

DITCH AREA AQUIFER TEST TECHNICAL SPECIFICATIONS

1.0 GENERAL

The relationship between the shallow water bearing zone and the base of the concrete lined ditch and the hydrogeology of the shallow water bearing zone will be evaluated by performing an aquifer test in this zone. This document describes how the aquifer test will be performed.

The following figures show the general vicinity and the location of the proposed pumping well, and observation wells.

Figure 1 – Vicinity map

Figure 2 – Pumping well and observation well locations

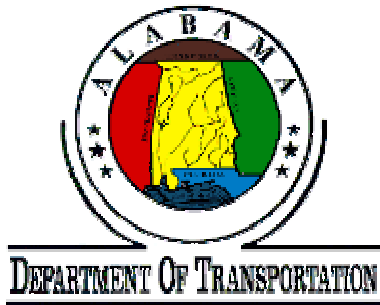
To date, all groundwater wells installed in the Coliseum Boulevard Plume area have been designed for groundwater elevation measurements and sample collection. These wells are not suitable as a pumping well for numerous reasons including limited well pumping efficiency (two-inch diameter machine slotted wells), well locations (a well located near the ditch is required for the aquifer test), and the well screen interval. Therefore, a pumping well will be installed near the ditch. As discussed below, three additional observation wells will be installed. The new wells along with selected existing wells and piezometers will be used to measure water levels during the aquifer test.

Two existing groundwater monitoring wells will be selected prior to the aquifer test to measure the antecedent groundwater elevations. These wells will also be monitored for the duration of the aquifer test for variations in groundwater elevation.

2.0 PUMPING WELL

2.1 Borehole

- 10 1/4-inch diameter with approximate depth of 30 to 35 feet (to the top of the aquitard).
- A Geoprobe® equipped with a soil conductivity unit will be used to determine the depth to the first distinct clay beneath the shallow water bearing unit. Following the Geoprobe® boring, a drilling-rig equipped with a hollow-stem auger will be used to complete a continuous boring to the top of the first distinct clay beneath the shallow water bearing unit. All drill cuttings will be containerized and disposed of in accordance with the Alabama Department of Environmental Management (ADEM) approved work plan.



ADDENDUM 01
DITCH AREA AQUIFER TEST
JUNE 29, 2001

2.2 Casing and Screen

- All casing and screen shall consist of 4-inch nominal diameter Schedule 40 flush threaded PVC.
- The screen shall be approximately 25 feet in length, circumslot with a 0.010-inch slot size. Bottom of the screen shall be installed at an approximate depth of 35 feet bgs, set on top of the clay aquitard.
- The casing shall be approximately 15 feet in length, with three feet of stickup above ground surface.

2.3 Filter Pack

- The material used as a filter pack shall consist of clean, well rounded, quartz sand graded to the size range appropriate for the screened interval. The filter pack grading has been evaluated to be a 16/30 sand. The filter pack will be tremied down from the base of the screen to 2 feet above the top of the screen. If flowing sands in the formation prevent treming the sand filter pack, other standard industry procedures such as washing the filter pack into place will be used.

2.4 Bentonite Seal

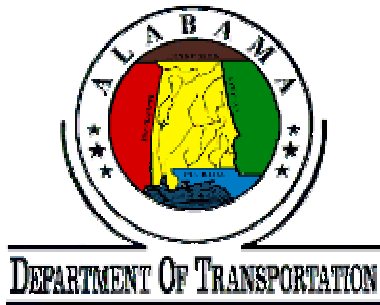
- The bentonite shall consist of high-grade sodium bentonite, and shall be supplied in a pellet form, with a minimum diameter of 1/4 inch and a maximum diameter of 1/2 inch. The bentonite seal will extend 2 feet above the top of the filter pack.

2.5 Grouting

- After adequate pellet hydration the remainder of the annular space will be grouted to the surface using cement/bentonite grout.

2.6 Protective Casing

- A temporary protective casing with a locking cover will be placed around the well stickup to prevent unauthorized tampering with the well. The protective casing will be set approximately two feet below ground surface. Following the completion of the aquifer test, the pump well will be modified by removing the protective casing and three foot stickup, and installing a flush mount shroud at

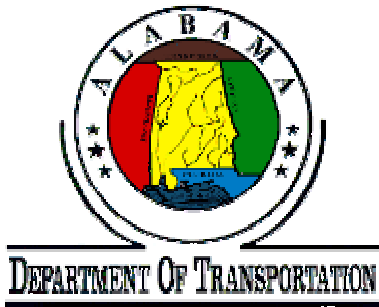


ADDENDUM 01
DITCH AREA AQUIFER TEST
JUNE 29, 2001

ground surface. A 3 ft. x 3 ft. concrete protective pad will be placed around the flush mount shroud sloping from the center to the outer edges to allow for rain water runoff. The well will be properly labeled for future identification.

3.0 PUMPS AND ACCESSORY EQUIPMENT

- One submersible pump and power sources capable of discharging up to 30 gpm. All equipment shall be reliable for periods of no less than 240 hours of continuous operation. If a portable generator is used, the generator will be placed within a secondary containment structure. In addition, a backup power source will be available in the event of a power failure to the main power supply unit.
- The pump shall be equipped with a check valve or other appropriate device to prevent water in the discharge line from back flowing into the well.
- All electrical equipment shall meet appropriate state and federal codes.
- Pump placement shall allow sufficient access in the well to obtain water level measurements at any time.
- An in-line flow meter capable of measuring a range of 10 gpm to 30 gpm continuously shall be installed in the discharge line of the test pump. A gate valve shall be installed so the discharge rate can be controlled with a goal of no more than 10 percent variation from the average rate. A sample port will be installed on the discharge line to allow for groundwater sample collection during the aquifer test.
- Provide sufficient discharge piping to allow disposal of the discharge water generated during the aquifer test to a portable tanker truck. Distance between the pumping well and tanker truck is anticipated to range between 50 and 100 feet. Frac-tanks will be used to store the collected pump test water from the site at the Alabama Department of Transportation (ALDOT) Central Staging Area until the water is treated and discharged to the sanitary sewer or transported to a licensed/ permitted waste water disposal facility.
- An automatic water level recording device, such as a Hermit data logger and pressure transducer, will be used for the pump test well and the observation well closest to the pumping well. Water levels in the remaining observation wells will be measured either manually or using an automatic water level recorder. Minimum measurement interval for the pump test duration is listed in the following table.



ADDENDUM 01
DITCH AREA AQUIFER TEST
JUNE 29, 2001

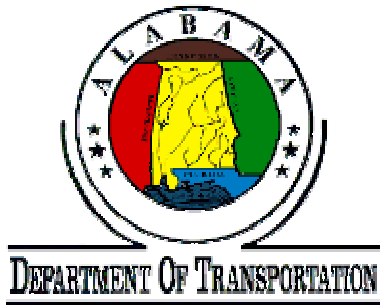
Time into Test	Measurement Interval
0 to 2 minutes	20 seconds
2 to 10 minutes	30 seconds
10 to 20 minutes	1 minute
20 to 30 minutes	2 minutes
30 to 60 minutes	5 minutes
60 to 120 minutes	10 minutes
120 to 180 minutes	20 minutes
180 to 300 minutes	30 minutes
300 to 4,320 minutes	60 minutes
Recovery	Repeat Interval to 95% Recovery

4.0 DRILLING AND INSTALLATION OF OBSERVATION WELLS

Three 2-inch diameter observation wells will be installed.

4.1 Observation Wells

- Three 2-inch wells at the approximate location shown on Figure 2 will be installed approximately 10 feet, 30 feet and 80 feet from the pump test well. Exact distances and locations will be determined during the well installations.
- All drilling tools will be decontaminated by steam cleaning before beginning to drill and install each observation well.
- The observation wells will be completed within 6-inch diameter borings with an approximate depth of 30 to 35 feet.
- All fluids and cuttings removed from the ground during drilling shall be drummed (or all fluids pumped to tankage and cutting drummed or covered with plastic).
- Prior to installing the observation wells, a GeoProbe[®] equipped with a soil conductivity unit will be used to determine the depth to the clay unit beneath



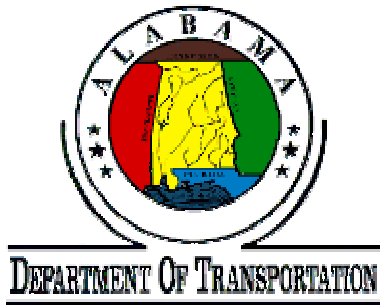
ADDENDUM 01
DITCH AREA AQUIFER TEST
JUNE 29, 2001

the surficial water bearing unit. Following the GeoProbe[®] boring, a drilling-rig equipped with a hollow-stem auger will be used to complete a continuous boring to the top of the clay unit. All drill cuttings will be containerized and disposed of in accordance with the Alabama Department of Environmental Management (ADEM) approved work plan.

- All casing and screen shall consist of 2-inch nominal diameter Schedule 40 flush threaded PVC.
- The screen shall be approximately 20 feet in length (screening the entire saturated zone), with a 0.010-inch slot size. Bottom of the screen shall be installed at an approximate depth of 30 feet bgs, set on top of the clay aquitard.
- The well shall be placed in the borehole such that the top of the casing is flush with ground surface.
- The filter pack shall be tremied into place using clean, potable water, from the bottom of the screen upward, to approximately two feet above the screen or by other industry approved techniques.
- A two-foot thick bentonite seal, using 1/4 or 1/2 inch bentonite pellets, shall be placed above the filter pack.
- After adequate pellet hydration of the annular space will be grouted to the surface using cement/bentonite grout.
- The top of the well will be set in a flush mount shroud at ground surface surrounded by a 3 foot by 3 foot concrete pad.
- The observation wells will be properly labeled for future identification.

5.0 WELL DEVELOPMENT

- The wells shall be developed using air-lift and pumping techniques.
- The pumping well will be fully developed prior to the aquifer test. Specific capacity in the pumping well will be evaluated during the well development process. The pumps used to develop the well will be shut off at periodic intervals to allow for measuring the water level recovery in the well. The pumping well will be developed until turbidity and specific capacity stabilizes.
- All fluids removed from the well during well development will be transported



ADDENDUM 01
DITCH AREA AQUIFER TEST
JUNE 29, 2001

to frac tanks for storage and treatment at the ALDOT Central Staging Area or disposed at a licensed/permitted waste water disposal facility.

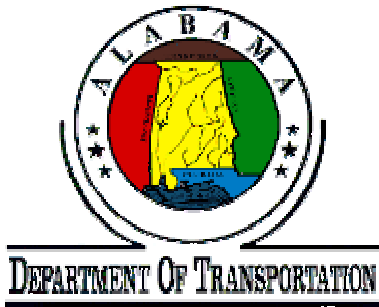
- The observation wells will be fully developed prior to the aquifer tests. The wells will be developed until turbidity stabilizes.

6.0 PUMP INSTALLATION

- The pump shall be installed such that the base of the pump is between one and two feet from the bottom of the screen.

7.0 PUMPING TESTS

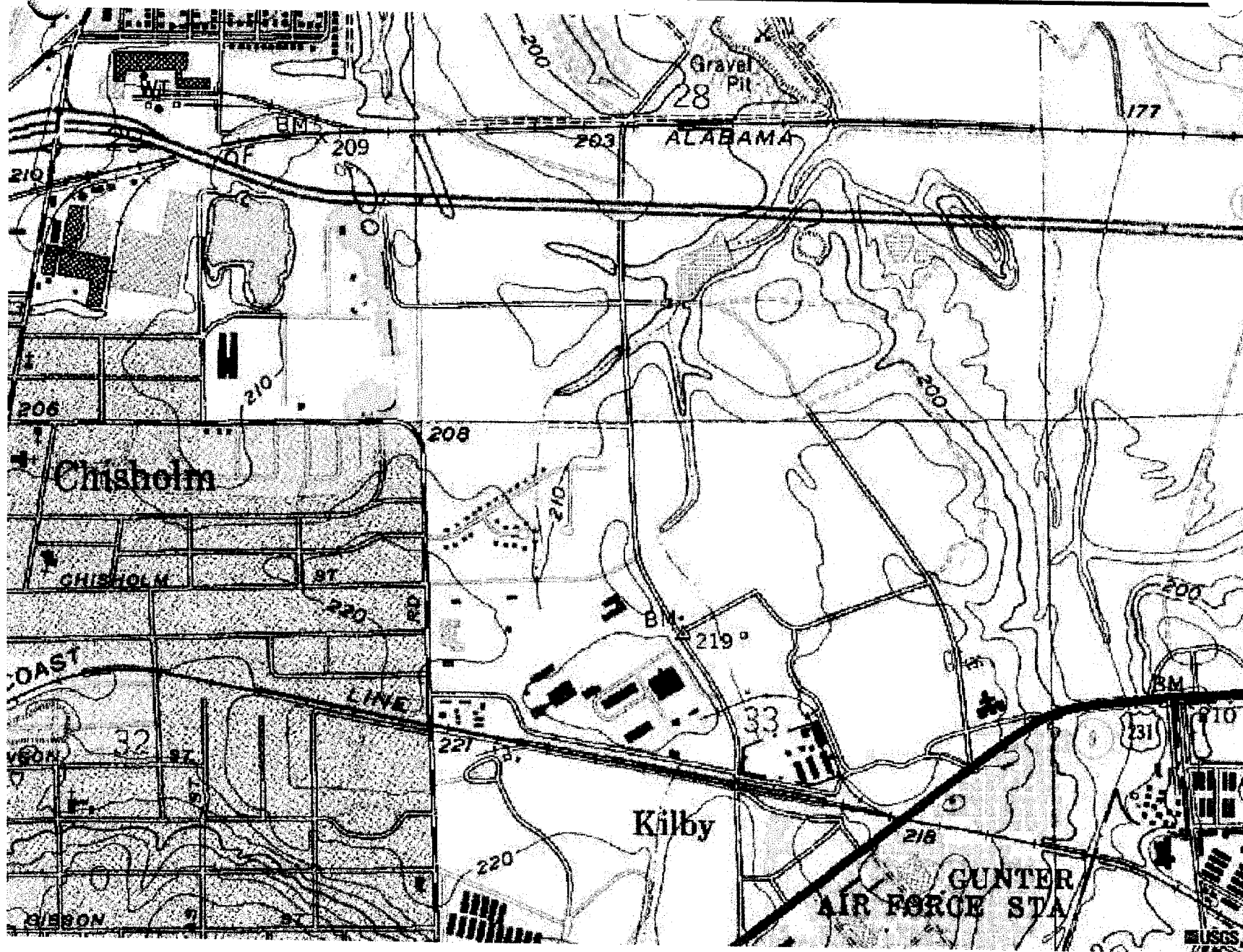
- It is anticipated that a step drawdown pumping test, followed by a constant rate aquifer test will be conducted. The step drawdown test will be a continuous test beginning with a low volume pump rate, approximately five gallons per minute, and measuring the drawdown in the pumping well until the groundwater elevation stabilizes. The time required for drawdown to stabilize (less than one foot of drawdown over a 10 minute period) from the first pumping rate will be recorded. The pumping rate will be increased by approximately five gallons per minute and the well will be pumped at this increased rate for the same time duration as the initial step. This process will be repeated for up to six steps.
- The constant rate test will be a minimum 72-hour test. The constant pumping rate will be based on the results of the step drawdown test. The length of any test may be adjusted based on the test progress or field conditions.
- All fluids removed from the well during the pumping test will be discharged to a tanker truck and transported to frac tanks at the ALDOT Central Staging Area for treatment and discharge to the sanitary sewer or disposed at a licensed/permitted waste water disposal facility. The transporter shall be responsible for all necessary materials and equipment required to discharge the fluids to the tankage.
- Should either the step drawdown test or constant rate test cease prior to completion of the test, the well will be allowed to recover to at least 95 percent of the static water level before restarting the test.
- During the aquifer test, samples will be collected within the first 30 minutes, at 4 hours, 24 hours, 48 hours, and 72 hours for analyses for VOCs (Methods 8260), dissolved oxygen, nitrate, nitrite, iron (II), sulfate, methane, alkalinity, oxidation-reduction potential, pH, temperature,



ADDENDUM 01
DITCH AREA AQUIFER TEST
JUNE 29, 2001

conductivity, chlorides, calcium, sodium, magnesium, and hardness.

- The pumping wells and observation wells, although intended as temporary wells only and not as remediation wells, will remain in place after conclusion of the aquifer test for measurement of water levels or for other appropriate measurement and investigation. However, ALDOT agrees that, upon receipt of ten (10) days written notice from Alfa, it will properly abandon said wells. The abandonment will comply with all ADEM and other appropriate standards and requirements and shall otherwise be conducted pursuant to the terms of the access agreement previously entered into between ALDOT and Alfa. All costs associated with the abandonment of these wells will be at ALDOT's expense.

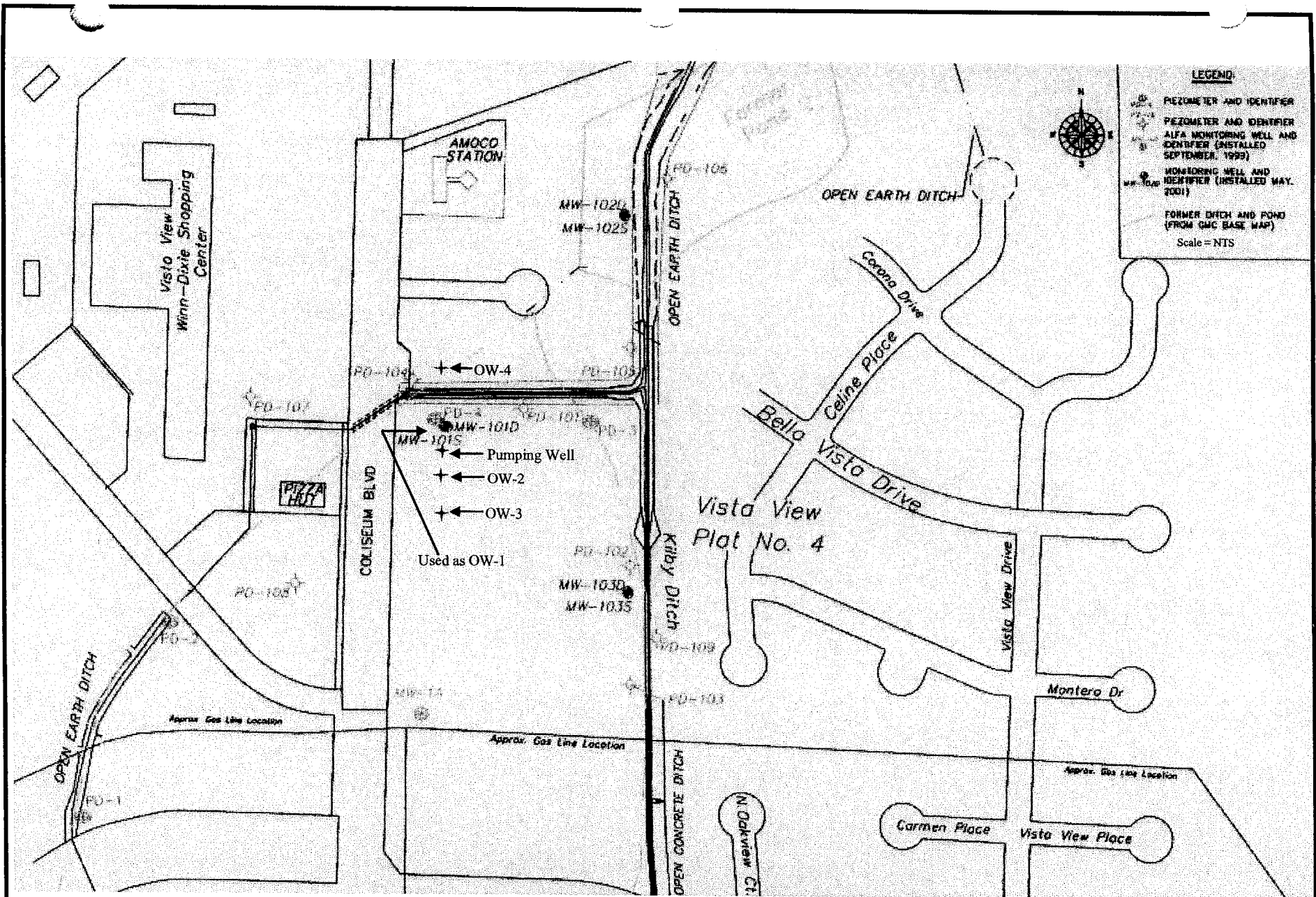


**MALCOLM
PIRNIE**

**SITE VICINITY
COLISEUM BLVD PLUME INVESTIGATION
MONTGOMERY, ALABAMA**

FIGURE 1

JUNE 2001



**MALCOLM
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**WELL LOCATIONS
DITCH AREA
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FIGURE 2

JUNE 2001