# Pesticide Monitoring Network
# 1993-1994

Greg Webb

GEORGIA DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION
GEORGIA GEOLOGIC SURVEY

Atlanta
1995

PROJECT REPORT 22

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## Introduction

As required by the Georgia Pesticide Management Plan, the Georgia Department of Agriculture (GDA), early in 1992, requested the Georgia Geologic Survey Branch (GGS) of the Environmental Protection Division (EPD) to assist in designing a Pesticide Monitoring Network to sample ground water in the Georgia farmbelt. The original plan called for the establishment of a network of dedicated shallow monitoring wells in those counties having the highest concentration of agricultural activity (primarily row crop farming). About the same time, the United States Geologic Survey (USGS) initiated a study of the Apalachicola-Chattahoochee-Flint River Basin (ACF) as part of the National Water Quality Assessment Program. In this regard, the USGS installed 40 shallow monitoring wells in the ACF (see Figure 1). Each well would be sampled twice for pesticides during a 12 month period by the USGS.

Rather than duplicate efforts, a cooperative plan between the GDA, EPD, and the USGS was developed. This cooperative plan called for the USGS to install the monitoring wells and sample them twice during 1993-94, testing the ground-water samples with analytical methods more precise than standard EPA GC Mass Spectrometer methods. EPD, in turn, would sample the USGS wells on a more frequent schedule for one year with the GDA Pesticide Residue Laboratory analyzing the ground-water samples using standard EPA-approved GC Mass Spectrometer methods.

## Well Location and Construction

The USGS used a geographic information system (GIS) to locate the preliminary sites for the monitoring wells. The search criteria was as follows:

- directly downgradient from ongoing row-crop agriculture,
- in or near recharge areas,
- land use around the site must be similar for at least ten years prior to the time of drilling,
- 100 meters from a stream or wetland,
- 100 meters from a building (especially important if the building has a septic system),
- 50 meters from a paved road, and
- not in an area of known contamination.

Moreover, the USGS project geologist had the authority to relocate well sites up to five hundred meters based on field conditions. The wells would be drilled only if the owner of the property agreed to allow the USGS to revisit the well after the initial construction.

The ACF wells were drilled during July and August of 1993 by a USGS drill crew under the supervision of Elizabeth Frick, project geologist. The wells were drilled to the water table with a 6" hollow-stem auger. The casing for the wells was of PVC construction, two inches in outer diameter, with a ten foot screened interval. The screened interval was backfilled with a filter pack of clean sand and capped with five gallons of bentonite pellets that were allowed to set from four to twenty-four hours. The wells were then backfilled with cuttings, and capped with three feet of cement grout (about 93 pounds). The casings extend one half to three feet above the ground and are covered by locking steel boxes set in 18 inch wide concrete aprons (see Appendix A for "as-built" construction logs of each well). Immediately after drilling, the wells were developed with an air bladder pump so that they would produce clean water.

## Sampling Equipment

EPD used two USGS recommended methods to purge wells during the project, bailing and pumping. During the first half of the project, disposable, PVC, single-use bailers were used to purge and sample the water. A Grundfos Redi-Flo 2" environmental submersible pump was used for the remaining period between February, 1994 and July, 1994.

Dissolved oxygen, temperature, specific conductance, and pH measurements were taken on the purged water with an Orion model 820 dissolved oxygen meter and a Presto-Tech DSpH-1 specific conductance/pH meter.

## Sampling Procedures

"Protocols and Recommended Procedures for Collection of Ground-Water Data from Wells" (Lapham, Wilde, and Korterba, 1992, unpublished) and the Georgia Environmental Protection Division's Manual for Groundwater Monitoring (1988, unpublished) were used as guides for sampling the Pesticide Monitoring Network (PMN) wells. Normally, monitoring wells are purged at least three case volumes of water to insure that formation water is being sampled. The volume of a well casing can be calculated from the following equation:

$$V = 0.0408HD2$$

where V is a number which represents case volume in gallons, H is the height in feet of the water column, and D is the diameter of the casing, in inches. The height (H) of the water column is estimated from the total depth of the well and the static water level, as measured with a water level indicator.

The stabilization of water quality parameters for the purged water, such as temperature, pH, and dissolved oxygen, can be used to tell if a monitoring well is providing formation water. Measurements taken on the first case volume of purged ground water tend vary widely, due to the fact that the water in the open case is stratified and not under the influence of the surrounding formation. The readings begin to stabilize with the removal of the second case volume of water, which is less affected by the open well case and under more influence from the surrounding formation. Usually, the readings will stabilize to a narrow range with the purging of the third case volume, indicating that water is being drawn from the formation. For times when the readings are not stable when three case volumes have been removed, the purge is continued until the the readings stabilize.

Since the initial USGS sampling results from the monitoring wells in the ACF basin suggested that none of the wells had

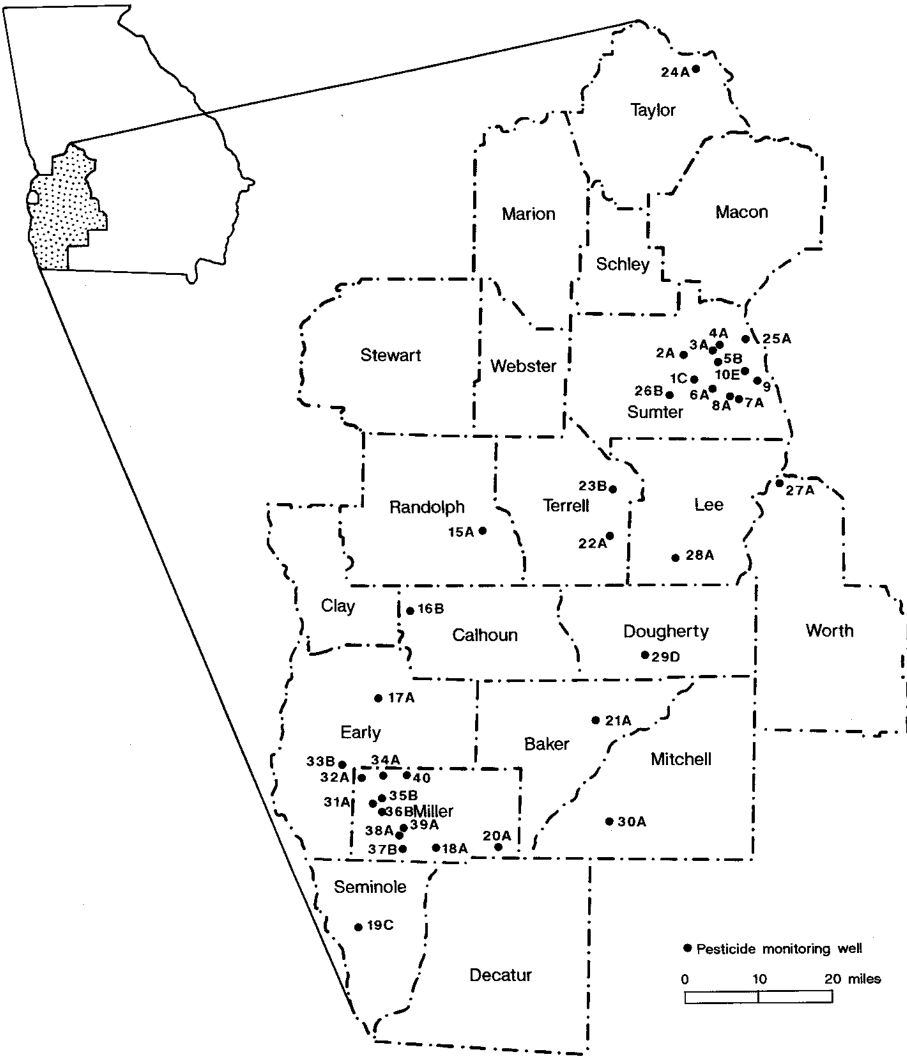



Figure 1. Apalachicola-Chattahoochee-Flint river basin pesticide monitoring well network.

any initial contamination, it was decided that water purged from the wells during the EPD monitoring project was safe to discharge onto the surface.

After purging, two types of samples were drawn at each well for the Pesticide Monitoring Network:

1) one liter samples, collected in amber glass bottles, with no preservation or filtration ( to be analyzed for screens 1, 2, and 3; see Appendix B);

2) a 60 ml sample; collected in an opaque 125 ml Teflon® bottle, preserved with 1.8 ml of monochloroaecetic acid (to be analyzed for screen 5 organics).

Samples were individually labeled and sealed in plastic bags before being stored on ice for preservation during transportation to the GDA laboratory in Atlanta. Samples were hand-delivered to the laboratory personnel by the sampler, maintaining a proper chain of custody.

### Decontamination and QA/QC

To prevent contamination of samples, the sampling equipment was cleaned between each use and was handled using dustless latex gloves. The gloves were worn because of the fact that the fields where the wells were located were being treated for pests during the time that the project was running. The residues from recent applications could be on the well cover and any of the dust in the sampling site. The gloves were changed frequently to reduce the chance of contaminating a clean surface after handling a (potentially) dirty one.

The pump and all of the hoses were cleaned in the field after each purge. First, the pump was pulled from the well and placed in a two-liter graduated cylinder. Then a one-gallon detergent mixture was cycled through all of the hoses for approximately five minutes. This solution was discharged onto the ground. Then the hoses were rinsed twice; first with five gallons of tap water, and then with five gallons of deionized water, directly through the system onto the ground. After the rinsing, the pump, all of the fittings, and the hoses were wrapped in aluminum foil for protection from dust during transportation and/or storage. Periodically, the pump was disassembled in the office and the parts individually cleaned and inspected for wear. All of the sampling equipment was stored in EPD's warehouse in Albany. Additonal quality control methods used included running blanks of deionized water, collecting replicate samples, and using spiked samples.

### Laboratory Analysis

The Georgia Department of Agriculture Pesticide Residue Laboratory uses EPA methods 507, 508, 515.1, and 531.1 for pesticide analysis. These methods have detection limits for pesticides that are below the maximum contaminant levels (MCL's) established for safe drinking water by EPA. Each method analyzes ground-water samples for specific types of compounds:

- method 507 is for nitrogen and phosphorous containing compounds,
- method 508 is for chlorinated pesticides,
- method 515.1 is for chlorinated acids,
- and method 531.1 is for N-methylcarbamoyloximes & N-methylcabamates.

These methods are commonly referred to as screens 1, 2, 3, and 5. Screens 1, 2, and 3 require the use of a gas chromatograph (GC), while screen 5 requires a high-performance liquid chromatograph (HPLC). See Appendix B for tables listing the compounds detectable by each method.

### Results

After nine months of sampling the ACF wells, no pesticides were detected above EPA MCL's. The USGS, using more precise methods, detected alachlor, metolachlor, atrazine, deethyl atrazine, fonofos, P,P-DDE (a breakdown product of DDT), and fluometuron in the 0.003 to 0.6 ppb concentration range (Elizabeth Frick, written communication, October, 1994). All of these concentrations are below the minimum detection limits of the EPA methods used by the GDA. QC samples spiked with various pesticides show that the GDA laboratory's procedures are capable of detecting pesticide concentrations that are near the MCL's established for the compounds (generally >1 ppb).

### Interpretive Conclusions

For the ACF basin, the first year of sampling indicates that the Best Management Practices for Pesticides currently being employed by most Georgia farmers do not result in pollution of Georgia's ground water by pesticides (as established by EPA's drinking water standards). If the EPA's risk-based MCL's are appropriate, then underground sources of drinking water are not in danger. This conclusion is consistent with previous surveys of pesticides in ground water conducted in Georgia. The lack of detections can be attributed to the rapid dilution and degradation of pesticides due to the low amount of organic materials in the soils of the Coastal Plain, the high soil and air temperatures that naturally occur during the times of peak pesticide application, and the abundant rainfall the area receives each year (average yearly rainfall is about 59 inches).

The USGS, using more sophisticated analytical procedures, have detected pesiticides at concentrations substantially below EPA's MCL's. This shows that pesiticides and pesticide breakdown products are reaching the surficial aquifer in the vicinity of the fields where pesiticides have been applied, but at concentrations below any reasonable expectation of human harm.

## References

EPD task force on Ground Water Monitoring, 1988. Manual for Groundwater Monitoring, Georgia Department of Natural Resources, Environmental Protection Division (unpublished), 37 p.

Elizabeth A. Frick, 1993, Personal communication.

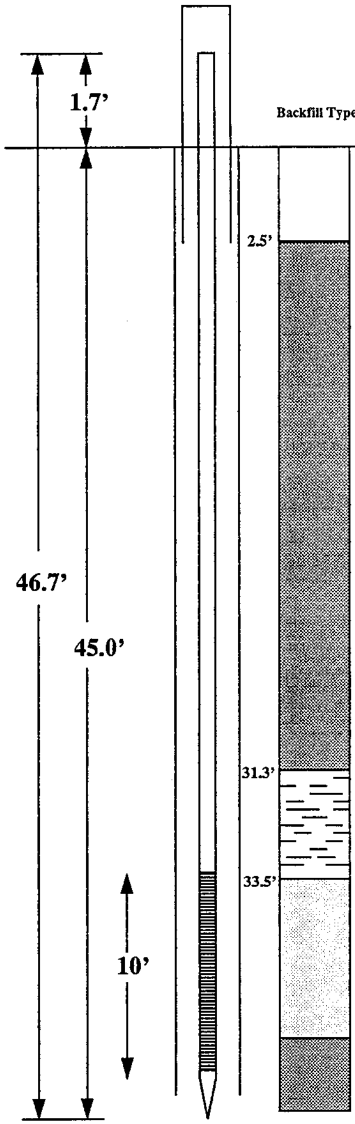
Lapham, W., Wilde, F., and Korterba, M., 1992. Protocols and Recommended Procedures for Collection of Selected Ground-water data from wells. USGS Open-file report 92-xxxx (provisional document, unfinished) pp 99-324.

**Appendix A**

Well construction diagrams (all data provided by the Water Resources Division of the United States Geological Survey). Includes all NAQWA Apalachicola-Chattahoochee-Flint River Basin wells.

# CONSTRUCTION LOG

## NAWQA WELL ID LC-1C




Notes

1 94-lb bag of Portland Type I cement
6/24/93

Backfilled with native materials
6/24/93 @ 18:00 EST

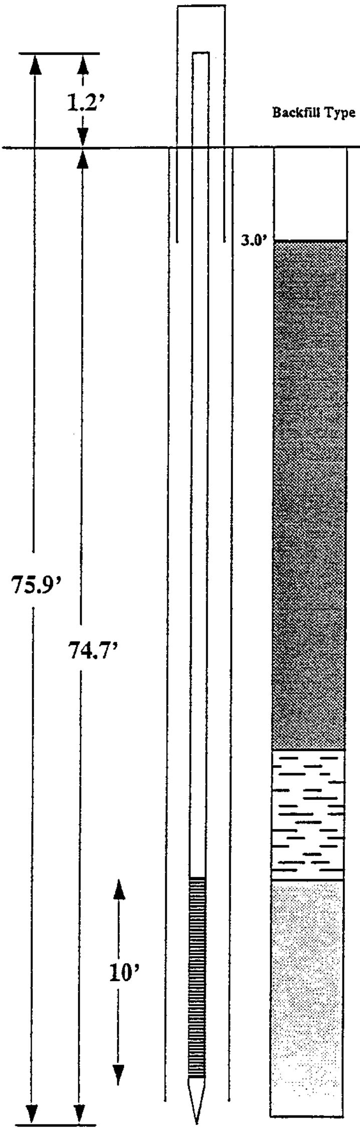
1 Five-gallon bucket of 3/8" bentonite pellets
6/23/93 @13:30 EST

1 bag of 20-40 grade sand
6/23/93

Native clay caved in

# CONSTRUCTION LOG

NAWQA WELL ID LC-2A




Notes

1 94-lb bag of Portland Type I cement
6/23/93

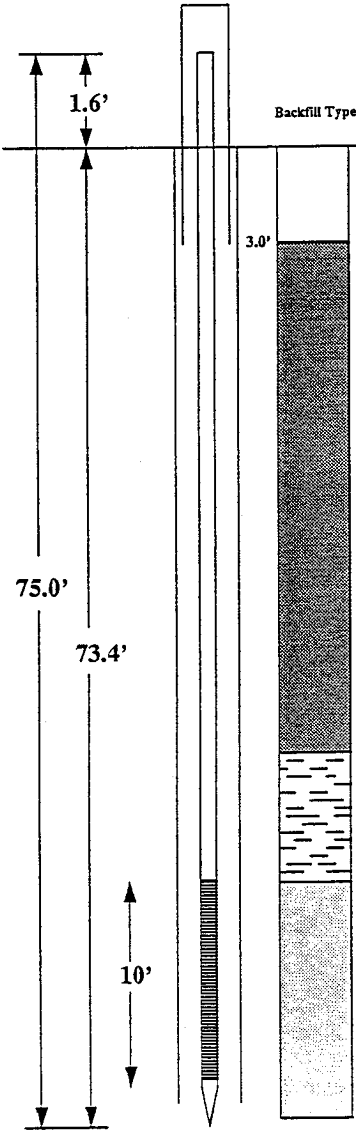
Backfilled with native materials
6/23/93

1 five-gallon bucket of 3/8" bentonite pellets
6/23/93 @ 9:00 EST

1 100-lb. bag of 20-40 grade sand
6/23/93

# CONSTRUCTION LOG

## NAWQA WELL ID LC-3A




Backfill Type | Notes

1 94-lb bag of Portland Type I cement
6/22/93

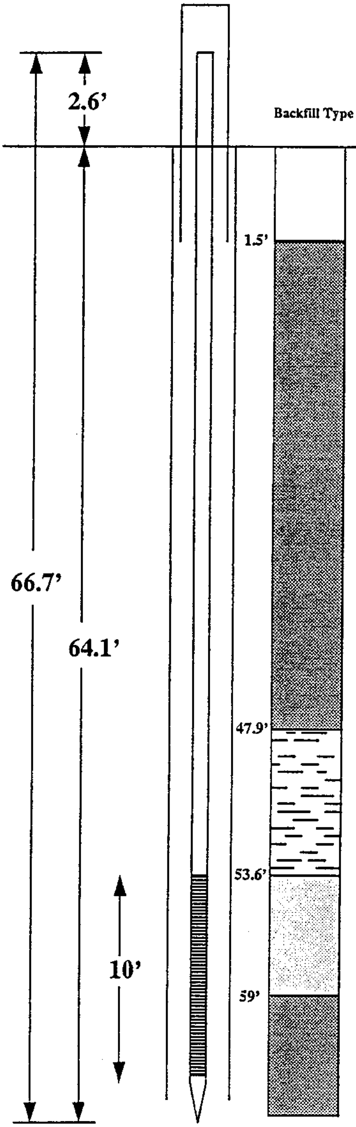
Backfilled with native materials
6/22/93 @ 16:00 EST

1 five-gallon bucket of 3/8" bentonite pellets
6/22/93 @ 13:00 EST

1 100-lb. bag of 20-40 grade sand
6/22/93 @ 12:55 EST

# CONSTRUCTION LOG

## NAWQA WELL ID LC-4A




Notes

1 94-lb bag of Portland Type I cement
8/5/93

Backfilled with native materials
8/5/93 @ 14:05

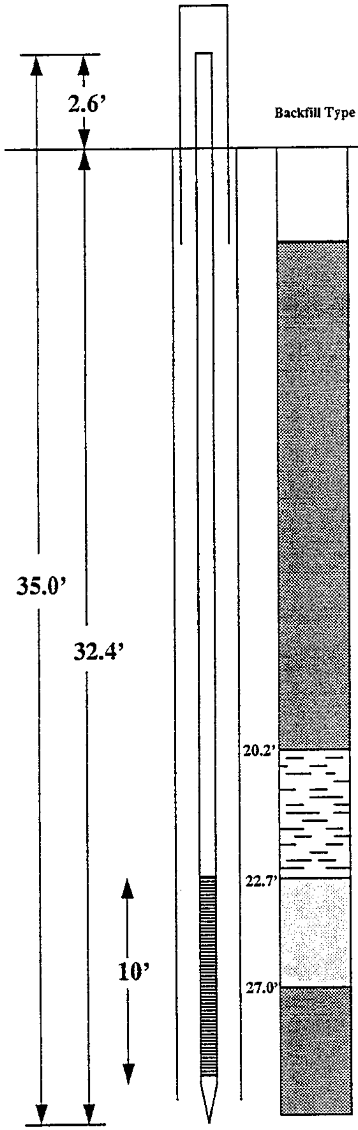
1 Five-gallon bucket of 3/8" bentonite pellets
8/4/93 @15:10 EST

2-1/2 100-lb. bags of 20-40 grade sand
8/4/93

Native material caved in

# CONSTRUCTION LOG

## NAWQA WELL ID LC-5B




Notes

1 94-lb bag of Portland Type I cement

Backfilled with native materials

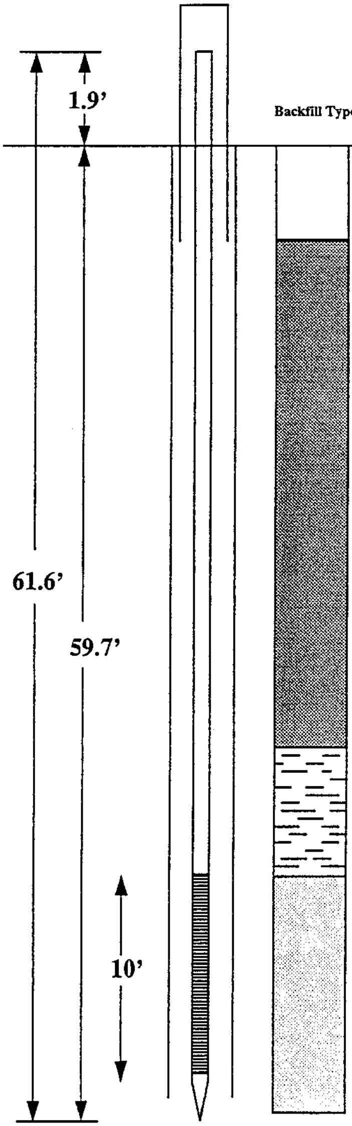
1 five-gallon bucket of 3/8" bentonite pellets
8/4/93 @ 11:45 EST

1-1/2 100-lb bags of 20-40 grade sand
8/4/93

Native materials caved in

# CONSTRUCTION LOG

## NAWQA WELL ID LC-6A




Backfill Type

Notes

1 94-lb bag of Portland Type I cement

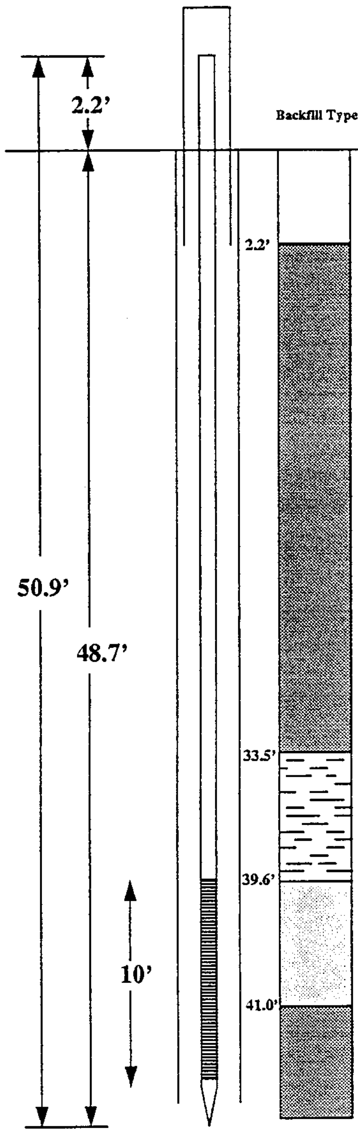
Backfilled with native materials

1 five-gallon bucket of 3/8” bentonite pellets

20-40 grade sand

# CONSTRUCTION LOG

NAWQA WELL ID LC-7A




Notes

1 94-lb bag of Portland Type I cement
8/5/93

Backfilled with native materials
8/5/93 @ 12:15 EST

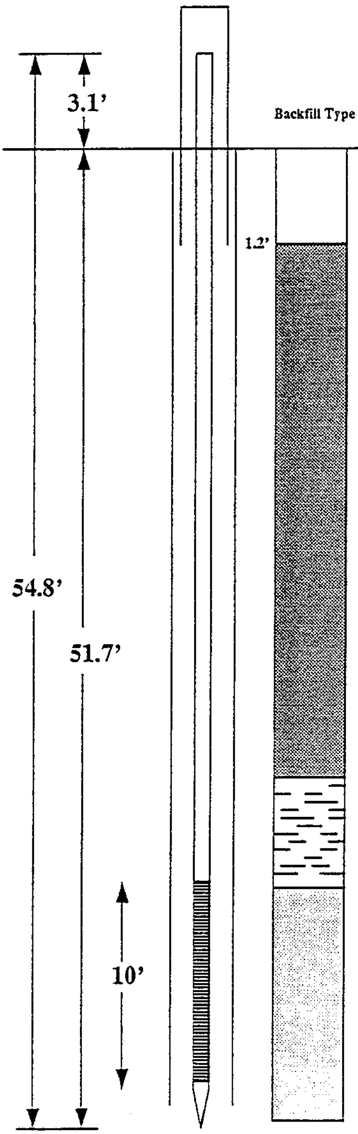
1 five-gallon bucket of 3/8" bentonite pellets
8/4/93 @10:00 EST

1 100-lb. bag of 20-40 grade sand
8/4/93

Native material caved in

# CONSTRUCTION LOG

NAWQA WELL ID LC-8A




Notes

1 94-lb bag of Portland Type I cement
6/24/93

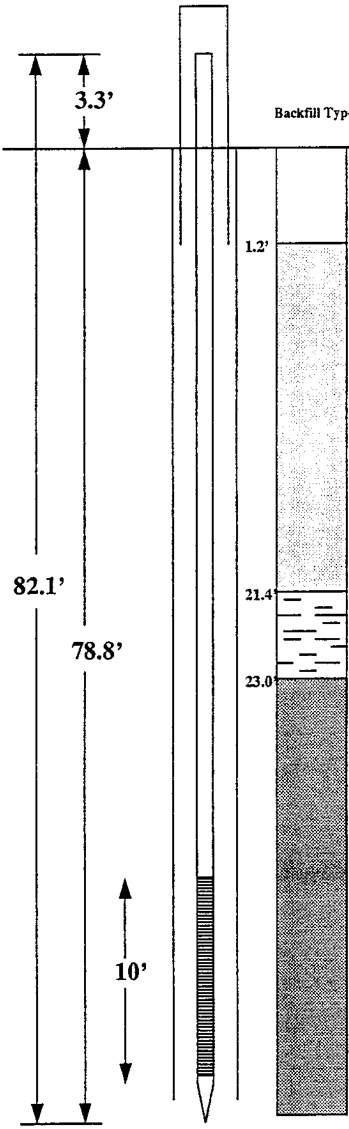
Backfilled with native materials
6/24/93

1 Five-gallon bucket of 3/8" bentonite pellets
6/24/93 @14:30 EST

1 100-lb. bag of 20-40 grade sand
6/24/93

# CONSTRUCTION LOG

NAWQA WELL ID LC-10E




Notes

1 94-lb bag of Portland Type I cement
8/7/93

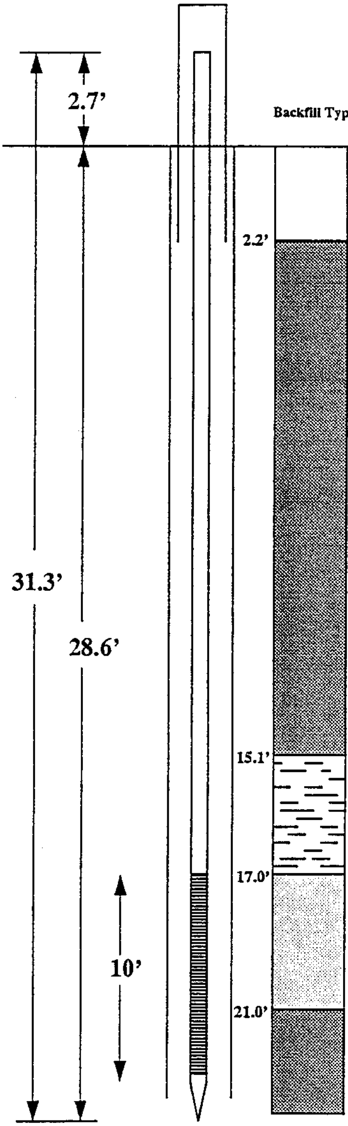
Backfilled with native sands and 2 100-lb. bags of 20-40 grade sand on 8/6/93 @ 11:00 EST

1-1/2 Five-gallon buckets of 3/8" bentonite pellets
8/5/93 @ 10:30 EST

Native material caved in
8/5/93

# CONSTRUCTION LOG

## NAWQA WELL ID CP-15A




**Notes**

1 94-lb bag of Portland Type I cement
8/2/93 @ 12:40 EST

Backfilled with native materials
8/2/93

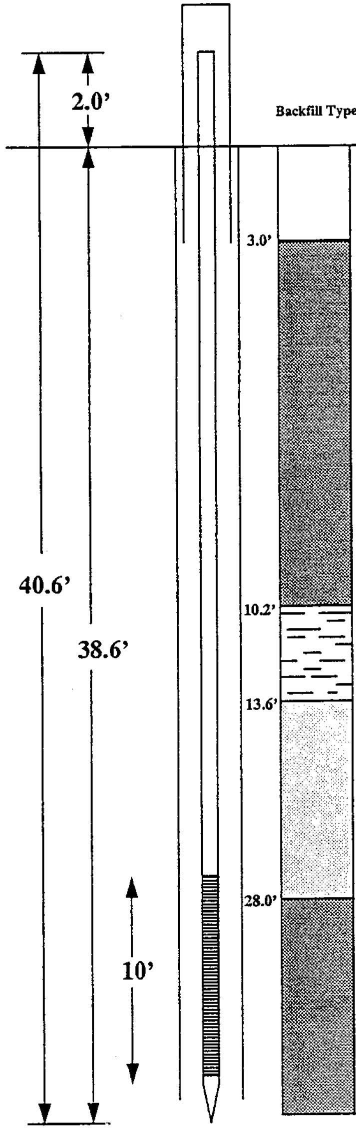
1 Five-gallon bucket of 3/8" bentonite pellets
7/31/93 @ 14:00 EST

1 100-lb. bag of blasting sand (16-40 grade)
7/31/93

Native material caved in

# CONSTRUCTION LOG

NAWQA WELL ID CP-16B




Notes

1 94-lb bag of Portland Type I cement
8/2/93 @ 11:15 EST

Backfilled with native materials
8/2/93

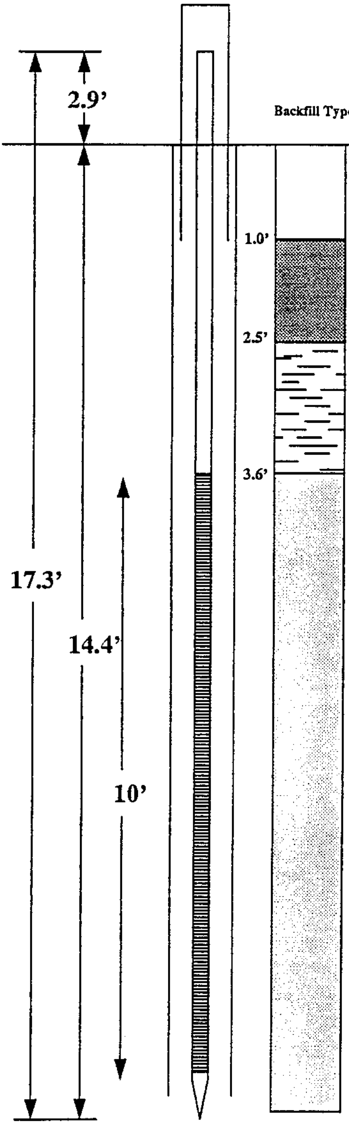
1 Five-gallon bucket of 3/8" bentonite pellets
7/31/93 @ 9:19 EST

2 100-lb. bags of 20-40 grade sand
7/31/93

Native material caved in

# CONSTRUCTION LOG

## NAWQA WELL ID CP-17A




Notes

1 94-lb bag of Portland Type I cement
8/2/93 @ 9:00 EST

Backfilled with native materials
8/2/93

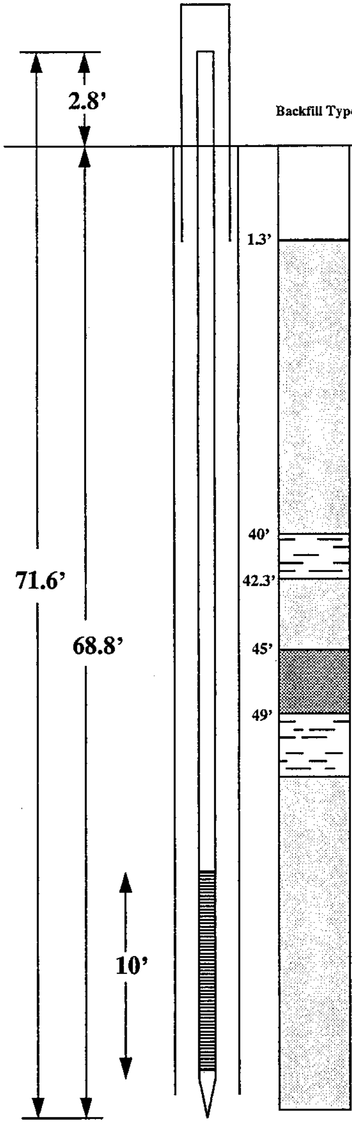
1 five-gallon bucket of 3/8" bentonite pellets
7/31/93 @11:00 EST

1 100-lb. bag of Class VIII blasting sand
2 100-lb. bags of 20-40 grade sand
1 50-lb. bag of play sand
7/31/93

# CONSTRUCTION LOG

## NAWQA WELL ID CP18A

Backfill Type | Notes




1 94-lb bag of Portland Type I cement
8/2/93 @ 9:00 EST

9-1/2 100-lb. bags of sand
7/21/93 @ 17:45 EST

1 five-gallon buckets of 3/8" bentonite pellets
7/21/93 @10:00 EST

6 100-lb bags of sand

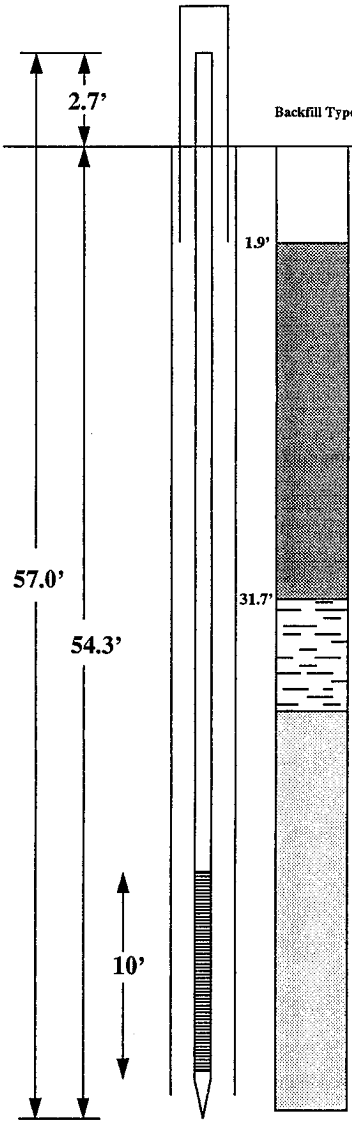
Backfilled with native materials 7/21/93 @ 8:00 EST

1 five-gallon bucket of 3/8" bentonite pellets
7/20/93 @ 18:30 EST

2 100-lb. bags of 20-40 grade sand
7/20/93

# CONSTRUCTION LOG

## NAWQA WELL ID CP-19C




Notes

1 94-lb bag of Portland Type I cement
8/1/93

Backfilled with native materials
8/1/93 @ 15:00 EST

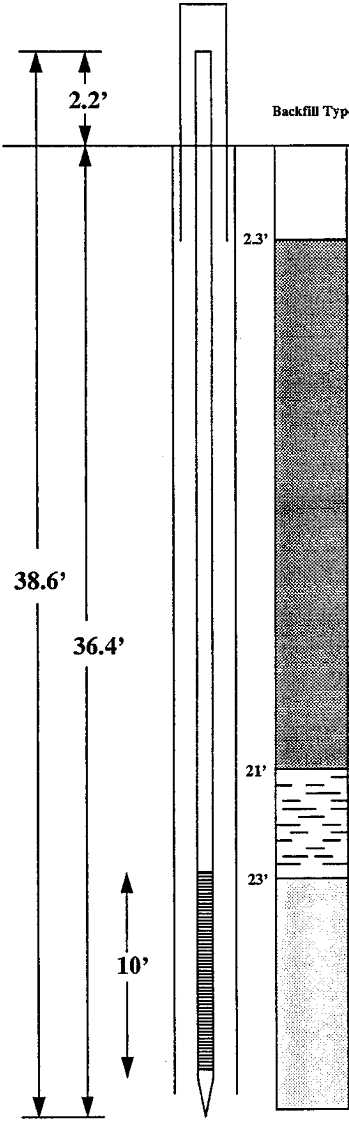
Caved in to 15.8' prior to backfilling

1 five-gallon bucket of 3/8" bentonite pellets
7/27/93 @9:00 EST

2 100-lb. bags of 20-40 grade sand
7/27/93

# CONSTRUCTION LOG

## NAWQA WELL ID CP-20A




Notes

1 94-lb bag of Portland Type I cement
7/28/93

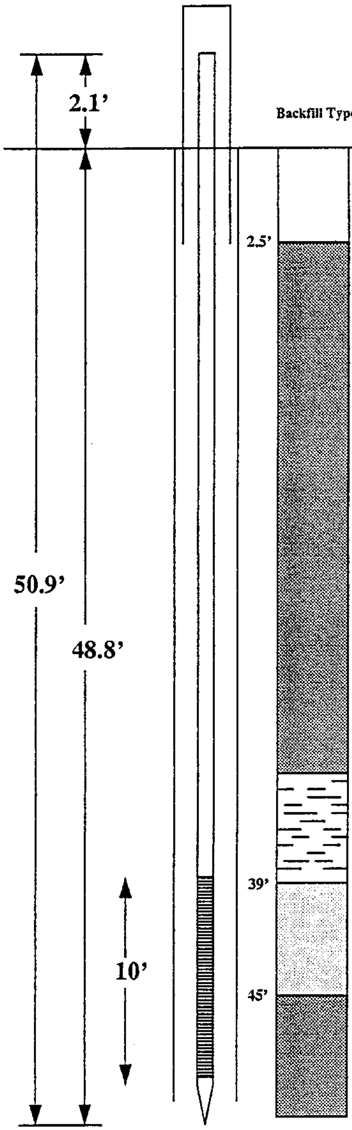
Backfilled with native materials
7/28/93 @ 10:30 EST

1 Five-gallon bucket of 3/8" bentonite pellets
7/27/93 @4:30 EST

2 100-lb. bags of 20-40 grade sand
7/27/93

# CONSTRUCTION LOG

## NAWQA WELL ID CP-21A




Backfill Type | Notes

1 94-lb bag of Portland Type I cement
7/31/93

Backfilled with native materials
7/31/93 @ 13:30 EST

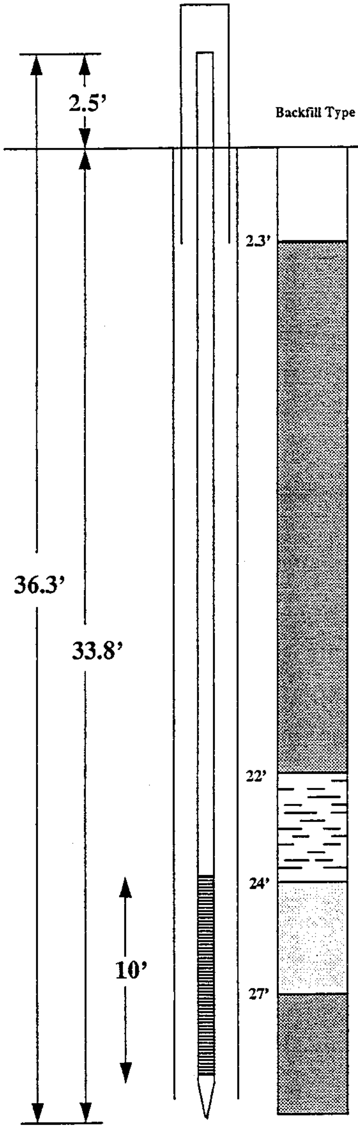
1 five-gallon bucket of 3/8" bentonite pellets
7/28/93 @14:00 EST

2-1/2 100-lb. bags of 20-40 grade sand
7/28/93

Native materials caved in

# CONSTRUCTION LOG

## NAWQA WELL ID CP-22A




Notes

1 94-lb bag of Portland Type I cement
8/2/93

Backfilled with native materials
8/2/93 @ 16:40 EST

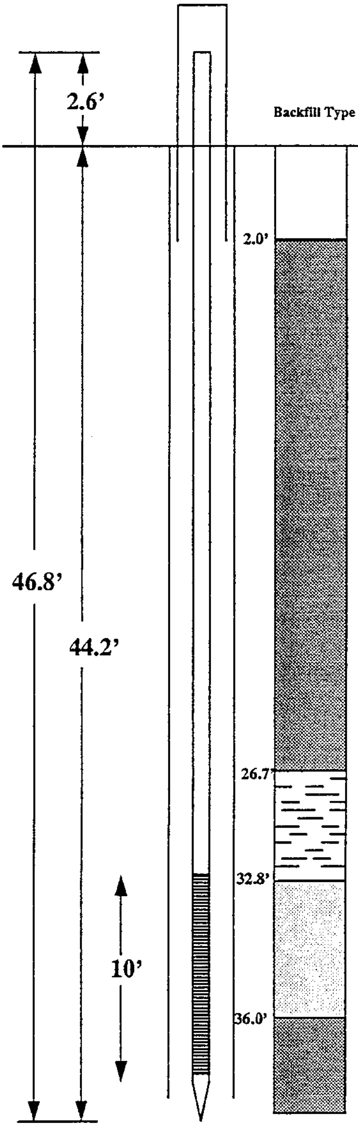
1 five-gallon bucket of 3/8" bentonite pellets
7/31/93 @15:30 EST

1 100-lb. bag of blasting sand
7/31/93

Native materials caved in

# CONSTRUCTION LOG

## NAWQA WELL ID CP-23B




Notes

1 94-lb bag of Portland Type I cement
8/3/93

Backfilled with native materials
8/3/93 @ 16:00 EST

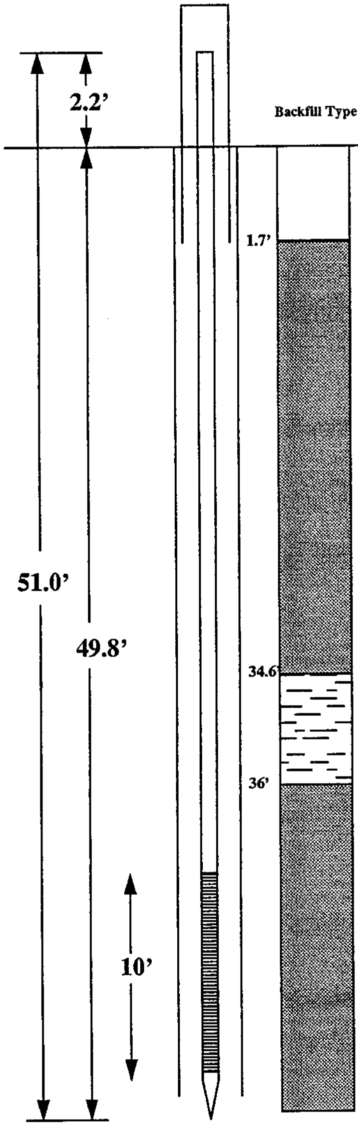
1 Five-gallon bucket of 3/8" bentonite pellets
8/2/93 @8:45 EST

3/4 100-lb. bag of 20-40 grade sand
8/2/93

Native material caved in

# CONSTRUCTION LOG

## NAWQA WELL ID CP24A




Notes

1 94-lb bag of Portland Type I cement
8/5/93

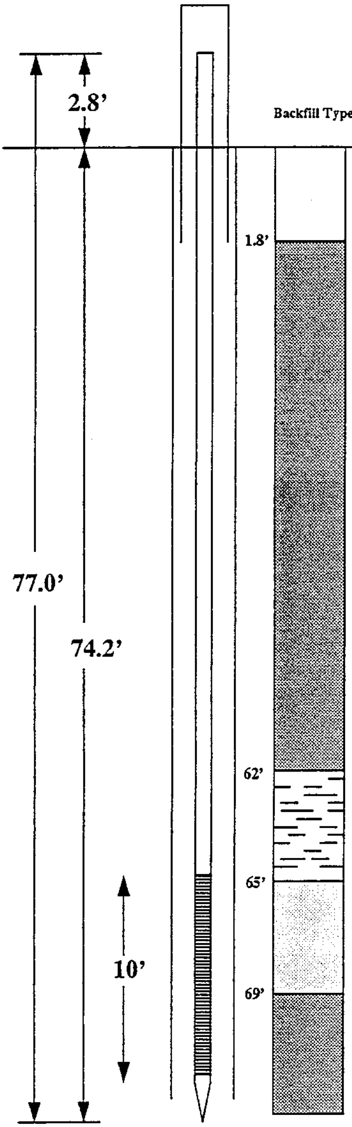
Backfilled with native materials
8/5/93 @ 8:40 EST

1 five-gallon buckets of 3/8" bentonite pellets
8/3/93 @10:15 EST

Native materials caved in

# CONSTRUCTION LOG

NAWQA WELL ID CP-25A




Notes

1 94-lb bag of Portland Type I cement
8/4/93

Backfilled with native materials
8/4/93 @ 8:30 EST

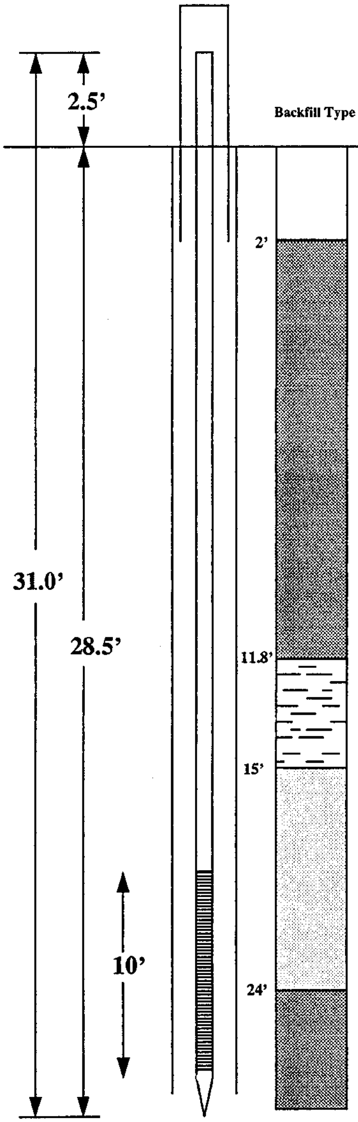
1 five-gallon bucket of 3/8" bentonite pellets
8/3/93 @14:30 EST

2 100-lb. bags of blasting sand
8/3/93

Native materials caved in

# CONSTRUCTION LOG

NAWQA WELL ID CP-26B




Notes

1 94-lb bag of Portland Type I cement
8/4/93

Backfilled with native materials
8/4/93 @ 10:45 EST

1 five-gallon bucket of 3/8" bentonite pellets
8/3/93 @17:40 EST

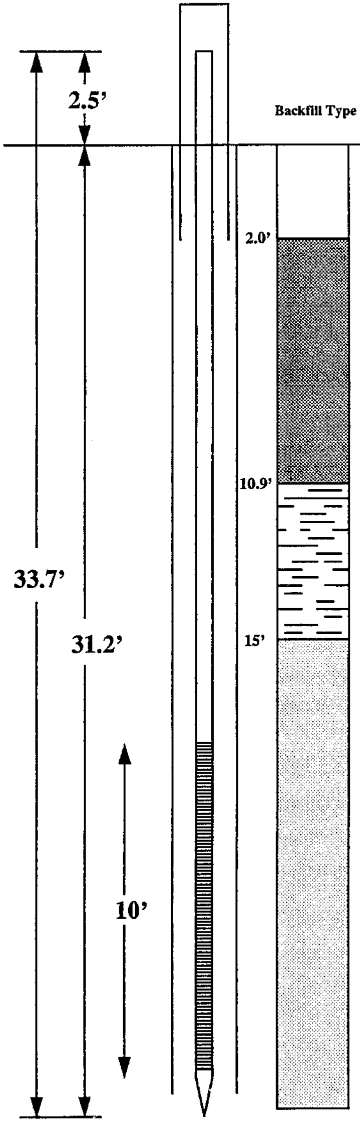
3 100-lb. bags of 20-40 grade sand
8/3/93

Native materials caved in

# CONSTRUCTION LOG

## NAWQA WELL ID CP-27A

Backfill Type | Notes




1 94-lb bag of Portland Type I cement
8/4/93

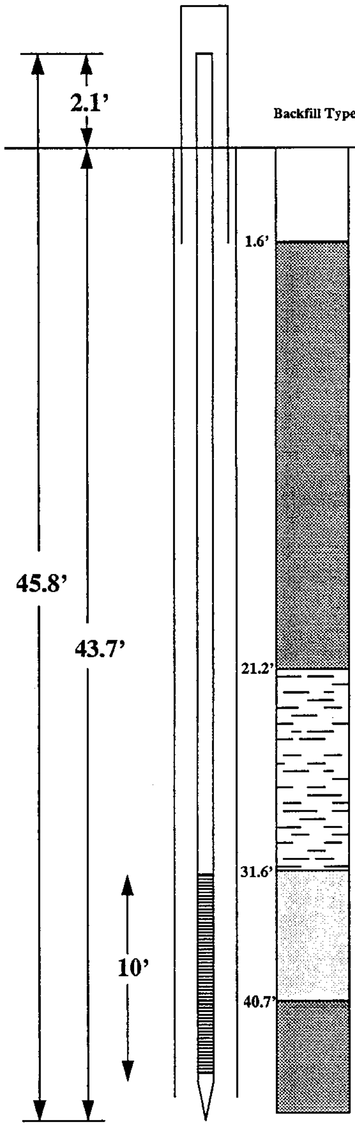
Backfilled with native materials
8/4/93 @ 10:45 EST

1 five-gallon bucket of 3/8" bentonite pellets
8/2/93 @14:30 EST

1 100-lb. bags of 16-40 grade blasting sand
4 100-lb. bags of 20-40 grade sand
8/2/93

# CONSTRUCTION LOG

NAWQA WELL ID CP-28A




Notes

1 94-lb bag of Portland Type I cement
8/3/93

Backfilled with native materials
8/3/93 @ 16:50 EST

1 five-gallon bucket of 3/8" bentonite pellets
8/2/93 @11:15 EST

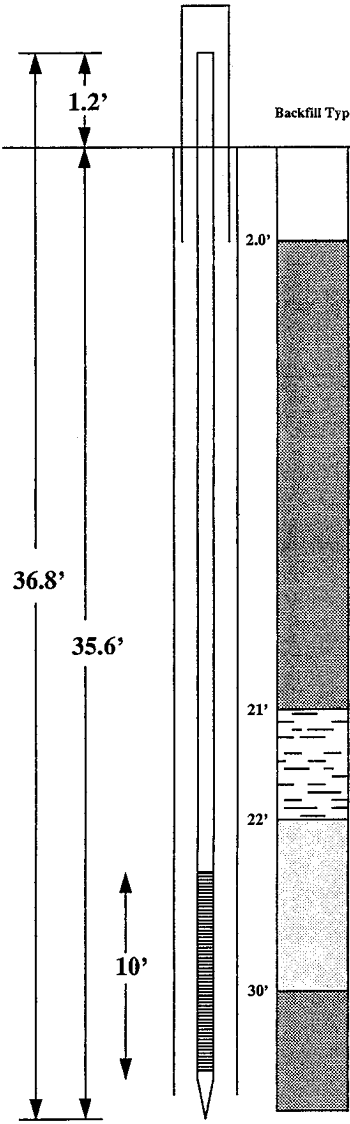
Possible bentonite bridge

2-1/4 100-lb bags of 20-40 grade sand
8/2/93

Native materials caved in

# CONSTRUCTION LOG

## NAWQA WELL ID CP-29D




Notes

1 94-lb bag of Portland Type I cement
7/29/93

Backfilled with native materials
7/29/93

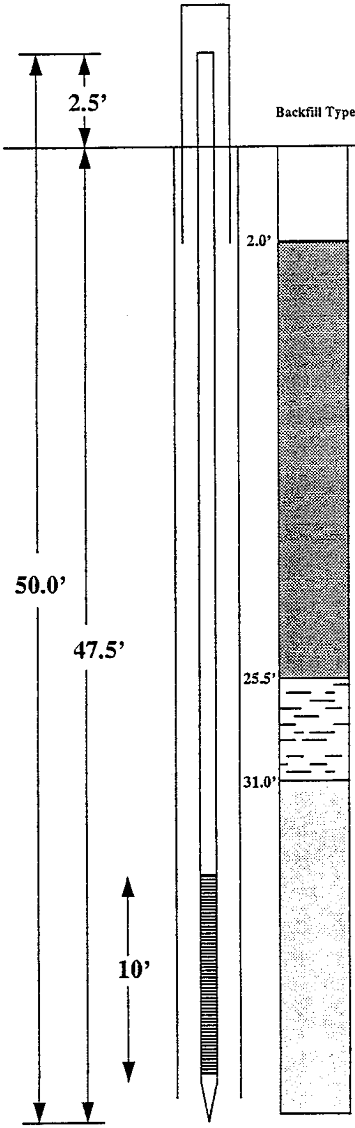
1 five-gallon bucket of 3/8" bentonite pellets
7/28/93 @16:00 EST

2-1/2 100-lb. bags of blasting sand
7/28/93

Native materials caved in

# CONSTRUCTION LOG

NAWQA WELL ID CP-30A




Notes

1 94-lb bag of Portland Type I cement
7/31/93

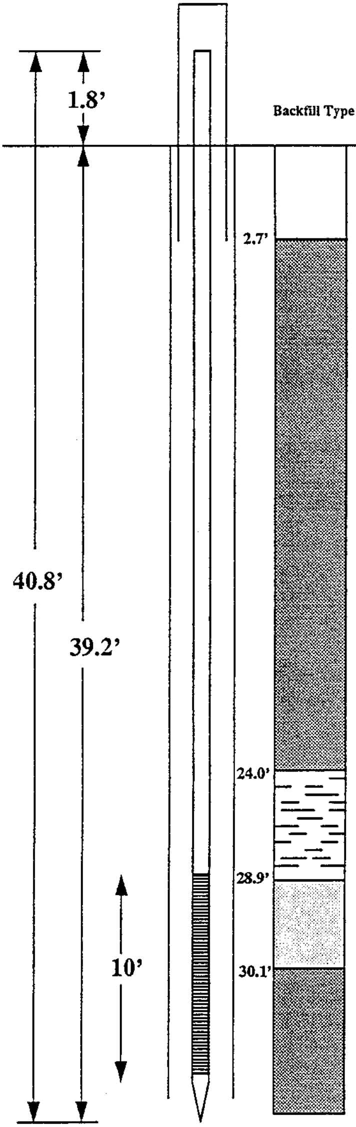
Backfilled with native materials
7/31/93 @ 15:00 EST

1 five-gallon bucket of 3/8" bentonite pellets
7/28/93 @8:30 EST

2 100-lb. bags of blasting sand
7/28/93

# CONSTRUCTION LOG

## NAWQA WELL ID AC-31A




Notes

1 94-lb bag of Portland Type I cement
7/23/93

Backfilled with native materials
7/23/93 @ 16:30 EST

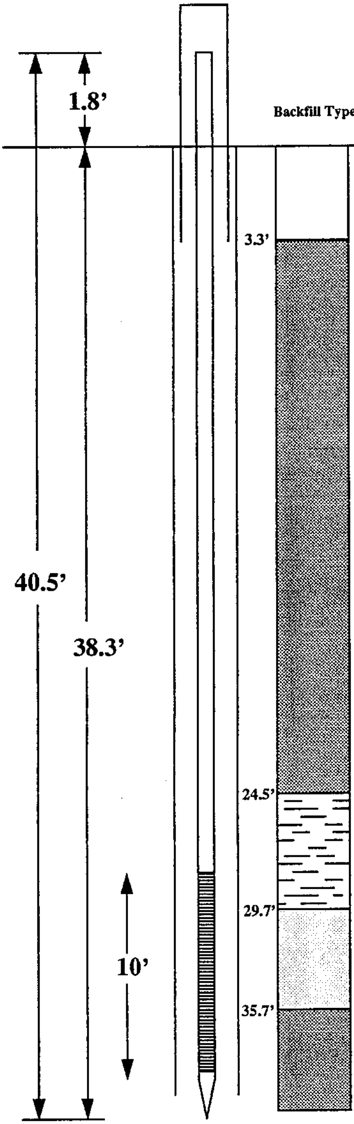
1 Five-gallon bucket of 3/8" bentonite pellets
7/22/93 @14:30 EST

1 100-lb. bag of 20-40 grade sand
7/22/93

Native material caved in

# CONSTRUCTION LOG

## NAWQA WELL ID AC-32A




Notes

1 94-lb bag of Portland Type I cement
7/28/93 @ 13:00

Backfilled with native materials
7/28/93

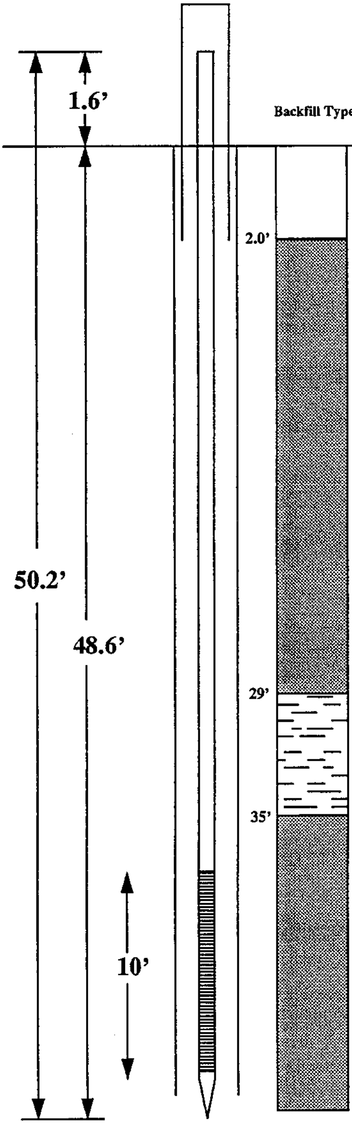
1 five-gallon bucket of 3/8" bentonite pellets
7/24/93 @8:00 EST

3 50-lb bags of play sand
7/24/93

Native materials caved in

# CONSTRUCTION LOG

## NAWQA WELL ID AC-33B




Notes

1 94-lb bag of Portland Type I cement
7/25/93

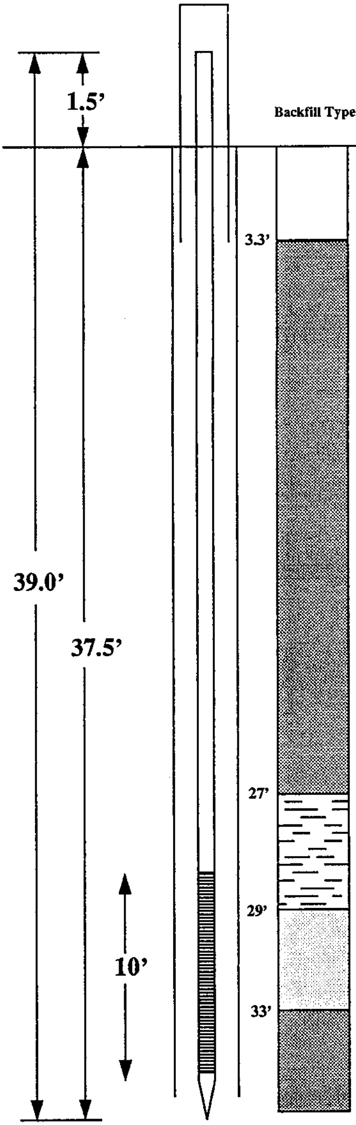
Backfilled with native materials
7/25/93 @ 15:30 EST

2 five-gallon buckets of 3/8” bentonite pellets
7/24/93 @12:00 EST

Native materials caved in

# CONSTRUCTION LOG

NAWQA WELL ID AC-34A




Notes

1 94-lb bag of Portland Type I cement
7/25/93

Backfilled with native materials
7/25/93 @ 13:20 EST

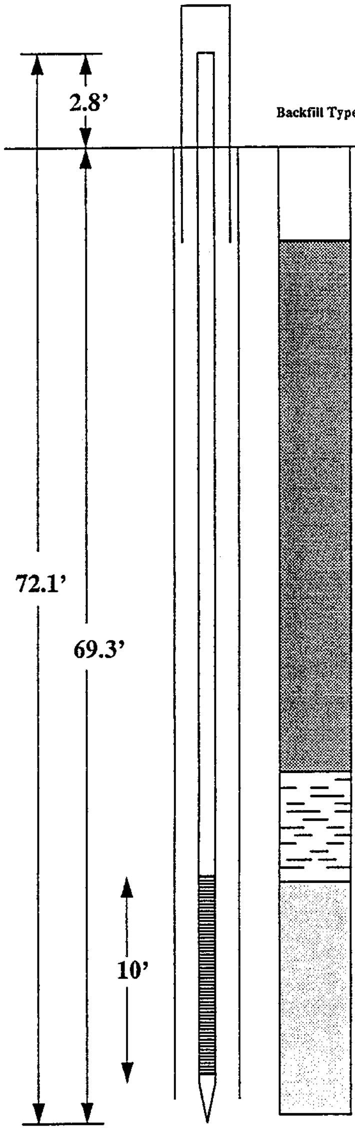
1 five-gallon bucket of 3/8" bentonite pellets
7/24/93 @9:30 EST

2 50-lb bags of play sand
7/24/93

Native materials caved in

# CONSTRUCTION LOG

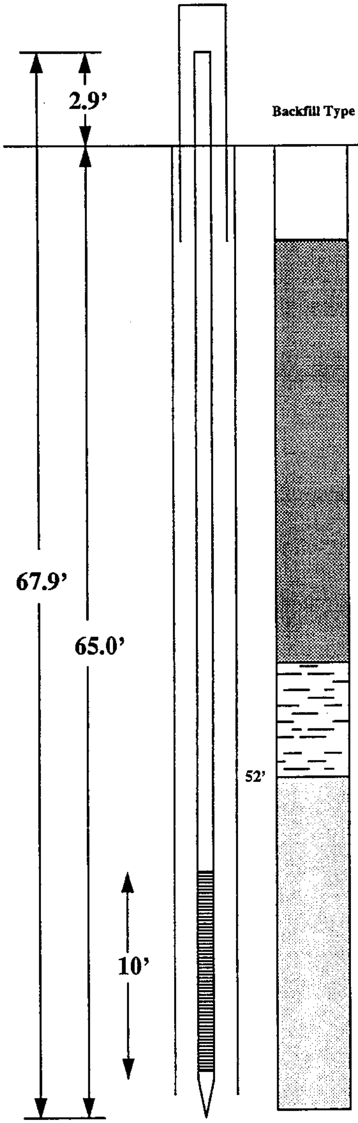
## NAWQA WELL ID AC-35B




| Backfill Type | Notes |
|---|---|
| | 1 94-lb bag of Portland Type I cement<br>7/24/93 |
| | Backfilled with native materials<br>7/24/93 @ 8:30 EST |
| | 1 Five-gallon bucket of 3/8" bentonite pellets<br>7/23/93 @13:30 EST |
| | 8 50-lb. bags of play sand<br>7/23/93 |

# CONSTRUCTION LOG

## NAWQA WELL ID AC-36B




**Notes**

1-1/2 94-lb bag of Portland Type I cement
7/24/93

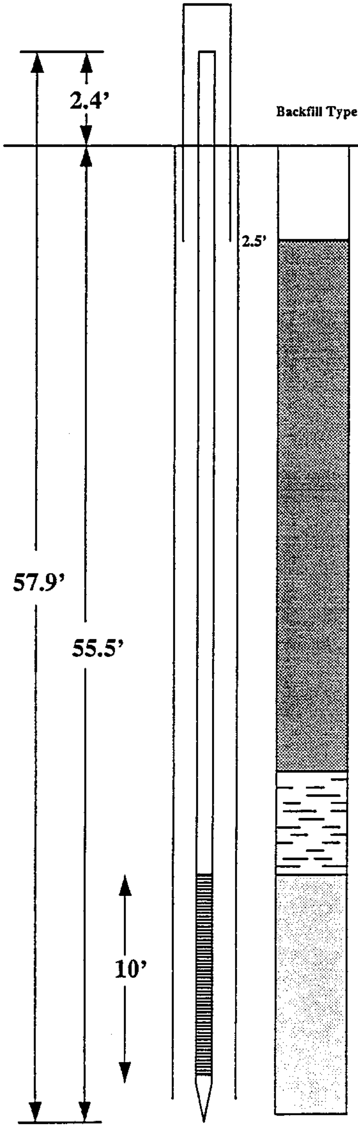
Backfilled with native materials
7/24/93 @ 7:30 EST

1 five-gallon bucket of 3/8" bentonite pellets
7/23/93 @18:30 EST

2 100-lb bags of 16-40 grade blasting sand
1 100-lb. bag of 20-40 grade sand
7/23/93

# CONSTRUCTION LOG

## NAWQA WELL ID AC-37B




Backfill Type | Notes

1 94-lb bag of Portland Type I cement
7/22/93

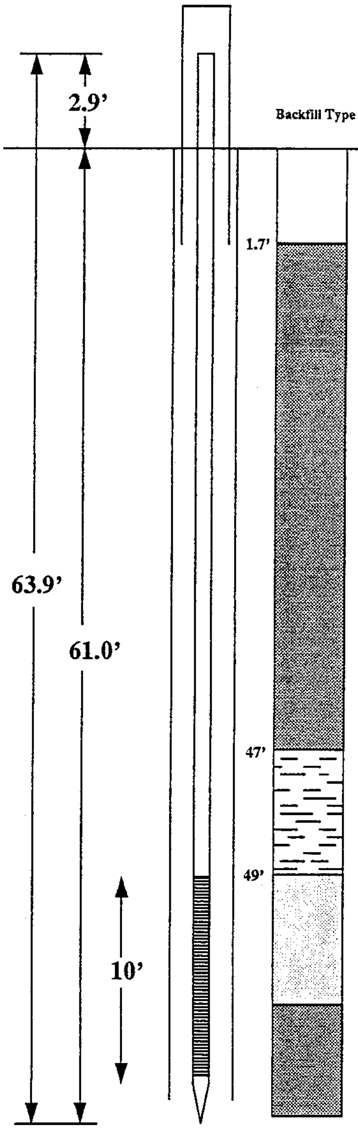
Backfilled with native materials
7/22/93 @ 9:00 EST

1 Five-gallon bucket of 3/8" bentonite pellets
7/21/93 @10:30 EST

2-1/2 100-lb. bags of 20-40 grade sand
7/21/93

# CONSTRUCTION LOG

## NAWQA WELL ID AC-38A




Notes

1 94-lb bag of Portland Type I cement
7/22/93

Backfilled with native materials
7/22/93 @ 9:00 EST

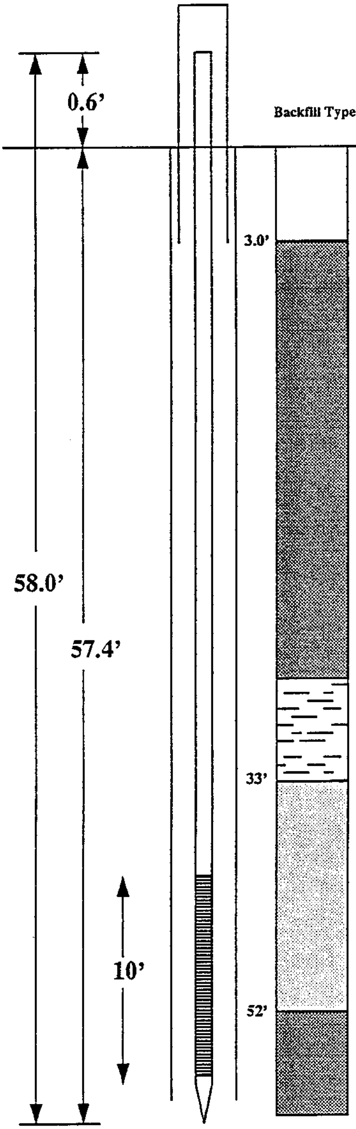
1 five-gallon bucket of 3/8" bentonite pellets
7/21/93 @15:30 EST

1 100-lb. bag of 20-40 grade sand
7/21/93

Native materials caved in

# CONSTRUCTION LOG

NAWQA WELL ID AC-39A




Notes

1-2/3 94-lb bags of Portland Type I cement
7/22/93

Backfilled with native materials
7/22/93 @ 18:30 EST

1 five-gallon bucket of 3/8" bentonite pellets
7/22/93 @9:30 EST

3 100-lb. bags of 20-40 grade sand
7/22/93

Native materials caved in

**Appendix B.** Pesticides Detectable by Methods 507, 508, 515.1, and 531.1

Table 1. Analytes detectable by EPA method 507 (screen 1).

| ANALYTE | STORET # | TYPICAL DETECTION LIMIT (PPB) |
|---|---|---|
| Alachlor | 77825 | 2 (M) |
| Ametryn | | |
| Atraton | | |
| Atrazine | 39033 | 0.30 (D) |
| Bromacil | | |
| Butachlor | | |
| Butylate | 81410 | 0.7 (D) |
| Carboxin | | |
| Chloprophan | | |
| Cycloate | | |
| Diazanon* | | 1 (D) |
| Dichlorvos | | |
| Disphenamid | | |
| Disulfoton* | 39010 | 1 (D) |
| Disulfoton sulftone* | | |
| Disulfoton sulfoxide* | | |
| EPTC | 81894 | 0.50 (D) |
| Ethoprop | 81758 | 0.50 (D) |
| Fenamiphos | | |
| Fenarimol | | |
| Fluridone | | |
| Hexazinone | | |
| MGK254 | | |
| Merphos* | | |
| Methyl paraoxon | | |
| Metolachlor | 38923 | 1.4 (D) |
| Metribuzin | 81408 | 0.9 (D) |
| Mevinphos | 39610 | 1.4 (D) |
| Molinate | | |
| Narpropamide | | |
| Norflurazon | | |
| Pebulate | | 0.60 (D) |
| Prometon | | |
| Pronamide* | | |
| Propazine | | |
| Simazine | 39055 | 0.6 (D) |
| Simetryn | | |
| Stirophos | | |
| Tebuthiuron | | |
| Terbacil | | |
| Terbufos* | 82088 | 0.9 (D) |
| Terbutryn | | |
| Triademefon | | |
| Tricyclazole | | |
| Vernolate | 82200 | 0.5 (D) |

Table 2. Analytes detectable by EPA method 508 (screen 2).

| ANALYTE | STORET # | TYPICAL DETECTION LIMIT (PPB) |
|---|---|---|
| 4,4 DDD | | |
| 4,4 DDE | | |
| 4,4 DDT | | |
| Aldrin | | |
| Chlorobenzylate | | |
| Chloroneb | | |
| Chlorothalnil | | |
| DCPA | | |
| Dieldrin | | |
| Endosulfan I | | |
| Endosulfan II | | |
| Endosulfan sulfate | | |
| Endrin | 39390 | 0.2 (M) |
| Endrinaldehyde | | |
| Etridiazol | | |
| Heptachlor | | 0.4 (M) |
| Heptachlor epoxide | | 0.4 (M) |
| Hexachlorobenzene | | |
| Methozychlor | 39480 | 40.0 (M) |
| Propachlor | | |
| Trifluralin | | |
| a-HCH | | |
| b-HCH | | |
| d-HCH* | | |
| G-HCH (lindane) | 39782 | 0.2 (M) |
| a-chlordane | | 2.0 (M) |
| b-chlordane | | 2.0 (M) |
| cis-Permethrin | | 0.3 (D) |
| trans-Permethrin | | 0.3 (D) |

(M) is a primary Maximum contaminant Level for drinking water, (D) is the detection limit for the equipment un use at the GDA Pesticide Residue Laboratory in Atlanta, and * indicates a qualitative result only. the number of significant digits varies within these tables.

Table 3. Analytes detectable by EPA methods 507, 508, 515.1, and 531.1.

| **Analyte** | **Storet #** | **Typical Detection Limit (ppb)** |
|---|---|---|
| 2,4-D | 39730 | 70 (M) |
| 2,4-DB | | |
| 2,4,5-TP | 39760 | 50 (M) |
| 2,4,5-T | | |
| 3,5 Dichlorobenzoic acid | | |
| 4-Nitrophenol* | | |
| Acifluren* | | 1.0 (D) |
| Bentazon | | |
| Chloramben | 82051 | 0.2 (D) |
| DCPA acid metabolites | | |
| Dalapon | | |
| Dicamba | | |
| Dicamba,5-hydroxy | | |
| Dichloroprop | | |
| Dinoseb | 38779 | 0.1 (D) |
| Pentachlorophenol (PCP) | | 0.1 (M) |
| Picloram | | |

Table 4. Analytes detectable by EPA method 531.1.

| Analyte | Storet # | Typical Detection Limit (ppb) |
|---|---|---|
| Aldicarb | | 3.0 (M) |
| Aldicarb sulfone | | 2.0 (M) |
| Aldicarb sulfoxide | | 4.0 (M) |
| Bayson | | |
| Carbaryl | | 10.0 (D) |
| Carbofuran | | 2.0 (D) |
| 3-Hydroxycarbofuran | | |
| Methiocarb | | |
| Oxamyl | | |

**Appendix C**
Sampling Results

**AC34A, Miller County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 12/01/93 | 12/10/93 | 7.48 | --- | 18.3 | -22.2 | ND |
| 01/05/94 | 01/13/94 | 7.52 | 8.5 | 19.3 | -14.1 | ND |
| 03/02/94 | 03/09/94 | 7.81 | 10.1 | 19.2 | -8.1 | ND |
| 04/19/94 | 04/29/94 | --- | 7.3 | 21.2 | -0.4 | ND |

**AC35B, Miller County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/28/93 | 11/09/93 | 7.75 | 8.39 | 19.1 | -42.3 | ND |
| 12/07/93 | 12/28/93 | 8.88 | --- | 18.4 | -37.77 | ND |
| 02/24/94 | 03/01/94 | 7.47 | 6.5 | 19.5 | -21.4 | ND |
| 04/19/94 | 04/29/94 | 6.88 | 6.2 | 21.1 | -11.95 | ND |

**AC36B, Miller County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 12/15/93 | 12/28/93 | --- | 6.4 | 19.6 | 34.9 | ND |

**AC38A, Miller County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/20/93 | 10/29/93 | 7.57 | 8.65 | 21.7 | -37.7 | ND |
| 12/08/93 | 12/28/93 | 7.65 | 7.3 | 19.8 | -36.45 | ND |
| 05/10/94 | 05/23/94 | --- | --- | --- | -22.2 | ND |

**AC39A, Miller County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/19/93 | 10/29/93 | 6.15 | --- | 22.6 | -33.6 | ND |
| 12/08/93 | 12/28/93 | 7.75 | 4.8 | 20.2 | -32.15 | ND |
| 02/23/94 | 03/01/94 | 6.93 | 4.8 | 20.4 | -19.9 | ND |
| 04/20/94 | 04/29/94 | --- | 5.9 | 21.6 | -16.5 | ND |

**CP15A, Randolph County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/19/93 | 10/27/93 | --- | 11.5 | 19.1 | -20.9 | ND |
| 12/02/93 | 12/10/93 | 5.56 | --- | 19.3 | -22.2 | ND |

**CP18A, Miller County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 12/15/93 | 12/28/93 | 9.12 | 8.1 | 19.9 | -30.83 | ND |
| 04/05/94 | 04/29/94 | 7.59 | 7.6 | 20.9 | -27.1 | ND |
| 05/04/94 | 05/18/94 | --- | 9.0 | 20.9 | -19.9 | ND |

**CP19C, Seminole County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/28/93 | 11/14/93 | 7.7 | 8.9 | 20.3 | -44.5 | ND |
| 04/20/94 | 04/29/94 | --- | 5.8 | 22.9 | -25.9 | ND |

**CP21A, Baker County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/27/93 | --- | 5.38 | 10.54 | 21.7 | 16.0 | ND |

**CP22A, Terrell County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/27/93 | --- | 5.38 | 10.54 | 21.7 | 16.0 | ND |

**CP23B, Terrell County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/03/93 | --- | --- | 9.34 | 20.0 | 32.2 | ND |

**CP24A, Taylor County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/05/94 | 10/14/93 | 4.52 | 9.27 | 23.8 | 37.3 | ND |
| 11/15/93 | 11/29/93 | 4.14 | 9.89 | 21.0 | 36.9 | ND |

**CP26B, Sumter County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 11/30/93 | 12/10/93 | 4.4 | 9.25 | 19.3 | -4.2 | ND |
| 01/12/94 | 01/19/94 | --- | 6.2 | 19.8 | -3.3 | ND |
| 04/27/94 | 04/29/94 | 4.33 | 5.1 | 22.2 | -7.6 | ND |
| 06/13/94 | 06/21/94 | 3.26 | 4.5 | 22.2 | -3.25 | ND |

**CP27A, Worth County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/11/93 | 10/27/93 | --- | 9.47 | 20.3 | -10.9 | ND |
| 11/03/93 | 11/04/93 | 7.53 | 9.27 | 20.4 | -7.4 | ND |
| 02/22/94 | 03/10/94 | 7.0 | 8.8 | 19.7 | -5.5 | ND |
| 04/28/94 | 05/04/94 | 6.29 | 7.8 | 20.3 | -4.5 | ND |
| 06/14/94 | 06/21/94 | 6.67 | 6.8 | 20.4 | -7.25 | ND |

**CP28A, Lee County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/12/93 | 10/27/93 | 7.42 | 9.23 | 17.7 | -18.8 | ND |
| 11/16/93 | 11/29/93 | 9.24 | --- | 21.8 | -13.9 | ND |
| 01/12/94 | 01/12/94 | --- | 6.7 | 19.6 | -13.7 | ND |
| 04/27/94 | 04/29/94 | 6.75 | 6.2 | 21.9 | -13.5 | ND |
| 06/14/94 | 06/21/94 | 6.81 | 5.6 | 21.3 | -14.6 | ND |

**CP31A, Miller County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 12/01/93 | 12/10/93 | 5.19 | --- | 18.3 | 15.2 | ND |

**CP29D, Dougherty County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/13/93 | 10/27/93 | --- | 11.6 | 17.3 | -18.8 | ND |
| 11/16/93 | 11/29/93 | 7.77 | --- | 20.0 | -17.4 | ND |
| 02/01/94 | 02/09/94 | --- | 7.9 | 18.8 | -12.5 | ND |
| 04/04/94 | 04/29/94 | 7.9 | 8.4 | 19.1 | -11.3 | ND |
| 05/03/94 | 05/18/94 | 6.86 | 8.2 | 19.3 | -9.8 | ND |
| 06/20/94 | 06/24/94 | 6.27 | 8.6 | 19.4 | -14.1 | ND |

**CP30A, Mitchell County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/18/93 | 10/27/93 | --- | 8.72 | 22.5 | -33.1 | ND |
| 12/.2/93 | 12/10/93 | 7.83 | --- | 19.4 | -34.55 | ND |
| 02/22/94 | 03/01/94 | 7.26 | 6.8 | 20.3 | -35.6 | ND |
| 04/05/94 | 04/29/94 | 7.5 | 7.6 | 20.6 | -35.0 | ND |
| 05/04/94 | 05/18/94 | --- | 9.8 | 21.0 | -24.1 | ND |

**LC1C, Sumter County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 11/02/93 | 11/15/93 | --- | 9.5 | 17.1 | -14.7 | ND |
| 12/08/93 | 12/28/93 | 8.19 | 7.0 | 18.2 | -7.05 | ND |
| 02/02/94 | 02/09/94 | --- | 7.5 | 18.0 | -1.3 | ND |

**LC2A, Sumter County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 09/29/93 | 10/08/93 | 7.11 | | | 59.6 | ND |

**LC3A, Sumter County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/06/93 | 10/14/93 | 6.35 | 8.27 | 22.6 | -66.6 | --- |
| 11/01/93 | 11/15/94 | 6.25 | 10.58 | 17.1 | -64.9 | --- |
| 01/06/94 | 01/13/94 | 6.65 | 7.4 | 19.1 | -65.1 | --- |
| 03/14/94 | 03/25/94 | 6.11 | 7.7 | 19.1 | -64.2 | --- |

**LC5B, Sumter County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/06/93 | 10/14/93 | 5.52 | 8.3 | 22.9 | -17.9 | ND |
| 11/01/93 | 11/29/93 | 4.69 | 11.33 | 17.0 | -12.35 | ND |
| 01/11/94 | 01/19/94 | --- | 7.9 | 19.3 | -7.9 | ND |
| 03/29/94 | 04/07/94 | 4.52 | 7.0 | 19.3 | -3.0 | ND |
| 04/27/94 | 05/06/94 | 4.59 | 7.4 | 20.2 | -8.6 | ND |
| 06/13/94 | 06/21/94 | 4.12 | 6.3 | 20.9 | -11.3 | ND |

**LC7A, Sumter County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 10/11/93 | 10/27/93 | --- | 4.74 | 18.6 | -24.8 | ND |
| 11/03/93 | 11/29/93 | 7.32 | 4.83 | 18.3 | -16.7 | ND |
| 02/22/94 | 03/01/94 | 7.7 | 3.7 | 18.6 | -5.4 | ND |
| 03/15/94 | 03/25/94 | 7.73 | 2.5 | 20.8 | -4.5 | ND |
| 04/11/94 | 04/29/94 | --- | --- | --- | -5.6 | ND |
| 05/09/94 | 05/23/94 | 7.19 | NA | NA | -7.2 | ND |
| 06/21/94 | 06/24/94 | 7.09 | 2.6 | 20.3 | -6.65 | ND |

**LC8A, Sumter County**

| Date Sampled | Date Analyzed | pH | DO | Temp. (C) | SWL | Results |
|---|---|---|---|---|---|---|
| 09/30/93 | 10/08/93 | 7.43 | NA | --- | -38.2 | ND |
| 11/02/93 | 11/29/93 | 7.81 | 9.61 | 17.2 | -29.6 | ND |
| 01/06/94 | 01/03/94 | 7.69 | 6.8 | 18.3 | -15.15 | ND |
| 03/15/94 | 03/25/94 | 7.42 | 6.2 | 20.4 | -11.9 | ND |
| 04/11/94 | 04/29/94 | 7.99 | 7.13 | 19.84 | -15.4 | ND |
| 05/09/94 | 05/23/94 | 7.38 | --- | --- | -15.1 | ND |

For convenience in selecting our reports from your bookshelves, they are color-keyed across the spine by subject as follows:

| | |
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| Red | Valley and Ridge mapping and structural geology |
| Dk. Purple | Piedmont and Blue Ridge mapping and structural geology |
| Maroon | Coastal Plain mapping and stratigraphy |
| Lt. Green | Paleontology |
| Lt. Blue | Coastal Zone studies |
| Dk. Green | Geochemical and geophysical studies |
| Dk. Blue | Hydrology |
| Olive | Economic geology |
| | Mining directory |
| Yellow | Environmental studies |
| | Engineering studies |
| Dk. Orange | Bibliographies and lists of publications |
| Brown | Petroleum and natural gas |
| Black | Field trip guidebooks |
| Dk. Brown | Collections of papers |

Colors have been selected at random, and will be augmented as new subjects are published.

Editor: Melynda Lewis