Engineering Report on the Construction and Testing of the Aquifer Storage and Recovery (ASR) System at the BCOES 2A Water Treatment Plant

Prepared for the

Broward County Office of Environmental Services

BCOES Project Number: 1134 ASR

and

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Executive Summary

An aquifer storage and recovery (ASR) well system has been constructed at the Broward County Office of Environmental Services (BCOES) 2A Water Treatment Plant (WTP) in Pompano Beach, Florida. The purpose of the ASR system is to store raw Biscayne aquifer water during times of excess, and recover this water during peak, seasonal, or emergency demands. Raw water is provided by surficial wellfields, completed into the prolific Biscayne aquifer. Water is stored in the brackish Floridan Aquifer System, confined by overlying clays of the Hawthorn Group that impede upward migration of stored water.

This facility will be one of the first in Florida to store raw groundwater, whereas most existing ASR systems use treated water. Raw water quality of the Biscayne aquifer water proposed to be stored indicates compliance with primary drinking water standards (DWS), but some secondary DWS (e.g., color, iron, odor) are exceeded. The State of Florida's Underground Injection Control (UIC) program regulates well construction practices, and the State's water quality criteria exemption (WQCE) allows exemption for secondary DWS parameters.

The ASR system consists of two, 1,200-feet wells; one a monitor well (6-inch) and the other an ASR well (16-inch). Surface facilities include piping, a recharge pump, electrically-actuated control valves, a bi-directional flowmeter, electric submersible pump, electrical systems, and instrumentation and control. Raw water is conveyed both to and from the ASR system via an onsite 20-inch raw water main. Stored water is pumped from the ASR well and conveyed to the head of the 2A WTP for treatment and distribution. Recharge and recovery rates are approximately 2.5 to 3.5 mgd.

Construction of the ASR system is now complete. An operations and maintenance (O&M) manual has been prepared as a companion document to the engineering report. It outlines suggested operational, monitoring, and maintenance of the ASR system. The engineering report, O&M manual, and record drawings of the facility are documents presented to FDEP in support of a request for operational testing. Upon approval of operational testing from FDEP, a cycle testing plan will be implemented. This will involve a series of recharge, storage, and recovery cycles to evaluate system performance. Upon successful completion of the cycle testing plan, an application for an operating permit shall be submitted to FDEP. This application will include the cycle testing data as supporting information.

SECTION 1

Introduction

Background Information

The Broward County Office of Environmental Services (BCOES) retained the services of Montgomery Watson (and CH2M HILL as a subconsultant) in December 1993 to design and oversee construction of an aquifer storage and recovery (ASR) system at the BCOES 2A water treatment plant (WTP) in Pompano Beach, Florida. The purpose of the project is to store raw Biscayne aquifer water into an ASR well for retrieval during peak, seasonal, or emergency demand periods. The ASR well is completed into the upper portions of the Floridan Aquifer System, separated from the overlying Biscayne aquifer by approximately 600 feet of relatively impermeable clays of the Hawthorn Group.

The location map for the 2A WTP is shown in Figure 1-1. The site layout of the ASR system is shown in Figure 1-2. The ASR well is cased with nominal 16-inch-diameter steel to an approximate depth of 995 feet below pad level (bpl), and is completed with open-hole construction to a depth of approximately 1,200 feet bpl. In addition to the ASR well, an exploratory, single-zone monitor well (MW-1) was constructed to evaluate potential ASR zones, and to monitor water quality of the stored water within the ASR zone. MW-1 is located approximately 275 feet due west of the ASR well on the 2A WTP site as shown in Figure 1-2.

A permit application was submitted to the Florida Department of Environmental Protection (FDEP) for the construction of the ASR system in August 1993. A permit for a treated water ASR system was issued by FDEP (Permit Number UC 06-242411) on July 29, 1994, and modified as UC-06-287325 on May 1, 1996. Subsequent to issuance of the treated water permit, BCOES applied for (August 1995) a water quality criteria exemption (WQCE) to facilitate storage of raw water, which was granted by FDEP on July 31, 1997. Copies of the draft raw water ASR construction permit (UC 06-242418), WQCE, and Broward County Department of Health (BCDH) are presented in Appendix A.

Project Description

Montgomery Watson served as overall project manager, with lead activities in project permitting. CH2M HILL served as the engineer of record for the design and construction activities for the ASR system. Diversified Drilling Corporation (DDC) of Tampa, Florida, selected as the low-bid contractor to construct the ASR system, was issued a Notice to

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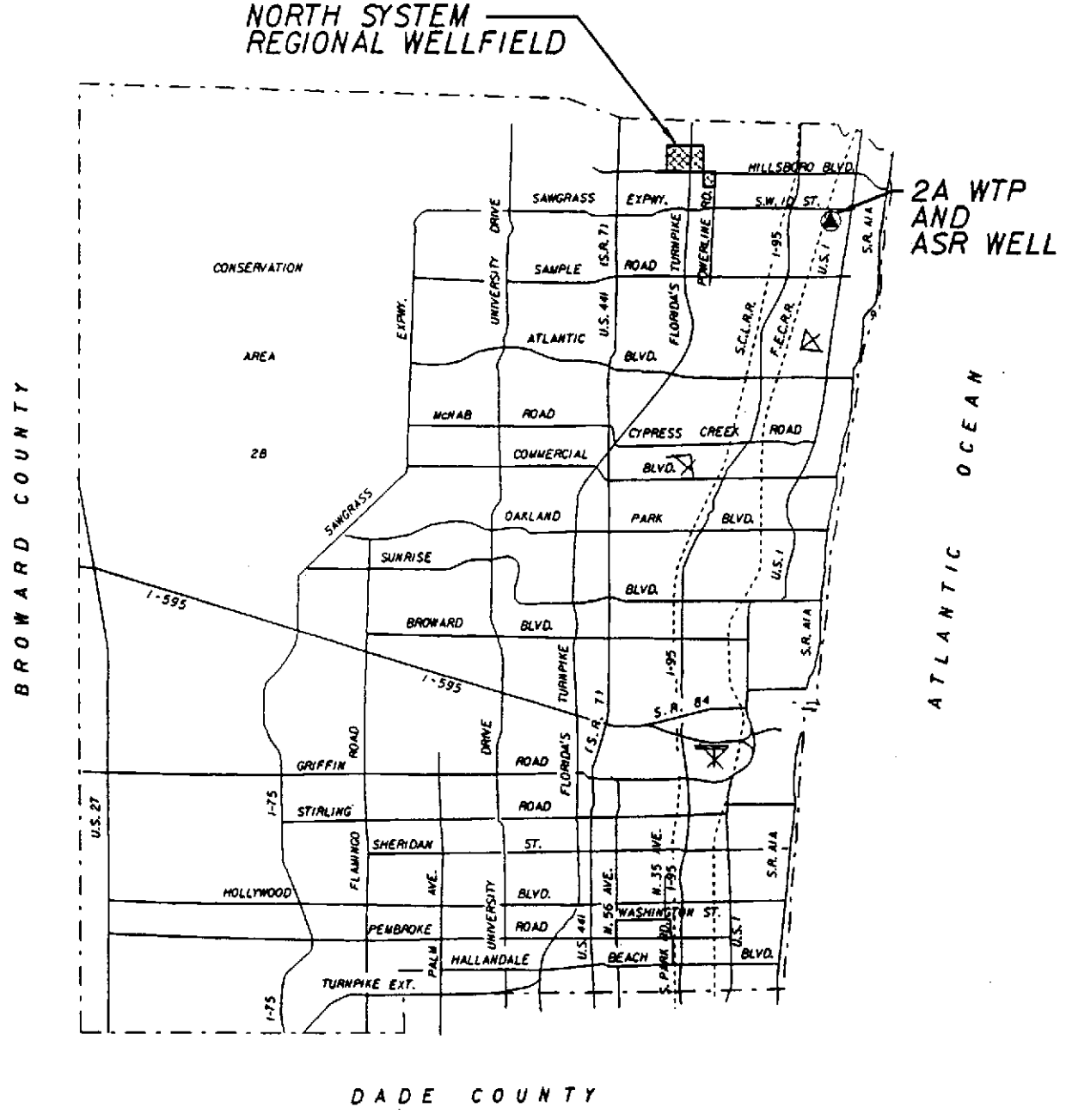

FIGURE 1-1
LOCATION MAP

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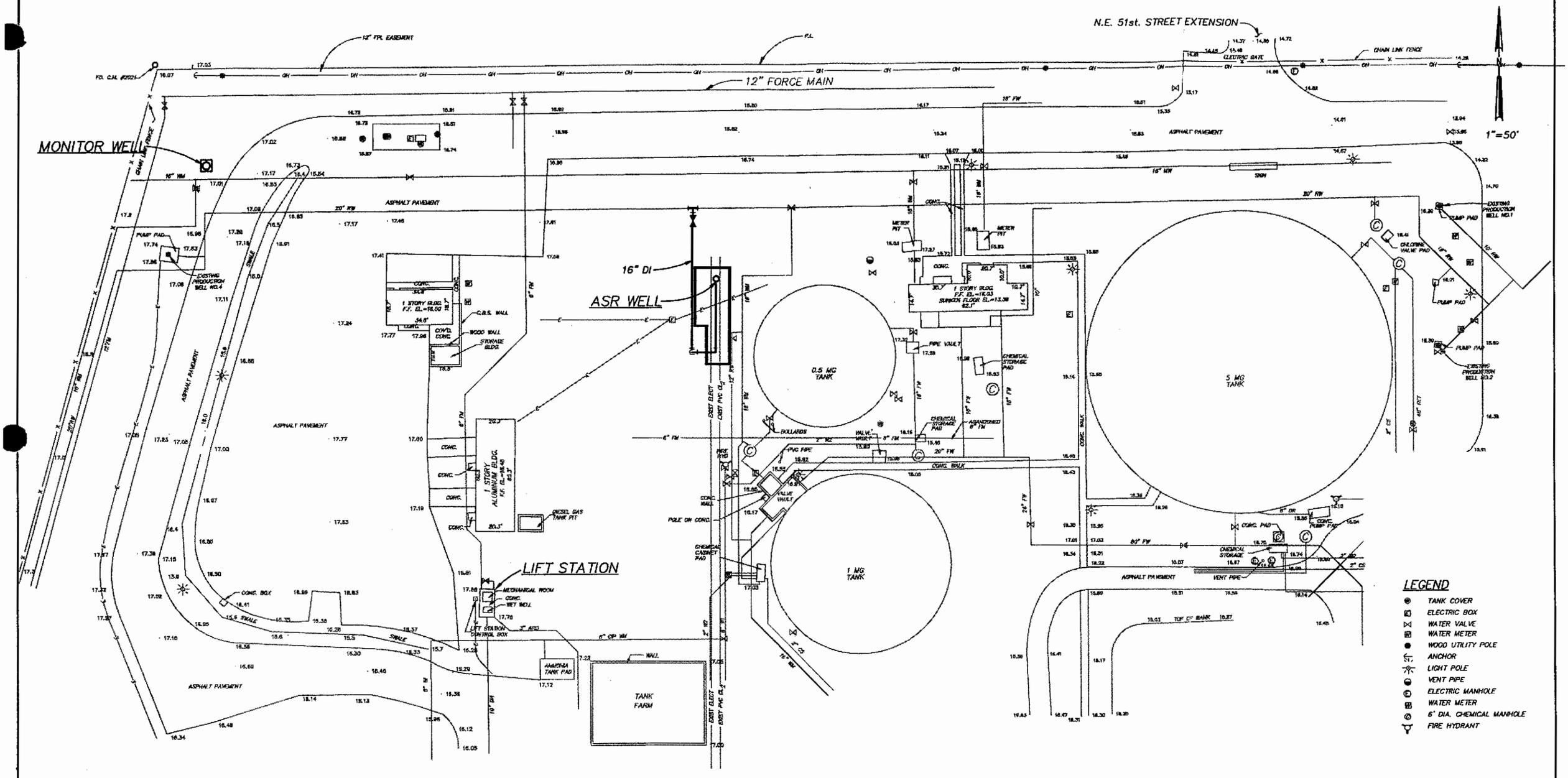

FIGURE 1-2
SITE PLAN

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Proceed on July 10, 1996. Construction was completed in September 1997 at a total construction cost of approximately $910,000.

Construction activities at MW-1 and ASR-1 included the installation of temporary drilling pads and shallow pad monitor wells; drilling, construction and testing of MW-1 and ASR-1, and the completion of wellhead piping and valves, electrical facilities, and instrumentation and control.

The FDEP Technical Advisory Committee (TAC) coordinated the actions of local, state, and federal; agencies including the Broward County Department of Health (BCDH), Broward County Department of Natural Resource Protection (DNRP), the South Florida Water Management District (SFWMD), the Environmental Protection Agency (EPA), and the United States Geological Survey (USGS). A tabulated summary of construction activities and weekly summaries of the construction progress are presented in Appendix B and C, respectively.

SECTION 2

Construction Phase

The following section describes the construction, drilling, and testing details associated with the construction of the ASR well (ASR-1) and the monitor well (MW-1).

Temporary Drilling Pads

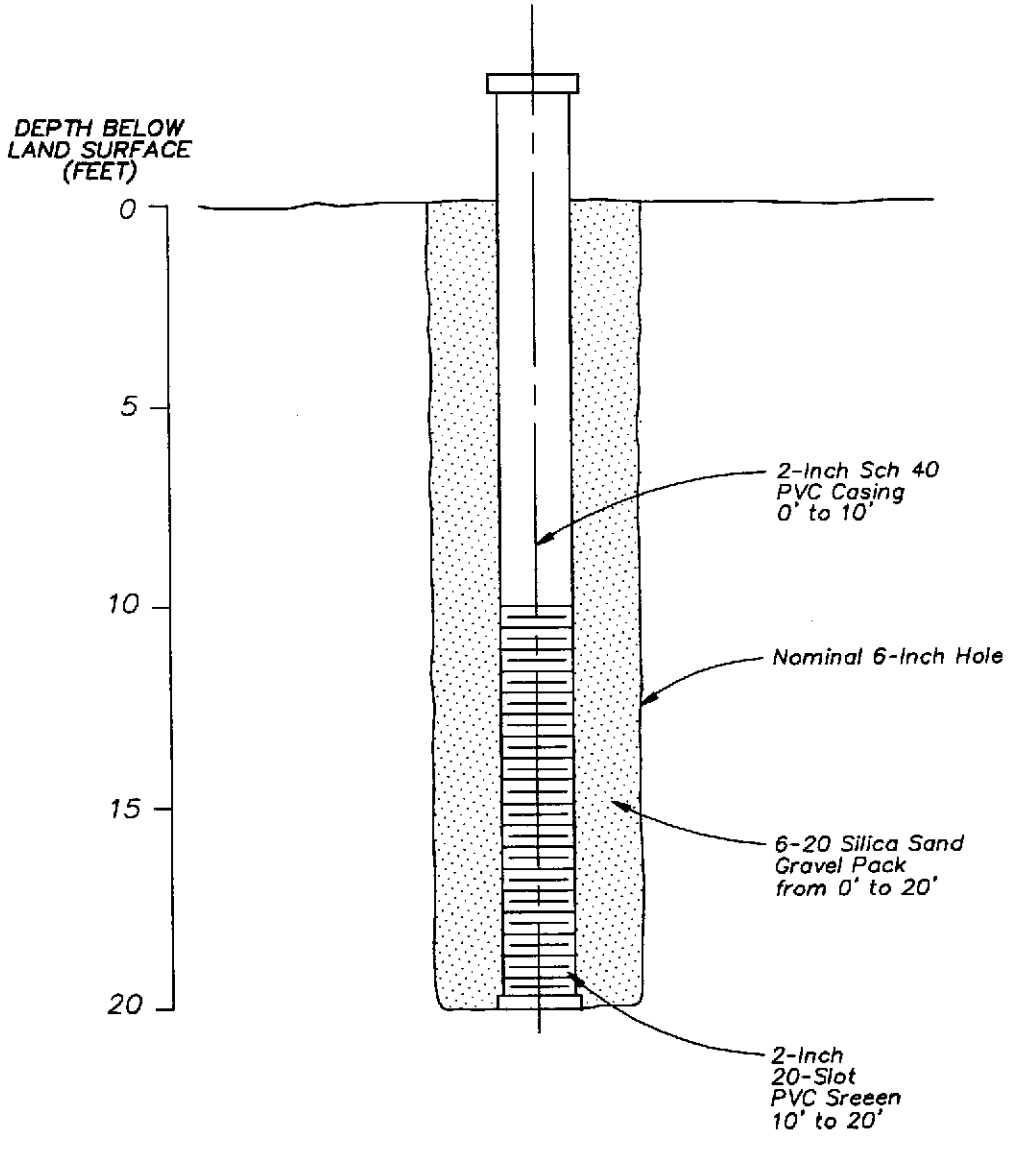
As required by the FDEP construction permit (Appendix A), temporary drilling pads were installed at both the MW-1 and ASR-1 sites prior to well construction. The purpose of these pads was to containerize drilling fluids and prevent migration of brackish groundwater into the Biscayne aquifer—the source of potable water for BCOES. DDC elected to construct the temporary pads by pouring concrete slabs with concrete block walls. Upon cement curing, a relatively impermeable coating was applied to the slab and walls to prevent leakage of drilling fluids. Upon completion of well construction activities, the pads were demolished to facilitate construction of the smaller, permanent well pads.

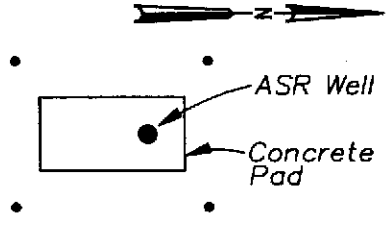
Pad Monitor Wells

As required by the FDEP construction permit (Appendix A), pad monitor wells (PMWs) were installed at MW-1 and ASR-1. PMWs are monitor wells completed into the Biscayne aquifer at a depth of approximately 20 feet, and installed at each corner of the drilling pads to monitor for discharge of drilling fluids and brackish groundwater during construction. Following installation of the PMWs, surficial groundwater samples were collected and analyzed to establish background water quality data, and sampled weekly during construction. A diagram of a typical PMW is presented in Figure 2-1. Water quality data from the PMWs is discussed in Section 4 of this report.

Single-Zone Monitor Well (MW-1)

Drilling of the 6-5/8-inch single-zone MW-1 commenced on August 19, 1996. Mud rotary techniques were used to drill through the Biscayne aquifer and clay intervals to a depth of approximately 1,000 feet bpl. Mud-rotary drilling is most appropriate while drilling through clay sediments, but yields limited information regarding hydraulic characteristics or water quality data. Reverse- air techniques were used during subsequent drilling stages





Pad Monitor Well Orientation

FIGURE 2-1
TYPICAL PAD MONITOR WELL COMPLETION DIAGRAM

CH2M HILL

to a total depth of 1,200 feet bpl to remove cuttings from the borehole and to collect water samples at 30-foot intervals. An open-circulation system was used during reverse-air drilling to collect more representative water samples during drilling. Water produced while reverse-air drilling was conveyed via temporary piping to an onsite 1 million gallon (MG) storage tank and from there to an onsite lift station for disposal.

The drilling schedule and casing setting depths were designed to conform to the hydrogeologic features observed at the site, as well as various regulatory agency requirements. Geologic formation samples were collected and described at 10-foot intervals during the drilling of the pilot hole, as more fully described in Section 3, *Geologic Framework*. Data from the pilot hole interval (formation samples [cuttings], water samples, and geophysical logs) were evaluated to provide the basis for describing the geologic formations encountered, to assist in selection of the actual casing setting depths, and to interpret the site lithology and hydrogeology. The pilot hole was then reamed to the specified diameter to the selected final casing setting depth as approved by FDEP.

Construction of MW-1 took place with three concentric steel casings (24-, 14-, and 6-5/8-inch outside diameters). The 24-inch casing was vibrated in place to an approximate depth of 40 feet bpl and did not require cement. The cementing program was specifically tailored for each casing installed. A table summarizing the casing depths and the types and quantities of cement used is presented in Appendix D. Appendix E contains the casing mill certificates for each of the casings used during construction. Refer to the MW-1 completion diagram presented in Figure 2-2 and the casing mill certificates in Appendix E for more precise casing dimensions.

The monitor zone was completed in a permeable zone between 990 and 1,200 feet bpl. Construction of MW-1 began with the drilling of a nominal 12-1/4-inch pilot hole to 430 feet bpl. The pilot hole was then geophysically logged (caliper, gamma ray, spontaneous potential [SP] and long and short normal [LSN] electric logs) and reamed to a nominal 24-inch diameter to a depth of 400 feet bpl. A 14-inch-diameter steel casing was installed and cemented through the surficial aquifer to a depth of 400 feet bpl.

Below the 14-inch casing, drilling of the 12-1/4-inch pilot hole continued within the casing to 1,015 feet bpl. The pilot hole was then geophysically logged (caliper, gamma ray, SP and LSN electric logs) and reamed to a nominal 14-inch diameter to a depth of 990 feet bpl. Installation of the 6-5/8-inch-diameter casing was completed via pressure- and tremie-grout methods through the confining units of the Hawthorn Group to a depth of 990 feet bpl. This setting depth was selected to seal off the overlying clay layers of the Hawthorn Group from

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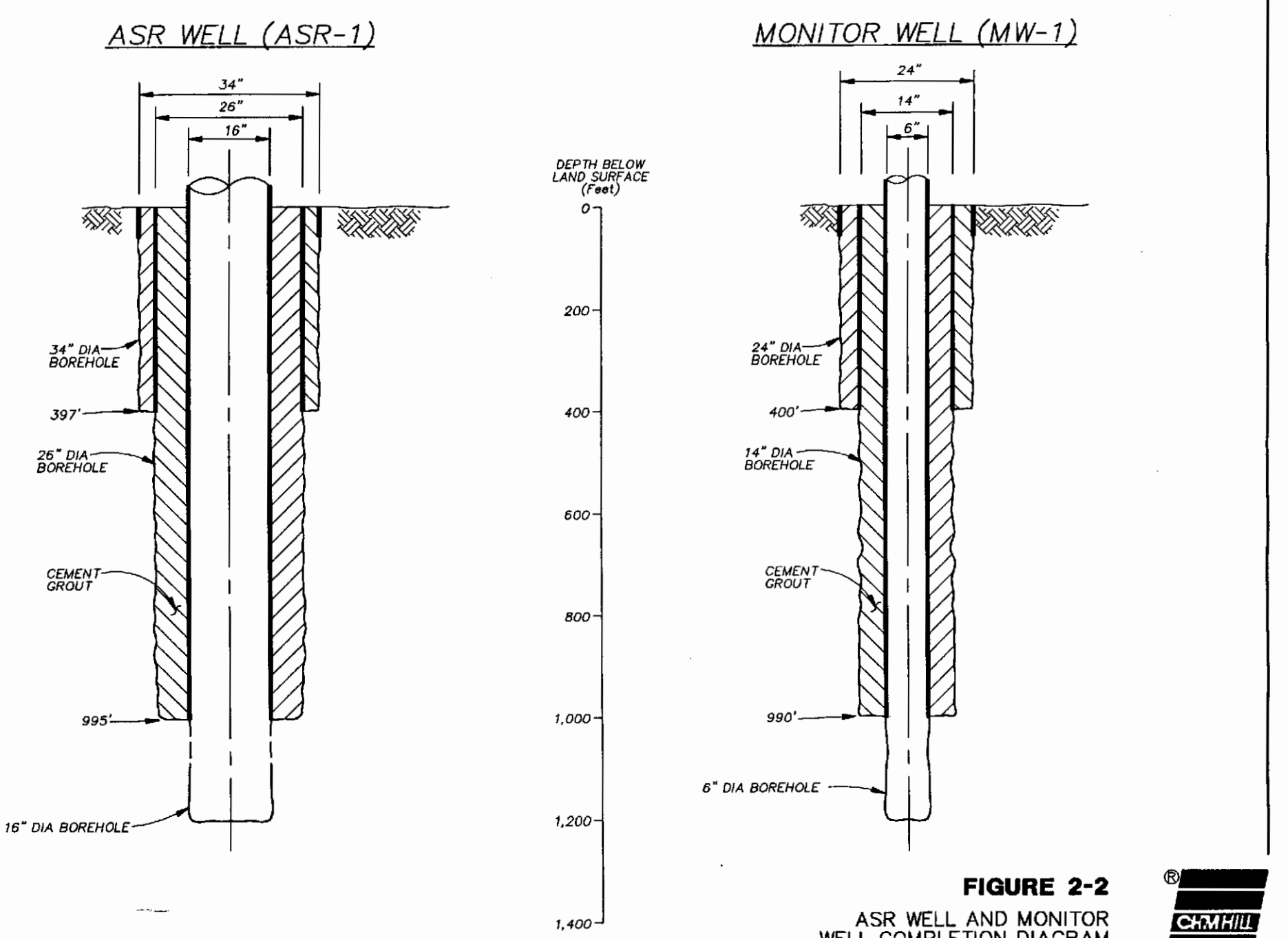

FIGURE 2-2

ASR WELL AND MONITOR WELL COMPLETION DIAGRAM

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the permeable limestone of the storage zone. Following the completion of casing cementing, a successful pressure test on the 6-5/8-inch steel casing was conducted, as described in Section 5, *Mechanical Integrity*.

Reverse-air drilling with open circulation was conducted through the cement plug at the base of the 6-5/8-inch casing to 1,200 feet bpl. The pilot hole was then developed with compressed air to remove cuttings/fines from the borehole and geophysically logged. The logs performed through this interval include caliper, gamma ray, SP, LSN electric, temperature, fluid resistivity, and flowmeter, as more fully described in Section 4, *Hydrogeologic Testing*.

The MW-1 wellhead was completed with the construction of a 6 x 6-foot concrete pad, wellhead piping and valves, sample taps, and the installation of below-grade, 3-inch-diameter PVC discharge piping. Discharge from the monitor zone is conveyed via this 3-inch piping to the onsite lift station (see Figure 1-2) for disposal. A pressure transmitter located at the wellhead transmits pressure readings from MW-1 to the field panel for display and recording. A pressure gauge at the wellhead allows local observation of ambient pressure from MW-1. Figure 2-3 depicts the completion diagram for the MW-1 wellhead.

ASR Well (ASR-1)

Drilling of the 16-inch ASR well (ASR-1) commenced on October 3, 1996. Mud rotary techniques were used to drill through the Biscayne aquifer and clay intervals to a depth of approximately 1,000 feet bpl. Reverse- air techniques were used during subsequent stages to a total depth of 1,200 feet bpl to remove cuttings from the borehole and to collect water samples at 30-foot intervals. An open-circulation system was used during reverse-air drilling to collect more representative water samples during drilling. Water produced while drilling on reverse air was conveyed via temporary piping to an onsite 1 MG storage tank and from there to an onsite lift station for disposal.

The drilling schedule and casing setting depths were designed to conform to the hydrogeologic features observed at the site, as well as various regulatory agency requirements. Geologic formation samples were collected and described at 10-foot intervals during the drilling of the pilot hole, as more fully described in Section 3, *Geologic Framework*. Data from the pilot hole interval (formation samples [cuttings], water samples, and geophysical logs) were evaluated to provide the basis for describing the geologic formations encountered, to

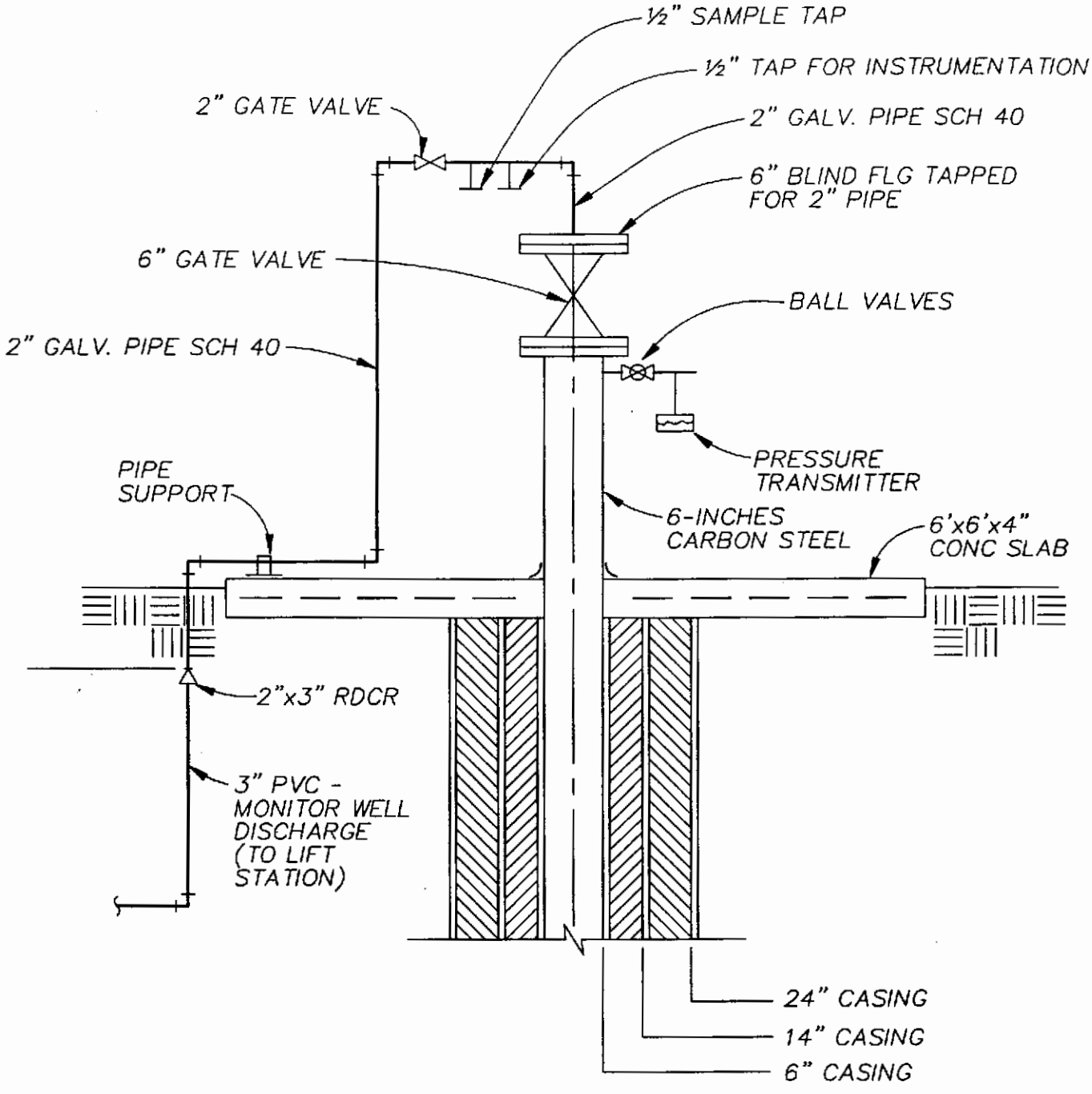

FIGURE 2-3

MONITOR WELL WELLHEAD DETAIL

assist in selection of the actual casing setting depths, and to interpret the site lithology and hydrogeology. The pilot hole was then reamed to the specified diameter to the selected final casing setting depth as approved by FDEP.

Construction of ASR-1 took place with three concentric steel casings (36-, 26-, and 16-inch outside diameters). The 36-inch casing was vibrated in place to an approximate depth of 40 feet bpl and did not require cement. The cementing program was specifically tailored for each casing installed. A table summarizing the casing depths and the types and quantities of cement used is presented in Appendix D. Appendix E contains the casing mill certificates for each of the casings used during construction. Refer to the ASR-1 completion diagram presented in Figure 2-2 and the casing mill certificates in Appendix E for more precise casing dimensions.

The ASR storage zone was completed in a permeable zone between 995 and 1,200 feet bpl. Construction of ASR-1 began with the drilling of a nominal 12-1/4-inch pilot hole to 430 feet bpl. The pilot hole was then geophysically logged (caliper, gamma ray, SP and LSN electric logs) and reamed to a nominal 36-inch diameter to a depth of 400 feet bpl. A 26-inch-diameter steel casing was installed and cemented through the surficial aquifer system to a depth of 397 feet bpl.

Below the 26-inch casing, drilling of the 12-1/4-inch pilot hole continued within the casing to a depth of 1,007 feet bpl. The pilot hole was then geophysically logged (caliper, gamma ray, SP and LSN electric logs) and reamed to a nominal 26-inch diameter to a depth of 1,000 feet bpl. Installation of the 16-inch-diameter casing was completed via pressure- and tremie-grout methods through the confining units of the Hawthorn Group to a depth of 995 feet bpl. This setting depth was selected to isolate the storage zone form the overlying clay layers of the Hawthorn Group. Following the completion of casing cementing, a successful pressure test on the 16-inch steel casing was conducted as more fully described in Section 5, *Mechanical Integrity*.

Reverse-air drilling with open circulation was conducted with a nominal 16-inch-diameter bit through the cement plug at the base of the 16-inch casing to 1,200 feet bpl. The pilot hole was then developed with compressed air to remove cuttings/fines from the borehole and geophysically logged, as more fully described in Section 4, *Hydrogeologic Testing*.

The ASR-1 wellhead was completed with the construction of a 52 x 18-foot concrete pad, wellhead piping, electrically and manually operated valves, bi-directional flowmeter, elec-

trical facilities, and instrumentation and control. A submerged pressure transducer records pressure readings from ASR-1 that are transmitted to the field panel for display and recording. One pressure gauge at the wellhead allows local observation of ambient pressure from ASR-1. Other pressure gauges allow observation of suction and discharge pressure from the recharge pump and discharge pressure from the recovery pump. A conductivity probe continuously transmits conductivity values of stored water to the field panel where it is recorded. Sample taps allow water samples to be obtained for analysis to document water quality per the permit. Figure 2-4 depicts the completion diagram for the ASR-1 wellhead. Figure 2-5 is a plan view of wellhead piping at the site.

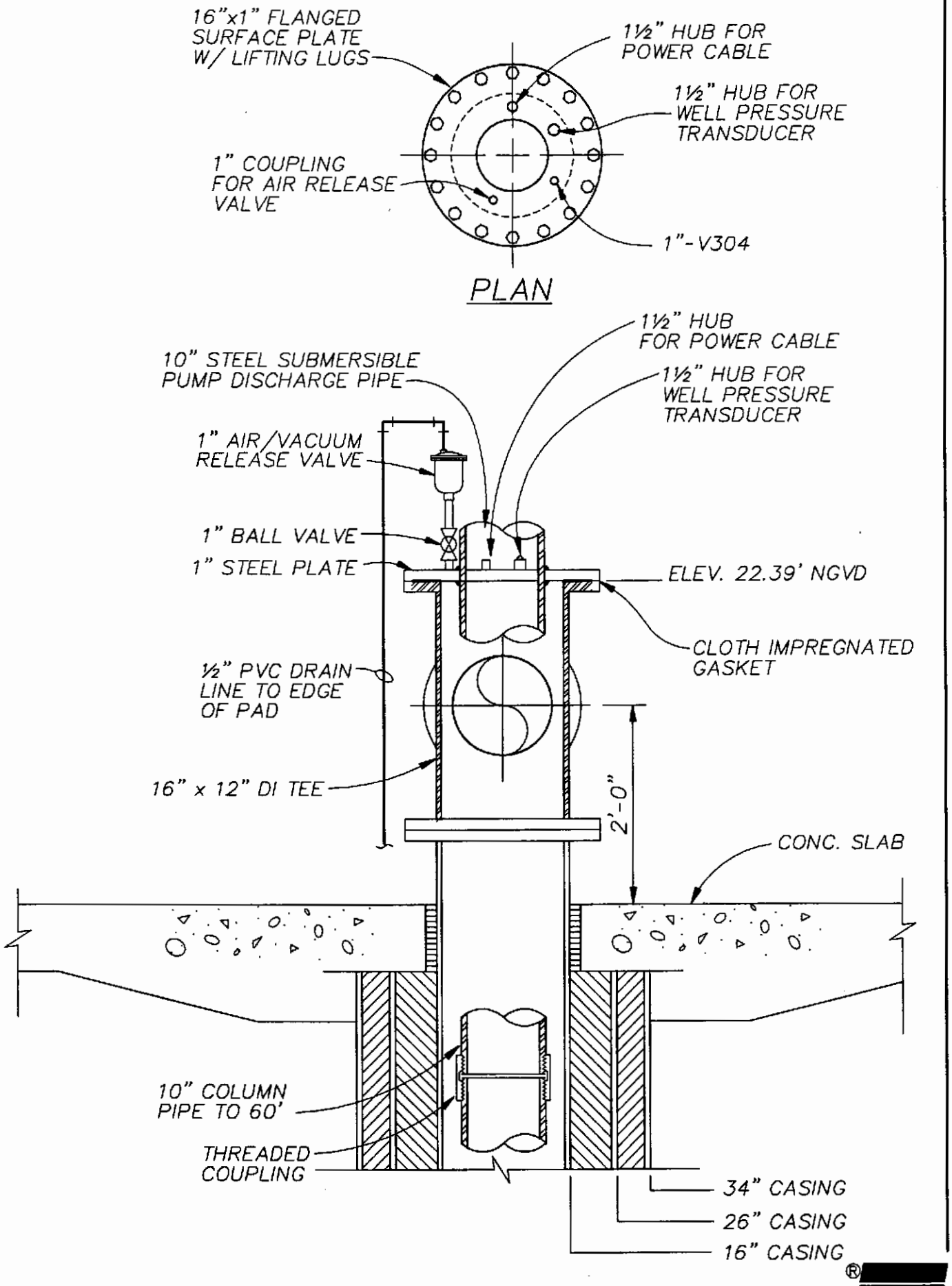

FIGURE 2-4

ASR WELLHEAD DETAIL

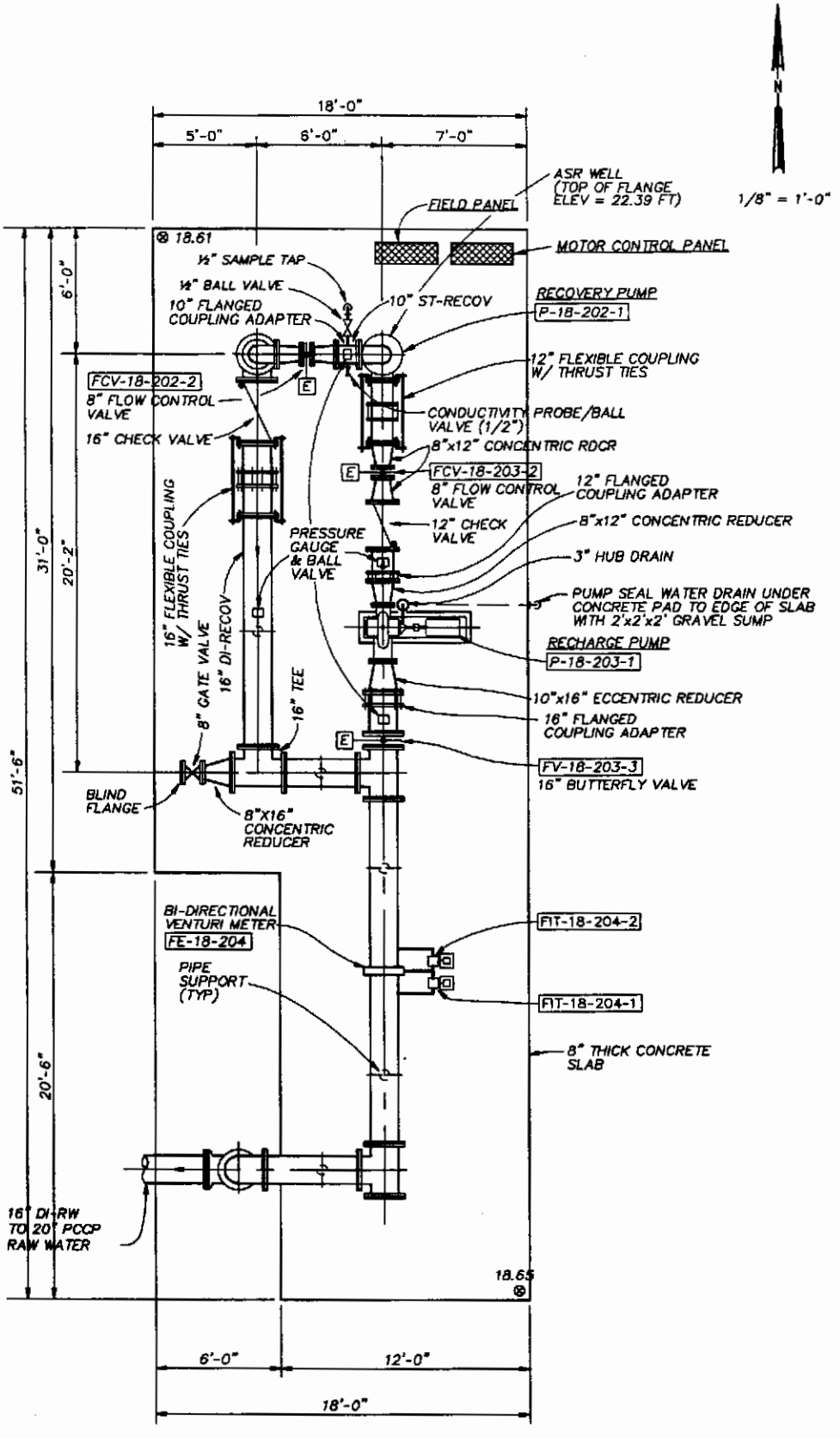

FIGURE 2-5

PIPING PLAN VIEW OF ASR SYSTEM

SECTION 3

Geologic Framework

Geology

Formation cutting samples from MW-1 and ASR-1 were collected at 10-foot intervals from land surface to total depth and were characterized for rock type, color, consolidation, hardness, and fossils. Detailed lithologic descriptions of samples from MW-1 and ASR-1 are provided in Appendix F.

Geophysical Logging

Geophysical logs were performed in the pilot holes of MW-1 and ASR-1 to correlate formation samples collected during drilling, identify formation boundaries, and obtain specific data pertaining to the underground formations. These data were then used to assist in the selection of the optimum casing setting depths for MW-1 and ASR-1. A summary of geophysical logs conducted in shown in Table 3-1. Copies of the pilot hole geophysical logs are presented in Appendix G.

A stratigraphic profile of MW-1 and ASR-1 was derived from the correlation of formation samples with geophysical logs run during pilot hole drilling. Strata encountered during construction of MW-1 and ASR-1 ranged in age from Eocene to Pleistocene deposits. The stratigraphic units and their respective ages (presented in order from youngest to oldest) are as follows: undifferentiated Pleistocene and Pliocene Age sediments; the Hawthorn Group of Miocene Age; the Suwannee Limestone of Oligocene Age; and the Ocala and Avon Park Limestones of Eocene Age. Figure 3-1 contains the general lithologic description, results from geophysical logs (gamma ray, caliper, and LSN electric), and casing setting depths for MW-1 and ASR-1.

Table 3-1
Summary of Geophysical Logs
BCOES ASR Demonstration Project

Date	Log(s)	Type	Depth (ft bpl)
	MW-1		
8/21/96	Caliper, Gamma, LSN Electric	Pilot Hole	430
8/29/96	Caliper, Gamma, LSN Electric, SP	Pilot Hole	990
9/25/96	Caliper, Gamma, LSN Electric, SP, Temperature, Fluid Resistivity, Flowmeter	Reamed Hole	1,200
	ASR-1		
10/9/96	Caliper, Gamma, LSN Electric, SP	Pilot Hole	430
10/22/96	Caliper, Gamma, LSN Electric, SP	Pilot Hole	1,015
11/15/96	Caliper, Temperature, Fluid Resistivity, Flowmeter	Pilot Hole	1,200
12/3/96	Cement Bond Log	Casing	998
12/3/96	Caliper, Gamma, LSN Electric, SP, Dual Induction, Temperature, Fluid Resistivity, Video	Reamed Hole	1,200

Notes:
SP = Spontanteous Potential
ft bpl = feet below pad level
LSN = Long and Short Normal

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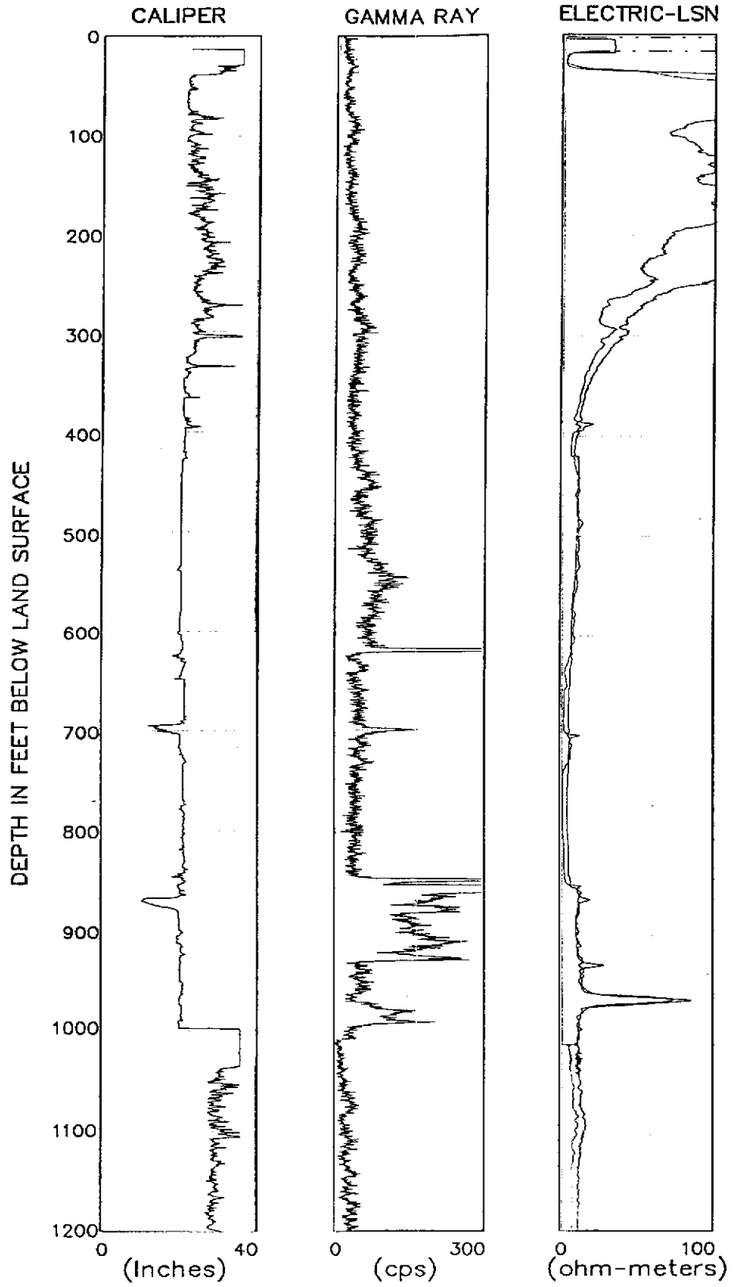
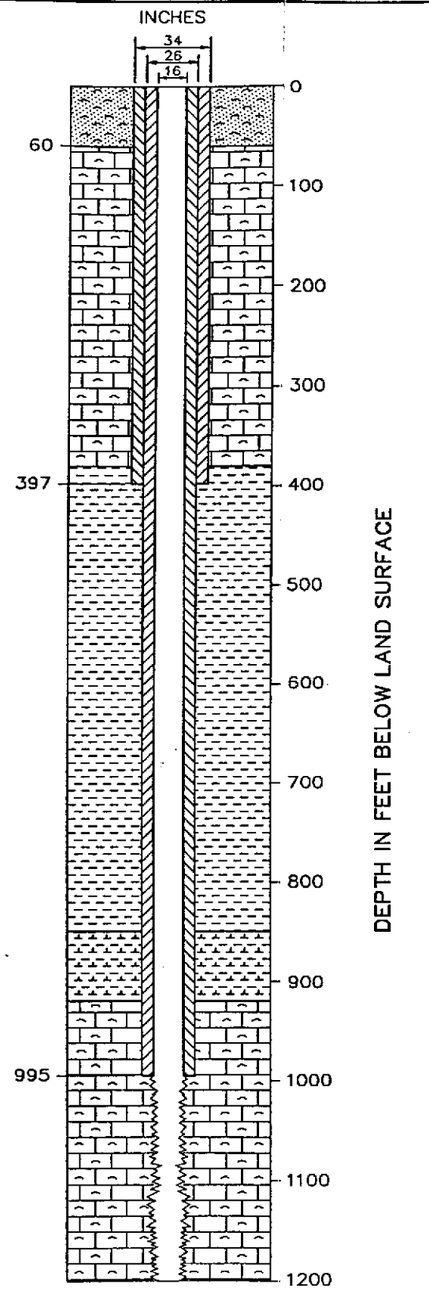
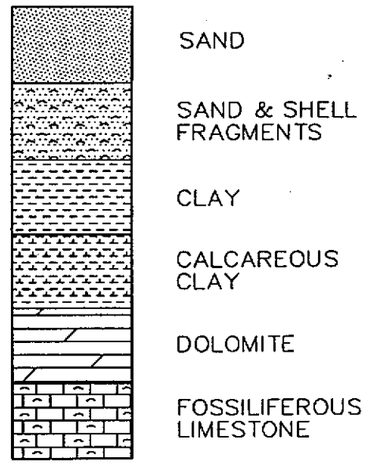
LITHOLOGIC DESCRIPTION	GEOLOGIC AGE	FORMATION NAME		
Shell, Sand, Limestone	Pleistocene	Pamlico Sand/ Anastasia	Biscayne Aquifer	
Calcareous Sandstone with Calcareous Clay	Pliocene	Tamiami		
Yellowish Gray to Light Olive Gray Phosphatic Clay, with Minor Amounts of Inter Bedded Limestone	Miocene	Hawthorn Group	Confining Units	
Fossiliferous Biomicritic Limestone, Yellowish Gray, Pinkish Gray	Oligocene	Suwannee Limestone	Floridan Aquifer System	Artesian Aquifer
White to Tan Limestone, Fossiliferous	Upper Eocene	Ocala Limestone		
Very pale Orange Yellowish Gray to Pinkish Gray Porous, Finely Fragmented, Highly Fossiliferous Limestone	Eocene	Avon Park Limestone		







NOTE

cps Counts per Second

LSN Long-Short Normal Electric Resistivity

NOTE: Geophysical Logs have been Generated from Computer Data Collected in Field.

FIGURE 3-1

GENERALIZED SUBSURFACE DATA AND COMPLETION DIAGRAM FOR ASR-1 BCOES ASR DEMONSTRATION PROJECT

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Lithostratigraphic Descriptions

Undifferentiated Pleistocene and Pliocene Series

From land surface to a depth of approximately 380 feet bpl, the lithology consists of poorly to well consolidated sandstone, calcareous silt, and limestone. Formations that make up the Pleistocene to Pliocene series at this site include the Pamlico Sand, Miami Limestone, Anastasia Formation, Fort Thompson Formation, Caloosahatchee Marl, and Tamiami Formation, though these formations were not differentiated in this project. These formations comprise the surficial aquifer system, locally known as the Biscayne aquifer. The gamma ray response in this interval is relatively low (0 to 50 counts per second [cps]), consistent with the clay-free formations encountered. The Tamiami Formation-Hawthorn Group boundary is not distinguishable on the gamma ray log, but is selected based on the first occurrence of olive-green sandstone and clays at a depth of 380 feet bpl.

Miocene Series

Hawthorn Group. The Hawthorn Group of Miocene Age constitutes the primary interval of confinement and low permeability between the surficial aquifer system and Floridan aquifer system.

The Hawthorn Group sediments at the site occur from approximately 380 to 850 feet bpl and consist of dense, phosphatic calcareous silt, olive-green clay, and phosphatic limestone. The gamma ray signature through this interval is consistently moderate to high (40 to 600 cps), with sharp off-scale peaks occurring at approximately 610 and 850 feet bpl. These gamma peaks correspond to highly phosphatic clays and limestones.

Oligocene Series

Suwannee Limestone. The Suwannee Limestone of Oligocene Age has variable thickness, ranging from 120 to more than 300 feet in southeast Florida (Miller, 1986). The Suwannee Limestone is characterized by a yellowish-gray silty limestone with diverse marine fauna including bryozoans, gastropods, and pelecypods.

The boundary between the Hawthorn Group and Suwannee Limestone at the site is placed at a depth of 850 feet bpl, coinciding with the largest off-scale peak on the gamma log. From 850 to 920 feet bpl, highly phosphatic zones occur on the gamma log with increasing limestone content with depth. At approximately 920 feet bpl, relatively clean fossiliferous limestone is recorded in the cuttings and where gamma ray response decreases. A slight

increase in gamma ray response is observed at approximately 990 feet bpl, consistent with soft layers interpreted to be silt/clay lenses. Reese (1994) confirms the existence of phosphatic sand zones and coincident increased gamma ray responses at the base of the Suwannee Limestone. The base of the Suwannee Limestone is interpreted to occur at the base of the last gamma ray peak at approximately 990 feet bpl.

Eocene Series

Ocala Limestone. The Ocala Limestone of Upper Eocene Age is lighter colored (white to tan), and possesses less-diverse fauna (forams and echinoids) than the overlying lower Suwannee Limestone. Because of the known relative purity (high calcium carbonate content) of the Ocala Limestone, the upper and lower limits for the Ocala Limestone are placed at approximately 1,000 and 1,120 feet bpl, based on the low gamma ray counts observed on the log, and the chalky, micritic, white limestone observed in the drill cuttings. The 1,000-foot depth identified as the top of the Ocala Limestone is consistent with the regionally identified top of Eocene-age sediments according to Reese (1994).

Avon Park Limestone. The Avon Park Limestone of Eocene Age occurs from a depth of approximately 1,120 feet bpl to below the total depth of the well. The observed lithology closely matches that described by Chih Shan Chen in Florida Geological Bulletin No. 45, *The Regional Lithostratigraphic Analysis of Paleocene and Eocene Rocks of Florida, 1965*. This late- to mid-Eocene age formation is a light gray to grayish-orange, poor to well consolidated limestone with microfauna including forams. Miller (1986) observed that portions of the Avon Park Limestone are fine-grained and have low permeability, thereby acting as intra-aquifer confining units within the Floridan aquifer system.

SECTION 4

Hydrogeologic Testing

Pad Monitor Wells

Prior to the start of and during construction at MW-1 and ASR-1, water samples were collected on a weekly basis from the four surficial pad monitor wells (PMWs; one located at each corner of each drilling pad). Samples were sent to the BCOES laboratory for pH, total dissolved solids [TDS], conductivity, and chlorides analysis. In general, slight variability in water quality values were observed, consistent with natural temporal variations in water quality and laboratory precision. One exception to this was a temporary pinhole leak in the temporary concrete pad at MW-1 and observed in the northeast PMW. This leak was identified, regulatory agencies promptly notified, and the leak promptly repaired. Remedial measures included continuous purging for several hours until water quality returned to ambient conditions. A summary of analytical data from each of the PMWs is presented in Appendix H.

Pilot Hole Data

Hydraulic information was obtained while drilling the pilot hole in the Floridan aquifer system in MW-1 and ASR-1. A clear manometer tube was attached to the wellhead to facilitate observation of static artesian head at 30-foot intervals. The well was then allowed to flow under its own artesian pressure, and both flow rate and dynamic head were measured at 60-foot intervals within the drill stem. With this information, specific capacity of the borehole could be estimated with depth.

Artesian head, flows, and estimated specific capacity in the open-hole portion of MW-1 and ASR-1 are presented in Table 4-1. This table indicates that artesian production of water increased significantly at a depth interval of 1,050 to 1,110 feet bpl in MW-1 and ASR-1. The data indicate that flow did not increase appreciably below 1,110 feet bpl.

Water samples were also collected at approximately 30-foot intervals during reverse-air open-circulation drilling of MW-1 and ASR-1. The purpose of these samples was to provide a generalized profile of water quality changes with respect to depth. Water samples were

Table 4-1
Pilot Hole Data
BCOES ASR Demonstration Project

Depth (feet bpl)	Static Head (feet apl)	Artesian Flow (gpm)	Dynamic Head (feet apl)	Specific Capacity (gpm/ft)
		MW-1		
1,050	21.05	50	3.8	3
1,110	22.15	125	6.0	8
1,170	21.9	120	6.1	8
1,200	22.6	120	6.1	7
		ASR-1		
1,020	16	30	NA	NA
1,050	24.4	90	NA	NA
1,080	NA	200	NA	NA
1,110	20.5	950	NA	NA
1,140	NA	NA	NA	NA
1,170	22.7	1000	NA	NA
1,200	22.8	1000	NA	NA

Notes:
bpl = below pad level
apl = above pad level
gpm = gallons per minute
gpm/ft = gallons per minute per foot of drawdown
MW-1 test conducted September 17, 1996
ASR-1 test conducted November 13, 1996
Head measurements obtained from manometer tube at wellhead
Flows are through 5-inch drill rod in 16-inch casing at ASR-1
Flows are through 3.5-inch drill rod in 6-inch casing at MW-1
N/A = Not Available

field-analyzed for conductivity and chlorides. In general, water quality was fairly consistent with depth.

Geophysical Logs

Geophysical logs were conducted on the open-hole portion of MW-1 and ASR-1 to delineate flow zones. Logs particularly useful in delineating flow zones include caliper, LSN, flowmeter, temperature, and fluid resistivity. By analyzing the flowmeter and caliper logs concurrently, water velocity with depth and therefore the percent contribution of flow within the borehole can be calculated.

MW-1

Based on the results of the geophysical logs, it was apparent that 90-percent of the flow from the open borehole originated from a depth between the base of casing (990 feet bpl) and 1,100 feet bpl. Artesian flow from the 6-5/8-inch well was estimated at 480 gallons per minute (gpm) during dynamic geophysical logging.

ASR-1

Flow logs were conducted at ASR-1 on November 15, 1996. The caliper log indicates a washout below the base of the casing, which is commonly observed following reverse-air drilling operations. A small cavity was identified at an approximate depth of 1,103 feet bpl. Otherwise, the caliper log indicated a relatively gauge hole (i.e., similar to the drilled diameter). The LSN log indicated a relatively high resistivity zone at approximately 1,088 feet bpl. This is consistent with the increased artesian flow observed during drilling near this depth. The temperature log indicated a shift between 1,080 and 1,100 feet bpl, consistent with the producing zone described above. The temperature log also indicated a gradual decrease in borehole fluid temperature (cooler water) with increasing depth.

Based on the results of the flowmeter log, it was apparent that 80 percent of the flow from the open borehole originated from a depth between 1,080 and 1,120 feet bpl. Smaller flow zones exist from 1,180 to 1,200 feet (10 percent) and from 1,080 to the base of the casing at 995 feet bpl (10 percent). A graphic representation of the flow profile is also provided in Appendix G. Artesian flow from the 16-inch well was estimated to be 1,150 gpm during dynamic geophysical logging.

Pumping Tests

Pumping tests were conducted at MW-1 and ASR-1 to evaluate flow characteristics of the storage zone and assist in the final design of the permanent recharge and recovery pumps. The tests included a 6-hour constant rate (480 gpm) test on MW-1, an 8-hour step pumping test on ASR-1, and a 24-hour constant-rate (1,000 gpm) test on ASR-1. Pumping test data is presented in Appendix I.

MW-1

The 6-hour constant rate pumping test was conducted at MW-1 on September 19, 1996. The purpose of this test was to estimate hydraulic characteristics of the production zone below the base of the casing. Results of this test indicated a specific capacity of approximately 20 gpm/ft.

ASR-1 Step Test

The step pumping test was conducted on ASR-1 on November 21, 1996. The purpose of the test was to evaluate water level drawdown in the well at three different pumping rates. From this information, hydraulic characteristics and pumping water level could be determined to assist in final pump design.

To perform the test, a temporary vertical turbine pump was installed at ASR-1, with the pump set to a depth of 100 feet bpl on 14-inch column pipe. A pressure gauge was used to measure and record discharge pressure. Temporary, 16-inch PVC piping was set up to convey water from the drilling pad at ASR-1 to the onsite 1-MG storage tank. During the test, the 1 MG tank was allowed to gravity flow via temporary piping from the 1 MG tank to the onsite lift station for disposal. Static water level prior to the test was approximately 21 feet above pad level. An in-line flowmeter with totalizer was used to measure flow. The test was conducted at three flow rates, and results are summarized in Table 4-2 below:

Table 4-2

Summary of Step-Test Results at ASR-1

Flow Rate (gpm)	Drawdown (feet)	Specific Capacity (gpm/ft)
1,050	11.58	90.6
1,825	29.58	61.6
2,950	57.68	51.1

Figure 4-1 displays drawdown data versus time for the three pumping rates of the step test. From this data, optimum well recharge and recovery rates were determined and assisted in final pump selection. Based on the above information, the final design recharge rate was

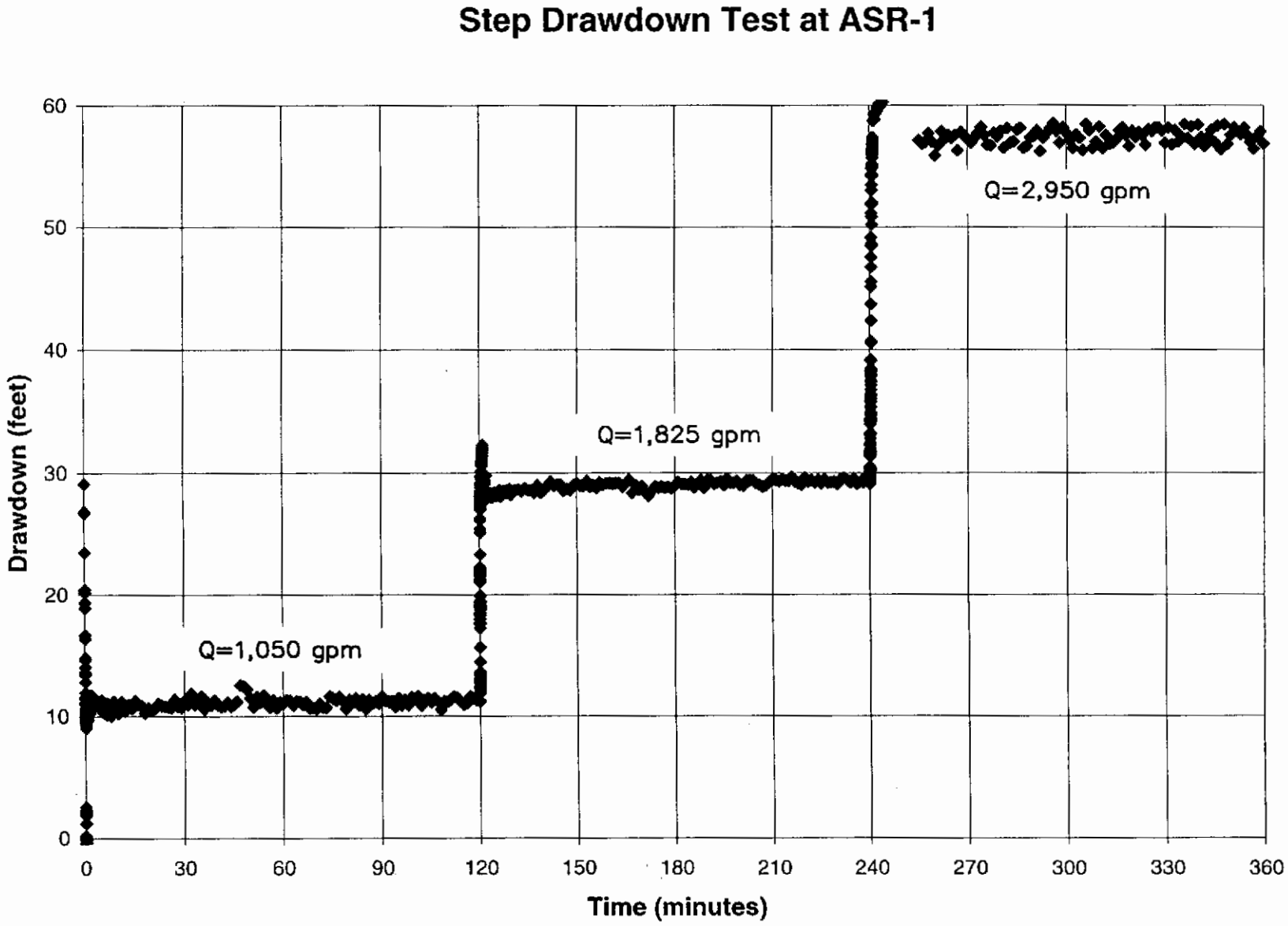

FIGURE 4-1

STEP-DRAWDOWN TEST DATA

1,800 gpm, and the final recovery rate was 2,100 gpm. Water availability and head conditions within the 20-inch raw water main and ASR well will determine actual recharge and recovery rates.

ASR-1 Constant Rate Test

A 24-hour, constant-rate (1,000 gpm) pumping test was conducted at ASR-1 on November 26, 1996. The purpose of this test was to evaluate aquifer characteristics of the proposed storage zone. The 1,000-gpm pumping rate was the greatest flow rate that could be conveyed to the 1-MG storage tank and lift station during a 24-hour period. Water levels were measured in both ASR-1 and MW-1 before, during, and after pumping ASR-1. The same apparatus described for the step test was used for the 24-hour test.

Data from the 24-hour aquifer test are presented in Appendix I. The data were analyzed by the Walton (1962) method for leaky aquifers, the Cooper-Jacob straight-line method, and the Theis recovery method. These data are summarized in Table 4-3 below, and indicate an average transmissivity of 275,000 gallons per day per foot (gpd/ft), and a storage coefficient of 7.95×10^{-5}. These data can be used to evaluate aquifer response based on future operating conditions in the ASR well. The data did not indicate leakance from above or below the storage zone, a positive indicator for the potential to store and retrieve water.

Table 4-3
Summary of Aquifer Test Analysis

Method	Well	Transmissivity (T) (gpd/ft)	Storage Coefficient (S) (dimensionless)
Walton	MW-1	216,000	1.06×10^{-4}
Cooper-Jacob	MW-1	278,000	5.3×10^{-5}
Theis Recovery	MW-1	329,000	NA
Average		275,000	7.95×10^{-5}

Water Quality

Background water quality samples were obtained at both ASR-1 and MW-1 to establish baseline water quality prior to cycle testing. The FDEP construction permit specified that samples be analyzed for primary and secondary drinking water standards (DWS) parameters and the minimum criteria parameters commonly known as "freefroms". Additionally, the BCDH requested that the samples be analyzed for unregulated organic compounds.

ASR-1 was sampled on December 3, 1996, and MW-1 was sampled on March 12, 1997. Results of these analyses are summarized in Table 4-4, and laboratory analytical reports are presented in Appendix J.

Table 4-4
Background Water Quality Data, BCOES ASR Project

Primary Drinking Water Standards: Inorganics			
Date Parameter	MCL (mg/L)	ASR-1 12/3/96 (mg/L)	MW-1 3/12/97 (mg/L)
Antimony	0.006	<0.0060	<0.0050
Arsenic	0.05	<0.010	<0.010
Asbestos	7 MFL	0.00	0.00
Barium	2	<0.010	<0.010
Beryllium	0.004	<0.00040	<0.00040
Cadmium	0.005	<0.0050	<0.0050
Chromium	0.10	<0.010	<0.010
Cyanide	0.20	<0.010	<0.010
Fluoride	4.0	1.10	1.10
Lead	0.015	<0.0050	<0.0050
Mercury	0.002	<0.00020	<0.00020
Nickel	0.1	<0.040	<0.040
Nitrate (as N)	10.0	<0.050	<0.050
Nitrite (as N)	1.0	<0.050	<0.050
Selenium	0.05	<0.0020	<0.035
Sodium	160	**970**	**1,100**
Thallium	0.002	<0.0020	<0.0020
Turbidity	1 NTU	**16**	0.59
Coliform, Total (col/100 ml)		<1	**720**
Primary Drinking Water Standards: Volatile Organics			
Parameter	**MCL (ug/L)**	**ASR-1 (ug/L)**	**MW-1 (ug/L)**
THMs (Total)	100	<0.50	<0.50
Trichloroethene	3	<0.50	<0.50
Tetrachloroethene	3	<0.50	<0.50
Carbon Tetrachloride	3	<0.50	<0.50
Vinyl Chloride	1	<0.50	<0.50
1,1,1-Trichloroethane	200	<0.50	<0.50
1,2-Dichloroethane	3	<0.50	<0.50
Benzene	1	<0.50	<0.50
Cis-1,2-Dichloroethene	70	<0.50	<0.50
1,1-Dichloroethene	7	<0.50	<0.50
1,2-Dichloropropane	5	<0.50	<0.50
Ethylbenzene	700	<0.50	<0.50
Monochlorobenzene	100	<0.50	<0.50
1,2-Dichlorobenzene	600	<0.50	<0.50
1,4-Dichlorobenzene	75	<0.50	<0.50
Styrene	100	<0.50	<0.50
Toluene	1,000	4.4	<0.50
Trans-1,2-Dichloroethene	100	<0.5	<0.5
Xylenes (Total)	10,000	<0.5	<0.5
Dichloromethane (Methylene Chloride)	5	<1.0	<1.0
1,2,4-Trichlorobenzene	70	<0.5	<0.5
1,1,2-Trichloroethane	NA	<0.5	<0.5
Ethylene Dibromide	0.02	<0.020	<0.020
Dibromochloropropane	0.2	<0.020	<0.020

Table 4-4
Background Water Quality Data, BCOES ASR Project

Primary Drinking Water Standards: Organics			
Parameter	**MCL (ug/L)**	**ASR-1 (ug/L)**	**MW-1 (ug/L)**
Pesticides/PCBs			
Alachlor	2	<1.0	<1.0
Atrazine	3	<1.0	<1.0
Simazine	4	<1.0	<1.0
Endrin	2	<0.40	<0.020
Lindane	0.2	<0.20	<0.010
Methyoxychlor	40	<0.50	<0.50
Toxaphene	3	<1.0	<1.0
Chlordane	2	<0.20	<0.10
Heptachlor	0.4	<0.20	<0.010
Heptachlor Epoxide	0.2	<0.40	<0.020
Aroclor-1016	NA	<10	<0.50
Aroclor-1221	NA	<10	<0.50
Aroclor-1232	NA	<10	<0.50
Aroclor-1242	NA	<10	<0.50
Aroclor-1248	NA	<10	<0.50
Aroclor-1254	NA	<10	<0.50
Aroclor-1260	NA	<0.50	<0.50
Herbicides			
2,4-D	70	<0.50	<0.50
2,4,5-TP (Silvex)	50	<0.50	<0.50
Pentachlorophenol	1	<1.0	<1.0
Picloram	500	<0.50	<0.50
Dalapon	200	<10	<10
Dinoseb	7	<0.50	<0.50
Base Neutrals			
Hexachlorobenzene	1	<1.0	<0.050
Hexachlorocyclopentadiene	50	<1.0	<0.050
Benzo(a)pyrene	0.2	<0.20	<0.20
Di(2-ethylhexyl)phthalate	6	<2.0	<2.0
Di(2-ethylhexyl)adipate	400	<2.0	<2.0
Other Organics			
Carbofuran	40	<1.0	<1.0
Oxamyl (Vydate)	200	<1.0	<1.0
Endothall	100	<10	<10
Glyphosate (Roundup)	700	<150	<150
Diquat	20	<1.0	<1.0
Primary Drinking Water Standards: Radionuclides			
Parameter	**MCL**	**ASR-1**	**MW-1**
Radium 266 and 228	5pCi/l	3.6+/-0.11	3.3+/-0.11
Gross Alpha	15pCi/l	25+/-38	13+/-43

Table 4-4
Background Water Quality Data, BCOES ASR Project

Secondary Drinking Water Standards			
Parameter	**MCL (mg/L)**	**ASR-1 (mg/L)**	**MW-1 (mg/L)**
Aluminum	0.2	<0.20	<0.20
Chloride	250	**1,900**	**1,900**
Copper	1.0	<0.025	<0.025
Color	15 PCU	5	10
Fluoride	2.0	1.10	1.10
Foaming Agents (MBAS)	0.5	<0.10	0.18
Iron	0.3	0.082	<0.050
Manganese	0.05	<0.010	<0.010
Odor	3 TON	**16**	**16**
pH (at Collection Point)	6.5 - 8.5	7.5	7.5
Silver	0.1	<0.010	<0.010
Sulfate	250	**380**	**460**
Total Dissolved Solids (TDS)	500	**3,200**	**2,600**
Zinc	5	0.05	<0.020
Other Parameters			
2,3,7,8-TCDD	NA	<2.8	<5.0
Ammonia	NA	0.98	0.58
TKN	NA	0.93	0.72
Total Phosphorous	NA	<0.10	<0.10
Total Nitrogen	NA	0.93	0.72
BOD (5-day)	NA	<0.20	<2.0
Chemical Oxygen Demand	NA	NA	60
Group I Unregulated Pesticides			
Parameter	**MCL (ug/L)**	**ASR-1 (ug/L)**	**MW-1 (ug/L)**
Butachlor	NA	<1.0	<1.0
Metolachlor	NA	<1.0	<1.0
Metribuzin	NA	<1.0	<1.0
Aldrin	NA	<0.20	<0.010
Dieldrin	NA	<0.40	<0.020
Group I Unregulated Herbicides			
Dicamba	NA	<0.50	<0.50
Group I Unregulated Carbamates			
Aldicarb	NA	<0.50	<0.50
Aldicarb Sulfone	NA	<0.50	<0.50
Aldicarb Sulfoxide	NA	<0.50	<0.50
Carbaryl	NA	<1.0	<1.0
3-Hydroxycarbofuran	NA	<1.0	<1.0
Methomyl	NA	<1.0	<1.0

Table 4-4
Background Water Quality Data, BCOES ASR Project

Group II Unregulated Purgeable Organics			
Parameter	**MCL (ug/L)**	**ASR-1 (ug/L)**	**MW-1 (ug/L)**
Bromobenzene	NA	<0.50	<0.50
Bromodichloromethane	NA	<0.50	<0.50
Bromoform	NA	<0.50	<0.50
Bromomethane	NA	<0.50	<0.50
Chloroethane	NA	<0.50	<0.50
Chloroform	NA	<0.50	<0.50
Chloromethane	NA	<0.50	<0.50
Dibromochloromethane	NA	<0.50	<0.50
DiChlorodifluoromethane	NA	<0.50	<0.50
P-Chlorotoluene	NA	<0.50	<0.50
Dibromomethane	NA	<0.50	<0.50
1,1-Dichloroethane	NA	<0.50	<0.50
cis-1,3-Dichloropropene	NA	<0.50	<0.50
trans-1,3-Dichloropropene	NA	<0.50	<0.50
1,3-Dichloropropylene	NA	<0.50	<0.50
1,3-Dichloropropane	NA	<0.50	<0.50
2,2-Dichloropropane	NA	<0.50	<0.50
Trichlorofluoromethane	NA	<0.50	<0.50
1,2,3-Trichloropropane	NA	<0.50	<0.50
1,3-Dichlorobenzene	NA	<0.50	<0.50
1,1,1,2-Tetrachloroethane	NA	<0.50	<0.50
1,1,2,2-Tetrachloroethane	NA	<0.50	<0.50
Methyl-tert-butyl ether (MTBE)	NA	<0.50	<0.50
1,1-Dichloropropene	NA	<0.50	<0.50
o-Chlorotoluene	NA	<0.50	<0.50
Group III Unregulated Acid Extractables			
2-Chlorophenol	NA	<10	<10
2-Methyl-4, 6-dinitrophenol	NA	<50	<50
Phenol	NA	<10	<10
2,4,6-Trichlorophenol	NA	<10	<10
Group III Unregulated BN Extractables			
Butylbenzylphthalate	NA	<10	<10
Di-n-butylphthalate	NA	<10	<10
Diethylphthalate	NA	<10	<10
Dimethylphthalate	NA	<10	<10
2,4-Dinitrotoluene	NA	<10	<10
Di-n-octylphthalate	NA	<10	<10
Isophorone	NA	<10	<10
Anthracene	NA	<10	<10
Naphthalene	NA	<10	<10
Phenanthrene	NA	<10	<10

1. Maximum Contaminant Level (MCL) per Rules 17-550.310 and 17-550.320, FAC.
2. Analyses conducted by Savannah Laboratories

Water quality data from ASR-1 is consistent with other data from wells completed within the Floridan aquifer system. The brackish waters of the Floridan aquifer system are known to contain higher dissolved solids concentrations than that of the Biscayne aquifer, for example. Inorganic parameters that exceed maximum contaminant levels (MCLs) from the ASR-1 water sample include sodium (970 mg/L), chloride (1,900 mg/L), sulfate (380 mg/L) TDS (3,200 mg/L) and odor (16 TON). The high odor level is consistent with that of a strong hydrogen sulfide odor observed during drilling operations. The only organic parameter detected was toluene (4.4 µg/L), though significantly below its MCL of 1,000µg/L. The gross alpha concentration (25 +/-38 pCi/L) may have exceeded its MCL (15 pCi/L). However, the relatively high turbidity levels in this sample (16 NTUs) may have resulted in a false positive reading for this parameter. Data from MW-1 are consistent with ASR-1, but the gross alpha level in this well (13 +/-3 pCi/L) was below the MCL.

SECTION 5

Mechanical Integrity Testing

Mechanical integrity testing (MIT) of MW-1 was performed by conducting a casing pressure test. MIT testing of ASR-1 was performed by conducting a cement bond log (CBL), a casing pressure test, and a video survey of the completed well.

MW-1

On September 10, 1996, a casing pressure test was successfully performed on MW-1 following cementing of the final 6-5/8-inch steel casing. The cement plug at the base of the casing served as a seal to facilitate the test. The pressure test was performed by filling the casing with freshwater to eliminate air from inside the casing, and sealing the wellhead with a welded steel plate. The casing was then pressurized to 100 psi with a high pressure pump. A 200-psi calibrated pressure gauge was used to measure casing pressure. A summary of the casing pressure test data sheet is presented in Appendix K. A copy of the pressure gauge calibration certificate is provided in Appendix L. One hour after establishing the initial pressure at 100 psi, the pressure was recorded at 99 psi. The 1 psi loss was well within the 5 percent limit (5 psi) specified by FDEP. The casing pressure test was observed by Mr. Mark Schilling from CH2M HILL and Mr. Len Fishkin from FDEP. A total of 2.25 gallons of water was drained from the casing while pressure was released.

ASR-1

On November 1, 1996, a casing pressure test was successfully performed on ASR-1 following cementing of the final 16-inch steel casing. The cement plug at the base of the casing served as a seal to facilitate the test. The pressure test was performed by filling the casing with freshwater to eliminate air from inside the casing, and sealing the wellhead with a welded steel plate. The casing was then pressurized to 150.75 psi with a high pressure pump. A 200-psi calibrated pressure gauge was used to measure casing pressure. A summary of the casing pressure test data sheet is presented in Appendix K. A copy of the pressure gauge calibration certificate is provided in Appendix L. One hour after establishing the initial pressure at 150.75 psi, the pressure was recorded at 143.5 psi. The 7.25 psi loss was within the 5 percent limit specified by FDEP. The casing pressure test was observed by Mr. Peter Kwiatkowski from CH2M HILL and Mr. Mark Silverman from FDEP. A total of 4.3 gallons of water was drained from the casing while pressure was released.

On December 3, 1996, the cement behind the ASR-1 casing was evaluated by conducting a CBL log from the base of the 16-inch-diameter steel casing at 995 feet bpl to pad level. The CBL log demonstrates an adequate cement bond around the 16-inch casing from 995 feet bpl to pad level. A copy of the CBL log is presented in Appendix G.

A video survey of ASR-1 was conducted on December 3, 1996. The video survey showed no inconsistencies and the 16-inch steel casing appeared in good condition. Casing joints were visible throughout the casing string. The video survey was conducted from pad level to 1,200 feet bpl at the borehole terminus. Fractures and several large cavities were observed between 1,081 and 1,095 feet bpl. The video survey summary and video tape are provided in Appendix M.

SECTION 6

Cycle Testing Plan

Background

Upon approval from FDEP, operational (cycle) testing of the ASR facility will begin. Cycle testing will be conducted to evaluate hydraulic performance of the ASR system, and determine water quality effects of storage of water in the ASR zone. Cycle testing will include variable periods of recharge, storage, and recovery as outlined in Table 6-1, and described below. For planning purposes, the recharge and recovery rates assumed in this cycle testing plan are 3 mgd, based on the actual design. Some variation in these rates should be anticipated, due to water availability and ambient pressure in the 20-inch raw water main used to convey water to the ASR system.

Table 6-1

Cycle Testing Plan

Cycle Number	Recharge (MG)	Recovery (MG)	Recharge (days)	Storage (days)	Recovery (days)
1	30	30	10	0	5
2	270	120	90	0	40
3	270	165	90	0	55
4	270	120	90	30	40
5	270	165	90	30	55
6	450	210	15	120	70

Note: MG = million gallons

A significant change in water quality in the ASR zone is expected to occur during cycle testing as a result of introducing fresh water into the brackish water of the ASR zone. By monitoring water quality parameters in the Floridan Aquifer Monitor Well (MW-1), approximately 270 feet away from the ASR well, the movement of the fresh water bubble will be observed. Recovered water will be monitored to ensure that the recovered water does not exceed drinking water standards for TDS (500 mg/L) or chloride (250 mg/L) for each cycle.

During cycle testing, recovery efficiencies (recovery volume/recharge volume) will be calculated for each cycle. It is anticipated that recovery efficiencies will progressively increase throughout each of the cycles.

Cycle 1

The first cycle will consist of a short recharge and recovery period to allow for a preliminary evaluation of the ASR system hydraulic performance, and to establish the water quality effects of recharge water on the ASR zone. Cycle 1 will begin with recharging the ASR zone for 10 days, followed immediately by recovery at the same rate. Recovery will continue until water quality indicates specific conductance increases to above 1,000 micromhos/cm. This is based on keeping the recovered water from exceeding drinking water standards for chloride and TDS.

Cycle 2

The second cycle will consist of a recharge and recovery mode with no storage period, and begin immediately after Cycle 1. The purpose of this cycle is to obtain baseline data on a cycle with a duration similar to that expected during normal operation. The recharge portion of the cycle is designed to simulate a typical wet season period when excess water is available. Recharge will occur for 90 days, followed immediately by recovery at the same rate. Recovery will continue until specific conductance of the recovered water reaches 1,000 micromhos/cm.

Cycle 3

The third cycle will be the same as Cycle 2. It will consist of a recharge and recovery mode with no storage period, and begin immediately after Cycle 2. The purpose of Cycle 3 is to observe if there is any increase in recovery efficiency over Cycle 2. Recharge will occur for 90 days, followed immediately by recovery at the same rate. Recovery will continue until specific conductance of the recovered water reaches 1,000 micromhos/cm.

Cycle 4

The fourth cycle will be similar to Cycles 2 and 3, but will include a 30-day storage period between recharge and recovery. The purpose of Cycle 4 is to observe the effects of the 30-day storage period on recovery efficiency and water quality. Cycle 3 will begin with recharging for 90 days, followed immediately by recovery at the same rate. Recovery will continue until specific conductance of the recovered water reaches 1,000 micromhos/cm.

Cycle 5

The fifth cycle will be similar to Cycle 4. The purpose of Cycle 5 is to observe if there is any increase in recovery efficiency over Cycle 4. Cycle 5 will begin with recharging for 90 days, followed by a 30-day storage period. Following this, recovery will occur at the same rate until specific conductance of the recovered water reaches 1,000 micromhos/cm.

Cycle 6

The sixth cycle will approximate planned operation of the facility. Recharge will occur for 153 days, corresponding to historical water availability during the wet season. Storage will occur for 120 days after recharge, corresponding to a seasonal, low-demand period. Following this, recovery will occur for 70 days during high-demand periods. Recovery will occur at the same rate until specific conductance of the recovered water reaches 1,000 micromhos/cm.

APPENDIX A

FDEP AND BCDH CONSTRUCTION PERMITS

Department of Environmental Protection

Lawton Chiles
Governor

Southeast District
P.O. Box 15425
West Palm Beach, Florida 33416

Virginia B. Wetherell
Secretary

SEP 17 1997

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

In the Matter of an
Application for Permit by:

Mr. Willie Horton
Director of Office of Environmental Services
Broward County Office of Environmental Services
2555 W. Copans Road
Pompano Beach, Florida 33069

BROWARD COUNTY
UIC - BCOES Class V, Group 7
Raw Water ASR Well ASR-1
File: UC 06-242418

INTENT TO ISSUE

The Southeast District Office of the Florida Department of Environmental Protection (Department or FDEP) hereby gives notice of its Intent to Issue a permit (draft copy enclosed) for the proposed project as detailed in the application specified above. The Southeast District is issuing this Intent to Issue for the reasons stated below.

The applicant, the Broward County Office of Environmental Services, applied on December 14, 1993 to the Department for a permit to construct and operationally test, with raw waters from the Biscayne aquifer, a Class V 16-inch outside diameter (O.D.) aquifer storage and recovery (ASR) well, ASR-1, and an associated 6-inch O.D. Floridan aquifer monitor well, ASR MW-1. The ASR well system is located at the Broward County 2A Water Treatment Plant, 1390 NE 50th Street, Pompano Beach, Florida 33064. The well will be used to store and recover raw waters from the Biscayne aquifer, by injection into the interval from 995 to 1,200 feet below land surface in the Upper Floridan aquifer. Under this permit, modification to Monitor Well ASR MW-1 may be authorized and/or an additional Floridan aquifer monitor well may also be constructed.

The Department has permitting jurisdiction under chapter 403 of the Florida Statutes and chapters 62-4, 62-520, 62-522, and 62-528, 62-550, 62-600 and 62-601 of the Florida Administrative Code. The project is not exempt from permitting procedures. The Department has determined that a construction permit is required for the proposed work.

Under section 403.815 of the Florida Statutes and rule 62-103.150 of the Florida Administrative Code, you (the applicant) are required to publish at your own expense the enclosed Notice of Intent to Issue Permit. The notice must be published one time only within 30 days in the legal ad section of a newspaper of general circulation in the area affected. For the purpose of this rule, "publication in a newspaper of general circulation in the area affected" means publication in a newspaper meeting the requirements of sections 50.011 and 50.031 of the Florida Statues, in the county where the activity is to take place. Where there is more than one newspaper of general circulation in the county, the newspaper used should be one with significant circulation in the area that may be affected by the permit. If you are uncertain that a newspaper meets these requirements, please contact the Department at the address or telephone number listed below. The applicant must provide proof of publication to the Department, at FDEP, UIC Section, P.O. Box 15425, West Palm Beach, FL 33416 within seven days of publication. Failure to publish the notice and provide proof of publication within the allotted time may result in the denial of the permit.

The Department will issue the permit with the attached conditions unless a timely petition for an administrative hearing is filed under sections 120.569 and 120.57 of the Florida Statutes.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative hearing in accordance with sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Department's Office of General Counsel, 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida, 32399-3000. Petitions filed by the permit applicant or any of the parties listed below must be filed within fourteen days of receipt of this notice of intent. Petitions filed by any other person must be filed within fourteen days of publication of the public notice or within fourteen days of receipt of this notice of intent, whichever occurs first. A petitioner must mail a copy of the petition to the applicant at the address indicated above, at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under sections 120.569 and 120.57 of the Florida Statutes, or to intervene in this proceeding and participate as a party to it. Any subsequent intervention will be only at the discretion of the presiding officer upon the filing of a motion in compliance with rule 28-106.205 of the Florida Administrative Code.

A petition must contain the following information:

(a) The name, address, and telephone number of each petitioner; the Department's permit identification number and the county in which the subject matter or activity is located;
(b) a statement of how and when each petitioner received notice of the Department's action;
(c) a statement of how each petitioner's substantial interests are affected by the Department's action;
(d) a statement of the material facts disputed by the petitioner, if any;
(e) a statement of facts that the petitioner contends warrant reversal or modification of the Department's action;
(f) a statement of which rules or statutes the petitioner contends require reversal or modification of the Department's action; and
(g) a statement of the relief sought by the petitioner, stating precisely the action that the petitioner wants the Department to take.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice of intent. Persons whose substantial interests will be affected by any such final decision of the Department on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

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Mediation under section 120.573 of the Florida Statutes is not available for this proceeding.

Executed in the City of West Palm Beach, Florida.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

for 09/17/97

Carlos Rivero-deAguilar Date
Director of District Management
Southeast District
P.O. Box 15425
West Palm Beach, FL 33416

CRA/AM/WWC/mas

Enclosures: Notice of Intent to Issue Permit
Draft Operation Permit

Copies furnished to:

Anne Murray, MW/PLNT	Richard Deuerling, FDEP/TLH	Nancy Marsh, USEPA/ATL
Garth Hinckle, BCDNRP	Ron Reese, USGS/MIA	Steve Anderson, SFWMD/WPB
John Morra, FDEP/WPB	Lynette Ciardulli, OGC	Phong Nguyen, BCPHU

CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this NOTICE OF INTENT TO ISSUE and all copies were mailed before the close of business on SEP 17 1997 to the listed persons.

FILING AND ACKNOWLEDGMENT

FILED, on this date, pursuant to §120.52(11), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk

SEP 17 1997
Date

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
NOTICE OF INTENT TO ISSUE PERMIT

The Florida Department of Environmental Protection (Department or FDEP) gives notice of its intent to issue a construction permit (Permit No. UC-06-242418) to Mr. Willie Horton, Director of the Broward County Office of Environmental Services, 2555 W. Copans Road, Pompano Beach, Broward County, Florida 33069, to complete construction and operationally test, with raw waters from the Biscayne aquifer, one Class V, Group 7, 16-inch outside diameter (O.D.) aquifer storage and recovery (ASR) well, ASR-1, and an associated 6-inch O.D., single-zone Floridan aquifer monitor well, ASR MW-1. The ASR system also includes one previously installed Biscayne aquifer monitor well, MW-4. The ASR system is located at the Broward County 2A Water Treatment Plant (WTP), 1390 NE 50th Street, Pompano Beach, Florida 33064.

Under the proposed permit, the purpose of the ASR system will be to store and recover waters from the Biscayne aquifer, by injection into a suitable storage zone in the Upper Floridan aquifer. The proposed injectate is raw water withdrawn from public water supply wells located at the Broward County North System Regional Wellfield (NSRW) and the Broward County 2A WTP.

The ASR well has been constructed with 16-inch diameter steel casing extending to a depth of approximately 995 feet below land surface (bls) and a nominal 16-inch borehole extending to depth of approximately 1,200 feet (bls). The Floridan aquifer monitor well has been completed into the same interval that is to be used for ASR.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative hearing in accordance with sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Department's Office of General Counsel, 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida, 32399-3000. Petitions must be filed within fourteen days of publication of this public notice or within fourteen days of receipt of the notice of intent, whichever occurs first. A petitioner must mail a copy of the petition to the applicant at the address indicated above, at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under sections 120.569 and 120.57 of the Florida Statutes, or to intervene in this proceeding and participate as a party to it. Any subsequent intervention will be only at the discretion of the presiding officer upon the filing of a motion in compliance with rule 28-106.205 of the Florida Administrative Code.

A petition must contain the following information: (a) The name, address, and telephone number of each petitioner; the Department's permit identification number and the county in which the subject matter or activity is located; (b) a statement of how and when each petitioner received notice of the Department's action; (c) a statement of how each petitioner's substantial interests are affected by the Department's action; (d) a statement of the material facts disputed by the petitioner, if any; (e) a statement of facts that the petitioner contends warrant reversal or modification of the Department's action; (f) a statement of which rules or statutes the petitioner contends require reversal or modification of the Department's action; and (g) a statement of the relief sought by the petitioner, stating precisely the action that the petitioner wants the Department to take.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice of intent. Persons whose substantial interests will be affected by any such final decision of the Department on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under section 120.573 of the Florida Statutes is not available for this proceeding.

The draft permit is available for public inspection during normal business hours, 8:00 a.m. to 5:00 p.m., Monday through Friday, except legal holidays, at the Department of Environmental Protection, Southeast District office, 400 North Congress Avenue, West Palm Beach, Florida 33401. Please contact Bill Cocke at (561) 681-6691 for additional information or to obtain a copy of the draft permit.

Department of Environmental Protection

Lawton Chiles
Governor

Southeast District
P.O. Box 15425
West Palm Beach, Florida 33416

Virginia B. Wetherell
Secretary

NOTICE OF PERMIT

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

BROWARD COUNTY
UIC - PLANTATION CENTRAL WTP
FILE: UC-06-242418 (ASR-1, MW-1)

Mr. Willie Horton
Director of Office of Environmental Services
Broward County Office of Environmental Services
2555 W. Copans Road
Pompano Beach, Florida 33069

DRAFT

Dear Mr. Horton:

Enclosed is Permit Number UC-06-242418, to complete construction of one Class V, Group 7 ASR well, ASR-1, and an associated Floridan aquifer monitor well, ASR MW-1, and to operationally test the ASR system with raw water, issued pursuant to Section(s) 403.087, Florida Statutes and Florida Administrative Codes 62-4, 62-520, 62-522, 62-528 and 62-550. The system is located at the Broward County 2A Water Treatment Plant (WTP).

Any party to this Order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, Mail Stop 35, 3900 Commonwealth Blvd., Tallahassee, Florida 32399-3000; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this Notice is filed with the Clerk of the Department.

Should you have any questions, please contact William W. Cocke, P.G. or Mark A. Silverman, P.G., of this office, telephone (561) 681-6691 or (561) 681-6695, respectively.

Executed in West Palm Beach, Florida.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

_____
Carlos Rivero-deAguilar Date
Director of District Management
Southeast District

CRA:AM:WWC:ms:dz

Copies furnished to:

Anne Murray, MW/PL
Garth Hinckle, BCDNRP
John Morra, FDEP/WPB
Richard Deuerling, FDEP/TLH
Ron Reese, USGS/MIA
Lynette Ciardulli, OGC
Nancy Marsh, USEPA/ATL
Steve Anderson, SFWMD/WPB
Phong Nguyen, BCPHU

CERTIFICATE OF SERVICE

This is to certify that this NOTICE OF PERMIT and all copies were mailed before the close of business on _____ to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGMENT FILED, on this date, pursuant to the §120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

_____ _____
Clerk Date

Department of Environmental Protection

Lawton Chiles
Governor

Southeast District
P.O. Box 15425
West Palm Beach, Florida 33416

Virginia B. Wetherell
Secretary

DRAFT

PERMITTEE:
Mr. Willie Horton
Director of Office of Environmental Services
Broward County Office of Environmental Services
2555 W. Copans Road
Pompano Beach, FL 33069

I. D. NUMBER: 5006M06093
PERMIT/CERTIFICATION NUMBER: UC-06-242418
DATE OF ISSUE:
EXPIRATION DATE:
COUNTY: Broward
LATITUDE/LONGITUDE: 26°17'35"N/80°06'25"W
PROJECT: Class V, Group 7 ASR Well ASR-1 and Monitor Well ASR MW-1

PROJECT: Permit to complete construction of Aquifer Storage and Recovery (ASR) Well ASR-1 and associated Floridan Aquifer Monitor Well ASR MW-1, and to operationally test the ASR system with raw waters from the Biscayne aquifer.

This permit is issued under the provisions of Chapter 403.087, Florida Statutes, and Florida Administrative Code (F.A.C.) Rules 62-4, 62-520, 62-522, 62-528 and 62-550. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

TO COMPLETE CONSTRUCTION AND OPERATIONALLY TEST: One Class V, Group 7, 16-inch outside diameter (O.D.) aquifer storage and recovery (ASR) well, ASR-1. The ASR well will be used to store and recover waters from the Biscayne aquifer, by injection at the Broward County 2A Water Treatment Plant (WTP) into a suitable storage zone in the Upper Floridan aquifer. The proposed injectate is water withdrawn from public water supply wells located at the Broward County North System Regional Wellfield (NSRW) and the Broward County 2A WTP. The ASR injection zone is constructed between approximately 995 feet and the total depth of the well at 1,200 feet below land surface (bls). The water quality in the storage zone and the lateral movement of the stored water shall be monitored by a single-zone, 6-inch O.D., Floridan aquifer monitor well, ASR MW-1. This monitor well is completed into the same interval that is to be used for ASR. The migration between underground sources of drinking water (USDWs) of fluids of significantly different water quality shall be monitored by Monitor Well ASR MW-1 and Biscayne Aquifer Monitor Well MW-4. Monitor Well MW-4 has been previously installed to monitor the public water supply wells at the 2A WTP, and has a monitoring interval of 100 feet to 144 feet bls. Under this permit, modification to Monitor Well ASR MW-1 may be authorized and/or an additional Floridan aquifer monitor well may also be constructed.

IN ACCORDANCE WITH: Application to Construct a Class V Aquifer Storage and Recovery Well System received December 14, 1993; contract documents for the construction of the aquifer storage and recovery project received December 14, 1993; a meeting between the Department, the Broward County Office of Environmental Services (BCOES) personnel, South Florida Water Management District (SFWMD) personnel and BCOES's consultants on January 12, 1994; a Request for Information (RFI) sent January 21, 1994; additional information received February 25, 1994; a meeting between the Department, BCOES personnel, SFWMD personnel and BCOES's consultants on March 17, 1994 in which additional information was requested by the Department; additional information received April 29, 1994; correspondence pertaining to a water quality criteria exemption received August 17, 1995, May 29, 1996, September 9, 1996, September 23, 1996, September 24, 1996, and October 2, 1996; additional information received April 23, 1997 and June 25, 1997; publication of the Notice of Draft Permit UC-06-242418 in the Sun Sentinel newspaper on July 23, 1997; and consideration of receipt of public comment received as a result of a public meeting held on August 26, 1997.

LOCATED AT: The Broward County 2A WTP, 1390 N.E. 50th Street, Pompano Beach, Broward County, Florida 33064.

TO SERVE: The Broward County 2A WTP Service Area.

SUBJECT TO: General Conditions 1-17 and Specific Conditions 1-10.

Form 17-1.201(5)
Effective November 30, 1982

GENERAL CONDITIONS:

The following General Conditions are referenced in Florida Administrative Code Rule 62-4.160.

1. The terms, conditions, requirements, limitations and restrictions set forth in this permit, are "permit conditions" and are binding and enforceable pursuant to Sections 403.141, 403.727, or 403.859 through 403.861, FS. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in subsections 403.087(6) and 403.722(5), FS, the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations. This permit is not a waiver of, or approval of, any other Department permit that may be required for other aspects of the total project which are not addressed in this permit.

4. This permit conveys no title to land or water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the permittee to achieve compliance with the conditions of this permit, are required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at reasonable times, access to the premises where the permitted activity is located or conducted to:

   (a) Have access to and copy any records that must be kept under conditions of the permit;
   (b) Inspect facility, equipment, practices, or operations regulated or required under this permit;
   (c) Sample or monitor any substances or parameters at any location reasonable necessary to assure compliance with this permit or Department rules. Reasonable time may depend on the nature of the concern being investigated.

8. If, for any reason, permittee does not comply with or will be unable to comply with any condition or limitation specified in the permit, permittee shall immediately provide the Department with the following:

   (a) A description of and cause of noncompliance; and
   (b) The period of noncompliance, including dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance. The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

GENERAL CONDITIONS:

9. In accepting this permit, permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source, which are submitted to the Department, may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Section 403.111 and 403.73, FS. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules. A reasonable time for compliance with a new or amended surface water quality standard, other than those standards addressed in Rule 62-302.500, shall include a reasonable time to obtain or be denied a mixing zone for the new or amended standard.

11. This permit is transferable only upon Department approval in accordance with Rule 62-4.120 and 62-730.300 FAC, as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. This permit also constitutes:

    (a) Determination of Best Available Control Technology (BACT)
    (b) Determination of Prevention of Significant Deterioration (PSD)
    (c) Certification of compliance with state Water Quality Standards (Section 401, PL 92-500)
    (d) Compliance with New Source Performance Standards

14. The permittee shall comply with the following:

    (a) Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.
    (b) The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.
    (c) Records of monitoring information shall include:

        1. the date, exact place, and time of sampling or measurements
        2. the person responsible for performing the sampling or measurements
        3. the dates analyses were performed
        4. the person responsible for performing the analyses
        5. the analytical techniques or methods
        6. the results of such analyses

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware the relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

GENERAL CONDITIONS:

16. In the case of an underground injection control permit, the following permit conditions also shall apply:

(a) All reports or information required by the Department shall be certified as being true, accurate and complete.
(b) Reports of compliance or noncompliance with, or any progress reports on, requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.
(c) Notification of any noncompliance, which may endanger health or the environment, shall be reported verbally to the Department within 24 hours and again within 72 hours, and a final written report provided within two weeks.

1. The verbal reports shall contain any monitoring or other information which indicate that any contaminant may endanger an underground source of drinking water and any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between underground sources of drinking water.
2. The written submission shall contain a description of and a discussion of the cause of the noncompliance and, if it has not been corrected, the anticipated time the noncompliance is expected to continue, the steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance and all information required by Rule 62-528.230(4)(b), FAC.

(d) The Department shall be notified at least 180 days before conversion or abandonment of an injection well, unless abandonment within a lesser period of time is necessary to protect waters of the state.

17. The following conditions also shall apply to a hazardous waste facility permit.

(a) The following reports shall be submitted to the Department:

1. Manifest discrepancy report. If a significant discrepancy in a manifest is discovered, the permittee shall attempt to rectify the discrepancy. If not resolved within 15 days after the waste is received, the permittee shall immediately submit a letter report, including a copy of the manifest, to the Department.
2. Unmanifested waste report. Permittee shall submit an unmanifested waste report to the Department within 15 days of receipt of unmanifested waste.
3. Biennial report. A biennial report covering facility activities during previous calendar year shall be submitted by March 1 of each even numbered year pursuant to Chapter 62-730, FAC

(b) Notification of any noncompliance which may endanger health or the environment, including the release of any hazardous waste that may endanger public drinking water supplies or the occurrence of a fire or explosion from the facility which could threaten the environment or human health outside the facility, shall be reported verbally to the Department within 24 hours, and a written report shall be provided within 5 days. The verbal report shall include the name, address, ID number, and telephone number of the facility, its owner or operator, the name and quantity of materials involved, the extent of any injuries, an assessment of actual or potential hazards, and the estimated quantity and disposition of recovered material. The written submission shall contain:

1. A description and cause of the noncompliance.
2. If not corrected, the expected time of correction, and the steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance.

(c) Reports of compliance or noncompliance with, or any progress reports on, requirements in any compliance schedule shall be submitted no later than 14 days after each schedule date.
(d) All reports or information required by the Department by a hazardous waste permittee shall be signed by a person authorized to sign a permit application.

SPECIFIC CONDITIONS:

DRAFT

1. General Requirements

   a) This permit is to complete construction of the Broward County 2A WTP Class V, Group 7 Aquifer Storage and Recovery (ASR) Well ASR-1, and associated Floridan aquifer Monitor Well ASR MW-1, and to operationally test, with raw waters from the Biscayne aquifer, the ASR system. Under this permit, modification to Monitor Well ASR MW-1 may be authorized and/or an additional Floridan aquifer monitor well may also be constructed. This permit does not authorize the construction or operational testing of any other well or wells associated with the Broward County 2A WTP ASR system.

   b) The measurement points for drilling and logging operations shall be surveyed and referenced to the National Geodetic Vertical Datum (NGVD) of 1929 prior to the onset of drilling activities for the ASR well and associated monitor well.

   c) Hurricane Preparedness - Upon the issuance of a "Hurricane Watch" by the National Weather Service, the preparations to be made include but are not necessarily limited to the following:

      i) Secure all on-site salt and stockpiled additive materials to prevent surface and/or groundwater contamination.

      ii) Properly secure drilling equipment and rig(s) to prevent damage to well(s) and on-site treatment process equipment.

2. Construction and Testing Requirements

   a) Blow-out preventers shall be installed on the ASR well during any downhole construction activities.

   b) Pressure gauges and flow meters must be installed on the ASR well prior to initiating ASR activities at the site.

   c) Mechanical integrity of the ASR well shall be determined pursuant to Rule 62-528.300(6)(b)(2), F.A.C. The pressure test for the final casing shall be accepted if tested with a fluid-filled casing at a high enough pressure such that the well operating pressures will never exceed 66% of the test pressure. A test tolerance of not greater than + or - 5% must be certified by the engineer of record. Verification of pressure gauge calibration, representative at the time of the test, must be provided with the certified test report.

   d) Department approval at a scheduled UIC-TAC meeting shall be based on the permittee's presentation that shows compliance with Department rules and this permit.

   e) UIC-TAC meetings are scheduled on the 2nd and 4th Tuesday of each month subject to a five (5) working day prior notice and timely receipt of critical data by all UIC-TAC members and the United States Environmental Protection Agency (EPA), Region IV, Atlanta. Emergency meetings may be arranged when justified to avoid undue construction delays.

   f) Department or Department delegated local program potable water construction permits must be issued for all surface piping and appurtenances upstream of the ASR well-head. Bacteriological clearances must be performed prior to operational testing of the ASR well system.

   g) Within thirty (30) days of permit issuance, the permittee shall submit to the Southeast District office for Department approval a complete set of signed and sealed, revised plan drawings (latest revision), which are in agreement with the most recent design, and which address the following:

      i) The lack of connection to the finished water system, and

      ii) The location of permanent sampling points for both the injectate and the recovered waters.

SPECIFIC CONDITIONS:

DRAFT

3. Quality Assurance/Quality Control Requirements

   a) Pursuant to Rule 62-528.440(5)(b), F.A.C., the Professional Engineer(s) of Record shall certify all documents related to the completion of the ASR well system as an ASR facility. The Department shall be notified immediately of any change of the Engineer(s) of Record.

   b) In accordance with Section 492, Florida Statutes, all documents prepared for the geological/hydrogeological evaluation of the ASR well system shall be signed and sealed by a Florida Licensed Professional Geologist or qualified Florida Licensed Professional Engineer.

   c) Continuous on-site supervision by qualified personnel (engineer and geologist) is required during all testing, geophysical logging, casing installation and cementing operations.

4. Reporting Requirements

   a) All reports and surveys required by this permit shall be submitted concurrently to all members of the UIC-TAC and the United States Environmental Protection Agency, Region IV, Atlanta. The UIC-TAC shall consist of representatives of the following agencies:

      Department of Environmental Protection, West Palm Beach and Tallahassee
      United States Geological Survey (USGS), Miami
      South Florida Water Management District (SFWMD), West Palm Beach
      Broward County Department of Natural Resource Protection (BCDNRP), Ft. Lauderdale
      Broward County Public Health Unit (BCPHU), Ft. Lauderdale

   b) The Department and other applicable agencies must be notified within twenty-four hours (24) of any unusual or abnormal events occurring during construction, and in the event the Permittee is temporarily unable to comply with the provisions of the permit (e.g., on-site spills, artesian flows, large volume circulation losses, equipment damage due to: fire, wind and drilling difficulties, etc.) A written report describing the incident shall also be given to the Department within five (5) days of the start of the event. The final report shall contain a complete description of the occurrence of the event, a discussion of its cause(s), and the steps being taken to prevent recurrence of the event and all other information deemed necessary by the Department.

   c) An interpretation of all test results and geophysical logs must be submitted with all submittals.

   d) Within one year after the initiation of cycle testing, or prior to obtaining an operation permit, whichever occurs first, an interim report shall be submitted to the Department, the UIC-TAC and EPA. This report shall include the following:

      i) An evaluation detailing the necessity, or conversely, the lack of necessity of installing an additional well to monitor the Floridan aquifer between the Broward County ASR well and the Deerfield Beach ASR well, for the purpose of monitoring the lateral movement of the stored water and protecting underground sources of drinking water (USDWs). For this evaluation, the permittee shall use the water quality data obtained during operational testing to develop and calibrate a model; which shall update the analytical approach used to predict that the color, odor, and iron standards would not be exceeded at the Deerfield Beach ASR well.

      ii) An evaluation detailing the necessity, or conversely, the lack of necessity of modifying Floridan Aquifer Monitor Well MW-1, and/or installing an additional Floridan aquifer monitor well, in order to monitor overlying zones (including the uppermost interval of the Floridan aquifer), the water quality in the storage zone, and migration between USDWs of fluids of significantly different water quality. The evaluation shall include the results of water quality monitoring to date, an analysis (which may include modeling), and interpretations.

e) Upon completion of construction and the cycle testing phase of operational testing, a final report shall be submitted to the Department, the UIC-TAC and EPA. The report shall include, but not be limited to, all information and data collected under Rules 62-528.605, 62-528.615, and 62-528.635, FAC, with appropriate interpretations. To the extent possible, the report should include:

i) Transmissivity test data for the storage zone, with evaluation.
ii) Evaluation of the maximum ASR capacity within safe and economical pressure limits.
iii) Detailed results and analysis of cycle testing.
iv) Operation and maintenance manual.
v) Record (as-built) drawings of the ASR well, surface equipment, instrumentation and appurtenances, certified by the engineer of record.
vi) Summary of all water quality, water level and well performance data collected, with conclusions and recommendations.
vii) Well locations surveyed relative to permanent reference points by a Florida registered land surveyor, and located on a site plan by latitude and longitude.
viii) Mill certificates for all casing.
ix) Evaluation detailing the necessity, or conversely, the lack of necessity of installing an additional well to monitor the Floridan aquifer between the Broward County ASR well and the Deerfield Beach ASR well, in order to monitor the lateral movement of the stored water. [S.C. 4.f)i)]
x) Evaluation detailing the necessity, or conversely, the lack of necessity of modifying Floridan Aquifer Monitor Well MW-1, and/or installing an additional Floridan aquifer monitor well, in order to monitor the water quality in the storage zone and to monitor for migration between USDWs of fluids of significantly different water quality. [S.C. 4.f)ii)]

5. Operational Testing Requirements

a) The operational testing of the ASR well system with raw water under this permit shall not commence without written authorization from the Department.

b) A draft operation and maintenance manual (or an updated version) must be submitted to the Department, the UIC-TAC, and EPA prior to a request for system operational testing approval.

c) Prior to operational testing approval, the following items must be submitted (with the request for operational testing approval) for Department approval and UIC-TAC and EPA review:

i) Downhole television survey of final casing, with interpretations.
ii) Geophysical logs with interpretations.
iii) Certification of mechanical integrity and interpreted test data.
iv) Transmissivity test data with evaluation.
v) Background water quality data (monitor and storage zones) to include primary and secondary drinking water standards and minimum criteria parameters as attached.
vi) Injectant analysis of primary and secondary drinking water standards and minimum criteria parameters, as attached.
vii) Surface equipment completion certification or certification of interim completion for the purposes of testing.
viii) Signed and sealed record (as-built) engineering drawings of all well construction, subsurface and surface equipment, and appurtenances. These drawings shall include the location of permanent sampling points for both the injectate and the recovered waters.
ix) Cycle testing plan.
x) Demonstration that the monitor zone in each monitor well has sufficient yield for collection of a representative sample.

d) Prior to the authorization of operational testing by the Department, the County will contact the Underground Injection Control Section of the Department, Southeast District, to arrange a site inspection. The inspection will determine if all equipment necessary to operate and monitor the ASR well in compliance with the permit and Department rules has been installed. During the inspection, reporting requirements shall be reviewed.

SPECIFIC CONDITIONS:

DRAFT

6. Operational Testing Conditions

a) Upon receipt of written authorization from the Department [S.C. 5.a)], the operational testing of the ASR well system shall be subject to the following conditions:

i) The progress of the operational testing for the system shall be reviewed during meetings scheduled at the beginning of and within one month of completion of each cycle or every three (3) months after operation has begun, whichever is the shortest period of time. Reports evaluating the system's progress must be submitted to the Department, each member of the UIC-TAC, and EPA at least two (2) weeks prior to the scheduled meeting. The conditions for the operational testing period may be modified by the Department at each of these UIC-TAC review intervals.

ii) Flows to the ASR well shall be monitored and controlled at all times to ensure the maximum injection rate does not exceed that rate at which the well was tested.

iii) The pressure at the wellhead shall be monitored and controlled at all times to ensure the maximum pressure on the final casing does not exceed 66 percent (%) of the mechanical integrity test pressure.

iv) Any failure of the ASR system monitoring and recording equipment for a period of more than forty-eight (48) hours shall be reported within twenty-four (24) hours to the Department. A written report describing the incident shall also be given to the Department within five (5) days of the start of the event. The final report shall contain a complete description of the occurrence, a discussion of its cause(s) and the steps being taken to reduce, eliminate, and prevent recurrence of the event, and all other information deemed necessary by the Department.

v) The following data shall be collected and reported to the Department in Monthly Operating Reports (MORs). The MORs shall be submitted to this office (FDEP, Southeast District Office, UIC Section, P.O. Box 15425, West Palm Beach, FL 33416) and our Tallahassee office (FDEP, UIC Program, MS 3530, Twin Towers Building, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400) by the **twenty-eighth (28th)** day of the month immediately following the end of the sampling period.

a) ASR well performance:

- total daily flow to/from ASR well (MG)
- monthly maximum daily flow to/from ASR well (MG),), with peak hour flow (MGD) on the day of the month with the maximum flow
- average, maximum and minimum daily flow rate to/from the ASR well (gpm)
- daily average, maximum and minimum injection pressure at the ASR well (psig)
- maximum and minimum daily water level (static head at wellhead)
- monthly average for the above daily measurements
- cumulative total volume injected and recovered from the well (MG)

b) Operational Testing: ASR Well ASR-1, Floridan Aquifer Monitor Well ASR MW-1, and Biscayne Aquifer Monitor Well MW-4 shall be monitored during each injection, storage and recovery cycle, in accordance with the parameters and frequency listed below:

PERMITTEE:
Mr. Willie Horton
Director of Office of Environmental Services
Broward County Office of Environmental Services

I. D. NUMBER: 5006M06093
PERMIT/CERTIFICATION NUMBER: UC-06-242418
DATE OF ISSUE:
EXPIRATION DATE:

SPECIFIC CONDITIONS:

DRAFT

SAMPLING OF ASR WELL ASR-1

Parameter	OPERATIONAL TESTING													
	CYCLE TESTING							NORMAL OPERATIONS						
	DAILY	WEEKLY	MONTHLY	QUARTERLY	BEGINNING OF STAGE	MID STAGE	END OF STAGE	DAILY	WEEKLY	MONTHLY	QUARTERLY	BEGINNING OF STAGE	MID STAGE	END OF STAGE
Chloride (mg/l)		I,S,R							I,S,R					
TDS (mg/l)		I,S,R							I,S,R					
Conductivity (umho/cm)		I,S,R							I,S,R					
Temperature (^{O}F)		I,S,R							I,S,R					
pH (standard units)	I	S,R						I	I,S,R					
Color (color units)	I	S,R						I	I,S,R					
Odor (odor threshold number)		I,S,R							I,S,R					
Total Iron (mg/l)		I,S,R							I,S,R					
Hardness (mg/l)	I		S,R					I			S,R			
Total Alkalinity (mg/l)	I		S,R					I			S,R			
Turbidity (NTU)	I		S,R					I			S,R			
Sulfate (mg/l)			I,S,R								I,S,R			
Fecal coliform (# of colonies/100 ml)			I,S,R							I,S,R				
TKN (mg/l)			I,S,R							I,S,R				
Ammonia-N (mg/l)			I,S,R							I,S,R				
Gross Alpha (pCi/L)					I	S	R					I	S	R
Radium-226 (pCi/L)					I	S	R					I	S	R
Dissolved Oxygen (mg/l)					I	S	R					I	S	R
Iron Hydroxide (mg/l)					I	S	R					I	S	R
Primary, Secondary and Minimum Criteria				I							I			

Explanation

I - denotes sampling of injectate during injection phase

S - denotes sampling of water withdrawn from storage zone during storage phase

R - denotes sampling of water withdrawn from storage zone during recovery phase

PERMITTEE:
Mr. Willie Horton
Director of Office of Environmental Services
Broward County Office of Environmental Services

I. D. NUMBER: 5006M06093
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DRAFT

SPECIFIC CONDITIONS:

SAMPLING OF FLORIDAN AQUIFER MONITOR WELL ASR-1 MW-1

Parameter	OPERATIONAL TESTING				
	CYCLE TESTING				NORMAL OPERATIONS
	WEEKLY	BEGINNING OF STAGE	MID STAGE	END OF STAGE	WEEKLY
Chloride (mg/l)	I,S,R				I,S,R
TDS (mg/l)	I,S,R				I,S,R
Conductivity (umho/cm)	I,S,R				I,S,R
Temperature (^{O}F)	I,S,R				I,S,R
pH (standard units)	I,S,R				I,S,R
Color (color units)			I,S,R		I,S,R
Odor (odor threshold number)			I,S,R		I,S,R
Total Iron (mg/l)			I,S,R		I,S,R
Gross Alpha (pCi/L)		I	S	R	
Radium-226 (pCi/L)		I	S	R	
Dissolved Oxygen (mg/l)		I	S	R	
Iron Hydroxide (mg/l)		I	S	R	

SAMPLING OF BISCAYNE AQUIFER MONITOR WELL MW-4

Parameter	OPERATIONAL TESTING				
	CYCLE TESTING				NORMAL OPERATIONS
	WEEKLY	BEGINNING OF STAGE	MID STAGE	END OF STAGE	WEEKLY
Chloride (mg/l)	I,S,R				I,S,R
TDS (mg/l)	I,S,R				I,S,R
Conductivity (umho/cm)	I,S,R				I,S,R
Temperature (^{O}F)	I,S,R				I,S,R
pH (standard units)	I,S,R				I,S,R

Explanation

I - denotes sampling of water withdrawn from monitor zone during injection stage

S - denotes sampling of water withdrawn from monitor zone during storage stage

R - denotes sampling of water withdrawn from monitor zone during recovery stage

Samples shall be collected according to the frequency specified in the above tables under the subheading of 'cycle testing' until the Department authorizes a reduction in sampling frequency to that shown under the subheading of 'normal operations'. A request for reduction in sampling frequency shall be accompanied by a minimum of six (6) months of cycle testing data accompanied by technical justification and interpretations.

The MORs shall indicate monthly averages for all parameters sampled daily or weekly.

c) The Department may require the monitoring of additional parameters if water quality monitoring of the Floridan and/or Biscayne aquifers or the injection fluid indicates any of the following:

(1) quality of the injectate is deteriorating
(2) results of the sampling indicate significant differences in water quality during consecutive sampling events
(3) a source of contamination to the ASR storage zone is discovered that was not addressed in the permit

d) Monitor zone potentiometric surface or water table height relative to NGVD (feet of head) or pressure (psig) referenced to NGVD (for Floridan Aquifer Monitor Well ASR MW-1 and Biscayne Aquifer Monitor Well MW-4):

- daily maximum sustained pressure
- daily minimum sustained pressure
- daily average pressure
- monthly maximum sustained pressure
- monthly minimum sustained pressure
- monthly average pressure

vi) A minimum of three (3) well volumes of fluid shall be evacuated from the monitor systems prior to sampling for the chemical parameters listed above. All samples shall be analyzed by a State-certified laboratory.

vii) All ASR well system data submissions including Monthly Operating Reports (MORs) shall be clearly identified on each page with facility name, I.D. Number, permit number, operator's name, license number, daytime phone number, date of sampling/recording, and type of data. Monitor zones shall be identified by well and depth interval. The lead plant operator or higher official must sign and date each submittal. An approved summary sheet from the FDEP Southeast District Underground Injection Control (UIC) Section is attached.

viii) All monthly reports (MORs) shall be submitted to this office (FDEP, UIC Section, P.O. Box 15425, West Palm Beach, FL 33416) and our Tallahassee office (FDEP, UIC Program, Mail Station No. 3530, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400) by the **twenty-eighth (28th)** day of the month immediately following the end of the sampling period.

ix) An analysis of the injectate (24 hour composite sample) for primary and secondary drinking water standards (Chapter 62-550, F.A.C.) and minimum criteria, see attached list, must be submitted quarterly.

x) The permittee shall be subject to all requirements and regulations of Broward County, the City of Pompano Beach, and the South Florida Water Management District regarding the construction, testing and operation of this ASR well system.

SPECIFIC CONDITIONS:

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xi) If either of the following occur because of injection at the Broward County 2A Water Treatment Plant ASR system, injection into the ASR well shall cease until a water quality criteria exemption has been obtained that addresses any additional parameters exceeding water quality standards, and a well capable of monitoring the Floridan aquifer has been constructed between the Broward County ASR well and the Deerfield Beach ASR well:

a) The maximum contaminant level (MCL) or natural background level (whichever is poorer) is exceeded in the Floridan aquifer system monitor well for any parameter contained in the primary or secondary drinking water standards, except parameters which have been exempted (i.e., color, odor, or iron); or

b) Parameters already exempted (i.e., color, odor, or iron) exceed the approved alternative levels specified in a water quality criteria exemption.

xii) Pursuant to Rule 62-4.080(3), a permittee may request that a permit be extended as a modification of an existing permit. A request for an extension is the responsibility of the permittee and shall be submitted to the Department before the expiration of the permit. In accordance with Rule 62-4.070(4) FAC, a permit cannot be extended beyond the maximum 5 year statutory limit. Should operational testing need to continue beyond the 5 years of this permit, the permittee must renew this construction permit.

xiii) Operational testing of this ASR well shall cease upon expiration of this permit, unless an operation permit is issued by the Department, or a timely renewal application (Rule 62-4.090, FAC) for this construction permit has been submitted to the Department.

xiv) The permittee shall unconditionally obligate themselves to plug and abandon the ASR and monitoring wells (with the appropriate Department permit) should the well or wells become a threat to the waters of the State, if the wells are no longer used, or if the wells are no longer usable for their intended purpose or other purposes as approved by the Department.

xv) In the event the ASR well must be plugged and abandoned, the permittee shall obtain an FDEP permit, as required by Rule 62-528.645, FAC.

xvi) The permittee shall calibrate all pressure gages, flowmeters, chart recorders, and other related equipment associated with the ASR well system on a semi-annual basis. The permittee shall maintain all monitoring equipment and shall ensure that the monitoring equipment is calibrated and in proper operating condition at all times. Laboratory equipment, methods, and quality control will follow EPA guidelines as expressed in Standard Methods for the Examination of Water and Wastewater. The pressure gages, flow meter, and chart records shall be calibrated using standard engineering methods.

xvii) A qualified representative of the Engineer of Record shall be present for the start-up operations.

xviii)The Department shall be notified in writing of the date of commencement operations.

b) No fluids shall be injected without prior written authorization from the Department.

c) The only source of injectate shall be water meeting all Primary and Secondary drinking water quality standards and minimum criteria unless otherwise exempted.

PERMITTEE:
Mr. Willie Horton
Director of Office of Environmental Services
Broward County Office of Environmental Services

I. D. NUMBER: 5006M06093
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7. Surface Equipment

a) The integrity of the monitor zone sampling systems shall be maintained at all times. Sampling lines and equipment shall be kept free of contamination with independent discharges and no interconnections with any other lines. Sampling lines shall be clearly and unambiguously identified by monitoring zone at the point at which samples are drawn. All reasonable and prudent precautions shall be taken to ensure that samples are properly identified by monitor zone and that samples obtained are representative of those zones.

b) The ASR well and monitoring well surface equipment and piping shall be kept free of corrosion at all times.

8. Financial Responsibility

a) The permittee shall maintain the resources necessary to close, plug and abandon the ASR and associated monitor wells, at all times [Rule 62-528.435(9), F.A.C.].

9. Operation Permit Application

a) An operation permit application with applicable fee must be submitted at least sixty (60) days prior to the expiration of this permit.

10. Signatories

a) All reports and other submittals required to comply with this permit shall be signed by a person authorized under Rules 62-528.340(1) or (2), F.A.C.

b) In accordance with Rule 62-528.340(4), F.A.C., all reports shall contain the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Issued this __ day of_____, 1997

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Carlos Rivero-deAguilar
Director of District Management

BEFORE THE STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

IN RE:	)	
	)	
Petition for Water Quality Exemptions by Broward County	)	OGC File No. 96-3218 Broward County
	)	

FINAL ORDER

BY THE DEPARTMENT:

On August 14, 1995, the Department received from Broward County a petition for exemptions, pursuant to rule 62-520.500 of the Florida Administrative Code. The Petitioner requested relief from rule 62-520.420 of the Florida Administrative Code (standards for Class G-I and Class G-II ground water), for an installation that will discharge into a Class G-II ground water. The exemptions are for color at an alternative level of 100 color units (secondary drinking water standard is 15 color units), iron at an alternative concentration of 3.0 mg/L (secondary drinking water standard is 0.30 mg/L), and odor at an alternative level of 6 threshold odor number (secondary drinking water standard is 3 threshold odor number). The installation is the Broward County North Regional 2A Water Treatment Plant aquifer storage and recovery (ASR) facility, which is located at the corner of SW 10 Street and US Route 1, in unincorporated Broward County.

After reviewing the petition, the Department has concluded that the requirements and criteria set forth in rule 62-520.500

of the Florida Administrative Code have been satisfied. A copy of the Department's Intent to Grant is attached as Exhibit I.

The letter with the Notice of Intent, notified the petitioner of the Department's proposed agency action and advised it of its right to a hearing pursuant to sections 120.569 and 120.57 of the Florida Statutes. On April 23, 1997, notice was given in the Sun-Sentinel, Fort Lauderdale, Florida, and on April 18, 1997, notice was published in the Florida Administrative Weekly, informing the public of the Department's intended action and offering an opportunity for hearing pursuant to sections 120.569 and 120.57 of the Florida Statutes. A copy of these notices are attached as Exhibits II and III, respectively.

The petitioner and interested parties having been advised of their rights under chapter 120 of the Florida Statutes, and having failed or declined to file a petition pursuant to sections 120.569 and 120.57 of the Florida Statutes are hereby deemed to have waived those rights.

Any party to this order has the right to seek judicial review of the order pursuant to section 120.68 of the Florida Statutes by the filing of a Notice of Appeal pursuant to rule 9.110 of the Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 3900 Commonwealth Boulevard, Mail Stop #35, Tallahassee, Florida 32399-3000; and by filing a copy of the Notice of Appeal, accompanied by the applicable filling fees, with the appropriate District Court of Appeal. The Notice of Appeal must be filed

within 30 days from the date this Order is filed with the Clerk of the Department.

IT IS THEREFORE ORDERED that the petition of Broward County requesting exemptions from the color, iron, and odor water quality standards set forth in rule 62-550.320 of the Florida Administrative Code as referenced in rule 62-520.420 of the Florida Administrative Code, for the ground waters specified herein is hereby GRANTED, subject to the following conditions:

(a) The exemptions are granted for the duration of permit UC06-242418 which is for the construction and testing of the Class V raw water ASR system at the Broward County 2A Water Treatment Plant. Future exemptions must be petitioned for by the applicant in conjunction with an operation permit for any ASR project at this site.

(b) The exemptions provide relief only for the color, iron, and odor standards contained in rule 62-550.320 of the Florida Administrative Code, as referenced in rule 62-520.420 of the Florida Administrative Code. All other ground water quality standards, including the primary drinking water standards contained in rule 62-550.310 of the Florida Administrative Code, and the minimum criteria contained in rule 62-520.400 of the Florida Administrative Code, apply to this ASR project.

(c) The permittee shall monitor water quality in accordance with the specific conditions of construction permit UC06-242418 and any authorization for operational testing issued under that permit.

(d) If either of the conditions addressed in 1. or 2. below occur because of injection at the Broward County 2A Water Treatment Plant ASR system, injection into the ASR well shall cease until a water quality criteria exemption that addresses any additional parameters exceeding water quality standards has been obtained, and a well capable of monitoring the Floridan aquifer has been constructed between the Broward County ASR well and the Deerfield Beach ASR well.

1. The maximum contaminant level (MCL) or natural background level (whichever is poorer) is exceeded in the Floridan aquifer monitor well for any parameter contained in the secondary drinking water standards except color, iron, or odor; or
2. Color, iron, or odor exceeds the approved alternative level of 100 color units, 3.0 mg/L, and 6 odor threshold number, respectively.

(e) The permittee shall use the water quality data obtained during operational testing to calibrate and update the model that was used to predict that the color, iron, and odor standards would not be exceeded at the Deerfield Beach ASR well. Based on the updated model, the permittee shall determine if additional monitoring is necessary to protect underground sources of drinking water prior to obtaining an operation permit.

These exemptions, unless otherwise ordered, shall be valid for the duration of the Broward County 2A Water Treatment Plant ASR project Class V well construction permit. Additionally, the applicant must petition the Department for exemptions in conjunction with an operation permit for any ASR project at this site.

DONE AND ORDERED this 31st day of July 1997 in Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

for VIRGINIA B. WETHERELL
Secretary

3900 Commonwealth Boulevard
Tallahassee, Florida

Telephone: (850)488-1554

Copies furnished to:

Mimi Drew - TLH
Richard Drew - TLH
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Cathy McCarty - TLH
Nancy Marsh - EPA Atlanta

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

In the Matter of a Petition for Water Quality Exemption, Broward County 2A Water Treatment Plant:	)))))	OGC File No. 96-3218 Broward County

INTENT TO GRANT

The Department of Environmental Protection gives notice of its intent to grant water quality exemptions to Broward County, Mr. Doug Andrews, P.E., Director, Broward County Environmental Engineering Division, 2555 West Copans Road, Pompano Beach, Florida, for the proposed project as detailed in the petition specified above. The Department is issuing this Intent to Grant for the reasons stated below.

On August 14, 1995, the Department received a petition from the applicant, Broward County (County), for the exemption for an installation discharging into Class G-II ground water pursuant to rule 62-520.500 of the Florida Administrative Code. The County requested exemption from the ground water standards contained in rule 62-520.420(1) of the Florida Administrative Code. Specifically, the petition requested exemption from three secondary drinking water standards which are incorporated as ground water standards. The exemption request for color is 100 color units, the maximum contaminant level (MCL) standard is 15 color units. The exemption request for odor is 6.0 odor threshold number, the MCL standard is 3 odor threshold number. The exemption request for iron is 3.0 mg/L, the MCL standard is

EXHIBIT I

0.30 mg/L. As a secondary drinking water standard, the standard is aesthetically based and does not pose a health threat at the requested levels. The installation is the Broward County 2A Water Treatment Plant aquifer storage and recovery (ASR) facility which is located at the corner of SW 10 Street and US Route 1, in unincorporated Broward County.

The Department has permitting jurisdiction under chapter 403 of the Florida Statutes. The project is not exempt from permitting procedures. The Department has determined that in addition to an exemption, a construction permit is required for the facility.

The Department has reviewed the above petition for the exemption under the requirements of rule 62-520.500 of the Florida Administrative Code, and hereby gives notice of its intent to grant the exemptions to the County for its aquifer storage and recovery facility based on the following findings:

(1) Granting this exemption is clearly in the public interest. Storing excess water of good quality by ASR projects for future use meets the public demand for a reliable supply of water at a reasonable cost, while not adversely affecting the environment.

The water to be used for this ASR operation has a maximum total dissolved solids concentration (TDS) of 750 mg/L. It is expected that the receiving aquifer will have a TDS concentration in the range of 1,000 to 5,000 mg/L. Since the injected fluid is to have a lower concentration of TDS and it

meets all of the primary drinking water standards and minimum standards for ground water, storing this water for future drinking water, via ASR, is in the public interest.

(2) Compliance with presently specified criteria is unnecessary for the protection of present and future potable water supplies. Native water from the Floridan aquifer in this area is not presently being used. Desalination of water from the Floridan aquifer, in the vicinity of the proposed project, would be necessary to render this water suitable for a potable supply. Desalination is usually accomplished by reverse osmosis. Color, odor, and iron are removed by the reverse osmosis process and granting the exemption is not likely to adversely impact the treatability of water from this aquifer. Color, odor, and iron are removed during the normal treatment process used for rendering water from the Biscayne aquifer potable.

(3) Granting the exemption will not interfere with existing uses or the designated use of the waters or of contiguous water. The Biscayne aquifer water which is proposed for injection is currently being used as a drinking water source in the Broward County area. The water to be injected is of better quality with respect to total dissolved solids than the ground water in the Floridan aquifer. There are no wells that penetrate the Floridan aquifer within the one mile area of review around this facility, therefore the existing use of the water should not be affected. There will be no impact on

quality of the contiguous water because injected water is recovered as needed and sent to the Broward County 2A Water Treatment Plant.

There should be no adverse effects to aquifers overlying the injection zone because a confining zone immediately overlies the ASR injection zone. There will also be no impact on quality of the aquifers overlying the injection zone because the aquifer overlying the injection zone is the Biscayne aquifer which is the source of the ASR water. In addition, the injected water meets all of the primary drinking water standards and all of the secondary drinking water standards with the exception of color, odor, and iron.

(4) The economic, environmental and social costs of compliance with existing criteria outweigh the economic, environmental, and social benefits of compliance. Compliance with the criteria would require that the water be treated before being injected. The operation and maintenance costs for the additional treatment process would be 45 cents per 1,000 gallons of water. There also would be energy costs associated with treating the water. Without this ASR operation, additional drinking water may have to be obtained by reverse osmosis (RO) treatment of ground water from the Floridan aquifer, desalination of sea water, or drilling new Biscayne aquifer water supply wells. The cost of using reverse osmosis to treat water from the Floridan aquifer is twice that of lime softening used to treat Biscayne aquifer

water. Desalination of seawater may cost up to ten times as much as the treatment required for water obtained from the Biscayne aquifer. There would also be an additional cost incurred for the disposal of the RO concentrate. The disposal of concentrate also would be an environmental factor. The stored water (even with the requested concentrations of color, iron, and odor) should tend to improve both the quality and yield of water from the Floridan aquifer. The economic, environmental, and social costs of compliance with the criteria, plus the energy costs associated with treating and pumping this water, outweigh the economic, environmental, and social benefits. The economic, environmental, and social benefits are a reliable supply of water at a reasonable cost, while not adversely affecting the environment or public. This is especially relevant because the receiving ground water is not currently used for potable supply, and any future potable use will require appropriate treatment technology.

(5) An adequate monitoring program approved by the Department has been established to ascertain the location of the stored water, to detect any leakage of the stored water to other aquifers or surface waters, and to detect any adverse effect on underground geologic formations or waters. This program has been designed to meet the requirements set forth in rule 62-528.615 of the Florida Administrative Code. Monitoring of the ASR system will include recharge water quality and recovered water quality. In addition, water quality will be

monitored in many Biscayne water supply wells and in a Floridan aquifer monitor well within the ASR injection zone. Monthly reporting of monitoring data will be required during the operational testing phase of the construction permit and under any subsequent operation permits.

(6) The exemption will not present a danger to the public health, safety, or welfare. The recharge water is Biscayne aquifer water which meets all primary drinking water standards. Color, odor, and iron are regulated as secondary drinking water standards. Secondary drinking water standards, by definition, are aesthetically based. Exceedence of these secondary drinking water standards at the alternative levels requested should have no adverse affect upon the health or safety of persons, or the Floridan or Biscayne aquifers. The proposed ASR operation will immediately improve public health, safety, and welfare by providing a reliable water source of suitable quality and at a relatively low cost to meet projected public demands.

The Department intends to grant these exemptions subject to the following conditions:

(a) The exemptions are granted for the duration of permit UC06-242418 which is for the construction and testing of the Class V raw water ASR system at the Broward County 2A Water Treatment Plant. Future exemptions must be petitioned for by the applicant in conjunction with an operation permit for any ASR project at this site.

(b) The exemptions provide relief only for the color, odor, and iron standards contained in rule 62-550.320 of the Florida Administrative Code, as referenced in rule 62-520.420 of the Florida Administrative Code. All other ground water quality standards, including the primary drinking water standards contained in rule 62-550.310 of the Florida Administrative Code, and the minimum criteria contained in rule 62-520.400 of the Florida Administrative Code, apply to this ASR project.

(c) The permittee shall monitor water quality in accordance with the specific conditions of construction permit UC06-242418 and any authorization for operational testing issued under that permit.

(d) If either of the conditions addressed in 1. or 2. below occur because of injection at the Broward County 2A Water Treatment Plant ASR system, injection into the ASR well shall cease until a water quality criteria exemption that addresses any additional parameters exceeding water quality standards has been obtained, and a well capable of monitoring the Floridan aquifer has been constructed between the Broward County ASR well and the Deerfield Beach ASR well.

1. The MCL or natural background level (whichever is poorer) is exceeded in the Floridan aquifer monitor well for any parameter contained in the secondary drinking water standards except color, odor, or iron; or

2. Color, odor, or iron exceeds the approved alternative level of 100 color units, 6 odor threshold number, and 3.0 mg/L, respectively.

(e) The permittee shall use the water quality data obtained during operational testing to calibrate and update the model that was used to predict that the color, odor, and iron standards would not be exceeded at the Deerfield Beach ASR well. Based on the updated model, the permittee shall determine if additional monitoring is necessary to protect underground sources of drinking water prior to obtaining an operation permit.

Pursuant to section 403.815 of the Florida Statutes, and DEP rule 62-103.150 of the Florida Administrative Code, you (the applicant) are required to publish at your own expense the enclosed Notice of Intent to Grant the Water Quality Exemption. The notice shall be published one time only within 30 days, in the legal ad section of a newspaper of general circulation in the area affected. For the purpose of this rule, "publication in a newspaper of general circulation in the area affected" means publication in a newspaper meeting the requirements of sections 50.011 and 50.031 of the Florida Statutes, in the county where the activity is to take place. The applicant shall provide an original copy of the proof of publication to Mr. Richard Deuerling of the Department, at 2600 Blair Stone Road, Twin Towers Office Building, Mail Station 3530, Tallahassee, Florida 32399-2400, within seven days of publication. Failure to publish

the notice and provide proof of publication within the allotted time may result in the denial of the exemption.

The Department will grant the exemption unless a petition for an administrative proceeding (hearing) is filed pursuant to the provisions of sections 120.569 and 120.57 of the Florida Statutes.

A person whose substantial interests are affected by the Department's proposed exemption decision may petition for an administrative proceeding (hearing) in accordance with sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Stop #35, Tallahassee, Florida 32399-3000. Petitions filed by the exemption applicant and the parties listed below must be filed within 21 days of receipt of this intent. Petitions filed by other persons must be filed within 21 days of publication of the public notice or within 21 days of their receipt of this intent, whichever first occurs. The petitioner must mail a copy of the petition to the applicant at the address indicated above, at the time of filing. The failure of any person to file a petition within the time period shall constitute a waiver of any right of that person's right to request an administrative determination (hearing) under sections 120.569 and 120.57 of the Florida Statutes, or to intervene in this proceeding and participate as a party to it. Any subsequent intervention will only be at the discretion of the presiding officer upon the filing of a motion in compliance with rule 28-5.207 of the Florida Administrative Code.

The Petition shall contain the following information:

(a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department File Number and the county in which the project is proposed;

(b) A statement of how and when each petitioner received notice of the Department's action or proposed action;

(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;

(d) A statement of the material facts disputed by Petitioner, if any;

(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;

(f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action; and

(g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this order. Persons whose substantial interests will be affected by any such final decision of the Department on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under section 120.573 of the Florida Statutes is not available for this proceeding.

DONE AND ENTERED this 12th day of March 1997 in Tallahassee, Florida.

Date

For Virginia B. Wetherell
Secretary

State of Florida Department
of Environmental Protection
The Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399

Copies furnished to:

Carlos Rivero-deAguilar, DEP/WPB
Richard Drew, DEP/TLH
Cynthia Christen, Office of General Counsel, DEP
Richard Deuerling, P.G., DEP/TLH
Nancy Marsh, USEPA/Atlanta
Bill Cocke, P.G. DEP/WPB
Cathy McCarty, P.G. DEP/TLH

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL PROTECTION

NOTICE OF INTENT TO GRANT WATER QUALITY EXEMPTION

The Department of Environmental Protection gives notice of its intent to grant water quality exemptions for the aesthetically based secondary drinking water standards for color (standard 15 color units, exemption limit 100 color units), iron (standard 0.3 mg/L, exemption limit 3.0 mg/L), and odor (standard 3 threshold odor number, exemption limit 6 threshold odor number) to Broward County, Mr. Doug Andrews Director, for the Broward County North Regional 2A Water Treatment Plant (WTP) aquifer storage and recovery (ASR) project. The exemptions are granted for the duration of the Broward County 2A WTP ASR Class V well construction permit. Future exemptions must be petitioned for by the applicant in conjunction with an operation permit for any ASR project at this site. The ASR wells are located at the Broward County 2A WTP at the corner of SW 10 Street and US Route 1, unincorporated Broward County.

A person whose substantial interests are affected by the Department's proposed exemption decision may petition for an administrative proceeding (hearing) in accordance with sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Stop #35, Tallahassee, Florida 32399-3000, within 21 days of publication of this notice. The petitioner must mail a copy of the petition to

the applicant at the address indicated above, at the time of filing. The failure of any person to file a petition within the time period shall constitute a waiver of any right of that person's right to request an administrative determination (hearing) under sections 120.569 and 120.57 of the Florida Statutes, or to intervene in this proceeding and participate as a party to it. Any subsequent intervention will only be at the discretion of the presiding officer upon the filing of a motion in compliance with rule 28-5.207 of the Florida Administrative Code.

The Petition shall contain the following information;

(a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department File Number and the county in which the project is proposed;

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(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;

(d) A statement of the material facts disputed by Petitioner, if any;

(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;

(f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action; and

(g) A statement of the relief sought by petitioner, stating

precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this order. Persons whose substantial interests will be affected by any such final decision of the Department on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under section 120.573 of the Florida Statutes is not available for this proceeding.

The application is available for public inspection during normal business hours, 8:00 a.m. to 5:00 p.m., Monday through Friday, except legal holidays, at the Tallahassee Office, 2600 Blair Stone Road, Room 212E, Tallahassee, Florida 32399-2400.

SUN-SENTINEL
PUBLISHED DAILY
FORT LAUDERDALE, BROWARD COUNTY, FLORIDA
BOCA RATON, PALM BEACH COUNTY, FLORIDA
MIAMI, DADE COUNTY, FLORIDA

TATE OF FLORIDA
OUNTY OF BROWARD/PALM BEACH/DADE
BEFORE THE UNDERSIGNED AUTHORITY PERSONALLY APPEARED
..... WHO ON OATH SAYS THAT
E/SHE IS A DULY AUTHORIZED REPRESENTATIVE OF THE
LASSIFIED DEPARTMENT OF THE SUN-SENTINEL, DAILY
EWSPAPER PUBLISHED IN BROWARD/PALM BEACH/DADE COUNTY,
LORIDA THAT THE ATTACHED COPY OF ADVERTISEMENT, BEING A

OTICE OF INTENT

N THE MATTER OF

ATER QUALITY EXEMPT

N THE CIRCUIT COURT, WAS PUBLISHED IN SAID NEWSPAPER IN
HE ISSUES OF
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AI ANT FURTHER SAYS THAT THE SAID SUN-SENTINEL IS A
EWSPAPER PUBLISHED IN SAID BROWARD/PALM BEACH/DADE
OUNTY, FLORIDA, AND THAT THE SAID NEWSPAPER HAS HERETOFOR
EEN CONTINUOUSLY PUBLISHED IN SAID BROWARD/PALM BEACH/DAD
OUNTY, FLORIDA, EACH DAY, AND HAS BEEN ENTERED AS SECOND
LASS MATTER AT THE POST OFFICE IN FORT LAUDERDALE, IN SAI
ROWARD COUNTY, FLORIDA, FOR A PERIOD OF ONE YEAR NEXT
RECEDING THE FIRST PUBLICATION OF THE ATTACHED COPY OF
DVERTISEMENT; AND AFFIANT FURTHER SAYS THAT HE/SHE HAS
EITHER PAID NOR PROMISED ANY PERSON, FIRM OR CORPORATION
NY DISCOUNT, REBATE, COMMISSION OR REFUND FOR THE PURPOSE
F SECURING THIS ADVERTISEMENT FOR PUBLICATION IN SAID
EWSPAPER.

.....
(SIGNATURE OF AFFIANT)

WORN TO AND SUBSCRIBED BEFORE ME
HIS 23 DAY OF APRIL
.D. 1997

.....
IATURE OF NOTARY PUBLIC)

BARBARA STRICKLAND
Notary Public - State of Florida
My Commission Expires Jul 24, 2000
Commission # CC571507

.....
NAME OF NOTARY TYPED, PRINTED OR STAMPED)

COP.1132ASR(1134) -1.9

STATE OF FLORIDA
DEPARTMENT OF
ENVIRONMENTAL
REGULATION
NOTICE OF INTENT
TO GRANT WATER
QUALITY EXEMPTION

The Department of Environmental Regulation gives notice of its intent to grant water quality exemptions for the aesthetically based secondary drinking water standards for color (standard 15 color units, exemption limit 100 color units), iron (standard 0.3 mg/L, exemption limit 3.0 mg/L, and odor (standard 3 threshold odor number, exemption limit 6 threshold odor number) to Broward County, Mr. Doug Andrews Director, for the Broward County North Regional 2A Water Treatment Plant (WTP) aquifer storage and recovery (ASR) project. The exemptions are granted for the duration of the Broward County 2A WTP ASR Class V well construction permit. Future exemptions must be petitioned for by the applicant in conjunction with an operation permit for any ASR project at this site. The ASR wells are located at the Broward County 2A WTP at the corner of SW 10 Street and US Route 1, unincorporated Broward County.

A person whose substantial interests are affected by the Department's proposed exemption decision may petition for an administrative proceeding (hearing) in accordance with Section 120.569 and 120.57 of the Florida Statues. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Stop #35, Tallahassee, Florida 32399-3000, within 21 days of publication of this notice. The petitioner must mail a copy of the petition to the applicant at the address indicated above, at the time of filing. The failure of any person to file a petition within the time period shall constitute a waiver of any right of that person's right to request an administrative determination (hearing) under sections 120.569 and 120.57 of the Florida Statutes, or to intervene in this proceeding and participate as a party to it. Any subsequent intervention will only be at the discretion of the presiding officer upon the filing of a motion in compliance with rule 28-5.207 of the Florida Administrative Code.

The Petition shall contain the following information; (a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed; (b) A statement of how and when each petitioner received notice of the Department's action or proposed action; (c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action; (d) A statement of the material

Volume 23, Number 16, April 18, 1997
Section XII Miscellaneous

...previous

Department of Environmental Protection

NOTICE OF AVAILABILITY

FLORIDA FINDING OF NO SIGNIFICANT IMPACT

CITY OF WAUCHULA

RECLAIMED WATER REUSE FACILITIES

The Florida Department of Environmental Protection has determined that the City of Wauchula's proposed Reclaimed Water Reuse Project will not have a significant adverse impact on the environment. The total project cost is estimated at $8,255,000 consisting of $1,747,000 for Phase I and $6,508,000 for Phase II. The project is expected to qualify for a State Revolving Fund loan composed of federal and state matching funds. A full copy of the Florida Finding of No Significant Impact can be obtained by writing to: Dick Smith, Bureau of Water Facilities Funding, Department of Environmental Protection, 2600 Blair Stone Road, MS #3505, Tallahassee, Florida 32399-2400.

NOTICE OF INTENT TO GRANT

WATER QUALITY EXEMPTION

The Department of Environmental Protection gives notice of its intent to grant water quality exemptions for the aesthetically based secondary drinking water standards for color (standard 15 color units, exemption limit 100 color units), iron (standard 0.3 mg/L, exemption limit 3.0 mg/L), and odor (standard 3 threshold odor number, exemption limit 6 threshold odor number) to Broward County, Mr. Doug Andrews, Director, for the Broward County North Regional 2A Water Treatment Plant (WTP) aquifer storage and recovery (ASR) project. The exemptions are granted for the duration of the Broward County 2A WTP ASR Class V well construction permit. Future exemptions must be petitioned for by the applicant in conjunction with an operation permit for any ASR project at this site. The ASR wells are located at the Broward County 2A WTP at the corner of S. W. 10 Street and US Route 1, unincorporated Broward County.

A person whose substantial interests are affected by the Department's proposed exemption decision may petition for an administrative proceeding (hearing) in accordance with sections 120.569 and 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station #35, Tallahassee, Florida 32399-3000, within 21 days of publication of this notice. The petitioner must mail a copy of the petition to the applicant at the address indicated above, at the time of filing. The failure of any person to file a petition within the time period shall constitute a waiver of any right of that person's right to request an administrative determination (hearing) under sections 120.569 and 120.57, Florida Statutes, or to intervene in this proceeding and participate as a party to it. Any subsequent intervention will only be at the discretion of the presiding officer upon the filing of

a motion in compliance with rule 28-5.207, Florida Administrative Code.

The Petition shall contain the following information;

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(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;

(d) A statement of the material facts disputed by Petitioner, if any;

(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;

(f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action; and

(g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this order. Persons whose substantial interests will be affected by any such final decision of the Department on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under section 120.573, Florida Statutes is not available for this proceeding.

The application is available for public inspection during normal business hours, 8:00 a.m. to 5:00 p.m., Monday through Friday, except legal holidays, at the Tallahassee Office, 2600 Blair Stone Road, Room 212E, Tallahassee, Florida 32399-2400.

Department of Children and Family Services

Leon County residents are invited to apply for a seat on the District 2, Health and Human Services Board. The Board oversees Dept. of Children and Families dollars that are spent to meet health and social service needs in the 14-county district.

Board members represent the District's population in terms of age, gender and ethnic background. Persons interested in serving, should have demonstrated an interest in health and social service issues.

Residents of Bay, Gulf, Franklin, Calhoun, Holmes, Washington, Gadsden, Jackson, Liberty, Leon, Jefferson, Wakulla, Madison and Taylor counties also are encouraged to submit an application now for future vacancies.

The deadline for new applications is Monday, May 19, 1997. Persons who have previously applied for Board membership will be considered in the selection process and need not reapply.

STATE OF FLORIDA
DEPARTMENT OF HEALTH AND REHABILITATIVE SERVICES

WATER TREATMENT PLANT CONSTRUCTION PERMIT

Broward County MW (Log #8611)
BCOES - 2A
(BCOES - 2A/ASR Demonstration Project)
August 6, 1996

PERMITTEE:

Rich Rollo, P.E., Director of Env. Engr.
Broward County Office of Environmental Services
2555 W. Copans Road
Pompano Beach, FL 33069

RE:

I.D. NUMBER:	4060163
PERMIT NUMBER:	**WC-06-288104**
DATE OF ISSUE:	08/06/1996
EXPIRATION DATE:	08/06/2001
PROJECT NAME:	BCOES - 2A/ASR Demonstration Project
PROJECT LOCATION:	1390 N.E. 50 St., Pompano Beach

Dear Mr. Rollo:

Effective August 6, 1996, this permit is issued according to the provisions of Chapter 403, F.S. , and Chapters 62-4, 62-550, 62-555, & 62-560, F.A.C. The above-named permittee is hereby authorized to perform the work or operate the facility shown on the approved applications, engineering plans, and other documents attached hereto or on file with Broward County Public Health Unit (BCPHU) and made a part hereof and specifically described as follows:

CONSTRUCT: One (1) 1,200-foot ASR well with a 16-inch diameter casing (1,000 feet long) using raw water from the Biscayne Aquifer for recharge and recovery; one (1) 1,200-foot monitoring well with a 6-inch diameter casing (1,000 feet long); one (1) submersible pump (1,800 gpm) for recovery; one (1) horizontal split-case centrifugal pump (1,800 gpm) for recharge; approximately 430 ft of 3-inch PVC monitor well discharge pipe and 80 ft of 16-inch DI ASR recharge/recovery pipe; associated pipings; and all related appurtenances as shown on the engineering plans and in the specifications.

SUBJECT TO: General Conditions 1-15 and Specific Conditions 1-15.

GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations and restrictions set forth in this permit, are "permit conditions" and are binding and enforceable pursuant to Sections 403.141, 403.727, or 403.859 through 403.861, F.S. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5), F.S., the issuance of this permit does not convey any vested right or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in this permit.

4. This permit conveys no title to land or water, does not constitute State's recognition or acknowledgement of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State's opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenance) that are installed and used by the permittee to achieve compliance with the conditions of this permit as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at

[illegible] permit [illegible] conditions.

(a) Determination of Best Available Control Technology (BACT)

(b) Determination of Preventions of Significant Deterioration (PSD)

(c) Certification of compliance with state Water Quality Standards (Section 401, PL 92-500)

(d) Compliance with New Source Performance Standards

14. The permittee shall comply with the following:

(a) Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

(b) The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for the permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

(c) Records of monitoring information shall include:

1. the date, exact place, and time of sampling or measurements;
2. the person responsible for performing the sampling or measurements
3. the date analyses were performed;
4. the person responsible for performing the analyses;
5. the analytical techniques or methods used;
6. the results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware the relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

SPECIFIC CONDITIONS:

1. The applicant is responsible for retaining a Florida registered professional engineer as the engineer of record in the application for supervision of the construction of this project, and upon completion, the engineer shall inspect the construction for complete conformity to the plans and specifications as approved. Appropriate certification documents [a letter of certification, one (1) set of as-built drawings, a business check or cash for $ 40.00, copies of pressure test and bacteriological clearance results (when applicable)] shall then be provided to **HRS Broward County Public Health Unit (BCPHU)**.

2. Water system components which come into contact with drinking water shall be certified as being in conformance with ANSI/NSF Standard 61-1995 (Drinking Water System Components).

3. Delete the notes regarding "Additive Alternate" and the 16-inch DI pipe connecting ASR well and the finished water main as shown in red on Sheet C-1 of the engineering plans.

4. Add one (1) 16-inch valve as shown in red on Sheet M-1 of the engineering plans.

5. Revise Sheets E-1 and I-1 to reflect the discussed changes as shown in red.

6. Analyze the native water from the ASR well for primary standards, ammonia as N, total phosphorus as P, BOD, secondary standards, and unregulated organic contaminants for four (4) consecutive quarters and submit the test results to BCPHU.

7. Analyze the recovery stream continuously for conductivity; daily for total and calcium hardness, alkalinity, turbidity, pH, temperature, chloride, color and iron; weekly for sulfate, total nitrate and nitrite, sodium, ammonia as N, total phosphorus as P, TDS, BOD, and H2S; and monthly for total coliform.

8. Analyze the recharge stream daily for chloride, total and calcium hardness, alkalinity, turbidity, pH, temperature, conductivity, color and iron; weekly for sulfate, total nitrate and nitrite, sodium, ammonia as N, total phosphorus as P, TDS, BOD, and H2S; and monthly for total coliform.

9. Analyze the water from the monitoring well weekly for chloride, total and calcium hardness, alkalinity, turbidity, pH, temperature, conductivity, color, iron, sulfate, total nitrate and nitrite; sodium, ammonia as N, total phosphorus as P, TDS, BOD, and H2S; and monthly for total coliform.

10. Submit to BCPHU data on the transmissivity and the water movement (direction and velocity) of the aquifer covering the ASR well and the monitoring well on a quarterly basis.

11. Submit to BCPHU daily flow rate data on the recharge and recovery cycles and those in Items 7, 8, and 9 on a monthly basis.

12. The entire recovery stream shall be pumped to the head of the plant and be fully treated along with the raw water from the Biscayne Aquifer.

13. Install an audible alarm to indicate the exceedance of the 100 ppm of chloride or the equivalent conductivity limit on the recovery stream signaling the end of the recovery cycle.

14. Additional tests and requirements may be required as deemed necessary by BCPHU upon further review of submitted data and/or documents. Written approval from BCPHU shall be required before the ASR well can be put into operation on a routine basis.

15. This permit does not indicate a waiver or approval of any permits required by this agency for other aspects of the project.

Executed in Fort Lauderdale, Florida,

HRS Broward County Public Health Unit

Thomas K. Mueller, P.E.
Environmental Engineering Director

Robert G. Self, M.D.
Acting Senior Administrator

TKM/dn

Copies furnished to:
A. Wayne Welch, P.E., Montgomery Watson
Alfred Mueller, P.E., DEP
Gary Back, Engineer III, Broward County Engineering Division
City of Pompano Beach Building Dept.

8/28/96

Post-it™ brand fax transmittal memo 7671	# of pages ▸ 1
To Anne Murray	From Bob Leonard
Co. Montgomery Watson	Co. DES/EERD
Dept.	Phone # 831-6969
Fax # 476-9995	Fax #

STATE OF FLORIDA
DEPARTMENT OF HEALTH AND REHABILITATIVE SERVICES

NOTICE OF PERMIT ISSUANCE

Broward County - MW (Log #8611)
BCOES - 2A
(BCOES-2A/ASR Demonstration Project)
August 6, 1996

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Rich Rollo, P.E., Director of Env. Engr.
Broward County Office of Environmental Services
2555 W. Copans Road
Pompano Beach, FL 33069

RE: **PROJECT NAME**: BCOES-2A/ASR Demonstration Project

PROJECT LOCATION: 1390 N.E. 50 Street, Pompano Beach

Dear Mr. Rollo:

Enclosed is Permit Number **WC-06-288104** issued pursuant to Chapter 403, F.S.

A person whose substantial interests are affected by this permit may petition for an administrative proceeding (hearing) in accordance with Section 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of Legal Counsel, DHRS/BCPHU, 201 West Broward Boulevard, Suite 513, Fort Lauderdale, FL 33301, within 14 days of receipt of this permit. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. Failure to file a petition within this time period shall constitute a waiver of any right such person may have to request an administrative determination (hearing) under Section 120.57, Florida Statutes.

The petition shall contain the following information:

(a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;

(b) A statement of how and when each petitioner received notice of the Department's action or proposed action;

(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;

(d) A statement of the material facts disputed by petitioner, if any;

(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;

(f) A statement of which rules or statues petitioner contends require reversal or modification of the Department's action or proposed action; and

(g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

If a petition is filed, the administrative hearing process is designed to formulate agency action. Accordingly, the Department's final action may be different from the position taken by it in this permit. Persons whose substantial interests will be affected by any decision of the Department with regard to the application have the right to petition to become a party to the proceeding. The petition must conform to the requirements specified above and be filed must conform to the requirements specified above and be filed (received) within 14 days of receipt of this notice in the Office of Legal Counsel at the above address of the Department. Failure to petition within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, F.S., and to participate as a party to this proceeding. Any subsequent intervention will only be at the approval of the presiding officer upon motion filed pursuant to Rule 28-5.207, F.A.C.

This permit is final and effective on the date filed with the Clerk of the Department unless a petition is filed in accordance with the above paragraphs or unless a request for extension of time in which to file a petition is filed within the time specified for filing a petition and conforms to Rule 62-103.070, F.A.C. Upon timely filing of a petition or request for an extension of time, this permit will not be effective until further Order of the Department.

When the Order (Permit) is final, any party to the Order has the right to seek judicial review of the Order pursuant to Section 120.68, Florida Statues, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules and Appellate Procedure, with the Clerk of the Department in the Office of Legal Counsel, DHRS/BCPHU, 201 West Broward Boulevard, Suite 513, Fort Lauderdale, FL 33301, and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date the Final Order is filed with the Clerk of the Department.

Executed in Ft. Lauderdale , Florida,

HRS Broward County Public Health Unit

Thomas K. Mueller, P.E.
Environmental Engineering Director

Robert G. Self, M.D.
Acting Senior Administrator

CERTIFICATE OF SERVICE

This undersigned duly designated deputy agency clerk hereby certifies that this NOTICE OF PERMIT ISSUANCE and all copies are mailed by certified mail before the close of business on August 7, 1996 to listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGMENT

FILED, on this date, pursuant to Section 120.52(11), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk: Donna L. Fagle Date: August 6, 1996

TKM/dn
Enclosures

Copies furnished to:
A. Wayne Welch, P.E., Montgomery Watson
Alfred Mueller, P.E., DEP
Gary Back, Engineer III, Broward County Engineering Division
City of Pompano Beach Building Dept.

2/27 3/11 3/26

17518

STATE OF FLORIDA
HRS Broward County Public Health Unit
ENVIRONMENTAL ENGINEERING SECTION
2421 S.W. 6 Avenue
Ft. Lauderdale, FL 33315

Reference # (Log/Permit): 8611

Employee I.D. #: 1C

• • RECEIPT FOR FEES • •

PROJECT NAME: ASR Demonstration Project DATE: 3/29/96

APPLICANT: Montgomery Watson UTILITY: BCES-2A

CK. NO. 06957

PUBLIC WATER TREATMENT PLANT FACILITY APPROVAL

WT1	a.	Exceeds	0.00	MGD - up to and including		0.10	MGD	$
WT2	b.	"	0.10	MGD	"	0.50	MGD	$
WT3	c.	"	0.50	MGD	"	1.00	MGD	$
WT4	d.	"	1.00	MGD	"	2.00	MGD	$
WT5	e.	"	2.00	MGD	"	4.00	MGD	$
WT6	f.	"	4.00	MGD	"	8.00	MGD	$
WT7	g.	"	8.00	MGD	"	20.00	MGD	$
WT8	h.	"	20.00	MGD				$
WGM	i.	Plant modification - no capacity charge						$ 100.00

WATER STORAGE FACILITY APPROVAL

WS1	a.	Exceeds	0.00	MGD - up to and including		1.00	MGD	$
WS2	b.	"	1.00	MGD	"	2.00	MGD	$
WS3	c.	"	2.00	MGD	"	3.00	MGD	$
WS4	d.	"	3.00	MGD	"	4.00	MGD	$
WS5	e.	"	4.00	MGD				$

PUBLIC WATER DISTRIBUTION SYSTEM APPROVAL

WDM	a.	Minimum charge					$
WD1	b.	Mains < 6"	$0. _____	X	_____	linear ft. =	$
WD2	c.	Mains 6" to 10"	$0. _____	X	_____	linear ft. =	$
WD3	d.	Mains 12" or larger	$0. _____	X	_____	linear ft. =	$
WD4	e.	Water project clearance					$
W05	f.	Resubmittal of plans requiring revision					$
W10	g.	Review of previously approved plans (revision/renewal)					$

PRIVATE WATER SYSTEM APPROVAL

PWW	a.	Private water well installation	$

ONSITE SEWAGE TREATMENT AND DISPOSAL SYSTEMS

EHT	a.	Holding tank permit	$
ESR	b.	Repair permit	$
ESN	c.	Standard subsurface system	$
ESP	d.	Prior site evaluation	$
EDA	e.	Abandoned system	$
EDS	f.	Single-pump positive dosing system	$
EDD	g.	Duplex-pump positive dosing system	$
EDR	h.	Revision due to positive dosing system	$
EAP	i.	I/M zone annual permit	$
EAS	j.	Amended sewage permit	$

SUBDIVISION ANALYSIS AND APPROVAL

EP1	a.	Plats with 5 to 25 building lots		$
EP2	b.	"	26 to 50 "	$
EP3	c.	"	51 to 75 "	$
EP4	d.	"	>75 "	$

PUBLIC POOL/BATHING PLACE APPROVAL

SPC	a.	Plan review for original construction	$
SPR	b.	Plan review for modification/revision	$
SPI	c.	Issuance of initial operating permit	$
WMI		Other (specify DEP MINOR MOD.)	$ 300.00

APPENDIX B

Summary of Construction Activities

Construction Progress Summary
Broward County Office of Environmental Services
Aquifer Storage and Recovery (ASR) Demonstration Project
2A Water Treatment Plant Site

Date	Description of Activities
6/19/96	Preconstruction Conference
7/10/96	Project Initiation (Notice to Proceed)
7/23/96	Vibrate surface casing (40 ft; 24-inch steel) at MW-1 and ASR-1; install 4 pad monitor wells
8/1/96	Pour temporary slab at MW-1.
8/8/96	Set up rig over MW-1 with cranes.
8/8/96	Conduct first sampling of pad monitor wells (PMWs).
8/19/96	Begin mud-rotary drilling with nominal 12-inch bit at MW-1
8/21/96	Complete pilot hole drilling to 430 feet bls.
8/21/96	Conduct geophysical logging of MW-1 pilot hole to 430 feet bls.
8/22/96	Ream pilot hole with 24-inch bit.
8/26/96	Complete reaming and install 14-inch casing to 430 feet bls.
8/27/96	Cement 14-inch casing with 619 sacks of neat cement.
8/28/96	Resume pilot hole drilling with 12-inch bit to 1,000 feet bls.
8/29/96	Conduct geophysical logging of MW-1 pilot hole to 990 feet bls.
8/30/96	Ream 14-inch borehole and install 6-inch casing to 990 feet bls.
8/31/96	Cement 6-inch casing with 625 sacks of neat cement to 990 feet bls.
9/10/96	Conduct 100-psi pressure test of 6-inch casing (1.5 psi drop in 1 hour).
9/11/96	Begin setup of piping/pump system to convey water to 1 MG tank and lift station.
9/16/96	Begin drilling 6-inch pilot hole with reverse-air drilling (open circulation).
9/17/96	Complete pilot hole drilling and begin well development
9/18/96	Complete well development. Set up for pumping test.
9/19/96	Conduct 4-hour pumping test of MW-1 at 525 gpm.
9/24/96	Conduct geophysical logs over open-hole interval at MW-1 to 1,200 feet bls.
10/1/96	Pad monitor wells at ASR well completed and developed.
10/2/96	Sample PMWs and submit to laboratory.
10/3/96	Begin pilot hole drilling (mud-rotary) with 12-1/4-inch bit at ASR-1.
10/9/96	Complete pilot hole to 420 feet bls and conduct geophysical logging.
10/10/96	Ream pilot hole with nominal 36-inch bit to 410 feet bls.
10/11/96	Install and cement 26-inch steel casing to 397 feet bls with 967 sacks neat cement.
10/16/96	Resume pilot hole drilling at ASR well with 12-1/4-inch bit
10/22/96	Complete pilot hole to 1,017 feet bls and conduct geophysical logs
10/23/96	Begin reaming pilot hole to nominal 26-inch diameter to 995 feet bls.
10/25/96	Install 16-inch steel casing to 995 feet bls.
10/26/96	Cement 16-inch casing with 383 sacks neat cement and 743 sacks 4% gel.
10/28/96	Tag cement at 70 feet and tremie grout 116 sacks neat cement to land surface.
11/1/96	Conduct 150-psi pressure test at ASR-1 16-inch casing.
11/12/96	Begin reverse-air drilling with 15-inch bit.
11/13/96	Complete reverse-air drilling to 1,200 feet bpl (TD). Begin air development.
11/14/96	Complete development at 11:00 am and trip out.
11/15/96	Conduct flow logs on open hole. Assemble temp. piping for step test.
11/19/96	Install 14-inch bowl diameter turbine pump for step test.
11/20/96	Conduct step test. Set up data logger/pressure transducers to record background.
11/26/96	Conduct 24-hour constant rate (1,000 gpm) aquifer test.
11/27/96	Record recovery data
12/3/96	Obtain water quality sample at ASR-1 for laboratory analysis.
12/3/96	Conduct final geophysical logs including cement bond log (CBL), caliper, temperature, dual induction, gamma, SP, fluid resistivity, LSN, and video.
12/4/96	Begin demobilization of drill rig and start up of surface facility construction.
3/4/97	Conduct wet tap of 20-inch raw water main and tie into ASR piping.
3/12/97	Obtain water quality sample at MW-1 for laboratory analysis.

APPENDIX C

Weekly Summaries

CH2M HILL
Hillsboro Executive Center North
800 Fairway Drive
Suite 350
Deerfield Beach, FL
33441-1831
Tel 954.426.4008
Fax 954.698.6010

CH2MHILL

Celebrating 50 Years

December 12, 1996
103715.A0

Mr. William W. Cocke, P.G.
Program Manager–UIC
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; FDEP File # UC 06-242411; BCOES #1134 ASR

Weekly Summary (November 25-December 01)

The drilling contractor (Diversified Drilling Corp. [DDC]). conducted the 24-hour constant rate aquifer test on the ASR well. A data logger/pressure transducer system was set up to record background data, test data, and recovery data from MW-1 and ASR-1. A background water quality was obtained and will be analyzed for primary/secondary drinking water standards parameters per the permit.

Upcoming Schedule

DDC will demobilize drilling equipment including drill rig, pumps, temporary piping etc. The temporary concrete pad will be decommissioned. Subcontractors will mobilize January 1997 to construct the surface facilities for the ASR system per the contract documents, which should be completed over the next 4 months. Upon completion, an engineering report, surface facility construction certification, and record drawings will be forwarded to FDEP per the permit. We will switch from weekly to monthly sampling of the pad monitor wells now that well activities are complete–per Mr. Kwiatkowski's conversation with Mr. Bill Cocke/FDEP.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB11776.DOC
Enclosures
c: Bob Leonard/BCOES
Anne Murray/Montgomery Watson
Members of the TAC

Project No. 10315.A0 Date 11-26-96

Client BROWARD COUNTY ASR

Contractor DIVERSIFIED DRILLING

Well No. ASR-1

DAILY OPERATIONS REPORT

Weather SUNNY, WARM, ≈ 85°F

Shift No. 1 Time 0700-1900

Driller JOE SCHMIDT

Activity 24-HOUR PUMPING TEST

Starting Depth

Shift No. 2 Time 1900-0700

Driller JOE SCHMIDT

Activity 24-HOUR PUMPING TEST

Starting Depth

Formation samples collected

Water samples collected

Deviation Survey

Drilling fluid additives

Well water level

Time	Depth

Measurement reference point

elevation

Supply deliveries

Time	Description of Operations
0715 -	M. SCHMIDT ARRIVES AT THE SITE. THE CONTRACTOR HAS COMPLETED ALL THE NECESSARY PREPARATIONS FOR THE 24-HOUR PUMP TEST. A 8"ø ORIFICE PLATE AND MANOMETER WILL BE USED TO MEASURE THE FLOW PUMPING RATE. THIS WILL DISCHARGE INTO THE POND AND THEN THE WATER WILL BE PUMPED BY TWO 6-INCH PUMPS TO THE ONE MILLION GALLON STORAGE TANK. THE TANK HAS BEEN DRAINED TO THE LOWEST POSSIBLE LEVEL AND WILL CONTINUED TO BE DRAINED THROUGHOUT THE PUMP TEST.
	M. SCHMIDT SETS UP THE DATA LOGGER TO MONITOR BOTH THE ASR WELL AND THE MONITOR WELL.
0805 -	START THE 24-HOUR PUMP TEST. THE PUMPING RATE WILL REMAIN CONSTANT AT 1,000 GPM FOR THE ENTIRE TEST.
1315 -	MARK SCHMIDT OFFSITE FOR THE DAY. THE CONTRACTOR WILL REMAIN ON SITE AND MONITOR PUMPING TEST THROUGHOUT THE NIGHT

REPRESENT - MARK SCHMIDT

M. Silberg

Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
MW-1	8/8/96	18	495	7.2	400	10	150	6.56	144	0	259	7.31	190	18	439	7.25	352	Initial Sampling
MW-1	8/22/96	21.5	542	6.93	452	17.5	178	6.65	260	5	307	7.13	264	44.5	467	7.12	364	
MW-1	8/29/96	20	533	7.14	308	6.6	158	6.64	410	5	322	7.16	246	52	445	7.18	378	
MW-1	9/4/96	14	337	8.28	272	8.5	193	6.74	274	5	332	7.48	222	56.5	515	7.37	410	
MW-1	9/11/96	24	496	8.81	362	8	194	6.61	146	8	364	7.17	224	44	494	7.20	348	
MW-1	9/18/96	180	1002	7.92	606	8	184	6.49	262	6	402	7.08	284	29	459	7.25	318	
MW-1	9/24/96	99	538	7.71	596	6	188	6.6	248	9	372	7.27	286	29	481	7.21	322	
MW-1	10/2/96	25.5	534	7.11	382	6	182	6.51	150	16	408	7.19	276	23.5	460	7.28	308	
MW-1	10/8/96	16	151	8.45	140	7	213	6.75	170	7	323	7.42	218	20	452	7.18	268	
MW-1	10/15/96	13	139	8.39	96	7	231	6.8	148	14	385	7.37	214	26	473	7.30	262	Final Sampling
ASR-1	10/2/96	44.5	455	7.33	314	37	871	7.27	366	25	379	7.18	260	39	418	7.29	292	Initial Sampling
ASR-1	10/8/96	6	448	10.65	276	24	500	7.28	278	32	387	7.13	234	30	395	6.91	242	
ASR-1	10/15/96	7	330	10.29	220	15	263	9.61	204	32	386	7.21	240	40	414	7.42	256	
ASR-1	10/22/96	11	235	9.48	166	24	499	7.28	282	38	391	7.24	236	38	392	7.07	244	
ASR-1	10/31/96	25	306	7.56	196	27	534	7.5	256	27	376	7.39	344	33	389	7.12	270	
ASR-1	11/5/96	38	463	7.21	308	35	690	7.2	426	34	401	7.31	254	34	381	7.15	258	
ASR-1	11/13/96	36.2	445	7.26	306	49.5	880	6.98	304	36.5	420	7.21	570	35	354	7.17	264	
ASR-1	11/20/96	36	458	7.70	314	60	967	6.98	628	35	432	7.09	320	39	457	7.08	318	
ASR-1	11/26/96	35	462	7.22	352	75	1051	7.01	682	36.5	448	7.11	320	51	506	7.06	346	
ASR-1	12/4/96																	
ASR-1	12/11/96																	
ASR-1	12/18/96																	
ASR-1	12/26/96																	
ASR-1	1/2/97																	
ASR-1	1/9/97																	
ASR-1	1/16/97																	

CH2M HILL
Hillsboro Executive Center North
800 Fairway Drive
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Deerfield Beach, FL
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Tel 954.426.4008
Fax 954.698.6010

CH2MHILL

Celebrating 50 Years

December 12, 1996

103715.A0

Mr. William W. Cocke, P.G.
Program Manager - UIC
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; FDEP File # UC 06-242411; BCOES #1134 ASR

Weekly Summary (N[redacted])

The drilling contractor (Diversified Drilling Corp. [DDC]). set up temporary piping to convey pumping test waters to the 1 million gallon storage tank. A vertical turbine test pump was set up to conduct the step pumping test. A 6-hour step test was conducted at the ASR well.

Schedule for Next Week

Conduct 24-hour constant rate (1,000 gpm) aquifer test.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB11775.DOC
Enclosures
c: Bob Leonard/BCOES
Anne Murray/Montgomery Watson
Members of the TAC

CH2M HILL
Hillsboro Executive Center North
800 Fairway Drive
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CH2MHILL

November 26, 1996

103715.A0

Mr. William W. Cocke, P.G.
Program Manager - UIC
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; FDEP File # UC 06-242411; BCOES #1134 ASR

Weekly Summary (November 11 – November 15)

The drilling contractor (Diversified Drilling Corp. [DDC]) conducted reverse-air drilling with a 15-inch-diameter bit from base of casing to total depth (1,200 feet bpl). The well was developed to remove fines from the borehole. Conducted flow logs (caliper, temperature, fluid resistivity, and flowmeter)on the open borehole to delineate flow zones.

Schedule for Next Week

Set up temporary piping to convey pumping test waters to the 1 million gallon storage tank. Set up test pump to conduct step pumping test. Conduct step test.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB/11679.DOC
Enclosures
c: Bob Leonard/BCOES
Anne Murray/Montgomery Watson
Members of the TAC

Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
MW-1	8/8/96	18	495	7.2	400	10	150	6.56	144	0	259	7.31	190	18	439	7.25	352	Initial Sampling
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MW-1	10/15/96	13	139	8.39	96	7	231	6.8	148	14	385	7.37	214	26	473	7.30	262	Final Sampling
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ASR-1	11/13/96	36.2	445	7.26	306	49.5	880	6.98	304	36.5	420	7.21	570	35	354	7.17	264	
ASR-1	11/21/96																	
ASR-1	11/28/96																	
ASR-1	12/4/96																	
ASR-1	12/11/96																	
ASR-1	12/18/96																	
ASR-1	12/26/96																	
ASR-1	1/2/97																	
ASR-1	1/9/97																	
ASR-1	1/16/97																	

MONTGOMERY WATSON

WELL # ASR #1 DAILY SHIFT REPORT

DATE(S): 11-14-96
HOURS WORKED: 8:00-15:00

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
				X		

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	overcast X	rain X	heavy rain
Temp.	32-50	50-70	70-86 X	>85
Wind	still	med X	high X	
Humidity	dry X	moderate	humid	Report No.

SHIFT SUMMARY

OBSERVER: Randy SKinner
DRILLER: Joe Schmidt
ACTIVITY: Development
SUB CONTRACTORS: —
FORMATION SAMPLES: —
WATER SAMPLES: —
TESTING: —

START DEPTH: 1200
END DEPTH: 1200

TIME	DESCRIPTION
0800 -	Talked w/ Joe Schmidt, development is proceeding.
1000 -	On site for Meeting. Cond 5500. Cl⁻ 7500, waiting for Pete K.
1100 -	Pete on site. Development has been terminated.
-	Progress Mtg.
1330 -	Talked w/ pete about details for Testing.
1400 -	Talked w/ Joe Schmidt about logging schedule
1500 -	off site

WRTC401W

Observer's Initials MRS

MONTGOMERY WATSON

WELL # ASR #1 DAILY SHIFT REPORT

DATE(S): 11-13-96
HOURS WORKED: 0700 - 1430

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
			X			

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	overcast X	rain X	heavy rain
Temp.	32-50	50-70	70-85 Y	>85
Wind	still	med Y	high	
Humidity	dry X	moderate	humid	Report No.

SHIFT SUMMARY

OBSERVER: Randy Skinner
DRILLER: Joe Schmidt
ACTIVITY: Pilot hole - Development
SUB CONTRACTORS:
FORMATION SAMPLES: Every 10'
WATER SAMPLES: Every 30'
TESTING: Static Head - Flow

START DEPTH: 1170'
END DEPTH: 1200'

TIME	DESCRIPTION
0730 -	Static head at 1170 22.4'. flow @ +1000 gpm
0830 -	Killing well.
1000 -	Drilling to 1200
1130 -	1200' Cl 3500, Cond 5500, Sample is cloudy. Begin well development.
1300 -	Pulling off bottom (wiper trip).

Post-it Fax Note 7671	Date 11-14-96	# of pages ▶ 2
To Pete K.	From Randy S	
Co./Dept.	Co.	
Phone #	Phone #	
Fax #	Fax #	

WRTC401W

Observer's Initials RS

PAGE 1 of 1

R=97%

5615868834

11-14-96 04:39PM P001 #11

MONTGOMERY WATSON

BC ASR #1

Notes

Lith- Description ASR ZONE Date 11-13-96

1020 - 1030	Limestone, pale white to Very pale Orange/gray, Recrystalized (secondary porosity contains Reducing "dog tooth") Fossiliferous Wackestone to packstone containing Gastropods, pleypods, Smaller Forams, coral, and Bryozoa. Secondary porosity includes micro Vug to Vug - Moldic - Inter-granular Inter-crystalline, Secondary spar is porosity Reducing. Granular to well indurated. Contains minor micrite. → Unit Contains Echinoid's ←
1030 - 1040	As Above
1040 - 1050	As Above
1050 - 1060	As Above, Fossils Include Forams & Echinoids
1060 - 1070	As Above
1070 - 1080	As Above, Pale White to Grayish Orange
1080 - 1090	As Above
1090 - 1100	Limestone. Very pale Orange to Grayish Orange As Above with 50% Granular poorly indurated Wackestone. 50% Well indurated micritic - Vuggy Wackestone Unit Contains Forams & Echinoids.
1100 - 1110	As Above.
1110 - 1120	As Above
1120 - 1130	No Echinoids
1130 - 1140	Orange - Tan micritic to granular, Recrystalized - Packstone, Porosity is Intergranular & Secondary Spar Reduced. Contains Forams & Echinoids.
1140 - 1150	As Above
1150 - 1160	As Above
1160 - 1170	As Above
1170 - 1180	As Above
1180 - 1190	As Above
1190 - 1200	As Above
	TD

MONTGOMERY WATSON

WELL # ASR #1 DAILY SHIFT REPORT

DATE(S): 11-12-96
HOURS WORKED: 7:00 - 18:00

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
		X				

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	overcast X	rain	heavy rain
Temp.	32-50	50-70	70-85 X	>85
Wind	still	med X	high	
Humidity	dry X	moderate	humid	**Report No.**

SHIFT SUMMARY

OBSERVER: Randy Skinner
DRILLER: Joe Schmidt
ACTIVITY: Drill Pilot hole
SUB CONTRACTORS:
FORMATION SAMPLES: Every 10'
WATER SAMPLES: Every 30'
TESTING: Head & Flow Every 60'

START DEPTH: 1050'
END DEPTH: 1170'

TIME **DESCRIPTION**

0700 - Testing Flow & Head at 1050' bpl. Flow is 90gpm, static Head @ 24.4' water sample is Sulfer enriched (Black) Cond 5500, Cl⁻ 3500.

1030 - Drilling pilot hole at 1075' bpl. Increased Flow from 90gpm to ≈ 200gpm.

1200 - Water Sample @ 1080' bpl - Cond 5500, Cl⁻ 3500.
Increased Flow while drilling from 1080' to 1105'. Stoped drilling to Kill Well.

1410 - Sample at 1110, cond - 5500, Cl - 3500. Sample is clear, Flow @ 950gpm
Static Head ≈ 20.5' Bpl.
- Killing Well to drill below 1110'.

1630 - Kelly down @ 1140, Cl⁻ 3500. Cond 5500

1800 - Kelly down @ 1170 → well will be brought Alive & Flowed tomorrow

WRTC401W

Observer's initials MRP

MONTGOMERY WATSON

WELL # ASR #2 DAILY SHIFT REPORT

DATE(S): 11-11-96
HOURS WORKED: 1530 - 1800

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
	X					

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear X	overcast X	rain	heavy rain
Temp.	32-50	50-70	70-85 X	>85
Wind	still	med X	high	
Humidity	dry X	moderate	humid	**Report No.**

SHIFT SUMMARY

OBSERVER: M Randal Skinner
START DEPTH: 1020'
DRILLER: Joe Schmidt
END DEPTH: 1050'
ACTIVITY: Pilot hole
SUB CONTRACTORS:
FORMATION SAMPLES: Every 10'
WATER SAMPLES: Every 30'
TESTING: Static Head — Flow Rate

TIME **DESCRIPTION**

1530 - Talked w/ Joe Schmidt, drilling from 1020' shall begin at 1600
1620 - On site. Not drilling. Still installing new Kelly hose.
1700 - Drilling from 1020' Sol. Limestone
1740 - Drilling @ 1040' bit is plugging off in soft formation.
1800 - Kelly down @ 1050'. Will check Flow & Head in the morning.

WRTC401W

Observer's initials MRS

CH2M HILL
Hillsboro Executive Center North
800 Fairway Drive
Suite 350
Deerfield Beach, FL
33441-1831
Tel 954.426.4008
Fax 954.698.6010

CH2MHILL

Celebrating 50 Years

November 20, 1996

103715.A0

Mr. William W. Cocke, P.G.
Program Manager - UIC
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; FDEP File # UC 06-242411; BCOES #1134 ASR

Weekly Summary ([redacted])

The drilling contractor (Diversified Drilling Corp. [DDC]) completed rigging up for reverse-air drilling and drilled out the cement plug at the base of the casing. Pumped down the 1 million gallon storage tank. Repaired pump and kelley hose.

Schedule for Next Week

Conduct reverse-air drilling with 15-inch-diameter bit from base of casing to total depth (1,200 feet bpl). Conduct flow logs on open borehole.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB/11607.DOC
Enclosures
c: Bob Leonard/BCOES
Anne Murray/Montgomery Watson
Members of the TAC

Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
MW-1	8/8/96	18	495	7.2	400	10	150	6.56	144	0	259	7.31	190	18	439	7.25	352	Initial Sampling
MW-1	8/22/96	21.5	542	6.93	452	17.5	178	6.65	260	5	307	7.13	264	44.5	467	7.12	364	
MW-1	8/29/96	20	533	7.14	308	6.6	158	6.64	410	5	322	7.16	246	52	445	7.18	378	
MW-1	9/4/96	14	337	8.28	272	8.5	193	6.74	274	5	332	7.48	222	56.5	515	7.37	410	
MW-1	9/11/96	24	496	8.81	362	8	194	6.61	146	8	364	7.17	224	44	494	7.20	348	
MW-1	9/18/96	180	1002	7.92	606	8	184	6.49	262	6	402	7.08	284	29	459	7.25	318	
MW-1	9/24/96	99	538	7.71	596	6	188	6.6	248	9	372	7.27	286	29	481	7.21	322	
MW-1	10/2/96	25.5	534	7.11	382	6	182	6.51	150	16	408	7.19	276	23.5	460	7.28	308	
MW-1	10/8/96	16	151	8.45	140	7	213	6.75	170	7	323	7.42	218	20	452	7.18	268	
MW-1	10/15/96	13	139	8.39	96	7	231	6.8	148	14	385	7.37	214	26	473	7.30	262	Final Sampling
ASR-1	10/2/96	44.5	455	7.33	314	37	871	7.27	366	25	379	7.18	260	39	418	7.29	292	Initial Sampling
ASR-1	10/8/96	6	448	10.65	276	24	500	7.28	278	32	387	7.13	234	30	395	6.91	242	
ASR-1	10/15/96	7	330	10.29	220	15	263	9.61	204	32	386	7.21	240	40	414	7.42	256	
ASR-1	10/22/96	11	235	9.48	166	24	499	7.28	282	38	391	7.24	236	38	392	7.07	244	
ASR-1	10/31/96	25	306	7.56	196	27	534	7.5	256	27	376	7.39	344	33	389	7.12	270	
ASR-1	11/5/96	38	463	7.21	308	35	690	7.2	426	34	401	7.31	254	34	381	7.15	258	
ASR-1	11/14/96																	
ASR-1	11/21/96																	
ASR-1	11/28/96																	
ASR-1	12/4/96																	
ASR-1	12/11/96																	
ASR-1	12/18/96																	
ASR-1	12/26/96																	
ASR-1	1/2/97																	
ASR-1	1/9/97																	
ASR-1	1/16/97																	

MONTGOMERY WATSON

WELL # ASR-1 DAILY SHIFT REPORT

DATE(S): 11-8-96

HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
					X	

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	overcast	rain	heavy rain
Temp.	32-50	50-70	70-85	>85
Wind	still	med	high	
Humidity	dry	moderate	humid	**Report No.**

SHIFT SUMMARY

OBSERVER: Randy Skinner

DRILLER: Joe Schmidt

START DEPTH: 1020

END DEPTH: 1020

ACTIVITY: Set up for Reverse Air

SUB CONTRACTORS:

FORMATION SAMPLES:

WATER SAMPLES:

TESTING:

TIME	DESCRIPTION
	Rig up for Reverse air, circulate hole clean
	Changing out Kelly hose.

WRTC401W

Observer's initials MRS

MONTGOMERY WATSON

WELL # ASR #2 DAILY SHIFT REPORT

DATE(S): 11-7-96

HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
				X		

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear X	overcast X	rain	heavy rain
Temp.	32-50	50-70	70-85 X	>85
Wind	still	med X	high	
Humidity	dry X	moderate	humid	**Report No.**

SHIFT SUMMARY

OBSERVER: Randy SKinner

DRILLER: Joe Schmidt

START DEPTH: 1020

END DEPTH: 1020

ACTIVITY: Set-up Reverse Air.

SUB CONTRACTORS: _____

FORMATION SAMPLES: _____

WATER SAMPLES: _____

TESTING: _____

TIME **DESCRIPTION**

Circulating in hole at 1020' BPL. Cleaning hole, preparing for Reverse Air

WRTC401W

Observer's initials MRA

MONTGOMERY WATSON

WELL # ASR #1 DAILY SHIFT REPORT

DATE(S): 11-6-96

HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
			X			

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	overcast X	rain X	heavy rain
Temp.	32-50	50-70	70-85	>85
Wind	still	med	high	
Humidity	dry	moderate	humid	**Report No.**

SHIFT SUMMARY

OBSERVER: Randy Skinner — START DEPTH: _____

DRILLER: Joe Schmidt — END DEPTH: _____

ACTIVITY: Drilling out Cement

SUB CONTRACTORS: _____

FORMATION SAMPLES: _____

WATER SAMPLES: _____

TESTING: _____

TIME	DESCRIPTION
(Phone Conversation)	Drilling out Cement. Repairing circulation pump.

WRTC401W

Observer's initials MRS

MONTGOMERY WATSON

WELL # BC DAILY SHIFT REPORT

DATE(S): 11-5-96

HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
		X				

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	overcast	rain X	heavy rain
Temp.	32-50	50-70	70-85	>85
Wind	still	med	high	
Humidity	dry	moderate	humid	**Report No.**

SHIFT SUMMARY

OBSERVER: Randy Skinner

START DEPTH: 1020

DRILLER: Joe Schmidt

END DEPTH: _____

ACTIVITY: _____

SUB CONTRACTORS: _____

FORMATION SAMPLES: _____

WATER SAMPLES: _____

TESTING: _____

TIME	DESCRIPTION
	Cement Tag at 920'. begin drilling cement.

WRTC401W

Observer's initials RDS

MONTGOMERY WATSON

WELL # ASR 1 DAILY SHIFT REPORT

DATE(S): 11-4-96

HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
	X					

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	overcast	rain	heavy rain
Temp.	32-50	50-70	70-85	>85
Wind	still	med	high	
Humidity	dry	moderate	humid	**Report No.**

SHIFT SUMMARY

OBSERVER: Randy Skinner

DRILLER: Joe Schmidt

START DEPTH: _____

END DEPTH: _____

ACTIVITY: _____

SUB CONTRACTORS: _____

FORMATION SAMPLES: _____

WATER SAMPLES: _____

TESTING: _____

TIME **DESCRIPTION**

Drillers are preparing to Drill pilot hole

→ Valve was left open, allowing Mil-gal Tank to fill, Need to drain Tank to Drill a Test Well.

WRTC401W

Observer's initials _____

CH2M HILL
Hillsboro Executive Center North
800 Fairway Drive
Suite 350
Deerfield Beach, FL
33441-1831
Tel 954.426.4008
Fax 954.698.6010

CH2MHILL

Celebrating 50 Years

November 15, 1996

103715.A0

Mr. William W. Cocke, P.G.
Program Manager - UIC
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; FDEP File # UC 06-242411; BCOES #1134 ASR

Weekly Summary (October 28 -- November 1)

The drilling contractor (Diversified Drilling Corp. [DDC]) completed cementing of the 16-inch steel casing with neat cement via the tremie method from 70 feet bpl to pad level. The well was allowed to set 24 hours prior to set up for the pressure test. A successful pressure test was conducted on November 1, 1996, as witnessed by Mr. Mark Silverman/FDEP. Cleaned mud pit of cuttings. Rigged up for reverse-air drilling.

Schedule for Next Week

Complete set up for reverse-air drilling and drill out cement plug at base of casing.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB/11606.DOC
Enclosures
c: Bob Leonard/BCOES
Anne Murray/Montgomery Watson
Members of the TAC

Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
MW-1	8/8/96	18	495	7.2	400	10	150	6.56	144	0	259	7.31	190	18	439	7.25	352	Initial Sampling
MW-1	8/22/96	21.5	542	6.93	452	17.5	178	6.65	260	5	307	7.13	264	44.5	467	7.12	364	
MW-1	8/29/96	20	533	7.14	308	6.6	158	6.64	410	5	322	7.16	246	52	445	7.18	378	
MW-1	9/4/96	14	337	8.28	272	8.5	193	6.74	274	5	332	7.48	222	56.5	515	7.37	410	
MW-1	9/11/96	24	496	8.81	362	8	194	6.61	146	8	364	7.17	224	44	494	7.20	348	
MW-1	9/18/96	180	1002	7.92	606	8	184	6.49	262	6	402	7.08	284	29	459	7.25	318	
MW-1	9/24/96	99	538	7.71	596	6	188	6.6	248	9	372	7.27	286	29	481	7.21	322	
MW-1	10/2/96	25.5	534	7.11	382	6	182	6.51	150	16	408	7.19	276	23.5	460	7.28	308	
MW-1	10/8/96	16	151	8.45	140	7	213	6.75	170	7	323	7.42	218	20	452	7.18	268	
MW-1	10/15/96	13	139	8.39	96	7	231	6.8	148	14	385	7.37	214	26	473	7.30	262	Final Sampling
ASR-1	10/2/96	44.5	455	7.33	314	37	871	7.27	366	25	379	7.18	260	39	418	7.29	292	Initial Sampling
ASR-1	10/8/96	6	448	10.65	276	24	500	7.28	278	32	387	7.13	234	30	395	6.91	242	
ASR-1	10/15/96	7	330	10.29	220	15	263	9.61	204	32	386	7.21	240	40	414	7.42	256	
ASR-1	10/22/96	11	235	9.48	166	24	499	7.28	282	38	391	7.24	236	38	392	7.07	244	
ASR-1	10/31/96	25	306	7.56	196	27	534	7.5	256	27	376	7.39	344	33	389	7.12	270	
ASR-1	11/7/96																	
ASR-1	11/14/96																	
ASR-1	11/21/96																	
ASR-1	11/28/96																	
ASR-1	12/4/96																	
ASR-1	12/11/96																	
ASR-1	12/18/96																	
ASR-1	12/26/96																	
ASR-1	1/2/97																	
ASR-1	1/9/97																	
ASR-1	1/16/97																	

CASING PRESSURE TEST

Project: BCOES ASR Demonstration Project
Well: Class V ASR Well (16-inch Diameter)
Driller: Diversified Drilling Corp. (Joe Schmidt)
Date: 1-Nov-96
Casing Depth: 995 feet bpl
Witnessed By: Mark Silverman, P.G./FDEP/West Palm Beach
Peter Kwiatkowski, P.G./CH2M HILL
Remarks: Cement plug at base of casing
Gauge: Ashcroft 200-psi gauge; 0.5 psi increments
Results: **4.81%** PASSED

Time	Elapsed Time (min)	Pressure (psi)	Differential (psi)	Comments
9:13 AM	0	**150.75**	0.00	Start test
9:18 AM	5	150.10	0.65	
9:23 AM	10	149.50	1.25	
9:28 AM	15	148.75	2.00	
9:33 AM	20	148.25	2.50	
9:38 AM	25	147.75	3.00	
9:43 AM	30	147.00	3.75	
9:48 AM	35	146.50	4.25	
9:53 AM	40	146.00	4.75	
9:58 AM	45	145.25	5.50	
10:03 AM	50	144.75	6.00	
10:08 AM	55	144.25	6.50	
10:13 AM	60	143.50	**7.25**	End test.
10:14 AM		143	0	Bleed off pressure
10:15 AM		108	1 gallon	
10:15 AM		77	1 gallon	
10:16 AM		44	1 gallon	
10:16 AM		12.5	1 gallon	
10:17 AM		0	0.3 gallon	4.3 gallons total

Project No. 103715-A&R0 Date 10-28-96

Client BROWARD COUNTY

Contractor DIVERSIFIED DRILLING

Well No. ASR-1

DAILY OPERATIONS REPORT

Weather SUNNY ≈ 85°F

Shift No. 1 Time 0700-1900

Driller JOE SCHMIDT

Activity TAGGING CEMENT AND BRINGING TO LAND SURFACE ON 16" CASING

Starting Depth 70 FEET B.P.L.

Shift No. _____ Time _____

Driller _____

Activity _____

Starting Depth _____

Formation samples collected _____

Water samples collected _____

Deviation Survey _____

Drilling fluid additives _____

Well water level

Time	Depth

Measurement reference point _____

elevation _____

Supply deliveries _____

Time	Description of Operations
1700	M. SCHILLING ARRIVES ON SITE. THE CONTRACTOR IS IN THE PROCESS OF SETTING UP TO CONDUCT THE SECOND STAGE OF CEMENTING ON THE 16-INCH CASING. TAG OF THE TOP OF THE FIRST STAGE OF CEMENT IS AT 70 FEET B.P.L. AND THE TREMIE WAS THEN PULLED UP TO 62 FEET B.P.L.
1705	START PREFLUSH OF TREMIE WITH H_2O.
1712	SWITCH TO PUMPING NEAT CEMENT. A TOTAL OF 35 BBLS OF H_2O PUMPED IN PREFLUSH.
1720	STOP PUMPING NEAT CEMENT AS CEMENT IS AT THE SURFACE. START FLUSHING TREMIE WITH H_2O. A TOTAL OF 216 BBLS OF NEAT CEMENT WAS PUMPED.
1721	STOP FLUSHING WITH H_2O. A TOTAL OF 1/2 BBL PUMPED.
1730	M. SCHILLING OFFSITE. THE CONTRACTOR IS IN THE PROCESS OF UNBILLING THE CEMENT PUMPER AND UPON COMPLETION WILL LET THE WELL SIT OVERNIGHT TO ALLOW THE CEMENT TO CURE.

CH2M HILL
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800 Fairway Drive
Suite 350
Deerfield Beach, FL
33441-1831
Tel 954.426.4008
Fax 954.698.6010

CH2MHILL

October 31, 1996

103715.A0

Mr. William W. Cocke, P.G.
Program Manager - UIC
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; FDEP File # UC 06-242411

Weekly Summary (October 21 -- October 26, 1996)

The drilling contractor (Diversified Drilling Corp. [DDC]) completed pilot hole drilling within the 26-inch casing with a 12-1/4-inch bit with mud circulation to approximately 1,017 feet bls. Conducted geophysical logs. Submitted casing seat request to FDEP for concurrence. Reamed nominal 26-inch hole to approximately 1,000 feet bls. Install 995 feet of 16-inch steel casing. Cemented in place with 4-percent gel and neat cement via pressure grout method.

Schedule for Next Week

Conduct pressure test on 16-inch casing. Clean mud pit of cuttings. Rig up for reverse-air drilling.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB/11516.DOC
Enclosures
c: Bob Leonard/BCOES
Anne Murray/Montgomery Watson
Members of the TAC

Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
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ASR-1	10/31/96																	
ASR-1	11/7/96																	
ASR-1	11/14/96																	
ASR-1	11/21/96																	
ASR-1	11/28/96																	
ASR-1	12/4/96																	
ASR-1	12/11/96																	
ASR-1	12/18/96																	
ASR-1	12/26/96																	
ASR-1	1/2/97																	
ASR-1	1/9/97																	
ASR-1	1/16/97																	

MONTGOMERY WATSON

WELL # ASR-1 DAILY SHIFT REPORT

DATE(S): 10-26-96
HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
						X

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear X	overcast X	rain X	heavy rain
Temp.	32-50	50-70	70-85 X	>85
Wind	still	med X	high	
Humidity	dry	moderate X	humid	Report No.

SHIFT SUMMARY

OBSERVER: M. Randal SKinner
DRILLER: Joe Schmidt - Bob Schmidt
ACTIVITY: 16" Casing & Cement
SUB CONTRACTORS: —
FORMATION SAMPLES:
WATER SAMPLES:
TESTING: Cement Samples

START DEPTH: 1017
END DEPTH: 1017

TIME	DESCRIPTION
0000 →	Running 16" Casing. Joint # 5 has been put in the well. (see casing Tally for details).
1200 →	at Joint # 19.
1524 →	End Casing Run at 24 Joints. Mule shoe @ 995' 6pi.
1630 →	Rig up for Cement.
2030 —	Start Cement
2130 —	End Cement. 205 bbls 4%, 86 bbls Neat.
2200 —	pulling Trem:
	Will Tag cement on 10-28-96.

WRTC401W

Observer's initials MRS

Casing Tally
Broward County ASR Demonstration Project
Well: ASR Well
Depth: 995' feet bls
Diameter: 24" inch (O.D.)
Project No.: 103715.A0
Date: DayTime

Pipe Number	Welding Completed (time)	Centralizer Location (ft from bottom)	Heat Number	Length (feet)	Total Length (feet)
10-25-96 1	10:35 Pm	5', 20'	Y69147	42.10'	37.6
2	11:05 pm	40'	A81027	42.05'	79.65
3	11:40 Pm	120'	Y69147	42.10	121.75
4	12:25 Pm		Y69147	42.10	163.85
5	12:55 Pm	200'	Y69147	42.10	205.95
10-26-96 6	1:35 Am		A81027	42.05	248
7	2:10		A81027	42.05	290.05
8	2:42	310'	A81027	42.10	332.15
9	3:37		A81027	42.05	374.20
10	4:35	415'	A81027	42.10	416.30
11	5:25		Y69147	42.10	458.40
12	6:30	500'	Y69147	42.05	500.45
13	7:25		Y69147	42.10	542.55
14	8:20		Y69147	42.05	584.60
15	9:00	620'	Y69147	42.10	626.70
16	9:50		Y69147	42.10	668.80
17	10:26	710'	Y69147	42.10	710.90
18	11:08		Y69147	42.10	753.00
19	11:48		Y69147	42.10	795.10
20	12:30	830'	Y69147	42.05	837.15
21	13:05		A81027	42.05	879.20
22	13:45	920'	Y69147	42.05	921.25
23	14:49		Y69147	42.10	963.35
24	15:24		Y69147	42.05	1005.4'
~~25~~					
26					- 7' substructure
27					- 3' stick-up
28					= -10'
29					
30					1005.4'
31					-10'
32					= 995.4'
33					
34					
35					
36					
37					
38					
39					
40					

M. Randal Skinner

MONTGOMERY WATSON

WELL # ASR-1 DAILY SHIFT REPORT

DATE(S): 10-25-96
HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
					X	

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear X	overcast	rain	heavy rain
Temp.	32-50	50-70	70-85 X	>85
Wind	still	med X	high	
Humidity	dry	moderate X	humid	Report No.

SHIFT SUMMARY

OBSERVER: M. Randy Skinner
DRILLER: Joe Schmidt - Bob Schmidt
ACTIVITY: Ream hole - set casing.
SUB CONTRACTORS:
FORMATION SAMPLES:
WATER SAMPLES:
TESTING:

START DEPTH: 1017
END DEPTH: 1017

TIME	DESCRIPTION
0700	On Site to Run 24" casing in ASR-1. Reaming will not be completed until 10:00 AM
1000	preparing to Trip out of hole. Will Run casing at 1400 Hr.
1400	Hole is Tight on TOOH, Re-Reaming to bottom. Run Casing at 1900 HR.
1900	Tony is broken, Waiting for part. Casing Run to start at 2100 HR.
2200	Picking up first Joint of casing. Bob Schmidt, Taking over Drill from Joe Schmidt.
2400	3 Joints in hole. 3 Welders on Site. (See Casing Tally for Heat #, Weld Times + Depths).

WRTC401W

Observer's initials MRS

MONTGOMERY WATSON

WELL # ASR-1 DAILY SHIFT REPORT

DATE(S): 10-24-96
HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
				X		

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	overcast X	rain	heavy rain
Temp.	32-50	50-70	70-85 X	>85
Wind	still	med X	high	
Humidity	dry	moderate X	humid	Report No.

SHIFT SUMMARY

OBSERVER: M. Randal Skinner
START DEPTH: 1017
DRILLER: Joe Schmidt — Bob Schmidt
END DEPTH: 1017
ACTIVITY: Reaming hole.
SUB CONTRACTORS: _____
FORMATION SAMPLES: _____
WATER SAMPLES: _____
TESTING: _____

TIME	DESCRIPTION
→ 1500 -	Update, Reaming at 810' bpl. Talked with Joe Schmidt, will be ready to run casing at 0700/Friday (10-25-96). Reaming through Hard clay is going slow but steady. Casing is on site. - Drillers are going 24hr a day.

WRTC401W

Observer's initials _____

MONTGOMERY WATSON

WELL # ASR-1 DAILY SHIFT REPORT

DATE(S): 10-23-96
HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
			X			

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	overcast X	rain	heavy rain
Temp.	32-50	50-70	70-85 X	>85
Wind	still	med X	high	
Humidity	dry	moderate X	humid	Report No.

SHIFT SUMMARY

OBSERVER: Randy SKinner
DRILLER: Joe Schmidt - Bobby Schmidt
START DEPTH: 1017
END DEPTH: 1017
ACTIVITY:
SUB CONTRACTORS:
FORMATION SAMPLES:
WATER SAMPLES:
TESTING:

TIME	DESCRIPTION
1000	Rigging up to Ream pilot hole TD = 1000' for ~~24~~ 16" casing. Night crew will arrive to drill 24 HR/day tonight, so casing can be set by weekend.

Observer's initials _____

MONTGOMERY WATSON

WELL # ASR-1 DAILY SHIFT REPORT

DATE(S): 10-22-96
HOURS WORKED: ______

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
		X				

BID PACKAGE: ______

CONTRACTOR: ______

Weather	clear	overcast X	rain	heavy rain
Temp.	32-50	50-70	70-85 X	>85
Wind	still	med X	high	
Humidity	dry	moderate X	humid	Report No.

SHIFT SUMMARY

OBSERVER: Randy Skinner
START DEPTH: 900
DRILLER: Joe Schmidt
END DEPTH: 1017
ACTIVITY: pilot hole.
SUB CONTRACTORS: Davey 10'
FORMATION SAMPLES:
WATER SAMPLES:
TESTING:

TIME	DESCRIPTION
0800	On Site Drilling pilot hole from 830'. Clay is very solid. Drilling is going very slow through the lower Hawthorn. Drilling at 15 min/ft
1200	- Still Drilling in clay. TR amounts of Limestone. Drilling at 10 min/ft - 3
1330	- Increasing Limestone, Drilling rate at 3 min/ft. at 900'. Should TD hole by 7:00pm
1600	- TD pilot hole at 1017' bpl. Relayed Info to pete - Logger to be on site at 1730.

WRTC401W

Observer's initials ______

MONTGOMERY WATSON

WELL # ASR-1 DAILY SHIFT REPORT

DATE(S): 10-21-96
HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
	X					

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	overcast X	rain	heavy rain
Temp.	32-50	50-70	70-85 X	>85
Wind	still	med X	high	
Humidity	dry	moderate X	humid	Report No.

SHIFT SUMMARY

OBSERVER: Randy SKinner
DRILLER: Joe Schmidt
ACTIVITY: pilot hole.
SUB CONTRACTORS:
FORMATION SAMPLES: Every 10'
WATER SAMPLES:
TESTING:

START DEPTH: 740
END DEPTH: 900

TIME	DESCRIPTION
1200	Drillers on Site After Weekend, TIH from Casing. Hole is a-Little Tight in clay. Spinning to bottom.
1700	Drilling at 830' 6pl. Very slow. drilling at 15min/ft. Should TD hole Tomorrow.

WRTC401W

Observer's initials MRS

MONTGOMERY WATSON

BCOES ASR Demonstration Project

Notes

Lithologic Log - BC ASR 2

System 2A

Date 10/22/96

0 - 10	No Sample
10 - 20	As Above
20 - 30	As Above
30 - 40	Limestone, white to yellowish Orange, moderate to well cemented. well indurated, texture is micritic. Appears to be recrystallized. Contains 15% by volume - broken shell material. Moderate porosity
40 - 50	As Above, with 25 - 35% white, brittle shell material.
50 - 60	As Above.
60 - 70	Limestone, pale white to yellowish Orange, Opaque to Translucent. Recrystallized wackestone & packstone. Depositional Sucrosic Texture is minimal. Rock is mostly xlin calcite spar. Well cemented, but cement is secondary. Porosity is moderate, & grains include Shell debris, Forams, & calc sand. Tr amounts of phosphate. Diagenesis is meteoric driven with Vadose components & includes porosity evolution & Recrystallization. Biotics total 15-25%
70 - 80	As Above with Trace amounts of Quartz Sand & Silt.
80 - 90	As Above
90 - 100	As Above, but mostly pale white. Very little yellowish orange & Biotics total 5 - 15%. porosity due to chemical destruction.
100 - 110	As above
110 - 120	"
120 - 130	"
130 - 140	"
140 - 150	"
150 - 160	"
161 - 170	"
170 - 180	As Above
180 - 190	Limestone, pale white to light gray. Sucrosic Texture. Limestone is Sand rich (packstone) & is Recrystallized. Biotics make up 5% of Rock Volume. and are mostly Broken. porosity is low & is Intra-granular. Contains minor phosphate. & is locally micritic
190 - 200	As Above

MONTGOMERY WATSON

Notes

Date

200-210	As Above
210-220	As Above
220-230	As Above, but color is light Grey to grey
230-240	As Above
240-250	As Above
250-260	As Above
260-270	"
270-280	"
280-290	"
290-300	As Above, biotics Increased to 15% of total Volume
300-310	As Above
310-320	80% of Volume As Above
	20% Silty Limestone, Olive green to light Green. Calcite cement, moderately
	cemented. Contains some sand size material & Tr phosphate.
	Shell material is Rare, unit is locally clastically based
320-330	As Above
	but with 30% Limestone —
	70% Silty Limestone —
330-340	As Above but 10% —
	90% —
340-350	Unit is comprised of All green Silty Limestone. As Above.
	Tr amounts of gray Limestone are Rounded & are due to
	contamination in borehole.
350-360	As Above
360-370	"
370-380	"
380-390	" but dominantly Clastic based.
390-400	" Material is clay based -vs- Lime mud based. Montmorillonite
400-410	"
410-420	"
420-430	"
430-440	"
440-450	" Clay is very dry.
450-460	"

MONTGOMERY WATSON

Notes

Date

460 - 470 As Above
470 - 480 "
480 - 490 "
490 - 500 "

500 - 650 As Above.
Unit becomes wetter towards bottom, but maintains Montmorillonite features, & Green color.

650 - 660 Clay, deforms plastically, olive green to light green. Contains minor amount of above. Clay stone, no fossils, ni Density

660 - 670 As Above
670 - 680 "
680 - 690 "
690 - 700 "

700 - 800 As Above

800 - 810 As Above
810 - 820 "
820 - 830 "
830 - 840 "
840 - 850 95% As Above
5% Limestone to silty limestone. medium to dark Grey, No porosity. Chalky texture, poor cementation, no biotics.
850 860 As Above.
860 - 870 As Above
870 - 880 As Above with 70% clay
30% Limestone
880 - 890 50% / 50%
890 - 900 25% clay
75% Limestone. Tan to green, phosphate rich, containing "few" biotics including shell debris & forams. Porosity is low. poorly indurated, Cement is reduced. Texture is grainier to succosic.
900 - 910 As Above

MONTGOMERY WATSON

Notes

Date

910 920	As Above
920 - 930	As Above
930 - 940	As Above, with 15% clay 85% Limestone Increase in biotics & porosity.
940 - 950	As Above.
950 - 960	Limestone, pale white to light grey, Recrystilized, micritic wackestone to packstone. porosity is common - as Intergranular, Intaparticle, & moldic. Porosity is dominantly secondary. Well Indurated. locally Contains calcic spar cement, & Infilling (Porosity Reducing calcite). biotics include Reef fauna (Coleoyzoa, Gastropoda, bryozoa, & Smaller forams).
960 - 970	As Above
970 - 980	As Above
980 - 990	"
990 - 1000	"
1000 - 1010	"
1010 - 1017	"
	TD of Borehole

CH2M HILL
Hillsboro Executive Center North
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Deerfield Beach, FL
33441-1831
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Fax 954.698.6010

CH2MHILL

Celebrating 50 Years

October 29, 1996

103715.A0

Mr. William W. Cocke, P.G.
Program Manager–UIC
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; FDEP File # UC 06-242411

Weekly Summary (October 14–October 18, 1996)

The drilling contractor (Diversified Drilling Corp. [DDC]) resumed pilot hole drilling within the 26-inch casing with a 12-1/4-inch bit with mud circulation.

Schedule for Next Week

Complete pilot hole to approximately 1,000 feet bls. Conduct geophysical logs. Submit casing seat request to FDEP for concurrence. Ream nominal 26-inch hole to approximately 1,000 feet bls. Install approximately 1,000 feet of 16-inch steel casing. Cement in place with neat cement via pressure grout method.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB11499.DOC
Enclosures
c: Bob Leonard/BCOES
Anne Murray/Montgomery Watson
Members of the TAC

Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
MW-1	8/8/96	18	495	7.2	400	10	150	6.56	144	0	259	7.31	190	18	439	7.25	352	Initial Sampling
MW-1	8/22/96	21.5	542	6.93	452	17.5	178	6.65	260	5	307	7.13	264	44.5	467	7.12	364	
MW-1	8/29/96	20	533	7.14	308	6.6	158	6.64	410	5	322	7.16	246	52	445	7.18	378	
MW-1	9/4/96	14	337	8.28	272	8.5	193	6.74	274	5	332	7.48	222	56.5	515	7.37	410	
MW-1	9/11/96	24	496	8.81	362	8	194	6.61	146	8	364	7.17	224	44	494	7.20	348	
MW-1	9/18/96	180	1002	7.92	606	8	184	6.49	262	6	402	7.08	284	29	459	7.25	318	
MW-1	9/24/96	99	538	7.71	596	6	188	6.6	248	9	372	7.27	286	29	481	7.21	322	
MW-1	10/2/96	25.5	534	7.11	382	6	182	6.51	150	16	408	7.19	276	23.5	460	7.28	308	
MW-1	10/8/96	16	151	8.45	140	7	213	6.75	170	7	323	7.42	218	20	452	7.18	268	
MW-1	10/15/96	13	139	8.39	96	7	231	6.8	148	14	385	7.37	214	26	473	7.30	262	Final Sampling
ASR-1	10/2/96	44.5	455	7.33	314	37	871	7.27	366	25	379	7.18	260	39	418	7.29	292	Initial Sampling
ASR-1	10/8/96	6	448	10.65	276	24	500	7.28	278	32	387	7.13	234	30	395	6.91	242	
ASR-1	10/15/96	7	330	10.29	220	15	263	9.61	204	32	386	7.21	240	40	414	7.42	256	
	10/24/96																	
	10/31/96																	
	11/7/96																	
	11/14/96																	
	11/21/96																	
	11/28/96																	
	12/4/96																	
	12/11/96																	
	12/18/96																	
	12/26/96																	
	1/2/97																	
	1/9/97																	
	1/16/97																	

CH2M HILL
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CH2MHILL

Celebrating 50 Years

October 16, 1996

103715.A0

Mr. William W. Cocke, P.G.
Program Manager–UIC
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; FDEP File # UC 06-242411

Weekly Summary (October 7 – October 11, 1996)

The drilling contractor (Diversified Drilling Corp. [DDC]) conducted pilot hole drilling to approximately 430 feet bls. Conducted geophysical logs on the mudded borehole. Reamed pilot hole to a nominal 35 inches to 400 feet bls. Installed approximately 400 feet of 26-inch-diameter steel casing. Cemented in place with neat cement via pressure grout method.

Schedule for Next Week

Resume pilot hole drilling within 26-inch casing with 12-1/4-inch bit with mud circulation to approximately 1,000 feet bls. Conduct geophysical logs. Submit casing seat request to FDEP for concurrence.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB11419.DOC
Enclosures
c: Bob Leonard/BCOES
Anne Murray/Montgomery Watson
Members of the TAC

Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
MW-1	8/8/96	18	495	7.2	400	10	150	6.56	144	0	259	7.31	190	18	439	7.25	352	Initial Sampling
MW-1	8/22/96	21.5	542	6.93	452	17.5	178	6.65	260	5	307	7.13	264	44.5	467	7.12	364	
MW-1	8/29/96	20	533	7.14	308	6.6	158	6.64	410	5	322	7.16	246	52	445	7.18	378	
MW-1	9/4/96	14	337	8.28	272	8.5	193	6.74	274	5	332	7.48	222	56.5	515	7.37	410	
MW-1	9/11/96	24	496	8.81	362	8	194	6.61	146	8	364	7.17	224	44	494	7.20	348	
MW-1	9/18/96	180	1002	7.92	606	8	184	6.49	262	6	402	7.08	284	29	459	7.25	318	
MW-1	9/24/96	99	538	7.71	596	6	188	6.6	248	9	372	7.27	286	29	481	7.21	322	
MW-1	10/2/96	25.5	534	7.11	382	6	182	6.51	150	16	408	7.19	276	23.5	460	7.28	308	
MW-1	10/8/96	16	151	8.45	140	7	213	6.75	170	7	323	7.42	218	20	452	7.18	268	
MW-1	10/15/96	13	139	8.39	96	7	231	6.8	148	14	385	7.37	214	26	473	7.30	262	Final Sampling
ASR-1	10/2/96	44.5	455	7.33	314	37	871	7.27	366	25	379	7.18	260	39	418	7.29	292	Initial Sampling
ASR-1	10/8/96	6	448	10.65	276	24	500	7.28	278	32	387	7.13	234	30	395	6.91	242	
ASR-1	10/15/96	7	330	10.29	220	15	263	9.61	204	32	386	7.21	240	40	414	7.42	256	
	10/24/96																	
	10/31/96																	
	11/7/96																	
	11/14/96																	
	11/21/96																	
	11/28/96																	
	12/4/96																	
	12/11/96																	
	12/18/96																	
	12/26/96																	
	1/2/97																	
	1/9/97																	
	1/16/97																	

Project No. 103715.00 Date 10-11-96

Client BROWARD COUNTY ASR DEMONSTRATION PROJECT

Contractor DIVERSIFIED DRILLING

Well No. ASR-1

DAILY OPERATIONS REPORT

Weather PARTLY CLOUDY, ≈ 85°F

Shift No. 1 Time 0700-1900

Driller JOE SCHMIDT

Activity INSTALLING 26" CASING

Starting Depth PAD LEVEL

Shift No. _____ Time _____

Driller _____

Activity _____

Starting Depth _____

Formation samples collected _____

Water samples collected _____

Deviation Survey _____

Drilling fluid additives _____

Well water level

Time	Depth

Measurement reference point _____

elevation _____

Supply deliveries _____

Time	Description of Operations
0800	M. SCHILLING ARRIVES AT THE SITE. THE CONTRACTOR IS IN THE PROCESS OF TRIPPING THE 33-INCH BIT FROM THE BOREHOLE AFTER REACHING A TOTAL DEPTH OF 410 FEET B.P.L. DURING THE PREVIOUS NIGHT SHIFT.
0915	- DRILL BIT REMOVED FROM BOREHOLE. THE CONTRACTOR STARTS PREPARING TO INSTALL THE 26-INCH CASING.
1000	- START 26-INCH CASING INSTALLATION.
1125	- 26-INCH CASING INSTALLATION IS COMPLETED. THE TOTAL DEPTH OF THE CASING IS 397 FEET B.P.L. THE CONTRACTOR STARTS PREPARING TO CEMENT THE 26-INCH CASING IN PLACE.
2030	- START CEMENTING OF THE 26-INCH CASING.
2135	- CEMENTING COMPLETED WITH CEMENT RETURNS AT LAND SURFACE.
2145	- M. SCHILLING LEAVES THE SITE. THE CONTRACTOR WILL FINISH TRIPPING OUT THE TREMIE PIPE AND THEN LEAVE THE SITE FOR THE WEEKEND.

Project No. 103715.A0 Date 10-9-96

Client BROWARD COUNTY ASR

Contractor DIVERSIFIED DRILLING

Well No. ASR-1

DAILY OPERATIONS REPORT

Weather PARTLY CLOUDY, ≈ 85° F

Shift No. 1 Time 0700-1900

Driller JOE SCHMIDT

Activity DRILLING PILOT HOLE; GEOPHYSICAL LOGGING

Starting Depth

Shift No. 2 Time 1900-0700

Driller BOBBY SCHMIDT

Activity REAMING PILOT HOLE

Starting Depth 35 FEET B.P.L.

Formation samples collected

Water samples collected

Deviation Survey

Drilling fluid additives

Well water level

Time	Depth

Measurement reference point

elevation

Supply deliveries

Time	Description of Operations
1145	P. KWIATKOWSKI ARRIVES ON SITE FOR A PROGRESS MEETING (SEE MEETING MINUTES). THE CONTRACTOR IS IN THE PROCESS OF DRILLING THE PILOT HOLE USING A 12.25-INCH. THE CURRENT DEPTH IS 270 FEET B.P.L.
1345	P. KWIATKOWSKI LEAVES THE SITE. PILOT HOLE DRILLING CONTINUES WITH THE CURRENT DEPTH AT ~~340~~ 340 FEET B.P.L.
1730	M. SCHILLING ARRIVES ON SITE WITH THE CH2M HILL GEOPHYSICAL LOGGING EQUIPMENT TO CONDUCT LOGGING ON THE PILOT HOLE. THE CONTRACTOR HAS COMPLETED DRILLING TO A DEPTH OF 430 FEET B.P.L. START GEOPHYSICAL LOGGING. THE LOGS TO BE CONDUCTED ARE THE CALIPER, GAMMA RAY, AND LONG & SHORT NORMAL ELECTRIC.
2030	GEOPHYSICAL LOGGING SUCCESSFULLY COMPLETED. THE CONTRACTOR STARTS PREPARING TO REAM THE PILOT HOLE TO A NOMINAL 34-INCH BOREHOLE
2100	M. SCHILLING OFFSITE. THE CONTRACTOR IS STILL SETTING UP TO START REAMING. HE WILL WORK A SECOND SHIFT TONIGHT AND WILL START REAMING WHEN ALL PREPARATIONS ARE COMPLETED.

RESIDENT - MARK SCHILLING

Mark Schilling

Project No. 103715.A0 Date 10-7-96

Client BROWARD COUNTY ASR

Contractor DIVERSIFIED DRILLING

Well No. ASR-1

DAILY OPERATIONS REPORT

Weather PARTLY CLOUDY, BREEZY, = 90°F

Shift No. 1 Time 0700-1900

Driller JOE SCHMIDT

Activity DRILLING PILOT HOLE

Starting Depth 90 FEET B.P.L.

Shift No. _____ Time _____

Driller _____

Activity _____

Starting Depth _____

Formation samples collected _____

Water samples collected _____

Deviation Survey _____

Drilling fluid additives _____

Well water level

Time	Depth

Measurement reference point _____

elevation _____

Supply deliveries _____

Time	Description of Operations
1500-	M. SCHILLING ARRIVES ON SITE. THE CONTRACTOR IS CURRENTLY DRILLING THE PILOT HOLE USING A 12.25-INCH BIT. THE CURRENT DEPTH OF THE PILOT HOLE IS 150 FEET B.P.L. J. SCHMIDT HAS STATED THAT HE IS EXPERIENCING SOME DIFFICULTY IN GETTING THE CUTTINGS OUT OF THE BOREHOLE DUE TO THE LOSS OF VELOCITY IN THE SURFACE CASING. DRILLING IS SLOWED DUE TO THIS.
1540-	M. SCHILLING OFFSITE.

RESIDENT - MARK SCHILLING

M. Schilling

Casing Tally
Broward County ASR Demonstration Project
Well: ASR Well
Depth: 397.0 feet bls
Diameter: 26 inch (O.D.)
Project No.: 103715.A0
Date: 10-11-96

Casing Installation Start Time: 1020
Casing Installation Completed Time: 1725

Pipe Number	Welding Completed (time)	Centralizer Location (ft from bottom)	Heat Number	Length (feet)	Total Length (feet)
1	1045	5, 20, 40	078080	40.1	40.1
2	1135		078080	40.0	80.1
3	1213	100	078082	40.0	120.1
4	1250		078082	40.0	160.1
5	1345	200	078080	40.0	200.1
6	1425		078080	39.9	240.0
7	1510		078080	40.0	280.0
8	1545	300	078082	40.0	320.0
9	1630		078080	40.0	360.0
10			078080	40.1	400.1
11					
12					
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Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
MW-1	8/8/96	18	495	7.2	400	10	150	6.56	144	0	259	7.31	190	18	439	7.25	352	Initial Sampling
MW-1	8/22/96	21.5	542	6.93	452	17.5	178	6.65	260	5	307	7.13	264	44.5	467	7.12	364	
MW-1	8/29/96	20	533	7.14	308	6.6	158	6.64	410	5	322	7.16	246	52	445	7.18	378	
MW-1	9/4/96	14	337	8.28	272	8.5	193	6.74	274	5	332	7.48	222	56.5	515	7.37	410	
MW-1	9/11/96	24	496	8.81	362	8	194	6.61	146	8	364	7.17	224	44	494	7.20	348	
MW-1	9/18/96	180	1002	7.92	606	8	184	6.49	262	6	402	7.08	284	29	459	7.25	318	
MW-1	9/24/96	99	538	7.71	596	6	188	6.6	248	9	372	7.27	286	29	481	7.21	322	
MW-1	10/2/96	25.5	534	7.11	382	6	182	6.51	150	16	408	7.19	276	23.5	460	7.28	308	
MW-1	10/10/96																	Final Sampling
ASR-1	10/2/96	44.5	455	7.33	314	37	871	7.27	366	25	379	7.18	260	39	418	7.29	292	Initial Sampling
	10/10/96																	
	10/17/96																	
	10/24/96																	
	10/31/96																	
	11/7/96																	
	11/14/96																	
	11/21/96																	
	11/28/96																	
	12/4/96																	
	12/11/96																	
	12/18/96																	
	12/26/96																	
	1/2/97																	
	1/9/97																	
	1/16/97																	

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CH2MHILL

Celebrating 50 Years

October 10, 1996

103715.A0

Mr. William W. Cocke, P.G.
Program Manager - UIC
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; FDEP File # UC 06-242411

Weekly Summary (September 23 – 27, 1996)

The drilling contractor (Diversified Drilling Corp. [DDC]) conducted geophysical logs of the open-hole interval of MW-1 to evaluate production horizons. DDC disassembled temporary piping to 1 million gallon storage tank. Mobilized drilling rig from MW-1 to the ASR well site. Constructed concrete-block walls on ASR well pad and mobilized other drilling equipment. Removed cuttings from monitor well pad.

Remedial measures were implemented on the northeast pad monitor well. These included purging of water and conveyance to the 1 million gallon storage tank for disposal. Water quality samples were obtained on 9/24/96 and indicate lower conductivity levels consistent with remediation.

Schedule for Next Week

Install , develop, and sample pad monitor wells at ASR well site. Complete setup of equipment and begin pilot hole drilling at ASR well.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB11362.DOC
Enclosures
c: Bob Leonard/BCOES
Anne Murray/Montgomery Watson
Members of the TAC

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CH2MHILL

Celebrating 50 Years

October 2, 1996

103715.A0

Mr. William W. Cocke, P.G.
Program Manager - UIC
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; ASR Well.

This letter serves to notify FDEP that drilling is scheduled to begin on Wednesday, October 2, 1996 at the ASR well at the subject site. Previously, FDEP has been notified regarding drilling commencement for the project monitor well, associated pad monitor wells, as well as documentation for the approved disposal site for drill cuttings.

A temporary concrete pad has been constructed at the ASR well site to contain drill cuttings and fluids. Also, four shallow pad monitor wells have been constructed at the corners of the pad for the required weekly monitoring during construction. Water quality samples have been obtained, and we are awaiting results from the laboratory. We will provide this information upon receipt from the laboratory.

Due to the documented increase in conductivity from the northeast pad monitor well at the MW-1 drilling site (MWNE), we will continue to sample this well until background readings are obtained.

Please call me at (561) 737-6665 if you have any questions.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB/11317.DOC
Enclosures
c: Anne Murray/Montgomery Watson
Members of the TAC

Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
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MW-1	9/24/96	99	538	7.71	596	6	188	6.6	248	9	372	7.27	286	29	481	7.21	322	
	10/3/96																	
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	12/4/96																	
	12/11/96																	
	12/18/96																	
	12/26/96																	
	1/2/97																	
	1/9/97																	
	1/16/97																	

Project No. 103715.A00 Date 9-25-96

Client BROWARD COUNTY ASR

Contractor DIVERSIFIED DRILLING

Well No. MW-1

DAILY OPERATIONS REPORT

Weather CLEAR, HUMID, = 85°F

Shift No. 1 Time 1200 - 0000

Driller JOE SCHMINT

Activity GEOPHYSICAL LOGGING

~~Starting Depth~~ LOGGING INTERVAL 800 - 1,200 FEET BPL.

Shift No. _____ Time _____

Driller _____

Activity _____

Starting Depth _____

Formation samples collected _____

Water samples collected _____

Deviation Survey _____

Drilling fluid additives _____

Well water level

Time	Depth

Measurement reference point _____

elevation _____

Supply deliveries _____

Time	Description of Operations
1700	M. SCHILLING ARRIVES ON SITE. THE CONTRACTOR IS WAITING ON GEO-PHEX, GEOPHYSICAL LOGGING SUBCONTRACTOR, TO ARRIVE TO CONDUCT THE FINAL GEOPHYSICAL LOGS ON THE COMPLETED WELL
1745	GEO-PHEX ARRIVES ON SITE AND STARTS THE GEOPHYSICAL LOGGING. THE LOGS TO BE CONDUCTED ARE THE CALIPER, GAMMA RAY, LONG & SHORT NORMAL ELECTRIC UNDER STATIC CONDITIONS, & TEMPERATURE, FLUID RESISTIVITY, AND FLOWMETER LOGS ARE TO BE CONDUCTED UNDER DYNAMIC CONDITIONS.
2300	GEOPHYSICAL LOGGING IS SUCCESSFULLY COMPLETED.
2330	GEO-PHEX, M. SCHILLING, AND THE CONTRACTOR OFFSITE FOR THE DAY

RESIDENT - MARK SCHILLING

M. Schilling

Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
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MW-1	9/24/96	99	538	7.71	596	6	188	6.6	248	9	372	7.27	286	29	481	7.21	322	
MW-1	10/2/96	25.5	534	7.11	382	6	182	6.51	150	16	408	7.19	276	23.5	460	7.28	308	
MW-1	10/8/96	16	151	8.45	140	7	213	6.75	170	7	323	7.42	218	20	452	7.18	268	
MW-1	10/15/96	13	139	8.39	96	7	231	6.8	148	14	385	7.37	214	26	473	7.30	262	Final Sampling
ASR-1	10/2/96	44.5	455	7.33	314	37	871	7.27	366	25	379	7.18	260	39	418	7.29	292	Initial Sampling
ASR-1	10/8/96	6	448	10.65	276	24	500	7.28	278	32	387	7.13	234	30	395	6.91	242	
ASR-1	10/15/96	7	330	10.29	220	15	263	9.61	204	32	386	7.21	240	40	414	7.42	256	
ASR-1	10/22/96	11	235	9.48	166	24	499	7.28	282	38	391	7.24	236	38	392	7.07	244	
ASR-1	10/31/96	25	306	7.56	196	27	534	7.5	256	27	376	7.39	344	33	389	7.12	270	
ASR-1	11/5/96	38	463	7.21	308	35	690	7.2	426	34	401	7.31	254	34	381	7.15	258	
ASR-1	11/13/96	36.2	445	7.26	306	49.5	880	6.98	304	36.5	420	7.21	570	35	354	7.17	264	
ASR-1	11/20/96	36	458	7.70	314	60	967	6.98	628	35	432	7.09	320	39	457	7.08	318	
ASR-1	11/26/96																	
ASR-1	12/4/96																	
ASR-1	12/11/96																	
ASR-1	12/18/96																	
ASR-1	12/26/96																	
ASR-1	1/2/97																	
ASR-1	1/9/97																	
ASR-1	1/16/97																	

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CH2MHILL

Celebrating 50 Years

September 25, 1996
103715.A0

Mr. William W. Cocke, P.G.
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; FDEP File # UC 06-242411

Weekly Summary (September 16 – 20, 1996)

The drilling contractor (Diversified Drilling Corp. [DDC]) conducted reverse-air drilling (open-hole circulation) in the Floridan Aquifer System from the base of casing to 1,200 feet at MW-1. MW-1 was developed to remove cuttings, fines etc. A 4-hour, constant-rate pumping test was conducted to estimate specific capacity of the formation. All flows were conveyed to the onsite 1-million-gallon storage tank and thence to the onsite lift station for disposal. A temporary concrete drilling pad was constructed for drilling at the ASR well.

Pad monitor well water quality data was reviewed upon receipt from the laboratory on September 24, 1996. It was observed that the Northeast (NE) pad monitor well exhibited elevated conductivity of approximately 1,000 umhos/cm. This is above the approximately 500 umhos/cm value exhibited as a background concentration. The source of this increase in conductivity was traced to pinholes observed in the mortar of the concrete block walls of the temporary pad. The other 3-pad monitor wells exhibit normal water quality and appear unaffected.

Mr. Mark Silverman/FDEP was notified via telephone of this occurrence on September 24, 1996, at approximately 4:00 p.m. Remedial measures have been implemented and include purging of the pad monitor well until background water quality is obtained.

Schedule for Next Week

Conduct geophysical logs of the open-hole interval of MW-1 to evaluate production horizons. Disassemble temporary piping. Mobilize drilling rig from MW-1 to the ASR well site. Construct concrete-block walls on ASR well pad and mobilize other drilling equipment.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB11278.DOC
Enclosures
c: Bob Leonard/BCOES
Anne Murray/Montgomery Watson
Members of the TAC

Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
MW-1	8/8/96	18	495	7.2	400	10	150	6.56	144	0	259	7.31	190	18	439	7.25	352	Initial Sampling
MW-1	8/22/96	21.5	542	6.93	452	17.5	178	6.65	260	5	307	7.13	264	44.5	467	7.12	364	
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MW-1	9/11/96	24	496	8.81	362	8	194	6.61	146	8	364	7.17	224	44	494	7.20	348	
MW-1	9/18/96	180	1002	7.92	606	8	184	6.49	262	6	402	7.08	284	29	459	7.25	318	
	9/27/96																	
	10/3/96																	
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	10/24/96																	
	10/31/96																	
	11/7/96																	
	11/14/96																	
	11/21/96																	
	11/28/96																	
	12/4/96																	
	12/11/96																	
	12/18/96																	
	12/26/96																	
	1/2/97																	
	1/9/97																	
	1/16/97																	

MONTGOMERY WATSON

WELL # Monitor DAILY SHIFT REPORT

DATE(S): 9-16-96
HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
	X					

BID PACKAGE: _____

CONTRACTOR: _____

Weather	(clear)	overcast	rain	heavy rain
Temp.	32-50	50-70	70-85	(>85)
Wind	(still)	med	high	
Humidity	dry	(moderate)	humid	Report No.

SHIFT SUMMARY

OBSERVER: Randy Skinner
DRILLER: Joe Schmidt
ACTIVITY: Drill hole.
SUB CONTRACTORS: —
FORMATION SAMPLES: Every 10'
WATER SAMPLES: Every 30'
TESTING: Head Pressure every 60'

START DEPTH: 1000'
END DEPTH: 1073'

TIME	DESCRIPTION
15[illegible]	- Circ. hole. As-per Drillers instructions. Drillers are preparing to go into hole.
16[illegible]	- Circulating on bottom cleaning hole.
17[illegible]	- Drilling from 1025'. First Echinoids in cuttings. Top of Cenia.
18[illegible]	- Drilling @ 1040' white/tan Limestone, forams + corals.
19[illegible]	- Kelly down @ 1050' circulating.
19[illegible]	- Well flows @ 50gpm (40" above pad). with a head of 44.5" above pad - closed in. Static = 21.05"
9[illegible]	- Off Site

WRTC401W

Observer's initials TMR

MONTGOMERY WATSON

WELL # Monitor DAILY SHIFT REPORT

DATE(S): 5-17-96

HOURS WORKED:

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
		X				

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	overcast	rain	heavy rain
Temp.	32-50	50-70	70-85	>85
Wind	still	med	high	
Humidity	dry	moderate	humid	Report No.

SHIFT SUMMARY

OBSERVER: Randy Skinner

DRILLER: Joe Schmidt

START DEPTH: 1070'

END DEPTH:

ACTIVITY: Drill & Log

SUB CONTRACTORS: —

FORMATION SAMPLES: Every 10'

WATER SAMPLES: Every 30'

TESTING: Every 60' - pressure & head.

TIME	DESCRIPTION
0730	on site. Drillers are preparing to drill from 1070'.
0750	Kelly down @ 1080'. Taking Water Sample.
0820	Resume Drilling from 1080'
	2-3 min/Ft. Very Smooth. Well is making more water. Tan Limestone Formation.
930	- Kelly down @ 1110'. Static head ≈ 22.15'. (increase of 1'1"). Well flows at 125gpm w/ 6' of head (Flowing at 40')
1000	Drilling from 1110'
1030	Kelly down @ 1140' Taking Water Sample.
110	- Drilling from 1140'
13	- Kelly down @ 1170' Taking Water Sample. Static Head ≈ 21.9', Flow is @ 125gpm w/ 6' of head
45	Drilling from 1170'

WRTC401W

Observer's initials RDS

1330 - Tot hole @ 1200'

1400 - Pete K on site to confirm final depth

- Final head @ ≈ 22.7'
- Drillers have been instructed to begin development.

1620 - Pete off Site

- Development began @ 1600 hrs

1645 - off Site.

WRTC401W

Observer's initials

MONTGOMERY WATSON

WELL # Monitor DAILY SHIFT REPORT

DATE(S): 9-18-96
HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
			X			

BID PACKAGE: _____

CONTRACTOR: _____

Weather	(clear)	overcast	rain	heavy rain
Temp.	32-50	50-70	70-85	(>85)
Wind	(still)	med	high	
Humidity	dry	(moderate)	humid	Report No.

SHIFT SUMMARY

OBSERVER: Randy SKinner
DRILLER: Joe Schmidt
START DEPTH: 1200'
END DEPTH: 1200
ACTIVITY: Development
SUB CONTRACTORS: -
FORMATION SAMPLES: 1 Water Sample for Background
WATER SAMPLES:
TESTING: -

TIME	DESCRIPTION
0900	On Site to check development
0930	Water apears to be free of particulate matterial.
1000	Talked to Pete K., End Development, Drillers are preparing for Pump Test Tommorow
1100	off Site.

WRTC401W

Observer's initials MRB

MONTGOMERY WATSON

WELL # Monitor DAILY SHIFT REPORT

DATE(S): 9-19-96
HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
				X		

BID PACKAGE: _____

CONTRACTOR: _____

Weather	(clear)	(overcast)	rain	heavy rain
Temp.	32-50	50-70	70-85	(>85)
Wind	(still)	(med)	high	
Humidity	dry	(moderate)	humid	**Report No.**

SHIFT SUMMARY

OBSERVER: Randy Skinner
DRILLER: Joe Schmidt
ACTIVITY: Pump Test
SUB CONTRACTORS:
FORMATION SAMPLES:
WATER SAMPLES: At End of Test.
TESTING:

START DEPTH: 1200'
END DEPTH: 1200'

TIME	DESCRIPTION
0800 -	On site for Test
0945 -	Start Test. Static head @ ≈ [redacted]. 20.10½"
	Well flows @ 300 gpm pumping @ 540 gpm. Draw down to 9.3' TOC.
100 -	Test is going fine. Draw down @ 9.83'.
345 -	End Test, Specific capacity ≈ 540 gal / 27' = 19.8'/gal.
30 -	Recovered Water level - 20.6"
00 -	Off site.

WRTC401W

Observer's initials MRS

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CH2MHILL

Celebrating 50 Years

September 18 1996

103715.A0

Mr. William W. Cocke, P.G.
Program Manager–UIC
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; FDEP File # UC 06-242411

Weekly Summary (September 9–13, 1996)

The drilling contractor (Diversified Drilling Corp. [DDC]) completed rigging up for reverse-air drilling. Conducted a casing pressure test (100 psi) for one hour on the 6-inch casing of MW-1. FDEP was notified of the test but did not witness it. Also, DDC constructed a 6-inch temporary pipeline to convey brackish water to the 1 million gallon above-ground storage tank and thence to the onsite lift station for disposal.

Schedule for Next Week

Conduct reverse-air drilling in the Floridan Aquifer System from the base of casing to 1,200 feet. Develop the well and conduct a short-term pumping test. Conduct geophysical logs of the open-hole interval.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB11212.DOC
Enclosures
c: Bob Leonard/BCOES
Anne Murray/Montgomery Watson
Members of the TAC

Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
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	9/20/96																	
	9/27/96																	
	10/3/96																	
	10/10/96																	
	10/17/96																	
	10/24/96																	
	10/31/96																	
	11/7/96																	
	11/14/96																	
	11/21/96																	
	11/28/96																	
	12/4/96																	
	12/11/96																	
	12/18/96																	
	12/26/96																	
	1/2/97																	
	1/9/97																	
	1/16/97																	

MONTGOMERY WATSON

WELL # Monitor DAILY SHIFT REPORT

DATE(S): 9/9/96

HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
	X					

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	(overcast)	rain	heavy rain
Temp.	32-50	50-70	70-85	(>85)
Wind	(still)	(med)	high	
Humidity	dry	(moderate)	humid	Report No.

SHIFT SUMMARY

OBSERVER: Randy Skinner

DRILLER: Joe Schmidt

START DEPTH: -

END DEPTH: -

ACTIVITY: Construction Mtg - Prelim Pressure Test

SUB CONTRACTORS: _____

FORMATION SAMPLES: _____

WATER SAMPLES: _____

TESTING: _____

TIME **DESCRIPTION**

1330 - On Site. Construction Mtg scheduled for 1400.

1400 - Construction Mtg.
- Anne Murray
- Stuart Anderson
- Pete K.
- Randy Skinner.

Discussion of Reverse Air drilling. Testing + Development.

1500 - End Mtg.
- Waiting on preliminary pressure test

1620 - Start Test

[illegible]20 - End Test, 4.1 psi in 1 Hr @ 100 psi to Start
- Will Run official test @ 0900, off site

WRTC401W

Observer's initials MBJ

MONTGOMERY WATSON

WELL # Monitor PRESSURE TEST DATA

Broward County ASR Monitor Well Date: 9/10/96

BID PACKAGE: 95-68
CONTRACTOR: Diversified Drilling
PROJECT MANAGER: Anne Murray
COUNTY: Broward
OWNER: Broward County
START TIME: 9:00
FINISH TIME: 10:00

DESCRIPTION OF OPERATIONS: 6" casing pressure test
INITIAL READINGS: 100 psi (HEADER PRESSURE)

TIME	TOTAL MINUTES	HEADER PRESSURE	COMMENTS
9:00	0	100 psi	
9:01	1	100 psi	
9:02	2	100 psi	
9:03	3	100 psi	
9:04	4	100 psi	
9:05	5	100 psi	
9:06	6	100 psi	
9:07	7	100 psi	
9:08	8	100 psi	
9:09	9	100 psi	
9:10	10	100 psi	
9:11	11	100 psi	
9:12	12	100 psi	
9:13	13	100 psi	
9:14	14	100 psi	
9:15	15	100 psi	
9:16	16	99.75 psi	
9:17	17	99.75 psi	
9:18	18	99.75 psi	
9:19	19	99.75 psi	
9:20	20	99.75 psi	
9:21	21	99.75 psi	
9:22	22	99.75 psi	
9:23	23	99.75 psi	
9:24	24	99.75 psi	
9:25	25	99.75 psi	
9:26	26	99.75 psi	
9:27	27	99.5 psi	
9:28	28	99.5 psi	
9:29	29	99.5 psi	
9:30	30	99.5 psi	

TIME	TOTAL MINUTES	HEADER PRESSURE	COMMENTS
9:31	31	99.5 psi	
9:32	32	99.5 psi	
9:33	33	99.5 psi	
9:34	34	99.5 psi	
9:35	35	99.25 psi	
9:36	36	99.25 psi	
9:37	37	99.25 psi	
9:38	38	99.25 psi	
9:39	39	99.25 psi	
9:40	40	99.25 psi	
9:41	41	99.25 psi	
9:24	42	99.25 psi	
9:43	43	99.25 psi	
9:44	44	99.25 psi	
9:45	45	99.25 psi	
9:46	46	99.25 psi	
9:47	47	99.25 psi	
9:48	48	99.0 psi	
9:49	49	99.0 psi	
9:50	50	99.0 psi	
9:51	51	99.0 psi	
9:52	52	99.0 psi	
9:53	53	99.0 psi	
9:54	54	99.0 psi	
9:55	55	99.0 psi	
9:56	56	98.75 psi	
9:57	57	98.75 psi	
9:58	58	98.75 psi	
9:59	59	98.75 psi	
10:00	60	98.75 psi	

Certified By: M. Randal Skinner

Pressure Decrease: 1.25 psi

MONTGOMERY WATSON

WELL # Monitor DAILY SHIFT REPORT

DATE(S): 9/10/96
HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
		X				

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	(overcast)	(rain)	heavy rain
Temp.	32-50	50-70	70-85	(>85)
Wind	(still)	(med)	high	
Humidity	dry	(moderate)	humid	Report No.

SHIFT SUMMARY

OBSERVER: Randy Skinner
DRILLER: Joe Schmidt
ACTIVITY: 6" Pressure Test
SUB CONTRACTORS: _____
FORMATION SAMPLES: —
WATER SAMPLES: —
TESTING: Casing pressure test

START DEPTH: —
END DEPTH: —

TIME	DESCRIPTION
0800	On site for pressure Test. Casing is @ 104 psi, & has been lossing 1-2 psi / Hr.
	- Called Pete K. D.E.P. has been notified of Test, we will Wait until 0900 to start Test.
0900	- Starting pressure Test.
1000	- End Test. loss of 1.5 psi in 1 Hr
1020	- Drillers will be ready to drill on Thursday
	- off site

WRTC401W

Observer's initials MRS

MONTGOMERY WATSON

WELL #Monitor DAILY SHIFT REPORT

DATE(S): 9/11/96

HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
			X			

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	overcast	rain	heavy rain
Temp.	32-50	50-70	70-85	>85
Wind	still	med	high	
Humidity	dry	moderate	humid	**Report No.**

SHIFT SUMMARY

OBSERVER: Randy Skinner

DRILLER: Joe Schmidt

ACTIVITY: Work on Rig

START DEPTH: _____

END DEPTH: _____

SUB CONTRACTORS: _____

FORMATION SAMPLES: _____

WATER SAMPLES: _____

TESTING: _____

TIME	DESCRIPTION
—	No Observer on site.
-	Driller is changing over to reverse air.
-	No drilling activity.

WRTC401W

Observer's initials RS

MONTGOMERY WATSON

WELL # Monitor DAILY SHIFT REPORT

DATE(S): 9/12/96
HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
				X		

BID PACKAGE: _____

CONTRACTOR: _____

Weather	clear	(overcast)	rain	heavy rain
Temp.	32-50	50-70	70-85	(>85)
Wind	still	(med)	high	
Humidity	dry	(moderate)	humid	Report No.

SHIFT SUMMARY

OBSERVER: Randy Skinner
DRILLER: Joe Schmidt
ACTIVITY: Pilot hole
SUB CONTRACTORS: —
FORMATION SAMPLES: Every 10'
WATER SAMPLES: Every 30'
TESTING: Head pressure.

START DEPTH: 1000'
END DEPTH: 1025'

TIME **DESCRIPTION**

1500 - On site, Starter is still not on site. Waiting for replacement
1600 - Rob Dennis (MW) on site.
- Still Waiting on starter
1635 - Starter on site. it will be 1800 hr before Drilling can resume.
- Will Start Drilling in the morning. Driller is going to repair drill & Procede from Cement plug to 1025' to Try to flow well. Will drill from 1025' in the morning.
1640 - off site.

WRTC401W

Observer's initials MRS

MONTGOMERY WATSON

WELL # Monitor DAILY SHIFT REPORT

DATE(S): 9/13/96

HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
					X	

BID PACKAGE: _____

CONTRACTOR: _____

Weather	(clear)	overcast	rain	heavy rain
Temp.	32-50	50-70	70-85	(>85)
Wind	(still)	med	high	
Humidity	dry	(moderate)	humid	Report No.

SHIFT SUMMARY

OBSERVER: Randy SKinner

START DEPTH: 1025

DRILLER: Joe Schmidt

END DEPTH:

ACTIVITY: Drill out Monitor Zone.

SUB CONTRACTORS: —

FORMATION SAMPLES: Every 10'

WATER SAMPLES: Every Kelly down.

TESTING: Head pressure Test.

TIME	DESCRIPTION
0700 -	On Site, Preparing to Drill reverse air from 1025'. Well flows @ ≈ 25 gpm
0730 -	Air Compressor broken. Down for Repairs
1000 -	New Air Compressor on site, preparing to Drill.
1040 -	Problem with air line, Rig is down again.
1100 -	Drillers are Looking for new air line.
1245 -	New air line on site. Preparing to drill from 1025'
1345 -	Drill bit is plugged off. Trying to open drill pipe.
1415 -	Unable to open drill pipe, — TOOH
1530 -	Still Turn. off site

WRTC401W

Observer's initials RSR

CH2M HILL
Hillsboro Executive Center North
800 Fairway Drive
Suite 350
Deerfield Beach, FL
33441-1831
Tel 954.426.4008
Fax 954.698.6010

CH2MHILL

Celebrating 50 Years

September 16, 1996

103715.A0

Mr. William W. Cocke, P.G.
Program Manager - UIC
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; FDEP File # UC 06-242411

Weekly Summary (September 2 – 6, 1996)

The drilling contractor, Diversified Drilling Corp. (DDC), rigged up for reverse-air drilling (i.e., exchanged drill rods and bit, mobilized frac tank and air compressor, etc.) during this short week following Labor Day weekend. Notified FDEP of pending pressure test on 6-inch casing of MW-1.

Schedule for Next Week

Conduct casing pressure test on 6-inch casing. Also, construct 6-inch temporary pipeline to convey brackish water to the 1 million gallon above-ground storage tank and thence to the onsite lift station for disposal.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB/11185.DOC
Enclosures
c: Bob Leonard/BCOES
Anne Murray/Montgomery Watson
Members of the TAC

Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
MW-1	8/8/96	18	495	7.2	400	10	150	6.56	144	0	259	7.31	190	18	439	7.25	352	Initial Sampling
MW-1	8/22/96	21.5	542	6.93	452	17.5	178	6.65	260	5	307	7.13	264	44.5	467	7.12	364	
MW-1	8/29/96	20	533	7.14	308	6.6	158	6.64	410	5	322	7.16	246	52	445	7.18	378	
MW-1	9/4/96	14	337	8.28	272	8.5	193	6.74	274	5	332	7.48	222	56.5	515	7.37	410	
	9/13/96																	
	9/20/96																	
	9/27/96																	
	10/3/96																	
	10/10/96																	
	10/17/96																	
	10/24/96																	
	10/31/96																	
	11/7/96																	
	11/14/96																	
	11/21/96																	
	11/28/96																	
	12/4/96																	
	12/11/96																	
	12/18/96																	
	12/26/96																	
	1/2/97																	
	1/9/97																	
	1/16/97																	

CH2M HILL
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Tel 954.426.4008
Fax 954.698.6010

CH2MHILL

Celebrating 50 Years

September 4, 1996

103715.A0

Mr. William W. Cocke, P.G.
Program Manager–UIC
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; FDEP File # UC 06-242411

Weekly Summary (August 23–30, 1996)

The drilling contractor (Diversified Drilling Corp. [DDC]) continued pilot hole drilling at the monitor well (MW-1) on August 23, 1996. The 12-inch pilot hole was extended with mud-rotary drilling to 1,000 feet below land surface (bls). Geophysical logs (caliper, gamma, LSN) were conducted on the pilot hole. The borehole was reamed to 13-inches. Casing seat was approved by the TAC on August 30, 1996. Approximately 990 feet of 14-inch casing was cemented in place with neat cement (625 sacks) to land surface.

Schedule for Next Week

Rig up for reverse-air drilling and conduct casing pressure test on 6-inch casing.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB11127.DOC
Enclosures
c: Bob Leonard/BCOES
Anne Murray/Montgomery Watson
Members of the TAC

Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
MW-1	8/8/96	18	495	7.2	400	10	150	6.56	144	0	259	7.31	190	18	439	7.25	352	Initial Sampling
MW-1	8/22/96	21.5	542	6.93	452	17.5	178	6.65	260	5	307	7.13	264	44.5	467	7.12	364	
MW-1	8/29/96	20	533	7.14	308	6.6	158	6.64	410	5	322	7.16	246	52	445	7.18	378	
	9/6/96																	
	9/13/96																	
	9/20/96																	
	9/27/96																	
	10/3/96																	
	10/10/96																	
	10/17/96																	
	10/24/96																	
	10/31/96																	
	11/7/96																	
	11/14/96																	
	11/21/96																	
	11/28/96																	
	12/4/96																	
	12/11/96																	
	12/18/96																	
	12/26/96																	
	1/2/97																	
	1/9/97																	
	1/16/97																	

MONTGOMERY WATSON

MW2

Notes

Lithologic Description
MW-1 ; BCOES ASR

Date 8/28/96

- Identification: This unit is composed of undifferentiated Plio-Pleistocen sediments (Tamiami Equivalent).

Interval : 410' - 440' No Recovery

Interval : 440' - 550'

- Description: Limey mudstone (Terraria). Light Olive green, poorly indurated, Non-Bedded, Calcite cemented clay. Few fossils including Pleurotoma & Gastropods. Calcite Cement has possible diagenetic Origen. Unit Contains 5%-10% Grey/Tan/White Limestone interbedded or contaminated from above. Clay appears to be Kaolinitic to Montmorillic (Possible Swelling clay).
- Identification: Upper Peace River (Hawthorn) interval.

Interval : 550' - 700'

- Description: Yellowish Gray to Olive Clay. Plastic, contains Trace amounts of white chalky Limestone. No fossils visible. Clay is nodular & Sticky in cuttings. appearing in Typical Peace River form. No Porosity
- Identification: Peace River formation (Upper Hawthorn)

Interval : 700 - 900

- Description: Green Gray to Light/Dark Olive clay. Plastic Contains up to 35% Limestone, locally abundant. No fossils Visible. Clay is nodular & sticky in cuttings. Limestone is soft, near white & non descript.
- Identification: Arcadia formation (Lower Hawthorn). distinguished from the Peace River by the marked increase in limestone.

Interval : 900' - 1000' (TD)

- Description: White to medium grey Limestone. Highly indurated, including fossiliferous packstones & Wackestones. Bioclasts are locally represented as moldic porosity, & Total porosity Varies

MONTGOMERY WATSON

MWR

Notes

Date 8/28/96

from low to high locally. Diagenetically the rock has experienced Dissolution, Recrystallization, & cementation. Spar cements are common (Dog Tooth). Bioclasts include Smaller forams, Pelecypods, Gastropods & Cnidarians. Possible Reef w/ a- fore slope material.

— Identification: Suwannee Limestone.

MONTGOMERY WATSON

WELL # Monitor DAILY SHIFT REPORT

DATE(S): 8/26/96
HOURS WORKED: _____

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat

BID PACKAGE: _____

CONTRACTOR: Diversified

Weather	(clear)	overcast	rain	heavy rain
Temp.	32-50	50-70	70-85	(>85)
Wind	(still)	med	high	
Humidity	dry	moderate	(humid)	Report No. 0

SHIFT SUMMARY

OBSERVER: Randy SKinner
DRILLER: Bob Schmidt
ACTIVITY: Pilot hole.
SUB CONTRACTORS:
FORMATION SAMPLES: Every 10'
WATER SAMPLES:
TESTING:

START DEPTH: _____
END DEPTH: _____

TIME **DESCRIPTION**

— Drillers were on-site by 10:00 am. Mixed mud & Tripped into hole to drill out cement plug. & start pilot hole to 1000'.

— Drillers are to inform Randy SKinner of Progress, so he can be On site for all drilling below 800'. This depth will not be reached until Tomorrow

COPY

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Observer's initials mbd

MONTGOMERY WATSON

WELL # MW-1 DAILY SHIFT REPORT

DATE(S): 8/27/96
HOURS WORKED: ______

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
		X				

BID PACKAGE: ______

CONTRACTOR: Diversified

Weather	(clear)	overcast	rain	heavy rain
Temp.	32-50	50-70	70-85	>85
Wind	(still)	mod	high	
Humidity	dry	(moderate)	humid	Report No. 1

SHIFT SUMMARY

OBSERVER: Randy Skinner
DRILLER: Bob Schmidt
ACTIVITY: Pilot hole
SUB CONTRACTORS:
FORMATION SAMPLES: Every 10'
WATER SAMPLES: -NA-
TESTING: -NA-

START DEPTH:
END DEPTH: 840'

TIME	DESCRIPTION
12:30	– Randy Skinner onsite. Met with Bob Schmidt. Drilling @ approx. 630' bpl.
	– Samples are Green Hawthorn clay and Limestone. Drilling ...
1400	off Site.
16:30	– On Site Driller were at 809' bpl. A substantial Limestone interval was encountered at 700'. Formation is still Hawthorn.
18:00	Kelly Down at 840' bpl. Formation still Hawthorn.
18:30	– Off Site, Drilling halted til the morning.

COPY

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Observer's initials ______

MONTGOMERY WATSON

WELL # MW#1 DAILY SHIFT REPORT

DATE(S): 8/28/96
HOURS WORKED:

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
			X			

BID PACKAGE:

CONTRACTOR: Diversified

Weather	clear	overcast	rain	heavy rain
Temp.	32-50	50-70	70-85	>85
Wind	still	med	high	
Humidity	dry	moderate	humid	Report No. 2

SHIFT SUMMARY

OBSERVER: Randy Skinner
DRILLER: Joe Schmidt
ACTIVITY: Pilot hole - Logging
SUB CONTRACTORS: Geophysics
FORMATION SAMPLES: Every 10'
WATER SAMPLES:
TESTING:

START DEPTH: 840'
END DEPTH: 1000'

TIME **DESCRIPTION**

11:00 - Randy Skinner on site. Drillers are preparing to Drill
12:45 - Drilling from 840'. 1-2min/Ft. Hawthorn Formation
14:10 - Drilling at 918' Formation changing to Limestone (Suwannee Fm.)
- Mark Schilling on site.
15:30 - Drilling at 935'. Talked to Pete about Formation Samples (Suwannee Fm.)
Pete wants to look for clay layer at 982'. Mark off site
16:10 - Drilling at 965'. Drilling rate at 2'min/Ft. possible clay zone.
- No clay in Drill cuttings.
- Kelly Down at 985'. 5-8min/Ft. Suwannee Fm.

wRTC401W

Observer's initials: RS

COPY

1745 - TD @ 1000'. Circulating hole for loggers.
1930 - TDOH
1900 - Logger on site
2040 - Laying down b.h.
- Logger over the hole.
2100 - Tool has been stuck w/ 445' for 30 min.
2130 - Driller will clean hole + Re log in the morning.
- off site

COPY

vvRTC401W

Observer's initials _____

MONTGOMERY WATSON

WELL # Master DAILY SHIFT REPORT

DATE(S): 8/29/96
HOURS WORKED: 7

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
				X		

BID PACKAGE: _____

CONTRACTOR: Diversified

Weather	(clear)	(overcast)	rain	heavy rain
Temp.	32-50	50-70	70-85	(>85)
Wind	(still)	(med)	high	
Humidity	dry	(moderate)	humid	Report No. 3

SHIFT SUMMARY

OBSERVER: Randy Sikkema
DRILLER: Joe Schmidt
ACTIVITY: Log pilot hole
SUB CONTRACTORS:
FORMATION SAMPLES:
WATER SAMPLES:
TESTING:

START DEPTH: 1000
END DEPTH: 1220

TIME	DESCRIPTION
1405	- On Site.
	- Drillers have comming out of hole for loggers.
1515	- Tool on bottom @ 988'
	- called Pete. Tool is below suspect clay zone, but not at bottom.
	- This is acceptable.
1800	- Logging completed. Logger Rigging Down
	- Diversified his ~~tools~~ modified drilling assembly & will [illegible] overnight.
2200	- Off Site

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Observer's initials RSS

MONTGOMERY WATSON

WELL # MW-1 DAILY SHIFT REPORT

DATE(S): 8/30/96
HOURS WORKED:

Broward County ASR WELL

Sun	Mon	Tue	Wed	Thr	Fri	Sat
					X	

BID PACKAGE:

CONTRACTOR:

Weather	clear	overcast	rain	heavy rain
Temp.	32-50	50-70	70-85	>85
Wind	still	med	high	
Humidity	dry	moderate	humid	Report No. 4

SHIFT SUMMARY

OBSERVER: Randy Skinner
DRILLER: Scott & Bob Schmidt
ACTIVITY: Run Cement & casing
SUB CONTRACTORS: -
FORMATION SAMPLES: -
WATER SAMPLES: -
TESTING: -

START DEPTH:
END DEPTH:

TIME	DESCRIPTION
1400 -	TODAY, Randy Skinner on site. Casing approx depth of 998' has been received.
1512 -	Joint #1 in hole w/ centralizers.
16[illegible] -	Welding 1 & 2.
1618 -	Welding 2 & 3
1644 -	Welding 3 & 4
1721 -	Welding 4 & 5
1741 -	Welding 5 & 6
1731 -	" 6 & 7
1747 -	" 7 & 8
18[illegible] -	Welding 8 & 9

COPY

WRTC401W

Observer's initials

1817 - 9 to 10
1835 - 10 to 11
1847 - 11 to 12
1904 - 12 to 13
1917 - 13 to 14
1933 - 14 to 15
1948 - 15 to 16
2000 - 16 to 17
2015 - 17 to 18
2030 - 18 to 19
2045 - 19 to 20
2100 - 20 to 21
2115 - 21 to 22
2133 - 22 to 23
2147 - 23 to 24
2200 - completed casing Run to 990'
- Start to Run Tremie pipe.
2345 - Tremie is in hole. Rigging up cementer.
0005 - Welding on header plate.
0005 - Turning over mud (Bottom's up).
0045 - End circulating of mud.
0100 - pre-flush
0106 - Sending cement.
0124 - @ 15 lb/gal 5 bbl-min.
0135 - Full Return at 130 bbl
0137 - End cement at 135 bbl
0200 - off site

COPY

WRTC401W

Observer's initials [initials]

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Deerfield Beach, FL
33441-1831
Tel 954.426.4008
Fax 954.698.6010

CH2MHILL

Celebrating 50 Years

September 4, 1996

103715.A0

Mr. William W. Cocke, P.G.
Program Manager–UIC
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, FL 33416

Dear Bill:

Subject: Broward County Office of Environmental Services (BCOES) ASR Demonstration Project; FDEP File # UC 06-242411

Weekly Summary (August 19–23, 1996)

The drilling contractor (Diversified Drilling Corp. [DDC]) began drilling at the monitor well (MW-1) on August 19, 1996. The 12-inch pilot hole was extended with mud-rotary drilling to 430 feet below land surface (bls). Geophysical logs (caliper, gamma, LSN) were conducted on the pilot hole. The borehole was reamed to 24-inches. Approximately 400 feet of 14-inch casing was cemented in place with neat cement (620 sacks) to land surface by the pressure grout method.

Schedule for Next Week

Continue pilot hole inside 14-inch casing to approximately 1,000 feet bls. Conduct geophysical logs (caliper, gamma, LSN) and evaluate casing setting depth for final 6-inch casing. Ream borehole to nominal 13 inches and cement 6-inch casing in pl: ce.

Sincerely,

CH2M HILL

Peter J. Kwiatkowski, P.G.
Project Manager

DFB11127.DOC
Enclosures
c: Bob Leonard/BCOES
Anne Murray/Montgomery Watson
Members of the TAC

Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
MW-1	8/8/96	18	495	7.2	400	10	150	6.6	144	0	259	7.3	190	18	439	7.3	352	Initial Sampling
MW-1	8/22/96	21.5	542	6.93	452	17.5	178	6.7	260	5	307	7.1	264	44.5	467	7.1	364	
	8/29/96																	
	9/6/96																	
	9/13/96																	
	9/20/96																	
	9/27/96																	
	10/3/96																	
	10/10/96																	
	10/17/96																	
	10/24/96																	
	10/31/96																	
	11/7/96																	
	11/14/96																	
	11/21/96																	
	11/28/96																	
	12/4/96																	
	12/11/96																	
	12/18/96																	
	12/26/96																	
	1/2/97																	
	1/9/97																	
	1/16/97																	

CH2M HILL

DAILY OPERATIONS REPORT

Project No. 103715.A0.30 Date 8-15-96

Client Broward County

Contractor Diversified

Well No. MW-1 & WTP 2A

Weather Partly Cloudy ≈ 90°F

Shift No. 1 Time 0700 - 1900

Driller Joe Schmidt

Activity Drilling Pilot Hole

Starting Depth 40 feet B.L.L.

Ending Depth 90 feet B.L.L.

Bit Size - 12.25"

Shift No. ______ Time ______

Driller ______

Activity ______

Starting Depth ______

Formation samples collected ______

Water samples collected ______

Deviation Survey ______

Drilling fluid additives ______

Well water level

Time	Depth

Measurement reference point ______

elevation ______

Supply deliveries ______

Time	Description of Operations
1300 -	Site Safety Meeting Conducted (See Mtg. Notes)
1400 -	Meeting completed. Contractor will start
	Pilot Hole drilling this afternoon
1430 -	M. Schilling offsite

Mark Schilling - Inspector

CH2M HILL

DAILY OPERATIONS REPORT

Project No. [illegible] Date 8-30-9[illegible]

Client BROWARD COUNTY

Contractor DIVERSIFIED

Well No. MW-1 & [illegible]

Weather PARTLY CLOUDY, BREEZY ≈90°F

Shift No. 1 Time 0700 1900

Driller JOE SCHMIDT

Activity DRILLING PILOT HOLE

Starting Depth 90 FEET BLL

ENDING DEPTH 240 FEET BLL

BIT SIZE 12.25"

Shift No. ______ Time ______

Driller ______

Activity ______

Starting Depth ______

Formation samples collected ______

Water samples collected ______

Deviation Survey 90 & 180 FEET BLL

Drilling fluid additives ______

Well water level

Time	Depth

Measurement reference point ______

elevation ______

Supply deliveries ______

Time	Description of Operations
0800	M SCHILLING ARRIVES AT THE SITE. THE CONTRACTOR
	HAD DRILLED THE 12.25-INCH PILOT HOLE TO 90 FEET
	BLL LAST NIGHT. HE IS IN THE PROCESS OF
	RUNNING A DEVIATION SURVEY ON THE 0-90 FEET
	RANGE. UPON COMPLETION, PILOT HOLE DRILLING
	WILL RESUME. M SCHILLING ADVISES JOE
08	SCHMIDT TO ENSURE FORMATION SAMPLES ARE
	TAKEN AND ANY LOST CIRCULATION ZONES
	ARE NOTED
0815	M SCHILLING OFFSITE
H3	

MARK SCHILLING - INSPECTOR

CH2M HILL

DAILY OPERATIONS REPORT

Project No. 153713.AX.3Y Date 5-21-96

Client BROWARD COUNTY

Contractor DIVERSIFIED

Well No. MW-1 @ WTP 2A

Weather PARTLY CLOUDY, BREEZY > 90°F

Shift No. 1 Time 0700-1900

Driller BOBBY SCHMIDT

Activity DRILLING PILOT HOLE, GEOPHYSICAL LOGGING, REAMING

Starting Depth 240 FEET BLL } 12.25" BIT

ENDING DEPTH 430 FEET BLL

STARTING DEPTH 38 FEET BLL } 23" BIT

ENDING DEPTH 75 FEET BLL

Shift No. ______ Time ______

Driller ______

Activity ______

Starting Depth ______

Formation samples collected ______

Water samples collected ______

Deviation Survey 270 : 360 FEET BLL

Drilling fluid additives ______

Well water level

Time	Depth

Measurement reference point ______

elevation ______

Supply deliveries ______

Time	Description of Operations
1030	M SCHILLING ARRIVES ON SITE WITH THE CH2M HILL GEOPHYSICAL LOGGING EQUIPMENT TO CONDUCT GEOPHYSICAL LOGGING ON THE PILOT HOLE. THE CONTRACTOR IS CURRENTLY AT 430 FEET BLL AND HAS BEEN DRILLING WITH NO RETURNS SINCE 240 FEET BLL. M SCHILLING ADVISES THE CONTRACTOR TO STOP DRILLING AND CIRCULATE THE BOREHOLE UNTIL THE CUTTINGS ARE REMOVED AND THE BOREHOLE IS CONDITIONED FOR THE GEOPHYSICAL LOGGING.
1045	M. SCHILLING OFFSITE
1300	M SCHILLING RETURNS TO THE SITE. THE CONTRACTOR IS STILL IN THE PROCESS OF TRIPPING OUT THE DRILL RODS AND BIT. BARTOW STEEL IS ON SITE WITH THE DELIVERY OF THE 14-INCH CASING.
1330	START GEOPHYSICAL LOGGING. LOGS TO BE CONDUCTED ARE THE CALIPER, NATURAL GAMMA RAY, AND THE LONG & SHORT NORMAL ELECTRIC RESISTIVITY LOGS.
1600	GEOPHYSICAL LOGGING COMPLETED. THE CONTRACTOR IS RIGGING UP TO START REAMING THE NOMINAL 12" PILOT TO A NOMINAL 23 INCHES. M SCHILLING OFFSITE

MARK SCHILLING - INSPECTOR

CH2M HILL

DAILY OPERATIONS REPORT

Project No. 103715.A1.3 Date 8-22-96

Client Broward County

Contractor Diversified

Well No. MW-1 & WTP 2A

Weather Partly Cloudy Breezy ≈ 90°F

Shift No. 1 Time 0700-1900

Driller Bobby Schmidt

Activity Reaming Pilot Hole

Starting Depth 75 feet bls
Ending Depth 340 feet bls
Bit size - 23"

Shift No. 2 Time 1900-0700

Driller Max

Activity Reaming Pilot Hole

Starting Depth 340 feet bls
Ending Depth 406 feet bls
Bit size 23"

Formation samples collected

Water samples collected

Deviation Survey

Drilling fluid additives

Well water level

Time	Depth
0700	30 feet bls

Measurement reference point

elevation

Supply deliveries

Time	Description of Operations
1125	M. Schilling arrives onsite. The contractor is currently reaming the pilot hole to a nominal 23 inches. Bobby Schmidt is reminded by M. Schilling to collect formation samples from the depth's that were missed during pilot hole drilling
1130	Ray Bratzel and Bob Harper of BCOES arrive onsite to sample the shallow monitor wells surrounding the drill pad
1145	M. Schilling offsite
1545	Bob Mathews of Diversified phones P. Kwiatkowski of CH2M Hill and informs him that a night shift will be run tonight to ensure the reaming is completed. This decision was made to allow the 14-inch casing to be set tomorrow

Mark Schilling - Inspector

CH2M HILL

DAILY OPERATIONS REPORT

Project No. 123715.A1.3 Date 8-23-96

Client Broward County

Contractor Diversified

Well No. MW-1 & WTF 7A

Weather Partly Sunny ≈ 88°F

Shift No. 1 Time 0700-1900

Driller Bobby Schmidt

Activity Setting & Cementing 14" casing

Starting Depth

Shift No. Time

Driller

Activity

Starting Depth

Formation samples collected

Water samples collected

Deviation Survey

Drilling fluid additives

Well water level

Time	Depth

Measurement reference point

elevation

Supply deliveries

Time	Description of Operations
0800	M Schilling arrives at the site. The Con-
	tractor is in the process of tripping out
	the drill rods and bit after tripping into
	the reamed borehole and circulating mud earlier
	this morning.
0900 -	Contractor completes tripping out and starts
	setting up to run the 14-inch casing.
1000 -	Start casing run.
1445 -	Casing run completed. Bottom of casing
	is at 401 feet b.l.s. Contractor starts
	setting up to cement the casing. 2-inch
	tremie pipe is being tripped into the casing
	in preparation for pressure grouting.
1545 -	Start cementing 14-inch casing.
1630 -	Cementing of 14-inch casing completed. A
	total of 619 sacks of neat cement (130 barrels)
	pumped with cement returns at the surface.
1700 -	M Schilling offsite for the day. The contractor
	will be waiting to pull down from cementing and
	shut-in well. No work will occur over the
	weekend.
Note:	Peter Kwiatkowski of CH2M Hill was on site
	from 1600 to 1635 to observe cementing
	of 14-inch casing.

Mark Schilling - Inspector

MONTGOMERY WATSON

MW28

Notes

Lith-logs

Date 9/28/96

Interval : 0'-20' No Recovery

Interval : 20'-70'

- Description: Limestone, with Sand. Variable amounts of Whole & Broken Gastropods/pleycpods. Unit is Tan to pale grey. Moderately cemented. Most CaCO3, including Biotics, has been Recrystalized (meteoric). Dissolution & cementation have also occured.
- Identification: This unit is composed of undifferentiated Pleistocene sediments.

Interval : 70'-200' No Recovery 100'-190'

- Description: Limestone (55%), Sandstone (5%), Calcite (5%) Shell (5%). Wholey to partialy recrystalized Limestone, with Variable amounts of moderately cemented Sand, Calcite Spar (Fracture & Void fill), and Biotics. Unit is Tan/Grey to pale Orange in color. Well Cemented, and Hard. Porosity, including moldic is present (Total Volume is not obtainable from cuttings). Diagenesis, including dissolution, recrystalization, & cementation, have been Wide Spread. Gastropods & Pleycpods are present
- Identification: This unit is composed of undifferentiated Plio-Pleistocene Sediments.

Interval : 200'-240' No Recovery

Interval : 240'-400'.

- Description: Limestone: Light Olive to White (60%), Recrystalized Limestone, devoid of Biotics. Very Hard & Well indurated.
- Gray-micritic, With phosphate. Very Hard. Depositional Low Mg Calcite, few fossils moderately Hard, Granular. (30%)
- Olive Green - Contains Terrigenous mudstone and Sand, poorly indurated (10%) crumbly

increases to 30% at Base of unit.

APPENDIX D

Summary of Casing Depths and Cement Quantities

Appendix D
Summary of Casing Depths and Cement Quantities
BCOES ASR Demonstration Project

Well	Casing Diameter (inches)	Casing Wall Thickness (inches)	Casing Depth (feet)	Date of Cement Event	Cement Type	Cement Interval (feet)	Cement Quantity (sacks)	Cement Quantity (barrels)	Comments
MW-1	14	0.375	400	8/23/96	Neat	0 to 400	619	130	Primary Pressure Grout
MW-1	6	0.575	990	8/30/96	Neat	0 to 990	635	135	Primary Pressure Grout
ASR-1	26	0.375	397	10/11/96	Neat	0 to 397	1020	217	Primary Pressure Grout
ASR-1	16	0.5	995	10/26/96	Neat	0 to 990	404	86	Primary Pressure Grout
ASR-1	16	0.5	995	10/26/96	4% gel	0 to 990	742	205	Primary Pressure Grout
ASR-1	16	0.5	995	10/28/96	Neat	0 to 70	122	26	Tremie Grout

APPENDIX E

Casing Mill Certificates

INSPECTION CERTIFICATE

Supplier : HYUNDAI CORPORATION

Contract No (L/C No) NY6035539K

Specification : ASTM A53B/API 5LB

Kind of Article : E. R. W. Steel pipe

주 식 회 사 신 호 스 틸

Shin Ho Steel Co., Ltd

C.P.O.Box904Seoul, Korea.

DAEBUL PLANT

Customer : HYUNDAI CORPORATION, U.S.

Issued Date : JUN. 08. 1996

Certificate No : D960608 - 069

Manufactured No : 96 - 5 - 211

Lot No. (Heat)	Q.TY (pcs)	Type	Nominal Size (in)	Dimension O.D (mm)	Dimension W.T (in)	Dimension Length (ft)	Weight (kg/m)	Chemical Comp.(%) C	Si	Mn x 100	Cu	Ni	Cr	Mo	P x 1000	S	V	Tension Test Tensile Strength (kgf/mm²)	Yield Strength (kgf/mm²)	Elongation (%)	WTS (kgf/
A87147	73	BPEB	14	355.6	0.250	42	54.6	15	TR	75	3	2	2	TR	16	7	3	51	37	33	52
A87508	11	BPEB	14	355.6	0.375	21	81.2	16	TR	76	2	3	2	TR	17	6	2	52	37	32	53
A83655	143	BPEB	14	355.6 ✓	0.375 ✓	42	81.2 ✓	17 ✓	TR	74 ✓	3	3	2	TR	15 ✓	5 ✓	3	50	36	34	51
A87049	112	BPEB	16	406.4	0.250	42	62.6	18	TR	76	3	3	3	TR	17	6	3	52	38	32	53
A81029	52	BPEB	16	406.4	0.500	42	123.3	16	TR	73	2	3	2	TR	15	7	2	49	35	35	50
				↓ 14 in			↓ 54.57 lb/ft														

Nominal Size (in)	NDT (UST)	F(B) Test	WDT	Hydrostatic Test (------, psi)	Ring Gage Test	Straigh - tness (%)	V.I	REMARK
14	pass	G	G	750	pass	0.1	G	
14	pass	G	G	1120	pass	0.1	G	
14	pass	G	G	1120	pass	0.1	G	
16	pass	G	G	660	pass	0.1	G	
16	pass	G	G	1310	pass	0.1	G	
		------		LAST ITEM	-------			

We hereby certify that the above products have been made in accordance with requirements called for the order.

(1) O.D : Outside Diameter.
(2) W.T : Wall Thickness.
(3) WTS : Weld Tensile Test.
(4) F(B) : Flattening (Bend).
(5) V.I : Visual Inspection.
(6) WDT : Weld Ductility Test.
(7) NDT : Non Destructive Test.
UST : Ultrasonic Test.

Y. R. KIM

Inspector in charge

Monitor Well MW-1

1m = 3.281 ft
1kg = 2.2051b.

INSPECTION CERTIFICATE

Supplier : HYUNDAI CORPORATION
Contract No (L/C No) NY6036539K
Specification : ASTM A53B & API 5LB
Kind of Article : E. R. W. Steel pipe

주식회사 신호스틸
Shinho Steel Co., Ltd.
C.P.O.Box904Seoul, Korea

Customer : HYUNDAI CORPORATION U.S.A
Issued Date : MAY. 18. 1996.
Certificate No : 960518 - 861
Manufactured No : 96-5-24

Lot No. (Heat)	Q.TY (pcs)	Type	Nominal Size (--,in)	Dimension O.D (-- in)	Dimension W.T (-- in)	Dimension Length (-- ft)	Weight 'kg/ft, --->	Chemical Comp.(%) C x 100	Si	Mn	Cu	Ni	Cr	Mo	P x 1000	S	V	Tension Test Tensile Strength (kgf/m)	Yield Strength (kgf/m)	Elongation (%)	WTS (kgf/m)
A- 82784	1196	BPES	2-3/8	2.375	0.154	21	1.66	11	TR	65	2	2	2	TR	10	5	2	47	31	36	*
A-85321	57	"	4-1/2	4.500	0.337	21	6.79	13	1	66	3	3	3	TR	11	6	3	48	32	35	*
F-513526	42	"	6-5/8	6.625	0.280	21	8.60	14	2	69	4	2	2	1	12	7	2	49	33	34	*
B-07430 A-86130	416	"	6-5/8	6.625	0.280	42	8.60 19.96	15	TR	70	2	2	3	TR	13	5	4	47	31	36	*
B-07430	186	"	8-5/8	8.625	0.322	21	12.95	12	1	71	3	3	3	TR	14	6	2	50	34	33	54
B-07430	276	"	8-5/8	8.625	0.322	42	12.95	13	TR	68	4	3	2	TR	11	7	3	48	32	35	52
A-86328	87	"	12-3/4	12.75	0.250	42	15.14	14	TR	69	2	2	1	1	12	8	4	49	33	34	53
A-83920 F-513526	100	"	12-3/4	12.75	0.375	42	22.48	15	2	73	3	2	3	2	15	6	2	50	34	33	54

Nominal Size (in)	NDT (UST ECT)	F(B) Test	WDT	Hydrostatic Test (----- psi)	Ring Gage Test	Straigh - tness (%)	V.I	REMARK
2-3/8	pass	G	G	2500	pass	0.1	G	
4-1/2	pass	G	G	2800	pass	0.1	G	
6-5/8	pass	G	G	1780	pass	0.1	G	
6-5/8	pass	G	G	1780	pass	0.1	G	
8-5/8	pass	G	G	1570	pass	0.1	G	
8-5/8	pass	G	G	1570	pass	0.1	G	
12-3/4	pass	G	G	820	pass	0.1	G	
12-3/4	pass	G	G	1240	pass	0.1	G	

----- LAST ITEM -----

We hereby certify that the above products have been made in accordance with the requirements called for the order.

(1) O.D : Outside Diameter.
(2) W.T : Wall Thickness.
(3) WTS : Weld Tensile Test.
(4) F(B) : Flattening (Bend).
(5) V.I : Visual Inspection.
(6) WDT : Weld Ductility Test.
(7) NDT : Non Destructive Test.
ECT : Eddy Current Test
UST : Ultrasonic Test

Inspector in charge

Monitor Well MW-1

BROWARD COUNTY JOB 16X500

PAGE : 1/2
증명서번호 CERTIFICATE NO. : E9604-0140-000814(EB6010036)
제품명 COMMODITY : E.R.W STEEL PIPE
제품규격 SPECIFICATION : API 5LB/ASTM A53B

INSPECTION CERTIFICATE

SeAH SeAH Steel Corp. 世亞製鋼

SEOUL OFFICE 40-1,3,GA HANGANG-RO, YONGSAN-GU, SEOUL, KOREA
POHANG PLANT 14-1, JANGHEUNG-DONG, NAM-GU POHANG
CHANGWON PLANT 50, WOONGNAM-DONG, CHANGWON

발급일자 DATE OF ISSUE: 96/04/29
계약서번호 L/C No. (P/O No.) :
수요가 CUSTOMER :
주문자 SHIPPER : HYUNDAI CORP.

ITEM NO.	HEAT(LOT) NO.	GRADE	주문치수 ORDER SIZE	본수 PCS	총길이 TOTAL LENGTH	중량(M/T) WEIGHT	비고 REMARK
1	D04056 Y70486	088	12,3/4" X 0.375" X 21'	54	1134.000FT	25.492	1 Metric Ton = 2205 pounds
2	Y73055	088	16" X 0.375" X 21'	30	630.000FT	13.886	22.074 MT = 48,673.17 pounds
3	Y73043	088	16" X 0.500" X 42'	14	588.000FT	22.074	Divided by 588.0 Feet → 82.77 pounds/Foot ✓

ITEM NO.	HEAT(LOT) NO.	HYDROSTATIC TEST	RESULT	N.D.T *1	VISUAL & DIMENSION	FLATTENING	WELD DUCTILITY	BENDING	DRIFT	CRUSH	FLARING	FLANGE	R-FLATTENING	ZINC COATING TEST: WEIGHT OF ZINC COATING	균일성 C·S *3	알칼리 ALK *4
1	D04056	[illegible]0.0	G	G	G	G	G									
	Y70486	1240.0	G	G	G	G	G									
2	Y73055	980.0	G	G	G	G	G									
3	Y73043	1310.0	G	G	G	G	G									

HEAT(LOT) NO.	DESIG. *5	C (2)	Si (2)	Mn (2)	P (3)	S (3)	Cu (2)	Ni (2)	Cr (2)	Mo (2)	V (3)	DIR. *6	TENSILE STRENGTH Psi	YIELD POINT STRENGTH Psi	E.L % *6	IMPACT TEST (°C) ENERGY Joule	SHEAR AREA %	HARDNESS TEST	HEAT TREATMENT
D04056	H	18	1	74	11	8	-	-	-	-	-								
	P	17	1	75	9	9	1	2	2	1	2	T	71306.0	52556.0	34				G
	P	-	-	-	-	-	-	-	-	-	-	W	76278.0						
Y70486	H	15	2	80	13	7	-	-	-	-	-								
	P	15	1	77	13	5	2	1	2	1	3	T	69318.0	48721.0	40				G
	P	-	-	-	-	-	-	-	-	-	-	W	74573.0						
Y73055	H	15	1	67	14	7	-	-	-	-	-								
	P	14	1	70	13	5	2	2	1	1	3	T	72869.0	56392.0	34				G
	P	-	-	-	-	-	-	-	-	-	-	W	77272.0						
Y73043	H	14	2	67	11	8	-	-	-	-	-								
	P	13	1	70	9	6	2	3	1	1	2	T	68607.0	52130.0	38				G
	P	-	-	-	-	-	-	-	-	-	-	W	74573.0						

NOTE: *: REFER TO THE BACK SIDE

OTHERS:

ASR-1

Surveyor :

본 제품은 관련 규격에 정한 시험 및 검사에 합격하였음을 증명합니다.

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE AND TESTED IN ACCORDANCE WITH ABOVE SPECIFICATION AND THE RESULTS OF ALL TEST ARE ACCEPTABLE.

Manager of Q.A Dept

J. H. Kim

PS-A-831-F1

A4(2

BROWARD COUNTY JOB 16"X.500

PAGE : 5/5

증명서번호 CERTIFICATE NO. : B9602-0171-000419(EE5010036)

제 품 명 COMMODITY : E.R.W STEEL PIPE

제품규격 SPECIFICATION : API 5LB/ASTM A53B

INSPECTION CERTIFICATE

SeAH Steel Corp. 世亞製鋼

SDOUL OFFICE 40-153,3GA HANGANG-NO, YONGSAN-GU, SEOUL, KOREA
POHANG PLANT 14-1, JANGHEUNG-DONG, NAM-GU POHANG
CHANGWON PLANT 50, WOONGNAM-DONG, CHANGWON

발 급 일 자 DATE OF ISSUE: 96/02/27

계 약 서 번 호 L/C No. (P/O No.) :

수 요 가 CUSTOMER :

주 문 자 SHIPPER : HYUNDAI CORP.

ITEM NO.	HEAT(LOT) NO.	관 단 TYPE *1	주문치수 ORDER SIZE	수량 QUANTITY 본수 PCS	총 길 이 TOTAL LENGTH	중량(M/T) WEIGHT	비 고 REMARK
14	Y69147	BBB	16" X 0.500" X 42'	35	1470.000FT	55.184	→ 82.77 lbs./ft ✓
15	Y70649 Y72342	BBB	20" X 0.500" X 42'	50	2100.000FT	99.183	

ITEM NO.	HEAT(LOT) NO.	HYDROSTATIC TEST Psi	RESULT	N. D. T *2	VISUAL & DIMENSION	FLATTENING	WELD DUCTILITY	BENDING	DRIFT	CRUSH	FLARING	FLANGE	R-FLATTENING	ZINC COATING TEST WEIGHT OF ZINC COATING	내측 C·S *4	내측 ALK *4	CHEMICAL COMPOSITION (%) DESIG. *3	C	Si	Mn	P *6	S	CU *2	NI *2	CR *2	MO *2	V *3	DIR. *7	TENSILE TEST (Gage Length: 50mm) TENSILE STRENGTH Psi	YIELD POINT STRENGTH Psi	E.L % *8	IMPACT TEST (℃) ENERGY Joule	SHEAR AREA %	HARDNESS TEST	HEAT TREAT KIND SN *9	PROTECTIVE COATING & LINING THICKNESS	PH *10
14	Y69147	1310.0	G	G	G	G	G										H	14	2	70	15	8	-	-	-	-	-										
																	P	14	1	69	14	7	2	1	2	1	3	T	68039.0	49005.0	40				G		
																	P	-	-	-	-	-	-	-	-	-	-	W	75710.0								
15	Y70649	1050.0	G	G	G	G	G										H	15	2	72	18	8	-	-	-	-	-										
																	P	14	1	69	16	7	3	1	2	1	4	T	69034.0	51420.0	40				G		
	Y72342	1050.0	G	G	G	G	G										P	-	-	-	-	-	-	-	-	-	-	W	75000.0								
																	H	13	2	67	20	8	-	-	-	-	-										
																	P	14	1	70	15	7	2	2	1	1	2	T	70170.0	52130.0	37				0		
																	P	-	-	-	-	-	-	-	-	-	-	W	77414.0								

NOTE * : REFER TO THE BACK SIDE

OTHERS

ASR-1

Surveyor :

본 제품은 관련 규격에 정한 시험 및 검사에 합격하였음을 증명합니다.

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN HAS BEEN MADE AND TESTED IN ACCORDANCE WITH ABOVE SPECIFICATION AND THE RESULTS OF ALL TEST ARE ACCEPTABLE.

Manager of Q.A Dept. J. H. KIM

SeAH

BROWARD COUNTY JOB 16X500

검 사 명 서
INSPECTION CERTIFICATE

동부제강주식회사
DONGBU STEEL CO., LTD

- HEAD OFFICE : 21-9, CHO-DONG, JUNG-KU, SEOUL 100-300, KOREA
- SEOUL WORKS : 123, ORYU-DONG, GURO-GU, SEOUL 152-102, KOREA
- INCHEON WORKS : 690-1, KAJWA-DONG, SEO-KU, INCHEON 403-251, KOREA
- BUSAN WORKS : 725-4, HAKJANG-DONG, BUK-GU, BUSAN 616-020, KOREA

증명서 번호 CERTIFICATE NO.: M93 · 10 · 014

발행년월일 DATE OF ISSUE: 93.10.30

주문번호 FILE-NO.: PFC04J25X

계약번호 PURCHASE ORDER NO.: 1816-8039

품명 COMMODITY: E.R.W. STEEL PIPE

적용규격 SPECIFICATION: A53 GR.B/API 5L-B/API 5LX-42

수요자 CUSTOMER: BARTOW STEEL

취급상사 SHIPPER: DAEWOO CORP.

ITEM NO.	관종 TYPE	주문칫수 ORDER SIZE	본수 PIECES	총길이 TOTAL LENGTH	중량(kg) WEIGHT	수압시험 HYDROSTATIC TEST MPa,PSI kg/cm²	비파괴시험 N.D.T (ECT/UST)	기계시험 M.T (MPT/FLT/BND/W.D)	제강번호 HEAT NO.	항복강도 Y.S or Y.P (N/mm², PSI, kg/mm²)	인장강도 T.S	연신율 EL %	충격 IMPACT TEST joule	경도 HARDNESS TEST	C (×100)	Si	Mn	P (×1000)	S	Cu (×100)	Ni	Cr	Mo	V
1	BPEB	12-3/4"X0.500"X40'	33	1,320'	39,204	1650	G	G	GA29517	45,371	74,527	32			15	1	70	14	6					
2	BPEB	14"X0.500"X40'	91	3,640'	103,376	980	G	G	GA28766	45,513	74,385	33			14	1	69	15	7					
3	BPEB	16"X0.500"X40'	27	1,080'	40,586	1310	G	G	GA29301	45,371	74,527	32			15	1	70	14	6					
		*** 1 0 1 A 1 ***	151	6,040'	183,166																			

Additional column heads (no entries): ORIFT TEST; 아연도금시험 ZINC COATING TEST (부착량 W.O.Z (02.1: g/m²), C.S, U.F); 알카리성 ALK (100MA); 도복장 COALTAR or ASPHALT COATING (도막두께 COATING THICKNESS IN.OUT, P.D); S.I.T

I A S I 1 1 1 M

$$= \frac{40{,}586\ \text{kg}}{1080\ \text{feet}} \cdot \frac{2.2046\ \text{lbs}}{\text{kg}}$$

$$= 82.77\ \text{lbs/feet}$$

ASR-1

STANDARD	MIN	35,000	60,000	#	
	MAX			26 (C)	115 (Mn) 40 (P) 50 (S)

*G : GOOD
FLT : FLATTENING
BND : BENDING
W.D : WELD DUCTILITY (용접부연성)
W.O.Z : WEIGHT OF ZINC
C.S : COPPER SALPHATE (황산동침적, DIPS)
UNIF : UNIFORMITY (균일성)
ALK : ALKALINITY
P.D : PINHOLE DETECTOR
S.I.T : SALT IMMERSION TEST (1HOUR)

비고 REMARKS: 01:1:29.5 / 02:28.0

상기 강관은 지정된 규격의 시험을 행하여 합격하였음을 증명합니다.
We hereby certify that the material herein has been made and tested in accordance with the above specification and also with the requirements called for by the above order.

Surveyor to.

MANAGER OF QUALITY CONTROL

INSPECTION CERTIFICATE

Supplier : HYUNDAI CORPORATION.
Contract No (L/C No) NY6035539K
Specification : ASTM A53B/API 5LB
Kind of Article : E. R. W. Steel pipe

주 식 회 사 신 호 스 틸
Shin Ho Steel Co., Ltd
C.P.O.Box904Seoul, Korea.
DAEBUL PLANT

Customer : HYUNDAI CORPORATION, U.S.A
Issued Date : JUN. 08, 1996
Certificate No : D960608 - 069
Manufactured No : 96 - 5 - 111

Lot No. (Heat)	Q.TY (pcs)	Type	Nominal Size (in)	Dimension O.D (mm)	Dimension W.T (in)	Dimension Length (ft)	Weight (kg/m)	Chemical Comp.(%) C	Si	Mn	Cu	Ni	Cr	Mo	P	S	V	Tension Test Tensile Strength (psi)	Yield Strength (psi)	Elongation (%)	WTS (psi)
								x 100							x 1000						
A87167	73	BPEB'	14	355.6	0.250	42	54.8	15	TR	75	3	8	2	TR	16	7	3	73000	53000	33	74000
A87308	63	BPEB	14	355.6	0.375	21	81.2	16	TR	76	2	3	2	TR	17	6	2	74000	53000	32	75000
A83655	163	BPEB	14	355.6	0.375	42	81.2	17	TR	74	3	3	2	TR	15	5	3	71000	51000	34	73000
A87049	112	BPEB	16	406.4	0.250	42	62.6	18	TR	76	3	3	3	TR	17	6	3	74000	54000	32	75000
A81027	52	BPEB	16	406.4	0.300	42	123.3	16	TR	73	2	3	2	TR	13	7	1	70000	50000	33	71000

Nominal Size (in)	NDT (UST)	F(B) Test	WDT	Hydrostatic Test (------, psi)	Ring Gage Test	Straigh - tness (%)	V.I	REMARK
14	pass	G	G	758	pass	0.1	G	
14	pass	G	G	1120	pass	0.1	G	
18	pass	G	G	1120	pass	0.1	G	
16	pass	G	G	660	pass	0.1	G	
16	pass	G	G	1310	pass	0.1	G	
			------	LAST ITEM	------			

We hereby certify that the above products have been made in accordance with the requirements called for the order.

(1) O.D : Outside Diameter.
(2) W.T : Wall Thickness.
(3) WTS : Weld Tensile Test.
(4) F(B) : Flattening (Bend).
(5) V.I : Visual Inspection.
(6) WDT : Weld Ductility Test.
(7) NDT : Non Destructive Test.
UST : Ultrasonic Test.

(123.3 kg/m)(.67192) = 82.85 lbs./Ft ✓
Conversion factor

K. R. KIM
Inspector In charge

ASR-1

APPENDIX F

Lithologic Logs

MONTGOMERY WATSON

WELL # ASR-1 LITHOLOGY DESCRIPTION

BROWARD COUNTY UTILITIES **WTP ASR WELL**

CONTRACTOR: Diversified

TOTAL DEPTH:	1140	feet
COUNTY:	Broward	
OWNER:	Broward County Utilities	
DRILLING METHOD:	Mud/Reverse Air Drilling	
DRILLER(S):	Joe Schmidt	
DATUM POINT:	Pad level	
HYDROLOGIC UNITS:	Biscayne/Upper Floridan	

0-10	Sand 70%, white to light tan, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean but has been mixed with drilling mud. Soil 30%, brown to black, organic rich.
5Q10	Sand 95%, white to light tan, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean but has been mixed with drilling mud. Shell 5%, tan opaque, recrystalized and low Mg calcite constituents, some are etched, breakage is common (possibly secondary), including gastropods and plecypods.
10-20	as above
20-30	as above
30-40	Shell, tan opaque, recrystalized and low Mg calcite constituents, some are etched, breakage is common (possibly secondary), including gastropods and plecypods.
40-50	as above
50-60	as above
60-70	Limestone 90%, tan to medium gray, wackestone to recrystalized packstone, contains carbonate sand- bioclasts- and trace quarts and lithics, possible Mn, recrystalized (clear tan rhombus, can make up as much as 40% of total volume), cemented with abundant pore filling calcite spar cement (white to tan),moderately cemented, porosity is present. Shell 10%, tan opaque, recrystalized and low Mg calcite constituents, some are etched, breakage is common (possibly secondary), including gastropods and plecypods.
70-80	as above
80-90	as above
90-100	as above
100-110	as above
110-120	as above
120-130	as above
130-140	as above
140-150	as above
150-160	as above
160-170	as above
170-180	as above

180-190	Limestone, medium to dark gray, wackestone to recrystalized packstone, contains carbonate sand- bioclasts- and trace quarts and lithics, possible Mn, recrystalized (clear tan rhombus, can make up as much as 25% of total volume), cemented with abundant pore filling calcite spar cement (white),moderately cemented, porosity is present.
190-200	as above
200-210	as above
210-220	as above
220-230	as above
230-240	as above with abundant shell material.
240-250	as above
250-260	as above
260-270	as above
270-280	as above
280-290	as above
290-300	as above
300-310	as above
310-320	as above
320-330	as above
330-340	Yellowish gray to olive clay. The clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material, and calcite and dolomite cement. Contains isolated occurrences of plecypods. Clay is dominantly montmorillonite.
340-350	as above
350-360	as above
360-370	as above
370-380	as above
380-390	as above
390-400	as above
400-410	as above
410-420	as above
420-430	as above
430-440	as above
440-450	as above
450-460	as above
460-470	as above
470-480	as above
480-490	as above
490-500	as above
500-510	as above. Unit grades from montmorillonite to kaolinite with depth. Maintains green color.
510-520	as above
520-530	as above
530-540	as above
540-550	as above
550-560	as above
560-570	as above
570-580	as above
580-590	as above
590-600	as above
600-610	as above
610-620	as above
620-630	as above
630-640	as above

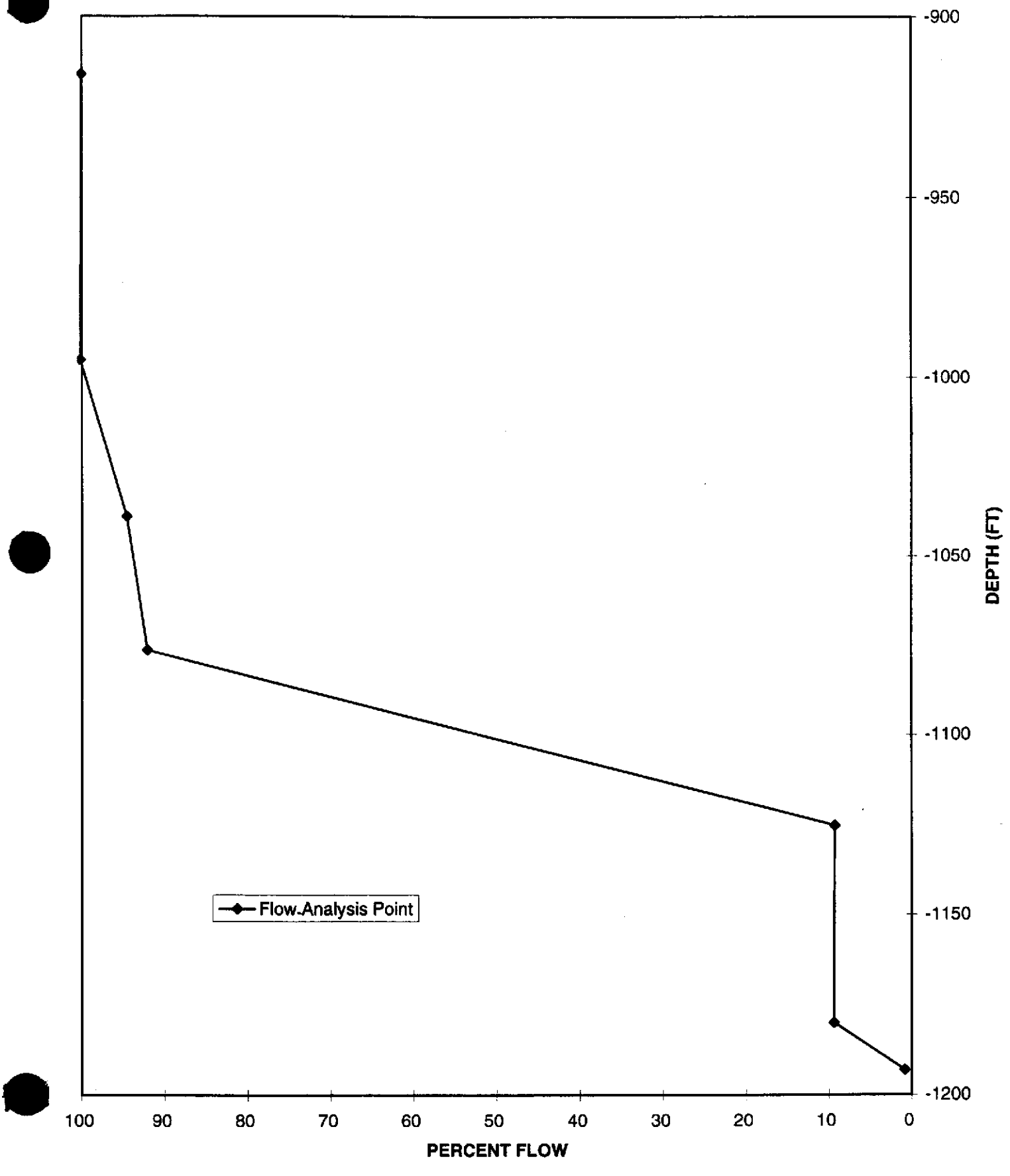
650-660	Light green to dark olive clay. The clay is plastic, and is interbedded with minor . amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and . minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and . permeability are absent due to plastic nature of clay
660-670	as above
670-680	as above
680-690	as above
690-700	as above
700-710	as above
710-720	as above
720-730	as above
730-740	as above
740-750	as above
750-760	as above
760-770	as above
770-780	as above
780-790	as above
790-800	as above
800-810	as above
810-820	as above
820-830	as above
830-840	as above
840-850	95 % Light green to dark olive clay. The clay is plastic, and is interbedded with minor . amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and . minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and . permeability are absent due to plastic nature of clay 5% Complexly interbedded, argillaceous limestone. Limestone is generally light gray to white, poor to moderately indurated, mudstones and wackestones. Porosity is low. Grains include minor fossil debris, and peloids.
850-860	as above
860-870	as above
870-880	as above with 70% clay, and 30% limestone.
880-890	as above with 50% clay, and 50% limestone.
890-900	as above with 25% clay, and 75% limestone. Limestone is Tan to green, phosphate rich, containing few biotics including mollusk debris and forams. Porosity is low. Poorly indurated. Cement is spar, and is porosity reducing. Texture is granular to sucrosic.
900-910	as above
910-920	as above
920-930	as above
930-940	as above with 15% clay, and 75% limestone.
940-950	as above
950-960	Limestone, white to medium gray, moderately indurated boundstones to wackstones, locally grades to packstone and grainstone. Contains phosphate nodules. Some bioclasts are represented as moldic porosity, and high secondary porosity and permeability are present (intergranular, interparticle and moldic). Locally the rock is recrystalized. Well indurated, and contains coarse spar cement (reducing). Biotics include reef fauna assemblage (diverse mollusk, foram, bryozoan, corals).
960-970	as above
970-980	as above
980-990	as above
990-1000	as above
1000-1010	as above Limestone is dominantly white. Unit has fine grained (chalky) texture.
1010-1020	as above.

1020-1030	as above. Limestone is white to very pale orange, and contains few echinoids.
1030-1040	as above
1040-1050	as above
1050-1060	as above
1060-1070	as above
1070-1080	as above
1080-1090	as above
1090-1100	as above
1100-1110	as above
1110-1120	as above
1120-1130	as above
1130-1140	Moderately soft, highly fossiliferous, very pale orange to tan, pelletal, wackestones and packstones, with 15% to 40% intergranular porosity. Locally, the unit is composed of thin layers of very hard micrite, of low porosity and permeability. Abundant foraminifera, and echinoids.
1140-1150	as above
1150-1160	as above
1160-1170	as above
1170-1180	as above
1180-1190	as above
1190-1200	as above.

APPENDIX G

Geophysical Logs

FLOW PROFILE
BROWARD COUNTY ASR-1



APPENDIX H

Pad Monitor Well Water Quality Data

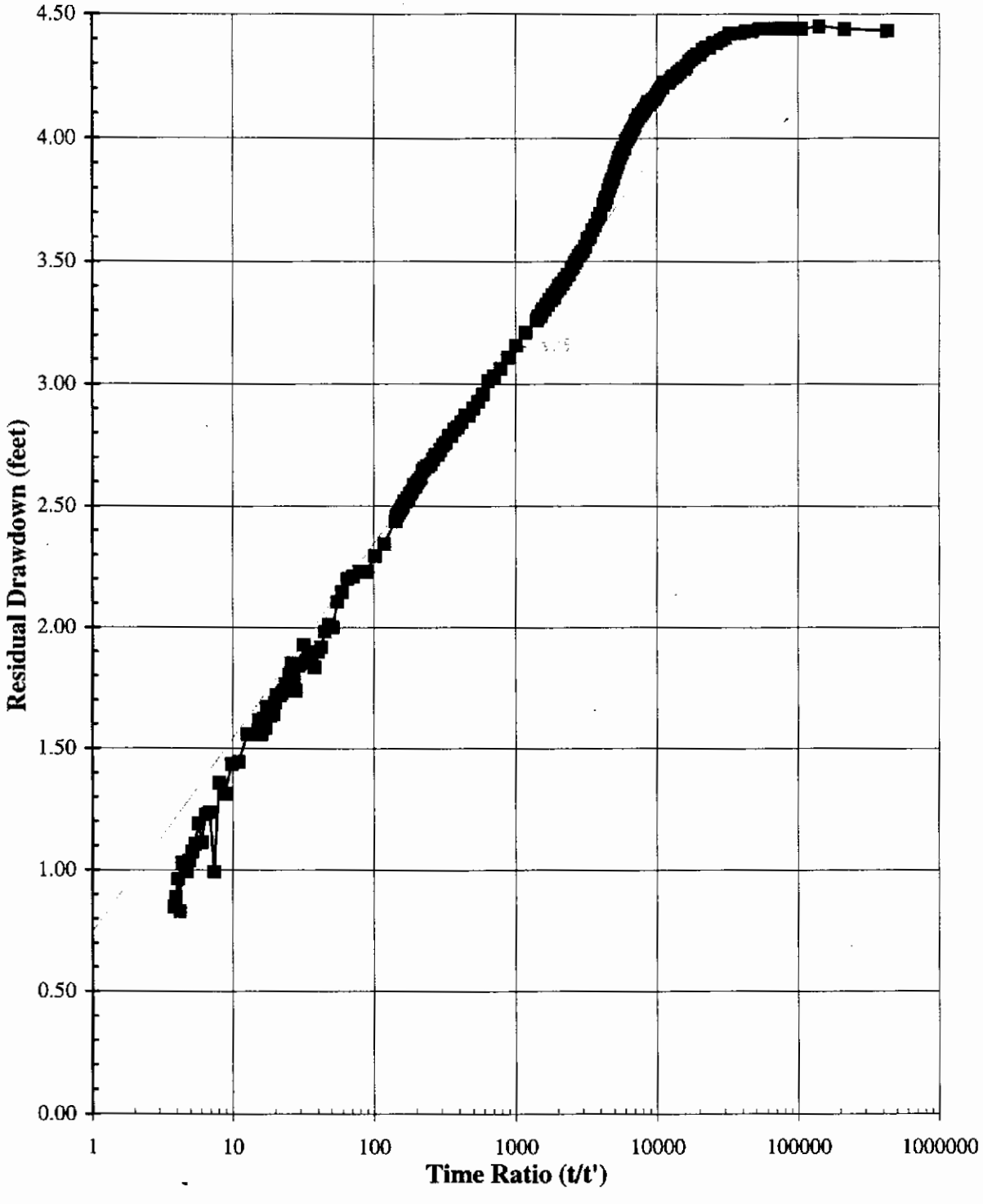
Broward County ASR Demonstration Project
Pad Monitor Well Water Quality Data

		PMW-NE				PMW-NW				PMW-SE				PMW-SW				
Well	Date	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Chloride (mg/l)	Conductivity (umho/cm)	pH	TDS (mg/l)	Comments
MW-1	8/8/96	18	495	7.2	400	10	150	6.56	144	0	259	7.31	190	18	439	7.25	352	Initial Sampling
MW-1	8/22/96	21.5	542	6.93	452	17.5	178	6.65	260	5	307	7.13	264	44.5	467	7.12	364	
MW-1	8/29/96	20	533	7.14	308	6.6	158	6.64	410	5	322	7.16	246	52	445	7.18	378	
MW-1	9/4/96	14	337	8.28	272	8.5	193	6.74	274	5	332	7.48	222	56.5	515	7.37	410	
MW-1	9/11/96	24	496	8.81	362	8	194	6.61	146	8	364	7.17	224	44	494	7.20	348	
MW-1	9/18/96	180	1002	7.92	606	8	184	6.49	262	6	402	7.08	284	29	459	7.25	318	
MW-1	9/24/96	99	538	7.71	596	6	188	6.6	248	9	372	7.27	286	29	481	7.21	322	
MW-1	10/2/96	25.5	534	7.11	382	6	182	6.51	150	16	408	7.19	276	23.5	460	7.28	308	
MW-1	10/8/96	16	151	8.45	140	7	213	6.75	170	7	323	7.42	218	20	452	7.18	268	
MW-1	10/15/96	13	139	8.39	96	7	231	6.8	148	14	385	7.37	214	26	473	7.30	262	Final Sampling
ASR-1	10/2/96	44.5	455	7.33	314	37	871	7.27	366	25	379	7.18	260	39	418	7.29	292	Initial Sampling
ASR-1	10/8/96	6	448	10.65	276	24	500	7.28	278	32	387	7.13	234	30	395	6.91	242	
ASR-1	10/15/96	7	330	10.29	220	15	263	9.61	204	32	386	7.21	240	40	414	7.42	256	
ASR-1	10/22/96	11	235	9.48	166	24	499	7.28	282	38	391	7.24	236	38	392	7.07	244	
ASR-1	10/31/96	25	306	7.56	196	27	534	7.5	256	27	376	7.39	344	33	389	7.12	270	
ASR-1	11/5/96	38	463	7.21	308	35	690	7.2	426	34	401	7.31	254	34	381	7.15	258	
ASR-1	11/13/96	36.2	445	7.26	306	49.5	880	6.98	304	36.5	420	7.21	570	35	354	7.17	264	
ASR-1	11/20/96	36	458	7.70	314	60	967	6.98	628	35	432	7.09	320	39	457	7.08	318	
ASR-1	11/26/96	35	462	7.22	352	75	1051	7.01	682	36.5	448	7.11	320	51	506	7.06	346	
ASR-1	12/4/96	35	450	7.19	342	82	1124	7.01	730	55	433	7.15	298	96	675	7.03	496	
ASR-1	12/11/96	34	459	7.19	334	84	1128	7.08	712	44	333	7.09	216	92.5	667	7.00	432	
ASR-1	12/17/96	28.5	458	7.38	306	93	1179	7.16	770	47	332	7.25	240	93	684	7.03	770	
ASR-1	12/23/96	24	462	7.42	290	114	1248	7.12	818	42	315	7.41	226	116.5	708	7.15	480	
ASR-1	12/31/96	24	447	7.27	278	112	1182	7.42	796	41.5	318	7.56	216	152	850	7.25	536	
ASR-1	1/7/97	19.5	471	7.26	330	270	1722	7.14	1060	39.5	326	7.07	248	125	769	7.25	482	
ASR-1	1/14/97	26	406	7.19	270	405	2130	7.14	1366	50	356	7.34	264	177.5	821	7.23	560	
ASR-1	1/22/97	22	477	7.06	315	370	1990	6.87	1186	44	345	7.07	220	115	722	7.46	438	
ASR-1	1/28/97	21	531	7.28	386	455	2250	7.05	1406	41	350	7.29	262	82	613	7.25	420	
ASR-1	2/4/97	22	552	7.06	340	515	2300	6.9	1372	44	357	7.36	264	75	567	7.18	368	
ASR-1	2/11/97	115	855	7.38	300	525	2440	7.12	1338	45	402	7.50	1028	75	582	7.24	222	
ASR-1	2/18/97	18	421	7.46	336	250	1615	7.15	956	53	507	7.37	370	40	457	7.18	298	
ASR-1	2/25/97	24	543	7.61	352	255	1625	7.64	928	63	559	7.32	406	33	420	7.42	296	
ASR-1	3/4/97	26	497	7.39	328	265	1623	7.04	1046	59	545	7.24	448	28	465	7.17	346	
ASR-1	3/11/97	22	571	7.46	330	265	1650	7.46	936	57.5	552	7.30	346	28	415	7.12	250	
ASR-1	3/18/97	24	557	7.48	366	120	984	7.23	596	49	356	7.46	234	25.5	407	7.24	288	
ASR-1	3/25/97	31	494	7.41	324	130	1124	7.12	706	50	394	7.40	340	24.5	401	7.24	456	
ASR-1	4/15/97	21	451	7.31	302	107.5	965	7.12	618	56	486	7.21	366	27.5	421	7.18	314	
ASR-1	4/22/97	24	527	7.58	234	47.5	911	7.57	294	60	453	7.35	334	32	412	7.77	298	
ASR-1	4/29/97	36.5	428	7.57	260	75	815	7.38	518	58	526	7.48	336	33	415	7.51	284	
ASR-1	5/6/97	31.5	677	7.19	420	83	968	7.15	618	55	541	7.21	348	33.5	430	7.06	272	
ASR-1	5/15/97	30	486	7.29	280	86	965	7.14	572	49	557	7.15	366	33	440	7.15	256	
ASR-1	5/20/97	33	500	7.23	298	72	879	7.09	546	46	509	7.19	440	33	401	7.13	368	
ASR-1	5/29/97	38	525	7.24	338	52	806	7.07	402	38	501	7.14	532	33	375	7.08	294	
ASR-1	6/4/97	32	552	7.25	314	46	794	7.15	656	35	530	7.26	340	29	435	7.20	540	
ASR-1	6/13/97	25	441	7.66	284	49	767	7.29	448	31	538	7.46	392	32	483	7.28	300	
ASR-1	6/19/97	27	521	7.28	302	62	818	7.21	502	28	408	7.42	270	32	382	7.42	304	Final Sampling

APPENDIX I

Pumping Test Data and Analysis

Monitor Well MW-1



Q = 1000 gpm = 192,513 cu ft/day

T = 2.3Q/4 s'π = 3.15 - 2.35 = 0.80

T = 329,450 gpd/ft

FIGURE 1
Theis Recovery Method

Broward County Office of Environmental Services
ASR Demonstration Project

CH2MHILL

File: mwr.xls : graph Date: 5/1/97 Time: 1:41 PM

Walton (1962) Method for Leaky Aquifers
Type-Curve Match, Q = 1,000 gpm, r = 275 Feet

$W(u, r/B) = 1$
$1/u = 1$
$s = 0.53$ ft.
$t = 0.1$ min
$r/B = 0$

$$s = \frac{114.6\,Q}{T} W(u, r/B)$$

$$T = \frac{114.6\,Q}{s}(1) = \frac{(114.6)(1000)}{0.53} = 216,226 \text{ gpd/ft}$$

$$S = \frac{T t u}{2693\, r^2} = \frac{(216,226)(0.1)(1)}{2693\,(275)^2} = 1.06 \times 10^{-4}$$

No leakance observed from Type-Curve Match.

	Transmissivity	Storativity
Average of methods:	275,000 gpd/ft	7.95×10^{-5}

CH2MHILL

SUBJECT BROWARD COUNTY ASR DEMONSTRATION PROJECT — STEP PUMPING TEST ON ASR-1 WELL

BY M. SCHILLING DATE 11-21-96

SHEET NO. 1 OF 3

PROJECT NO. 103715.B0.30

TIME	TOTAL TIME (MIN)	DTW (FT) REF. PAD LEVEL	DRAWDOWN (FT)	PUMPING RATE (GPM)	HEAD PRESSURE (PSI)	COMMENTS
0955	-	+21.0'	STATIC HEAD			TRANSDUCER IS SET AT 71.0 FEET BELOW PAD LEVEL.
1000	0			1050		START STEP TEST
1001	1	+10.0'	11.0'		12	NOTE: VALVE IS 7/8 THS CLOSE
1002	2	+9.5'	11.5		12	IN ORDER TO KEEP FLOWRATE
1003	3	+9.5	11.5		12	AT 1050, THIS HEAD PRESSURE
1004	4	+9.67	11.33		12	IS AFFECTED.
1005	5	+9.75	11.25	1050		NOTE: TURBINE PUMP SET AT
1007	7	+9.83	11.17		12	100 FEET BELOW PAD LEVEL
1009	9	+10.0	11.0			
1011	11	+10.0	11.0	1050	12	
1013	13	+10.0	11.0			
1015	15	+10.0	11.0	1050	12	
1020	20	+9.92	11.08	1050	12	
1025	25	+9.83	11.17	1050	12	
1030	30	+9.75	11.25	1050	12	
1035	35	+9.67	11.33	1050	12	
1040	40	+9.67	11.33	1050	12	
1045	45	+9.58	11.42	1050	12	
1100	60	+9.58	11.42	1050	12	
1115	75	+9.5	11.5	1050	12	
1130	90	+9.5	11.5	1050	12	
1145	105	+9.5	11.5	1050	12	
1200	120	+9.42	11.58	1050	12	CHANGE PUMP RATE TO 1800 GPM
1202	122	-7.68	28.68	1900		
1203	123	-8.18	29.18	1800		
1204	124	-8.18	29.18	1800	9	NOTE: VALVE IS FULLY OPEN
1205	125	-8.68	29.68	1800		THUS HEAD PRESSURE IS
1206	127	-8.68	29.68	1800		UNAFFECTED.
1209	129	-8.88	29.88			
1211	131	-8.88	29.88	1800		

CH2M HILL

SUBJECT BROWARD COUNTY ASR DEMONSTRATION PROJECT
STEP PUMPING TEST ON ASR-1 WELL

BY M. SCHILLING DATE 11-21-96
SHEET NO. 2 OF 3
PROJECT NO. 10371.A0.30

TIME	TOTAL TIME (MIN)	DTW (FT) REF. PAD LEVEL	DRAWDOWN (FT)	PUMPING RATE (GPM)	HEAD PRESSURE (PSI)	COMMENTS
1213	133	-8.93	29.93			
1215	135	-8.08	29.08		9	
1220	140	-8.08	29.08	1825	9	
1225	145	-8.13	29.13	1825	9	
1230	150	-8.28	29.28	1825	9	
1235	155	-8.38	29.38	1825	9	
1240	160	-8.38	29.38	1825	9	
1245	165	-8.38	29.38	1825	9	
1300	180	-8.38	29.38	1825	9	
1315	195	-8.48	29.48	1825	9	
1330	210	-8.58	29.58	1825	9	
1345	225	-8.68	29.68	1850	9	NOTE: PUMP RATE IS INCREASI... WITHOUT ANY EXTERNAL CHAN...
1400	240	-8.78	29.78	1850	9	CHANGE PUMP RATE TO = 3000 ...
1402	242	-38.63	59.63	2950	15.5	
1405	245	-39.18	60.18	2975	12.5	NOTE: DTW IS DIFFICU...
1407	247	-42.28 ~~-39.28~~	63.48		12	TO READ WITH THE WATE...
1408	248	-42.48 ~~-39.48~~	63.48			LEVEL INDICATOR DUE TO
1409	249	-43.08	64.08	2975	12	WETNESS ON PROBE WHI...
1411	251	-43.08	64.08	2975	12	NEXT TO PUMP COLUMN
1413	253	-43.13	64.13	3000+	12	NOTE: ADJUSTED PUMP RATE
1415	255	-42.98	63.98	3000+	12	BACK TO 2950 GPM
1420	260	-42.98	63.98	2950	12	
1425	265	-36.58	57.68	2950	12	
1430	270	-36.58	57.68	2950	12	
1435	275	-36.68	57.68	2950	12	
1440	280	-36.68	57.68	2950	12	
1445	285	-36.68	57.68	2950	12	
1500	300	-36.73	57.73	2975	11	
1515	315	-36.93	57.93	3000	11	
1530	330	-36.93	57.93	3000	11	

FORM 3B

SUBJECT BROWARD COUNTY ASR DEMONSTRATION PROJECT BY M. SCHILLING DATE 11-21-96

STEP PUMPING TEST ON ASR-1 WELL SHEET NO. 3 OF 3

PROJECT NO. 103715.A0.30

TIME	TOTAL TIME (MIN)	DTW (FT) REF PAD LEVEL	DRAWDOWN (FT)	PUMPING RATE (GPM)	HEAD PRESSURE (PSI)	COMMENTS
1545	345	-37.08	58.08	≈ 2000	11	NOTE: FLOWMETER STOPPED WORKIN JUST PRIOR TO TAKING THIS READIN
1600	360	-37.08	58.08	≈ 3000	11	STOP TEST. COLLECT RECOVERY DATA
1605	365	+18.42	2.58	—	—	
1630	390	+20.5	0.50	—	—	STOP COLLECTING RECOVERY DATA

SUBJECT BROWARD COUNTY ASR DEMONSTRATION PROJECT BY M. SCHILLING DATE 11-26/27-96

24-HOUR CONSTANT RATE PUMP TEST ON ASR-1 WELL

SHEET NO. 1 OF 1

PROJECT NO. 10375.A0.30

TIME	DTW	DRAWDOWN	HEAD PRESSURE	PUMPING RATE	COMMENTS
0800	+21.5'				TRANSDUCER SET AT SAME LEVEL AS IN STEP 1 STATIC WATER LEVEL
0805				≈1000	START 24-HR PUMPING TEST
0809	+11.5'	10.0'		~~999~~995	FLOW RATE STABILIZED
0825	+11.8'	9.7'	17	1000	
0905	+11.4'	10.1'	17	995	
1005	+11.0'	10.5'	17	795	
1105	+10.92'	10.58'	17	995	NOTE: TRANSDUCER IN ~~FOR~~ ASR WELL IS
1205	+10.5'	11.0	17	1000	GIVING ERRATIC READINGS.
1305	+10.33'	11.17	17	1000	
1405	+10.16'	11.34	16	1000	
1430	~~+10.0~~	~~11.50~~	~~16~~	~~1000~~	NOTE: CONTRACTOR CHECKED LEVEL OF
1505	+10.0	11.50	16	1000	MILLION GALLON STORAGE TANK. EMPT
1605	+10.0	11.50	16	1000	SPACE BELOW TOP OF TANK = 10', 4"
1610			~~16~~	~~1000~~	NOTE: LEVEL IN STORAGE TANK IS
1705	+10.0	11.50	16	1000	NOW 10' BELOW TOP OF TANK.
1805	+10.16	11.34	16	1000	
1905	+10.16	11.34	16	1000	
2005	+10.16	11.34	16	1000	
2105	+10.0	11.50	16	1000	cut back flow into wet well to
2205	+10.16	11.34	16	1000	let catch up.
2305	+10.0	11.50	16	1000	
0005	+10.0	11.50	16	1000	tank level 6' below top of tank
0105	+10.0	11.50	16	1000	
0205	+9.83	11.67	16	1000	
0305	+9.83	11.67	16	1000	tank level 4' - Had to slow
0405	+9.83	11.67	16	1000	flow down in wet well
0505	+9.91	12.09	16	1000	tank level at 2'.
0605	+9.91	12.09	16	1000	
0705	+9.25	12.25	16	1000	
0805	+9.16	12.34	16	1000	STOP PUMP. START RECOVERY
0810	~~19.75~~ +2.25	1.75	—	—	

FORM 3B

APPENDIX J

Background Water Quality Data

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (954) 421-7400 • Fax (954) 421-2584

LOG NO: D6-72759
Received: 03 DEC 96
Reported: 09 JAN 97

Mr. Pete Kwiatkowski
CH2M Hill
800 Fairway Dr. Suite 350
Deerfield Beach, FL 33441

Project: #103715.A0 (Broward County ASR)
Sampled By: Mark Schilling
Code: 212170225

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
72759-1	ASR-1	12-03-96/1135

PARAMETER	72759-1
Primary Organics - Volatiles (524)	
Vinyl chloride, ug/l	<0.50
Benzene, ug/l	<0.50
Carbon tetrachloride, ug/l	<0.50
1,2-Dichloroethane, ug/l	<0.50
Trichloroethylene, ug/l	<0.50
1,4-Dichlorobenzene, ug/l	<0.50
1,1-Dichloroethene, ug/l	<0.50
1,1,1-Trichloroethane, ug/l	<0.50
cis-1,2-Dichloroethene, ug/l	<0.50
1,2-Dichloropropane, ug/l	<0.50
Ethylbenzene, ug/l	<0.50
Chlorobenzene, ug/l	<0.50
1,2-Dichlorobenzene, ug/l	<0.50
Styrene, ug/l	<0.50
Tetrachloroethene, ug/l	<0.50
Toluene, ug/l	4.4
trans-1,2-Dichloroethene, ug/l	<0.50
Xylenes, ug/l	<0.50
Methylene chloride (Dichloromethane), ug/l	<1.0
1,2,4-Trichlorobenzene, ug/l	<0.50
1,1,2-Trichloroethane, ug/l	<0.50
Date Analyzed	12.17.96
Method Number	EPA 524.2
Dilution factor	1

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Code: 212170225

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
72759-1	ASR-1	12-03-96/1135

PARAMETER	72759-1
Primary Organics - Trihalomethanes (524.2)	
Bromoform, ug/l	<0.50
Chloroform, ug/l	<0.50
Dichlorobromomethane, ug/l	<0.50
Dibromochloromethane, ug/l	<0.50
Total Trihalomethanes, ug/l	<0.50
Date Analyzed	12.17.96
Method Number	EPA 524

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Sampled By: Mark Schilling
Code: 212170225

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
72759-1	ASR-1	12-03-96/1135

PARAMETER	72759-1
Group II Unregulated Purgeables	
Bromobenzene, ug/l	<0.50
Bromodichloromethane, ug/l	<0.50
Bromoform, ug/l	<0.50
Bromomethane, ug/l	<0.50
Chloroethane, ug/l	<0.50
Chloroform, ug/l	<0.50
Chloromethane, ug/l	<0.50
Dibromochloromethane, ug/l	<0.50
Dichlorodifluoromethane, ug/l	<0.50
P-Chlorotoluene, ug/l	<0.50
Dibromomethane, ug/l	<0.50
1,1-Dichloroethane, ug/l	<0.50
cis-1,3-Dichloropropene, ug/l	<0.50
trans-1,3-Dichloropropene, ug/l	<0.50
1,3-Dichloropropylene, ug/l	<0.50
1,3-Dichloropropane, ug/l	<0.50
2,2 Dichloropropane, ug/l	<0.50
Trichlorofluoromethane, ug/l	<0.50
1,2,3-Trichloropropane, ug/l	<0.50
1,3-Dichlorobenzene, ug/l	<0.50
1,1,1,2-Tetrachloroethane, ug/l	<0.50
1,1,2,2-Tetrachloroethane, ug/l	<0.50
Methyl-tert-butyl ether (MTBE), ug/l	<0.50
1,1-Dichloropropene, ug/l	<0.50
O-Chlorotoluene, ug/l	<0.50
Date Analyzed	12.17.96
Method Number	EPA 524.2
Dilution factor	1

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
72759-1	ASR-1	12-03-96/1135

PARAMETER	72759-1
Microextractables (504)	
1,2-Dibromoethane (EDB) , ug/l	<0.020
1,2-Dibromo-3-chloropropane, ug/l	<0.020
Date Extracted	12.17.96
Date Analyzed	12.17.96
Method Number	EPA 504
Primary Organics - Pesticides (507)	
Alachlor, ug/l	<1.0
Atrazine, ug/l	<1.0
Simazine, ug/l	<1.0
Date Extracted	12.05.96
Date Analyzed	12.17.96
Method Number	EPA 507
Group I Unregulated Pesticides (507)	
Butachlor, ug/l	<1.0
Metolachlor, ug/l	<1.0
Metribuzin, ug/l	<1.0
Date Extracted	12.05.96
Date Analyzed	12.17.96
Method Number	EPA 507

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
72759-1	ASR-1	12-03-96/1135

PARAMETER	72759-1
Primary Organics - Pesticides (508)	
alpha-Chlordane, ug/l	<0.20*F65
Gamma Chlordane, ug/l	<0.20*F65
Endrin, ug/l	<0.40*F65
Heptachlor, ug/l	<0.20*F65
Heptachlor epoxide, ug/l	<0.40*F65
Lindane (g-BHC), ug/l	<0.20*F65
Methoxychlor, ug/l	<0.50
Toxaphene, ug/l	<1.0
Aroclor-1016, ug/l	<10*F65
Aroclor-1221, ug/l	<10*F65
Aroclor-1232, ug/l	<10*F65
Aroclor-1242, ug/l	<10*F65
Aroclor-1248, ug/l	<10*F65
Aroclor-1254, ug/l	<10*F65
Aroclor-1260, ug/l	<0.50
Date Extracted	12.04.96
Date Analyzed	12.10.96
Method Number	EPA 508
Group I Unregulated Pesticides (508)	
Aldrin, ug/l	<0.20*F65
Dieldrin, ug/l	<0.40*F65
Date Extracted	12.04.96
Date Analyzed	12.10.96
Method Number	EPA 508

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Sampled By: Mark Schilling
Code: 212170225

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
72759-1	ASR-1	12-03-96/1135

PARAMETER	72759-1
Primary Organics - Herbicides (515.1)	
2,4-D, ug/l	<0.50
Dalapon, ug/l	<10
Dinoseb, ug/l	<0.50
Pentachlorophenol, ug/l	<1.0
Picloram, ug/l	<0.50
2,4,5-TP Silvex, ug/l	<0.50
Date Extracted	12.09.96
Date Analyzed	12.11.96
Method Number	EPA 515.1
Group I Unregulated Herbicides (515.1)	
Dicamba, ug/l	<0.50
Date Extracted	12.09.96
Date Analyzed	12.11.96
Method Number	EPA 515.1
Primary Organics - BN (525.2)	
Benzo(a)pyrene, ug/l	<0.20
Bis(2-ethyl hexyl)adipate, ug/l	<2.0
bis(2-Ethylhexyl) phthalate, ug/l	<2.0
Hexachlorobenzene, ug/l	<1.0
Hexachlorocyclopentadiene, ug/l	<1.0
Date Extracted	12.05.96
Date Analyzed	12.11.96
Method Number	EPA 525.2

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
72759-1	ASR-1	12-03-96/1135

PARAMETER	72759-1
Group III Unregulated Acid Extractables	
2-Chlorophenol, ug/l	<10
2-Methyl-4,6-dinitrophenol, ug/l	<50
Phenol, ug/l	<10
2,4,6-Trichlorophenol, ug/l	<10
Date Extracted	12.04.96
Date Analyzed	12.09.96
Method Number	EPA 625
Group III Unregulated BN Extractables	
Butylbenzylphthalate, ug/l	<10
Di-n-butylphthalate, ug/l	<10
Diethylphthalate, ug/l	<10
Dimethylphthalate, ug/l	<10
2,4-Dinitrotoluene, ug/l	<10
Di-n-octylphthalate, ug/l	<10
Isophorone, ug/l	<10
Date Extracted	12.04.96
Date Analyzed	12.09.96
Method Number	EPA 625
Primary Organics - Carbamates (531.1)	
Carbofuran, ug/l	<1.0
Oxamyl, ug/l	<1.0
Date Analyzed	12.11.96
Method Number	EPA 531.1

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Code: 212170225

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
72759-1	ASR-1	12-03-96/1135

PARAMETER	72759-1
Group I Unregulated Carbamates (531.1)	
Aldicarb, ug/l	<0.50
Aldicarb Sulfone, ug/l	<0.50
Aldicarb Sulfoxide, ug/l	<0.50
Carbaryl, ug/l	<1.0
3-Hydroxycarbofuran, ug/l	<1.0
Methomyl, ug/l	<1.0
Date Analyzed	12.11.96
Method Number	EPA 531.1
Primary Organics - Glyphosate (547)	
Glyphosate, ug/l	<150
Date Analyzed	12.11.96
Method Number	EPA 547
Primary Organics - Endothall (548.1)	
Endothall, ug/l	<10
Date Extracted	12.06.96
Date Analyzed	12.09.96
Method Number	EPA 548.1
Primary Organics - Diquat (549.1)	
Diquat, ug/l	<1.0
Date Analyzed	12.10.96
Method Number	EPA 549.1

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

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Deerfield Beach, FL 33441

Project: #103715.A0 (Broward County ASR)
Sampled By: Mark Schilling
Code: 212170225

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
72759-1	ASR-1	12-03-96/1135

PARAMETER	72759-1
Primary ICP Metals (200.7)	
Barium, mg/l	<0.010
Beryllium, mg/l	<0.00040
Cadmium, mg/l	<0.0050
Chromium, mg/l	<0.010
Nickel, mg/l	<0.040
Sodium (200.7), mg/l	970
Date Analyzed	12.26.96
Method Number	EPA 200.7
Antimony (200.7)	
Antimony, mg/l	<0.0060
Date Analyzed	12.26.96
Method Number	EPA 200.7
Arsenic (206.2)	
Arsenic, mg/l	<0.010
Date Analyzed	12.06.96
Method Number	EPA 206.2
Lead (239.2)	
Lead, mg/l	<0.0050
Date Analyzed	12.06.96
Method Number	EPA 239.2
Mercury (245.1)	
Mercury, mg/l	<0.00020
Date Analyzed	12.04.96
Method Number	EPA 245.1

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
72759-1	ASR-1	12-03-96/1135

PARAMETER	72759-1
Selenium (270.2)	
Selenium, mg/l	<0.0020
Date Analyzed	12.09.96
Method Number	EPA 279.2
Thallium (279.2)	
Thallium, mg/l	<0.0020
Date Analyzed	12.09.96
Method Number	EPA 279.2
Coliform, Total (SM 9222B)	
Coliform (MF), Total, col/100ml	<1
Date Analyzed	12.04.96
Method Number	SM 9222B
Cyanide, Total	
Cyanide, Total , mg/l	<0.010
Date Analyzed	12.06.96
Method Number	EPA 335.2
Fluoride (340.2)	
Fluoride, mg/l	1.1
Date Analyzed	12.03.96
Method Number	EPA 340.2
Nitrogen, Nitrate	
Nitrate-N, mg/l	<0.050
Date Analyzed	12.04.96
Method Number	EPA 353.3
Nitrogen, Nitrite	
Nitrite-N, mg/l	<0.050
Date Analyzed	12.04.96
Method Number	EPA 353.3

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LOG NO: D6-72759
Received: 03 DEC 96
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Project: #103715.AO (Broward County ASR)
Sampled By: Mark Schilling
Code: 212170225

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
72759-1	ASR-1	12-03-96/1135

PARAMETER	72759-1
Nitrogen, Nitrate + Nitrite	
Nitrate + Nitrite-N, mg/l	<0.050
Date Analyzed	12.04.96
Method Number	EPA 353.3
Turbidity	
Turbidity, NTU	16
Date Analyzed	12.04.96
Method Number	EPA 180.1
Secondary Metals (200.7)	
Aluminum, mg/l	<0.20
Copper, mg/l	<0.025
Iron, mg/l	0.082
Manganese, mg/l	<0.010
Silver, mg/l	<0.010
Zinc, mg/l	0.050
Date Analyzed	12.26.96
Method Number	EPA 200.7
Chloride	
Chloride, mg/l	1900
Date Analyzed	12.09.96
Method Number	EPA 325.3
Color	
Color, c.u.	5.0
Date Analyzed	12.03.96
Method Number	EPA 110.2

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REPORT OF RESULTS

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72759-1	ASR-1	12-03-96/1135

PARAMETER	72759-1
Odor	
Odor, t.o.n.	16
Date Analyzed	12.12.96
Method Number	EPA 140.1
pH	
pH , units	7.5
Date Analyzed	12.05.96
Method Number	EPA 150.1
Solids, Total Dissolved (160.1)	
Solids, Total Dissolved, mg/l	3200
Date Analyzed	12.06.96
Method Number	EPA 160.2
Sulfate as SO4	
Sulfate as SO4, mg/l	380
Date Analyzed	12.10.96
Method Number	EPA 375.4
Surfactants (MBAS)	
Surfactants (MBAS), mg/l	<0.10
Date Analyzed	12.05.96
Method Number	SM 5540C
Biochemical Oxygen Demand (5-Day) (405.1)	
Biochemical Oxygen Demand (5 Day), mg/l	<2.0
Date Analyzed	12.05.96
Method Number	EPA 405.1
Nitrogen, Ammonia	
Nitrogen, Ammonia, mg/l	0.98
Date Analyzed	12.11.96
Method Number	EPA 350.3

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72759-1	ASR-1	12-03-96/1135

PARAMETER	72759-1
Kjeldahl Nitrogen as N, Total (EPA 351.2)	
Kjeldahl Nitrogen-N, mg/l	0.93
Date Analyzed	12.10.96
Method Number	EPA 351.2
Phosphorus, Total (365.4)	
Phosphorus, Total (365.4), mg/l	<0.10
Date Analyzed	12.09.96
Method Number	EPA 365.4
Asbestos in Water (TEM), mg/l	*F71
2,3,7,8-TCDD (1613), ug/l	*F71

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
72759-2	Lab Blank
72759-3	Accuracy - % Recovery (Mean)
72759-4	Precision - Relative % Difference
72759-5	Detection Limit

PARAMETER	72759-2	72759-3	72759-4	72759-5
Primary Organics - Volatiles (524)				
Vinyl chloride, ug/l	<0.50	114 %	5.8 %	0.50
Benzene, ug/l	<0.50	100 %	1.4 %	0.50
Carbon tetrachloride, ug/l	<0.50	104 %	8.7 %	0.50
1,2-Dichloroethane, ug/l	<0.50	98 %	1.8 %	0.50
Trichloroethylene, ug/l	<0.50	102 %	6.4 %	0.50
1,4-Dichlorobenzene, ug/l	<0.50	90 %	0.10 %	0.50
1,1-Dichloroethene, ug/l	<0.50	112 %	4.3 %	0.50
1,1,1-Trichloroethane, ug/l	<0.50	100 %	2.6 %	0.50
cis-1,2-Dichloroethene, ug/l	<0.50	97 %	2.8 %	0.50
1,2-Dichloropropane, ug/l	<0.50	93 %	3.9 %	0.50
Ethylbenzene, ug/l	<0.50	100 %	2.7 %	0.50
Chlorobenzene, ug/l	<0.50	96 %	4.0 %	0.50
1,2-Dichlorobenzene, ug/l	<0.50	94 %	2.6 %	0.50
Styrene, ug/l	<0.50	98 %	6.0 %	0.50
Tetrachloroethene, ug/l	<0.50	105 %	0.30 %	0.50
Toluene, ug/l	<0.50	98 %	2.4 %	0.50
trans-1,2-Dichloroethene, ug/l	<0.50	96 %	3.8 %	0.50
Xylenes, ug/l	<0.50	96 %	4.2 %	0.50
Methylene chloride (Dichloromethane), ug/l	<1.0	102 %	0.30 %	1.0
1,2,4-Trichlorobenzene, ug/l	<0.50	110 %	4.0 %	0.50
1,1,2-Trichloroethane, ug/l	<0.50	102 %	3.0 %	0.50
Date Analyzed	12.17.96	---	---	---
Method Number	EPA 524.2	---	---	---

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
72759-2	Lab Blank
72759-3	Accuracy - % Recovery (Mean)
72759-4	Precision - Relative % Difference
72759-5	Detection Limit

PARAMETER	72759-2	72759-3	72759-4	72759-5
Primary Organics - Trihalomethanes (524.2)				
Bromoform, ug/l	<0.50	---	---	0.50
Chloroform, ug/l	<0.50	---	---	---
Dichlorobromomethane, ug/l	<0.50	---	---	---
Dibromochloromethane, ug/l	<0.50	---	---	---
Total Trihalomethanes, ug/l	<0.50	---	---	---
Date Analyzed	12.17.96	---	---	---
Method Number	EPA 524	---	---	---

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72759-3	Accuracy - % Recovery (Mean)
72759-4	Precision - Relative % Difference
72759-5	Detection Limit

PARAMETER	72759-2	72759-3	72759-4	72759-5
Group II Unregulated Purgeables				
Bromobenzene, ug/l	<0.50	102 %	1.4 %	0.50
Bromodichloromethane, ug/l	<0.50	106 %	6.8 %	0.50
Bromoform, ug/l	<0.50	107 %	2.0 %	0.50
Bromomethane, ug/l	<0.50	106 %	3.6 %	0.50
Chloroethane, ug/l	<0.50	116 %	7.5 %	0.50
Chloroform, ug/l	<0.50	97 %	2.0 %	0.50
Chloromethane, ug/l	<0.50	96 %	8.8 %	0.50
Dibromochloromethane, ug/l	<0.50	101 %	5.9 %	0.50
Dichlorodifluoromethane, ug/l	<0.50	78 %	6.2 %	0.50
P-Chlorotoluene, ug/l	<0.50	94 %	1.7 %	0.50
Dibromomethane, ug/l	<0.50	98 %	3.7 %	0.50
1,1-Dichloroethane, ug/l	<0.50	100 %	2.8 %	0.50
cis-1,3-Dichloropropene, ug/l	<0.50	114 %	3.6 %	0.50
trans-1,3-Dichloropropene, ug/l	<0.50	115 %	5.2 %	0.50
1,3-Dichloropropylene, ug/l	<0.50	---	---	0.50
1,3-Dichloropropane, ug/l	<0.50	102 %	1.9 %	0.50
2,2 Dichloropropane, ug/l	<0.50	102 %	6.7 %	0.50
Trichlorofluoromethane, ug/l	<0.50	129 %	0.4 %	0.50
1,2,3-Trichloropropane, ug/l	<0.50	93 %	8.4 %	0.50
1,3-Dichlorobenzene, ug/l	<0.50	93 %	2.1 %	0.50
1,1,1,2-Tetrachloroethane, ug/l	<0.50	100 %	1.0 %	0.50
1,1,2,2-Tetrachloroethane, ug/l	<0.50	94 %	3.4 %	0.50
Methyl-tert-butyl ether (MTBE), ug/l	<0.50	98 %	1.8 %	0.50
1,1-Dichloropropene, ug/l	<0.50	102 %	3.4 %	0.50
O-Chlorotoluene, ug/l	<0.50	---	3.8 %	0.50
Date Analyzed	12.17.96	---	---	---
Method Number	EPA 524.2		---	---

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Code: 212170225

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
72759-2	Lab Blank
72759-3	Accuracy - % Recovery (Mean)
72759-4	Precision - Relative % Difference
72759-5	Detection Limit

PARAMETER	72759-2	72759-3	72759-4	72759-5
Microextractables (504)				
1,2-Dibromoethane (EDB) , ug/l	<0.020	96 %	3.1 %	0.020
1,2-Dibromo-3-chloropropane, ug/l	<0.020	84 %	8.3 %	0.020
Date Extracted	12.17.96	---	---	---
Date Analyzed	12.17.96	---	---	---
Method Number	EPA 504	---	---	---
Primary Organics - Pesticides (507)				
Alachlor, ug/l	<1.0	91 %	6.4 %	1.0
Atrazine, ug/l	<1.0	88 %	1.0 %	1.0
Simazine, ug/l	<1.0	95 %	15 %	1.0
Date Extracted	12.05.96	---	---	---
Date Analyzed	12.17.96	---	---	---
Method Number	EPA 507	---	---	---
Group I Unregulated Pesticides (507)				
Butachlor, ug/l	<1.0	82 %	12 %	1.0
Metolachlor, ug/l	<1.0	85 %	6.7 %	1.0
Metribuzin, ug/l	<1.0	94 %	3.3 %	1.0
Date Extracted	12.05.96	---	---	---
Date Analyzed	12.17.96	---	---	---
Method Number	EPA 507	---	---	---

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72759-4	Precision - Relative % Difference
72759-5	Detection Limit

PARAMETER	72759-2	72759-3	72759-4	72759-5
Primary Organics - Pesticides (508)				
alpha-Chlordane, ug/l	<0.010	---	---	0.010
Gamma Chlordane, ug/l	<0.010	---	---	0.010
Endrin, ug/l	<0.020	97 %	0 %	0.020
Heptachlor, ug/l	<0.010	73 %	8.2 %	0.010
Heptachlor epoxide, ug/l	<0.020	---	---	0.020
Lindane (g-BHC), ug/l	<0.010	83 %	4.8 %	0.010
Methoxychlor, ug/l	<0.50	---	---	0.50
Toxaphene, ug/l	<1.0	---	---	1.0
Aroclor-1016, ug/l	<0.50	---	---	0.50
Aroclor-1221, ug/l	<0.50	---	---	0.50
Aroclor-1232, ug/l	<0.50	---	---	0.50
Aroclor-1242, ug/l	<0.50	---	---	0.50
Aroclor-1248, ug/l	<0.50	---	---	0.50
Aroclor-1254, ug/l	<0.50	---	---	0.50
Aroclor-1260, ug/l	<0.50	---	---	0.50
Date Extracted	12.04.96	---	---	---
Date Analyzed	12.10.96	---	---	---
Method Number	EPA 508	---	---	---
Group I Unregulated Pesticides (508)				
Aldrin, ug/l	<0.010	75 %*F82	8.0 %	0.010
Dieldrin, ug/l	<0.020	95 %*F82	0 %	0.020
Date Extracted	12.04.96	---	---	---
Date Analyzed	12.10.96	---	---	---
Method Number	EPA 508	---	---	---

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72759-3	Accuracy - % Recovery (Mean)
72759-4	Precision - Relative % Difference
72759-5	Detection Limit

PARAMETER	72759-2	72759-3	72759-4	72759-5
Primary Organics - Herbicides (515.1)				
2,4-D, ug/l	<0.50	83 %	21 %	0.50
Dalapon, ug/l	<10	107 %	11 %	10
Dinoseb, ug/l	<0.50	53 %	20 %	0.50
Pentachlorophenol, ug/l	<1.0	93 %	25 %	1.0
Picloram, ug/l	<0.50	104 %	7.1 %	0.50
2,4,5-TP Silvex, ug/l	<0.50	106 %	11 %	0.50
Date Extracted	12.09.96	---	---	---
Date Analyzed	12.11.96	---	---	---
Method Number	EPA 515.1	---	---	---
Group I Unregulated Herbicides (515.1)				
Dicamba, ug/l	<0.50	94 %	14 %	0.50
Date Extracted	12.09.96	---	---	---
Date Analyzed	12.19.96	---	---	---
Method Number	EPA 515.1	---	---	---
Primary Organics - BN (525.2)				
Benzo(a)pyrene, ug/l	<0.20	85 %	4.7 %	0.20
Bis(2-ethyl hexyl)adipate, ug/l	<2.0	94 %	1.1 %	2.0
bis(2-Ethylhexyl) phthalate, ug/l	<2.0	95 %	4.2 %	2.0
Hexachlorobenzene, ug/l	<1.0	85 %	2.4 %	1.0
Hexachlorocyclopentadiene, ug/l	<1.0	74 %	4.0 %	1.0
Date Extracted	12.05.96	---	---	---
Date Analyzed	12.11.96	---	---	---
Method Number	EPA 525.2	---	---	---

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72759-2	Lab Blank
72759-3	Accuracy - % Recovery (Mean)
72759-4	Precision - Relative % Difference
72759-5	Detection Limit

PARAMETER	72759-2	72759-3	72759-4	72759-5
Group III Unregulated Acid Extractables				
2-Chlorophenol, ug/l	<10	67 %	0 %	10
2-Methyl-4,6-dinitrophenol, ug/l	<50	---	---	50
Phenol, ug/l	<10	66 %	7.5 %	10
2,4,6-Trichlorophenol, ug/l	<10	---	---	10
Date Extracted	12.04.96	---	---	---
Date Analyzed	12.09.96	---	---	---
Method Number	EPA 625	---	---	---
Group III Unregulated BN Extractables				
Butylbenzylphthalate, ug/l	<10	---	---	10
Di-n-butylphthalate, ug/l	<10	---	---	10
Diethylphthalate, ug/l	<10	---	---	10
Dimethylphthalate, ug/l	<10	---	---	10
2,4-Dinitrotoluene, ug/l	<10	76 %	17 %	10
Di-n-octylphthalate, ug/l	<10	---	---	10
Isophorone, ug/l	<10	---	---	10
Date Extracted	12.04.96	---	---	---
Date Analyzed	12.09.96	---	---	---
Method Number	EPA 625	---	---	---
Primary Organics - Carbamates (531.1)				
Carbofuran, ug/l	<1.0	92 %	0 %	1.0
Oxamyl, ug/l	<1.0	96 %	2.1 %	1.0
Date Analyzed	12.11.96	---	---	---
Method Number	EPA 531.1	---	---	---

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REPORT OF RESULTS

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72759-3	Accuracy - % Recovery (Mean)
72759-4	Precision - Relative % Difference
72759-5	Detection Limit

PARAMETER	72759-2	72759-3	72759-4	72759-5
Group I Unregulated Carbamates (531.1)				
Aldicarb, ug/l	<0.50	96 %	2.1 %	0.50
Aldicarb Sulfone, ug/l	<0.50	---	---	0.50
Aldicarb Sulfoxide, ug/l	<0.50	---	---	0.50
Carbaryl, ug/l	<1.0	---	---	1.0
3-Hydroxycarbofuran, ug/l	<1.0	---	---	1.0
Methomyl, ug/l	<1.0	---	---	1.0
Date Analyzed	12.11.96	---	---	---
Method Number	EPA 531.1	---	---	---
Primary Organics - Glyphosate (547)				
Glyphosate, ug/l	<150	108 %	10 %	150
Date Analyzed	12.11.96	---	---	---
Method Number	EPA 547	---	---	---
Primary Organics - Endothall (548.1)				
Endothall, ug/l	<10	72 %	4.1 %	10
Date Extracted	12.06.96	---	---	---
Date Analyzed	12.09.96	---	---	---
Method Number	EPA 548.1	---	---	---
Primary Organics - Diquat (549.1)				
Diquat, ug/l	<1.0	46 %	20 %	1.0
Date Analyzed	12.10.96	---	---	---
Method Number	EPA 549.1	---	---	---

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REPORT OF RESULTS

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72759-2	Lab Blank
72759-3	Accuracy - % Recovery (Mean)
72759-4	Precision - Relative % Difference
72759-5	Detection Limit

PARAMETER		72759-2	72759-3	72759-4	72759-5
Primary ICP Metals (200.7)					
Barium, mg/l		<0.010	96 %	3.1 %	0.010
Beryllium, mg/l		<0.0040	98 %	3.1 %	0.0040
Cadmium, mg/l		<0.0050	92 %	1.1 %	0.0050
Chromium, mg/l		<0.010	96 %	3.1 %	0.010
Nickel, mg/l		<0.040	90 %	3.3 %	0.040
Sodium (200.7), mg/l		<0.50	108 %	16 %	0.50
Date Analyzed		12.26.96	---	---	---
Method Number		EPA 200.7	---	---	---
Antimony (200.7)					
Antimony, mg/l		<0.0060	94 %	3.2 %	0.0060
Date Analyzed		12.26.96	---	---	---
Method Number		EPA 200.7	---	---	---
Arsenic (206.2)					
Arsenic, mg/l		<0.010	80 %	2.5 %	0.010
Date Analyzed		12.06.96	---	---	---
Method Number		EPA 206.2	---	---	---
Lead (239.2)					
Lead, mg/l		<0.0050	103 %	5.8 %	0.0050
Date Analyzed		12.06.96	---	---	---
Method Number		EPA 239.2	---	---	---
Mercury (245.1)					
Mercury, mg/l		<0.00020	96 %	1.0 %	0.00020
Date Analyzed		12.04.96	---	---	---
Method Number		EPA 245.1	---	---	---

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (954) 421-7400 • Fax (954) 421-2584

LOG NO: D6-72759
Received: 03 DEC 96
Reported: 09 JAN 97

Mr. Pete Kwiatkowski
CH2M Hill
800 Fairway Dr. Suite 350
Deerfield Beach, FL 33441

Project: #103715.A0 (Broward County ASR)
Sampled By: Mark Schilling
Code: 212170225

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
72759-2	Lab Blank
72759-3	Accuracy - % Recovery (Mean)
72759-4	Precision - Relative % Difference
72759-5	Detection Limit

PARAMETER	72759-2	72759-3	72759-4	72759-5
Selenium (270.2)				
Selenium, mg/l	<0.0050	106 %*F75	2.8 %	0.0050
Date Analyzed	12.05.96	---	---	---
Method Number	EPA 270.2	---	---	---
Thallium (279.2)				
Thallium, mg/l	<0.0020	80 %	1.2 %	0.0020
Date Analyzed	12.09.96	---	---	---
Method Number	EPA 279.2	---	---	---
Cyanide, Total				
Cyanide, Total , mg/l	<0.010	96 %	17 %	0.010
Date Analyzed	12.06.96	---	---	---
Method Number	EPA 335.2	---	---	---
Fluoride (340.2)				
Fluoride, mg/l	<0.20	100 %	5.0 %	0.20
Date Analyzed	12.03.96	---	---	---
Method Number	EPA 340.2	---	---	---
Nitrogen, Nitrate				
Nitrate-N, mg/l	<0.050	110 %	28 %	0.050
Date Analyzed	12.04.96	---	---	---
Method Number	EPA 353.3	---	---	---
Nitrogen, Nitrite				
Nitrite-N, mg/l	<0.050	95 %	4.2 %	0.050
Date Analyzed	12.04.96	---	---	---
Method Number	EPA 353.3	---	---	---

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LOG NO: D6-72759
Received: 03 DEC 96
Reported: 09 JAN 97

Mr. Pete Kwiatkowski
CH2M Hill
800 Fairway Dr. Suite 350
Deerfield Beach, FL 33441

Project: #103715.AO (Broward County ASR)
Sampled By: Mark Schilling
Code: 224370226

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
72759-2	Lab Blank
72759-3	Accuracy - % Recovery (Mean)
72759-4	Precision - Relative % Difference
72759-5	Detection Limit

PARAMETER	72759-2	72759-3	72759-4	72759-5
Nitrogen, Nitrate + Nitrite				
Nitrate + Nitrite-N, mg/l	<0.050	110 %	28 %	0.050
Date Analyzed	12.04.96	---	---	---
Method Number	EPA 353.3	---	---	---
Secondary Metals (200.7)				
Aluminum, mg/l	<0.20	100 %*F75	3.0 %	0.20
Copper, mg/l	<0.025	94 %	3.2 %	0.025
Iron, mg/l	<0.050	100 %	6.0 %	0.050
Manganese, mg/l	<0.010	90 %	3.3 %	0.010
Silver, mg/l	<0.010	93 %	4.3 %	0.010
Zinc, mg/l	<0.020	88 %	3.4 %	0.020
Date Analyzed	12.26.96	---	---	---
Method Number	EPA 200.7	---	---	---
Chloride				
Chloride, mg/l	<1.0	102 %	3.0 %	1.0
Date Analyzed	12.09.96	---	---	---
Method Number	EPA 325.3	---	---	---
Sulfate as SO4				
Sulfate as SO4, mg/l	<5.0	104 %	1.9 %	5.0
Date Analyzed	12.10.96	---	---	---
Method Number	EPA 375.4	---	---	---
Surfactants (MBAS)				
Surfactants (MBAS), mg/l	<0.10	99 %	24 %	0.10
Date Analyzed	12.05.96	---	---	---
Method Number	SM 5540C	---	---	---

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& ENVIRONMENTAL SERVICES, INC.

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LOG NO: D6-72759
Received: 03 DEC 96
Reported: 09 JAN 97

Mr. Pete Kwiatkowski
CH2M Hill
800 Fairway Dr. Suite 350
Deerfield Beach, FL 33441

Project: #103715.AO (Broward County ASR)
Sampled By: Mark Schilling
Code: 224370226

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
72759-2	Lab Blank
72759-3	Accuracy - % Recovery (Mean)
72759-4	Precision - Relative % Difference
72759-5	Detection Limit

PARAMETER	72759-2	72759-3	72759-4	72759-5
Biochemical Oxygen Demand (5-Day) (405.1)				
Biochemical Oxygen Demand (5 Day), mg/l	<2.0	100 %	10 %	2.0
Date Analyzed	12.05.96	---	---	---
Method Number	EPA 405.1	---	---	---
Nitrogen, Ammonia				
Nitrogen, Ammonia, mg/l	<0.050	95 %	2.1 %	0.050
Date Analyzed	12.11.96	---	---	---
Method Number	EPA 350.3	---	---	---
Kjeldahl Nitrogen as N, Total (EPA 351.2)				
Kjeldahl Nitrogen-N, mg/l	<0.20	108 %	1.9 %	0.20
Date Analyzed	12.10.96	---	---	---
Method Number	EPA 351.2	---	---	---
Phosphorus, Total (365.4)				
Phosphorus, Total (365.4), mg/l	<0.10	84 %	14 %	0.10
Date Analyzed	12.09.96	---	---	---
Method Number	EPA 365.4	---	---	---

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: D6-72759
Received: 03 DEC 96
Reported: 09 JAN 97

Mr. Pete Kwiatkowski
CH2M Hill
800 Fairway Dr. Suite 350
Deerfield Beach, FL 33441

Project: #103715.AO (Broward County ASR)
Sampled By: Mark Schilling
Code: 224370226

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
72759-2	Lab Blank
72759-3	Accuracy - % Recovery (Mean)
72759-4	Precision - Relative % Difference
72759-5	Detection Limit

PARAMETER	72759-2	72759-3	72759-4	72759-5

SL Environmental HRS Cert. #E86221 and SL Drinking Water HRS Cert. #86371.
Method References: EPA 40 CFR Part 136, EPA 600/4-88-039, EPA 600/4-79-020 and Standard Methods for the Examination of Water and Wastewater.
*F65 = Elevated detection limits were reported due to sample matrix interference which required sample or extract dilution.

*F71 = Subcontracted results are attached to this report.

*F75 = Matrix spike recoveries were outside advisory limits possibly due to matrix interference present in the sample; therefore, recovery of the laboratory control standard analyzed concurrently with the sample batch has been reported.

*F82 = Insufficient sample volume was available to perform a batch-specific matrix spike. However, an LCS analyzed with the sample batch met control criteria.

Marianne J. Walker, Project Manager

Final Page Of Report

MICRO ANALYTICAL LABORATORIES, INC.
3618 NW 97th Blvd.
Gainesville, FL 32606
(904)332-1701

TEM ASBESTOS ANALYSIS REPORT FOR WATER

MAL LOG#:	**15575-1**		
Client:	Savannah Lab	Vol. Analyzed:	0.025 liter
Client Ref:	D672783	Filter Diameter:	25 mm PC
Sample ID:	ASR-1	Filter Area:	2.30E+08 sq. microns
Sample Received:	12/10/96	Grids Examined:	2
Sample Filtered:	12/10/96	Average Opening Area:	10000 sq.microns
Sample Analyzed:	12/24/96	# of Grid Openings:	8
Type Analysis:	Water	Total Area Examined:	80000 sq. microns
Magnification:	12000X		
Microscopist:	N.D.		
Reviewed by:			

	Number of Structures >= 10 microns	Concentration (MFL) >=10 microns
Chrysotile Morphology (CM):	0	0.00
Chrysotile Diffraction (CD):	0	0.00
Chrysotile Quantified EDS (CQ):	0	0.00
Chrysotile Quant. EDS & Diff. (CDQ:	0	0.00
Amphibole Diffraction (AD):	0	0.00
Amphibole Diff.& Qual. EDS (ADX):	0	0.00
Amphibole Diff.&Quant. EDS (ADQ):	0	0.00
Amphibole ZA Diff.&Quant.EDS (AZQ)	0	0.00

* Detection Limit:	0.1	(MFL) Millions of Fibers/Liter
Asbestos Best Estimate (Fibers >10 microns):	0.00	**(MFL) Millions of Fibers/Liter**
Confidence Limits: +/-	1.65	(MFL) Millions of Fibers/Liter

*The Detection Limit is calculated on the probility of analyzing one asbestos fiber or structure in the total area examined. 0.0 Display = Below Detection Limit

Preparation and Analysis: Micro Analytical Laboratories, Inc. SOP-007; SOP-009.
Taken from: EPA-600/4-83-043

 Nancy Dehgan, Laboratory Manager

NIST Certification: #1151
State of Florida Certification: # 82436

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (954) 421-7400 • Fax (954) 421-2584

LOG NO: D6-72759A
Received: 03 DEC 96
Reported: 14 DEC 96

Mr. Pete Kwiatkowski
CH2M Hill
800 Fairway Dr. Suite 350
Deerfield Beach, FL 33441

Project: #103715.A0 (Broward County ASR)
Sampled By: Mark Schilling
Code: 124970122

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
72759A-1	ASR-1	12-03-96/1135

PARAMETER	72759A-1
Gross Alpha (EPA 900.0)	
Gross Alpha, pCi/l	25+/-38
Date Analyzed	12.10.96
Method Number	EPA 900.0
Radium 226 (EPA 903.1)	
Radium 226, pCi/L	3.6+/-0.11
Date Analyzed	12.12.96
Method Number	EPA 903.1
Radium 228 (EPA 904.0)	
Radium 228, pCi/l	<2.0
Date Analyzed	12.12.96
Method Number	EPA 904.0

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

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Mr. Pete Kwiatkowski
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Deerfield Beach, FL 33441

Project: #103715.AO (Broward County ASR)
Sampled By: Mark Schilling
Code: 124970122

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
72759A-2	Lab Blank
72759A-3	Accuracy - % Recovery (Mean)
72759A-4	Precision - Relative % Difference
72759A-5	Detection Limit

PARAMETER	72759A-2	72759A-3	72759A-4	72759A-5
Gross Alpha (EPA 900.0)				
Gross Alpha, pCi/l	<3.0	100 %	24 %	3.0
Date Analyzed	12.09.96	---	---	---
Method Number	EPA 900.0	---	---	---
Radium 226 (EPA 903.1)				
Radium 226, pCi/L	<0.60	94 %	30 %	0.60
Date Analyzed	12.04.96	---	---	---
Method Number	EPA 903.1	---	---	---
Radium 228 (EPA 904.0)				
Radium 228, pCi/l	<2.0	113 %	19 %	2.0
Date Analyzed	12.10.96	---	---	---
Method Number	EPA 904.0	---	---	---

Marianne J. Walker Project Manager

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TRIANGLE LABS

CASE NARRATIVE

Analysis of Samples for the Presence of

2,3,7,8-Tetrachlorinated Dibenzo-*p*-Dioxin by

High-Resolution Chromatography / High-Resolution Mass Spectrometry

Method 1613A (10/90)

Date: January 7, 1997

Client ID: Savannah Laboratories, Inc.

P.O. Number:

TLI Project Number: 39939

Rev. 06/02/95

Triangle Laboratories, Inc.
801 Capitola Drive
Durham, NC 27713-4411
919-544-5729
P.O. Box 13485
Research Triangle Park, NC 27709-3485
Fax # 919-544-5491

Overview

One water sample was received from Savannah Laboratories, Inc. in good condition December 10, 1996 at 6.0 ° C and stored in a refrigerator at 4°C. The chain-of-custody did not indicate if the sample was preserved prior to shipment. The sample and associated QC samples were extracted using a distillation procedure and analyzed according to procedures described in EPA Method 1613A (October 1990) and in the Triangle Laboratories Data User's Manual (Rev. 1/93-VDE-3-AH-2/93). Any particular difficulties encountered during the sample handling by Triangle Laboratories will be discussed in the QC Remarks section below. Results reported relate only to the items tested.

Quality Control Samples

A laboratory method blank and an ongoing precision and recovery (OPR) sample are included with each batch of samples. A batch of samples may include samples from one or more TLI projects.

Quality Control Remarks

This analytical data has been released after being subjected to a series of inspections. General deviations from acceptable QC requirements are identified below. Comments on the effect of these deviations upon the validity and reliability of the results can be obtained from TLI's Data User's Manual. Specific QC issues associated with this particular project are:

Sample receipt: Additional sample volume was received in good condition on December 11, 1996 at 6.0 ° C and was stored in a refrigerator at 4°C.

Sample Preparation Laboratory: None

Mass Spectrometry: None

Data Review: None

General Comments: Any analytes detected in the TLI Blank are at levels equal to or less than the Target Detection Limit. This level of contamination is acceptable as per Method 1613A.

The detection limits in some samples may be above the Target Detection Limit due to Method 1613A reporting format which requires that GC peaks which do not meet QC criteria for ion-abundance ratio be reported in the detection limit.

By our interpretation, the analytical data in this project are valid based on the guidelines of Method 1613A and the Triangle Laboratories' Method 1613 Data User's Manual. Any specific QC concerns or problems have been discussed in the QC Remarks section of this case narrative with emphasis on their effect on the data. Should Savannah Laboratories, Inc. have any questions or comments regarding this data package, please feel free to contact our Project Scientist, Mary McDonald, at 919/544-5729 ext. 269.

For Triangle Laboratories, Inc.,

Report Preparation

Glenn S. Smith
Report Preparation Chemist

Quality Control

Deborah E. Hage
Report Preparation Chemist

The total number of pages in this data package is: 52.

TRIANGLE LABORATORIES, INC.

LIST OF CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

American Association for Laboratory Accreditation. Expires July 31, 1997. Certificate Number 0226-01. Accreditation for technical competence in Environmental Testing.(Including Waste Water, Sol/Haz Waste, Pulp/Paper, and Air Matrices) Parameters are AOX/TOX, Volatiles, Pesticides, PCB's, BNA's, and Dioxin/Furan. Method 1613 for Drinking Water.

State of Alabama, Department of Environmental Management. Expires December 31, 1997. Laboratory I.D. # 40950. Dioxin in drinking water.

State of Alaska, Department of Environmental Conservation. Expires December 21, 1997. Certificate number OS-00397. Dioxin in drinking water.

State of Arizona, Department of Health Services. Expires May 26, 1997. Certificate #AZ0423. Drinking Water for Dioxin, Dioxin in WW and S/H Waste.

State of Arkansas, Department of Pollution Control and Ecology. Expires February 14, 1997. Primary No. 94-06497. Pulp/paper, soil, water, and Hazardous Waste for Dioxin/Furan; AOX/TOX.

State of California, Department of Health Services. Expires August 31, 1997. Certificate #1922. Selected Metals in Waste Water; Volatiles, Semi-volatiles, and Dioxin/furan in WW and Sol/Haz Waste. Dioxin in drinking water.

State of Connecticut, Department of Health Services. Expires September 30, 1997. Registration # PH-0117. Dioxin in drinking water.

Delaware Health and Social Services. Expires December 31, 1996. Certificate #NC 140. Dioxin in drinking water.

Florida Department of Health and Rehabilitative Services. Expires June 30, 1997.Dioxin in DW. Drinking Water ID HRS# 87424. Metals, Extractable Organics (GC/MS), Pesticides/PCB's (GC) and Volatiles (GC/MS) in Environmental Samples. Environmental water ID HRS# E87411.

Hawaii Department of Health. Expires March 1, 1997. Dioxin in drinking water. "Accepted" status for regulatory purposes .

Triangle Laboratories, Inc.
801 Capitola Drive
Durham, NC 27713-4411
919-544-5729
P.O. Box 13485
Research Triangle Park, NC 27709-3485
Fax # 919-544-5491

Idaho Department of Health and Welfare. Expires November 30, 1997. Dioxin in drinking water.

State of Kansas, Department of Health and Environment. Expires January 31, 1997. Environmental Analyses/Non potable Water and Solid and Hazardous Waste. Method 1613 for drinking water. ID #'s - Drinking water and/or poilution control - E-215. Solid or Hazardous Waste - E-1209.

Commonwealth of Kentucky, Department for Environmental Protection. Expires December 31, 1996. ID#90060. Dioxin in drinking water.

Maryland Department of Health and Mental Hygiene. Expires September 30, 1997. Certification #235. Drinking water by Method 1613A.

State of Michigan, Department of Public Health. Expires March 31, 1997. Drinking water by Method 1613.

Montana Department of Health and Environmental Services. Expires December 31, 1996. Dioxin in drinking water.

State of New Jersey, Department of Environmental Protection and Energy. Extended by state. Temporary certificate until June 30, 1997 or sooner. ID #67851. BNAs and Volatiles. Dioxin in drinking water.

State of New Mexico, Environment Department. Expires July 31, 1997. Dioxin in drinking water.

New York State Department of Health. Expires March 31, 1997. ID #11026. Environmental Analyses of non-potable Water, Solid and Hazardous Waste. Method 1613 in DW.

State of North Carolina, Department of Environment Health and Natural Resources Expires December 31, 1996. Certificate # 37751. Dioxin in drinking water.

State of North Carolina, Department of Environment, Health, and Natural Resources, Division of Environmental Management. Expires December 31, 1997. Certificate # 485. Metals, pesticides & PCBs, semi-volatiles and volatiles; TCLP.

North Dakota State Department of Health and Consolidated Laboratories. Expires December 31, 1996. Certificate # R-076. Effective October 4, 1993. Dioxin in drinking water.

Oklahoma Department of Environmental Quality. Expires May 31, 1997. Laboratory #9612. Dioxin by 1613A, 8290 and 8280.

Revised December 4,, 1996 apw

Printed December 4, 1996

State of South Carolina, Department of Health and Environmental Control. Expires April 1, 1997. Certificate number #99040001 (drinking water). Expires August 31, 1997. Certificate number #99040002 (other parameters). Dioxin/Furans, BNA, Volatiles, and PCBs/pesticides under Clean Water Act, 2,3,7,8-TCDD for Drinking Water, and Organic extractables for Solid and Hazardous Waste.

State of Tennessee. Department of Environment and Conservation. Expires February 5, 1999. ID #02992. Method 1613 Drinking water only.

U.S. Department of Agriculture Soil Permit. Expires September 30, 2001. Permit No. S-3790 Revised. Under the authority of the Federal Plant Pest Act, permission is granted to receive foreign soil samples for use in laboratory analysis.

U.S. Army Corps of Engineers. Expires November 30, 1997. Validated to perform methods 8280 & 8290 for Lockbourne Landfill Site Investigation, Defense Distribution Depot Projects, and assorted projects for the USACE North Pacific Division Laboratory.

U.S. EPA Region V. Expires November 14, 1999. Dioxin in drinking water.

U.S. EPA Region VIII, for the State of Wyoming. Expires November 13, 1997. Dioxin in drinking water.

State of Utah, Department of Health. Expires December 31, 1997. Certificate Number E-166. Certification for the following parameters: Semi-Volatiles and Volatiles under RCRA; Volatiles under Clean Water Act; Dioxin/furans by Method 8280; Drinking water for Dioxin by Method 1613; Metals including Mercury and Microwave Digestion.

Commonwealth of Virginia, Department of General Services, Division of Consolidated Laboratory Services. Expires June 30, 1997. ID # 00341. Dioxin in drinking water.

State of Washington, Department of Ecology. Expires September 11, 1997. Lab Accreditation Number C067. Scope of Accreditation applies to water analyses for Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans, BNA Extr (Semivolatile) Organics and Purgeable (Volatile) Organics.

State of Washington, Department of Health. Expires April 30, 1997. Dioxin in drinking water.

State of West Virginia, Department of Health. Expires December 31, 1996. Certificate No. 9923(C). Dioxin in drinking water.

State of Wisconsin, Department of Natural Resources. Expires June 30, 1997. Laboratory ID Number 999869530. Certification for the following categories of Organics: Purgeable, Base/Neutral, Acid, PCBs, and Dioxin.

Expires November 14, 1999. Laboratory ID 999869530. Dioxin in drinking water.

PHARMACEUTICAL

Drug Enforcement Agency (DEA). Expires November 30, 1997. Registration number RT01195835. Controlled substance registration for schedules 1,2,3,3N,4,5.

N.C. Department of Human Resources. Expires October 31, 1997. Registration number NC-PT 0000 0031. North Carolina controlled substances registration. Application submitted for renewal.

Food & Drug Administration (FDA) Registration. Expires July 1997. ID #'s 001500 1053481. Annual registration of drug establishment. Annual registration of drug establishment.

OTHER

Clinical Laboratory Improvement Amendments (CLIA) Registration. Expires May 30, 1997. ID # 34D0705123. Department of Health & Human Services, Health Care Financing Administration.

U.S. EPA Large Quantity Hazardous Waste Generator. No expiration date. EPA ID #NCD982156879. Permit indicates that the laboratory is a large generator of hazardous waste.

North Carolina Radioactive Materials License. Expires April 30 1998. License No. 032-0954-1. License authorizes the licensee to receive, acquire, own, possess, transfer, import and use such radioactive materials as designated.

North Carolina General License for Radiation Protection. No. expiration date. License No. 032-875-OG. The general license applies only to radioactive material contained in devices which have been manufactured and labeled in accordance with specific requirements.

Savannah Laboratories, Inc.

TLI Project: **39939**
Client Sample: **ASR-1**

1613A TCDD Analysis (DB-5)
Analysis File: **P970067**

Client Project:	D672759				
Sample Matrix:	AQUEOUS	Date Received:	12/10/96	Spike File:	SP161F2S
TLI ID:	149-78-1	Date Extracted:	12/16/96	ICal:	PF51276
		Date Analyzed:	01/07/97	ConCal:	P970064
Sample Size:	1.000 L	Dilution Factor:	n/a	% Moisture:	100.0
Dry Weight:	n/a	Blank File:	P970066	% Lipid:	n/a
GC Column:	DB-5	Analyst:	DL	% Solids:	0.0

Analytes	Conc. (pg/L)	DL		Ratio	RT	Flags
2,3,7,8-TCDD	ND	2.8				—

Internal Standard	Conc. (pg/L)	% Recovery	QC Limits	Ratio	RT	Flags
$^{13}C_{12}$-2,3,7,8-TCDD	1680	83.8	25%-150%	0.81	33:20	—

Surrogate Standard (Type C)	Conc. (pg/L)	% Recovery	QC Limits	Ratio	RT	Flags
$^{37}Cl_4$-2,3,7,8-TCDD	166	83.1	25%-150%		33:21	—

Recovery Standard	Ratio	RT	Flags
$^{13}C_{12}$-1,2,3,4-TCDD	0.81	33:07	—

Data Reviewer: _____ 01/07/97

Triangle Laboratories, Inc.®
801 Capitola Drive • Durham, North Carolina 27713
Phone: (919) 544-5729 • Fax: (919) 544-5491

Printed: 15:39 01/07/97

Initial ....Date...

Data Review By: _____ ___/___/___ Calculated Noise Area: 0.54

Listing of P970067B.dbf
01/07/97
Matched GC Peaks / Ratio / Ret. Time

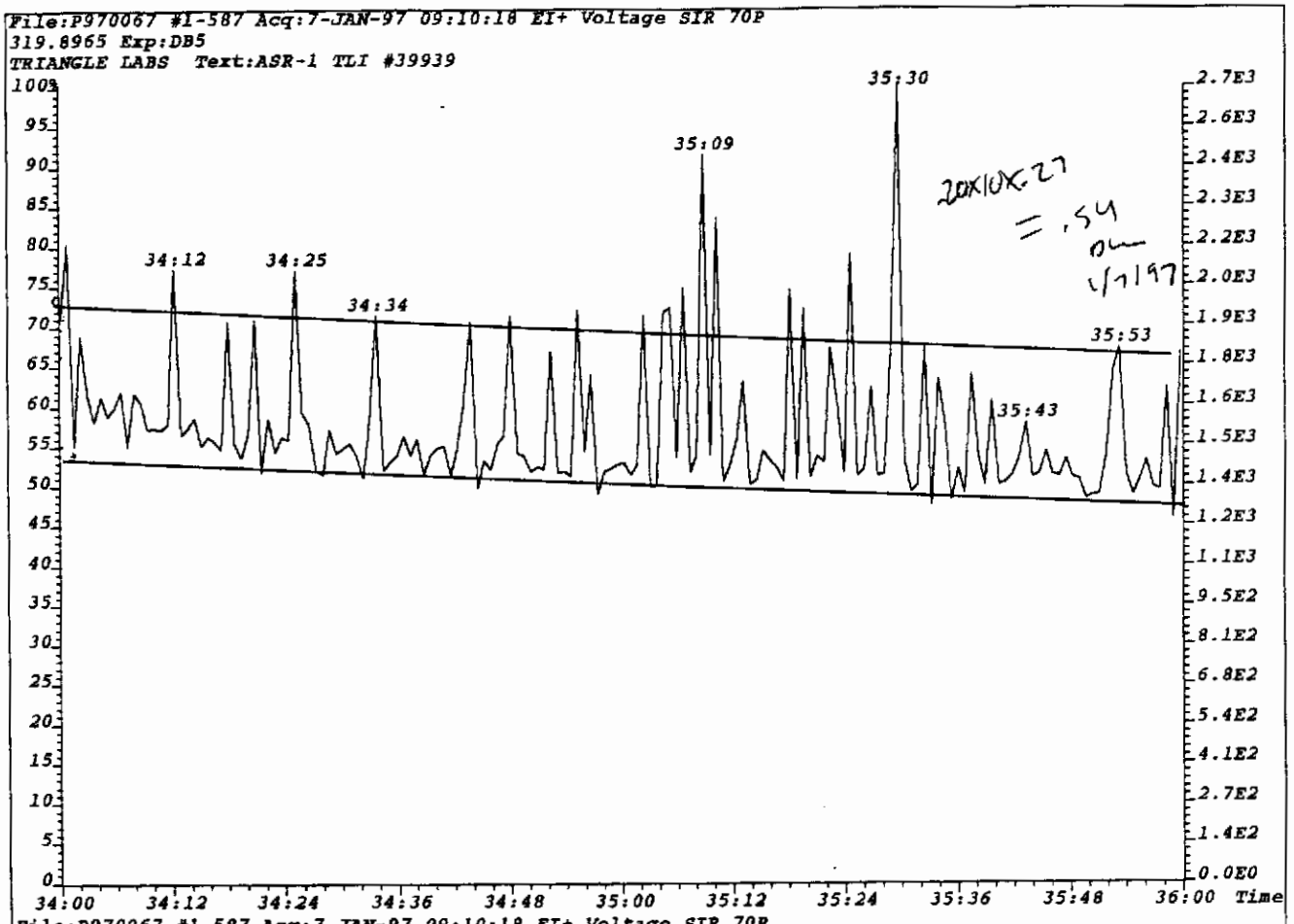
Compound/ M_z....	QC.Log	Omit	Why	..RT.	OK	Ratio	Total.Area...	Area.Peak.1..	Area.Peak.2..	Rel.RT	Compound.Name..	ID..	Flags.
TCDD				0.65-0.89						0.915-1.038			
320-322	DC	NL		0:00	RO	1.13		0.32		0.000			
	DC	WL		29:19		0.86		0.26		0.880			
	DC	WL		29:39	RO	3.50		0.27		0.890			
	DC	WL		29:51	RO	0.24		0.21		0.896			
	DC	WL		30:12	RO	2.25		0.13		0.906			
	DC	WL		30:16	RO	0.14		0.16		0.908			
	DC	WL		30:20		0.89		0.17		0.910			
	DC	WL		30:25	RO	1.18		0.37		0.913			
	DC	SN		30:40	RO	1.27		0.25		0.920			
	DC	SN		31:08		0.79		0.25		0.934			
	DC	SN		31:10	RO	0.44		0.13		0.935			
	DC	SN		31:20	RO	1.80		0.14		0.940			
	DC	SN		31:25	RO	1.33		0.21		0.943			
	DC	SN		31:38		0.80		0.09		0.949			
	DC	SN		31:43	RO	0.43		0.10		0.952			
	DC	SN		32:18	RO	0.60		0.08		0.969			
	DC	SN		32:32	RO	2.63		0.58		0.976			
	DC	SN		32:54	RO	1.13		0.17		0.987			
	DC	SN		33:09		0.74		0.33		0.995			
	DC	SN		33:15	RO	3.60		0.23		0.998			
	DC	SN		33:21	RO	0.55		0.17		1.001	2378-TCDD		AN
	DC	SN		33:35	RO	0.50		0.12		1.008			
	DC	SN		34:07	RO	1.00		0.10		1.024			
	DC	SN		34:12	RO	3.00		0.32		1.026			
	DC	SN		34:25		0.79		0.25		1.033			
	DC	SN		34:34	RO	1.67		0.08		1.037			
	DC	WH		34:48	RO	0.27		0.19		1.044			
	DC	WH		35:32	RO	0.44		0.13		1.066			
	DC	WH		35:37	RO	1.38		0.19		1.069			
	DC	WH		35:43	RO	2.00		0.15		1.072			
320-322			0	Peaks				0.00					
37Cl-TCDD										0.940-1.060			
328	DC	NL		0:00				0.18		0.000			
	DC	WL		29:18				0.16		0.879			
	DC	WL		29:56				0.12		0.898			
	DC	WL		30:04				0.04		0.902			
	DC	WL		30:08				0.05		0.904			
	DC	WL		30:14				0.41		0.907			
	DC	WL		30:19				0.30		0.910			
	DC	WL		30:26				0.02		0.913			
	DC	WL		30:26				0.03		0.913			
	DC	WL		30:30				0.20		0.915			
	DC	WL		30:33				0.06		0.917			
	DC	WL		30:53				0.06		0.927			
	DC	WL		31:07				0.08		0.934			

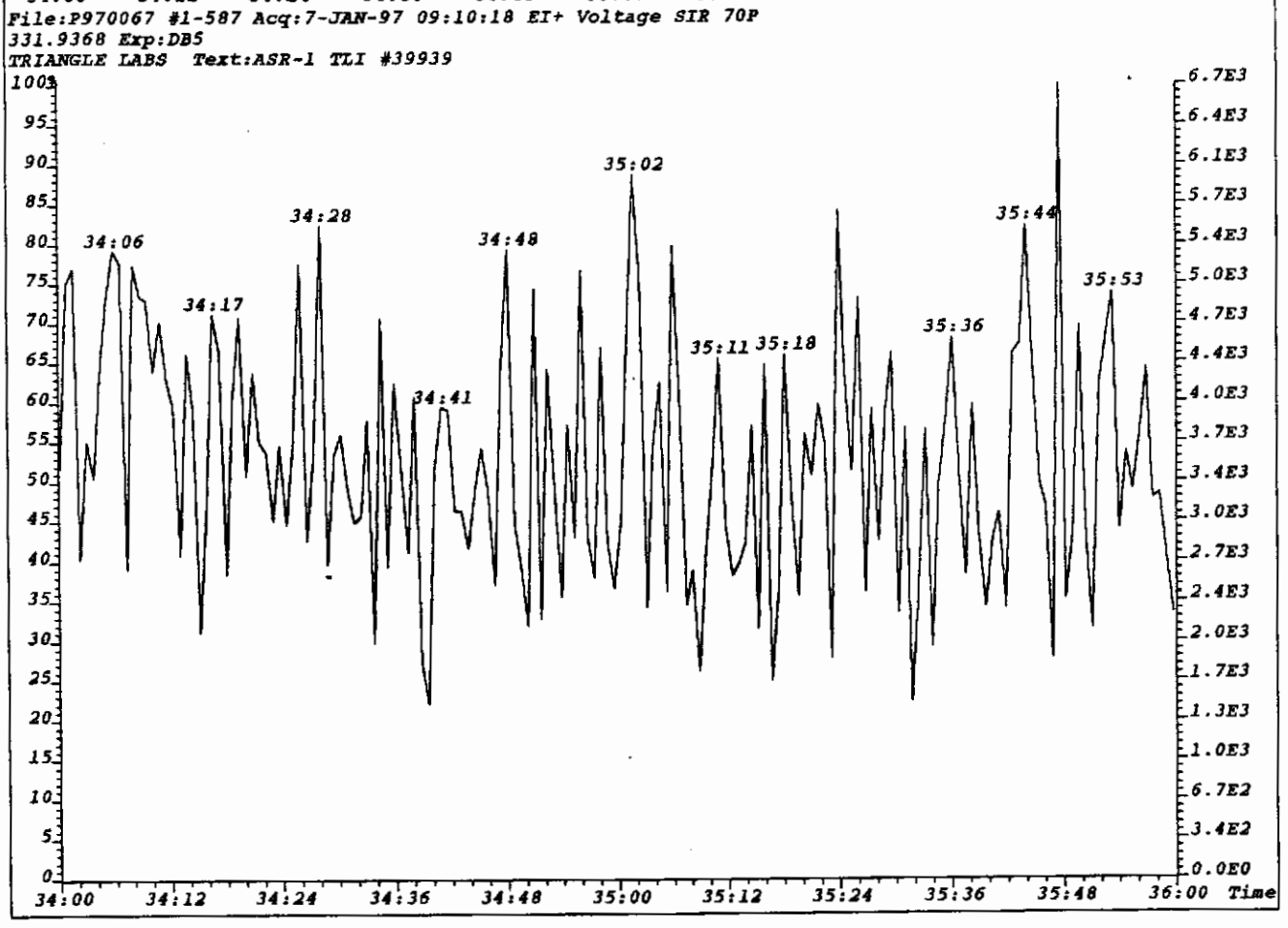
Compound/ Z....	QC.Log	Omit	Why	..RT.	OK	Ratio	Total.Area...	Area.Peak.1..	Area.Peak.2..	Rel.RT	Compound.Name..	ID..	Flags.
	DC		WL	31:07			0.08			0.934			
	DC		WL	31:14			0.09			0.937			
	DC		SN	31:23			0.13			0.942			
	DC		SN	31:28			0.07			0.944			
	DC		SN	31:35			0.10			0.948			
	DC		SN	31:39			0.03			0.950			
	DC		SN	31:39			0.02			0.950			
	DC		SN	31:45			0.19			0.953			
	DC		SN	31:48			0.14			0.954			
	DC		SN	31:52			0.24			0.956			
	DC		SN	31:59			0.04			0.960			
	DC		SN	32:02			0.07			0.961			
	DC		SN	32:10			0.12			0.965			
	DC		SN	32:10			0.04			0.965			
	DC		SN	32:15			0.08			0.968			
	DC		SN	32:23			0.33			0.972			
	DC		SN	32:24			0.07			0.972			
	DC		SN	32:31			0.14			0.976			
	DC		SN	32:43			0.05			0.982			
	DC		SN	32:46			0.14			0.983			
	DC		SN	32:54			0.08			0.987			
	DC		SN	33:07			0.08			0.994			
	DC		SN	33:11			0.08			0.996			
				33:21			73.86		73.86	1.001	37Cl-TCDD	SUR1	
	DC		SN	33:34			0.49			1.007			
	DC		SN	33:40			0.13			1.010			
	DC		SN	33:44			0.35			1.012			
	DC		SN	33:49			0.21			1.015			
	DC		SN	33:54			0.29			1.017			
	DC		SN	34:04			0.16			1.022			
	DC		SN	34:05			0.09			1.023			
	DC		SN	34:12			0.23			1.026			
	DC		SN	34:16			0.04			1.028			
	DC		SN	34:34			0.08			1.037			
	DC		SN	34:38			0.26			1.039			
	DC		SN	34:47			0.36			1.044			
	DC		SN	34:51			0.09			1.046			
	DC		SN	34:55			0.23			1.048			
	DC		SN	35:00			0.06			1.050			
	DC		SN	35:10			0.06			1.055			
	DC		WH	35:24			0.12			1.062			
	DC		WH	35:30			0.10			1.065			
	DC		WH	35:32			0.07			1.066			
	DC		WH	35:35			0.05			1.068			
	DC		WH	35:36			0.05			1.068			
	DC		WH	35:44			0.24			1.072			
	DC		WH	35:51			0.10			1.076			
	DC		WH	35:59			0.04			1.080			
328			1	Peak			73.86						
13C12-TCDD					0.65-0.89					0.940-1.060			
332-334	DC		NL	0:00	RO	2.21	2.34			0.000			

Compound/ M_Z....	QC.Log	Omit	Why	..RT.	OK	Ratio	Total.Area...	Area.Peak.1..	Area.Peak.2..	Rel.RT	Compound.Name..	ID..	Flags.
				32:04	RO	0.60	2.66	1.00	1.66	0.962			
				33:07		0.81	803.84	359.51	444.33	0.994	13C12-1234-TCDD	RS1	
				33:20		0.81	739.28	331.14	408.14	1.000	13C12-2378-TCDD	IS1	
				33:33	RO	0.44	5.56	1.71	3.85	1.007			
				33:44	RO	1.05	13.93	7.12	6.81	1.012			
				33:47	RO	1.35	1.76	1.01	0.75	1.014			
	DC	SN		33:58		0.81	1.32			1.019			
332-334			6 Peaks				1,567.03						

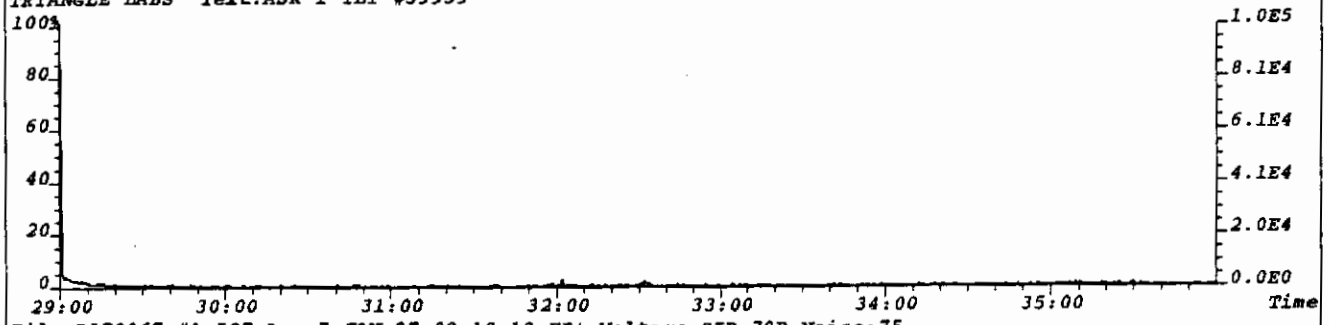
Column Description.....	"Why" Code Description.....	QC Log Desc.....
M_Z -Nominal Ion Mass(es)	WL-Below Retention Time Window	A-Peak Added
..RT. -Retention Time (mm:ss)	WH-Above Retention Time Window	K-Peak Kept
Rat.1 -Ratio of M/M+2 Ions	SN-Below Signal to Noise Level	D-Peak Deleted
OK -RO=Ratio Outside Limits	<M-Below Method Detection Limit	T-Time Changed
Rel.RT-Relative Retention Time	NL-Channel Specific Noise Level	M-Peak Area Changed
		N-Name Changed
		E-Ether Interference

*** End of Report ***

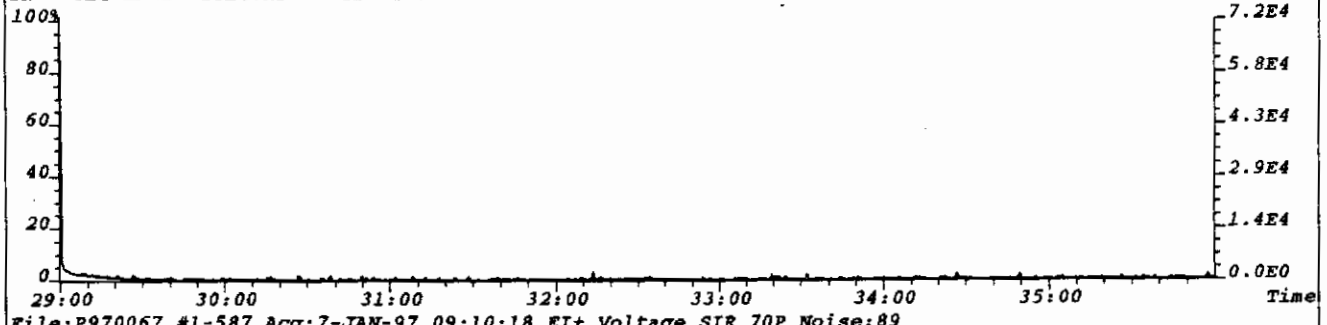

File:P970067 #1-587 Acq:7-JAN-97 09:10:18 EI+ Voltage SIR 70P
319.8965 Exp:DB5
TRIANGLE LABS Text:ASR-1 TLI #39939
34:12
34:25
34:34
35:09
35:30
35:43
35:53
20x10x.27
= .54
ohm
1/7/97
Time


File:P970067 #1-587 Acq:7-JAN-97 09:10:18 EI+ Voltage SIR 70P
331.9368 Exp:DB5
TRIANGLE LABS Text:ASR-1 TLI #39939
34:06
34:17
34:28
34:41
34:48
35:02
35:11
35:18
35:36
35:44
35:53
Time

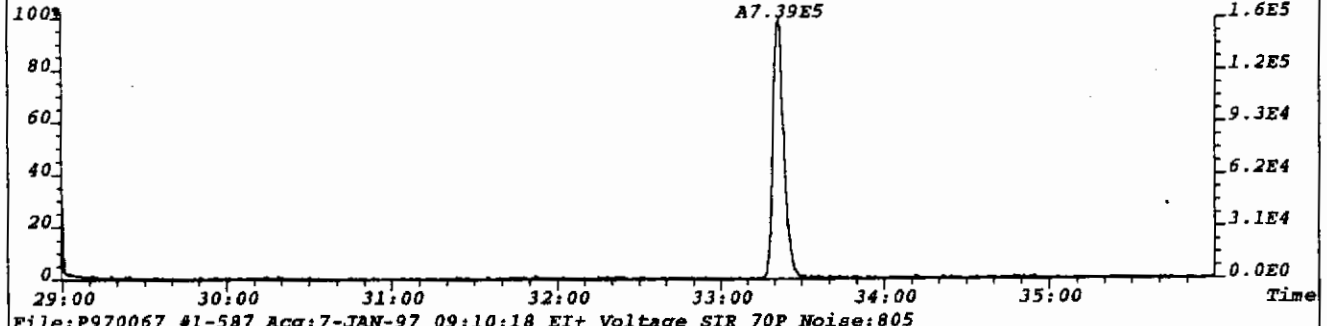
File:P970067 #1-587 Acq:7-JAN-97 09:10:18 EI+ Voltage SIR 70P Noise:87
319.8965 BSUB(256,30,-3.0) PKD(5,3,1,0.10%,348.0,0.00%,F,F) Exp:DB5
TRIANGLE LABS Text:ASR-1 TLI #39939



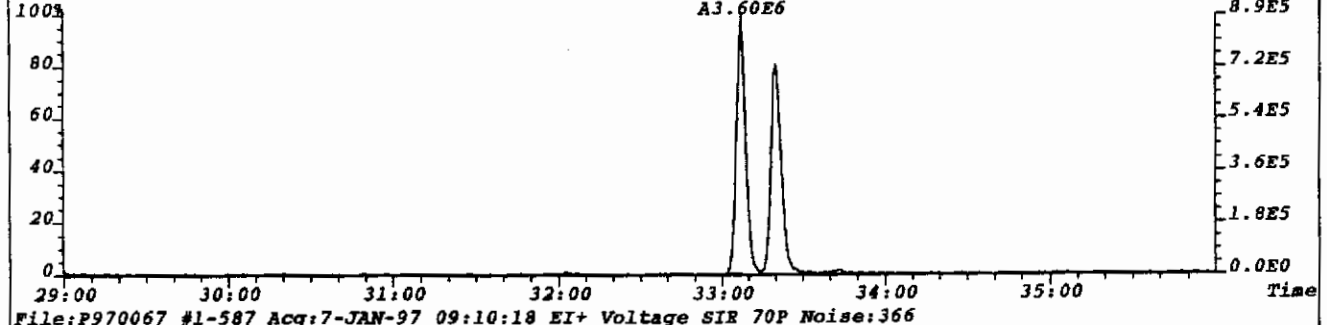
File:P970067 #1-587 Acq:7-JAN-97 09:10:18 EI+ Voltage SIR 70P Noise:75
321.8936 BSUB(256,30,-3.0) PKD(5,3,1,0.10%,300.0,0.00%,F,F) Exp:DB5
TRIANGLE LABS Text:ASR-1 TLI #39939



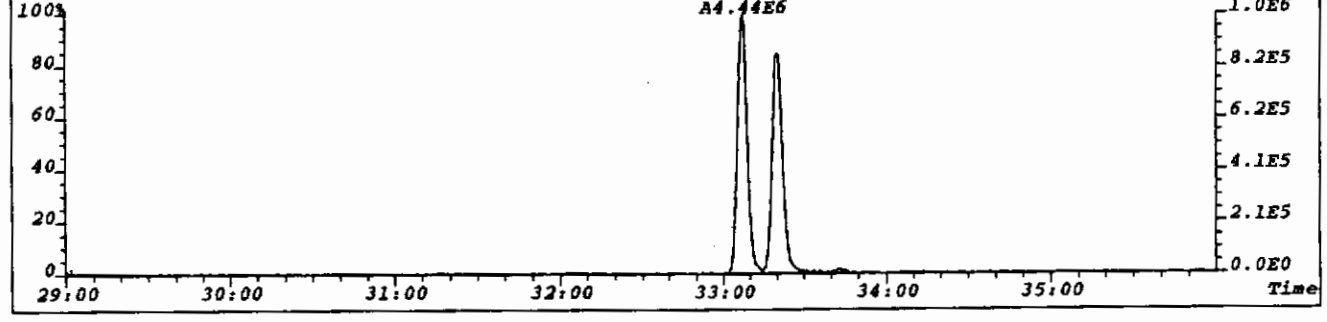
File:P970067 #1-587 Acq:7-JAN-97 09:10:18 EI+ Voltage SIR 70P Noise:89
327.8847 BSUB(256,30,-3.0) PKD(5,3,1,0.10%,356.0,0.00%,F,F) Exp:DB5
TRIANGLE LABS Text:ASR-1 TLI #39939



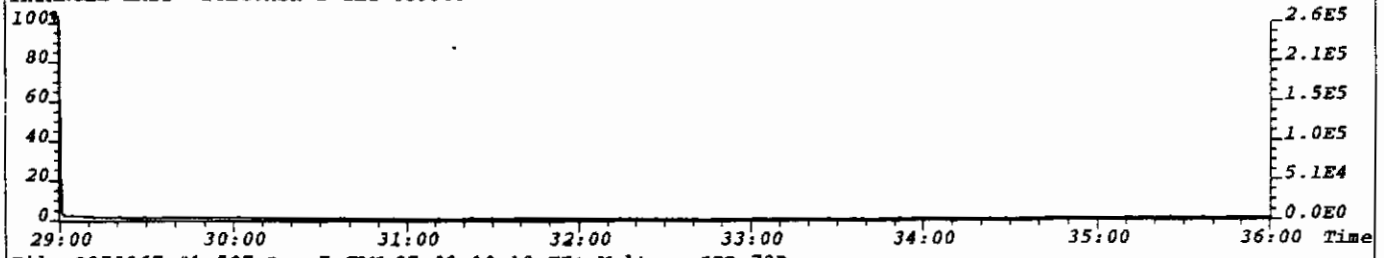
File:P970067 #1-587 Acq:7-JAN-97 09:10:18 EI+ Voltage SIR 70P Noise:805
331.9368 BSUB(256,30,-3.0) PKD(5,3,1,0.10%,3220.0,0.00%,F,F) Exp:DB5
TRIANGLE LABS Text:ASR-1 TLI #39939



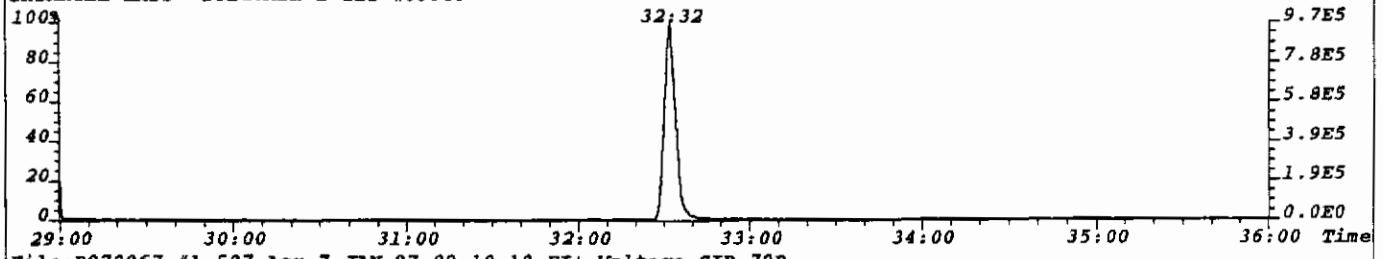
File:P970067 #1-587 Acq:7-JAN-97 09:10:18 EI+ Voltage SIR 70P Noise:366
333.9338 BSUB(256,30,-3.0) PKD(5,3,1,0.10%,1464.0,0.00%,F,F) Exp:DB5
TRIANGLE LABS Text:ASR-1 TLI #39939



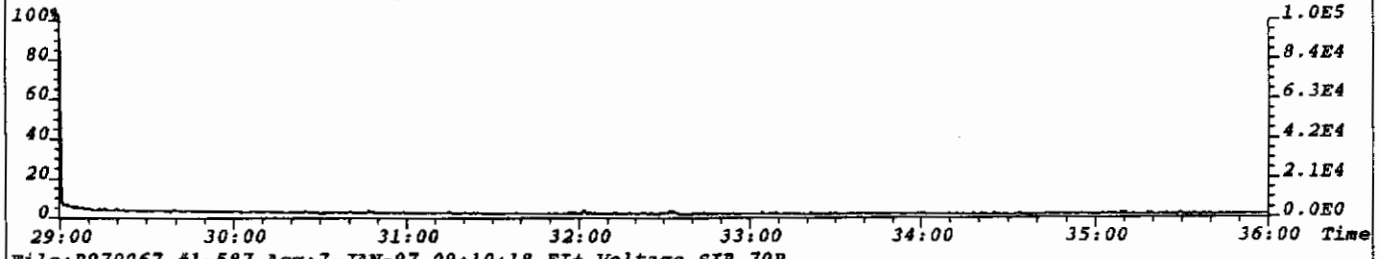
File:P970067 #1-587 Acq:7-JAN-97 09:10:18 EI+ Voltage SIR 70P
303.9016 Exp:DB5
TRIANGLE LABS Text:ASR-1 TLI #39939



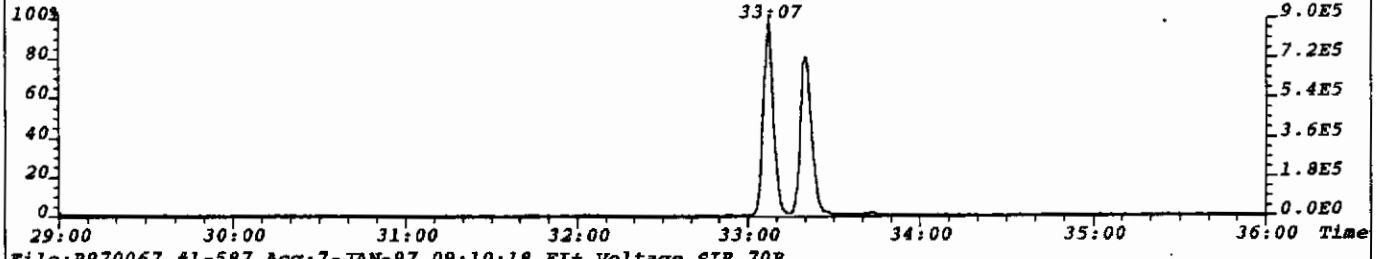
File:P970067 #1-587 Acq:7-JAN-97 09:10:18 EI+ Voltage SIR 70P
315.9419 Exp:DB5
TRIANGLE LABS Text:ASR-1 TLI #39939



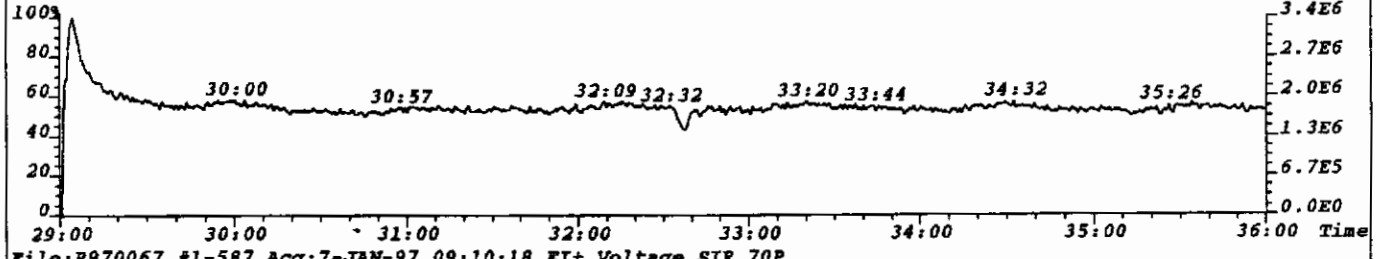
File:P970067 #1-587 Acq:7-JAN-97 09:10:18 EI+ Voltage SIR 70P
319.8965 Exp:DB5
TRIANGLE LABS Text:ASR-1 TLI #39939



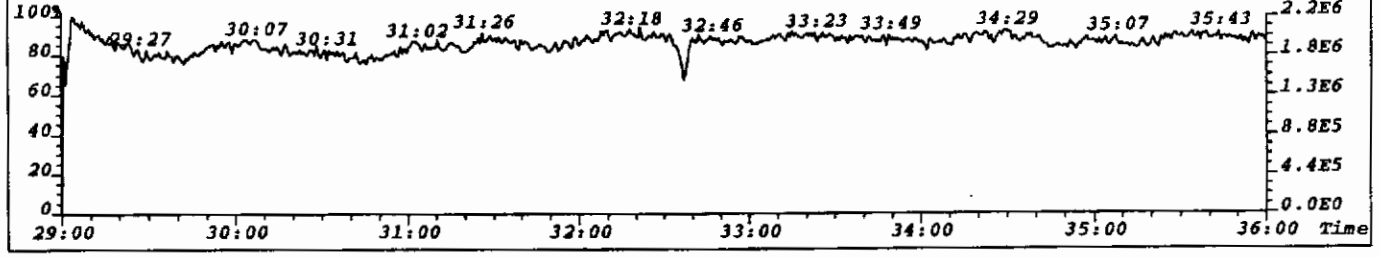
File:P970067 #1-587 Acq:7-JAN-97 09:10:18 EI+ Voltage SIR 70P
331.9368 Exp:DB5
TRIANGLE LABS Text:ASR-1 TLI #39939

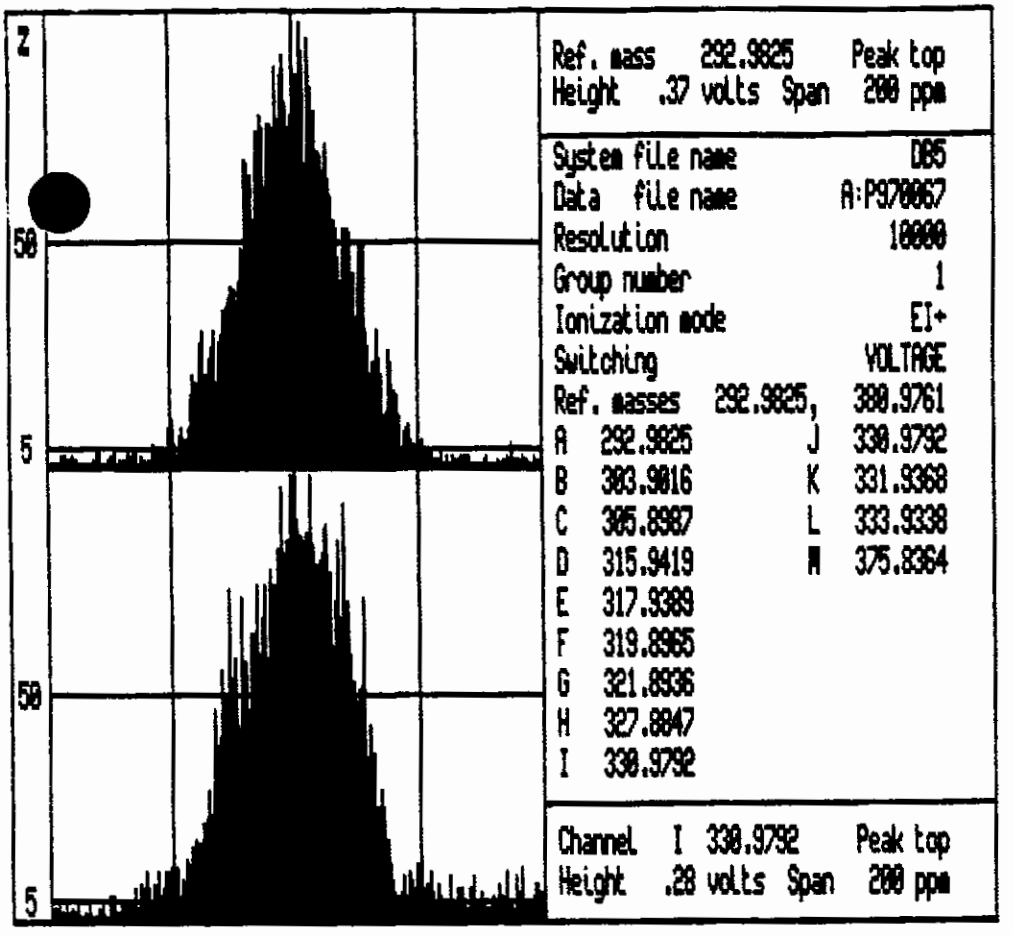


File:P970067 #1-587 Acq:7-JAN-97 09:10:18 EI+ Voltage SIR 70P
292.9825 Exp:DB5
TRIANGLE LABS Text:ASR-1 TLI #39939



File:P970067 #1-587 Acq:7-JAN-97 09:10:18 EI+ Voltage SIR 70P
330.9792 Exp:DB5
TRIANGLE LABS Text:ASR-1 TLI #39939





Ref. mass	292.9825		Peak top
Height	.37 volts	Span	200 ppm

System file name	DB5
Data file name	A:P970057
Resolution	10000
Group number	1
Ionization mode	EI+
Switching	VOLTAGE
Ref. masses	292.9825, 380.9761

A	292.9825	J	330.9792
B	303.9816	K	331.9368
C	305.8987	L	333.9338
D	315.9419	M	375.8364
E	317.9389		
F	319.8965		
G	321.8936		
H	327.8847		
I	330.9792		

Channel	I 330.9792		Peak top
Height	.28 volts	Span	200 ppm

Serial Number 4[illegible]378

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

☐ 5102 LaRoche Avenue, Savannah, GA 31404 Phone: (912) 354-7858 Fax: (912) 352-0165
☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301 Phone: (904) 878-3994 Fax: (904) 878-9504
☐ 414 SW 12th Avenue, Deerfield Beach, FL 33442 Phone: (305) 421-7400 Fax: (305) 421-2584
☐ 900 Lakeside Drive, Mobile, AL 36693 Phone: (205) 666-6633 Fax: (205) 666-6696
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634 Phone: (813) 885-7427 Fax: (813) 885-7049
☐ 100 Alpha Drive, Suite 110, Destrehan, LA 70047 Phone: (504) 764-1100 Fax: (504) 725-1163

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

PROJECT REFERENCE: Broward County ASR
PROJECT NO.: 103715.A0
P.O. NUMBER:
PROJECT LOC. (State): FL
SAMPLER(s) NAME: Mark Schilling
PHONE: 954-426-4008
FAX: 954-698-6010
CLIENT NAME: CH2M Hill
CLIENT PROJECT MANAGER: Peter Kwiatkowski
CLIENT ADDRESS (CITY, STATE, ZIP): 800 Fairway Dr, Ste 350, Deerfield Beach, FL 33441

PAGE 1 OF 2

☒ STANDARD REPORT DELIVERY
☐ EXPEDITED REPORT DELIVERY (surcharge)
Date Due:

MATRIX TYPE: AQUEOUS (WATER) / SOLID OR SEMISOLID / AIR / NONAQUEOUS LIQUID (oil, solvent, etc)

REQUIRED ANALYSES / NUMBER OF CONTAINERS SUBMITTED

SAMPLE DATE	SAMPLE TIME	SL NO.	SAMPLE IDENTIFICATION	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (oil, solvent, etc)	524 (HCL)	504 (-)	504+508, 515.1, 525.2	531.1, 547, 548.1, 549.1 (-)	Primary ICP Metal (HNO3)	Secondary Metals (HNO3)	Mercury (HNO3)	Cyanide (NaOH)	Color, Odor, MBAS (-)	pH, NO2, NO3, Turb, TDS, Asbestos (-)	REMARKS
12-3-96	1135		ASR-1					3	3	4	4	1	1	1	1	1	3	
12-3-96	—		Trip Blank					3										

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
Kimberly A. Koster	11/26/96	1730	M G Schilling	12-3-96	1235			
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
M G Schilling	11/26/96	1730						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
Kimberly A. Koster	12/3/96	1235	☐ YES ☐ NO		D672759	

ORIGINAL

Serial Number 44098

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

☐ 5102 LaRoche Avenue, Savannah, GA 31404 Phone: (912) 354-7858 Fax: (912) 352-0165
☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301 Phone: (904) 878-3994 Fax: (904) 878-9504
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☐ 100 Alpha Drive, Suite 110, Destrehan, LA 70047 Phone: (504) 764-1100 Fax: (504) 725-1163

PROJECT REFERENCE	PROJECT NO.	P.O. NUMBER
BROWARD COUNTY ASR	103715.A0	

PROJECT LOC. (State)	SAMPLER(s) NAME	PHONE	FAX
FL	MARK SCHILLING	954-426-4008	954-698-6010

CLIENT NAME	CLIENT PROJECT MANAGER
CH2M HILL	PETER KWIATKOWSKI

CLIENT ADDRESS (CITY, STATE, ZIP)
800 FAIRWAY DRIVE, STE 350
DEERFIELD BEACH, FL 33441

MATRIX TYPE: AQUEOUS (WATER) / SOLID OR SEMISOLID / AIR / NONAQUEOUS LIQUID (oil, solvent etc)

REQUIRED ANALYSES: TOTAL COLIFORMS (-) / GROSS α, RAD 226 / RAD 228 (HNO3) / DIOXIN (-) / CHLORIDE, FLUORIDE, SULFATE (H2SO4) / NITRATE, NITRITE, TKN (-) (H2SO4) / EXTRA

PAGE 2 OF 2

☒ STANDARD REPORT DELIVERY
☐ EXPEDITED REPORT DELIVERY (surcharge)
Date Due: ____

SAMPLE DATE	SAMPLE TIME	SL NO.	SAMPLE IDENTIFICATION	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (oil, solvent etc)	NUMBER OF CONTAINERS SUBMITTED										REMARKS
12-3-96	1135		ASR-1					2	3	1	1	1	3					

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
			M. C. Schilling	12-3-96	1235			
RECEIVED BY: (SIGNATURE) M. C. Schilling	DATE 12/2/96	TIME 1730	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
Kimberly A. Hosler	12/3/96	1255	☐ YES ☐ NO		D672759	

ORIGINAL

SL ***SAVANNAH LABORATORIES***
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (954) 421-7400 • Fax (954) 421-2584

LOG NO: D7-50529
Received: 12 MAR 97
Reported: 18 APR 97

Mr. Pete Kwiatkowski
CH2M Hill
800 Fairway Dr. Suite 350
Deerfield Beach, FL 33441

Project: #103715.AO (Broward County ASR)
Sampled By: Mark Schilling
Code: 133570424

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
50529-1	MW-1	03-12-97/1335

PARAMETER	50529-1
Primary Organics - Volatiles (524)	
Vinyl chloride, ug/l	<0.50
Benzene, ug/l	<0.50
Carbon tetrachloride, ug/l	<0.50
1,2-Dichloroethane, ug/l	<0.50
Trichloroethylene, ug/l	<0.50
1,4-Dichlorobenzene, ug/l	<0.50
1,1-Dichloroethene, ug/l	<0.50
1,1,1-Trichloroethane, ug/l	<0.50
cis-1,2-Dichloroethene, ug/l	<0.50
1,2-Dichloropropane, ug/l	<0.50
Ethylbenzene, ug/l	<0.50
Chlorobenzene, ug/l	<0.50
1,2-Dichlorobenzene, ug/l	<0.50
Styrene, ug/l	<0.50
Tetrachloroethene, ug/l	<0.50
Toluene, ug/l	<0.50
trans-1,2-Dichloroethene, ug/l	<0.50
Xylenes, ug/l	<0.50
Methylene chloride (Dichloromethane), ug/l	<0.50
1,2,4-Trichlorobenzene, ug/l	<0.50
1,1,2-Trichloroethane, ug/l	<0.50
Date Analyzed	03.19.97
Method Number	EPA 524

SL ***SAVANNAH LABORATORIES***
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (954) 421-7400 • Fax (954) 421-2584

LOG NO: D7-50529
Received: 12 MAR 97
Reported: 18 APR 97

Mr. Pete Kwiatkowski
CH2M Hill
800 Fairway Dr. Suite 350
Deerfield Beach, FL 33441

Project: #103715.A0 (Broward County ASR)
Sampled By: Mark Schilling
Code: 125270424

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
50529-1	MW-1	03-12-97/1335

PARAMETER	50529-1
Primary Organics - Trihalomethanes (524.2)	
Bromoform, ug/l	<0.50
Chloroform, ug/l	<0.50
Dichlorobromomethane, ug/l	<0.50
Dibromochloromethane, ug/l	<0.50
Total Trihalomethanes, ug/l	<0.50
Date Analyzed	03.19.97
Method Number	EPA 524

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Project: #103715.A0 (Broward County ASR)
Sampled By: Mark Schilling
Code: 134070424

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
50529-1	MW-1	03-12-97/1335

PARAMETER	50529-1
Group II Unregulated Purgeables	
Bromobenzene, ug/l	<0.50
Bromodichloromethane, ug/l	<0.50
Bromoform, ug/l	<0.50
Bromomethane, ug/l	<0.50
Chloroethane, ug/l	<0.50
Chloroform, ug/l	<0.50
Chloromethane, ug/l	<0.50
Dibromochloromethane, ug/l	<0.50
Dichlorodifluoromethane, ug/l	<0.50
P-Chlorotoluene, ug/l	<0.50
Dibromomethane, ug/l	<0.50
1,1-Dichloroethane, ug/l	<0.50
cis-1,3-Dichloropropene, ug/l	<0.50
trans-1,3-Dichloropropene, ug/l	<0.50
1,3-Dichloropropylene, ug/l	<0.50
1,3-Dichloropropane, ug/l	<0.50
2,2 Dichloropropane, ug/l	<0.50
Trichlorofluoromethane, ug/l	<0.50
1,2,3-Trichloropropane, ug/l	<0.50
1,3-Dichlorobenzene, ug/l	<0.50
1,1,1,2-Tetrachloroethane, ug/l	<0.50
1,1,2,2-Tetrachloroethane, ug/l	<0.50
Methyl-tert-butyl ether (MTBE), ug/l	<0.50
1,1-Dichloropropene, ug/l	<0.50
O-Chlorotoluene, ug/l	<0.50
Date Analyzed	03.19.97
Method Number	EPA 524

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Sampled By: Mark Schilling
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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
50529-1	MW-1	03-12-97/1335

PARAMETER	50529-1
Microextractables (504)	
1,2-Dibromoethane (EDB) , ug/l	<0.020
1,2-Dibromo-3-chloropropane, ug/l	<0.020
Date Extracted	03.14.97
Date Analyzed	03.14.97
Method Number	EPA 504
Primary Organics - Pesticides (507)	
Alachlor, ug/l	<1.0
Atrazine, ug/l	<1.0
Simazine, ug/l	<1.0
Date Extracted	03.18.97
Date Analyzed	03.19.97
Method Number	EPA 507
Group I Unregulated Pesticides (507)	
Butachlor, ug/l	<1.0
Metolachlor, ug/l	<1.0
Metribuzin, ug/l	<1.0
Date Extracted	03.18.97
Date Analyzed	03.19.97
Method Number	EPA 507

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
50529-1	MW-1	03-12-97/1335

PARAMETER	50529-1
Chlorinated Pesticides (508)	
Aldrin, ug/l	<0.010
Chlordane, ug/l	<0.10
Dieldrin, ug/l	<0.020
Endrin, ug/l	<0.020
Heptachlor, ug/l	<0.010
Heptachlor epoxide, ug/l	<0.020
Hexachlorobenzene, ug/l	<0.050
Hexachlorocyclopentadiene, ug/l	<0.050
gamma-BHC (Lindane), ug/l	<0.010
Methoxychlor, ug/l	<0.50
Propachlor, ug/l	<1.0
Toxaphene, ug/l	<1.0
PCB-1016, ug/l	<0.50
PCB-1221, ug/l	<0.50
PCB-1232, ug/l	<0.50
PCB-1242, ug/l	<0.50
PCB-1248, ug/l	<0.50
PCB-1254, ug/l	<0.50
PCB-1260, ug/l	<0.50
Date Extracted	03.18.97
Date Analyzed	03.21.97
Method Number	EPA 508

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
50529-1	MW-1	03-12-97/1335

PARAMETER	50529-1
Group I Unregulated Pesticides (508)	
Aldrin, ug/l	<0.010
Dieldrin, ug/l	<0.020
Propachlor, ug/l	<1.0
Date Extracted	03.18.97
Date Analyzed	03.21.97
Method Number	EPA 508
rimary Organics - Herbicides (515.1)	
2,4-D, ug/l	<0.50
Dalapon, ug/l	<10
Dinoseb, ug/l	<0.50
Pentachlorophenol, ug/l	<1.0
Picloram, ug/l	<0.50
2,4,5-TP Silvex, ug/l	<0.50
Date Extracted	03.17.97
Date Analyzed	03.24.97
Method Number	EPA 515.1
Group I Unregulated Herbicides (515.1)	
Dicamba, ug/l	<0.50
Date Extracted	03.17.97
Date Analyzed	03.24.97
Method Number	EPA 515.1

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
50529-1	MW-1	03-12-97/1335

PARAMETER	50529-1
Primary Organics - BN (525.2)	
Benzo(a)pyrene, ug/l	<0.20
Bis(2-ethyl hexyl)adipate, ug/l	<2.0
bis(2-Ethylhexyl) phthalate, ug/l	<2.0
Hexachlorobenzene, ug/l	<1.0
Hexachlorocyclopentadiene, ug/l	<1.0
Date Extracted	03.18.97
Date Analyzed	03.20.97
Method Number	EPA 525.2
Group III Unregulated Acid Extractables	
2-Chlorophenol, ug/l	<10
2-Methyl-4,6-dinitrophenol, ug/l	<50
Phenol, ug/l	<10
2,4,6-Trichlorophenol, ug/l	<10
Date Extracted	03.12.97
Date Analyzed	03.17.97
Method Number	EPA 625
Group III Unregulated BN Extractables	
Butylbenzylphthalate, ug/l	<10
Di-n-butylphthalate, ug/l	<10
Diethylphthalate, ug/l	<10
Dimethylphthalate, ug/l	<10
2,4-Dinitrotoluene, ug/l	<10
Di-n-octylphthalate, ug/l	<10
Isophorone, ug/l	<10
Date Extracted	03.12.97
Date Analyzed	03.17.97
Method Number	EPA 625

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
50529-1	MW-1	03-12-97/1335

PARAMETER	50529-1
Primary Organics - Carbamates (531.1)	
Carbofuran, ug/l	<1.0
Oxamyl, ug/l	<1.0
Date Analyzed	03.19.97
Method Number	EPA 531.1
Group I Unregulated Carbamates (531.1)	
Aldicarb, ug/l	<0.50
Aldicarb Sulfone, ug/l	<0.50
Aldicarb Sulfoxide, ug/l	<0.50
Carbaryl, ug/l	<1.0
3-Hydroxycarbofuran, ug/l	<1.0
Methomyl, ug/l	<1.0
Date Analyzed	03.19.97
Method Number	EPA 531.1
Primary Organics - Glyphosate (547)	
Glyphosate, ug/l	<150
Date Analyzed	03.21.97
Method Number	EPA 547
Primary Organics - Endothall (548.1)	
Endothall, ug/l	<10
Date Extracted	03.19.97
Date Analyzed	03.21.97
Method Number	EPA 548.1
Primary Organics - Diquat (549.1)	
Diquat, ug/l	<1.0
Date Extracted	03.12.97
Date Analyzed	03.13.97
Method Number	EPA 549.1

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
50529-1	MW-1	03-12-97/1335

PARAMETER	50529-1
Primary ICP Metals (200.7)	
Barium, mg/l	<0.010
Beryllium, mg/l	<0.0040
Cadmium, mg/l	<0.0050
Chromium, mg/l	<0.010
Nickel, mg/l	<0.040
Sodium (200.7), mg/l	1100
Date Analyzed	03.20.97
Method Number	EPA 200.7
Antimony (SM 3113B)	
Antimony, mg/l	<0.0050
Date Analyzed	03.24.97
Method Number	SM 3113B
Arsenic (SM 3113B)	
Arsenic, mg/l	<0.010
Date Analyzed	03.21.97
Method Number	SM 3113B
Lead (SM 3113B)	
Lead, mg/l	<0.0050
Date Analyzed	03.17.97
Method Number	SM 3113B
Mercury (245.1)	
Mercury, mg/l	<0.00020
Date Analyzed	03.14.97
Method Number	EPA 245.1

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
50529-1	MW-1	03-12-97/1335

PARAMETER	50529-1
Selenium (3113B)	
Selenium, mg/l	0.035*F4
Date Analyzed	03.24.97
Method Number	SM 3113B
Thallium (279.2)	
Thallium, mg/l	<0.0020
Date Analyzed	03.18.97
Method Number	EPA 279.2
Coliform, Total (SM 9222B)	
Coliform (MF), Total, col/100ml	720
Date Analyzed	03.12.97
Method Number	SM 9222B
Cyanide, Total (EPA 335.2)	
Cyanide (EPA 335.2), mg/l	<0.010
Date Analyzed	03.20.97
Method Number	EPA 335.2
Fluoride (EPA 340.2)	
Fluoride, mg/l	1.1
Date Analyzed	03.14.97
Method Number	EPA 340.2
Nitrogen, Nitrate	
Nitrate-N, mg/l	<0.050
Date Analyzed	03.12.97
Method Number	EPA 353.3
Nitrogen, Nitrite	
Nitrite-N, mg/l	<0.050
Date Analyzed	03.12.97
Method Number	EPA 353.3

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
50529-1	MW-1	03-12-97/1335

PARAMETER	50529-1
Nitrogen, Nitrate + Nitrite	
Nitrate + Nitrite-N, mg/l	<0.050
Date Analyzed	03.12.97
Method Number	EPA 353.3
Turbidity	
Turbidity, NTU	0.59
Date Analyzed	03.13.97
Method Number	EPA 180.1
Secondary Metals (200.7)	
Aluminum, mg/l	<0.20
Copper, mg/l	<0.025
Iron, mg/l	<0.050
Manganese, mg/l	<0.010
Silver, mg/l	<0.010
Zinc, mg/l	<0.020
Date Analyzed	03.20.97
Method Number	EPA 200.7
Chloride (EPA 325.2)	
Chloride, mg/l	1900
Date Analyzed	03.26.97
Method Number	EPA 325.2
Color	
Color, c.u.	10
Date Analyzed	03.13.97
Method Number	EPA 110.2

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
50529-1	MW-1	03-12-97/1335

PARAMETER	50529-1
Odor	
Odor, t.o.n.	16
Date Analyzed	03.13.97
Method Number	EPA 140.1
pH	
pH , units	7.5
Date Analyzed	03.13.97
Method Number	EPA 150.1
Solids, Total Dissolved (160.1)	
Solids, Total Dissolved, mg/l	2600
Date Analyzed	03.13.97
Method Number	EPA 160.1
Sulfate as SO4 (EPA 375.3)	
Sulfate, mg/l	460
Date Analyzed	03.24.97
Method Number	EPA 375.2
Surfactants (MBAS)	
Surfactants (MBAS), mg/l	0.18*F73
Date Analyzed	03.13.97
Method Number	SM 5540C
Biochemical Oxygen Demand (5-Day) (405.1)	
Biochemical Oxygen Demand (5 Day), mg/l	<2.0
Date Analyzed	03.13.97
Method Number	EPA 405.1
Chemical Oxygen Demand (410.1)	
Chemical Oxygen Demand, mg/l	60
Date Analyzed	03.22.97
Method Number	EPA 410.1

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
50529-1	MW-1	03-12-97/1335

PARAMETER	50529-1
Ammonia Nitrogen as N (EPA 350.1)	
Ammonia-N, mg/l	0.58
Date Analyzed	03.18.97
Method Number	EPA 350.1
Kjeldahl Nitrogen as N, Total (EPA 351.2)	
Kjeldahl Nitrogen-N, mg/l	0.72
Date Analyzed	03.18.97
Method Number	EPA 351.2
Phosphorus as P	
Phosphorus, Total, mg/l	<0.10
Date Analyzed	03.18.97
Method Number	EPA 365.4
Asbestos in Water (TEM), MFL	0.00
2,3,7,8-TCDD (1613), ug/l	*F71

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
50529-2	Lab Blank
50529-3	Accuracy - % Recovery (Mean)
50529-4	Precision - Relative % Difference
50529-5	Detection Limit

PARAMETER	50529-2	50529-3	50529-4	50529-5
Primary Organics - Volatiles (524)				
Vinyl chloride, ug/l	<0.50	110 %	7.0 %	0.50
Benzene, ug/l	<0.50	103 %	0.5 %	0.50
Carbon tetrachloride, ug/l	<0.50	95 %	0.8 %	0.50
1,2-Dichloroethane, ug/l	<0.50	80 %	0.8 %	0.50
Trichloroethylene, ug/l	<0.50	95 %	0.3 %	0.50
1,4-Dichlorobenzene, ug/l	<0.50	90 %	2.3 %	0.50
1,1-Dichloroethene, ug/l	<0.50	102 %	4.8 %	0.50
1,1,1-Trichloroethane, ug/l	<0.50	100 %	0 %	0.50
cis-1,2-Dichloroethene, ug/l	<0.50	93 %	0.5 %	0.50
1,2-Dichloropropane, ug/l	<0.50	83 %	2.0 %	0.50
Ethylbenzene, ug/l	<0.50	98 %	0.3 %	0.50
Chlorobenzene, ug/l	<0.50	98 %	0.6 %	0.50
1,2-Dichlorobenzene, ug/l	<0.50	92 %	2.1 %	0.50
Styrene, ug/l	<0.50	92 %	2.0 %	0.50
Tetrachloroethene, ug/l	<0.50	104 %	1.7 %	0.50
Toluene, ug/l	<0.50	100 %	1.1 %	0.50
trans-1,2-Dichloroethene, ug/l	<0.50	96 %	0.1 %	0.50
Xylenes, ug/l	<0.50	100 %	0.9 %	0.50
Methylene chloride (Dichloromethane), ug/l	<0.50	101 %	0.5 %	0.50
1,2,4-Trichlorobenzene, ug/l	<0.50	94 %	1.2 %	0.50
1,1,2-Trichloroethane, ug/l	<0.50	82 %	6.3 %	0.50
Date Analyzed	03.19.97	---	---	---
Method Number	EPA 524	---	---	---

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
50529-2	Lab Blank
50529-3	Accuracy - % Recovery (Mean)
50529-4	Precision - Relative % Difference
50529-5	Detection Limit

PARAMETER	50529-2	50529-3	50529-4	50529-5
Primary Organics - Trihalomethanes (524.2)				
Bromoform, ug/l	<0.50	80 %	5.3 %	0.50
Chloroform, ug/l	<0.50	96 %	3.0 %	0.50
Dichlorobromomethane, ug/l	<0.50	88 %	8.2 %	0.50
Dibromochloromethane, ug/l	<0.50	80 %	10 %	0.50
Total Trihalomethanes, ug/l	<0.50	---	---	0.50
Date Analyzed	03.19.97	---	---	---
Method Number	EPA 524	---	---	---

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50529-2	Lab Blank
50529-3	Accuracy - % Recovery (Mean)
50529-4	Precision - Relative % Difference
50529-5	Detection Limit

PARAMETER	50529-2	50529-3	50529-4	50529-5
Group II Unregulated Purgeables				
Bromobenzene, ug/l	<0.50	92 %	7.0 %	0.50
Bromodichloromethane, ug/l	<0.50	88 %	8.2 %	0.50
Bromoform, ug/l	<0.50	80 %	5.3 %	0.50
Bromomethane, ug/l	<0.50	106 %	5.1 %	0.50
Chloroethane, ug/l	<0.50	98 %	11 %	0.50
Chloroform, ug/l	<0.50	96 %	3.0 %	0.50
Chloromethane, ug/l	<0.50	112 %	12 %	0.50
Dibromochloromethane, ug/l	<0.50	80 %	10 %	0.50
Dichlorodifluoromethane, ug/l	<0.50	128 %	5.9 %	0.50
P-Chlorotoluene, ug/l	<0.50	96 %	0.1 %	0.50
Dibromomethane, ug/l	<0.50	92 %	12 %	0.50
1,1-Dichloroethane, ug/l	<0.50	100 %	1.8 %	0.50
cis-1,3-Dichloropropene, ug/l	<0.50	96 %	13 %	0.50
trans-1,3-Dichloropropene, ug/l	<0.50	98 %	8.6 %	0.50
1,3-Dichloropropylene, ug/l	<0.50	---	---	0.50
1,3-Dichloropropane, ug/l	<0.50	82 %	5.5 %	0.50
2,2 Dichloropropane, ug/l	<0.50	102 %	0.2 %	0.50
Trichlorofluoromethane, ug/l	<0.50	101 %	1.6 %	0.50
1,2,3-Trichloropropane, ug/l	<0.50	82 %	12 %	0.50
1,3-Dichlorobenzene, ug/l	<0.50	94 %	1.2 %	0.50
1,1,1,2-Tetrachloroethane, ug/l	<0.50	81 %	9.9 %	0.50
1,1,2,2-Tetrachloroethane, ug/l	<0.50	81 %	7.0 %	0.50
Methyl-tert-butyl ether (MTBE), ug/l	<0.50	78 %	9.1 %	0.50
1,1-Dichloropropene, ug/l	<0.50	93 %	0.3 %	0.50
O-Chlorotoluene, ug/l	<0.50	100 %	0.8 %	0.50
Date Analyzed	03.19.97	---	---	---
Method Number	EPA 524	---	---	---

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LOG NO: D7-50529
Received: 12 MAR 97
Reported: 18 APR 97

Mr. Pete Kwiatkowski
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Deerfield Beach, FL 33441

Project: #103715.AO (Broward County ASR)
Sampled By: Mark Schilling
Code: 125270424

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
50529-2	Lab Blank
50529-3	Accuracy - % Recovery (Mean)
50529-4	Precision - Relative % Difference
50529-5	Detection Limit

PARAMETER	50529-2	50529-3	50529-4	50529-5
Microextractables (504)				
1,2-Dibromoethane (EDB) , ug/l	<0.020	112 %	4.5 %	0.020
1,2-Dibromo-3-chloropropane, ug/l	<0.020	114 %	6.2 %	0.020
Date Extracted	03.14.97	---	---	---
Date Analyzed	03.14.97	---	---	---
Method Number	EPA 504	---	---	---
Primary Organics - Pesticides (507)				
Alachlor, ug/l	<1.0	80 %	7.5 %	1.0
Atrazine, ug/l	<1.0	87 %	11 %	1.0
Simazine, ug/l	<1.0	94 %	5.4 %	1.0
Date Extracted	03.18.97	---	---	---
Date Analyzed	03.19.97	---	---	---
Method Number	EPA 507	---	---	---
Group I Unregulated Pesticides (507)				
Butachlor, ug/l	<1.0	71 %	5.6 %	1.0
Metolachlor, ug/l	<1.0	72 %	7.8 %	1.0
Metribuzin, ug/l	<1.0	80 %	10 %	1.0
Date Extracted	03.18.97	---	---	---
Date Analyzed	03.19.97	---	---	---
Method Number	EPA 507	---	---	---

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
50529-2	Lab Blank
50529-3	Accuracy - % Recovery (Mean)
50529-4	Precision - Relative % Difference
50529-5	Detection Limit

PARAMETER	50529-2	50529-3	50529-4	50529-5
Chlorinated Pesticides (508)				
Aldrin, ug/l	<0.010	85 %	2.4 %	0.010
Chlordane, ug/l	<0.10	---	---	0.10
Dieldrin, ug/l	<0.020	82 %	2.4 %	0.020
Endrin, ug/l	<0.020	98 %	3.0 %	0.020
Heptachlor, ug/l	<0.010	87 %	2.3 %	0.010
Heptachlor epoxide, ug/l	<0.020	91 %	2.2 %	0.020
Hexachlorobenzene, ug/l	<0.050	54 %	1.9 %	0.050
Hexachlorocyclopentadiene, ug/l	<0.050	30 %	3.4 %	0.050
gamma-BHC (Lindane), ug/l	<0.010	85 %	4.7 %	0.010
Methoxychlor, ug/l	<0.50	88 %	5.7 %	0.50
Propachlor, ug/l	<1.0	91 %	2.2 %	1.0
Toxaphene, ug/l	<1.0	---	---	1.0
PCB-1016, ug/l	<0.50	---	---	0.50
PCB-1221, ug/l	<0.50	---	---	0.50
PCB-1232, ug/l	<0.50	---	---	0.50
PCB-1242, ug/l	<0.50	---	---	0.50
PCB-1248, ug/l	<0.50	---	---	0.50
PCB-1254, ug/l	<0.50	---	---	0.50
PCB-1260, ug/l	<0.50	---	---	0.50
Date Extracted	03.18.97	---	---	---
Date Analyzed	03.20.97	---	---	---
Method Number	EPA 508	---	---	---

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
50529-2	Lab Blank
50529-3	Accuracy - % Recovery (Mean)
50529-4	Precision - Relative % Difference
50529-5	Detection Limit

PARAMETER	50529-2	50529-3	50529-4	50529-5
Group I Unregulated Pesticides (508)				
Aldrin, ug/l	<0.010	85 %	2.4 %	0.010
Dieldrin, ug/l	<0.020	82 %	2.4 %	0.020
Propachlor, ug/l	<1.0	91 %	2.2 %	1.0
Date Extracted	03.18.97	---	---	---
Date Analyzed	03.20.97	---	---	---
Method Number	EPA 508	---	---	---
Primary Organics - Herbicides (515.1)				
2,4-D, ug/l	<0.50	92 %	22 %	0.50
Dalapon, ug/l	<10	54 %	11 %	10
Dinoseb, ug/l	<0.50	82 %	8.1 %	0.50
Pentachlorophenol, ug/l	<1.0	102 %	10 %	1.0
Picloram, ug/l	<0.50	46 %	9.2 %	0.50
2,4,5-TP Silvex, ug/l	<0.50	100 %	18 %	0.50
Date Extracted	03.17.97	---	---	---
Date Analyzed	03.24.97	---	---	---
Method Number	EPA 515.1	---	---	---
Group I Unregulated Herbicides (515.1)				
Dicamba, ug/l	<0.50	92 %	14 %	0.50
Date Extracted	03.17.97	---	---	---
Date Analyzed	03.24.97	---	---	---
Method Number	EPA 515.1	---	---	---

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REPORT OF RESULTS

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50529-2	Lab Blank
50529-3	Accuracy - % Recovery (Mean)
50529-4	Precision - Relative % Difference
50529-5	Detection Limit

PARAMETER	50529-2	50529-3	50529-4	50529-5
Primary Organics - BN (525.2)				
Benzo(a)pyrene, ug/l	<0.20	88 %	15 %	0.20
Bis(2-ethyl hexyl)adipate, ug/l	<2.0	92 %	9.8 %	2.0
bis(2-Ethylhexyl) phthalate, ug/l	<2.0	93 %	11 %	2.0
Hexachlorobenzene, ug/l	<1.0	83 %	17 %	1.0
Hexachlorocyclopentadiene, ug/l	<1.0	74 %	12 %	1.0
Date Extracted	03.18.97	---	---	---
Date Analyzed	03.20.97	---	---	---
Method Number	EPA 525.2	---	---	---
Group III Unregulated Acid Extractables				
2-Chlorophenol, ug/l	<10	78 %	1.3 %	10
2-Methyl-4,6-dinitrophenol, ug/l	<50	---	---	50
Phenol, ug/l	<10	71 %	8.4 %	10
2,4,6-Trichlorophenol, ug/l	<10	---	---	10
Date Extracted	03.12.97	---	---	---
Date Analyzed	03.17.97	---	---	---
Method Number	EPA 625	---	---	---

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REPORT OF RESULTS

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50529-2	Lab Blank
50529-3	Accuracy - % Recovery (Mean)
50529-4	Precision - Relative % Difference
50529-5	Detection Limit

PARAMETER	50529-2	50529-3	50529-4	50529-5
Group III Unregulated BN Extractables				
Butylbenzylphthalate, ug/l	<10	---	---	10
Di-n-butylphthalate, ug/l	<10	---	---	10
Diethylphthalate, ug/l	<10	---	---	10
Dimethylphthalate, ug/l	<10	---	---	10
2,4-Dinitrotoluene, ug/l	<10	90 %	3.3 %	10
Di-n-octylphthalate, ug/l	<10	---	---	10
Isophorone, ug/l	<10	---	---	10
Date Extracted	03.12.97	---	---	---
Date Analyzed	03.17.97	---	---	---
Method Number	EPA 625	---	---	---
Primary Organics - Carbamates (531.1)				
Carbofuran, ug/l	<1.0	88 %	3.4 %	1.0
Oxamyl, ug/l	<1.0	92 %	3.3 %	1.0
Date Analyzed	03.19.97	---	---	---
Method Number	EPA 531.1	---	---	---
Group I Unregulated Carbamates (531.1)				
Aldicarb, ug/l	<0.50	92 %	3.3 %	0.50
Aldicarb Sulfone, ug/l	<0.50	---	---	0.50
Aldicarb Sulfoxide, ug/l	<0.50	---	---	0.50
Carbaryl, ug/l	<1.0	---	---	1.0
3-Hydroxycarbofuran, ug/l	<1.0	---	---	1.0
Methomyl, ug/l	<1.0	---	---	1.0
Date Analyzed	03.19.97	---	---	---
Method Number	EPA 531.1	---	---	---

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
50529-2	Lab Blank
50529-3	Accuracy - % Recovery (Mean)
50529-4	Precision - Relative % Difference
50529-5	Detection Limit

PARAMETER	50529-2	50529-3	50529-4	50529-5
Primary Organics - Glyphosate (547)				
Glyphosate, ug/l	<150	108 %	8.3 %	150
Date Analyzed	03.21.97	---	---	---
Method Number	EPA 547	---	---	---
Primary Organics - Endothall (548.1)				
Endothall, ug/l	<10	51 %	12 %	10
Date Extracted	03.19.97	---	---	---
Date Analyzed	03.21.97	---	---	---
Method Number	EPA 548.1	---	---	---
Primary Organics - Diquat (549.1)				
Diquat, ug/l	<1.0	71 %	1.4 %	1.0
Date Extracted	03.12.97	---	---	---
Date Analyzed	03.13.97	---	---	---
Method Number	EPA 549.1	---	---	---
Primary ICP Metals (200.7)				
Barium, mg/l	<0.010	96 %	0 %	0.010
Beryllium, mg/l	<0.0040	96 %	1.0 %	0.0040
Cadmium, mg/l	<0.0050	94 %	1.1 %	0.0050
Chromium, mg/l	<0.010	96 %	0 %	0.010
Nickel, mg/l	<0.040	94 %	1.1 %	0.040
Sodium (200.7), mg/l	<0.50	92 %*F81	3.2 %	0.50
Date Analyzed	03.20.97	---	---	---
Method Number	EPA 200.7	---	---	---

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
50529-2	Lab Blank
50529-3	Accuracy - % Recovery (Mean)
50529-4	Precision - Relative % Difference
50529-5	Detection Limit

PARAMETER	50529-2	50529-3	50529-4	50529-5
Antimony (SM 3113B)				
Antimony, mg/l	<0.0050	118 %*F75	0.84 %	0.0050
Date Analyzed	03.24.97	---	---	---
Method Number	SM 3113B	---	---	---
Arsenic (SM 3113B)				
Arsenic, mg/l	<0.010	107 %*F75	5.6 %	0.010
Date Analyzed	03.21.97	---	---	---
Method Number	SM 3113B	---	---	---
Lead (SM 3113B)				
Lead, mg/l	<0.0050	113 %	0 %	0.0050
Date Analyzed	03.14.97	---	---	---
Method Number	SM 3113B	---	---	---
Mercury (245.1)				
Mercury, mg/l	<0.00020	108 %	0.92 %	0.00020
Date Analyzed	03.14.97	---	---	---
Method Number	EPA 245.1	---	---	---
Selenium (3113B)				
Selenium, mg/l	<0.0050	106 %*F75	0.95 %	0.0050
Date Analyzed	03.24.97	---	---	---
Method Number	SM 3113B	---	---	---
Thallium (279.2)				
Thallium, mg/l	<0.0020	82 %	1.2 %	0.0020
Date Analyzed	03.18.97	---	---	---
Method Number	EPA 279.2	---	---	---

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REPORT OF RESULTS

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50529-2	Lab Blank
50529-3	Accuracy - % Recovery (Mean)
50529-4	Precision - Relative % Difference
50529-5	Detection Limit

PARAMETER	50529-2	50529-3	50529-4	50529-5
Cyanide, Total (EPA 335.2)				
Cyanide (EPA 335.2), mg/l	<0.010	104 %	2.9 %	0.010
Date Analyzed	03.20.97	---	---	---
Method Number	EPA 335.2	---	---	---
Fluoride (EPA 340.2)				
Fluoride, mg/l	<0.20	103 %	0 %	2.0
Date Analyzed	03.14.97	---	---	---
Method Number	EPA 340.2	---	---	---
Nitrogen, Nitrate				
Nitrate-N, mg/l	<0.050	98 %*F75	7.1 %	0.050
Date Analyzed	03.12.97	---	---	---
Method Number	EPA 353.3	---	---	---
Nitrogen, Nitrite				
Nitrite-N, mg/l	<0.050	88 %*F75	1.1 %	0.050
Date Analyzed	03.12.97	---	---	---
Method Number	EPA 353.3	---	---	---
Nitrogen, Nitrate + Nitrite				
Nitrate + Nitrite-N, mg/l	<0.050	98 %*F75	7.1 %	0.050
Date Analyzed	03.12.97	---	---	---
Method Number	EPA 353.3	---	---	---

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50529-2	Lab Blank
50529-3	Accuracy - % Recovery (Mean)
50529-4	Precision - Relative % Difference
50529-5	Detection Limit

PARAMETER	50529-2	50529-3	50529-4	50529-5
Secondary Metals (200.7)				
Aluminum, mg/l	<0.20	109 %	7.3 %	0.20
Copper, mg/l	<0.025	94 %	1.1 %	0.025
Iron, mg/l	<0.050	98 %	1.0 %	0.050
Manganese, mg/l	<0.010	94 %	1.1 %	0.010
Silver, mg/l	<0.010	92 %	0 %	0.010
Zinc, mg/l	<0.020	94 %	0 %	0.020
Date Analyzed	03.20.97	---	---	---
Method Number	EPA 200.7	---	---	---
Chloride (EPA 325.2)				
Chloride, mg/l	<1.0	97 %	20 %	1.0
Date Analyzed	03.26.97	---	---	---
Method Number	EPA 325.2	---	---	---
Sulfate as SO4 (EPA 375.3)				
Sulfate, mg/l	<1.0	106 %	0.94 %	1.0
Date Analyzed	03.24.97	---	---	---
Method Number	EPA 375.3	---	---	---
Surfactants (MBAS)				
Surfactants (MBAS), mg/l	<0.10	86 %	22 %	0.10
Date Analyzed	03.13.97	---	---	---
Method Number	SM 5540C	---	---	---
Biochemical Oxygen Demand (5-Day) (405.1)				
Biochemical Oxygen Demand (5 Day), mg/l	<2.0	82 %	2.4 %	2.0
Date Analyzed	03.13.97	---	---	---
Method Number	EPA 405.1	---	---	---

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50529-4	Precision - Relative % Difference
50529-5	Detection Limit

PARAMETER	50529-2	50529-3	50529-4	50529-5
Chemical Oxygen Demand (410.1)				
Chemical Oxygen Demand, mg/l	<20	98 %*F75	0 %	20
Date Analyzed	03.22.97	---	---	---
Method Number	EPA 410.1	---	---	---
mmonia Nitrogen as N (EPA 350.1)				
Ammonia-N, mg/l	<0.030	95 %	1.1 %	0.030
Date Analyzed	03.18.97	---	---	---
Method Number	EPA 350.1	---	---	---
Kjeldahl Nitrogen as N, Total (EPA 351.2)				
Kjeldahl Nitrogen-N, mg/l	<0.20	102 %	8.8 %	0.20
Date Analyzed	03.18.97	---	---	---
Method Number	EPA 351.2	---	---	---
Phosphorus as P				
Phosphorus, Total, mg/l	<0.10	95 %	0 %	0.10
Date Analyzed	03.18.97	---	---	---
Method Number	EPA 365.4	---	---	---

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50529-4	Precision - Relative % Difference
50529-5	Detection Limit

PARAMETER	50529-2	50529-3	50529-4	50529-5

SL Environmental HRS Cert. #E86221 and SL Drinking Water HRS Cert. #86371.
Method References: EPA 40 CFR Part 136, EPA 600/4-88-039, EPA 600/4-79-020 and Standard Methods for the Examination of Water and Wastewater.
*F4 = The reported value was determined by the method of standard additions (MSA).
*F71 = Subcontracted results attached.
*F73 = Matrix spike recoveries were outside advisory limits due to matrix interference present in the sample.
*F75 = Matrix spike recoveries were outside advisory limits possibly due to matrix interference present in the sample; therefore, recovery of the laboratory control standard analyzed concurrently with the sample batch has been reported.
*F81 = Matrix spike recoveries were outside advisory limits due to abundance of target analytes present in the sample; therefore, laboratory control standards analyzed concurrently with the sample batch have been reported.

Marianne J. Walker, Project Manager

Final Page Of Report

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Code: 135070424

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE/ TIME SAMPLED
50529A-1	MW-1	03-12-97/1335

PARAMETER	50529A-1
Gross Alpha (EPA 900.0)	
Gross Alpha, pCi/l	13+/-43
Date Extracted	03.26.97
Date Analyzed	03.27.97
Method Number	EPA.900.0
Radium 226 (EPA 903.1)	
Radium 226, pCi/L	3.3+/-0.11
Prep or Extraction Date	03.26.97
Date Analyzed	04.04.97
Method Number	EPA 903.1
Radium 228 (EPA 904.0)	
Radium 228, pCi/l	<1.0+/-.43
Prep or Extraction Date	04.07.97
Date Analyzed	04.08.97
Method Number	EPA 904.0

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CH2M Hill
800 Fairway Dr. Suite 350
Deerfield Beach, FL 33441

Project: #103715.AO (Broward County ASR)
Sampled By: Mark Schilling
Code: 135070424

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
50529A-2	Lab Blank
50529A-3	Accuracy - % Recovery (Mean)
50529A-4	Precision - Relative % Difference
50529A-5	Detection Limit

PARAMETER	50529A-2	50529A-3	50529A-4	50529A-5
Gross Alpha (EPA 900.0)				
Gross Alpha, pCi/l	<3.0	129 %	13 %	3.0
Date Extracted	03.21.97	---	---	---
Date Analyzed	03.24.97	---	---	---
Method Number	EPA 900.0	---	---	---
Radium 226 (EPA 903.1)				
Radium 226, pCi/L	<0.60	79 %	20 %	0.60
Prep or Extraction Date	03.26.97	---	---	---
Date Analyzed	04.03.97	---	---	---
Method Number	EPA 903.1	---	---	---
Radium 228 (EPA 904.0)				
Radium 228, pCi/l	<1.0	74 %	37 %	1.0
Prep or Extraction Date	04.07.97	---	---	---
Date Analyzed	04.07.97	---	---	---
Method Number	EPA 904.0	---	---	---

Marianne J. Walker, Project Manager

Final Page Of Report

TRIANGLE LABS

SAMPLE DATA

Triangle Laboratories, Inc.
801 Capitola Drive
Durham, NC 27713-4411
919-544-5729
P.O. Box 13485
Research Triangle Park, NC 27709-3485
Fax # 919-544-5491

TRIANGLE LABORATORIES OF RTP, INC.
Sample Result Summary for Project 41064
1613A TCDD Analysis (DB-5)

03/28/97

Data File	W087701	W087702	W087703	W087704
Sample ID	OPR Water	TLI Water Blank	MW-1	RO8
Units	pg/L	pg/L	pg/L	pg/L
Extraction Date	03/19/97	03/19/97	03/19/97	03/19/97
Analysis Date	03/28/97	03/28/97	03/28/97	03/28/97
Instrument	W	W	W	W
Matrix	AQUEOUS	AQUEOUS	AQUEOUS	AQUEOUS
Extraction Type	sp/soxh	sp/soxh	sp/soxh	sp/soxh
Analytes				
2378-TCDD	209	< 5.0	< 5.0	< 5.0
Other Standards Percent Recovery Summary (% Rec)				
37Cl-TCDD	68.4	73.8	74.8	71.5
Internal Standards Percent Recovery Summary (% Rec)				
13C12-2378-TCDD	66.5	66.3	74.0	66.2

Data File	W088001	W088002
Sample ID	RO9	RO10
Units	pg/L	pg/L
Extraction Date	03/19/97	03/19/97
Analysis Date	03/28/97	03/28/97
Instrument	W	W
Matrix	AQUEOUS	AQUEOUS
Extraction Type	sp/soxh	sp/soxh
Analytes		
2378-TCDD	< 5.0	< 5.0
Other Standards Percent Recovery Summary (% Rec)		
37Cl-TCDD	67.9	65.9
Internal Standards Percent Recovery Summary (% Rec)		
13C12-2378-TCDD	62.4	56.0

(Concentration of GC peaks out of theoretical isotopic abundance ratio range expressed as a detection limit).
Minimum levels are reported for non-detected GC peaks.
***** = INTERFERENCE

SL *SAVANNAH LABORATORIES*
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (954) 421-7400 • Fax (954) 421-2584

REMIT TO: P.O. Box 13548, Savannah, Georgia 31416-0548

Project: #103715.A0 (Broward County ASR)

Ms. Anne Murray
Montgomery Watson
1776 N. Pine Island Rd. Suite 200
Plantation, FL 33322

Invoice No: D70860

Invoice Date: 18 APR 1997

Terms: Net 30 Days
Federal Tax ID NO: 58-1485724
CODE: MW-PLANT$-D-90MW

LOG NO: D750529 INVOICE

ITEM	QTY	SAMPLE IDENTIFICATION	ANALYSIS	UNIT PRICE	PRICE/SAMP	TOTAL
1	1	MW-1	Primary Organics - Volatiles (524) Primary Organics - Trihalomethanes (524.2) Group II Unregulated Purgeables Microextractables (504) Primary Organics - Pesticides (507) Group I Unregulated Pesticides (507) Chlorinated Pesticides (508) Group I Unregulated Pesticides (508) Primary Organics - Herbicides (515.1) Group I Unregulated Herbicides (515.1) Primary Organics - BN (525.2) Group III Unregulated Acid Extractables Group III Unregulated BN Extractables Primary Organics - Carbamates (531.1) Group I Unregulated Carbamates (531.1) Primary Organics - Glyphosate (547)	$1,764.00	$2,578.40	2,578.40

INVOICE CONTINUED ON PAGE 2

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (954) 421-7400 • Fax (954) 421-2584

REMIT TO: P.O. Box 13548, Savannah, Georgia 31416-0548

Project: #103715.AO (Broward County ASR)

Ms. Anne Murray
Montgomery Watson
1776 N. Pine Island Rd. Suite 200
Plantation, FL 33322

Invoice No: D70860

Invoice Date: 18 APR 1997

Terms: Net 30 Days
Federal Tax ID NO: 58-1485724
CODE: MW-PLANT$-D-90MW

LOG NO: D750529 INVOICE

ITEM	QTY	SAMPLE IDENTIFICATION	ANALYSIS	UNIT PRICE	PRICE/SAMP	TOTAL
			Primary Organics - Endothall (548.1)			
			Primary Organics - Diquat (549.1)			
			Primary ICP Metals (200.7)			
			Antimony (SM 3113B)			
			Arsenic (SM 3113B)			
			Lead (SM 3113B)			
			Mercury (245.1)			
			Selenium (3113B)			
			Thallium (279.2)			
			Coliform, Total (SM 9222B)			
			Cyanide, Total (EPA 335.2)			
			Fluoride (EPA 340.2)			
			Nitrogen, Nitrate			
			Nitrogen, Nitrite			
			Nitrogen, Nitrate + Nitrite			
			Turbidity			
			Secondary Metals (200.7)			
			Chloride (EPA 325.2)			
			Color			
			Odor			
			pH			
			Solids, Total Dissolved (160.1)			
			Sulfate as SO4 (EPA 375.3)			

INVOICE CONTINUED ON PAGE 3

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (954) 421-7400 • Fax (954) 421-2584

REMIT TO: P.O. Box 13548, Savannah, Georgia 31416-0548

Project: #103715.A0 (Broward County ASR)

Ms. Anne Murray
Montgomery Watson
1776 N. Pine Island Rd. Suite 200
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Invoice No: D70860

Invoice Date: 18 APR 1997

Terms: Net 30 Days
Federal Tax ID NO: 58-1485724
CODE: MW-PLANT$-D-90MW

LOG NO: D750529 INVOICE

ITEM	QTY	SAMPLE IDENTIFICATION	ANALYSIS	UNIT PRICE	PRICE/SAMP	TOTAL
			Surfactants (MBAS)			
			Biochemical Oxygen Demand (5-Day) (405.1)	$22.00		
			Chemical Oxygen Demand (410.1)	$17.60		
			Ammonia Nitrogen as N (EPA 350.1)	$13.20		
			Total Kjeldahl Nitrogen - N (EPA 351)	$30.80		
			Phosphorus as P	$30.80		
			Asbestos in Water (TEM)	$250.00		
			2,3,7,8-TCDD (1613)	$450.00		

OICE CONTINUED ON PAGE 4

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (954) 421-7400 • Fax (954) 421-2584

REMIT TO: P.O. Box 13548, Savannah, Georgia 31416-0548

Project: #103715.AO (Broward County ASR)

Ms. Anne Murray
Montgomery Watson
1776 N. Pine Island Rd. Suite 200
Plantation, FL 33322

Invoice No: D70860

Invoice Date: 18 APR 1997

Terms: Net 30 Days
Federal Tax ID NO: 58-1485724
CODE: MW-PLANT$-D-90MW

LOG NO: D750529 INVOICE

ITEM	QTY	SAMPLE IDENTIFICATION	ANALYSIS	UNIT PRICE	PRICE/SAMP	TOTAL
2	4	Lab Blank Accuracy - % Recovery (Mean) Precision - Relative % Difference Detection Limit	Primary Organics - Volatiles (524) Primary Organics - Trihalomethanes (524.2) Group II Unregulated Purgeables Microextractables (504) Primary Organics - Pesticides (507) Group I Unregulated Pesticides (507) Chlorinated Pesticides (508) Group I Unregulated Pesticides (508) Primary Organics - Herbicides (515.1) Group I Unregulated Herbicides (515.1) Primary Organics - BN (525.2) Group III Unregulated Acid Extractables Group III Unregulated BN Extractables Primary Organics - Carbamates (531.1) Group I Unregulated Carbamates (531.1) Primary Organics - Glyphosate (547)			

INVOICE CONTINUED ON PAGE 5

SL *SAVANNAH LABORATORIES*
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (954) 421-7400 • Fax (954) 421-2584

REMIT TO: P.O. Box 13548, Savannah, Georgia 31416-0548

Project: #103715.A0 (Broward County ASR)

Ms. Anne Murray
Montgomery Watson
1776 N. Pine Island Rd. Suite 200
Plantation, FL 33322

Invoice No: D70860

Invoice Date: 18 APR 1997

Terms: Net 30 Days
Federal Tax ID NO: 58-1485724
CODE: MW-PLANT$-D-90MW

LOG NO: D750529 INVOICE

ITEM	QTY	SAMPLE IDENTIFICATION	ANALYSIS	UNIT PRICE	PRICE/SAMP	TOTAL
			Primary Organics - Endothall (548.1) Primary Organics - Diquat (549.1) Primary ICP Metals (200.7) Antimony (SM 3113B) Arsenic (SM 3113B) Lead (SM 3113B) Mercury (245.1) Selenium (3113B) Thallium (279.2) Cyanide, Total (EPA 335.2) Fluoride (EPA 340.2) Nitrogen, Nitrate Nitrogen, Nitrite Nitrogen, Nitrate + Nitrite Secondary Metals (200.7) Chloride (EPA 325.2) Sulfate as SO4 (EPA 375.3) Surfactants (MBAS) Biochemical Oxygen Demand (5-Day) (405.1) Chemical Oxygen Demand (410.1) Ammonia Nitrogen as N (EPA 350.1) Total Kjeldahl Nitrogen			

INVOICE CONTINUED ON PAGE 6

SL *SAVANNAH LABORATORIES*
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (954) 421-7400 • Fax (954) 421-2584

REMIT TO: P.O. Box 13548, Savannah, Georgia 31416-0548

Project: #103715.A0 (Broward County ASR)

Ms. Anne Murray
Montgomery Watson
1776 N. Pine Island Rd. Suite 200
Plantation, FL 33322

Invoice No: D70860

Invoice Date: 18 APR 1997

Terms: Net 30 Days
Federal Tax ID NO: 58-1485724
CODE: MW-PLANT$-D-90MW

LOG NO: D750529 INVOICE

ITEM	QTY	SAMPLE IDENTIFICATION	ANALYSIS	UNIT PRICE	PRICE/SAMP	TOTAL
			- N (EPA 351) Phosphorus as P			
TOTAL						$2,578.40

INVOICE NOTE: Prices as per quote DQ60260

REPORTED TO: Mr. Pete Kwiatkowski CUSTOMER PHONE: 954/426-4008

For Proper Credit, please show INVOICE NUMBER on your remittance.
After 30 days, service charges of 1.5% per 30 days will be applied to unpaid balance.

SL *SAVANNAH LABORATORIES*
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (954) 421-7400 • Fax (954) 421-2584

REMIT TO: P.O. Box 13548, Savannah, Georgia 31416-0548

Project: #103715.A0 (Broward County ASR)

Ms. Anne Murray
Montgomery Watson
1776 N. Pine Island Rd. Suite 200
Plantation, FL 33322

Invoice No: D70894

Invoice Date: 24 APR 1997

Terms: Net 30 Days
Federal Tax ID NO: 58-1485724

LOG NO: D750529A

INVOICE

CODE: MW-PLANT$-D-90MW

ITEM	QTY	SAMPLE IDENTIFICATION	ANALYSIS	UNIT PRICE	PRICE/SAMP	TOTAL
1	1	MW-1	Gross Alpha (EPA 900.0) Radium 226 (EPA 903.1) Radium 228 (EPA 904.0)	$166.50	$166.50	166.50
2	4	Lab Blank Accuracy - % Recovery (Mean) Precision - Relative % Difference Detection Limit	Gross Alpha (EPA 900.0) Radium 226 (EPA 903.1) Radium 228 (EPA 904.0)			

TOTAL $166.50

REPORTED TO: Mr. Pete Kwiatkowski

CUSTOMER PHONE: 954/426-4008

For Proper Credit, please show INVOICE NUMBER on your remittance.
After 30 days, service charges of 1.5% per 30 days will be applied to unpaid balance.

SL *SAVANNAH LABORATORIES*
& ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (954) 421-7400 • Fax (954) 421-2584

REMIT TO: P.O. Box 13548, Savannah, Georgia 31416-0548

Project: #103715.A0 (Broward County ASR)

Ms. Anne Murray
Montgomery Watson
1776 N. Pine Island Rd. Suite 200
Plantation, FL 33322

Invoice No: D70894

Invoice Date: 24 APR 1997

Terms: Net 30 Days
Federal Tax ID NO: 58-1485724
CODE: MW-PLANT$-D-90MW

LOG NO: D750529A

INVOICE

ITEM	QTY	SAMPLE IDENTIFICATION	ANALYSIS	UNIT PRICE	PRICE/SAMP	TOTAL
1	1	MW-1	Gross Alpha (EPA 900.0) Radium 226 (EPA 903.1) Radium 228 (EPA 904.0)	$166.50	$166.50	166.50
2	4	Lab Blank Accuracy - % Recovery (Mean) Precision - Relative % Difference Detection Limit	Gross Alpha (EPA 900.0) Radium 226 (EPA 903.1) Radium 228 (EPA 904.0)			

TOTAL $166.50

REPORTED TO: Mr. Pete Kwiatkowski CUSTOMER PHONE: 954/426-4008

For Proper Credit, please show INVOICE NUMBER on your remittance.
After 30 days, service charges of 1.5% per 30 days will be applied to unpaid balance.

Serial Number 66555

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

☐ 5102 LaRoche Avenue, Savannah, GA 31404 Phone: (912) 354-7858 Fax: (912) 352-0165
☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301 Phone: (904) 878-3994 Fax: (904) 878-9504
☐ 414 SW 12th Avenue, Deerfield Beach, FL 33442 Phone: (305) 421-7400 Fax: (305) 421-2584
☐ 900 Lakeside Drive, Mobile, AL 36693 Phone: (205) 666-6633 Fax: (205) 666-6696
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634 Phone: (813) 885-7427 Fax: (813) 885-7049
☐ 100 Alpha Drive, Suite 110, Destrehan, LA 70047 Phone: (504) 764-1100 Fax: (504) 725-1163

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

PROJECT REFERENCE	PROJECT NO.	P.O. NUMBER
BROWARD COUNTY ASR	103715.A0	

PROJECT LOC. (State)	SAMPLER(s) NAME	PHONE	FAX
FL	MARK SCHILLING	954-426-4008	954-698-6010

CLIENT NAME	CLIENT PROJECT MANAGER
CH2M HILL	PETER KWIATKOWSKI

CLIENT ADDRESS (CITY, STATE, ZIP) 800 FAIRWAY DR, STE 350 DEERFIELD BEACH, FL. 33441

MATRIX TYPE: AQUEOUS (WATER) | SOLID OR SEMISOLID | AIR | NONAQUEOUS LIQUID (oil, solvent, etc)

REQUIRED ANALYSES

PAGE 1 OF 3

☐ STANDARD REPORT DELIVERY

☐ EXPEDITED REPORT DELIVERY (surcharge)

Date Due:

SAMPLE DATE	SAMPLE TIME	SL NO.	SAMPLE IDENTIFICATION	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (oil, solvent, etc)	EPA 524	EDB (EPA 504)	EPA 507	EPA 508	EPA 515	EPA 525	EPA 625	EPA 531	EPA 547	EPA 548	REMARKS
			NUMBER OF CONTAINERS SUBMITTED					HCL	—	SODIUM THIOSULFATE		HCL	—	MCA	SODIUM THIOSULFATE			
3-12-97	1335		MW-1	X				3	2	2	2	2	2	6	1	1	1	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
James G. Cole	3/10/97	12:30	Mark Schilling	3/12/97	1440			
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
Mark Schilling	3/11/97	8:00						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
James G. Cole	3/12/97	14:40	☐ YES ☐ NO		D750529	

ORIGINAL

Serial Number 66554

SL *SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.*

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

☐ 5102 LaRoche Avenue, Savannah, GA 31404	Phone: (912) 354-7858	Fax: (912) 352-0165
☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301	Phone: (904) 878-3994	Fax: (904) 878-9504
☐ 414 SW 12th Avenue, Deerfield Beach, FL 33442	Phone: (305) 421-7400	Fax: (305) 421-2584
☐ 900 Lakeside Drive, Mobile, AL 36693	Phone: (205) 666-6633	Fax: (205) 666-6696
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634	Phone: (813) 885-7427	Fax: (813) 885-7049
☐ 100 Alpha Drive, Suite 110, Destrehan, LA 70047	Phone: (504) 764-1100	Fax: (504) 725-1163

PROJECT REFERENCE: BROWARD COUNTY ASR
PROJECT NO.: 103715.A0
P.O. NUMBER:
PROJECT LOC. (State): FL
SAMPLER(s) NAME: MARK SCHILLING
PHONE: 954-426-4008
FAX: 954-~~426~~ 698-6010
CLIENT NAME: CH2M HILL
CLIENT PROJECT MANAGER: PETER KWIATKOWSKI
CLIENT ADDRESS (CITY, STATE, ZIP): 800 FAIRWAY DR, STE 350, DEERFIELD BEACH, FL 33441

PAGE 2 OF 3

MATRIX TYPE: AQUEOUS (WATER) / SOLID OR SEMISOLID / AIR / NONAQUEOUS LIQUID (oil, solvent, etc)

REQUIRED ANALYSES

☐ STANDARD REPORT DELIVERY
☐ EXPEDITED REPORT DELIVERY (surcharge)
Date Due:

Required analyses	EPA 549	DW METALS	MERCURY	TOTAL COLIFORM	CYANIDE	NO3/NO2/TURBIDITY/COLOR/PH	CL/SO4/FL	ODOR/MBAS/TDS	BOD	COD/NH3/TKN/TOTAL PHOS
Preservative	SODIUM THIOSULFATE	HNO3	HNO3	~~NaOH~~ NaOH	—	—	—	—		H2SO4

DATE	TIME	SL NO.	SAMPLE IDENTIFICATION	AQUEOUS	SOLID	AIR	NONAQ.	EPA 549	DW METALS	MERCURY	TOTAL COLIFORM	CYANIDE	NO3/NO2/TURB/COLOR/PH	CL/SO4/FL	ODOR/MBAS/TDS	BOD	COD/NH3/TKN/TOTAL PHOS	REMARKS
3-12-97	1335		MW-1					1	1	1	2	1	1	1	1	1	1	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
James A. Cote	3/10/97	12:30	[signature]	3/12/97	1440			
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
[signature]	3/11/97	8:00						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
James A. Cote	3/12/97	14:40	☐ YES ☐ NO		D750529	

ORIGINAL

Serial Number 66553

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

☐ 5102 LaRoche Avenue, Savannah, GA 31404 Phone: (912) 354-7858 Fax: (912) 352-0165
☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301 Phone: (904) 878-3994 Fax: (904) 878-9504
☐ 414 SW 12th Avenue, Deerfield Beach, FL 33442 Phone: (305) 421-7400 Fax: (305) 421-2584
☐ 900 Lakeside Drive, Mobile, AL 36693 Phone: (205) 666-6633 Fax: (205) 666-6696
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☐ 100 Alpha Drive, Suite 110, Destrehan, LA 70047 Phone: (504) 764-1100 Fax: (504) 725-1163

PROJECT REFERENCE	PROJECT NO.	P.O. NUMBER
BROWARD COUNTY ASR	103715.A0	

PROJECT LOC. (State)	SAMPLER(s) NAME	PHONE	FAX
FL	MARK SCHILLING	954-426-4008	954-698-6010

CLIENT NAME	CLIENT PROJECT MANAGER
CH2M HILL	PETER KWIATKOWSKI

CLIENT ADDRESS (CITY, STATE, ZIP) 800 FAIRWAY DR, STE 350 DEERFIELD BEACH, FL. 33441

MATRIX TYPE: AQUEOUS (WATER) / SOLID OR SEMISOLID / AIR / NONAQUEOUS LIQUID (oil, solvent, etc.)

REQUIRED ANALYSES — PAGE 3 OF 3

		ASBESTOS	DIOXIN (1613)	GROSS α	RADIUM 226	RADIUM 228	EXTRA
		—	—	HNO_3	HNO_3	HNO_3	SODIUM THIOSULFATE

☐ STANDARD REPORT DELIVERY
☐ EXPEDITED REPORT DELIVERY (surcharge)
Date Due: .....

SAMPLE DATE	SAMPLE TIME	SL NO.	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS SUBMITTED										REMARKS
3-12-97	1335		MW-1	1	4	1	1	1	4					

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
James G. Cote'	3/10/97	12:30	Mark G. Schilling	3-12-97	7440			
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
Mark G. Schilling	3/11/97	8:00						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
James G. Cote'	3/12/97	14:40	☐ YES ☐ NO		D750529	

ORIGINAL

APPENDIX K

Casing Pressure Test Data

CASING PRESSURE TEST

Project: BCOES ASR Demonstration Project
Well: Class V ASR Well (16-inch Diameter)
Driller: Diversified Drilling Corp. (Joe Schmidt)
Date: 1-Nov-96
Casing Depth: 995 feet bpl
Witnessed By: Mark Silverman, P.G./FDEP/West Palm Beach
Peter Kwiatkowski, P.G./CH2M HILL
Remarks: Cement plug at base of casing
Gauge: Ashcroft 200-psi gauge; 0.5 psi increments
Results: **4.81%** PASSED

Time	Elapsed Time (min)	Pressure (psi)	Differential Pressure (psi)	Comments
9:13 AM	0	**150.75**	0.00	Start test
9:18 AM	5	150.10	0.65	
9:23 AM	10	149.50	1.25	
9:28 AM	15	148.75	2.00	
9:33 AM	20	148.25	2.50	
9:38 AM	25	147.75	3.00	
9:43 AM	30	147.00	3.75	
9:48 AM	35	146.50	4.25	
9:53 AM	40	146.00	4.75	
9:58 AM	45	145.25	5.50	
10:03 AM	50	144.75	6.00	
10:08 AM	55	144.25	6.50	
10:13 AM	60	143.50	**7.25**	End test.
10:14 AM		143	0	Bleed off pressure
10:15 AM		108	1 gallon	
10:15 AM		77	1 gallon	
10:16 AM		44	1 gallon	
10:16 AM		12.5	1 gallon	
10:17 AM		0	0.3 gallon	4.3 gallons total

APPENDIX L

Pressure Gauge Calibration Certificate

DIVERSIFIED DRILLING CORPORATION

LETTER OF TRANSMITTAL

Job No. 960701

Date 9/6/96

P.O. BOX 290699 · Tampa, Florida 33687-0699

TO PETER KWIATKOWSKI
CH2M HILL, INC.

RE PRESSURE TEST GAUGE CERTIFICATION

WE ARE FORWARDING TO YOU:

- ☐ Estimates
- ☐ Plans
- ☐ Shop Drawings
- ☐ Copy of letter
- ☐ Proposals
- ☐ Prints
- ☐ Samples
- ☐ Change order
- ☐ Reports
- ☐ Under separate cover via: _____
- ☐ Specifications
- ☐ _____

NO. OF COPIES	DRAWING NO.	LAST DATED	CODE	DESCRIPTION
1		9/5/95		GAUGE CERTIFICATION

THESE ARE TRANSMITTED

- ☐ For approval
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DIVERSIFIED DRILLING CORPORATION

Per STUART C. ANDERSON

SALES SERVICE
SINCE 1932

Epperson & Company

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TO WHOM IT MAY CONCERN,

THIS IS TO CERTIFY THE FOLLOWING, GAUGE

TYPE Ashcroft Test Gauge 4½" 0-200psi #1211

IS ACCURATE TO 0.25 OF 1.00 PERCENT,

TESTED ON OUR DEADWEIGHT TESTER #38443, TRACEABLE

TO THE NATIONAL BUREAU OF STANDARDS.

EPPERSON & COMPANY

BY M. Wacker

DATE 9-5-96

APPENDIX M

Video Survey Summary and Video Tape

RECORD OF UNDERWATER TV SURVEY

Client:	Broward County Office of Environmental Services
Project:	ASR Demonstration Project
Well:	Class V ASR Well (16-inch Diameter)
Survey By:	Deep Venture Inc. (Jim Hayden)
Survey Date:	3-Dec-96
Total Depth:	1,189 feet
Witnessed By:	Mark Schilling/CH2M HILL
Reviewed By:	Peter Kwiatkowski, P.G./CH2M HILL
Remarks:	Camera zeroed at wellhead flange, 14 inches above pad level.

Depth (feet bpl)	Observations
32	Tubing Joint
72	Tubing Joint
116	Tubing Joint
158	Tubing Joint
200	Tubing Joint
242	Tubing Joint
283	Tubing Joint
325	Tubing Joint
367	Tubing Joint
409	Tubing Joint
450	Tubing Joint
492	Tubing Joint
535	Tubing Joint
576	Tubing Joint
618	Tubing Joint
660	Tubing Joint
702	Tubing Joint
744	Tubing Joint
785	Tubing Joint
827	Tubing Joint
869	Tubing Joint
911	Tubing Joint (with cement coating).
953	Tubing Joint (with cement coating).
990	Bottom of 16-inch casing; large washout below base of casing
1011	Centralizer in open hole
1081	Fracture
1095	Rugged borehole with several large fractures
1108	Color change in picture
1160	Cloudier picture
1189	Bottom filled in with loose sand.
1189	END OF SURVEY