preferential migration pathways and the areal extent of chemical migration.
3. Provide data to aid in developing strategies for monitoring groundwater quality, and developing future investigative studies.

5.0 SCOPE OF WORK

Sixty (60) PETREX soil gas samplers were utilized for this soil gas survey. Samplers were placed throughout the downtown area, where accessibility allowed.

The sampler locations are shown on Plate 1, provided separately.

6.0 FIELD ACTIVITIES

Samplers were installed on December 14 - 15, 1994. On December 14, 1994, a NERI Geologist trained representatives from ADEM in PETREX field methods and protocols. Sampler installation and retrieval was then completed by ADEM. Sampler installation was performed by creating a narrow borehole, approximately 18" in depth below the surface, with a rotary hammer drill. The opened sampler was then placed, inverted, at the bottom of the hole. The borehole was backfilled with aluminum foil, with the sampler in place, and sealed with a concrete patch.

Sampler exposure time was determined by the use of time test samplers (time tests). Time test samplers were installed concurrently with the survey sampler installation and removed for analysis following varying exposure periods. The purpose of the time test samplers was to assess the loading rate of Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs) onto the PETREX collectors. Based upon the analyses of time test samplers 29 days was determined to be a sufficient exposure period for this phase of investigation. The exposure period for the pilot investigation was 12 days; the difference in exposure periods between the two phases of sampling was due to seasonal variations in soil gas emanation rates.

Samplers were retrieved on January 17, 1995. Samples 57 and 59 were destroyed in field, therefore they were not retrieved.

7.0 METHOD QA/QC

7.1 Lot Control

Quality assurance/quality control (QA/QC) collectors from each lot manufactured by NERI were analyzed by TD-MS to ensure that they were contaminant free before the lot of collectors used in the field was released from the PETREX laboratory. No compounds were detected above background on the QA/QC collectors.

7.2 Travel Blanks

Two PETREX samplers were provided as travel blanks. These travel blanks remained sealed and traveled with the survey samplers from the laboratory to the field and back to the laboratory to monitor for potential contamination of the survey samplers. The travel blanks were analyzed under the same instrument conditions as the survey collectors. The results of the analysis of the travel blank samples are provided in Table 1, Appendix C.

A more detailed description of the PETREX QA/QC may be found in the PETREX Protocol located in Appendix B.

8.0 RESULTS

All samplers were analyzed by NERI's standard method of Thermal Desorption/Mass Spectrometry (TD-MS). Tetrachloroethene (PCE) and the petroleum hydrocarbon compounds benzene, toluene, ethylbenzene/xylene(s) were the most prominent compounds detected in soil gas. The distributions of the compound occurrences were reported and mapped. In order to map the reported compounds, mass spectral peaks indicative of the compounds were selected and their corresponding ion counts were summed and plotted. Table 2 lists the reported compounds and their selected indicator mass peaks.

TABLE 2

Reported Compounds and Their Indicator Mass Peaks

Reported Compound	Indicator Mass Peak(s) (AMU)
PCE	164
BTEX	78, 92, 106

The distributions of the compounds have been mapped and are shown on the following plates:

Plate 1: Sample Locations Map
Plate 2: Relative Response of Tetrachloroethene (PCE)
Plate 3: Relative Response of Benzene, Toluene, Ethylbenzene/Xylene(s) (BTEX)

Plates 1-3 are provided separately.

Sample mass spectra of the compounds and compound mixtures identified are provided as Figures 1-3, Appendix D.

9.0 DISCUSSION

The soil gas response levels discussed in the following section are described as elevated and moderate relative to the entire data set. The ion count values that have been reported represent qualitative soil gas values that were evaluated relative to the other sampler locations.

The response values are reported in ion counts. Ion count values are the unit of measure assigned by the mass spectrometer to the relative intensities associated with each of the reported compounds. These intensity levels or response levels do not represent an actual concentration of the reported compounds; however, they are best utilized as a qualitative measurement. A difference in ion count values of an order of magnitude or more is considered significant when interpreting potential source areas and migration/dispersion pathways versus background areas.

The contour intervals depicted on Plates 2-3 were determined based upon groupings in the data as observed in histograms formulated from the statistical distribution of the soil gas data. The histograms are shown as Figures 1-2, Appendix E.

For a complete discussion of relative response map evaluation, please refer to the PETREX Protocol, Appendix A.

9.1 The Distribution of Tetrachloroethene (PCE)

The distribution of PCE as detected in soil gas is shown on Plate 2. High relative response values, which generally depict potential source areas, were detected in the southwest corner of the intersection of Hull Street and Madison Avenue, and within the city block located northeast of the intersection of Mc Donough Street and Madison Avenue. A secondary potential source area may have also been identified in the vicinity located between Monroe, Mc Donough and Hull Streets and Madison Avenue. Migration of PCE appears to have occurred in a northwest southeast pattern, depending upon the location of the potential source area. The areal extent of PCE migration appears to be limited to this vicinity.

9.2 The Distribution of Benzene, Toluene, Ethylbenzene/Xylene(s) (BTEX)

BTEX distribution is shown on Plate 3. The primary BTEX occurrence was identified in the vicinity of Monroe Street, north of the city block located at Monroe, Dexter, Lawrence and Mc Donough Streets. Migration of BTEX appears to have occurred towards the northeast and potentially to the southeast from the potential source area. The areal extent of BTEX migration extends beyond the survey boundaries to the south and east, and was not defined in these directions. Secondary BTEX occurrences were identified in the southern portion of the city block bound by Jefferson, Hull and Decatur Streets and Madison Avenue; and in the center of the city block located at Columbus, Perry, Lawrence and Jefferson Streets. Isolated occurrences were identified in the northwestern portion of the survey area. The data surrounding these occurrences are insufficient to determine the environmental significance of the isolated detections.

10.0 CONCLUSIONS

Tetrachloroethene (PCE) and the petroleum hydrocarbon compounds benzene, toluene, ethylbenzene/xylene(s) (BTEX) were detected in the soil gas. The distributions of the compound occurrences have been mapped and potential source areas and preferential migration pathways appear to have been identified. Potential source areas for PCE were identified in the vicinity of the city blocks bounded by Monroe Street to the south, McDonough Street to the west, Decatur Street to the east and on the north and south sides of Madison Avenue. The primary potential source area of BTEX release appears to be located in the vicinity of the city block bounded by Dexter Street to the south, Lawrence Street to the west, McDonough Street to the east and Monroe Street to the north. The areal extent of PCE migration appears to be limited, and confined to the study area; the areal extent of BTEX migration extends beyond the survey limits to the south and southeast, and was not defined.

Because soil gas emanation rates are site and chemical specific, the environmental significance of the soil gas response values must be determined relative to compound concentrations in *subsurface soil and/or groundwater. Changes in soil gas response in orders of magnitude* may be used to plan future investigative studies, and to aid in characterizing the behavior (migration, attenuation) of the chemicals in the subsurface. The PETREX method is extremely sensitive and often detects compounds in the low part per billion (ppb) to part per trillion (ppt) range; therefore areas depicted as background by the PETREX method generally do not represent environmentally significant contaminant levels in the subsurface.

11.0 RECOMMENDATION

Based upon the findings of the PETREX soil gas survey, NERI makes the following recommendation:

1. Extend the soil gas survey to the south where chemical migration appears to have extended beyond the survey boundaries, and in areas where further source identification is warranted (i.e. in the city blocks bound by Madison Avenue to the north, Monroe Street to the south and Hull and Mc Donough Streets to the east and west). The information obtained from this follow-up investigation can be used to determine additional potential source areas, define preferential migration pathways and the areal extent of chemical occurrences.

12.0 LIMITATIONS

This report represents NERI's professional interpretation and judgment based on technical information gathered during investigative activities. Professional judgments expressed herein are restricted to facts available within the established limits of the scope of work, budget, and schedule. NERI assumes no responsibility for the existence or disclosure of conditions which did not come to its knowledge, or conditions not generally recognized as environmentally unacceptable, at the time this report was prepared.

It is NERI's specific intent that all observations and conclusions presented will be used as a guide and not necessarily a firm course of action unless explicitly stated as such. No warranties are expressed or implied and the information included in this report is not to be construed as legal advice.

D2224JG/08.15.94

APPENDIX A

Results of the PETREX Pilot Soil Gas Investigation

Northeast Research Institute LLC

605 Parfet Street • Suite 100
Lakewood, Colorado 80215-5518
303-238-0090 • 800-845-5137
Fax 303-238-2522

FINAL REPORT ON THE FINDINGS OF THE PETREX SOIL GAS SURVEY CONDUCTED FOR THE ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT AT THE DOWNTOWN MONTGOMERY SITE LOCATED IN MONTGOMERY, ALABAMA

PREPARED BY: DATE:

Julia Olney Gullett 8/17/94
Julia Olney Gullett, Senior Geologist

APPROVED BY: DATE:

8/17/94
Paul A. Harrington, Operations Manager

NORTHEAST RESEARCH INSTITUTE
605 PARFET STREET, SUITE 100
LAKEWOOD, COLORADO 80215
(303) 238-0090

0997-IU

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APPENDICES

1.0 EXECUTIVE SUMMARY

Northeast Research Institute (NERI) and the Alabama Department of Environmental Management (ADEM) recently performed PETREX Soil Gas sampling at the Downtown Montgomery Site located in Montgomery, Alabama. Tetrachloroethene (PCE) has been discovered in groundwater on site. The purpose of this phase of the soil gas investigation was to determine the effectiveness of the PETREX technique in detecting the known contaminant.

Tetrachloroethene (PCE) was detected at all locations sampled in this investigation. The highest soil gas response levels for PCE were detected at sample locations 1 and 2, while lower response levels were detected at location 3. The relative soil gas response levels for each of these locations are provided in Table 1, Appendix B.

2.0 INTRODUCTION

Northeast Research Institute *(NERI)* and the *Alabama Department of Environmental* Management (ADEM) recently performed PETREX Soil Gas sampling at the Downtown Montgomery Site located in Montgomery, Alabama. Tetrachloroethene (PCE) has been discovered in groundwater on site. The purpose of this phase of the soil gas investigation was to determine the effectiveness of the PETREX technique in detecting the known contaminant.

3.0 OVERVIEW OF THE PETREX TECHNIQUE

Each PETREX soil gas sampler consists of two or three activated charcoal adsorption elements (collectors) housed in a resealable glass container in an inert atmosphere.

Soil gas sample collection is performed by unsealing the sampler and exposing the collector to the soil gas of the subsurface environment at the base of a shallow borehole. Sample collection proceeds via free vapor diffusion through the opening of the uncapped sampler container. Following a controlled period of time, the sampler is retrieved from the borehole, resealed, and submitted for analysis.

One collector from each soil gas sampler is analyzed by Thermal Desorption/Mass Spectrometry (TD-MS). Selected second collectors may be analyzed by Thermal Desorption-Gas Chromatography/Mass Spectrometry (TD-GC/MS) for compound confirmation. At least ten percent of samplers used in any project are three collector samplers. The third collector is used for setting instrument sensitivity prior to analysis.

Compounds are identified by comparison to standard reference spectra run on the same instrument. The mass spectral ion count of the appropriate indicator peak(s) for each compound or group of compounds is then plotted as relative response on a map and contoured using a variety of standard geostatistical analyses.

For a more detailed and technical discussion of the method, please refer to Appendix A, PETREX Protocol.

4.0 OBJECTIVES

The purpose of the PETREX Soil Gas Survey was to identify PCE in soil gas.

5.0 SCOPE OF WORK

Three (3) PETREX soil gas samplers were utilized for this pilot soil gas survey. Samplers were placed in the vicinity of groundwater monitoring wells with known concentrations of PCE.

Sampler installation and retrieval was performed by personnel of the ADEM.

6.0 FIELD ACTIVITIES

Sampler installation and retrieval was performed between August 1st and August 12th 1994.

Sampler exposure time was determined based upon the nature of the target compounds and site conditions. The samplers were exposed for twelve days.

7.0 METHOD QA/QC

7.1 Lot Control

Quality assurance/quality control (QA/QC) collectors from each lot manufactured by NERI were analyzed by TD-MS to ensure that they were contaminant free before the lot of collectors used in the field was released from the PETREX laboratory. No compounds were detected above background on the QA/QC collectors.

7.2 Travel Blanks

Two PETREX samplers were provided as travel blanks. These travel blanks remained sealed and traveled with the survey samplers from the laboratory to the field and back to the laboratory to monitor for potential contamination of the survey samplers. The travel blanks were analyzed under the same instrument conditions as the survey collectors.

A more detailed description of the PETREX QA/QC may be found in the PETREX Protocol located in Appendix A.

8.0 RESULTS

Tetrachloroethene (PCE) was detected at all locations sampled in this investigation. The relative soil gas response levels for each of these locations are provided in Table 1, Appendix B.

The response values are reported in ion counts. Ion count values are the unit of measure assigned by the mass spectrometer to the relative intensities associated with each of the reported compounds. These intensity levels or response levels do not represent an actual concentration of the reported compounds; however, they are best utilized as a semiquantitative measurement. A difference in ion count values of an order of magnitude or more is considered significant when interpreting potential source areas and migration/dispersion pathways versus background areas.

Table 2 lists the reported compound and the indicator mass peak which was selected to represent the compound occurrences reported on Table 1.

TABLE 2
REPORTED COMPOUND AND ITS INDICATOR MASS PEAK

Compound	Indicator peak
Tetrachloroethene (PCE)	164

A sample mass spectra of the compounds identified is provided as Figure 1, Appendix C.

9.0 CONCLUSIONS

Tetrachloroethene (PCE) was detected at all locations sampled in this investigation. The highest soil gas response levels for PCE were detected at sample locations 1 and 2, while lower response levels were detected at location 3.

10.0 RECOMMENDATIONS

Based upon the findings of the PETREX soil gas survey, the following recommendations can be made:

1. Perform a full size PETREX soil gas survey throughout the site to locate the potential source area, preferential migration pathways and the areal extent of PCE migration.

11.0 LIMITATIONS

This report represents NERI's professional interpretation and judgment based on technical information gathered during investigative activities. Professional judgments expressed herein are restricted to facts available within the established limits of the scope of work, budget, and schedule. NERI assumes no responsibility for the existence or disclosure of conditions which did not come to its knowledge, or conditions not generally recognized as environmentally unacceptable, at the time this report was prepared.

It is NERI's specific intent that all observations and conclusions presented will be used as a guide and not necessarily a firm course of action unless explicitly stated as such. No warranties are expressed or implied and the information included in this report is not to be construed as legal advice.

APPENDIX A
PETREX Protocol

REVISED SEPTEMBER 1993

PETREX ENVIRONMENTAL SOIL GAS PROTOCOL

INTRODUCTION

The PETREX Technique provides a means by which trace quantities of gases from subsurface derived organic contaminants can be detected and collected at the earth's surface. The Technique is integrative, thereby eliminating the short-term variations associated with other gas/vapor detection methods. The PETREX Technique directly collects and records a broad range of organic compounds emanating from subsurface sources.

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Adsorption collector wires (after construction) are cleaned by heating to 358° C in a high vacuum system. Wires are packed under an inert atmosphere in glass culture tubes. One collector out of every batch of thirty is checked for cleanliness by mass spectrometry. Another collector from the batch is checked for adsorptive capability. Based on the results, the batch of collectors is approved for release into the field.

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The PETREX soil gas sampling technique is adaptable to various surface conditions commonly encountered within survey areas. These surfaces typically include concrete, asphalt, grass, and gravel. Two installation methods are routinely utilized to adapt to these surface conditions.

The first method utilizes a coring shovel for sampler installations in grass or otherwise loosely consolidated soil conditions. The shovel cores a 14 inch deep by 2 inch diameter hole in the surface soils.

PETREX soil gas samplers are placed (open end down) at the bottom of each core hole. The samplers are then backfilled with an aluminum foil plug and the original excavated soil. To complete installation, sample locations are marked with ribbon flagging and a numbered pin flag, as well as entered into a field notebook and plotted on a field map.

The second method of sampler installation utilizes an electric rotary hammer, equipped with an 18 inch by 1.5 inch diameter drill bit, for sampler installations under concrete, asphalt, or otherwise consolidated conditions. A hole is drilled through the surface to the dimensions of the drill bit equipped to the rotary hammer.

PETREX soil gas samplers are placed at the bottom of each drilled hole. For retrieval purposes, a cleaned galvanized steel wire is attached to each sampler. Aluminum foil is used to plug each hole to approximately two inches below grade. Then each hole is capped to grade with hydraulic cement. The hydraulic cement serves as protection from the external surface environment.

To complete sampler installation, sampler locations are marked with paint (where applicable), entered into a field notebook, and plotted on a field map.

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PETREX soil gas samplers are retrieved following a time period that has allowed for the soil gas emanating from the subsurface environment of a survey area to equilibrate with the installed PETREX samplers. This time integration period is determined for each PETREX soil gas survey based on time calibration data or site conditions.

Retrieval operations are dependent on surface conditions and routinely consist of the following two methods.

The first method applies to grass covered or loosely consolidated soil conditions. A trowel is utilized to expose the backfilled samplers; then with a pair of tongs, the samplers are brought to the surface. At the surface, the samplers are sealed, cleaned, and labeled. Following retrieval, all debris are gathered and the core hole is backfilled with original material.

The second method applies to concrete, asphalt, or other consolidated surface conditions. A hammer and chisel is utilized to remove the hydraulic cement plug and expose the sampler. By means of the pre-attached retrieval wire, the sampler is brought to the surface. At the surface, the retrieval wire is removed and the sampler is sealed, cleaned, and labeled. Following retrieval, each drill hole is backfilled and patched with cement or asphalt.

TIME CALIBRATION SAMPLERS

Time calibration samplers are included in PETREX soil gas surveys, as appropriate. These samplers are included as a means of monitoring the loading rates of volatile and semivolatile organic compounds (VOCs and SVOCs) emanating from the soil gas at a survey area onto the PETREX collectors.

During PETREX sampler installation, two sets of three to five time calibration samplers are also installed at survey sample locations that best represent the range of soil gas response for the survey area. These representative locations are determined based on previous soils and/or groundwater studies and other site specific conditions such as gradient and potential source areas.

The first set of time calibration samplers are generally retrieved within a week or less following the initial installation and the second set one week later. Often, permanent on-site personnel are instructed to perform time calibration sampler retrieval.

Lengths of exposure periods of the survey samplers for each survey are determined based on the results of each respective set of time calibration samplers. Time calibration samplers are usually analyzed within 24 hours upon receipt at the laboratory. At the first indication of significant relative ion count intensities and significant total ion count values, the decision is made to retrieve the entire complement of survey samplers.

If there are no significant relative ion count intensities detected from the second set of time calibration samplers, then the survey samplers are allowed to equilibrate in the field for a maximum time period of up to 30 days. The average environmental PETREX soil gas survey requires a collector integration period of one day to two weeks.

METHOD QA/QC

Within every survey sampler, the two or three collector wires should have adsorbed identical compounds. Like compounds on separate collectors relate an acceptable quality assurance (QA) during the survey's analysis. The first wire is analyzed by Thermal Desorption/Mass Spectrometry (TD/MS). The data from the first wire is reported on the relative response maps. The second wire is retained for analysis by Thermal Desorption-Gas Chromatography/Mass Spectrometry (TD-GC/MS), if warranted by the initial TD/MS analysis of the second wire.

Approximately ten percent of the total PETREX survey samplers contain three collector wires. The third collector wire, a QC collector wire, is used by the operator to test the mass spectrometer's operating conditions prior to survey analysis. Some of these quality control (QC) collectors are also used to check the mass spectrometer sensitivity during survey analysis. In addition, the QC collector may be used to compare the reproducibility of the detected VOCs.

TRAVEL BLANKS

Two PETREX samplers, each containing a single collector wire, are included with each PETREX soil gas survey as travel blanks. These blanks are analyzed with the survey samplers to indicate whether there may have been contamination introduced to the survey samplers during installation or shipment. If compounds other than normal atmospherics (e.g., CO_2, H_20, N_2, and Ar) are detected on the blanks, these results are taken into consideration in the data presentation. This process, an *initial step to data interpretation*, involves the correction of ion count values of the detected blank contaminants from the entire survey's data set. The resulting ion count values are provided on the relative response maps.

MASS SPECTROMETER TUNING

An Extranuclear Quadrupole C-50 Mass Spectrometer or similar instrument, equipped with a Curie-point pyrolysis/thermal desorption inlet, is used for collector analysis. Mass assignment and resolution are manually adjusted using a Perfluorotributylamine (PFTBA) standard or a built-in tuning program, depending on the instrument. A linear correction, based on the known spectrum of PFTBA, is calculated. This correction is applied to a second PFTBA spectrum. If correct mass (M/Z) values are obtained, the operator proceeds to the next tuning step. If not, Step 1 is repeated until correct masses are obtained.

Peak intensity ratios are set from the major peaks in the PFTBA spectrum using the following values:

Mass (M/Z)		Spectrum Intensities
69	=	100%
131	=	48% ± 5%
219	=	50% ± 5%

During tuning, the ion signal for mass (M/Z) 69 of PFTBA is measured at a preset sample pressure and detector voltage and compared to previous values at the same setting.

Electron energy is set to 70 electron volts. All other operating parameters, such as scans, scan range, and mass offset, are established in the computer program. These values may only be changed by the laboratory manager.

Tuning is performed at the beginning of a run so that an individual survey is analyzed at the same set of instrument conditions. The samplers are analyzed in random order.

LABORATORY ANALYSIS

Periodic machine background and blank PETREX collector analyses are performed to assure that there is no carry-over between successive collectors. If there are peaks present which are not related to atmospheric gases, the supervisor is notified and the mass spectrometer is shut down and cleaned as necessary.

A written sample number record is kept during the analysis to prevent accidental cross numbering. The mass spectrometer control program contains appropriate "flag statements" that prompt the operator with a warning if an input sample number has already been analyzed. The operator then checks the current number, along with the disk storage location of the previously entered number to identify the true numbering situation.

COMPOUND IDENTIFICATION

Compound identification is based on molecular weight, compound fragmentation, and isotope distribution, as applicable. Each VOC exhibits a unique mass spectral signature. NERI maintains a large library of spectra of individual compounds, accessible by computer. In addition, the company maintains a large library of mass spectra of commonly used chemical mixtures; e.g., gasolines, diesels, industrial oils and solvents, coatings, plastics, etc. These spectra are used to assist in both compound and mixture identifications.

The ion count response of an indicator peak(s), representative of the compound and away from interference by other compounds, is extracted for data presentation and mapping.

INTERPRETATION OF SOIL GAS DATA

Soil gas data (including PETREX) reflect volatile and semivolatile organics collected at a point in the near surface. The sources of these volatile organics may be in the stratigraphic column and/or in groundwater below the collection point. Thus, the organics can be derived from surface spills, deposition, or migration into the deeper vadose zone, and groundwater. The soil gas survey reveals the areal extent of contamination and is the optimum guide in identifying areas in order to develop a vertical profile, including the drilling of soil borings and monitoring wells.

Soil gas data are always semi-quantitative in that multiple sources in soil and/or groundwater cannot be differentiated. However, the higher ion responses are representative of higher concentrations in the subsurface, given that geologic conditions are relatively consistent.

Due to chemical differences between individual compounds, including their ability to both adsorb and desorb from the charcoal PETREX collector element, it is invalid to compare the ion count of a compound at one sampling location to that of another compound.

Patterns of compound distribution in the soil gas, as detected at the surface, can be strongly influenced by irregularities in the near surface and subsurface environment through which the soil gas diffuses. These irregularities include subsurface man-made structures, such as concrete foundations, drainage systems, and wells, and such naturally occurring structures as fractured and unfractured bedrock, clay, and shale lenses.

Other factors influencing the soil gas signal include ground and surface water, the free carbon content of soils, microbiotic activity in the soil, and natural and synthetic ground cover.

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APPENDIX B
Table 1

TABLE 1
PETREX Relative Soil Gas Response Values
(in ion counts)

ADEM Site - Montgomery, Alabama

Sample	PCE
1	868098
2	2120106
3	33080

PCE- Tetrachloroethene
Indicator Mass Peak - 164

APPENDIX C
Sample Mass Spectra

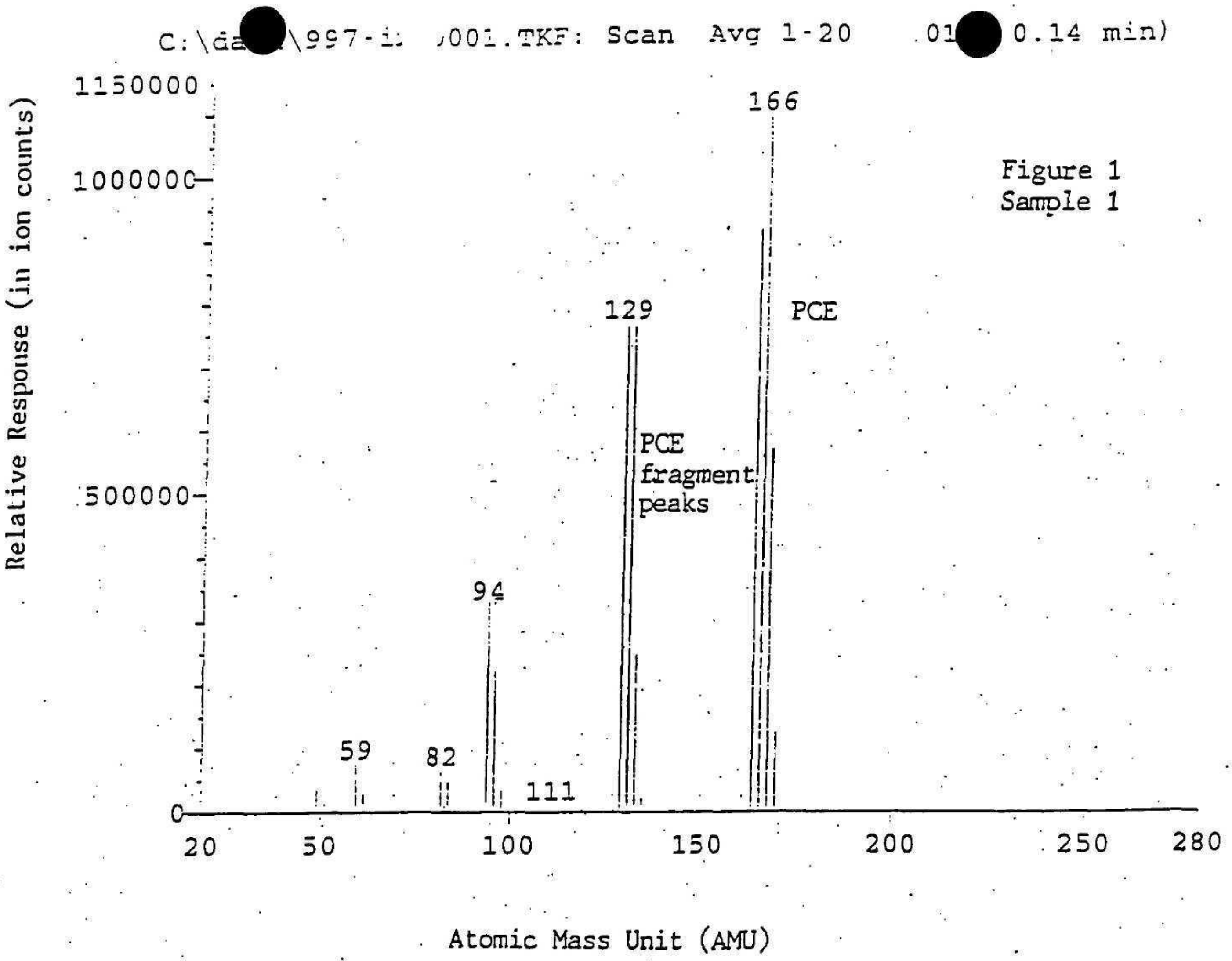

Figure 1
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PETREX Protocol

REVISED SEPTEMBER 1993

PETREX ENVIRONMENTAL SOIL GAS PROTOCOL

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APPENDIX C
Tabular Data

Table 1

Pl REX Relative Soil Gas Response V es

(in ion counts)

ADEM Montgomery, Alabama Site

Sample	PCE	BTEX
1	4,119	32,090
2	ND	173,136
3	1,119	41,762
4	489	15,910
5	7,295	411,622
6	2,349	47,561
7	ND	11,553
8	6,462	7,271
9	ND	12,852
10	ND	71,384
11	ND	13,232
12	12,416	38,616
13	502	3,974
14	52,197	10,685
15	7,642	183,579
16	ND	14,963
17	4,038	8,757
18	ND	26,445
19	4,571	41,652
20	ND	ND
21	1,203	15,528
22	1,192,590	23,292
23	ND	18,315
24	8,812	99,216
25	19,167	500,077
26	1,956	14,641
27	ND	1,395
28	ND	1,766
29	545	7,131
30	1,742	17,339
31	5,579	1,060,887
32	ND	31,372
33	199,503	240,141
34	33,606	164,581
35	208,082	400,689
36	ND	41,232
37	ND	4,849

Table 1
PETREX Relative Soil Gas Response Values
(in ion counts)
ADEM Montgomery, Alabama Site

Sample	PCE	BTEX
43	19,560	353,922
44	108,770	34,301
45	ND	52,988
46	601	211,303
47	19,441	171,125
48	1,978	2,503,283
49	129,486	161,181
50	ND	430
51	16,385	501
52	18,582	263,433
53	583	42,114
54	9,145	984,201
55	20,658	1,247,738
56	3,601	132,857
57	MISSING	
58	4,754	107,846
59	MISSING	
60	2,772	448,599
* 900	ND	ND
* 901	ND	ND

PCE - Tetrachloroethene
Indicator Mass Peak - 164

BTEX - Benzene, Toluene, Ethylbenzene/xylene(s)
Indicator Mass Peaks - 78, 92, 106

* QA/QC Travel Blank Sample

ND - Not Detected

Missing - Missing Sample

NERI
Northeast Research Institute LLC

Lakewood, Colorado 80
303-238-0090 • 800-845-51
Fax 303-238-25

FACSIMILE COVER SHEET

FEB 1995
ADEM
PECIAL PROJECTS

DATE: 2/1/95

TO: Jeremy Stamps FAX: ____

COMPANY: ADEM

FROM: Julie Collett

TOTAL NUMBER OF PAGES 3 (Including Cover Sheet)

COMMENTS: Jeremy,

Data for samples 38-42 were lost due to the page break, They have been added to the following Table and are included on the maps. Sorry for the oversight.

Julie

If there is a problem with this fax, please call at the phone number listed above.

____ Original to follow by Overnight / 2nd Day Mail
____ Original will *not* follow by Mail
____ Original to follow by Regular Mail

Table 1

PETREX Relative Soil Gas Respon[illegible] Valu[illegible]

(in ion counts)

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Sample	PCE	BTEX
1	4,119	32,090
2	ND	173,136
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33	199,503	240,141
34	33,606	164,581
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36	ND	41,232
37	ND	4,849

Table 1
PETREX Relative Soil Gas Respon[illegible] Val[illegible]
(in ion counts)
ADEM Montgomery, Alabama Site

Sample	PCE	BTEX
38	1,436,060	17,370
39	ND	50,225
40	6,044	75,173
41	8,098	550,749
42	5,436	693,082
43	19,560	353,922
44	108,770	34,301
45	ND	52,988
46	601	211,303
47	19,441	171,125
48	1,978	2,503,283
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51	16,385	501
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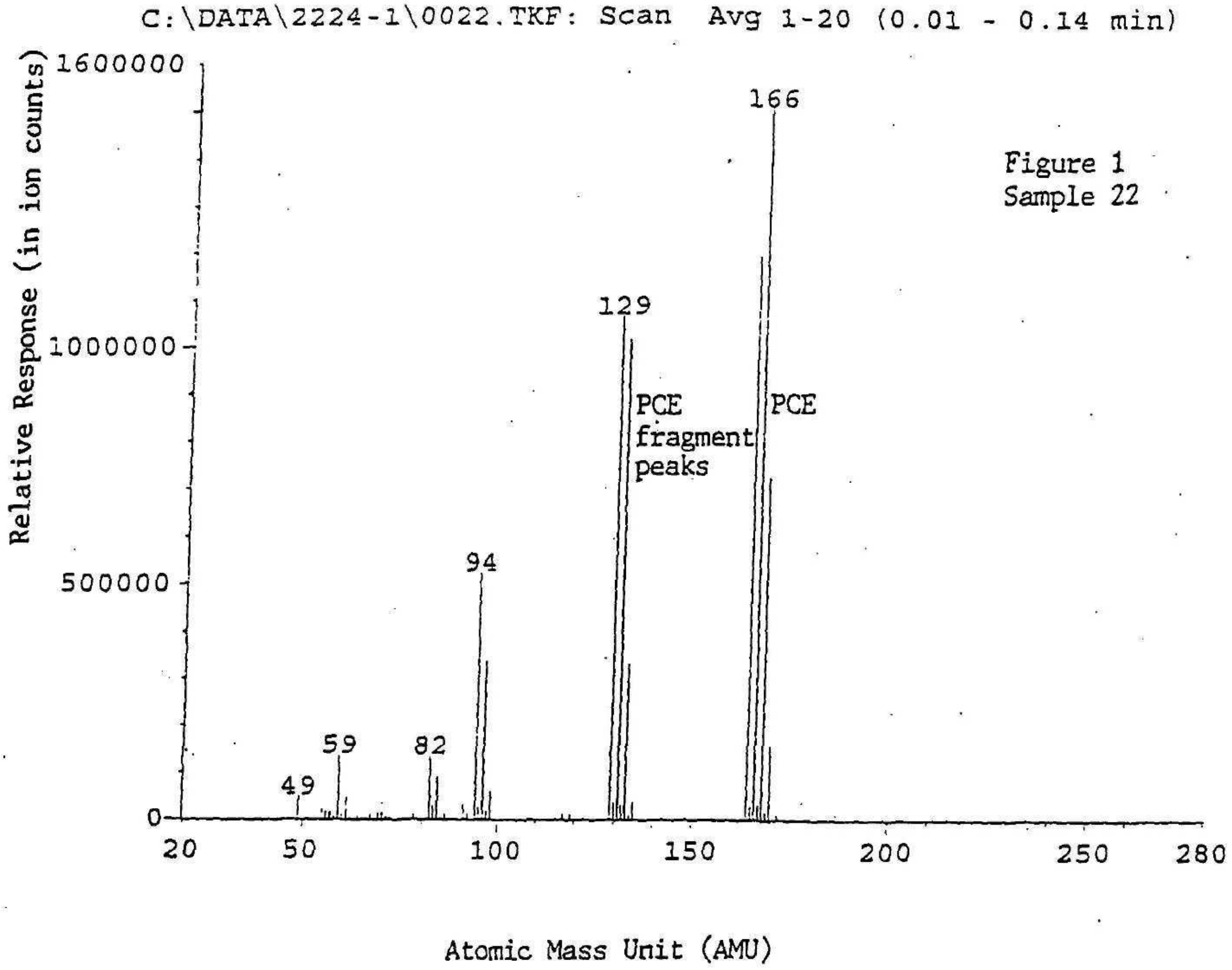
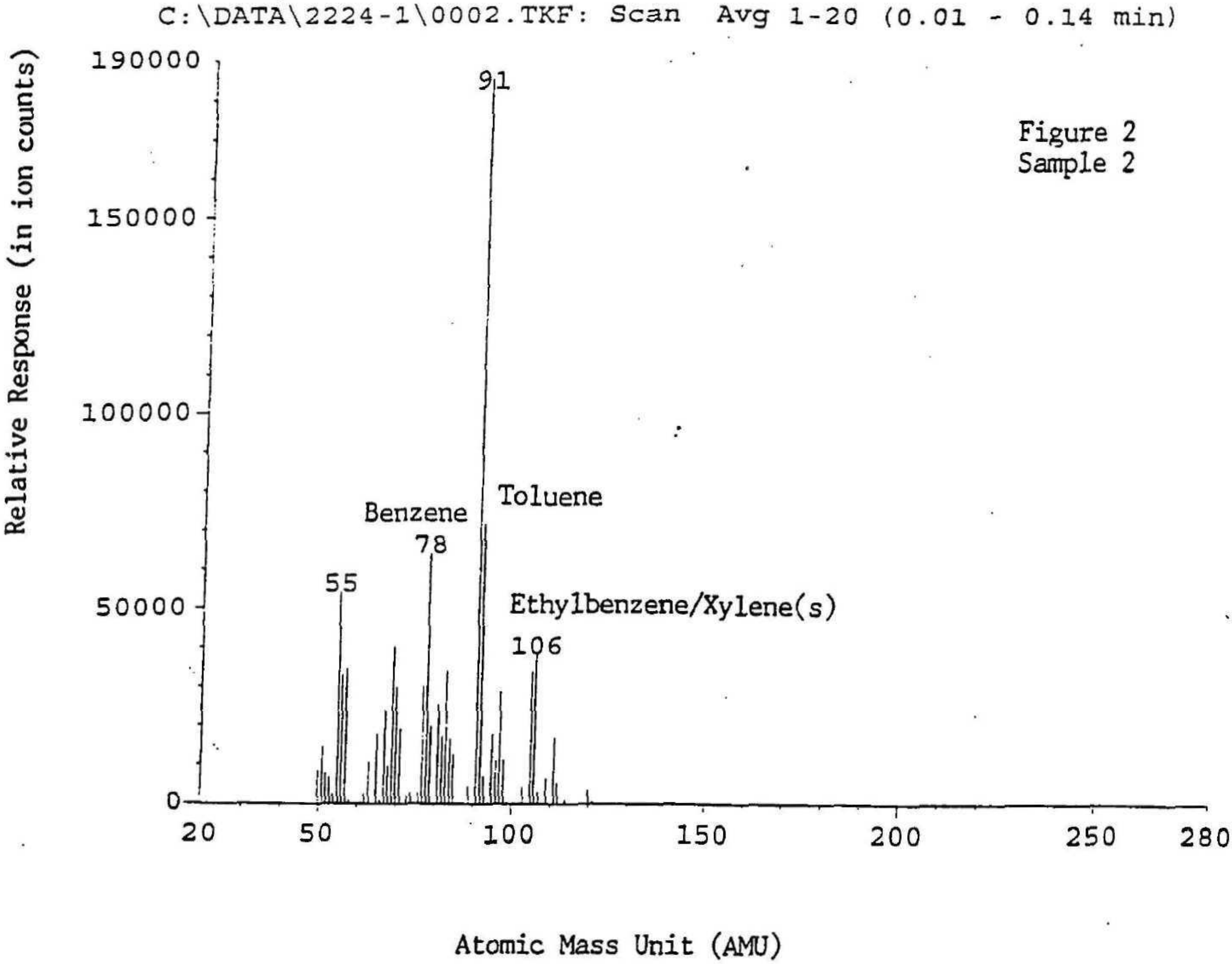


C:\DATA\2224-1\0022.TKF: Scan Avg 1-20 (0.01 - 0.14 min)

Figure 1
Sample 22


C:\DATA\2224-1\0002.TKF: Scan Avg 1-20 (0.01 - 0.14 min)
Figure 2
Sample 2
Relative Response (in ion counts)
190000
150000
100000
50000
0
91
Toluene
Benzene
78
55
Ethylbenzene/Xylene(s)
106
20
50
100
150
200
250
280
Atomic Mass Unit (AMU)

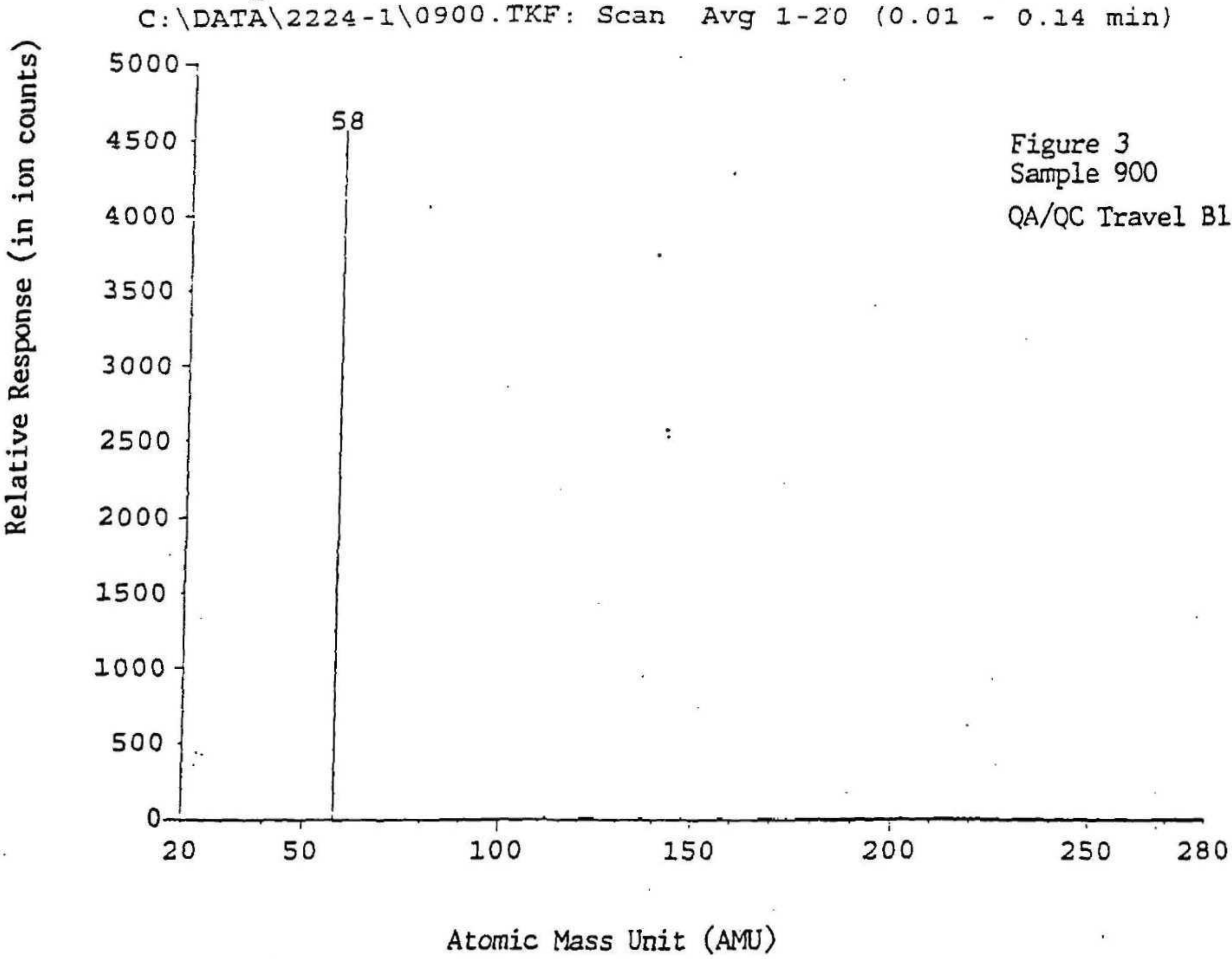
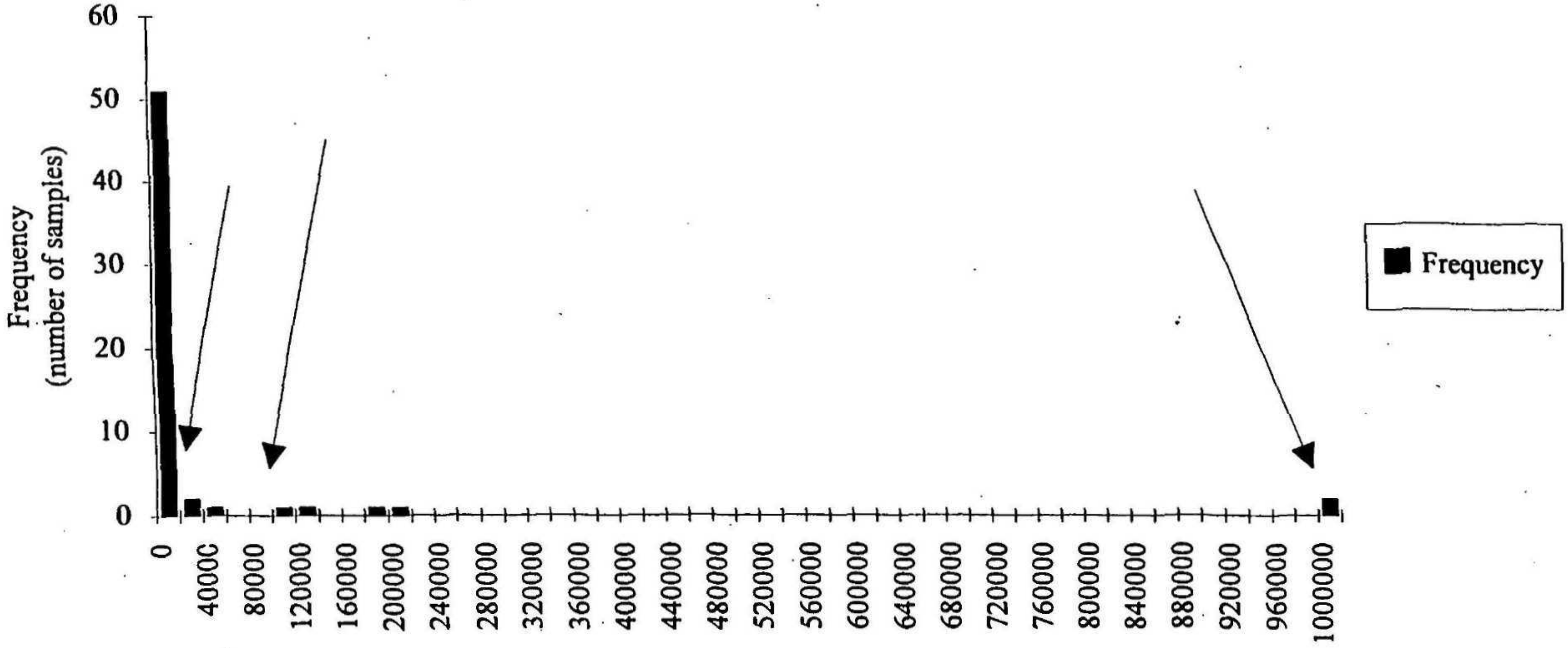


Figure 3
Sample 900
QA/QC Travel Blank Sampl

APPENDIX E
Histograms

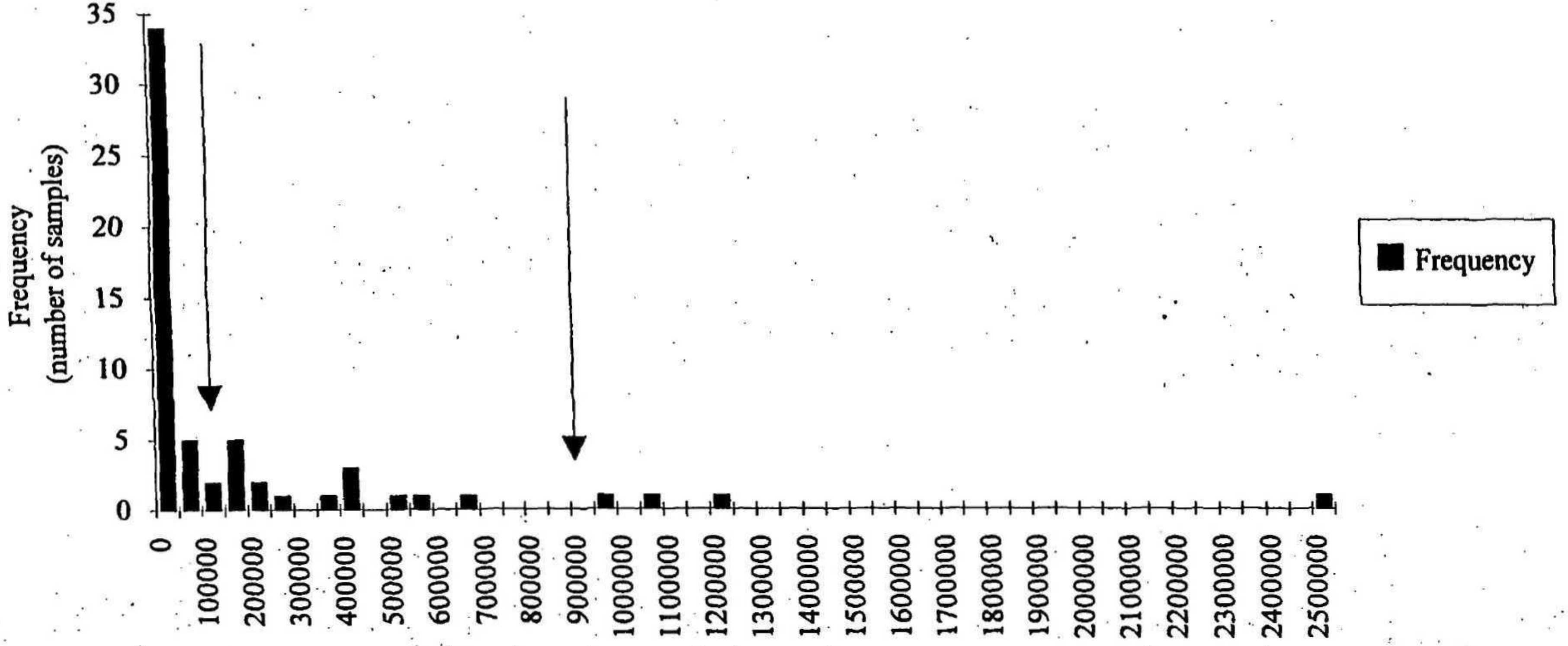
Figure 1
PCE Histogram



Relative Response (in ion counts)
Arrows indicate sample population breaks used to establish contour intervals depicted on Plate 2.

2224pce.his

Figure 2
BTEX Histogram



Relative Response (in ion counts)
Arrows indicate sample population breaks used to establish contour intervals depicted on Plate 3.

U.S. EPA REGION IV

SDMS

Unscannable Material Target Sheet

DocID: 10469683 Site ID: AL0001058056

Site Name: Capital City Plume

Nature of Material:

Map:

Photos:

Blueprints:

Slides:

Computer Disks:

CD-ROM:

Oversized Report:

Log Book:

Other (describe): Sample Locations

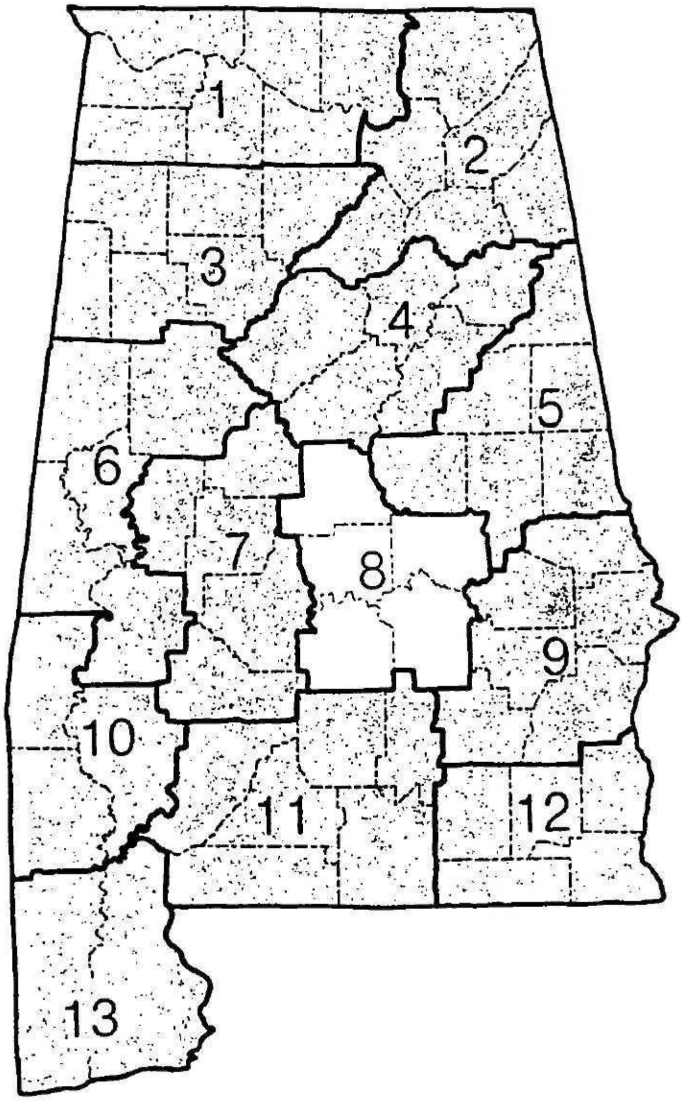
Amount of material:

Please contact the appropriate Records Center to view the material.

GEOLOGY

WATER-RESOURCES INVESTIGATIONS REPORT

GEOHYDROLOGY AND SUSCEPTIBILITY OF MAJOR AQUIFERS TO SURFACE CONTAMINATION IN ALABAMA; AREA 8



Prepared by

U.S. GEOLOGICAL SURVEY

in cooperation with the

ALABAMA DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT

GEOHYDROLOGY OF THE STUDY AREA

Geologic formations that crop out in and underlie the study area range in age from Cambrian to Quaternary (fig. 2). Metamorphic and igneous rocks crop out in eastern Chilton and northern Elmore Counties and underlie all of the study area except the northwestern corner of Chilton County. Sedimentary rocks of Paleozoic age crop out in the northwestern corner of Chilton County. These rocks range in age from Cambrian to Mississippian. Unconsolidated sedimentary deposits of Late Cretaceous age crop out in central and southern Chilton County, western and southern Elmore County, all of Autauga County, and in all but southernmost parts of Lowndes and Montgomery Counties. Sedimentary deposits of Tertiary age crop out in the southernmost part of Lowndes County. Alluvial and terrace deposits overlie older rocks in and adjacent to the flood plains of the Alabama, Coosa, and Tallapoosa Rivers and larger streams in the study area. Generalized subsurface sections of formations that underlie the study area are shown in figures 3 and 4. The approximate locations of these sections are shown in figure 2. A summary of the thickness, lithology, and water-bearing properties of each geologic unit underlying the study area is given in table 1.

Igneous and Metamorphic Rocks

The igneous and metamorphic rocks exposed in the study area range in age from Precambrian to Pennsylvanian (Adams and others, 1926), and consist mainly of schist, gneiss, marble, quartzite, and granite. These rocks crop out in Chilton and Elmore Counties (see fig. 2) and underlie most of the study area. The rocks generally trend northeastward except in northeastern Chilton County where thrust faults and intrusive igneous rocks have resulted in an east-southeastward trend. Foliation planes in the metamorphic rocks generally dip southeastward, but dip northward and northwestward in some places.

The metamorphic rocks, except for marble and metamorphosed dolomite, are relatively impermeable, and do not comprise a major aquifer in the study area. Wells developed in schist or gneiss generally produce less than 20 gal/min (gallons per minute); however, wells developed in marble or dolomite may produce 100 gal/min or more at some places.

Paleozoic Rocks

Sedimentary rocks ranging in age from Cambrian to Mississippian crop out in the northwestern corner of Chilton County (fig. 2). Geologic units, from oldest to youngest, include the Brierfield, Ketona, and Bibb Dolomites of Cambrian age; part of the Knox Dolomite of Cambrian and Ordovician age; the Longview, Newala, and Little Oak Limestones of Ordovician age; and the Fort Payne Chert and Floyd Shale of Mississippian age (Adams and others, 1926). These rocks, which crop out in an area of about 50 square miles in northwestern Chilton County, are complexly folded and faulted and, except for the Floyd Shale, are deeply weathered. The rocks strike northeastward and generally dip southeastward. No large-capacity wells have been drilled in this part of Chilton County, but the limestones and dolomites are potential sources of large water supplies. For example, a municipal spring discharging from the Brierfield Dolomite at the city of Montevallo in adjacent Shelby County flowed at a rate of more than 1,000 gal/min in 1968; and a well developed in the Brierfield Dolomite at the University of Montevallo had a drawdown in water level of only 32 feet when pumped at 340 gal/min in 1962.

Cretaceous Formations

Sedimentary deposits of Late Cretaceous age overlie the metamorphic and igneous rocks or Paleozoic rocks throughout most of the study area (fig. 2). These deposits include, from oldest to youngest, the Coker and Gordo Formations of the Tuscaloosa Group (Drennen, 1953); the Eutaw Formation; and the Mooreville and Demopolis Chalks, the Ripley Formation, the Prairie Bluff Chalk, and the Providence Sand of the Selma Group (Drennen, 1953; Eargle, 1950). These formations strike generally eastward and dip southward 30 to 40 feet per mile (figs. 3 and 4).

Coker Formation

The Coker Formation crops out in western and southern parts of Chilton County and the central part of Elmore County (fig. 2). The Coker underlies all of the study area south of its area of outcrop, and is one of the major aquifers in the study area.

The Coker Formation consists of a basal zone of nonmarine gravel, sand, and clay and an upper zone of marine sand and clay beds. In most parts of the study area the basal zone is separated from the marine sand beds by 50 feet or more of clay. A clay zone is usually present at the top of the Coker. This clay is a confining layer between the Coker aquifer and the overlying Gordo aquifer (figs. 3 and 4). The Coker Formation ranges in thickness from less than 100 feet where only the basal beds remain to more than 1,000 feet in southernmost parts of the study area.

The basal gravelly zone in the Coker is developed for public water supplies for the towns of Jemison, Maplesville, and Thorsby, and the Chilton County Water Authority in Chilton County, and for the town of Billingsley in Autauga County. This zone is also tapped by municipal wells as far downdip as the city of Montgomery.

The marine sand beds in the Coker are tapped by numerous wells in the study area. Wells that supply the towns of Elmore, Holtville, Marbury, and Deatsville are developed in this zone. The Coker is tapped in conjunction with the Eutaw and Gordo aquifers at the cities of Montgomery, Prattville, and Millbrook. For this report, the upper and lower permeable zones in the Coker Formation comprise the Coker aquifer.

The Coker aquifer has not been developed as a source of water supply south of the Montgomery West Well Field. Available data indicate that the Coker is a source of potable water in central and southeastern parts of Montgomery County, but the water in southwestern Montgomery County and southern Lowndes County may contain more than 1,000 mg/L (milligrams per

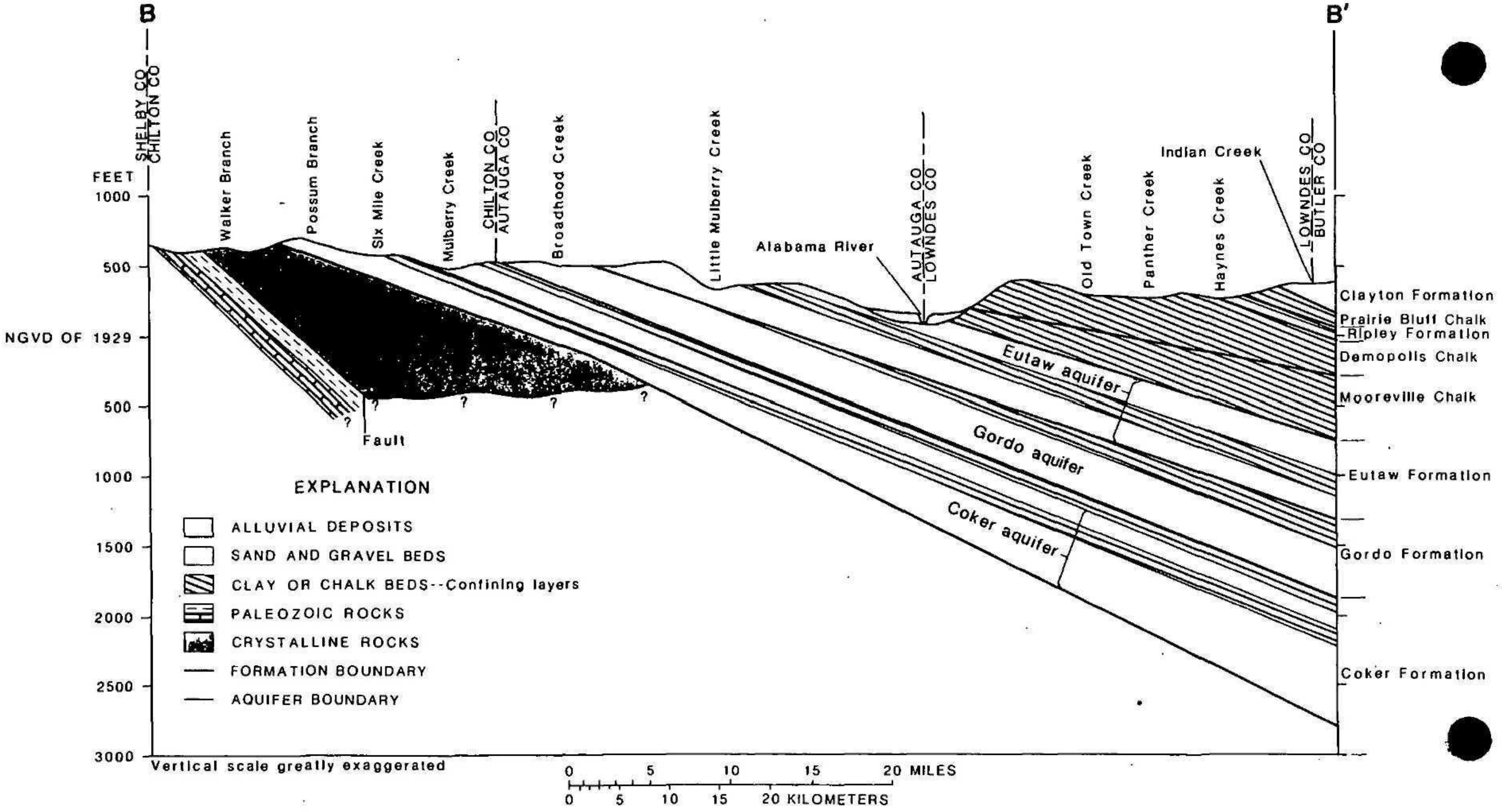


Figure 4.--Generalized subsurface section of the major aquifers in the western part of the study area. (trace of section shown on figure 2.)

liter) chloride. Wells developed solely in the Coker produce 500 gal/min or more at some places. Wells developed in the Coker in conjunction with the Gordo and Eutaw aquifers produce as much as 1,000 gal/min in the Montgomery West Well Field.

Gordo Formation

The Gordo Formation overlies the Coker Formation and crops out in the southern part of Chilton County, the western and southern parts of Elmore County, and the northern part of Autauga County (fig. 2). The Gordo consists of a basal zone of gravelly sand overlain by alternating lenticular beds of sand and varicolored mottled clay. The Gordo ranges in thickness from about 100 feet at outcrops to more than 300 feet in the subsurface in the southern part of the study area.

The Gordo Formation is one of the major aquifers in the study area. It is the principal source of water for the city of Prattville, a major source for the city of Montgomery, and is the sole source for the town of Autaugaville, Autauga Hills, and the Autauga County Water System. The Gordo is the source of all public water supplies in Lowndes County except the town of Fort Deposit. The Gordo is not a major aquifer in Chilton and Elmore Counties because of its proximity to the land surface.

Wells developed solely in the Gordo aquifer produce from 200 to 500 gal/min. Wells developed in the Gordo in conjunction with the Eutaw and Coker produce as much as 1,000 gal/min. Water in the Gordo aquifer in southern Lowndes County contains more than 1,000 mg/L chloride. Limited water-quality data for the Gordo aquifer in southern Montgomery County indicate that the water is potable in the vicinity of the town of Ramer. The water is probably potable in the southeastern part of the county.

Eutaw Formation

The Eutaw Formation overlies the Gordo Formation, and crops out over a large part of Autauga County, western and southern parts of Elmore County, and in the northern part of Montgomery County (fig. 2). The Eutaw consists of upper and lower zones of marine sand separated by a zone of clay. The Eutaw Formation ranges in thickness from about 200 to 400 feet where the entire formation is present. The lower part of the formation consists of 30 to 50 feet of glauconitic sand interbedded with sandy clay. The middle part consists of 50 to 150 feet of calcareous clay and sandy clay. The upper part consists of as much as 150 feet of massive glauconitic sand interbedded with calcareous sandstone and sandy limestone. The formation thins from 400 feet in the vicinity of Montgomery to about 250 feet in eastern Montgomery County, and the upper zone of sand is generally absent in this area.

The Eutaw Formation is a major aquifer in the vicinity of Montgomery, and is a potential aquifer throughout Montgomery County. For this report, the upper and lower permeable zones in the Eutaw Formation comprise the Eutaw aquifer. The upper sand zone in the Eutaw is a major aquifer for most public water systems in the county except the city of Montgomery.

The Eutaw Formation is not a major aquifer in Chilton and Elmore Counties because of its limited areal extent and thinness; is not in Autauga County because in most of this area water in the formation contains excessive concentrations of iron; and is not in Lowndes County because chloride concentrations in the water are more than 1,000 mg/L in most parts of the county.

Wells developed in the lower part of the Eutaw in the Montgomery area produce as much as 450 gal/min; wells developed in the upper part of the Eutaw reportedly produce as much as 500 gal/min. Wells developed in both the upper and lower parts of the Eutaw in central and southern parts of the county may have the capacity to produce 700 gal/min or more.

Mooreville Chalk

The Mooreville Chalk overlies the Eutaw Formation, and crops out in southern Autauga County, northern Lowndes County, and central Montgomery County (fig. 2). The Mooreville consists of about 400 to 500 feet of chalk, calcareous clay, sandy clay and limestone. The Arcola Limestone Member of the Mooreville, at the top of the unit (not shown in fig. 2), consists of two to four thin beds of limestone separated by clay and sandy clay. The Mooreville Chalk is relatively impermeable and is not a source of water in the study area. The chalk is an upper confining layer for the upper Eutaw aquifer.

Demopolis Chalk

The Demopolis Chalk overlies the Mooreville Chalk, and crops out in central Lowndes County and southern Montgomery County (fig. 2). The Demopolis consists of about 400 to 450 feet of chalk, calcareous clay, and sandy clay. The Demopolis merges laterally with the Cusseta Sand Member of the Ripley Formation in southeastern Montgomery County.

In a small area between the towns of Pine Level and Ramer the Demopolis underlies and overlies an eastward-trending tongue of the Cusseta Sand Member. Eastward from Pine Level the Demopolis thins and grades from chalk to calcareous sandy clay as the Cusseta thickens. The Demopolis is relatively impermeable and is not an aquifer in the study area.

Ripley Formation

The Ripley Formation overlies the Demopolis Chalk and crops out in southern Lowndes and Montgomery Counties (fig. 2). In Montgomery County the Ripley is divided into a lower Cusseta Sand Member and an upper unnamed member. The Cusseta Sand Member merges into the upper part of the Demopolis Chalk in southeastern Montgomery County, and is not present from U.S. Highway 331 westward. The Cusseta Sand Member consists of 100 to 120 feet of fossiliferous sand, calcareous sandstone and sandy chalk. The upper unnamed member of the Ripley overlies the Cusseta Sand Member in southeastern Montgomery County, and overlies the Demopolis Chalk in southwestern Montgomery County and southern Lowndes County. The upper member consists of sand, sandy clay, silty fossiliferous clay, and calcareous sandstone beds. The Ripley ranges in thickness from about 200 feet in southwestern Lowndes County to 300 feet in southeastern Montgomery County.

The Ripley Formation is not a major aquifer in the study area, but is a major aquifer south of the study area. The town of Fort Deposit in the southern part of Lowndes County uses the Ripley aquifer, but the town's wells are located downdip in Butler County. Fort Deposit formerly pumped water from the Ripley using wells located in the town, but relocated their wells in Butler County to take advantage of the higher well production and less-mineralized water.

Prairie Bluff Chalk

The Prairie Bluff Chalk overlies the Ripley Formation and crops out in southern Lowndes and Montgomery Counties (fig. 2). The Prairie Bluff consists of fossiliferous sandy chalk and calcareous sandy clay. The Prairie Bluff is about 100 feet thick in south central Montgomery County, but thins eastward to about 40 feet in southeastern Montgomery County where it merges with the Perote Member of the Providence Sand. The Prairie Bluff also thins westward from south central Montgomery County, and is only about 60 feet thick in southwestern Lowndes County. The Prairie Bluff is relatively impermeable, and is not an aquifer in the study area.

Providence Sand

The Providence Sand overlies the Prairie Bluff Chalk, and crops out in southern Montgomery and southeastern Lowndes Counties (fig. 2). The Providence is divided into a lower Perote Member and an upper unnamed member. The Perote Member consists of laminated carbonaceous fossiliferous silty sand and silty clay. The Perote generally ranges in thickness from 60 to 100 feet in southern Montgomery County. The upper unnamed member consists of about 100 feet of coarse poorly sorted cross-bedded sand interbedded with thick beds of silty clay. Both members thin westward in Montgomery County, and are not present west of the town of Fort Deposit in Lowndes County.

The Providence Sand is not a major aquifer in the study area. The Perote Member is relatively impermeable, and is not considered to be a major aquifer in Alabama. The upper unnamed member is a major aquifer in southeast Alabama, especially in Coffee, Dale, Henry, and Houston Counties.

Tertiary Formations

Tertiary deposits in the study area are limited to the Clayton Formation of Paleocene age. The Clayton Formation overlies the Providence Sand in Montgomery County and the southeastern corner of Lowndes County, and overlies the Prairie Bluff Chalk westward from the town of Fort Deposit in Lowndes County. Only weathered basal beds of the Clayton are present in Montgomery County and are not shown in figure 2. These beds consist of deeply weathered sand and residual sandy clay and chert fragments and boulders. In Lowndes County the Clayton consists of calcareous fossiliferous silty clay, chalk, and sandy limestone and siltstone. The Clayton is as much as 150 feet thick in southwestern Lowndes County (fig. 2).

The Clayton is not a major aquifer in the study area, but is a major aquifer in southeastern Alabama. The Clayton in southwestern Lowndes County is relatively impermeable and is not an aquifer. The unit grades eastward from silt, silty clay, and silty limestone to sand and relatively-pure limestone south and southeast of Montgomery County.

Quaternary Deposits

Quaternary alluvial deposits overlie older formations throughout a large part of the study area (fig. 2). These deposits, which underlie flood plains of present and ancestrial large streams, consist mainly of gravel, sand, silt, and clay. Alluvial deposits along the flood plains of the Alabama, Coosa, and Tallapoosa Rivers are shown on the geologic map (fig. 2). Remnants of older alluvial deposits (usually mapped as high terrace deposits) are not shown on the geologic map, but form relatively flat uplands in several parts of the study area. The alluvial deposits generally range in thickness from 30 to 50 feet, but are as much as 80 feet thick in some places.

The alluvial deposits are a potential source of large water supplies in the flood plains of the Alabama, Coosa, and Tallapoosa Rivers, but generally are not developed for public water supplies. A few municipal wells in Montgomery North Well Field are screened in the alluvium and the underlying basal part of the Eutaw Formation, which is hydraulically connected with the alluvium.

HYDROLOGY OF THE MAJOR AQUIFERS

The major aquifers in the study area are sand and gravel beds in the Eutaw, Gordo, and Coker Formations (figs. 3 and 4). These aquifers crop out in Autauga, Chilton, Elmore, and Montgomery Counties, and underlie most of the study area. Water in these aquifers occurs under artesian conditions in most parts of the study area. Recharge areas for the major aquifers and areas susceptible to surface contamination are shown on plate 1. Also shown on plate 1 are locations of public water-supply wells and areas of major withdrawals as indicated by depressions in the potentiometric surface, as near Montgomery and Prattville. Construction of wells, water levels, and other pertinent well data are given in table 2.

Recharge and Movement of Ground Water

The source of recharge to the major aquifers is rainfall. Average annual rainfall is about 50 inches per year, but a large part runs off during and directly after rainstorms. Most of the remainder is returned to the atmosphere by evaporation and transpiration of trees and other plants; a small part infiltrates to the water table to recharge aquifers. Knowles and others (1963) estimated that, based on the low flow of streams, recharge to the Coker, Gordo, and Eutaw aquifers in the Montgomery area is at least 4 to 5 inches per year. The recharge areas for the Eutaw and Gordo aquifers are in Autauga, Chilton, Elmore, and Montgomery Counties (plate 1). The recharge area for the Coker aquifer is mainly in Chilton and Elmore Counties (plate 1). These recharge areas consist largely of rolling sand hills, part of which are wooded and part cultivated. In Autauga and Elmore Counties remnants of high terrace deposits overlie significant parts of the recharge areas for the aquifers. These terrace remnants form relatively flat, permeable landscapes that enhance infiltration and increase recharge to the aquifers. Alluvial deposits overlie the major aquifers along the flood plains in the Alabama, Coosa, and Tallapoosa Rivers. These permeable deposits provide recharge to the aquifers, especially in areas where the potentiometric surface of the water in the aquifers is lowered by large withdrawals of ground water. Water moves downdip from areas of recharge to areas of natural discharge or areas of ground-water withdrawals, generally perpendicular to the potentiometric contour lines shown on plate 1.

Natural Discharge and Ground-Water Withdrawals

A large part of the recharge discharges through seeps and springs to provide the base (dry weather) flow of streams. This natural discharge is especially notable in Autauga County where southward-flowing streams have cut deeply into the recharge areas of the aquifers. A significant part of the recharge is also discharged to the rivers that are entrenched into the aquifers.

Most of the remainder of the recharge is discharged through wells, mainly at large pumping centers. The largest pumping center in the study area is the city of Montgomery. The combined capacity of Montgomery's North and West Well Fields (see figs. 5 and 6) is more than 30 Mgal/d. The average pumpage from the well fields in 1985 was about 11 Mgal/d; however, the well fields were pumped near capacity on peak-demand days during the year. Pumpage from the well fields will likely increase during the next 5 to 10 years because Montgomery's surface water plant, which has a capacity of about 20 Mgal/d, presently runs at capacity most of the time. The peak demand on the municipal system was about 50 Mgal/d in 1986.

Other large pumping centers and their estimated capacities are Prattville, 4 Mgal/d; Millbrook, 1 Mgal/d; Elmore, 1 Mgal/d; Chilton County Water Authority, 2 Mgal/d; Union Camp Corporation, 4 Mgal/d; General Electric Corporation, 4 Mgal/d; rural water systems in Montgomery County, 4 Mgal/d; public water systems in Lowndes County (exclusive of the town of Fort Deposit), 4 Mgal/d; and rural water systems in Autauga County, 4 Mgal/d. The town of Fort Deposit withdraws water from an aquifer that is outside the study area.

Water is also discharged by wells used for domestic stock, industrial, and irrigation purposes. The amount of water used for these purposes is estimated to be 5 to 10 Mgal/d. A significant amount of water is wasted through flowing wells. For example, about 1 Mgal/d was discharging through flowing wells in Autauga County in 1959 (Scott, 1960). Smaller amounts are discharged through flowing wells in Chilton, Elmore, Lowndes, and Montgomery Counties.

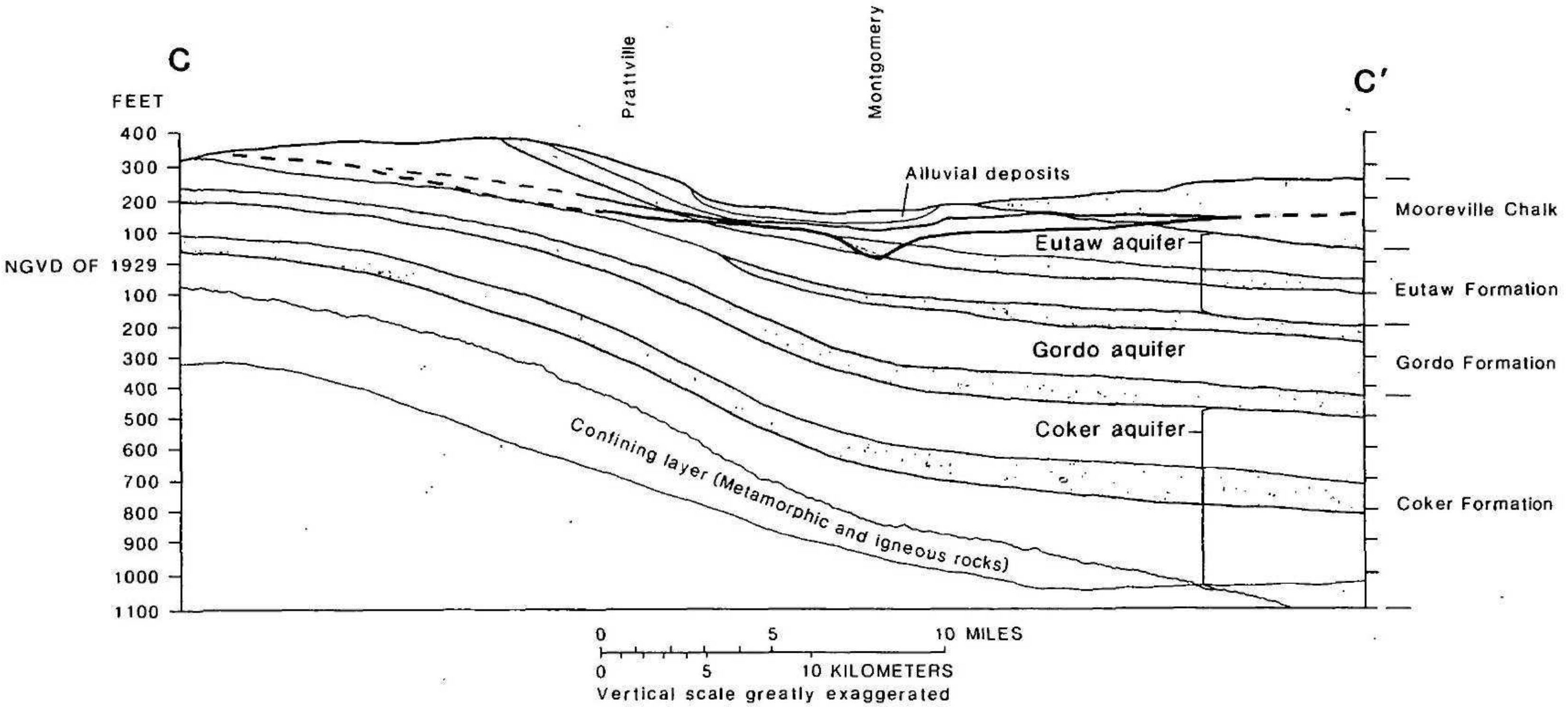
Total maximum withdrawals of ground water for all uses in the study area in 1986 are estimated to be about 65 Mgal/d. Converted to inches per year for the total recharge areas for the three major aquifers (estimated to be about 950,000 acres), these withdrawals are equal to about 0.9 inch of recharge per year.

Effects of Withdrawals from the Aquifers

Large long-term withdrawals of water from the major aquifers have resulted in formation of depressions on the potentiometric surface of the aquifers. Extensive depressions have formed in the Gordo aquifer in the vicinities of Montgomery's West Well Field and Prattville (see fig. 7). Less-extensive depressions have formed in the Eutaw and Coker aquifers in the Montgomery area (figs. 8 and 9) and a depression is forming in the Coker aquifer in the vicinity of the town of Elmore (fig. 9).

The Alabama River and its flood plain appear to be a hydrologic boundary for the Gordo aquifer (fig. 7). The potentiometric map for the Gordo aquifer indicates that either a reduction in natural discharge from the aquifer to the river, vertical leakage from the river and the alluvium to the aquifer, or a combination of the two, is preventing convergence of the cones of depression that have developed in the Montgomery and Prattville areas. If the Gordo aquifer is being recharged from the river and the flood plain, the Eutaw aquifer is also being recharged in the Montgomery area where the potentiometric surface in the Eutaw has been lowered by pumpage (fig. 10). The Coker aquifer also may be affected by recharge entering the aquifer system from the river and the flood plain in the Montgomery area where the potentiometric surface has been lowered by pumpage.

Outside the Montgomery and Prattville areas the potentiometric surfaces of the Gordo and Coker aquifers are similar, and potentiometric contour lines show the combined potentiometric surface of the Gordo and Coker aquifers (see plate 1).



EXPLANATION

☐ CONFINING LAYER--Chalk or clay

– – —— POTENTIOMETRIC SURFACE OF THE EUTAW AQUIFER--Dashed where inferred

POTENTIOMETRIC SURFACE OF THE GORDO AQUIFER--Dashed where inferred

– – —— POTENTIOMETRIC SURFACE OF THE COKER AQUIFER--Dashed where inferred

Figure 10.--Generalized subsurface section through the Montgomery-Prattville area showing configurations of the potentiometric surfaces of the major aquifers (line of section shown on figure 7).

SUSCEPTIBILITY OF THE AQUIFERS TO SURFACE CONTAMINATION

All of the areas of recharge for the major aquifers in the study area are susceptible to surface contamination (plate 1). However, throughout a large part of the study area, the recharge areas are in rural terrains that are used for timberlands, farms, or pastures. These recharge areas are several miles from areas where withdrawals are being made, and consist of sand hills and intermediate streams except where high terrace deposits have resulted in relatively-flat landscapes.

The areas highly susceptible to contamination from the surface are 1) the area from Jemison southeastward to Clanton, and 2) the flood plains of the Alabama, Coosa, and Tallapoosa Rivers (see plate 1). The Jemison-Clanton area is a relatively flat terrain that is underlain by the basal part of the Coker aquifer. Public water-supply wells in Jemison and Thorsby are screened in this aquifer less than 100 feet below land surface (see table 2). Some beds of clay are present between the surface and the top of the aquifer. However, depressions on the water surface in the aquifer caused by pumpage could induce vertical leakage from the surface to the aquifer.

The flood plains of the Alabama, Coosa, and Tallapoosa Rivers are low, flat terrains that are underlain by alluvial gravel, sand, and clay. The Eutaw, Gordo, and Coker aquifers underlie the alluvial deposits in the area between Wetumpka and Montgomery, and along the flood plain of the Tallapoosa River (plate 1). The Eutaw aquifer underlies the alluvial deposits along the flood plain of the Alabama River from Montgomery westward to Benton. The major aquifers are overlain by, and are in hydraulic contact with the highly-permeable alluvial sand and gravel. The alluvial sediments permit water to move downward from the land surface to the aquifers, especially in areas where the potentiometric surfaces in the aquifers have been lowered by pumpage.

Depressions have formed on the potentiometric surfaces of all three major aquifers in the Montgomery area. Several municipal wells less than 100 feet deep and screened in river alluvium and the Eutaw aquifer are pumped in the Montgomery North Well Field, and several wells in the Montgomery West Well Field are screened in the Eutaw aquifer at depths of 150 to 200 feet. Some of the public water-supply wells in the vicinities of Millbrook and Elmore are screened at depths just below 100 feet.

Pumpage along the flood plain of the Alabama River west of Montgomery and along the flood plain of the Tallapoosa River is presently minimal. However, future pumpage in these areas could result in the formation of depressions in the potentiometric surfaces of the major aquifers. Therefore, these areas are assumed to be especially highly susceptible to contamination from the surface.

SUMMARY AND CONCLUSIONS

The major aquifers in Area 8 in south-central Alabama are the Eutaw, Gordo, and Coker aquifers. The recharge areas for these aquifers are in Chilton, Autauga, Elmore, and Montgomery Counties. The aquifers underlie most of the study area. The aquifers consist of sand and gravel beds, and water in the aquifers occurs under artesian conditions in most parts of the area.

The Eutaw aquifer is a major source of public water supplies in Montgomery County. The aquifer is a partial source of water for the city of Montgomery, and the exclusive source of water for rural public water supplies in central and southern parts of the county.

The Gordo aquifer is a major source of public water supplies in Autauga and Montgomery Counties, and is the exclusive source of public water supplies in Lowndes County. The Gordo is pumped extensively at the cities of Montgomery and Prattville, and is the sole source of water for the Autaugaville, Autauga Hills, and Autauga County water systems.

The Coker aquifer is pumped extensively in conjunction with the Eutaw and Gordo aquifers at Montgomery and Prattville. It is used exclusively by the Billingsley, Jemison, Maplesville, and Thorsby water systems, and by the Chilton County water system. The Coker is also the source of water for the towns of Elmore, Holtville, Marbury, and several other water systems in Elmore County.

The largest pumping centers in the study area are Montgomery and Prattville. Maximum ground-water pumpage at Montgomery is more than 30 Mgal/d. Maximum pumpage in the Prattville area is more than 8 Mgal/d. Maximum ground-water withdrawals for all uses in the study area was estimated to be about 65 Mgal/d in 1985.

Extensive depressions have developed in the potentiometric surface of the Gordo aquifer in the vicinities of Montgomery and Prattville. Vertical leakage from the Alabama River and alluvial deposits on the flood plain of the river has apparently prevented convergence of these depressions. Less-extensive depressions have developed in the Eutaw and Coker aquifers in the Montgomery area.

All the recharge areas for the major aquifers are susceptible to surface contamination. Throughout a large part of the study area, however, the recharge areas are in rural terrains that are used for timberlands, farms, and pastures, and are several miles from pumping centers. The areas highly susceptible to contamination are 1) from Jemison to Clanton in Chilton County where the Coker aquifer is generally less than 100 feet below land surface, and 2) the flood plains of the Alabama, Coosa, and Tallapoosa Rivers which are underlain by alluvial sediments that are in hydraulic contact with the major aquifers. Within the highly susceptible areas, the areas that are especially susceptible to contamination are the flood plain of the Alabama River in the Montgomery area and the flood plain of the Tallapoosa River. In this area pumpage from the major aquifers has significantly lowered the potentiometric surface in the aquifers. The lowering of the potentiometric surface in the major aquifers has resulted in vertical leakage from the river and the alluvial deposits to the major aquifers.

REFERENCE 7

MONTGOMERY WATER WORKS WELL DISTRIBUTION AND POPULATION

REFERENCE 7

The Water Works and Sanitary Sewer Board
of the City of Montgomery
P.O. BOX 1631
MONTGOMERY, ALABAMA 36102-1631

THOMAS R. MORGAN
GENERAL MANAGER
JAMES P. HENRY, III
GENERAL MANAGER, OPERATIONS
ROY D. HOLMBERG
ASSISTANT GENERAL MANAGER
PHONE (205) 240-1607
FAX (205) 240-1616

FAX TRANSMISSION

DATE: 8/20/93

TIME: 3:45 pm

SENT TO: Bonnie Temple

COMPANY: ADEM

FAX NUMBER: 260-2795

SENT FROM: Engineering Department

PHONE NUMBER: 240-1626

RETURN FAX NUMBER: 205/261-3448

[illegible]
[illegible]
[illegible]

This is page 1 of 3 pages.

SENT BY: Barry Dees

Tallapoosa River (Surface water) = 66%

WEST WELL FIELD
WELLS CURRENTLY IN OPERATION

Well Number	Plat Sheet	Map Legend Reference	Motor Horsepower	Well Depth (ft)	Year Drilled	Year Reworked	Aquifer	Reported Capacity (gpm) Original	1962	1970	1983	1989
21	24	I-10	40	155	1941	1980	E	467	467	488	393	659
22	25	I-10	40	181	1953	1980	E	350	495	495	517	329
23	22	I-10	40	164	1941		E	349	439	439	465	535
26	33-A	I-9	50	1010	1985		E,G,C	800	—	—	—	556
27	33-B	J-8	50	676	1953	1990	G,C	383	393	448	361	363
28	33-B	J-8	50	620	1984		E,G,C	500	—	—	—	404
29	33-B	J-8	50	755	1953		G,C	541	503	485	560	545
30	28-D	J-8	50	615	1949	1992	G,C	650	566	595	560	373
31	28-D	J-8	60	622	1949	1978	G,C	503	510	503	644	485
32	28-D	J-8	50	635	1949	1992	E,G,C	580	518	584	503	305
33	64	J-7	50	621	1949		E,G,C	524	526	620	572	431
34	64	J-7	50	618	1949		E,G,C	517	495	560	361	305
36	64-A	J-7	50	629	1950		E,G,C	530	578	503	644	431
38	64-C	J-7	75	618	1985		E,G,C	750	—	—	—	687
39	64-B	J-7	75	688	1952		E,G,C	703	703	430	656	590
40	64-B	K-6	60	275	1952		E	457	548	624	596	431
41	90	K-6	50	296	1953	1988	E	460	430	393	247	384
*42	----	K-6	50	462	1953		E,G	372	328	372	*	*
43	91-W	K-5	75	704	1953	1987	E,G,C	572	524	548	448	474
*44	91-D	K-5	50	740	1953		E,G,C	439	402	328	383	**
45	91-D	K-5	50	786	1953	1988	E,G	700	503	465	488	670
46	91-G	K-4	60	700	1955	1993	E,G,C	1,000	595	560	632	570
47	91-T	K-4	75	702	1955	1989	E,G,C	1,000	863	810	777	556
48	91-T	K-4	60	700	1955	1978	E,G,C	1,012	560	305	WEST	384
49	91-S	K-4	60	704	1955		E,G,C	1,000	737	WE	692	543
50	91-S	L-3	75	716	1955		E,G,C	1,000	908	880	974	777
54	31-D	K-8	60	605	1985		G,C	450	—	—	—	440
55	32-H	L-7	75	1015	1985		G,C	700	—	—	—	550
56	67-B	L-7	75	695	1985		E,G,C	700	—	—	—	687
57	91-X	K-5	75	720	1985		E,G,C	700	—	—	—	528
58	91-W	K-5	75	750	1985		E,G,C	700	—	—	—	528
		TOTAL CAPACITY (gpm)						19,100	12,582	11,948	12,160	14,520
		(mgd)						(27.5)	(18.1)	(17.2)	(17.5)	(21.0)

* Removed from service.
** Flow not measurable
— Information not available. Assume capacity is the same as previous test.
T Terrace
E Eutaw
G Gordo
C Coker

29 wells in operation - 21%

NORTH WELL FIELD
WELLS CURRENTLY IN OPERATION

Well Number	Plat Sheet	Map Legend Reference	Motor Horsepower	Well Depth (ft)	Year Drilled	Year Reworked	Aquifer	Reported Capacity (gpm) Original	1962	1969	1976	1983	1989
2	118	G-12	20	70	1957		T	524	503	339	517	457	354
5A	6	H-11	60	699	1957		G,C	596	597	795	654	---	772
7	118	G-12	50	645	1957		G,C	416	416	465	837	530	472
8	102	H-11	50	695	1957		G,C	620	620	743	---	810	777
9E	102	H-11	25	74	1962		T	---	---	---	658	844	816
9W	102	H-11	25	79	1962		T	---	---	---	720	732	731
11	117	H-12	40	270	1959		G	600	600	457	568	820	521
13	117	H-12	60	755	1959		C	600	600	795	915	372	797
14	122	G-13	50	644	1937		G	316	316	480	530	383	357
15	122	G-13	25	73	1957	1986	E	407	405	316	200	820	216
18	118	G-12	20	72	1957	1988	T	407	361	372	430	---	341
19	118	G-12	50	610	1937		C	271	271	280	316	350	221
20	118	G-12	20	74	1957		T	473	473	430	503	---	415
51	6	H-11	50	600	1956		G,C	510	429	548	656	596	521
52	4	G-11	50	600	1958		G,C	657	335	538	620	608	557
53	4	G-11	50	600	1958		G,C	566	437	572	524	180	543
		TOTAL CAPACITY (gpm) (mgd)						8,238 (11.9)	7,738 (11.1)	8,504 (12.2)	9,287 (13.4)	8,289 (11.9)	8,211 (11.8)

---

* Removed from service.

** Flow not measurable

-- Information not available. Assume capacity is the same as previous test.

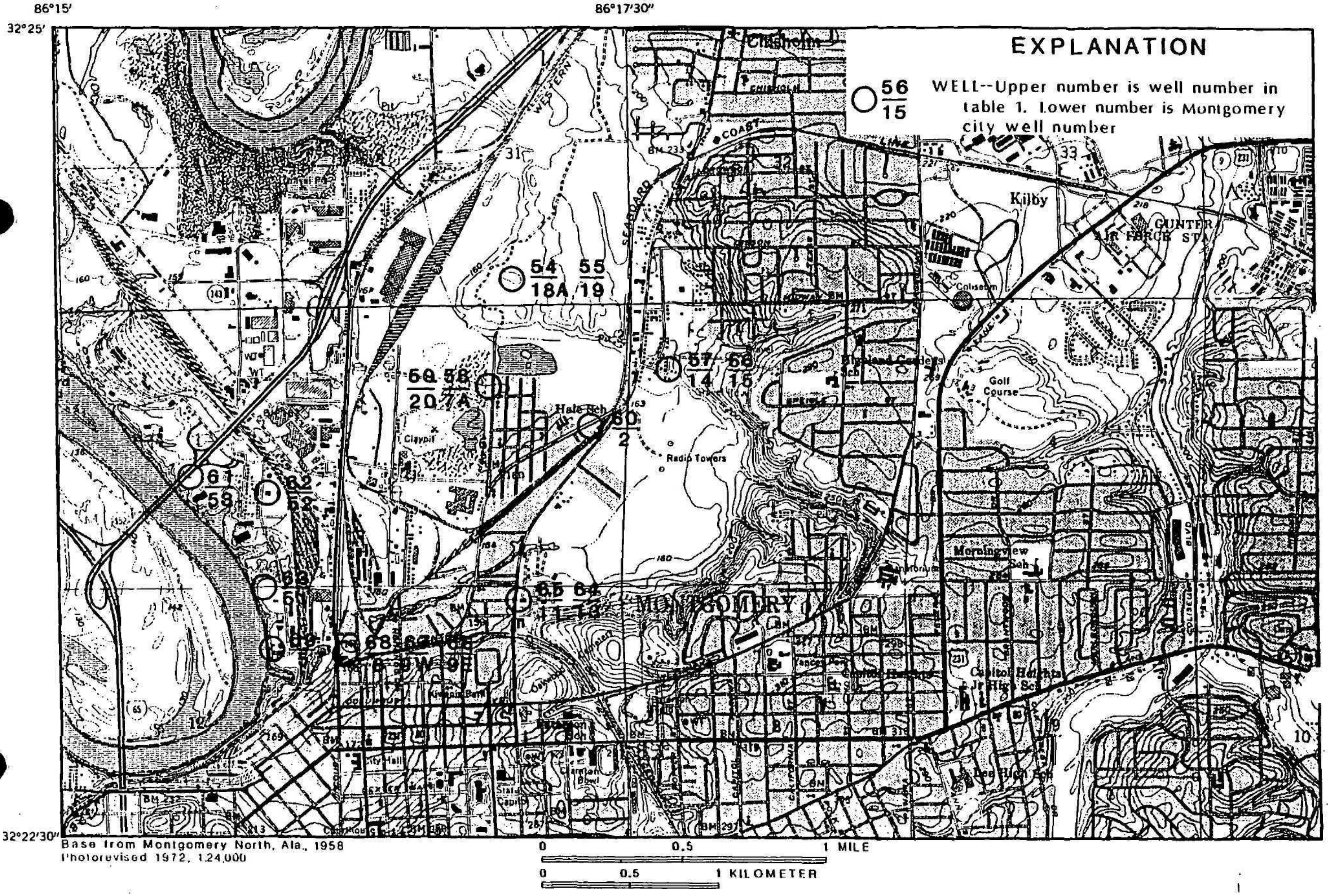
T Terrace

E Eutaw

G Gordo

C Coker

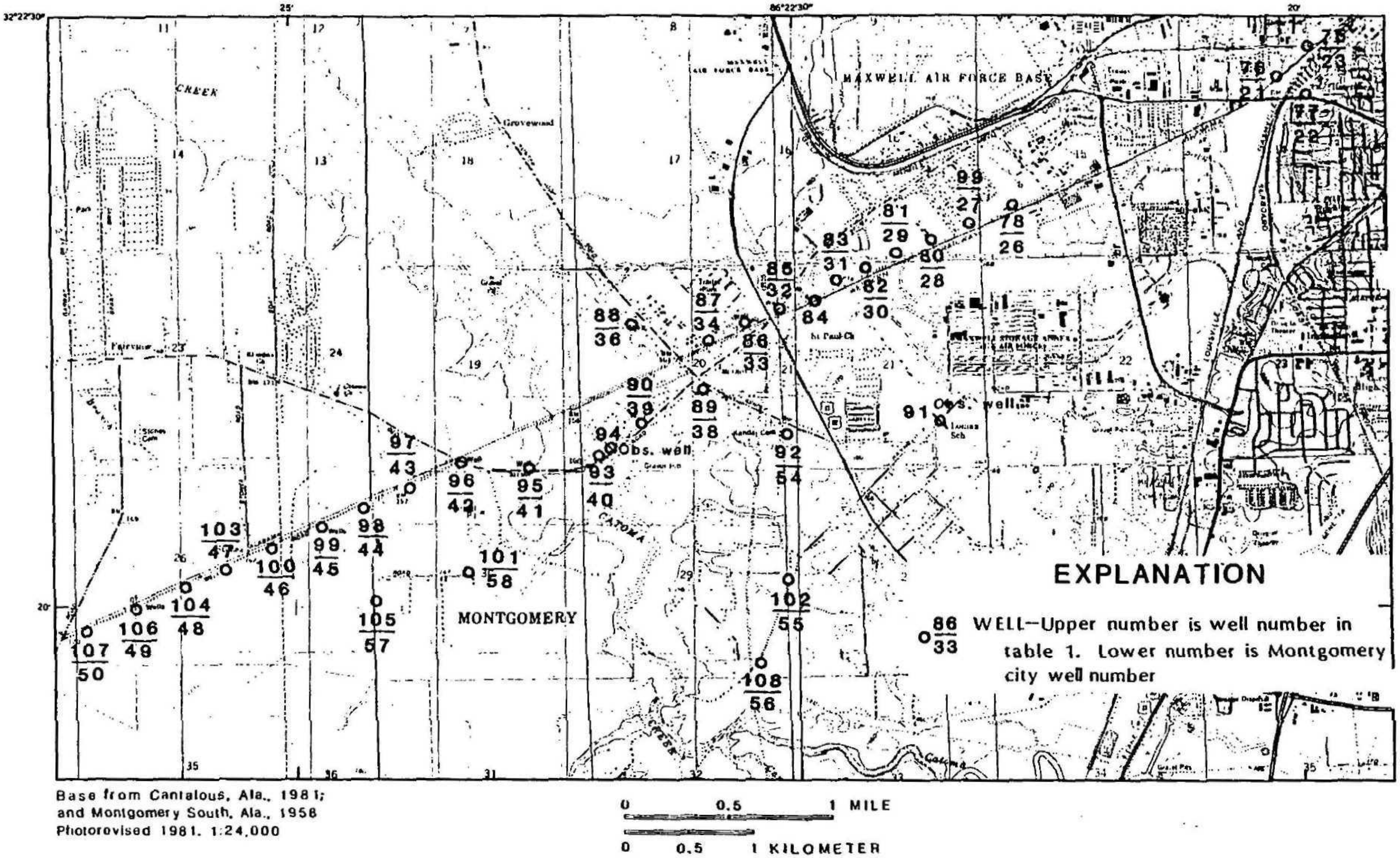
16 wells in operation [illegible]



Base from Montgomery North, Ala., 1958
Photorevised 1972, 1:24,000

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL
DATUM OF 1929

Figure 5.--Locations of wells in the Montgomery north well field.

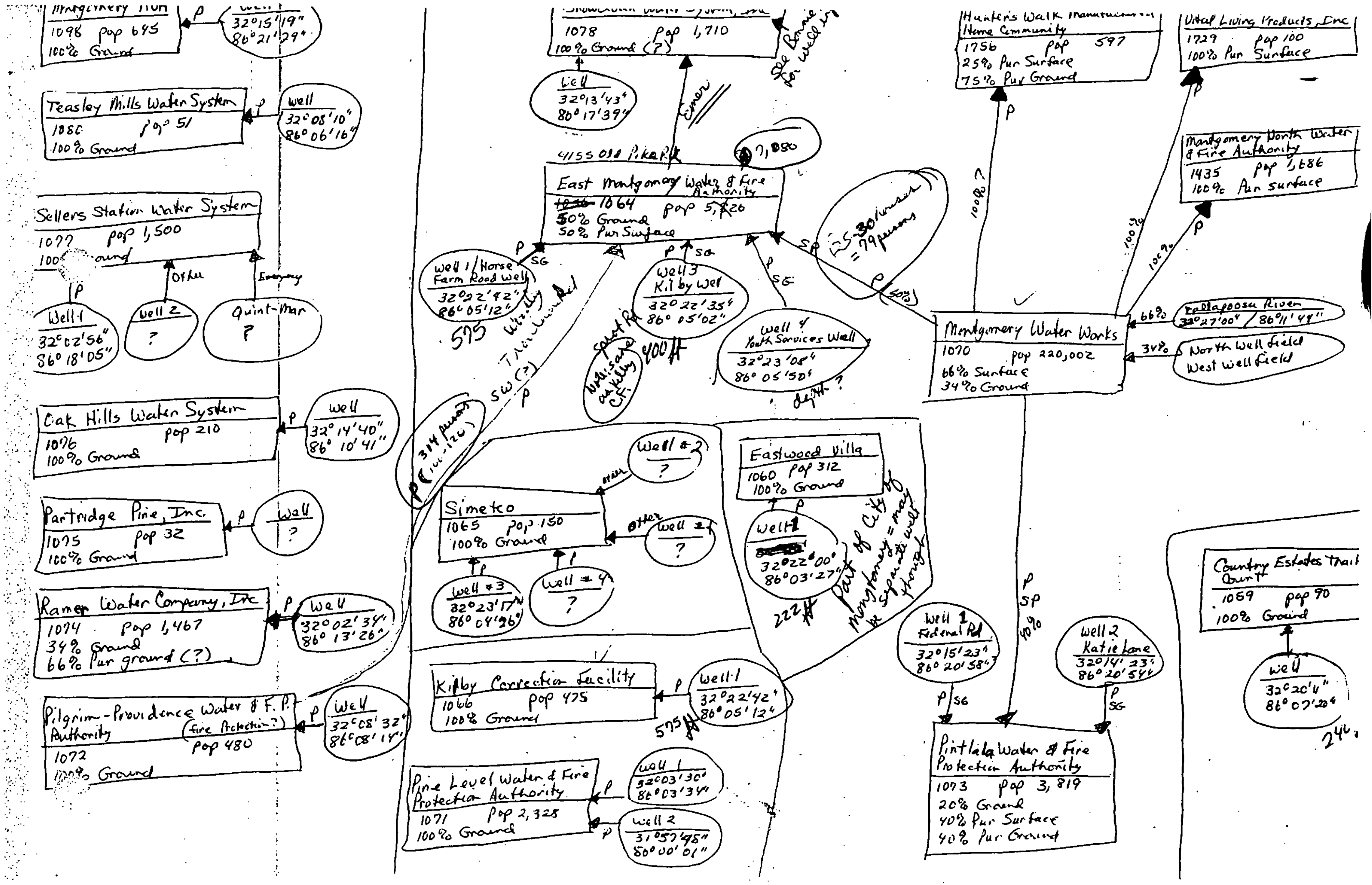


EXPLANATION

86/33 WELL—Upper number is well number in table 1. Lower number is Montgomery city well number

Base from Cantalous, Ala., 1981;
and Montgomery South, Ala., 1958
Photorevised 1981. 1:24,000

Figure 6.--Locations of wells in the Montgomery west well field.


Montgomery Hun
1098 pop 695
100% Ground
P
Well
32°15'19"
86°21'29"
Teasley Mills Water System
1080 pop 51
100% Ground
P
Well
32°08'10"
86°06'16"
Sellers Station Water System
1077 pop 1,500
100% Ground
P
Well 1
32°02'56"
86°18'05"
Other
Well 2
?
Emergency
Quint-Mar
?
Oak Hills Water System
1076 pop 210
100% Ground
P
Well
32°14'40"
86° 10'41"
Partridge Pine, Inc.
1075 pop 32
100% Ground
P
Well
?
Ramer Water Company, Inc
1074 pop 1,467
34% Ground
66% Pur ground (?)
P
Well
32°02'34"
86°13'26"
Pilgrim-Providence Water & F.P. Authority
(fire Protection?)
1072 pop 480
100% Ground
P
Well
32°08'32"
86°08'14"
Snowdoun Water System, Inc
1078 pop 1,710
100% Ground (?)
Well
32°13'43"
80°17'39"
Emer
See Bonnie for well info
4155 098 Pike Rd
7,080
East Montgomery Water & Fire Authority
~~1066~~ 1064 pop 5,826
50% Ground
50% Pur Surface
P
SG
Well 1/Horse Farm Road Well
32°22'42"
86°05'12"
575
Kilby
Thr Line Road
SW (?)
P
314 persons (126)
P
P
SG
Well 3 Kilby Wel
32°22'35"
86°05'02"
Spout Rd
Not same as Kilby CF.
400 ft
P
SG
Well 4 Youth Services Well
32°23'08"
86°05'50"
depth ?
SP
~~30~~ 30 houses = 79 persons
P
(50%)
Hunter's Walk Manufactured Home Community
1756 pop 597
25% Pur Surface
75% Pur Ground
P
100% ?
Vital Living Products, Inc
1729 pop 100
100% Pur Surface
P
100%
Montgomery North Water & Fire Authority
1435 pop 1,686
100% Pur surface
P
100%
Montgomery Water Works
1070 pop 220,002
66% Surface
34% Ground
66%
Tallapoosa River
32°27'00" / 86°11'49"
34%
North Well field
West Well field
P
SP
40%
Simetco
1065 pop 150
100% Ground
Other
Well #2
?
Other
Well #1
?
P
Well #3
32°23'17"
86°04'26"
P
Well #4
?
Eastwood Villa
1060 pop 312
100% Ground
P
Well 1
32°22'00"
86°03'27"
222 ft
Part of City of Montgomery = may be separate well though
Kilby Correction Facility
1066 pop 475
100% Ground
P
Well 1
32°22'42"
86°05'12"
575 ft
Pine Level Water & Fire Protection Authority
1071 Pop 2,328
100% Ground
P
Well 1
32°03'30"
86°03'34"
P
Well 2
31°57'45"
80°00'01"
Well 1 Federal Rd
32°15'23"
86°20'58"
P
SG
Well 2 Katie Lane
32°14'23"
86°20'54"
P
SG
Pintlala Water & Fire Protection Authority
1073 Pop 3,819
20% Ground
40% Pur Surface
40% Pur Ground
Country Estates Trailer Court
1069 pop 90
100% Ground
Well
32°20'4"
86°07'20"
246