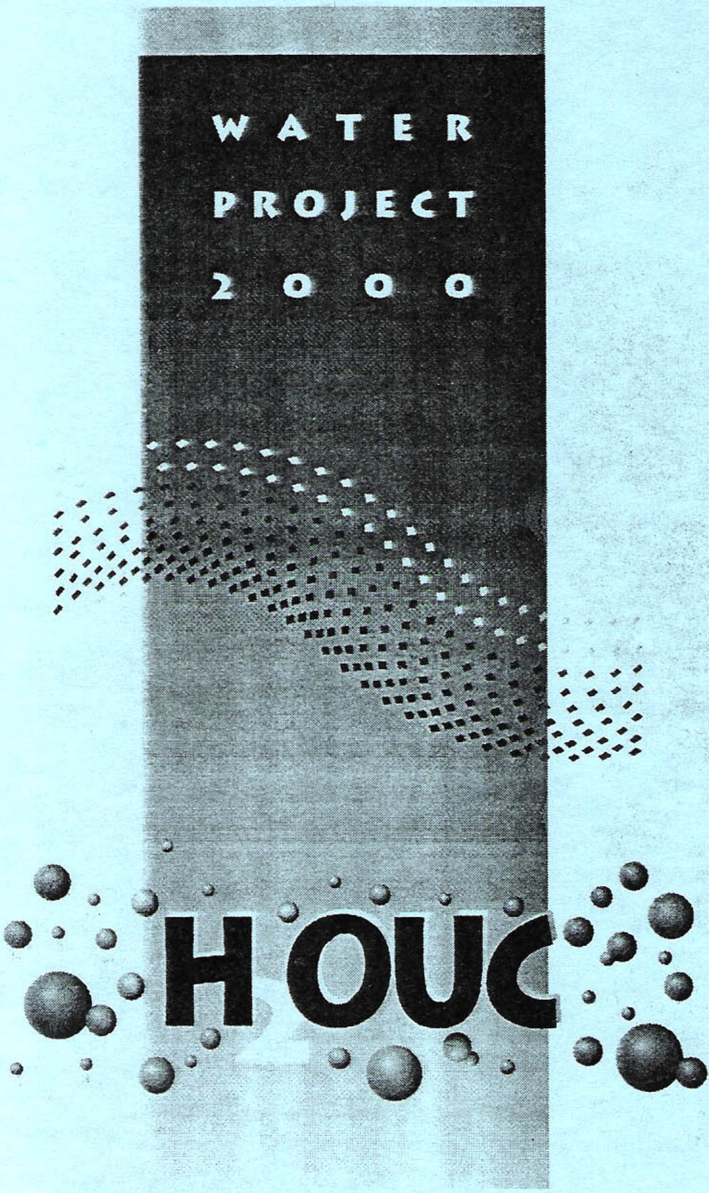
Construction and Testing of the Orange and Southeast Test Wells



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June 1996 *103634.E1*

Construction and Testing of the Orange and Southeast Test Wells

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Background

OUC's Water Quality Master Plan (WQMP) was prepared to lay the groundwork for modernization of the network of OUC WTPs that serve the greater Orlando area. Based on the results of the WQMP, ozone was selected to achieve efficient sulfide oxidation and improve finished water taste. Water Project 2000 was initiated carry out the WQMP strategies and to set a roadmap for OUC to modernize all its WTPs. The current proposed, system-wide OUC treatment process strategy includes: ozone for hydrogen sulfide (H_2S) oxidation and primary disinfection, free chlorine as a residual disinfectant, and pH adjustment for corrosion control.

The Southeast (SE) and Orange test well sites were selected because the southern portion of the OUC service area is projected for the greatest increase in demand and OUC currently has insufficient facilities to serve the southern service area. One of the main reasons for installing test wells was to evaluate water quality at these sites and determine the impact on treatment process implementation and cost, and to confirm aquifer production capability.

This report presents the salient findings of the drilling and testing program as they relate to the Water Project 2000, the potential use of the sites for development of potable water supply facilities, and as input data for the water use permitting process. The details and specific results of the drilling and testing program are documented in the attached report prepared by Barnes, Ferland and Associates, Inc. (BFA). The report is entitled *Results of Construction and Testing of the Southeast and Orange Test Wells for the Orlando Utilities Commission.*

Objectives

The scope of work for this project included installation of test wells at both the Orange and SE test well sites to:

1. Assess aquifer production capacity in each zone for well field design and water use permitting considerations.
2. Identify the depth of the 250 milligram per liter (mg/L) chloride concentration in the aquifer (or drill to 2,000 feet, whichever is more shallow) to assist in the water use permitting process.
3. Evaluate water quality in the Upper and Lower Floridan aquifer for treatability and facility requirements.
4. Recommend the aquifer to be targeted for the WTP supply at each site based on water quality, production capacity and cost to allow OUC to move forward in the Water Use Permitting process.

This report addresses these objectives by presenting a summary of well construction and testing activities, reviewing water quality data, and formulating recommendations regarding the selected treatment process for these locations.

Site Descriptions

Two sites were selected for installation and testing of test/observation wells. The site for the SE WTP test well is along Dowden Road east of the Orlando International Airport. A map showing the location of the SE test well is provided in Figure 1. The SE test well was drilled at the planned SE WTP. The site for the Orange test well is at an OUC electrical substation along the Florida East Coast railroad spur used to deliver coal to the OUC Stanton Energy Plant, south of Taft, Florida. The Orange test well was drilled for the planned Boggy Creek WTP. The location of the Boggy Creek WTP has not been determined at this time. A map showing the location of the Orange test well is provided in Figure 2.

Well Construction and Testing Progress

A well construction and testing plan was developed by OUC and CH2M HILL then reviewed and approved by the South Florida Water Management District (SFWMD) to meet the objectives of the test well program. The overall goals of the program were to primarily collect water quality data to evaluate the water treatment process and collect data on the position of the 250 mg/L chloride concentration for water use permitting; and secondarily to evaluate the production capability of the Upper and Lower Floridan aquifers and complete the test wells as Lower Floridan aquifer monitoring wells to allow for long-term observation of groundwater levels and water quality. Gantt charts of construction and testing activities for both sites is provided in Figure 3. An overview of the construction process is as follows:

- 24-inch diameter surface casing was installed into clay, of sufficient composition to seat casing, at 80 to 100 feet in depth. The purpose of the casing is to stabilize the bore hole to allow for more efficient drilling. Formation samples were collected at 10-foot intervals over the entire depth of the well to describe the geology and assist in the selection of casing setting depths.

- 16-inch diameter casing was installed in to limestone, of sufficient composition to seat casing, at the top of the Floridan aquifer. The depths of the casings are 200 feet for the Orange well and 230 feet for the SE well.

- 16-inch diameter bore hole was drilled from the bottom of the casing to approximately 1,100 feet in depth. Groundwater samples were collected from the drill return at 10-foot intervals over the entire interval of the Floridan aquifer to evaluate changes in water quality with depth and to identify the depth to the 250 mg/L chloride concentration, if that concentration was encountered. Measurements of chloride concentration were made using a field test kit and specific conductance measurements were collected using a field test meter.

- Aquifer performance testing, static and pumped geophysical logging and groundwater sampling were performed over the interval from the bottom of the casing to approximately 1,100 feet.

- 8-inch diameter casing was installed to segregate the Upper Floridan aquifer from the Lower Floridan aquifer. The casing was placed from approximately 50 feet above the bottom 16-inch casing to 1,100 feet in depth. The casing was terminated well below ground surface to allow for the installation of larger test pumps to stress the Lower Floridan aquifer to a greater degree than could be done if the 8-inch casing extended to ground surface.
- 8-inch diameter bore hole was drilled from 1,100 feet to approximately 1,400 feet for aquifer performance testing and groundwater sampling. The open-hole interval of 1,100 to 1,400 feet aligns with the typical OUC production interval.
- Drilling of the 8-inch diameter bore hole was continued to 2,000 feet to identify the depth of the 250 mg/L chloride concentration, if it was encountered.
- Static and pumped geophysical logs were conducted to evaluate the general hydrogeology and water bearing characteristics of the wells.
- The SE test well was left open to 2,000 feet to allow for additional drilling and testing to be performed on the behalf of the St. Johns River Water Management District. The Orange test well was backfilled with cement grout and gravel from 2,000 feet to 1,435 feet to allow monitoring of the typical Lower Floridan aquifer production interval.

Southeast Site

Construction began at the SE site on June 19, 1995 when mobilization of the drilling equipment to the site was initiated. Actual drilling began on July 10, 1995. The Upper Floridan aquifer step drawdown test was conducted October 12-13, 1995 and geophysical logging was conducted on October 16, 1995. The well was cased with 16-inch diameter casing to a depth of 230 feet with a 16-inch diameter open hole from 230 to 1,090 feet.

The Lower Floridan aquifer step drawdown test was conducted November 28-29, 1995 and geophysical logging was completed December 15, 1995. The configuration of the well was different for the aquifer performance testing than for the geophysical logging. For the performance testing, the open hole interval of the well was from 1,090 to 1,410 feet. For geophysical logging, the well had an open bore hole from 1,090 feet to 2,000 feet deep.

The interval of 1,090 to 1,410 feet corresponds to the typical production zone for OUC's Lower Floridan aquifer wells. Water collected from the test would be most representative of an anticipated Lower Floridan aquifer production well.

The well was drilled to 2,000 feet without encountering 250 mg/L chloride water. The chloride concentration of a bottom hole water sample was 45 mg/L. Water quality data (chloride concentration and specific conductance measurements) from the last two water samples (1,990 and 2,000 feet) indicated mild degradation of water quality.

Drilling was delayed over the period of August 17 through September 26, 1995 because loose formation materials caved into the well. This occurred as the driller was reaming the pilot hole to 16 inches in preparation for Upper Floridan aquifer testing, groundwater sampling and geophysical logging. The pilot hole was advanced to 1,100 feet and the reaming was advanced to approximately 315 feet in depth when the caving was encountered. The condition was overcome by placing cement grout over the interval of approximately 330 to 275 feet and drilling through the grout after it cured. The cement grout infiltrated the formation and sealed off the source of the caving material to allow continuation of the reaming process.

Orange Site

Construction began at the Orange site on July 17, 1995 when mobilization of the drilling equipment to the site was initiated. Actual drilling began on July 26, 1995. The Upper Floridan aquifer step drawdown test was conducted October 3 through 13, 1995 and geophysical logging was conducted on October 14, 1995. During the pumping test, an Upper Floridan aquifer well at the substation was monitored for water level changes. The well was cased with 16-inch diameter casing to a depth of 200 feet with a 16-inch diameter open hole from 200 to 1,100 feet.

The Lower Floridan aquifer step drawdown test was conducted January 12 through 14, 1996 and geophysical logging was completed January 23, 1996. The configuration of the well was different for the aquifer performance testing than for the geophysical logging. For the performance testing, the open hole interval of the well was from 1,100 to 1,400 feet. For geophysical logging, the well had an open bore hole from 1,100 feet to 2,000 feet deep.

The well was drilled to 2,000 feet without encountering 250 mg/L chloride water. The chloride concentration of a bottom hole water sample was 15 mg/L.

Drilling was delayed over the period of September 3, 1995 through January 7, 1996 because drilling tools were dropped into the well. At that time the pilot hole was advanced to 1,100 feet and the bore hole was being reamed to 16 inches in diameter in preparation for the pumping test, water sampling and geophysical logging. The reaming was advanced to 702 feet. Numerous attempts were made to retrieve the tools with no success.

The driller presumed that the tools were spinning on the loose drill cuttings that had fallen into the pilot hole as a result of the reaming process, and therefore there was not a solid platform for the tools to sit on to successfully retrieve them. A decision was made by the driller on September 11, 1995 continue the reaming and push the tools ahead of the drilling bit until virgin formation was encountered at approximately 1,100 feet. After this level was reached, the testing, sampling and logging was performed on the Upper Floridan aquifer. Attempts to retrieve the tools continued after the testing was completed.

Additional attempts to retrieve the tools were unsuccessful. On or about December 11, 1995 the driller decided to mill or drill through the drilling tools. Periodically a small quantity of cement grout was placed on the drilling tools to stabilize them and therefore assist in the milling process. Milling concluded on January 7, 1996 when the drill return from the milling process was free of metal shavings.

Aquifer Production Characteristics

Single well aquifer performances tests (APT) were conducted on the Upper Floridan aquifer at the SE site and on the Lower Floridan aquifer at the SE and Orange sites. A dual -well APT was performed on the Upper Floridan aquifer at the Orange site because an existing well was available to monitor during the test. The data that are obtained from a dual-well, or multiple-well, test can provide additional data to evaluate aquifer transmitting properties because a larger area of the aquifer is monitored using a dual- or multiple-well APT.

For a single-well APT water is pumped from a well and the drawdown of water level is measured in the same well. The drawdown in the pumped well is attributed to two factors: drawdown of the water level in the aquifer and loss of hydraulic head due to friction in the well. When performing single well tests, the well is pumped at multiple rates in order to provide data to distinguish between aquifer losses and casing friction losses.

For a multiple-well APT water is pumped from a well and the drawdown of aquifer water levels is measured at one or more observation wells. The drawdown data from the observation well(s) are indicative of aquifer hydraulic characteristics in the vicinity of the test.

Southeast Site

The results of the Upper and Lower Floridan aquifer single-well APTs performed on the SE test well indicate that either zone penetrated by the test well is capable of producing large quantities of water with little drawdown of aquifer water levels. The value of greater than 500,000 ft^2/day for each of the zones was concluded as reasonable aquifer transmissivities based on the results of the tests.

This transmissivity value indicates that there is adequate production capability to meet the projected demands. Well capacities could be greater than 5 mgd for either aquifer, however permitting considerations may constrain OUC from installing wells of this capacity.

The capacity of the supply wells could be greater than 5 mgd, however permitting considerations may preclude wells of this capacity.

Orange Site

For the Upper Floridan aquifer APT at the Orange site, an existing water supply well for the OUC electrical substation was used to monitor water levels during the test. This well is approximately 275 feet west of the test well. The existing well is cased to 176 feet in depth with cast iron casing and completed open hole to 450 feet. The well completion report is provided in BFA report.

The results of the Upper and Lower Floridan aquifer single-well APTs performed on the SE test well indicate that either zone penetrated by the test well is capable of producing large quantities of water with little drawdown of aquifer water levels. However, based on the APTs the production capability of the Upper Floridan aquifer was less than the Lower Floridan and less than either zone at the SE site. Aquifer water level data were analyzed from both the pumping well and observation well for the Upper Floridan aquifer APT. The results of the two analyses for Upper Floridan provided consistent results deriving transmissivity values of approximately 93,000 ft^2/day and 96,000 ft^2/day for the dual-well and single-well tests, respectively. A value of approximately 100,000 ft^2/day will be used for the purposes of evaluating design considerations for the Upper Floridan aquifer at the Orange site. The value of 500,000 ft^2/day for the Lower Floridan aquifer was concluded as value that provided a reasonable aquifer transmissivity based on the results of the tests.

This transmissivity values indicates that there is adequate production capability to meet the projected demands. The lower production capacity of the Upper Floridan means that the installed wells should be smaller relative to the Lower Floridan and either zone at the SE sit. Well capacities could be greater than 3 mgd for the Upper Floridan aquifer and greater than 5 mgd for the Lower Floridan aquifer, however permitting considerations may constrain OUC from installing wells of this capacity.

Projected Water Demands

The projected water demands and WTP sizes for the two planned WTPs are provided in Table 1.

TABLE 1.
OUC Projected Water Demands and Assumed WTP Capacities for the Planned SE and Boggy Creek WTPs

	Projected ADF Water Demand (mgd)	Projected MDF Water Demand (mgd)	Assumed WTP Average Day Design Flow (mgd)	Assumed WTP Maximum Day Design Flow (mgd)
SE WTP	6.2	9.4	7	10
Boggy Creek WTP	11.9	14.9	12	15

Well Field Design Considerations

Two sets of considerations need to be addressed to design, and permit a well field: technical and institutional. This project was focused on the collection of the technical data to develop well fields at the two sites. The primary factor that can be evaluated with the testing results is the effect of well spacing on drawdown in the production wells. The production characteristics of the Upper or Lower Floridan aquifer at either site are sufficiently great that they should not be the limiting factors in designing and permitting well fields at the sites.

Evaluation of the effects of well field development on nearby existing legal users of water is beyond the realm of the project. These are institutional considerations that are evaluated during the permitting process. Factors considered to evaluate the impacts are as follows:

- projected capacity of the well fields (which are available)
- the capacities and the numbers of individual wells needed to meet the projected demands
- spacing of the wells

Fewer, but higher capacity spaced closely together wells can have the impact of increased aquifer drawdown and increase the potential for water quality degradation. More but lower capacity wells spaced further apart allows the hydraulic stress on the aquifer system to be more broadly distributed with the effect of lowering the potential for water quality degradation. The goal is to develop a reasonable balance between the number of wells needed to be installed and maintained to meet customer demands and the potential for lowering aquifer water levels and water quality degradation.

Two well performance factors need to be considered to evaluate pump selection and setting depth: aquifer drawdown and head loss in the casing due to friction. Calculations were performed to evaluate various drawdown affects on a range of pumping rates and a range of distances from a pumped well using both aquifer transmissivity values from the field testing. The purpose of the analysis is to provide a tool to evaluate well interferences that would impact pump selection and operating characteristics, once individual well capacities and well spacings have been determined by OUC's permitting consultant. Average day withdrawals were used for this analysis. The pumping rates were 2.5 3, 3.5, and 5 million gallons per day (mgd). The analyses were conducted over a distance range of 1 foot to 10,000 feet. The 1-foot distance corresponds to aquifer drawdown at the pumping well. The analysis was expanded to 10,000 feet to accommodate flexibility in well spacing distances.

Fig 4 is a well log and a map

The results corresponding to an aquifer transmissivity of 500,000 ft^2/day are presented in ? Figure 4. These results should be for completing the wells into the Upper and Lower Floridan at the SE site and into the Lower Floridan at the Orange site. As can be seen from the graph, approximately 5 feet of drawdown is aquifer anticipated at the pumping well while pumping a single well at 5 mgd. This was the maximum drawdown calculated for the analysis. Well yields exceeding 5 mgd appear achievable.

The collective drawdowns at a point resulting from pumping multiple wells in a well field are additive. For example, if the drawdown from a pumping well is 5 feet at some location and the drawdown from another pumping well at that same location is 1 foot then the collective drawdown that can be measured at that point is 6 feet. This concept can be used to evaluate the drawdowns at the pumping wells within a well field.

The results corresponding to an aquifer transmissivity of 100,000 ft^2/day are presented in Figure 5. These results should be for completing the wells into the Upper Floridan at the Orange site. As can be seen from the graph, approximately 11.5 feet of drawdown is aquifer anticipated at the pumping well while pumping single well at 5 mgd. This was the maximum drawdown calculated for the analysis. Well yields exceeding 3 mgd appear achievable.

Water level decline in the well due to friction was also calculated using Manning's equation for design considerations for pump operating characteristics and setting depths. Assumptions made for the calculations are provided in Table 2. The results of the calculations are presented in Figure 6. The results indicate that approximately 6 feet of head loss is to be expected if the wells are completed into the Lower Floridan aquifer while pumping at 5 mgd.

TABLE 2.
Assumptions for Head Loss from Friction

Parameter	Assumption
Casing diameter	20 inches
Casing length	200 feet (Upper Floridan production wells) 1,100 feet (Lower Floridan production wells)
Roughness (Manning's n)	0.017 (welded steel pipe)

Water Quality

Water quality samples were collected during the four APTs to assess the impact on treatment process performance and facility sizing. The samples were analyzed for Primary and Secondary Drinking Water Standards, H_2S, bromide, carbonate/bicarbonate, TOC and general water quality parameters. The samples were collected at the end of the tests to receive samples most representative of production water quality that could have been collected during the tests. In short, none of the organic constituents exceeded the Primary or Secondary DWS and will not be discussed further. Discussion of the findings of other pertinent water quality results follow. A summary of the most pertinent water quality results are presented in Table 3. The following water quality data were added to the table for comparison purposes:

- a grab sample from 2,000 feet in the SE test well
- Lake Nona WTP
- Sky Lake WTP
- Average of OUC's system

Southeast Site

Upper Floridan

Hardness and alkalinity were both about 200 mg/L in the Upper Floridan at the site. This is approximately 75 mg/L harder than OUC's other water supply wells. The H_2S was approximately 2.5 mg/L; fairly similar to what is found at other OUC WTP sites.

Color and TOC values in the samples collected were 16 cpu and 3.7 mg/L, respectively. These values are higher than those found in other existing OUC wells. These values compare well with color and TOC from the Lake Nona Development WTP, Table 3.

Lower Floridan

The color and TOC values in the Lower Floridan sample were approximately 5 cpu and 2 mg/L, respectively. These values are lower than the values for the upper Floridan and similar to most of OUC's established Lower Floridan wells. The hardness and alkalinity was about the same as the Upper Floridan, moderately higher than the average

TABLE 3.
Comparison of Selected Raw Water Quality

Parameter	Southeast Site			Orange Site		Existing WTPs		
	Upper Floridan	Lower Floridan	Grab Sample from the bottom of the hole	Upper Floridan	Lower Floridan	Current Lake Nona WTP	OUC Sky Lake WTP	Average Other OUC WTPs
Approximate Production Interval	230 - 700	1,100 - 1,410	2000	201 - 700	1,100 - 1,400	250 - 600	920 - 1,400	1,000 - 1,400
H_2S (mg/L)	1	5	2.5	1	5	0.9 - 2.5	2.4	2.0
T. Hardness (mg/L)	196	212	335	218	180	156	131	128
Alkalinity (mg/L)	196	190	230	195	130	168	118	116
TDS (mg/L)	270	290	ns	286	240	200	164	154
Sulfate (mg/L)	2	70	ns	13	61	4	12	9
Color (pcu)	16	< 5	ns	11	5	18	6	9
TOC (mg/L)	3.7	2.1	ns	2.9	3	3.8	1.7	1.7
Bromide (mg/L)	0.020	0.020 - 0.045	0.045	< 0.020	0.024	0.020	< 0.020	< 0.020
Langelier Index at pH 8	0.76	0.84	ns	0.80	0.49	0.63	0.44	0.36
CCPP at pH 8 (mg/L)	24.7	28.6	ns	26.5	9.58	16.8	7.45	5.57

ns = Not sampled.
* Field analyses.
CCPP = Calcium Carbonate Precipitation Potential

for OUC's WTPs. The most significant difference in water quality, in terms of treatment considerations, between the Upper and Lower Floridan was the H_2S concentration, which was 5 mg/L for the Lower Floridan and 1 mg/L for the Upper Floridan. This concentration is higher than the Upper Floridan and the other OUC Lower Floridan wells.

Orange Site

Upper Floridan

Water quality at this site was similar to that for the SE site. The TOC in the Upper Floridan at the Orange site was about 3 mg/L, compared with 3.7 mg/L for the SE. The color in the Upper Floridan at the Orange site was 11 cpu, compared with 16 cpu for the SE site. Upper Floridan water at this site was slightly harder than water at the SE site; 218 mg/L total hardness compared to 199 mg/L at the SE site. The H_2S concentration was about 1.0 mg/L.

Lower Floridan

The Lower Floridan aquifer water quality at the Orange site was comparable with the Upper Floridan for TOC and color. TOC in the Lower Floridan was 3 mg/L, and the color was 5 cpu. As with the SE site, the H_2S in the Lower Floridan was about 5 mg/L. The most significant difference in water quality, in terms of treatment considerations, between the Upper and Lower Floridan was the H_2S concentration.

The hardness and alkalinity were slightly less in the Lower Floridan than the Upper Floridan at this site. In the Upper Floridan the total hardness was 218 mg/L while the Lower Floridan total hardness was 180 mg/L. The alkalinity the in Lower Floridan sample was 130 mg/L compared with the Upper Floridan at about 200 mg/L.

Impact of Water Quality on Water Treatment

With respect to water quality at these sites, there are essentially five constituents that could have a significant impact on the selected treatment process or the ability of that process to meet future water quality regulations. These constituents are: H_2S, hardness, bromide, TOC and color.

Hydrogen Sulfide

H_2S is the constituent that has the most impact on treatment cost. The H_2S level in the Upper Floridan at both sites (1.0 mg/L) is at the upper end of the range currently being treated by OUC. However, the H_2S level in the Lower Floridan at both sites (5.0 mg/L) is about twice as high as the typical maximum for the OUC system. This higher concentration can still be treated with ozone, though it will result in a larger capital outlay and greater operation and maintenance (O&M) costs.

Hardness

The hardness value of approximately 200 mg/L in both the Upper and Lower Floridan aquifer at the test well site is significantly higher than the average seen at current OUC facilities. The increased hardness can lead to increased detergent use, spotting of dishes, and scaling in hot water heaters. There is no state or federal standard for hardness, therefore softening is not required from a regulatory standpoint.

Unless this water is softened, higher hardness levels at these sites may cause OUC to seek a modification to its current approved Lead and Copper Rule water quality standards. This will be further discussed later in this section.

Bromide

Bromide can react with ozone to form bromate which is currently scheduled to be regulated under the Disinfection By-products Rule at 10 μg/L. Currently, the bromide concentrations in the wells at the existing OUC facilities are all < 20 μg/L which is the current, best-achievable detection limit. The bromide concentrations at the SE test well were 20 μg/L and 20 to 45 μg/L from Upper and Lower Floridan aquifer, respectively. For the Orange test well the bromide concentrations were < 20 μg/L and 24 μg/L, respectively for the Upper and Lower Floridan aquifer. These data are presented in Table 3.

Based on the results of previous studies elsewhere in Florida, the ozonation of water with bromide has shown a bromate formation to bromide concentration of approximately 1:10. Therefore, it does not appear at this time that bromate formation will be a concern for OUC regardless of the site selected or whether the Upper or Lower Floridan is used. However, the bromate formation potential at these sites should be verified. A two-step testing process is recommended:

- Collect water from the SE test well completed into the Lower Floridan, ozone the water at different ozone doses and measure the bromate concentration. The SE Lower Florida was selected as it exhibited the highest bromide concentration.
- Spike the raw water from the Upper Floridan at the SE test well with varying bromide concentrations up to approximately 100 μg/L, and measure bromate formation at different ozone doses.

TOC

The TOC concentrations in the Upper and Lower Floridan at both sites are greater than the average of 1.9 mg/L found in the established OUC water system. Higher TOC values typically correspond to higher disinfection by-product (DBP) formation. The formation of DBPs depends on several factors which include TOC concentration and chlorine concentration and contact time. The impact of increased TOC concentration on the ability of the overall OUC system to meet future Total Trihalomethane (TTHM) and Haloacetic Acid (HAA5) standards with free chlorine can not be determined until the WTP goes on-line.

However, the water for the planned SE WTP should be evaluated for the potential for THM and HAA formation to determine the difference in THM and HAA formation of water with higher TOC concentrations compared to the current OUC water supply. Since the test well is now completed through the Upper Floridan aquifer, samples cannot be collected. However, water from the Lake Nona Development WTP has similar TOC concentrations and can serve as a reasonable surrogate sampling location. It is recommended that this water be sampled, ozonated, and subjected to chlorine demand, THM and HAA formation potential analyses.

Color

The color in the Upper Floridan at the SE test site was 16 cpu which is slightly higher than the secondary standard of 15 cpu. However, this should not impact process selection since some supplemental color destruction will occur as a result of ozonation and residual chlorination.

Impact of Water Quality on Future Compliance with the Lead and Copper Rule

To comply with the Lead and Copper Rule, OUC will achieve copper corrosion control through pH adjustment in its general water system. The targeted, FDEP-approved range is pH 7.7 to pH 8.3 with a midpoint of pH 8. A discussion of the chemistry behind using pH adjustment for corrosion control can be found in *OUC's Corrosion Control Engineering Report, 1993*.

Corrosion indices were presented in Table 3 for water from the SE and Orange sites and they showed that at pH 8, the water could potentially precipitate excess amounts of calcium carbonate due to the higher hardness in these waters. Based on the precipitation indices, the recommended pH for these waters would be pH 7.3 to pH 7.6. Unless this water is softened it is likely that once the WTPs are connected to the rest of the OUC system, a modification in the operating parameters for this WTP will be required.

Upper vs. Lower Floridan Aquifer

Aquifer Vulnerability

It has been OUC's past practice to use the Lower Floridan whenever possible to minimize the potential for source contamination. These two new planned WTPs are in settings that differ significantly from many of the other OUC WTPs. The primary factors to consider are drainage patterns and the hydrogeologic setting.

The natural and modified drainage pattern in the metropolitan Orlando area is characterized as internal drainage. This means that storm water runoff flows overland to lakes which serve as storage basins for water to infiltrate into the aquifer system. Internally drained systems typically do not have surface features (e.g. streams) to move storm water runoff out of the area. To accommodate growth and the increased quantity of storm water runoff associated with growth, numerous drainage wells have been installed to direct runoff from lakes and roadways into the Upper Floridan aquifer. This drainage can also act as conduits for contaminated storm water to be transferred rapidly into the Upper Floridan aquifer. This is the principal reason that OUC's well fields have been comprised of Lower Floridan aquifer wells - to avoid potential contamination as a result of drainage well discharges.

In the vicinity of the SE and Orange sites the morphology shows a greater number of streams and wetlands, and significantly fewer lakes. This is typical of surface water drainage patterns where storm water is routed away from an area through surface water systems.

The drainage patterns and hydrogeologic setting are closely tied together. The internally drained areas rely on direct infiltration of storm water, typically through overland flow to lakes then infiltration into the groundwater system. As a result the recharge potential the Floridan aquifer system has been enhanced through thousands of years of this process, and the metropolitan Orlando area is designated as a high recharge area. The potential for contamination of the Upper Floridan aquifer here is relative high and is the risk is increased by the presence of drainage wells.

In contrast, the area of the SE and Orange sites the presence of major streams and wetlands is indicative of lower potential for infiltration of surface water into the groundwater system. The area south and southeast of Orlando is designated as a low recharge area. The potential for contamination of the Upper Floridan aquifer is lower, and there are no drainage wells in these areas.

The vulnerability of the Upper Floridan aquifer near the SE and Orange sites appears to be low. The vulnerability of the Lower Floridan would appear to be lower by virtue of the greater depth to the aquifer.

Production Capability

Both the Upper and Lower Floridan aquifer are highly productive at both sites. The Upper and Lower Floridan aquifer at the SE test well and the Lower Floridan aquifer at the Orange test well were immeasurably high. The production potential Upper Floridan aquifer at the Orange test well is lower than the other zones but is still is quite high and can accommodate OUC's projected needs. The Upper Floridan at the Orange site may require greater well spacings and lower capacity wells.

Permitting Potential

The SFWMD has recently declared that the south Orlando/southern Orange County area is not a competitive water use area. Therefore, permitting of well fields into the Upper or Lower Floridan aquifer should be similar.

Nearby municipal well fields completed into the Upper Floridan aquifer are well fields for the Orange County Public Utilities Division (OCPUD) and the City of Cocoa. Well fields for the OCPUD Meadow Woods, Hunters Creek and Vistana WTPs, serving areas southwest of Orlando, are currently planned for consolidation into OCPUD Southern Regional well field, which is planned to be completed into the Lower Floridan aquifer. OCPUD is also constructing the Eastern Regional WTP and well field to serve areas east of Orlando. The water supply wells are being completed into the Upper Floridan aquifer. The City of Kissimmee and the City of St. Cloud also use water supply wells completed into the Upper Floridan aquifer.

Nearby municipal well fields completed into the Lower Floridan aquifer are the planned OCPUD Southern Regional well field and OUC's well fields. The City of Kissimmee has one Lower Floridan well for its North Bermuda WTP.

The potential for an indirect-reuse system utilizing the Floridan aquifer, in the vicinity of the CONSERV I WWTP, is receiving attention. Currently it appears more likely that the Lower Floridan aquifer would be a more permissible receiving body than the Upper Floridan.

Cost for Water Treatment

Currently, the treatment process for the Southeast has not been selected. Although the other OUC plants are using ozone followed by chlorine for treatment, OUC may choose to soften this water for aesthetic reasons due to the higher hardness values. This decision has not yet been made and will be an issue for further analysis. If OUC does choose to soften, the difference in cost of facilities to treat water in the upper vs. lower will not be that significant. However, if ozone is used, the cost for ozone treatment of Upper Floridan aquifer water is significantly lower than the cost for ozone treatment of Lower Floridan aquifer water. Therefore, cost can not be factored into the decision until a treatment process decision has been made.

Recommendations

The hydraulic characteristics of the Upper and Lower Floridan aquifer are capable of supplying the large quantities of water the OUC is accustomed to enjoying. CH2M HILL recommends that minimum individual well capacities of 3 to 3.5 mgd be used. The number and capacity of the wells at each plant should be selected to best match planned operations to optimize pump cycling, and to provide OUC flexibility in WTP operations.

Both the water from the Upper and Lower Floridan aquifer at the SE and Orange test well sites can be treated to meet OUC's water quality goals and compliance with the regulations. However, since a water treatment process decision has not yet been made, cost can not be factored into the final decision. Based on these issues, OUC should perform the following activities to determine how to best serve the Southeast area:

1. Proceed with obtaining a CUP for the Upper Floridan aquifer at both locations for the required capacities. If the decision is made at a later date to go to the Lower Floridan, it will likely be easier to change the permit to the lower Floridan than to permit the Lower as this time and change to the Upper Floridan.
2. Proceed with an evaluation of the following treatment process:
   - Lime Softening
   - Membrane Softening
   - Ozonation

   The lime softening and membrane softening evaluations should be paper studies to determine costs, impact on operations, residuals disposal, etc. The ozone evaluation should consist of the following components:

   - Determine the bromate formation potential with varying ozone doses in water from the Lower Floridan Aquifer.
   - Determine the bromate formation potential of water from the Upper Floridan aquifer by spiking the raw water with varying concentrations of bromide from 25 $\mu g/L$ up to 100 $\mu g/L$.
   - Ozone raw water from the existing Lake Nona WTP and measure the chlorine demand, THM formation potential, and HAA formation potential.

3. Evaluate the potential to revise the Lake Nona and Southeast area from existing WTPs or with a joint WTP with Orange County in the Southern Region in case treatment is cost prohibitive or difficulties with permitting.

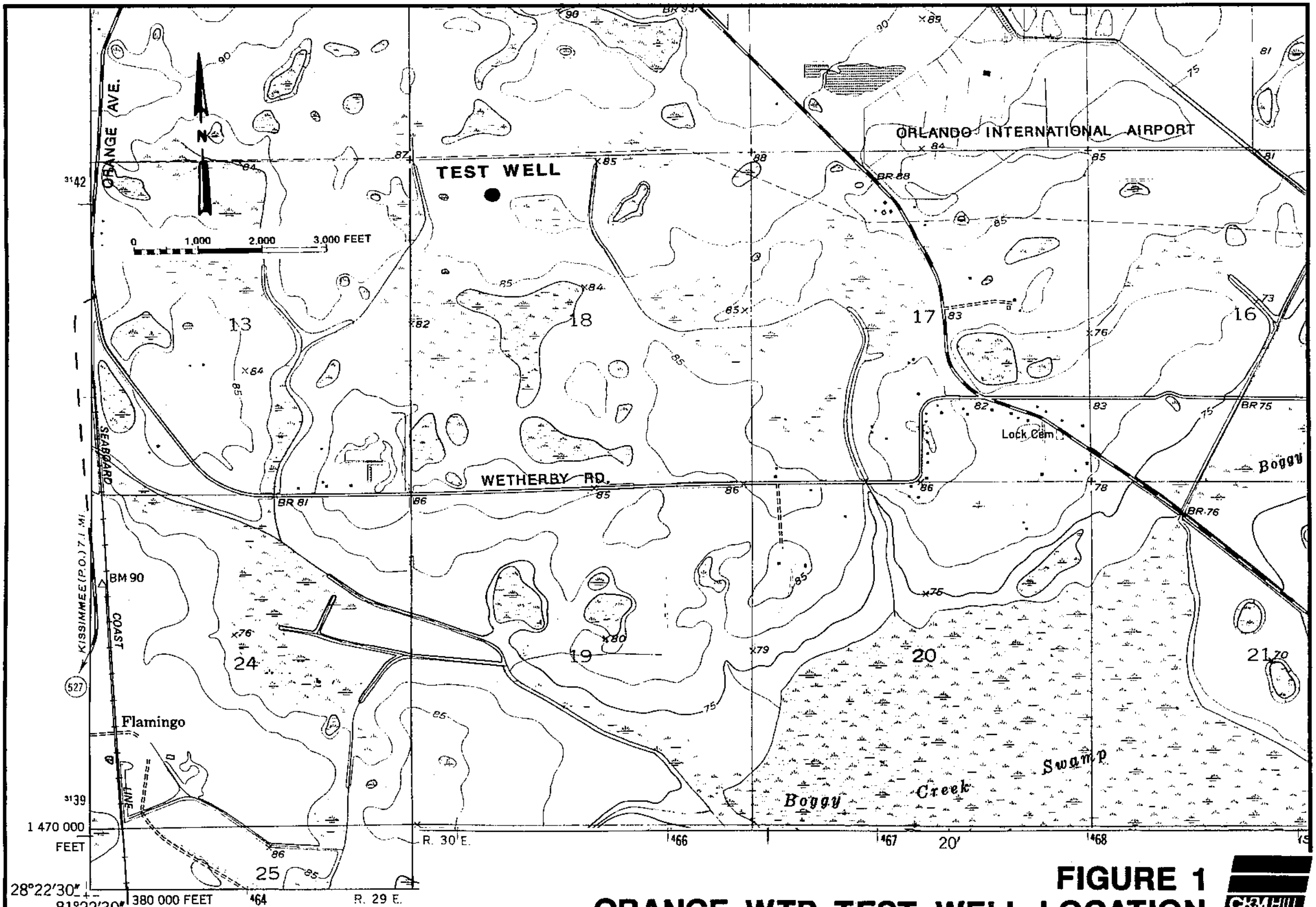

FIGURE 1
ORANGE WTP TEST WELL LOCATION

CH2M HILL

OVERLAY IDENTIFICATION
PROJ NO.
CONTRACT
COMPOSITE
OVERLAY
PMS/%
DESIGNED BY
DRAWN BY
CHECKED BY

OVERLAY IDENTIFICATION	COMPOSITE						
PROJ NO. [redacted]	OVERLAY						
CONTRACT [redacted]	PMS/%						

DESIGNED BY	DRAWN BY	CHECKED BY
1	1	1
2	2	2
3	3	3

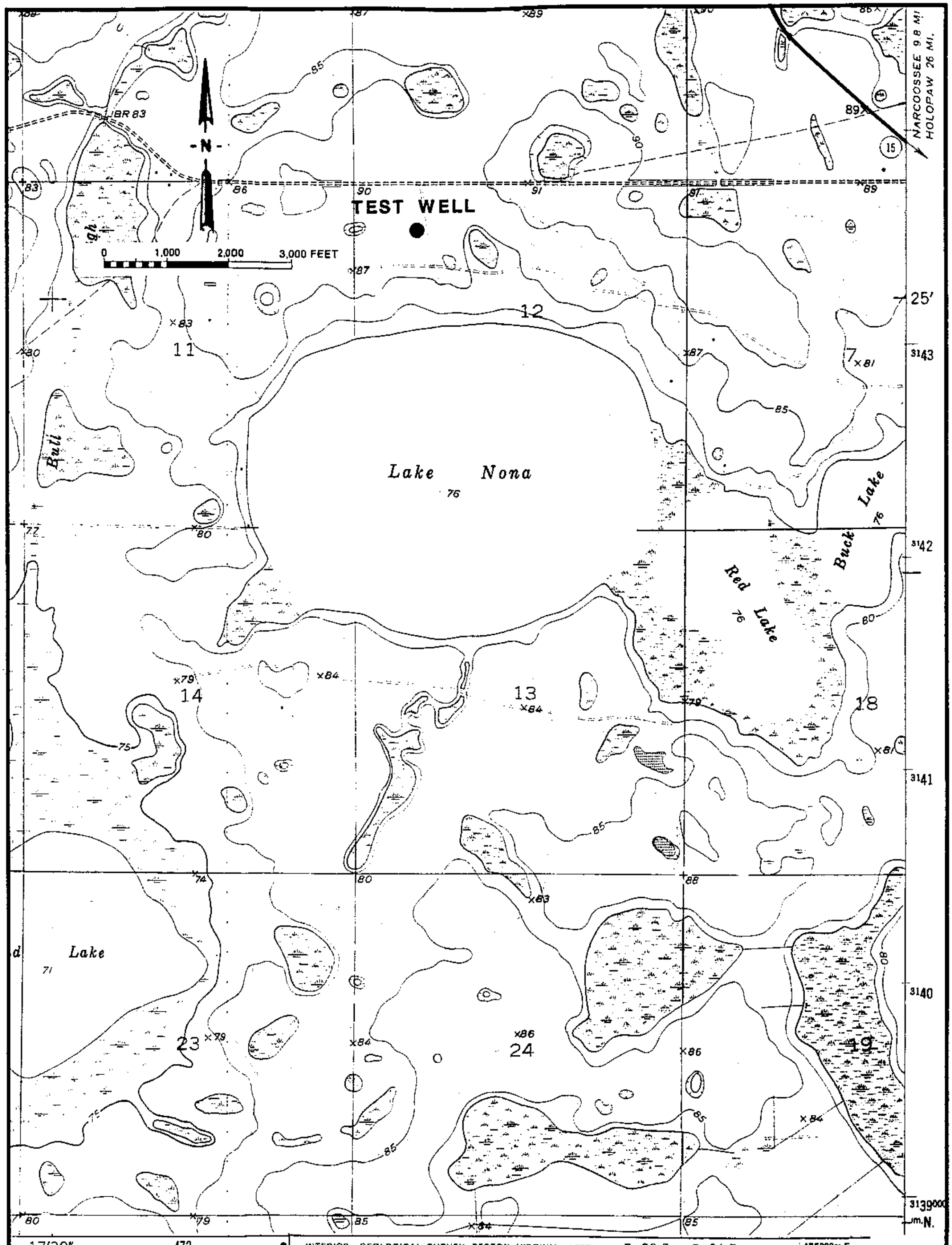

FIGURE 2
SE WTP TEST WELL LOCATION

CH2M HILL

RESULTS OF:

CONSTRUCTION AND TESTING OF THE SOUTHEAST AND ORANGE TEST WELLS ORLANDO UTILITIES COMMISSION

Prepared for:

CH2M Hill
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Orlando, Florida 32803

June, 1996

CERTIFICATION

I have reviewed this document, entitled Results of Construction and Testing of the Southeast and Orange Test Wells, Orlando Utilities Commission and certify that the investigation was conducted in accordance with accepted practices and sound hydrogeologic principles.

Joel O. Kimrey
Joel O. Kimrey, P.G.
Registration No. 1014
Barnes, Ferland and Associates, Inc.

20 JUNE, 1996
Date

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Section 1.0
Introduction

1.0 INTRODUCTION

1.1 Purpose and Scope

The Orlando Utilities Commission (OUC) plans to construct two new water treatment plants (WTP) to meet projected customer demands that will develop with anticipated growth in the southeast and southern parts of their service area. Site and area specific data for aquifer potential and groundwater quality are required for proper well field siting and design, water treatment process selection, and to obtain a Water Use Permit (WUP) from the South Florida Water Management District (SFWMD). On December 20, 1994, Barnes, Ferland and Associates, Inc. (BFA) was hired by CH2M HILL to perform a hydrogeological analysis of Upper and Lower Floridan Aquifer System relative to the planned water use. In performing these services, BFA implemented a program of test drilling, geophysical logging, hydraulic testing, water quality sampling and observation well construction at each site, with specific objectives to:

- Evaluate the production capability of the upper and lower zones of the Floridan aquifer;
- Evaluate the water quality of the upper and lower zones of the Floridan aquifer with regard to treatment process selection;
- Complete the test wells to lower Floridan aquifer observation wells for long-term water quality and water level monitoring;
- Provide data in support of the existing WUP application.

This report describes the program of field data collection, and presents all pertinent related interpretations and data.

1.2 Test Well Site Locations and Descriptions

The sites at which data were collected to accomplish the above objectives are herein referred to as the Southeast Test Well Site and the Orange Test Well Site (Figure 1). Each site is described separately below:

<u>Southeast Test Well Site</u>:

Figure 2 shows the location of the Southeast Test Well Site along Dowden Road east of Orlando International Airport. The test site is located on property owned by the Lake Nona Development Corporation. The test/observation well lies in Section 12, Township 24 and Range 30. Average site elevation is about 87 feet above mean sea level. Land cover around the site is mainly pine flatwoods interspersed with cypress marsh. The vegetation is mainly saw palmetto, pines, wax myrtle and cypress.

entirely of the upper part of the Avon Park Formation. Major water production from the Upper Floridan often occurs from a combination of soft limestones and cavernous zones.

Middle Semiconfining Unit: This designation applies to a sequence of less permeable limestones, dolomitic limestones, and dolomites that underlie the Upper Floridan aquifer. These rocks are generally tan to dark brown in color, and tend to become more dolomitic with depth. All of this hydrogeologic unit is considered to be in the Avon Park Formation of Middle Eocene age. Both the upper contact with the Upper Floridan aquifer and the lower contact with the Lower Floridan aquifer are judgmental and based largely on incidence of cavity development. Though individual zones (both thin cavities and softer materials) may yield moderate quantities of groundwater, the middle confining unit is seldom used as a direct source of groundwater. The primary effect of its presence is the retardation of groundwater movement between the Upper and Lower Floridan aquifers.

Lower Floridan Aquifer: This highly productive unit consists of limestones and dolomites, generally light to dark brown in color. The upper part of this unit is composed of the Avon Park Formation and the lower part is composed of the Oldsmar Formation. Typically, these rocks tend to be hard (more dolomitic than calcareous) and have extensive cavernous development. Some chert, peat and minor amounts of gypsum and anhydrite may occur in the lower parts. Average transmissivity of this zone may be significantly higher than that of the Upper Floridan at many sites, but there is increased expense of constructing wells into this deeper zone. Major users of the Lower Floridan in central Florida are OUC, Orange County and City of Winter Park. There is, however, greater interest in the potential of this zone as development pressures grow and stresses to the Upper Floridan increase.

Lower Confining Unit: This unit forms the base of the Floridan aquifer system. It is generally considered to be composed of hard dolomites with gypsum, anhydrites and some limestones of the Cedar Keys Formation of Paleocene age, underlain by materials of Cretaceous age. Few test holes have penetrated the lower covering unit in central Florida.

It is important to understand and consider the areal and regional hydrogeologic settings when major new groundwater withdrawals are planned. Under natural conditions, fresh water enters an aquifer in recharge areas and moves down gradient to discharge areas. The fresh water that enters an aquifer in recharge areas gradually becomes more mineralized during its down gradient movement and, particularly in major confined aquifer systems, may naturally exceed potable limits for some dissolved constituents. This decline in groundwater quality results from a combination of 1) continued exposure of water to soluble aquifer materials, and 2) mixing of inflowing groundwater with in situ aquifer fluids (that is, the flushing process). These processes result in occurrence of more mineralized groundwater at downgradient and deeper locations in an aquifer system.

Groundwater movement in the Floridan aquifer system in Orange County is generally from west to east; that is, from high rate recharge areas in west and central Orange to natural discharge areas in the St. Johns River valley (Lichtler et al, 1968). Quality of water in this aquifer flow system exhibits the expected pattern; that is, from very fresh groundwater in both the Upper and Lower

Floridan units in the recharge areas to brackish groundwater in the Upper Floridan in the eastern part of the county, and in the Lower Floridan in the City of Cocoa Well Field about 7 miles east of the Southeast Test Well Site. Additional decline in ground water quality in the east has probably also occurred as a result of withdrawals from the Cocoa well field.

Both the Southeast and Orange Test Well Sites are in areas mapped as low rate, or poor, recharge areas and at significant distances from any high rate recharge area (refer to Lichtler, etal, 1968, fig. 54). Most existing OUC production wells, however, are in high rate recharge areas. These high rate recharge areas are characterized by internal drainage; that is by the absence of surface streams and occurrence of numerous closed surface drainage basins, some of which contain lakes. Such conditions indicate a good hydraulic connection between the surficial and Floridan aquifers, and thus a relatively high potential for recharge to the Floridan. High rate recharge is a desirable factor in well location, but it is accompanied by an increased potential for conveyance of contaminants that may be entrained in the recharge waters. Total recharge in much of the internally drained areas of Orlando has been further increased by use of drainage wells, but these also greatly increase the potential for pollution of the Upper Floridan aquifer (Kimrey, 1978). As a result the typical existing OUC production well has been installed in the Lower Floridan to minimize possible effects of pollution from drainage wells. Both proposed new locations, however, are in areas that have been mapped as poor recharge areas. Significantly lower recharge to the Floridan aquifer in these areas is evident in the well developed surface water drainage patterns, and these areas are also less developed. Thus, the Upper Floridan is much less vulnerable to pollution at these locations than anywhere else in the OUC Service Area.

Section 2.0
Well Construction and Testing Programs

2.0 WELL CONSTRUCTION AND TESTING PROGRAMS

All test drilling was by the rotary method; conventional mud-rotary was used in the material overlying the Floridan aquifer, and reverse-air rotary was used in the Floridan aquifer. Cuttings were collected at 10-foot intervals to characterize the geology and evaluate casing setting depths. Water samples were collected within the Floridan aquifer at 10-foot intervals and analyzed in the field to evaluate general water quality and to identify the depth of the 250 mg/l chloride concentration. The water quality data were collected to assist in analysis for potential upconing. Step drawdown tests were performed to evaluate the production and water quality characteristics of the Upper and Lower Floridan aquifer producing zones. Geophysical logs were conducted in the Upper and Lower Floridan sections of the borehole to support interpretations derived from lithologic logs regarding the character, distribution and thickness of the geologic materials.

South Florida Water Management District Well Construction Permits for both test wells are contained in Appendix A. The lithologic descriptions for both test sites and the Driller's Well Completion Reports are included in Appendix B. Water level measurements made during step testing are contained in Appendix C. Water quality results taken during drilling and after step drawdown testing are provided in Appendix D. Appendix E includes the geophysical logs of both test wells. Well construction and testing generally proceeded as follows:

2.1 Southeast Test Well Drilling Summary

2.1.1 Upper Floridan Aquifer Test Drilling

Construction details of the Southeast Test Well are shown in Figure 5. Construction at the site began on 11 July, 1995. By 13 July the contractor had set and grouted 80 feet of 24-inch casing to stabilize the unconsolidated materials of the surficial aquifer. Then a pilot hole was drilled and reamed to a depth of 230 feet; and 16-inch casing was set and grouted 30 feet into the top of the Upper Floridan aquifer on 22 July. Conventional mud-rotary drilling was used in drilling these upper two sections of the test hole, and drill cuttings were collected at 10-feet intervals for lithologic analysis and used to determine casing setting depths.

On 28 July, the cement plug was drilled out and an 8-inch diameter pilot hole was drilled through the Upper Floridan aquifer and middle semi-confining unit to depth of 1,100 feet using the reverse-air drilling method. The pilot hole was advanced to 1,100 feet on August 16, 1995. Drilling was paused at each 10-foot interval for collection of drill cuttings and, following clearing of the return fluid, water samples were obtained. The drill cuttings were later examined by hand lens and brief descriptions were prepared (Appendix B). Water samples were field tested for chloride concentration and specific conductance. From these results, selected samples were later verified in the laboratory (Appendix D).

The pilot hole to 1,100 feet was completed on 16 August, and efforts began on 17 August to ream the hole to nominal 16-inch diameter. During this process it was found that the borehole had plugged at a depth of 315 feet. This plugging apparently occurred from caving of materials in the upper part of the formation, and some considerable delay followed related to attempts to clear the borehole by "dredging" and then redrilling with use of mud. The borehole was eventually reamed out using mud-rotary and was grouted up from 320 to about 225 feet in depth. The top of the grout was allowed to rise 5 feet within the bottom of the casing. Subsequently the 16-inch borehole was redrilled and reamed to 1,100 feet. Reaming was completed on 10 October, 1995, and the borehole was cleaned out and developed by pumping on 11 October.

Step drawdown tests were performed during 11-13 October, as described in Section 4 entitled "Step Drawdown Tests and Results". On 16 October, borehole geophysical logs were obtained, as described in Section 3 entitled "Borehole Geophysical Logs". The open borehole interval for step drawdown testing and geophysical logging was from 230-1,100 feet.

On 25 October the contractor began to emplace and grout in 8-inch casing to depth of 1,090 feet so that drilling could begin on the Lower Floridan portion of borehole. The top of the 8-inch casing was terminated at 180 feet below ground surface to allow installation of a 15-inch pump to achieve higher pumping rates. Difficulties in return of grout material occurred, apparently related to loss of cement to cavernous zones. Eventual success was achieved by 12 November, following emplacement of cement grout and limestone gravel (in cavernous zones) as shown in Figure 5.

2.1.2 Lower Floridan Aquifer Test Drilling

On 17 November drilling began through the concrete plug at 1,070 feet and proceeded, with a nominal 8-inch size drilling bit, to a depth of 1,409 feet where drilling was paused to test the probable Lower Floridan production interval. Step-drawdown tests were conducted during 23-30 November, 1995 (refer to Section 4 entitled "Step Drawdown Tests and Results" and Table 1). Drilling then resumed to total depth of 2,000 feet which was achieved on 7 December, 1995. Drill cuttings and water samples were collected as described above. The borehole was cleaned and developed on 8 December.

Geophysical logging of the interval 1,090-2,000 feet on 11 December was unsuccessful because the borehole was blocked at depth of 1,320 feet. The hole was then cleared and logging was completed on 15 December (refer to Section 3 entitled "Borehole Geophysical Logging"). The site was cleaned on 18 December, and work was completed with performance of the 16-inch casing straightness test on March 29, 1996. Upon completion of the test well, a video survey was conducted. At a depth of 1130-1140 feet two sections of loose casing were identified which may also be evident in the self potential log. The Contractor will address this at a later date.

The static water levels, measured in the permeable zones of the Upper Floridan (230' - 470' open hole) and Lower Floridan (1090' - 1410' open hole) aquifers, were 40.64 feet and 41.80 feet below the top of the 16-inch diameter casing, respectively. This supports a slight downward gradient occurs from the Upper to Lower Floridan aquifers at the site. These measurements, however, were taken four months apart due to delays in well construction.

2.2 Orange Test Well Drilling Summary

2.2.1 Upper Floridan Aquifer Test Drilling

Construction details of the Orange Test Well are shown in Figure 6. Construction at the Orange Test Well Site began on 26 July, 1995. By 3 August a pilot hole had been drilled and reamed to a depth of 110 feet; and 24-inch casing was pressure grouted to depth of 100 feet to stabilize the unconsolidated materials of the surficial aquifer. Then a pilot hole was drilled and reamed to depth of 200 feet, and 16-inch casing was grouted 25 feet into the top of the Upper Floridan aquifer on 12 August. Conventional mud-rotary drilling was used for these two upper sections of the test borehole. Drill cuttings were collected at 10-feet intervals for lithologic analysis and used to determine casing setting depths.

The pilot hole was advanced from 200 feet to 1,100 feet in depth over the period of 14 - 30 August. All drilling in the Floridan aquifer was by the reverse-air method. Drilling was paused at each 10-foot interval for collection of drill cuttings and, following clearing of the return fluid, water samples were obtained. The drill cuttings were later examined by hand lens and brief descriptions were prepared (Appendix B). Water samples were field tested for chloride concentration and specific conductance. From these results, selected samples were later verified in the laboratory (Appendix D).

Work began on reaming the 1,100 foot pilot hole to nominal diameter of 16 inches on 31 August. On 3 September some drilling tools were dropped into the hole, at depth of 703 feet, and caused considerable difficulty and delays. Several unsuccessful attempts were made to retrieve the tools. The tools were not retrieved but pushed downhole while reaming with the intention that a solid base of formation would provide a more stable platform to retrieve the lost tools. Reaming to 1,100 feet was eventually completed on 29 September, and the well was developed by air-lift pumping on 30 September. Step tests were conducted on 4 and 10 October, and geophysical logs were obtained on 14 October. The hydraulic tests and geophysical logs were for the interval 200-1,100 feet of the Upper Floridan aquifer, and are described in the following sections of this report entitled "Borehole Geophysical Logging" and "Step Drawdown Tests and Results".

Work began on installing and grouting 8-inch casing to depth of 1,098 feet on 7 November, and was completed on 14 December. The top of the 8-inch casing was terminated at 150 feet below ground surface to allow installation of a 15 inch pump to achieve higher pumping rates. Then (from 14 December, 1995 to 5 January, 1996) efforts were directed to milling (drilling out) the tools that had been dropped in the borehole.

2.2.2 Lower Floridan Aquifer Test Drilling

A nominal 8-inch diameter borehole from 1,098-2,000 feet was started on 8 January, 1996 and completed to depth of 1,400 feet to allow step-drawdown tests (for the interval 1,098-1,400 feet) on 12-13. Drilling was then resumed and completed to final depth of 2,000 feet by 22 January. Lithologic samples were collected as described above. Difficulty (dredging) was encountered in drilling at 1,710-1,730 and 1,850-1,860 feet, apparently related to presence of numerous cavities and fractured rock. The dredging delayed advancement a few days.

Borehole geophysical logs were made for this lower section of borehole on 23 January. A blockage occurred at 1,835 feet and prevented obtaining of logs below this depth. The borehole was then back-plugged to depth of 1,424 feet by emplacement of grout from 25 January to 19 February, and the well was developed by pumping and fitted with a cap. Final completion was on 28 March with performance of the 16-inch casing straightness test.

The static water levels, measured in the permeable zones of the Upper Floridan (200' to 470' open hole) and Lower Floridan (1098' - 1400' open hole) aquifers, were 33.5 feet and 34.55 feet below the top of the 16-inch diameter casing respectively. This suggests a slight downward gradient occurs from the Upper to Lower Floridan aquifers at the site. These measurements, however, were taken five months apart due to delays in well construction.

Section 3.0
Borehole Geophysical Logging

3.0 BOREHOLE GEOPHYSICAL LOGGING

Borehole geophysical logging involves lowering measuring devices down a borehole on a wire line to record various parameters related to the borehole and the rocks which it penetrates. The parameters measured at the Southeast and Orange Test Well Sites were caliper, electrical resistivity and spontaneous potential, natural gamma-ray radiation; and fluid resistivity, temperature and flow under non-pumping and pumping conditions. The borehole geophysical logs support the interpretations derived from the lithologic logs regarding the character, distribution and thickness of the geologic materials present in the borehole. The general characteristics of these borehole geophysical logs are discussed below, followed by specific interpretations of the logs for each site. Copies of all geophysical logs are in Appendix E.

A caliper log, which measures the diameter of a borehole (or casing), may be used to determine the occurrence and thickness of lithologies that respond in different ways to drilling stresses. Caliper logs may also be used to increase the accuracy of interpretations of other logs by accounting for variations in instrument responses coincident with borehole diameter. Caliper logs are particularly useful in differentiating between high and low yielding zones in the Floridan aquifer. Cavernous zones, which may yield large quantities of water, are readily identified by abrupt changes in borehole diameter, often to full extension of the caliper arms. Softer rock zones, which may also be quite permeable, are noted in sections of the borehole that are significantly larger than the bit size. Harder (denser) rock zones, usually of lower permeability, are indicated by sections of the borehole where diameter is persistently low, often near the drill bit size.

The electrical resistivity of a rock is a function of its density, pore shape and size, porosity, and quality and temperature of its interstitial fluids. As a generalization the three (3) types of resistivity logs (single point, short and long normal) obtained during this project record electrical properties of the rocks at increasing depths in the borehole walls. Unconsolidated sands and shell beds that contain fresh water have generally higher resistivities, and clayey materials have lower resistivities. The electric log is thus useful in determining the distribution of water-bearing and confining beds in the overburden of the Floridan aquifer. In fresh water zones of the Floridan aquifer, the most resistant zones are usually the dense dolomites and dolomitic limestones which yield little water. The presence of brackish or saline formation water decreases the resistivity of any rock type. The SP (spontaneous potential) curve obtained during electric logging is often useful in determining the contact between fresh and saline formation fluids.

Gamma-ray logs measure the natural radiation of rocks by counting the gamma-ray activity of potassium 40, uranium 238, and thorium 232 decay series (Fetter, 1980). These elements are usually found in clays and other fine-grained materials to a greater degree than in clean sands. Gamma-ray-ray logs are thus very useful in identifying confining beds and water-bearing zones in the unconsolidated materials that overlie the Upper Floridan aquifer. A zone of high gamma-ray activity usually occurs related to phosphatic clays in the base of the Hawthorn Formation.

Fluid flow, resistivity, and temperature logs are usually recorded under both static (non-pumping) and non-static (pumping) conditions. Collectively, these three logs address the vital issue of location of production zones within a well or borehole. In effect, the fluid flow or flow meter log addresses this issue directly, while the other two logs furnish supporting and, at times, specialized information of their own. For best interpretative results, the flow meter logs should be recorded while the logging tool is lowered and raised in the borehole (descending and ascending logs). For flow meter logs under static (non-pumping) conditions any fluid flow that may be observed is between zones (intrazonal) within the borehole, and this may also be reflected in the fluid resistivity/temperature logs. When this process is noted, it is indicative that both the losing and receiving zones have generally good permeability; that is, are potential water production zones. Temperature logs are also often useful in defining zones where intrazonal flow occurs. The interpretation of flow meter logs obtained under pumping conditions can better identify and quantify the water bearing potential of various zones penetrated by the borehole. Flows at different depths can be computed, and percentage of flow graphs vs. depth prepared from these data. Fluid resistivity logs are also useful in determining the changes in saline formation water.

3.1 Southeast Test Well Geophysical Logging Summary

3.1.1 Geophysical Logging Interpretations

Two zones were logged during construction of the test well. Logging for these two zones (i.e., Upper and Lower) was performed while each zone was open only to its respective logged interval. Each zone could thus be considered as a completely separate test well. The upper zone was logged from an interval of 228 - 1090 feet within the 16-inch diameter borehole and includes the Upper Floridan and middle semi-confining units. The lower zone was logged from an interval of 1090 - 2000 feet within an 8-inch diameter borehole and corresponds to the Lower Floridan aquifer. Caliper, single point and multiple electrode resistivity, SP, natural gamma-ray, fluid resistivity, fluid temperature and fluid flow logs were obtained from both zones of borehole. The test hole was drilled with reverse air and filled with formation fluid at the time of logging. Field analysis of groundwater samples collected during drilling indicate chloride concentrations of 20 - 45 mg/L and related low conductivity, < 500 micro mhos/centimeter (μmhos/cm).

Caliper and Multiple Electrode Resistivity Logs:

Upper Zone

Caliper and multiple (long/short normal) electrode logs are most useful for hydrogeologic interpretations in this borehole. General distribution of lithologic/hydrologic properties, as indicated by these logs is:

228-310: Soft rock; borehole diameter up to more than 30 inches.

310-428: Harder rock with borehole size generally decreasing downward to near bit diameter in bottom of interval.

428-500: Very hard rock with cavities interspersed; the most resistant zones in entire borehole are in this interval.

500-970: Mostly hard rock with some relatively thin cavities interspersed throughout; thickest cavity at about 759-768 feet.

970-1,090: Very hard rocks, borehole essentially at bit diameter bore size.

The thickest tight zone is in the 970-1,088 interval. Thinner tight zones (10-15 feet) occur in the 390-500, and 570-800 intervals. The entire section penetrated by the borehole below 500 feet will be retardant to vertical flow; section from 970 to bottom of hole (1,090) is a major aquitard (middle semi-confining unit). High transmissivity (based on occurrence of soft rock) probably occurs at 228-310 feet. However, some cavities (particularly those in 428-500 feet interval) may also be large producers.

Lower Zone

1,090-1,130: Softer rock, grading downward to hard.

1,130-1,630: Generally hard rock, numerous cavities interspersed throughout.

1,630-1,850: Alternating hard and softer rock; no cavities.

1,850-2,000: Hard rock with a few thin cavities; very resistant section from 1,900-1,940, with borehole almost at bit diameter size in this interval.

Highest transmissivity zones are related to the section of hard rock with interspersed cavities from 1,130-1,630. Tightest zones are related to section of constricted borehole below 1,900 feet.

Natural Gamma-ray Log:

Upper Zone

Sandy materials are indicated to predominate in the surficial aquifer to depths of about 115 feet. Finer grained materials from 115-195 act as the upper confining unit. Highest activity occurs in phosphatic clays from about 170 feet to the base of the Hawthorn Formation at about 195 feet. The gamma-ray log is without prominent features in the Floridan aquifer, particularly below 500 feet.

Lower Zone

Gamma-ray levels are alternating but relatively low from 1,090 - 1,325 feet; very low from 1,325 - 1,500 feet; and alternating higher in remainder of the hole. The highest levels are between 1,565 - 1,580 feet.

Borehole Fluid Flow:

Upper Zone

Static: The flow log traverses under non-pumping conditions do not appear to indicate any internal flow in the borehole.

Pumping: The non-static flow log was run, descending direction, while pumping at rate of about 820 gpm. The percentage of flow log analysis (as supplied by the logging contractor) indicates that:

- About 85-90 percent of total flow enters the borehole below the tight zone at 415-428 feet;
- About 50-55 percent enters the borehole below the tight zone at 440-455 feet; and,
- Essentially no water enters the borehole below 500 feet.

The major producing zone is thus the interval of hard rock with interspersed cavities between about 428-500 feet.

Lower Zone

Static: These logs indicate a prominent intrazonal flow of groundwater. Water enters the borehole from thin cavities below 1,980 feet, flows upward in the borehole, and re-enters the formation in cavities beginning at about 1,330 feet.

Pumping: These logs were obtained while pumping the borehole at approximately 920 gpm. Flow computations for several pertinent zones indicate the following:

- More than 95 percent of total flow comes from below 1,140 feet; the cavity at about 1,180 feet appears to be a major contributor/of water to the well.
- About 50 percent of total flow comes from below 1,320 feet.
- About 50 percent of total flow is still present in the constricted interval from 1,906-1,934 feet.

In summary, about one-half of the total flow (at this pumping rate and pump setting) appears to enter the borehole from the two thin cavities near the bottom, and much of the remaining one-half enters the borehole from the cavity at about 1,180 feet.

Fluid Resistivity / Temperature Logs:

<u>Upper Zone</u>

Static: The fluid resistivity shows only slight variations throughout the borehole below depths of 500 feet; the fluid temperature log shows the expected slight increase of temperature with depth of hole.

Pumping: The fluid resistivity log shows increasing resistivity above 500 feet, which coincides with the majority of flow entering the borehole above this depth. The fluid temperature log shows increasing temperature, or gradient, below 500 feet to bottom of borehole.

<u>Lower Zone</u>

Static: The temperature log may show some effects of the intrazonal flow where water re-enters the formation in the upper part of the open interval.

Pumping: The fluid resistivity log is expressionless. The temperature log shows only a slight downward gradient.

3.1.2 Summary of Geophysical Logs at the Southeast Test Well Site

All logs indicate uniform fluid conditions (i.e., very fresh groundwater) throughout both sections of the borehole. For the Upper Floridan, virtually all the pumping yield enters the borehole above 500 feet. The middle semi-confining unit at this site is probably best defined between 500 - 1,090 feet due to the tight nature of formation materials. The dense dolomitic zone from about 970-1,090 feet should function as an effective barrier against vertical interchange of groundwater between the Upper and Lower Floridan aquifers at this site. For the Lower Floridan, intrazonal flow occurs under non-pumping conditions with water entering the borehole from thin cavities below 1,980 feet and re-entering the formation above 1,330 feet. More than 95 percent of the pumping yield from the Lower Floridan enters the borehole from below 1,140 feet; and about 50 percent enters the borehole from below the constriction at 1,906-1,934 feet. Zones of highest gamma-ray activity occur in the base of the Hawthorn Formation (depths 170-195) just above the base of the Hawthorn Formation, and within the Lower Floridan aquifer at 1,565-1,580 feet. The zone in the Lower Floridan appears to correspond to the zone of similar high gamma-ray activity that occurs in the Orange test hole at 1,585 - 1,615 feet.

3.2 Orange Test Well Site Geophysical Logging Summary

3.2.1 Geophysical Logging Interpretations

Two zones were logged during construction of the test well. The upper zone was logged from an interval of 200 - 1100 feet within the 16-inch diameter borehole and includes the Upper Floridan and Middle Semi-Confining Units. The lower zone was logged from an interval of 1100 - 1835 feet within an 8-inch diameter borehole which corresponds to the Lower Floridan aquifer. Caliper, single point and multiple electrode resistivity, SP, natural gamma-ray, fluid resistivity, fluid temperature and fluid flow logs were obtained from both zones of borehole. The test hole was drilled with reverse air and filled with formation fluid at the time of logging. Field analysis of groundwater samples collected during drilling indicate chloride concentrations of 15 - 40 mg/L and related low conductivity (< 500 μmhos/cm).

Caliper and Multiple Electrode Resistivity Logs:

Upper Zone

Caliper and multiple (long/short normal) electrode logs are the most useful for hydrogeologic interpretations in this borehole. General distribution of lithology/hydraulic properties, as indicated by these logs, is:

205-360: Soft rock; borehole diameter from about 23 to greater than 30 inches; relatively low resistivity..

360-397: Harder rock: caliper log comes almost back to bit diameter size.

397-444: Softer rock; caliper at 20-25 inches; cavity at 438-444 feet.

444-500: Hard rock, hole close to bit diameter; most resistant zone in entire length of hole; a few thin cavities.

500-525: Gradational contact, harder to softer rock.

525-590: Softer rock; caliper up to about 25 inches.

590-620: Gradational contact, softer to harder rock .

620-670: Hard rock; caliper almost back to bit diameter size in much of this interval.

670-856: Alternating hard and softer rocks.

856-900: Softer rock.

900-1,100: Alternating, harder/softer rocks to bottom of hole. Tightest zones at 1,060-1,070 and 1,085-1,095 feet where hole comes close to bit diameter size.

Thicker tight zones are at the 444-500 and 620-670 depth intervals. These are probably dolomites or dolomitic limestones and will function as the major confining zones within the upper 1,100 feet. There are also thinner tight zones in the 670-1,100 feet interval.

Zones of softer rock are at 205-360, and particularly at 260-330 feet; 395-420 feet; 555-590 feet; and 860-900 feet. There are also some thinner soft zones between 900-1,100 feet. There are relatively few cavities in this section of borehole. The thickest cavities apparent are at 438-444 feet and 1,030-1,037 feet, with some thinner cavities in the intervening areas.

<u>Lower Zone</u>

1,100-1,120: Softer rock, grading downward to harder materials.

1,120-1,530: Generally hard rock with relatively high resistivity; some softer zones and thin cavities interspersed throughout.

1,530-1,680: Harder rock to 1,620 feet, grading to softer rock in 1,620-1,680 interval; no cavities throughout.

1,680-1,835: Numerous cavities, including one of about 14 feet thickness from 1,714-1,728 feet.

Highest transmissivities probably relate to cavities and softer rocks in intervals 1,120-1,530 feet and 1,680-1,835 feet. Thickest section of lower transmissivity materials probably 1,530-1,620 feet.

Gamma-ray Log:

<u>Upper Zone</u>

The natural gamma-ray log is largely featureless within the Floridan aquifer (typical for this area). It is more useful in the cased off upper portion, appearing to indicate predominance of sandy material to depths of about 100 feet, with increase in marine clay content below that depth. Highest gamma-ray counts at 195-210 feet, again typical of the base of the Hawthorn Formation in this area.

<u>Lower Zone</u>

Alternating, but generally low activities throughout section logged; highest levels in 1,585-1,615 interval, which correlates with a zone of similar gamma-ray counts in the Southeast test hole.

Borehole Fluid Flow:

<u>Upper Zone</u>

Static: The flow log traverses do not indicate any internal flow in the borehole under non-pumping conditions.

Pumping: The borehole fluid flow logs were made ascending/descending while pumping at about 1,000 gpm. The most pertinent flow computations were for the intervals at about 460 feet and 650 feet where the borehole diameter is reduced to near bit size by presence of dense rocks. These computations indicate that more than 95 percent of total flow originates below the 460 feet constriction, and about 15 percent originates below the 650 feet constriction. Of even greater interest is the observation that most of the more than 95 percent of total flow observed at 460 feet appears to originate from the thin cavity between about 477-480 feet, which indicates that this cavity has a wide effective lateral extent.

<u>Lower Zone</u>

Static: Significant flow enters the borehole from thin cavities below 1,800 feet, and re-enters the aquifer in zones above 1,150 feet.

Pumping: The non-static borehole fluid flow logs were made ascending/descending while pumping at about 1,000 gpm. Computation at pertinent constricted intervals of borehole indicate that more than 95 percent of total flow comes from below a depth of about 1,130 feet; less than 15 percent comes from below a depth of 1,190 feet, and less than 5 percent originates below a depth of 1,385 feet. Visual examination of the logs further indicates that most of the total flow enters the borehole from the zone of softer rocks between about 1,130-1,140 feet.

Fluid Resistivity/Temperature Logs:

<u>Upper Zone</u>

Static: Fluid resistivity log indicates uniform conditions throughout borehole. Only expression on fluid temperature log is the expected slight increase in temperature with depth.

Pumping: Fluid resistivity and temperature under pumping conditions are essentially the same as for non-pumping conditions. The single point resistivity also indicates very uniform borehole conditions; this log, in effect, is another log of borehole fluid resistivity because of the relatively large diameter of the well bore.

Lower Zone

Both static logs show results of the inter-intrazonal flow mentioned above; that is, warmer water from nearer the bottom of the hole enters the bore and then re-enters the formation above 1,150 feet. The non-static logs show generally uniform resistivity/temperature throughout the borehole.

3.2.2 Summary, Geophysical Logs, Orange Test Well Site

All logs indicate uniform fluid conditions, or fresh groundwater, throughout both sections of borehole. For the Upper Floridan aquifer, more than 95 percent of the total pumping yield originates below 460 feet, and about 15 percent originates below 650 feet. The middle semi-confining unit is probably best defined between 650 - 1100 feet due to the tight nature of formation materials. There is poor hydraulic connection between the Upper/Lower Floridan aquifers because of the more than 100 feet of what appear to be very tight rocks in the middle semi-confining unit. For the Lower Floridan, prominent intrazonal flow occurs under non-pumping conditions, entering the borehole below 1,800 feet and re-entering the formation in zones above 1,150 feet. About 95 percent of total pumping yield enters the borehole below 1,130 feet, and less than 5 percent enters the borehole below 1,385 feet. Gamma-ray activity is highest in the interval 195-210 feet near the base of the Hawthorn Formation and in the Lower Floridan aquifer at 1,585-1,615 feet. The zone in the Lower Floridan appears to correspond to the zone of similar high gamma-ray activity that occurs in the Southeast test hole at 1,565 - 1,580 feet.

SECTION 4.0
Step Drawdown Test Data

4.0 STEP DRAWDOWN TESTS AND RESULTS

BFA inspected data from variable rate, or step-drawdown tests performed for both the Upper and Lower Floridan aquifer zones penetrated by the Southeast and Orange Test Wells. These tests were performed to evaluate the production and water quality characteristics of the individual zones, and provide data for determination of well losses and specific capacities for a range of pumping rates.

The step-drawdown tests were performed by temporarily installing a vertical turbine pump in the well, and recording drawdowns related to pumping at various rates. Well discharge was measured by use of an in-line flow meter in the discharge pipe and drawdowns were measured in the pumping well with an electronic water-level indicator. A monitoring well was available for use during the step-drawdown tests at the Orange Test Well Site. Three (3) rates of discharge were used for each step-test, and composite water samples collected for laboratory analysis at end of each test (refer "Groundwater Quality Sampling and Results") . A summary of step-testing is shown in Table 1, and the water levels data are included in Appendix C. Individual tests are described below.

4.1 Southeast Test Well Site Step-Drawdown Test Results

4.1.1 Upper Floridan Aquifer Step Drawdown Test

The two principal parameters for quantitative description of an aquifer's water bearing characteristics are its transmissivity (T) and storativity (S): Transmissivity is a measure of the aquifer's ability to transmit water in response to differences in hydraulic head; storativity is a measure of the aquifer's capacity to take water into, or release water from, storage in response to changes in hydraulic head. These parameters are usually determined by application of analytical techniques to field data for well drawdown vs. time at constant pumping rates. Thus the initial step of the conventional step drawdown test can supply data that allows determination of transmissivity.

The test for the Upper Floridan zone (230 - 1,100 feet) was completed on 12 October 1995. Each of the steps was run for 180 minutes at rates of 1,535, 2,200 and 2,720 gpm. Water levels from this step-drawdown test are shown as a hydrograph in Figure 7, and the raw data are included in Appendix C. These data indicate an aquifer with high transmissivity. The total drawdown at highest discharge rate (2,720 gpm) is only about 7 feet, and the hydrograph configuration indicates that probably more than 80 percent of this drawdown results from turbulent flow or friction, which is more commonly termed "well loss". The drawdown data (s) for Step 1 were then plotted vs. time on semi-logarithmic paper in an attempt to derive values for transmissivity and storativity using the Cooper and Jacob, 1946 method. However, the slope of the actual drawdown related to aquifer losses is essentially flat parallel to the time axis at these pumping rates and will not allow any confident or meaningful calculations of the aquifer coefficients (Figure 8). Transmissivity for this, and similar zones, thus must be estimated.

Accordingly a working value of 500,000 ft^2/d is assumed in line with the determinations of previous analysts of Floridan aquifer data in this area (Lichtler et al, 1968; Leggette, Brashears and Graham, 1994; Boyle, 1995, etc.). Storativity values are not estimated because single well pumping tests do not provide meaningful data for their analysis.

The primary purpose of conducting the step drawdown tests was for determination of well losses and specific capacities for a range of pumping rates. The data were thus further analyzed by use of a method based on an equation proposed by Jacob, 1946. That equation, $\Delta s = BQ + CQ^2$, suggests that total measured drawdown in a pumping well (Δs) is the sum of components (BQ), related to laminar flow, and (CQ^2) related to turbulent flow (Walton, 1967). The coefficients B and C may be graphically evaluated by use of the step-drawdown data, as illustrated in Figure 9, and subsequently used to estimate adjusted values for drawdown and specific capacity. Data for observed and adjusted values for drawdowns and the related specific capacities are tabulated in Table 2.

Data in Table 2 indicate that observed specific capacities, Upper Floridan aquifer, Southeast Test Well Site, ranged from 604-423 gpm/ft at pumping rates from 1,535-2,800 gpm, respectively. The water production capability of this zone is very high based on these values, the highest by far of any of the four zones tested during this program. It is suggested that transmissivity for this zone is on the high side of 500,000 ft^2/d.

4.1.2 Lower Floridan Aquifer Step Drawdown Test

The test for the Lower Floridan zone (1,098 - 1,409 feet) was completed on 28 November 1995. The steps were run for 300, 180 and 600 minutes at discharge rates of 635, 825 and 840 gpm, respectively. Water levels from this step-drawdown test are shown as a hydrograph in Figure 10. Note that Steps 2 and 3 plot as essentially the same curve, because it was not possible to increase discharge for Step 3 to a sufficiently higher rate. The third step, however, was run for 10 hours to determine if water quality changes were observed over time. These data indicate a zone of high transmissivity, with the majority of total drawdown related to well losses. Drawdown data for step 1 were then plotted vs. time on semi-logarithmic paper in an attempt to derive values for transmissivity (Fig. 11). But the slope of the curve is too flat to allow any confident calculations. It is thus impossible to derive meaningful values for transmissivity from conventional analytical methods, so transmissivity is again estimated as on the order of 500,000 ft^2/d.

An attempt to use the step-drawdown data in developing relations for adjusting the observed drawdowns was unsuccessful, as it resulted in a negative slope. This was probably related to the close grouping of values for discharge rates during the step drawdown tests. It was not possible to fit a meaningful curve of relation by use of these step-drawdown data so, as noted on Table 2, adjusted drawdowns and specific capacities are indeterminate.

Observed specific capacities ranged from 78-80 gpm/ft (Table 2) for discharges of 635-840 gpm, respectively. It should be noted that direct comparison of observed specific capacities between the Upper and Lower Floridan zones may be misleading. Observed values for drawdowns in the Upper Floridan reflect friction losses related to withdrawal from a nominal 16-inch borehole, whereas those in the Lower Floridan reflect higher losses related to withdrawal from a longer nominal 8-inch borehole. Thus, for equivalent transmissivities, observed specific capacity values for the Lower Floridan will be less. This zone is productive, though not to the degree of the overlying Upper Floridan at the site. Transmissivity on the low side of 500,000 ft^2/d is suggested.

4.2 Orange Test Well Site Pumping Test Results

4.2.1 Upper Floridan Aquifer Step Drawdown Tests

The test for the Upper Floridan zone (200 - 1,100 feet) was performed on 5 October 1995 (steps 1 and 2) and 10 October, 1995 (step 3). The steps were run for 300 minutes each and at discharge rates of 1,760, 2,240 and 2,780 gpm. Mechanical problems with the pump drive and engine prevented smooth transition of pump testing through all three (3) steps, and delayed completion of Step 3. Water levels from this step-drawdown test are shown as a hydrograph in Figure 12. These differ from the equivalent hydrographs for the tests described above for the Southeast Test Well Site (Figures 7 and 8) in that there is discernible continuing drawdown following the period of initial well losses. Accordingly the possibility of determining transmissivity from the data by use of the Cooper-Jacob (1946) straight-line method was investigated, as follows:

Drawdown data were also available from an observation well for the Upper Floridan step-drawdown test at Orange Test Well Site; this well was 275 feet from the pumped well and open to the 176 - 450 foot interval of the aquifer. This well was installed for water supply during the construction of the electrical sub-station near the Orange Test Well Site. Drawdown data during Step 1 for the observation well were plotted versus time on semi-logarithmic paper, and indicated transmissivity on the order of 96,000 ft^2/d. The drawdowns from Step 1 for the observation well were relatively small and resulted in a scattered plot, probably because of the distance between the wells and the lower discharge of this step. Therefore, drawdown data from the observation well for Step 3 were also plotted, and resulted in transmissivity of about 93,000 ft^2/d (data from Step 3 could be used because the break in pumping related to mechanical problems had allowed aquifer levels to recover to essentially pretest levels). These two values for transmissivity seem to confirm each other, and are considered the most reliable values that can be computed from any of the step-drawdown testing at Southeast and Orange Test Well Sites. These site values, though quite high by many reference standards, are still significantly lower those transmissivities reflected by drawdown data from the other three (3) step-tests; that is, those for the Upper and Lower Floridan, Southeast Test Well Site, and the Lower Floridan at the Orange Test Well Site.

Upper Florid. Trans.

Data for adjusted drawdowns and specific capacities are compiled in Table 2. Observed specific capacities range from 109-91 gpm/ft for discharges of 1,760-2,780 gpm respectively. This zone, though productive, would be the lowest yielding of the four tested.

4.2.2 Lower Floridan Aquifer Step Drawdown Tests

The test for the Lower Floridan zone (1,098 - 1,400 feet) was performed on 12 January 1996. The steps were run for 180, 180 and 600 minutes at discharge rates of 465, 745 and 1015 gpm, respectively. Water levels from this step-drawdown test are shown as a hydrograph in Figure 14. These data again appear to be composed largely of well losses. The drawdown data from step 1 were plotted against time on semi-logarithmic paper and the resulting curve (Figure 15) is essentially flat, thus precluding any conventional analysis. Thus a transmissivity value of about 500,000 ft^2/d is assumed for this site.

Data for adjusted drawdowns and specific capacities are compiled in Table 2. Observed specific values range from 119-63 gpm/ft for discharges of 470-1,020 gpm respectively. To put these observed values in proper perspective, refer to the previous discussion of comparison of specific capacity values (Lower Floridan Aquifer Tests, Southeast Test Well Site). Here the adjusted specific capacity values, in Table 2, are a better measure of comparison between the Upper Floridan and Lower Floridan. The Lower Floridan is a much more productive aquifer zone than the Upper Floridan at the Orange Test Site.

Section 5.0
Groundwater Quality Sampling and Results

5.0 GROUNDWATER QUALITY SAMPLING AND RESULTS

During test drilling, BFA collected and analyzed water samples for determination of groundwater quality parameters throughout the total depths of Floridan aquifer penetrated in both the Southeast and Orange test wells. Downward drilling progress was paused at 10-foot intervals and drill cuttings were collected from the discharge fluid; then circulation was continued until the fluid return was clear (generally 5-20 minutes), and a water sample was collected in plastic containers. Groundwater samples were collected through the drill stem with the open hole interval of the well extending from the bottom of the casing to the total depth of the bit/well at the time of sampling. Field determinations were made for chloride concentration and specific conductance, later to be validated by laboratory analysis (these data are summarized in Appendix D). Additional water samples, for more comprehensive analysis, were collected from each test hole at the end of the four step-drawdown tests, for which data are also shown in Appendix D.

Comparison between the field chloride values and laboratory determinations for the same water samples indicate good precision. The laboratory values, though generally lower, appeared to be consistently proportional to the field values. Part of these differences in field/laboratory chloride values relate to the field values being determined to 5 mg/L difference intervals, and a tendency on part of the field person to assure that the threshold has been reached prior to recording a field value. Interpretations of results of these analyses follow, along with summaries of general water quality relationships for both the Southeast and Orange Test Well Sites.

5.1 Southeast Test Well Groundwater Quality

Field values for chloride concentrations and specific conductivity, spanning the depths of 300-2,000 feet in Southeast Test Well, are shown in Appendix D. These data indicate very slight increases in chloride concentrations with increasing depth: that is, from 300-400 feet, most chloride field values are 20 mg/L; 25 mg/L values predominate from 400-700 feet; 30 mg/L values predominate from 700-1,950 feet; 35 mg/L concentrations occur for the 1,950-1,980 interval and then 45 mg/L concentrations occur in the bottom two samples from 1,980-2,000 feet. This increase in chloride concentrations near the bottom of hole correlate well with the static flow meter survey logs (described previously) which indicate a significant inflow of formation water from thin cavities near the bottom of hole. Field specific conductivity values also show this same pattern of gradual increase with increasing depth, with a possible accelerated increase in the bottom 50 feet of bore hole. There are a few chloride values throughout that appear to be out of order with other values in their range. Many of these are isolated and they may simply result from minor inconsistencies in sample collection and testing. Some values, however, such as those for 15 mg/L in the 1,300-1,350 foot interval are grouped; these could again result from inconsistent collection/testing procedures or they may represent isolated aquifer zones that contain slightly less mineralized groundwater.

Selected analytical data collected at end of the step drawdowns test from both Upper and Lower Floridan tests are shown in Table 3. These parameters relate to water treatment process selection. All values shown are for laboratory determinations except those for hydrogen sulfide. For comparative purposes data are also shown for the current Lake Nona WTP; OUC Sky Lake WTP; averages for other OUC WTP plants; and a thief sample from the bottom of the Southeast WTP test hole.

For the Southeast Test Well, total dissolved solids concentrations are similar for both the Upper and Lower Floridan zones, though slightly higher in the Lower Floridan (i.e., 270 vs. 290 mg/L respectively). Alkalinity was 196 mg/L in the Upper Floridan, and 190 mg/L in the Lower Floridan. Groundwater in both the Upper and Lower Floridan is relatively hard; i.e., 196 and 212 mg/L respectively. Sulfates are 2 mg/L in the upper zone, and 70 mg/L in the lower; and sulfides are, respectively, 2.5 and 4.5 mg/L.

Data from the bottom hole grab sample indicate higher concentrations for hardness (335 mg/L) and alkalinity (230 mg/L). This again correlates with the bottom hole permeability which appears to allow a significant contribution of water to the borehole.

5.2 Orange Test Well Groundwater Quality

Field values for chloride concentrations and specific conductivity for the Orange Test Well are shown in Appendix D for the interval spanning 220-2,000 feet. Chloride values for the upper part of this interval indicate the expected pattern of downward increasing concentrations; i.e.: 25-30 mg/L from 220-1,100 feet; and 30-40 from 1,100-1,400 feet. Then chloride/depth relations appear to reverse with 20-25 mg/l values from 1,400-1,550 feet, and 15-20 mg/L values from 1,550-1,940 feet. Finally in the bottom interval, 1,950-2,000 feet, chloride values increase to about 25 mg/L. This profile of data indicates that chloride concentrations are slightly lower in the Lower Floridan aquifer than in the Upper Floridan. However, by bottom of hole, the relation appears to have again reversed with an increase in chloride concentrations in the 1,940-2,000 foot interval.

Selected analytical data for two composite groundwater samples collected at the end of step-drawdown tests for the Upper and Lower Floridan zones are provided in Appendix D. All these data are for laboratory determinations except those for hydrogen sulfide. The laboratory data for dissolved solid constituents tend to verify the peculiar relation noted above for chloride concentrations; that is, groundwater in the Lower Floridan is slightly less mineralized than in the Upper Floridan. As examples, total hardness in the Lower Floridan is 180 mg/L as compared to 218 mg/L for the upper zone; total dissolved solids are 240 mg/L in the Lower Floridan and 286 mg/L in the Upper Floridan; and alkalinity is 130 mg/L in the Lower Floridan, and 195 mg/L in the Upper Floridan.

Section 6.0
Discussion

6.0 DISCUSSION

6.1 Comparison of Aquifer Zones at Each Site

BFA believes there is generally good lithologic correlation of the Upper and Lower Floridan aquifer sections between the Southeast and Orange Test Well Site. As examples (a) soft, cream colored limestones comprise the top of the Upper Floridan at both sites, and (b) zones of relatively high natural gamma-ray activity are present in the Lower Floridan in both boreholes within the depth range of 1,565-1,615 feet. Numerous other correlations between the two test wells are evident from examination of the lithologic logs in Appendix B.

The lithologic correlation is reflected in the distribution of well yields (noted during geophysical logging) in the Upper Floridan aquifer, where the majority of production in both wells is from cavities in hard dolomitic zones above 500 feet depth. In the Lower Floridan, however, production from the Southeast Test Well was split about equally between a zone at 1,140-1,180 feet and two thin cavities below 1,980 feet; whereas more than 95 percent of total flow for the Orange Test Well appears to originate from above 1,385 feet. The lack of production from depth at the Orange Test Well was not expected because the non-pumping flow logs showed prominent inter-zonal flow originating from cavities near bottom of hole at both sites. For example, the non-pumping (static) flow-meter log for the Lower Floridan aquifer, Orange Test Well Site, indicates that significant flow enters the borehole from thin cavities below 1,800 feet (losing zone) flows upward in the borehoe, and then re-enters the aquifer in zones above 1,150 feet (gaining zone). This indicates that (1) the hydraulic head in the formation is higher at 1,800 feet than at 1,150 feet, and (2) both the losing and gaining zones are characterized by relatively high permeability. A factor in non-contribution of the lower zones under pumping conditions at the Orange Test Well Site may have been the poor condition of the borehole at depth. Drilling difficulties had been encountered in this borehole at 1,710 - 1,730 feet and it was partially blocked in this interval during geophysical logging.

Overall transmissivity, as indicated from the step-drawdown testing, is higher at the Southeast Test Well Site. Here the measured drawdowns in both Upper and Lower Floridan zones were insufficient to allow any credible analysis for transmissivity. Thus it is concluded that transmissivity for both zones at the Southeast Test Well Site are at least 500,000 ft^2/d. At the Orange Test Well Site, drawdowns in the Upper Floridan allowed calculation of transmissivity of about 96,000 ft^2/d; but transmissivities for the Lower Floridan zone had to be estimated at about 500,000 ft^2/d because of lack of analyzable drawdown relations. ?

Field analyses indicate that chloride concentrations of the groundwater samples at the Southeast Test Well Site ranged from about 15-45 mg/L, and their vertical distribution shows a very gradual downward increasing trend with probable acceleration in the 1,950-2,000 foot interval. Total dissolved solids concentrations and total hardness (laboratory determinations) were slightly higher in the Lower Floridan as compared to the Upper Floridan. Field analysis for hydrogen sulfide indicated a maximum concentration of 5 mg/l at 1090 - 1409 feet.

At the Orange Test Well Site, field analyses indicate that chloride concentrations in the vertical profile range from about 15-40 mg/L. They show the expected gradual downward increase to about 1,400 feet, then decrease slightly and have a bottom-hole value of about 25 mg/L. Total dissolved solids concentrations and total hardness (from laboratory determinations) also reflect this unexpected slight reversal in groundwater quality relations between the Upper and Lower Floridan aquifers at the Orange Test Well Site. Field analyses for hydrogen sulfide indicated a maximum concentration of 5 mg/L at depth of about 1098 - 1400 feet.

The Upper Floridan aquifer is better confined at both sites than at existing OUC production well sites. This results from thicker and generally finer sections of overburden materials at both sites, which are classified as poor recharge areas, than at the existing OUC production well sites which are in high rate recharge areas. Additionally, there are no known drainage wells and land is generally less developed in the vicinity of the Southeast and Orange Test Well Sites. Thus, the Upper Floridan aquifer is less vulnerable to pollution at these locations than anywhere else in the OUC Service Area.

The Lower Floridan appears to be tightly confined at both sites by dense dolomitic zones in the middle semi-confining units. The hydraulic isolation between the Upper and Lower Florida zones is probably greater at the Southeast site where a continuous thickness of dense dolomite occurs between about 970-1,090 feet.

6.2 Regulatory Considerations

OUC has submitted Application No. 951103-10 to the SFWMD for proposed water supply facilities at the Southeast and Orange Test Well Sites. The OUC application has undergone preliminary review and a request for additional information has been made. The primary issue with both proposed wellfields is that a potential for adverse impacts to other legal users could result. Impact concerns include saline water movement on a regional scale and affecting the operation of Cocoa East and West Well Fields due to increases or shifts in drawdowns. The thickness and permeability of the upper confining unit limits recharge which should lessen concerns of surface water impacts or surface contamination potential.

Additionally, the Orange County Public Utilities Division has submitted an application to SFWMD for a new well field located about 2 miles south of the proposed Orange Test Well Site. The SFWMD considers these two applications to be competing uses due to limited water resource availability and anticipated interference due to their proximity (Section 373.233 F.S.).

The relative proximity of the planned Southeast Site to the City of Cocoa Well Field should have continued high priority. The City of Cocoa westernmost wells are about seven (7) miles east of the Southeast Test Well Site (Figure 1). The Cocoa Well Field began operation in the late 1950's in an area about 4 miles east of its present western limits and encountered early problems with water quality degradation, which have necessitated moving the withdrawals west in order to maintain production within dissolved solids tolerances. Initially, total withdrawals grew rapidly to more than 16 million gallons/day (mgd) by the late 1960's, then declined or leveled, over a period of years coincident with decreased withdrawals in relation to the Cape Canaveral defense and space complex. However, withdrawals now have grown to an average of about 25 mgd. All production from the Cocoa Well Field is from the Upper Floridan and is exported for use in Brevard County. The Lower Floridan is known to contain brackish groundwater throughout the well field area.

OUC is faced with selecting a production zone, for both proposed WTPs, that will provide a suitable long term source of freshwater and minimal drawdown impacts from the withdrawals requested. As part of the permitting requirements, a groundwater modeling effort may be performed to simulate optimal pumping scenarios and minimize drawdown effects.

Section 7.0
Conclusions

7.0 CONCLUSIONS

7.1 Southeast Test Well Site

from what test?

1. Both the Upper and Lower Floridan aquifer zones tested are capable of supplying large quantities of water. Transmissivity is estimated to be at least 500,000 ft^2/d in each aquifer; and the Upper Floridan at this site is likely the most productive of any of the four (4) aquifer zones tested during this project.

2. Based on geophysical logging interpretations, most production from the Upper Floridan occurs above 500 feet. In the Lower Floridan about 50 percent of production enters the borehole from two thin cavities below 1,980 feet; and much of the remainder enters from a cavity at 1,180 feet. So, what

3. The middle semi-confining unit at this site is best defined between about 500 - 1,100 feet due to the tight nature of formation materials. The dense dolomitic zone from about 970 - 1,090 should function as an effective barrier against vertical interchange of groundwater between the Upper and Lower Floridan.

4. Water quality in both the Upper and Lower Floridan aquifers is generally good; however, H_2S in the Lower Floridan was elevated (4.5 mg/l). Florida Primary and Secondary Drinking Water Standards (Ch. 62-555 F.A.C.) were not exceeded with exception of odor in the Lower Floridan (128 T.O.N.). The 250 mg/l isochlor was not encountered at the total depth of 2,000 feet. However, there was an observed increase in chloride concentrations in the 1,950-2,000 feet interval.

5. The Upper Floridan aquifer is less vulnerable to pollution at this site, classified as a poor recharge area, than at existing OUC well sites which are in high rate recharge areas.

6. If production well depths do not exceed 1,500 feet, vertical encroachment of brackish groundwater (upconing) is not considered to be a potential problem. The total thickness of dense dolomitic zones that are present between this depth and the fresh-brackish water interface at some depth below 2,000 feet should be an effective barrier to upconing. However, caution and additional investigation is advisable in regard to potential lateral encroachment into the Lower Floridan because of its high transmissivity and the unknown position of the fresh-saltwater interface to the east.

7.2 Orange Test Well Site

1. Both the Upper and Lower Floridan aquifer zones tested are capable of supplying large quantities of water, though neither zone is as highly transmissive as the Upper Floridan zone at the Southeast Test Well Site. Transmissivity in the Upper Floridan at Orange Test Well Site is calculated as about 96,000 ft^2/d, the lowest of any of the four (4) aquifer zones tested

during this project. Transmissivity in the Lower Floridan at Orange Test Site is estimated to be on the order of 500,000 ft^2/d.

2. Based on geophysical logging interpretations, most production from the Upper Floridan occurs above 500 feet, and most production from the Lower Floridan comes from above 1,200 feet. Dolomit + (semi-confining layer) only 100 feet aquifer (see No. 3 below)

3. The middle semi-confining unit at this site is probably best defined between 500 - 1,100 feet. The most effective confining beds probably occur at 620-670 feet.

4. Water quality in both the Upper and Lower Floridan aquifers is generally good; however, slightly less mineralized groundwater occurs in the Lower than in the Upper Floridan. Hydrogen sulfide in the Lower Floridan was elevated (5 mg/l). Florida Primary and Secondary Drinking Water Standards (Ch. 62-555 F.A.C.) were not exceeded with exception of odor in the Lower Floridan (16 T.O.N.). The 250 mg/l isochlor was not encountered at the total depth of 2000 feet.

5. The Upper Floridan aquifer is less vulnerable to pollution at this site, classified as a poor recharge area, than at existing OUC well sites which are in high rate recharge areas.

6. If total production well depths do not exceed 1,500 feet, vertical encroachment of brackish groundwater (upconing) is not considered to be a potential problem. The total thickness of dense dolomitic zones that are present between this depth and the fresh-brackish water interface at some depth below 2,000 feet should be an effective barrier to upconing. Lateral encroachment is also not considered a potential problem at the Orange Test Well Site because of its remoteness from any fresh-brackish groundwater interface.

SELECTED REFERENCES

Boyle Engineering Corporation, 1995; Hydrogeologic Report - Orange County Southern Regional Wellfield, August, 1995

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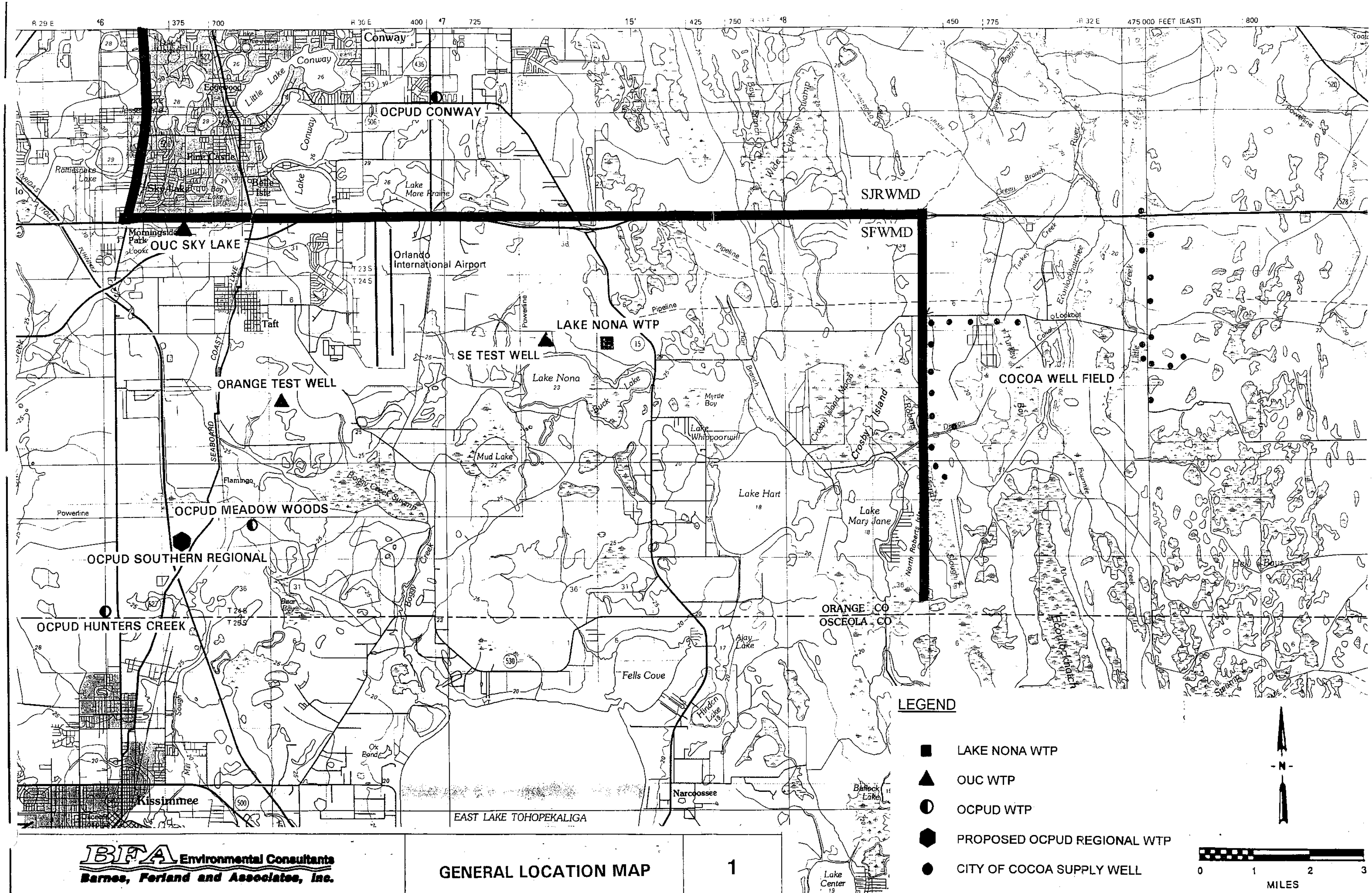
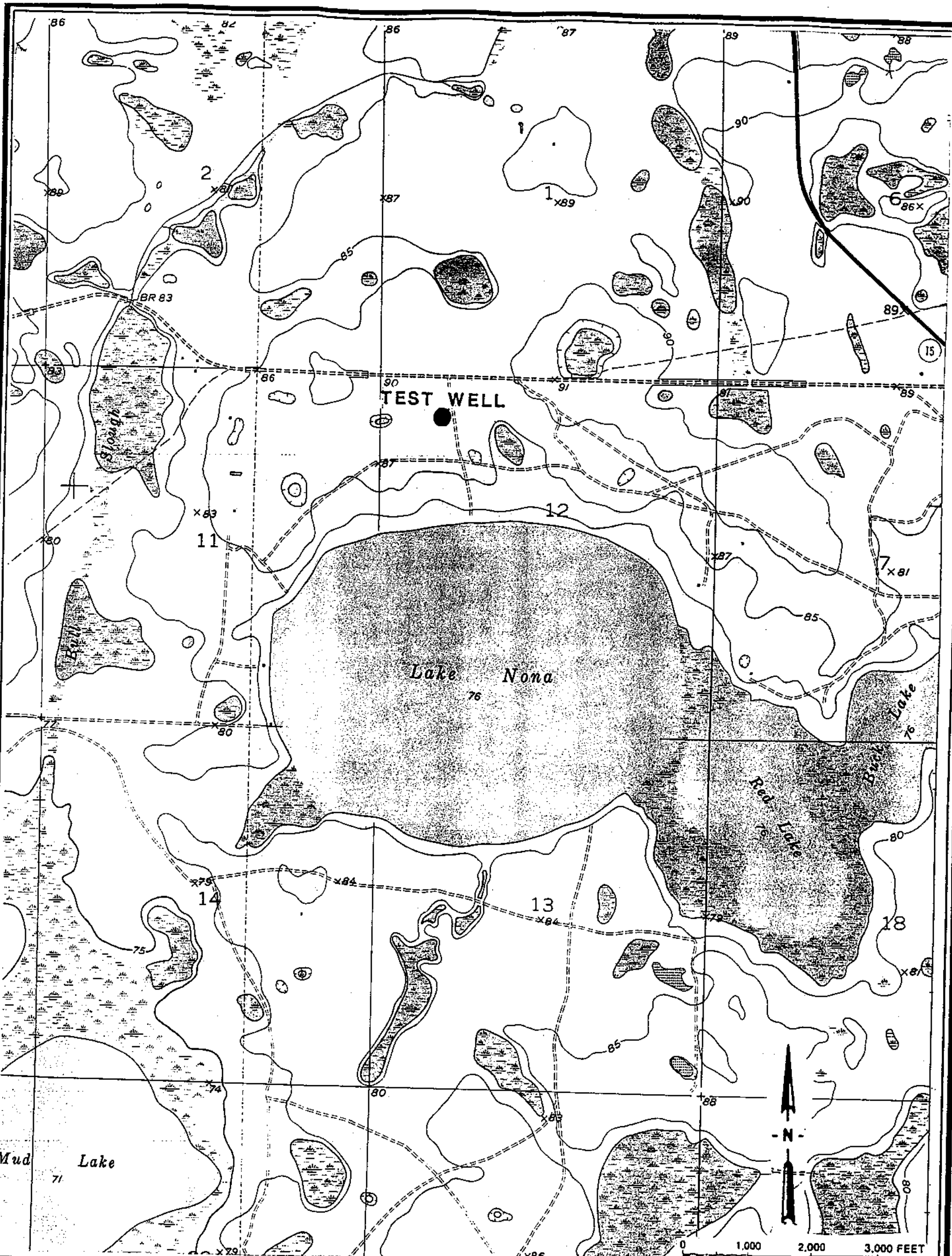
Figures



GENERAL LOCATION MAP

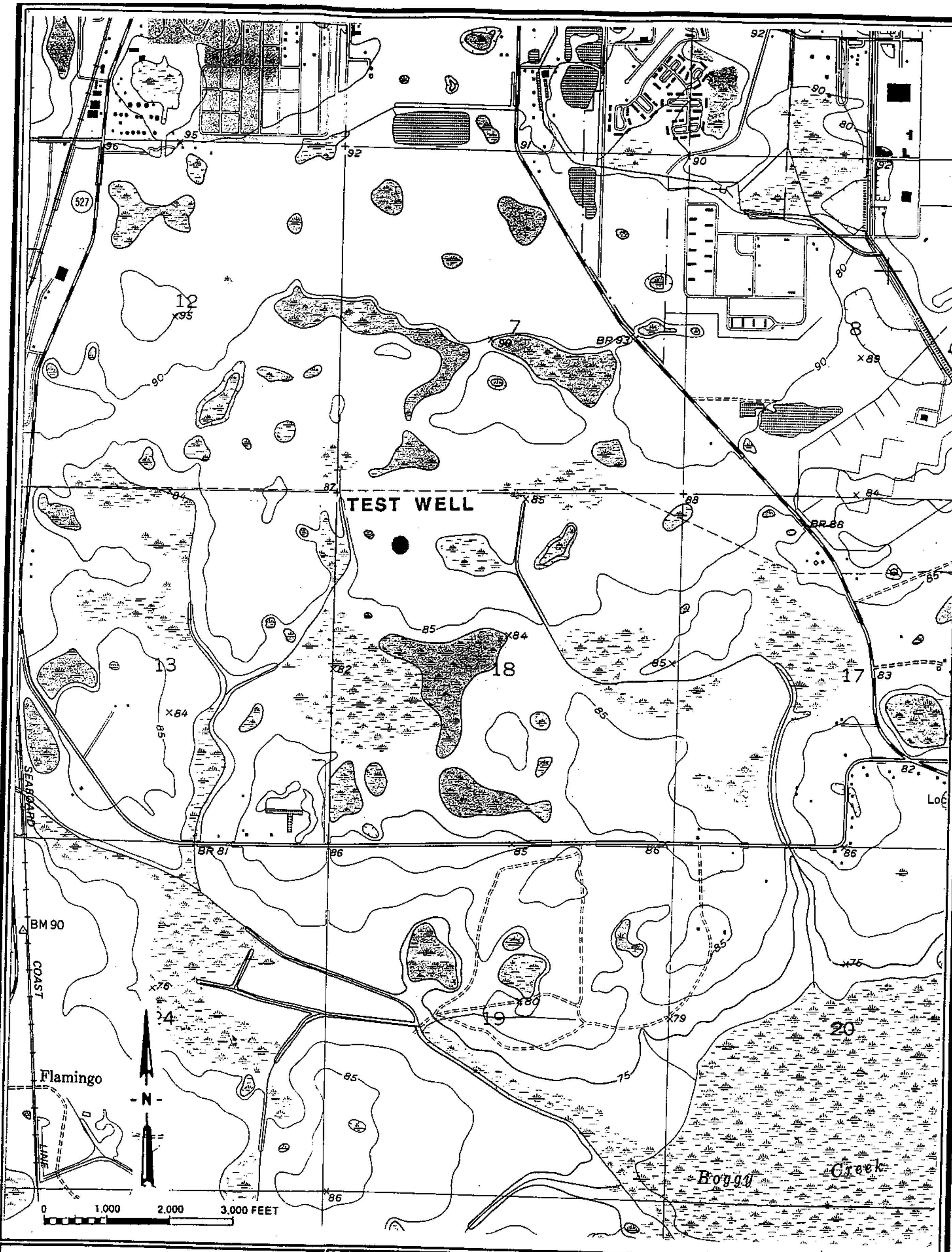
1



BFA Environmental Consultants
Barnes, Ferland and Associates, Inc.

SE TEST WELL LOCATION

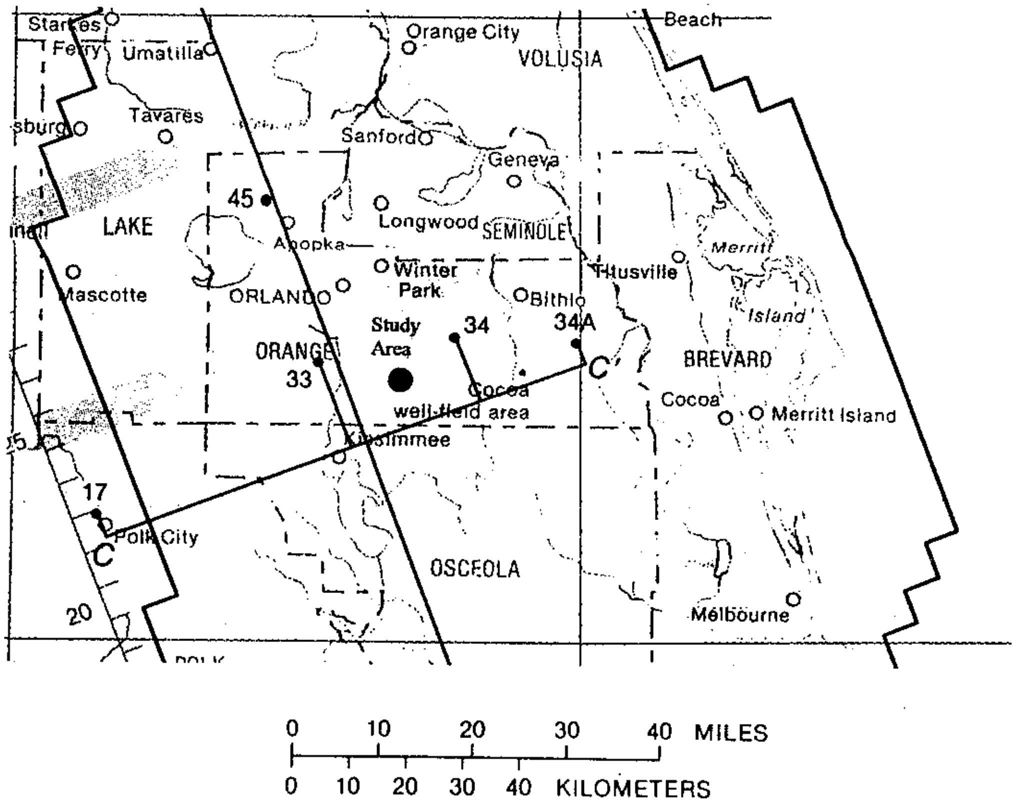
2



BFA Environmental Consultants
Barnes, Ferland and Associates, Inc.

ORANGE TEST WELL LOCATION

3



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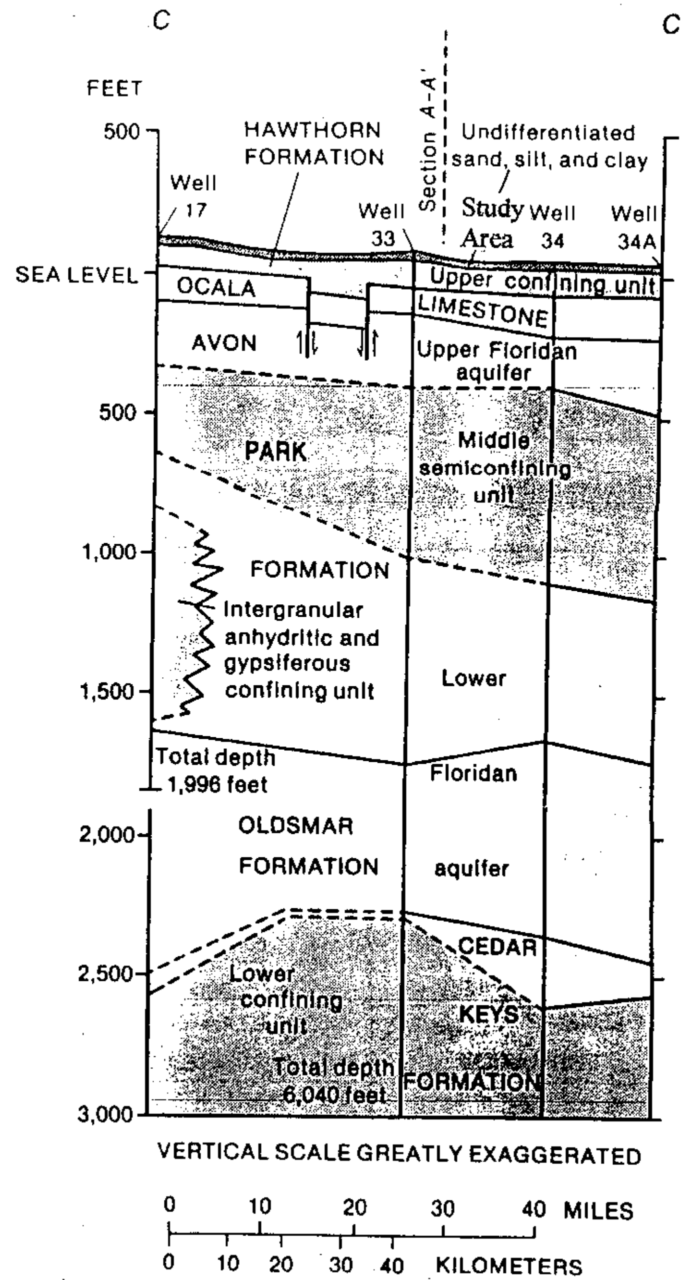
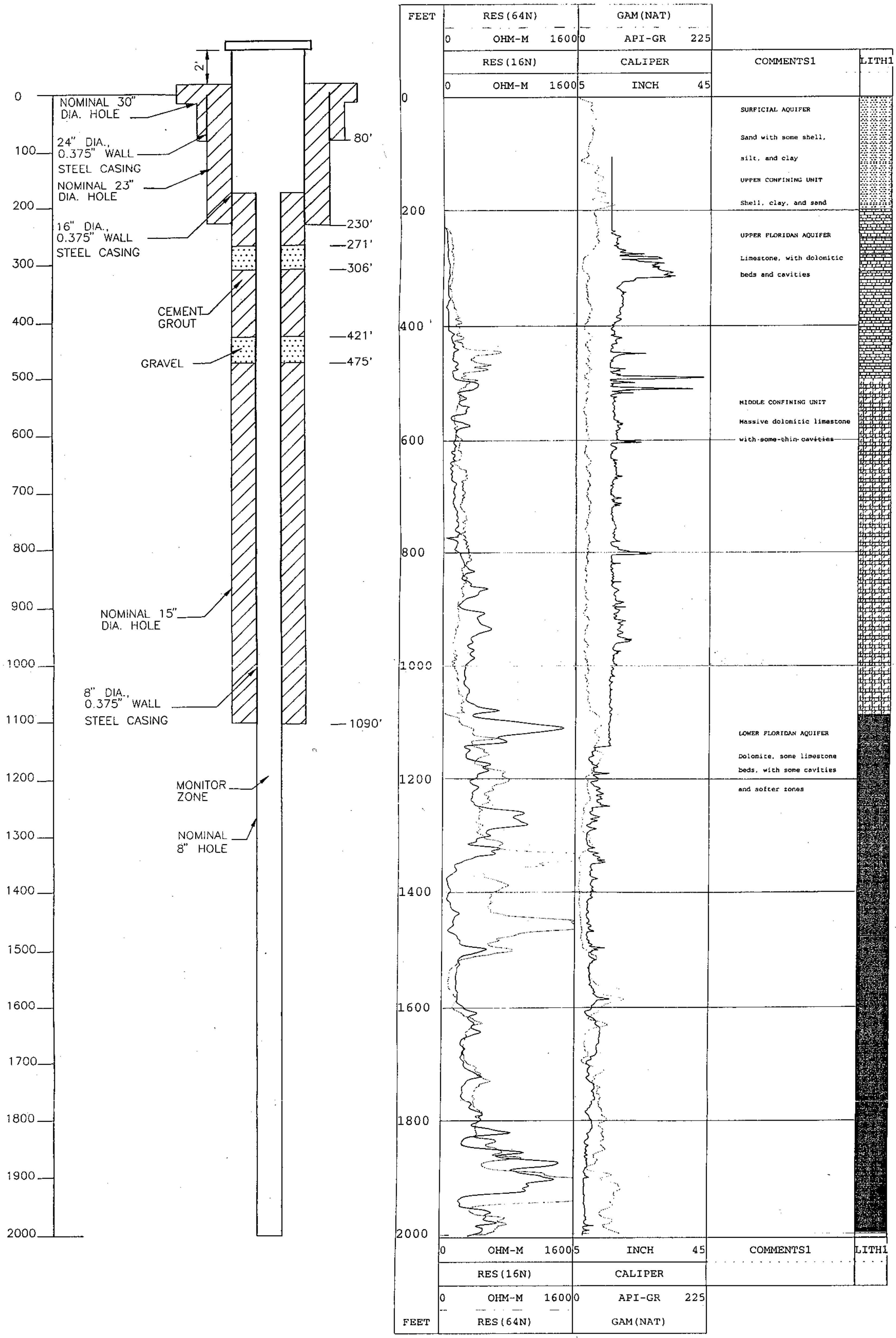


BFA Environmental Consultants
Barnes, Ferland and Associates, Inc.

HYDROGEOLOGIC SECTION OF STUDY AREA

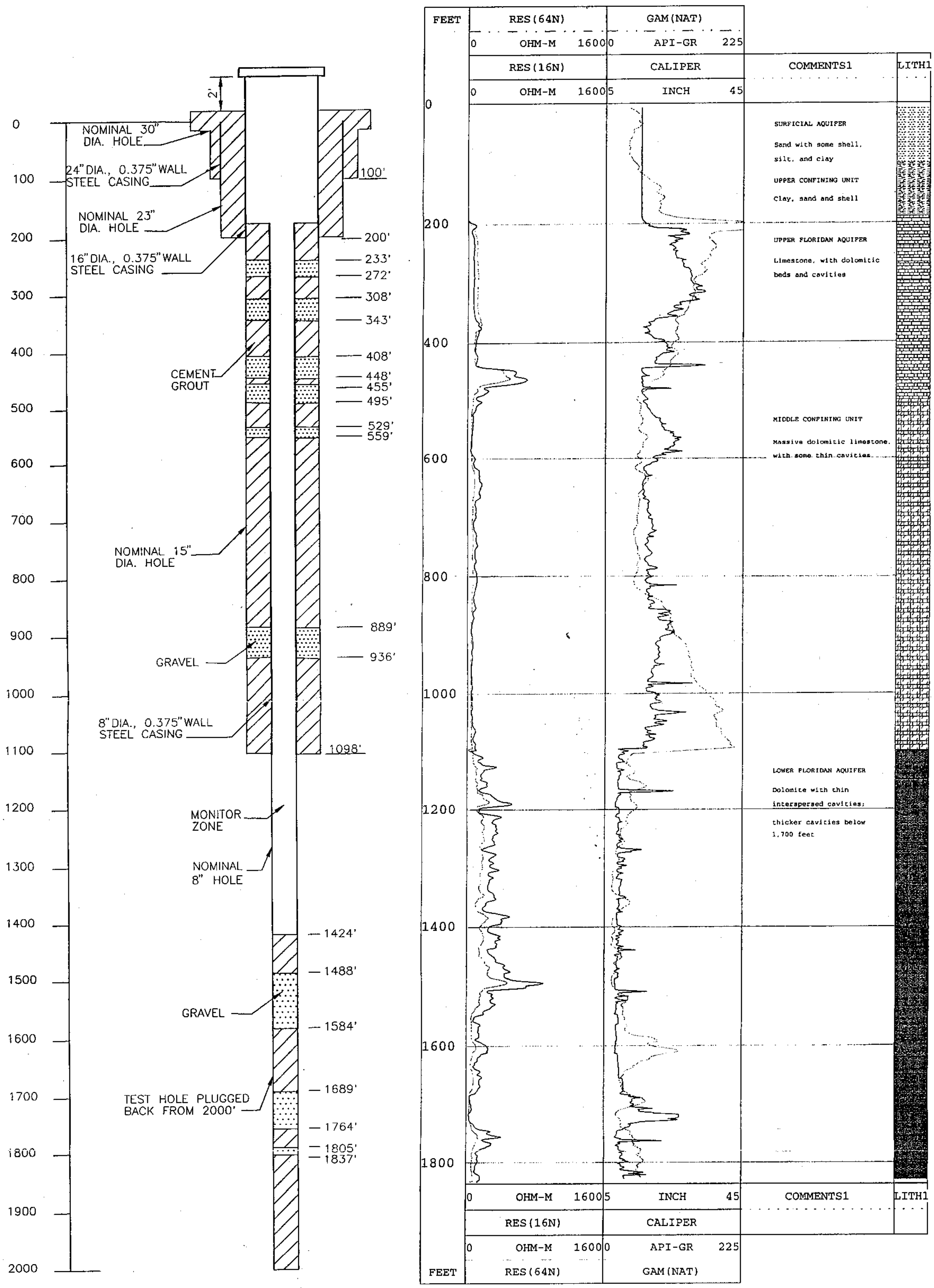
4



BFA Environmental Consultants
Barnes, Ferland and Associates, Inc.

SOUTHEAST TEST WELL CONSTRUCTION DETAILS AND SELECTED GEOPHYSICAL LOGS

FIGURE 5

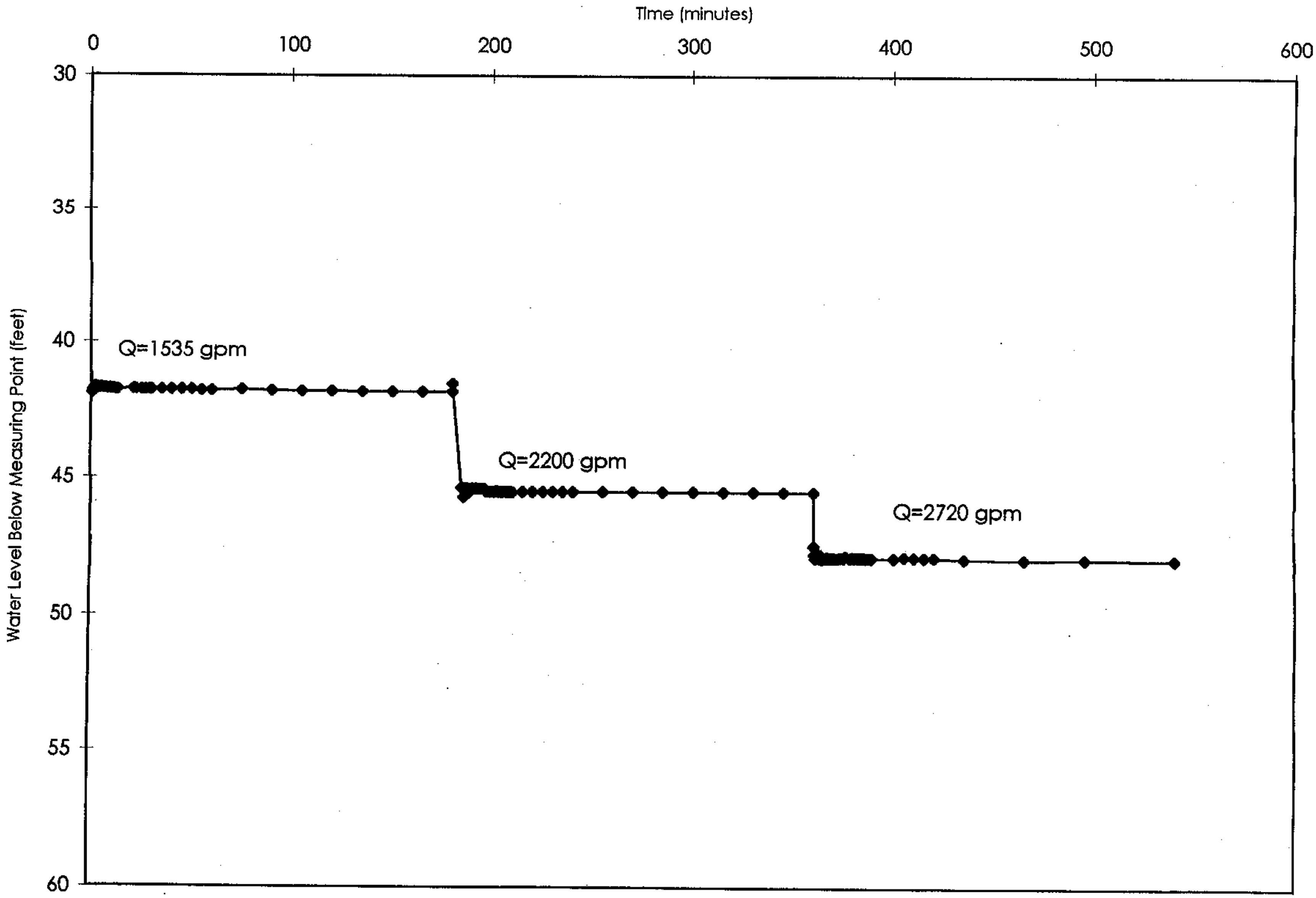


BFA Environmental Consultants
Barnes, Ferland and Associates, Inc.

ORANGE TEST WELL CONSTRUCTION DETAILS AND SELECTED GEOPHYSICAL LOGS

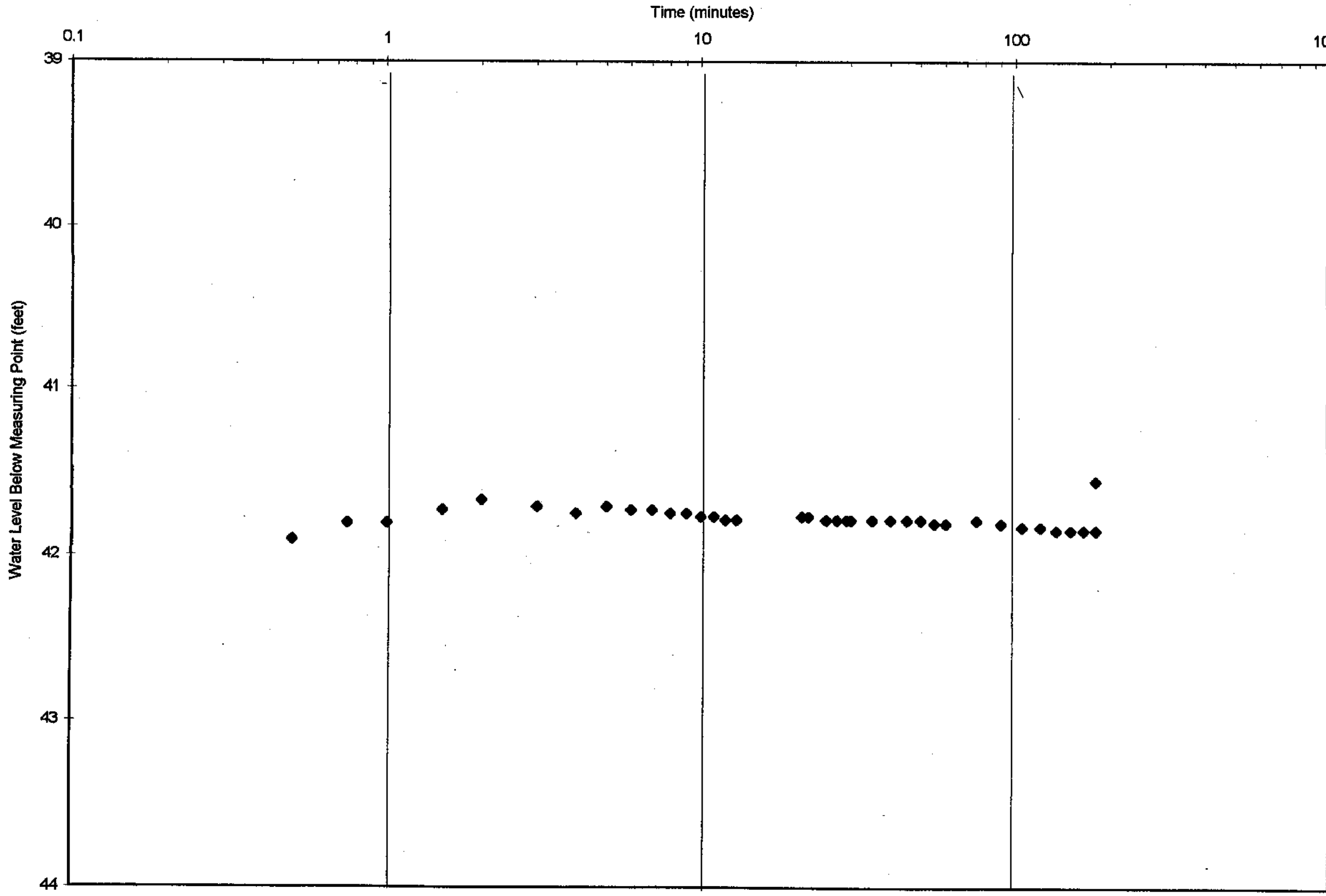
FIGURE 6

Figure 7 - Water Levels in the Southeast Test Well During the Upper Floridan Step Drawdown Test



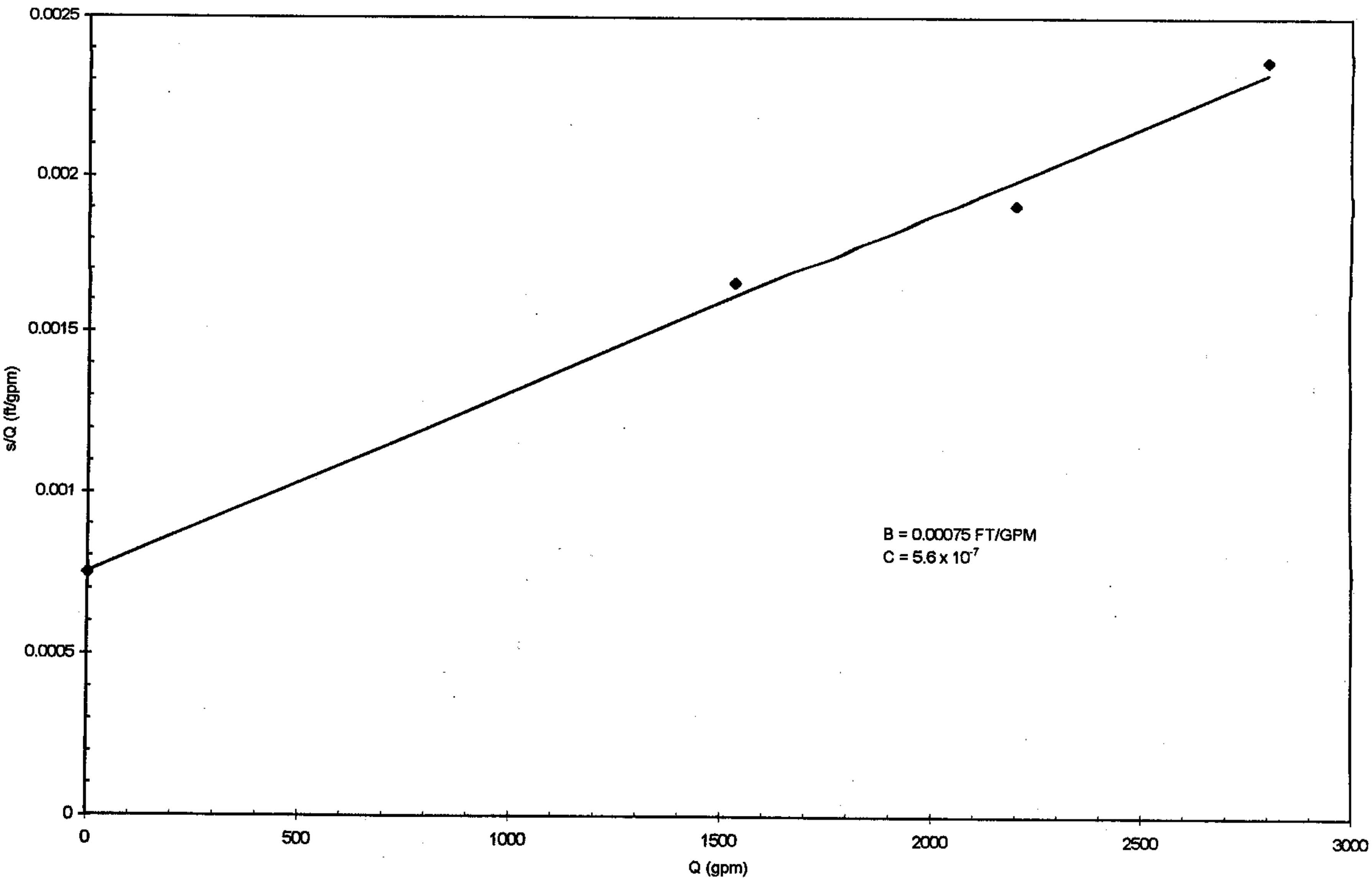
OUC-SE Chart 4

Figure 8 - Semi-Logarithmic Plot of Water Level Vs Time During Step 1 of the Upper Floridan Step Drawdown Test at the Southeast Test Well



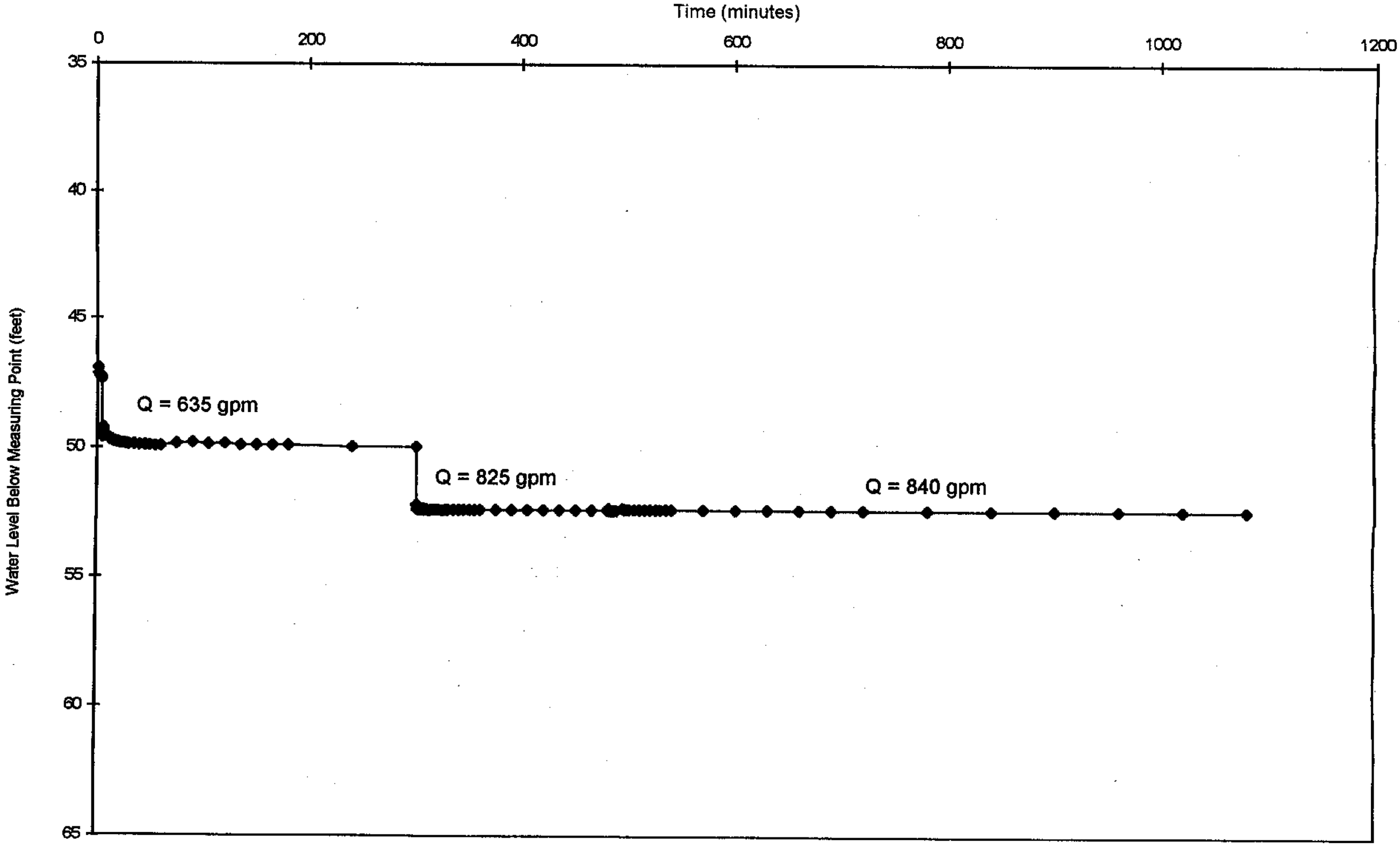
OUC-SE Chart 8

Figure 9 - Step Drawdown Test, Upper Floridan Aquifer, Southeast Test Well



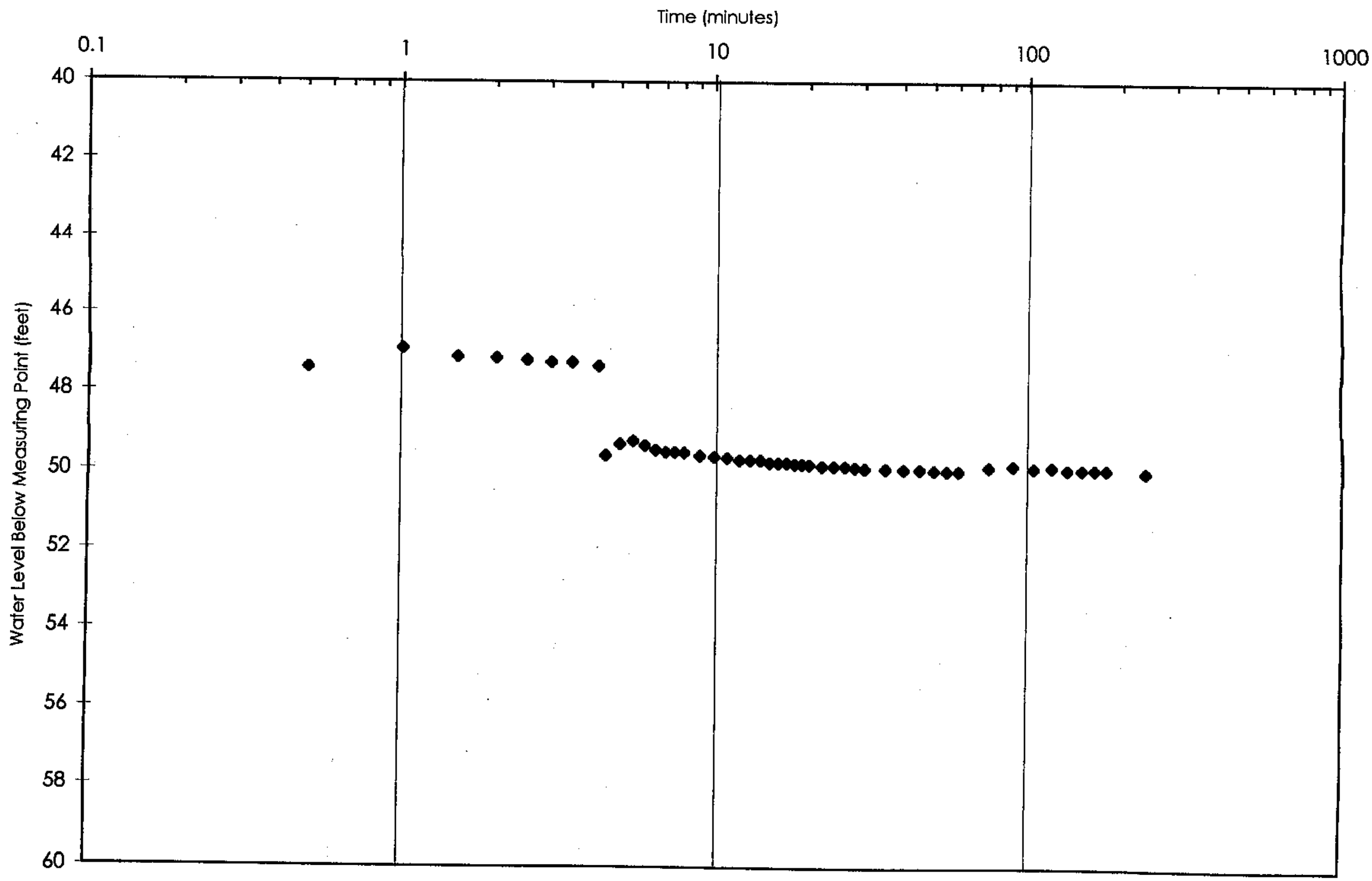
Sheet1 Chart 3

Figure 10 - Water Levels in the Southeast Test Well During the Lower Floridan Step Drawdown Test



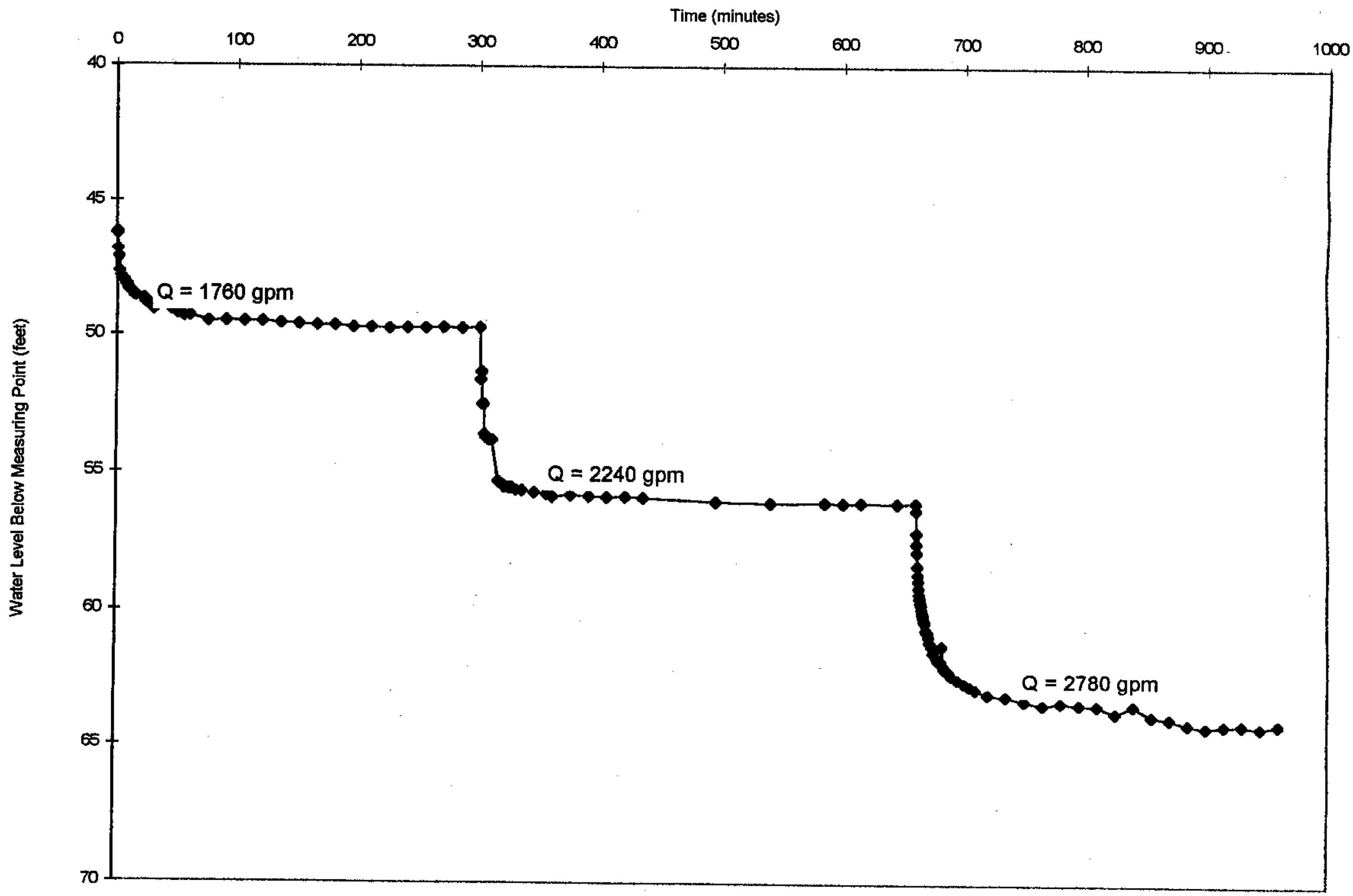
OUCLF2 Chart 10

Figure 11 - Semi-Logarithmic Plot of Water Level Vs Time During Step 1 of the Lower Floridan Step Drawdown Test at the Southeast Test Well



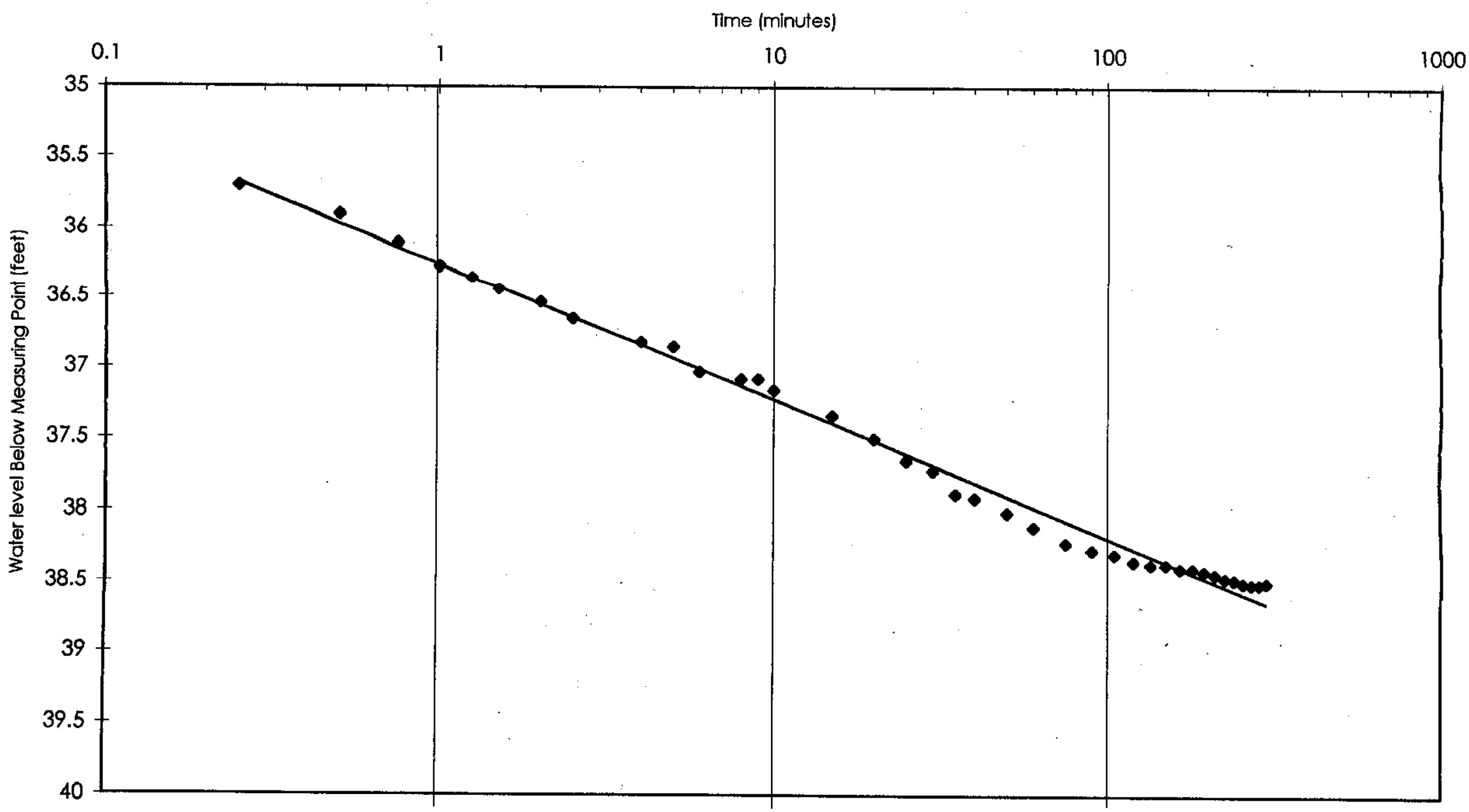
OUCLF2 Chart 3

Figure 12 - Water Levels In the Orange Test Well During the Upper Floridan Step Drawdown Test



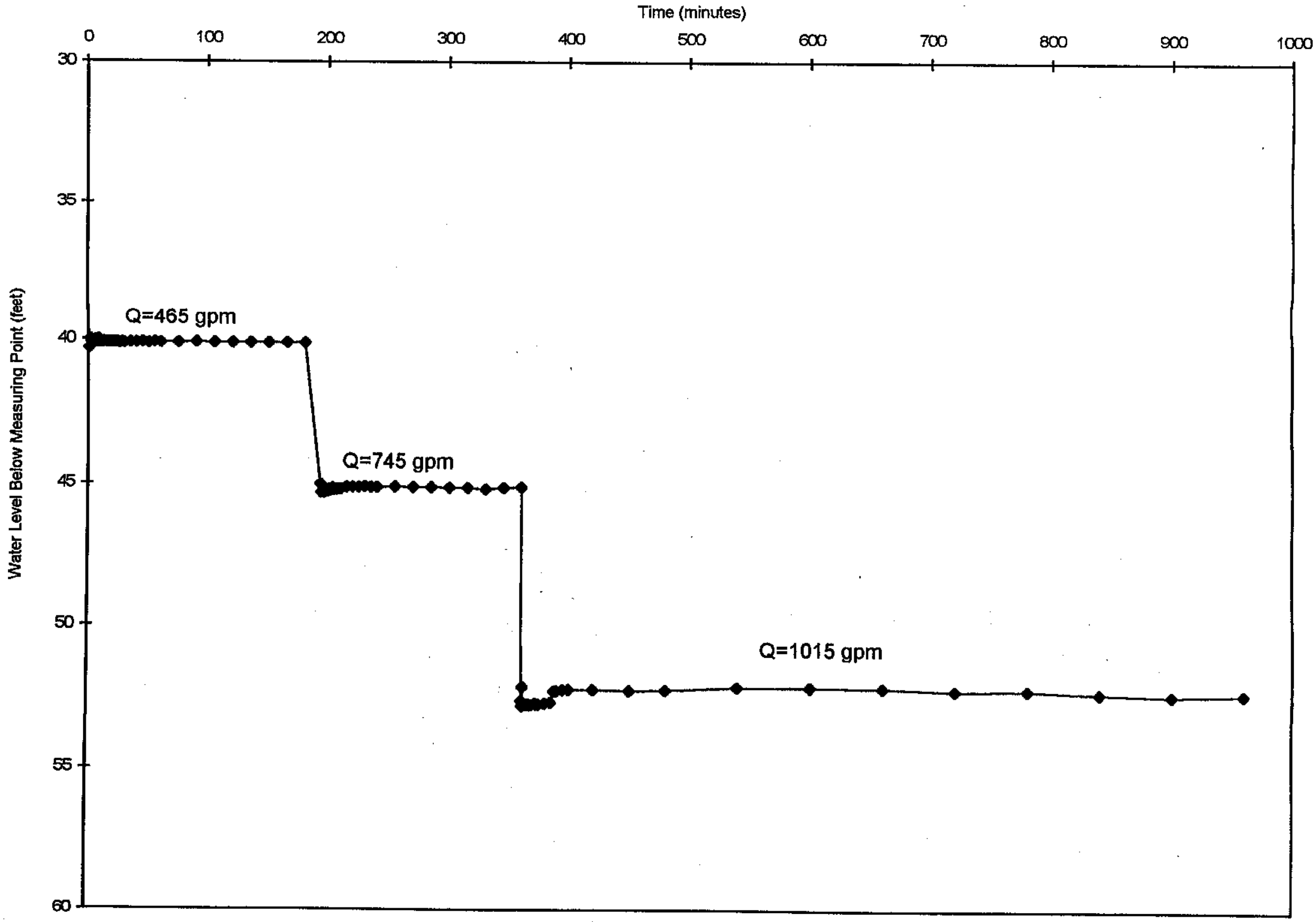
OUC-OR Chart 5

Figure 13 - Semi-Logarithmic Plot of Water Level Vs Time During Step 3 of the Upper Floridan Step Drawdown Test at the Orange Monitoring Well



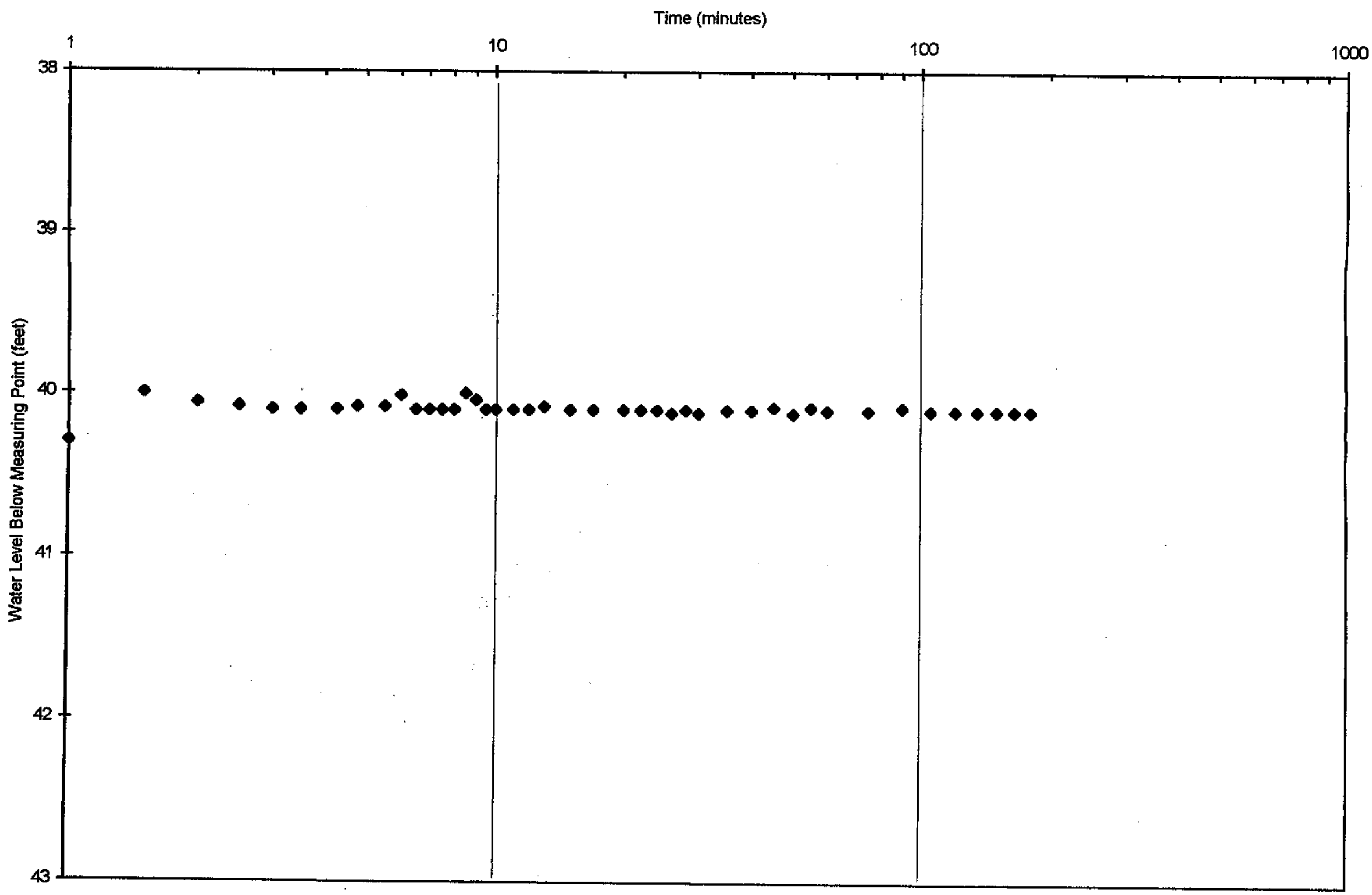
OUCMWO1 Chart 1

Figure 14 - Water Level in the Orange Test Well During the Lower Floridan Step Drawdown Test



OUCLF1 Chart 3

Figure 15 - Semi-Logarithmic Plot of Water Level Vs Time During Step 1 of the Lower Floridan Step Drawdown Test at the Orange Test Well



OUCLF1 Chart 2

Tables

TABLE 1. SUMMARY OF STEP DRAWDOWN TESTING AT THE SOUTHEAST AND ORANGE TEST WELLS

TEST SITE	(1) AQUIFER	OPEN HOLE INTERVAL	STEP NO	PUMPING DURATION (min)	DISCHARGE RATE (gpm)	(2) CHLORIDES (mg/l)	(3) HYDROGEN SULFIDE (mg/l)	(4) SPECIFIC CONDUCTANCE (umhos/cm)
SOUTHEAST	UF	230-1100	1	180	1535	25	0.50	415
	UF	230-1100	2	180	2200	30	0.50	430
	UF	230-1100	3	180	2720	35	1.00	428
SOUTHEAST	LF	1090-1409	1	300	635	35	5.00	450
	LF	1090-1409	2	180	825	30	5.00	450
	LF	1090-1409	3	600	840	35	5.00	450
ORANGE	UF	200-1100	1	300	1760	25	1.00	432
	UF	200-1100	2	300	2240	30	1.00	454
	UF	200-1100	3	300	2780	30	1.00	446
ORANGE	LF	1098-1400	1	180	465	30	5.00	399
	LF	1098-1400	2	180	745	30	5.00	398
	LF	1098-1400	3	600	1015	30	5.00	398

NOTES:
1) UF - UPPER FLORIDAN; LF - LOWER FLORIDAN
2) HACH TEST KIT MODEL 8-P - (5 - 400 mg/l range) - SAMPLE RESULT AT THE END OF EACH STEP TEST
3) HACH TEST KIT MODEL HS-C - (0 - 5 mg/l range) - SAMPLE RESULT AT THE END OF EACH STEP TEST
4) CONDUCTIVITY METER (HAZCO YSI - 33) - SAMPLE RESULT AT THE END OF EACH STEP TEST. RESULTS CORRECTED TO 25°C.

OUC-WQ.XLS

Table 2: Adjusted Drawdown And Specific Capacity Results

OUC - Southeast Upper Floridan - October 12, 1995
Production Interval : 230 - 1,100 Feet

Pumping Rate Q (gpm)	Elapse Time (min)	Observed Drawdown Δs (ft)	Observed Specific Capacity $Q/\Delta s$ (gpm/ft)	Adjusted Drawdown $\Delta s'$ (ft)	Adjusted Specific Capacity $Q/\Delta s'$ (gpm/ft)
1,535	180	2.54	604	1.22	1,258
2200	360	4.20	524	1.50	1,469
2,800	540	6.62	423	2.23	1,256

$\Delta s = BQ + CQ^2$
$B = 7.5E^{-4}$ $C = 5.6\,E^{-7}$

OUC - Southeast Lower Floridan - November 28, 1995
Production Interval : 1,090 - 1,409 Feet

Pumping Rate Q (gpm)	Elapse Time (min)	Observed Drawdown Δs (ft)	Observed Specific Capacity $Q/\Delta s$ (gpm/ft)	Adjusted Drawdown $\Delta s'$ (ft)	Adjusted Specific Capacity $Q/\Delta s'$ (gpm/ft)
635	300	8.16	78	* Indeterminate	* Indeterminate
825	480	10.58	78	* Indeterminate	* Indeterminate
840	1,080	10.56	80	* Indeterminate	* Indeterminate

* Values for B and C are Indeterminate

OUC - Orange Upper Floridan - October 5, 10, 1995
Production Interval : 200 - 1,100 Feet

Pumping Rate Q (gpm)	Elapse Time (min)	Observed Drawdown Δs (ft)	Observed Specific Capacity $Q/\Delta s$ (gpm/ft)	Adjusted Drawdown $\Delta s'$ (ft)	Adjusted Specific Capacity $Q/\Delta s'$ (gpm/ft)
1,760	300	16.2	109	10.75	164
2,240	600	22.5	96	13.7	164
2,780	900	30.7	91	17.1	163

$\Delta s = BQ + CQ^2$
$B = 6.07E^{-3}$ $C = 1.76E^{-6}$

OUC - Orange Lower Floridan - January 12, 1996
Production Interval : 1,098 - 1,400 Feet

Pumping Rate Q (gpm)	Elapse Time (min)	Observed Drawdown Δs (ft)	Observed Specific Capacity $Q/\Delta s$ (gpm/ft)	Adjusted Drawdown $\Delta s'$ (ft)	Adjusted Specific Capacity $Q/\Delta s'$ (gpm/ft)
470	180	3.96	119	0.91	516
745	360	8.98	83	1.32	564
1,020	960	16.18	63	1.82	560

$\Delta s = BQ + CQ^2$
$B = 1.75E^{-3}$ $C = 1.38E^{-5}$

Table 3. Comparison of Selected Raw Water Quality

Parameter	Southeast Site			Orange Site		Current Lake Nona WTP	OUC Sky Lake WTP	Average Other OUC WTPs
	Upper Floridan	Lower Floridan	Grab Sample From Bottom of Hole [a]	Upper Floridan	Lower Floridan			
Approximate Production Interval	230-700	1,100 - 1,400	2000	201 - 700	1,100 - 1,400	250 - 600	920 - 1,400	1,000 - 1,400
Sulfide (mg/L)	2.5	4.5	2.5	1	5	0.9 - 2.5	2.4	2.0
T. Hardness (mg/L)	196	212	335	218	180	156	131	128
Alkalinity (mg/L)	196	190	230	195	130	168	118	116
TDS (mg/L)	270	290	ns	286	240	200	164	154
Sulfate (mg/L0	2	70	ns	13	61	4	12	9
Color (mg/L)	<5	16	ns	11	5	18	6	9
TOC (mg/L)	2.1	3.7	ns	2.9	3.0	3.8	1.7	1.7
Bromide (mg/L)	0.020	0.020 - 0.045	0.045	<0.020	0.024	0.020	<0.020	<0.020
Langelier Index at pH 8	0.76	0.84	ns	0.80	s	0.63	0.44	0.36
CCPP at pH 8 (mg/L)	24.7	28.6	ns	26.5	s	16.8	7.45	5.57

Notes:

ns = Not Sampled

s = Sampled but analytical data not received from lab at the time

[a] Field analyses

CCPP = Calcium Carbonate Precipitation Potential

Appendix A
SFWMD Well Construction Permits

South Florida Water Management District
3301 Gun Club Road, West Palm Beach, Florida 33406 • (407) 686-8800 • FL WATS 1-800-432-2045

CON 24-06

June 15, 1995

PERMITTEE
ORLANDO UTILITIES COMMISSION
500 SOUTH ORANGE AVENUE
ORLANDO, FL 32801

CONTRACTOR
FRIEDLANDER, EUGENE C.
2801 N.W. 6TH AVENUE
MIAMI, FL 33127
LICENSE NO:11033

WATER WELL CONSTRUCTION PERMIT # SF061495A
EXPIRATION DATE: December 15, 1995

PROJECT: ORANGE UTILITIES SOUTHEAST TEST WELL
TYPE OF USE: TEST/MONITOR
COUNTY: ORANGE SEC: 12 TWP: 24 RGE: 30

WELL CONSTRUCTION SPECIFICATIONS:	**INNER**	**OUTER**
CASING DIAMETER:	8"	16"
CASING DEPTH:	1100.00'	250.00'
SCREENED INTERVAL:	-	
OPEN HOLE INTERVAL:	1100' - 2000'	
TOTAL DEPTH OF WELL:	2000.00'	
GROUT REQUIREMENT:		

Inner casing shall be grouted bottom to top.
Outer casing shall be grouted bottom to top.

See additional conditions of permit on attached sheet.

We appreciate your assistance and cooperation in better managing the water resources of the District. If you have any questions on this matter, please call Ann-Marie Superchi at extension 6929.

Sincerely,

Jeffrey Rosenfeld
for Steve D. Anderson, P.G., Supervising Professional
Water Use Division, Regulation Department

Attachment: Additional Conditions of Permit
c: MR. AL AIKENS-CH2M HILL
MERIDITH ASSOCIATES

COMPLETION REPORT REQUIRED

A Water Well Completion Report (Form 0124) must be filed with the District within 30 days of completion of work.

ADDITIONAL CONDITIONS OF PERMIT

TEST RESULTS SHALL BE SUBMITTED TO THE DISTRICT WITHIN 30 DAYS OF COMPLETION OF TESTING.

South Florida Water Management District

3301 Gun Club Road, West Palm Beach, Florida 33406 • (407) 686-8800 • FL WATS 1-800-432-2045

CH2M HILL
JUN 17 1995
ORLANDO

CON 24-05

June 15, 1995

PERMITTEE
ORLANDO UTILITIES COMMISSION
500 SOUTH ORANGE AVENUE
ORLANDO, FL 32801

CONTRACTOR
FRIEDLANDER, EUGENE C.
2801 N.W. 6TH AVENUE
MIAMI, FL 33127
LICENSE NO:11033

WATER WELL CONSTRUCTION PERMIT # SF061495B
EXPIRATION DATE: December 15, 1995

PROJECT: ORANGE UTILITIES WATER TREATMENT PLANT TEST WELL
TYPE OF USE: TEST/MONITOR
COUNTY: ORANGE SEC: 18 TWP: 24 RGE: 30

WELL CONSTRUCTION SPECIFICATIONS:	**INNER**	**OUTER**
CASING DIAMETER:	8"	16"
CASING DEPTH:	1100.00'	175.00'
SCREENED INTERVAL:	-	
OPEN HOLE INTERVAL:	1100' - 2000'	
TOTAL DEPTH OF WELL:	2000.00'	

GROUT REQUIREMENT:
Inner casing shall be grouted bottom to top.
Outer casing shall be grouted bottom to top.

See additional conditions of permit on attached sheet.

We appreciate your assistance and cooperation in better managing the water resources of the District. If you have any questions on this matter, please call Ann-Marie Superchi at extension 6929.

Sincerely,

Jeffrey Rosenfeld
for Steve D. Anderson, P.G., Supervising Professional
Water Use Division, Regulation Department

Attachment: Additional Conditions of Permit
c: MR. AL AIKENS-CH2M HILL
MERIDITH ASSOCIATES

Mailing Address: P.O. Box 24680, West Palm B...

COMPLETION REPORT REQUIRED

A Water Well Completion Report (Form 0124) must be filed with the District within 30 days of completion of work.

ADDITIONAL CONDITIONS OF PERMIT

TEST RESULTS SHALL BE SUBMITTED TO THE DISTRICT WITHIN 30 DAYS OF COMPLETION OF TESTING.

South Florida Water Management District

3301 Gun Club Road, West Palm Beach, Florida 33406 • (407) 686-8800 • FL WATS 1-800-432-2045

CON 24-06

April 05, 1996

PERMITTEE	**CONTRACTOR**
ORLANDO UTILITIES COMMISSION	FRIEDLANDER, EUGENE C.
500 SOUTH ORANGE AVENUE	2801 N.W. 6TH AVENUE
ORLANDO, FL 32801	MIAMI, FL 33127
	LICENSE NO:11033

WATER WELL CONSTRUCTION PERMIT # SF061495B
EXPIRATION DATE: October 05, 1996

PROJECT: ORANGE UTILITIES WATER TREATMENT PLANT TEST WELL
TYPE OF USE: TEST/MONITOR
COUNTY: ORANGE SEC: 18 TWP: 24 RGE: 30

WELL CONSTRUCTION SPECIFICATIONS:	**INNER**	**OUTER**
CASING DIAMETER:	8"	16"
CASING DEPTH:	1100.00'	175.00'
SCREENED INTERVAL:	-	
OPEN HOLE INTERVAL:	1100' - 2000'	
TOTAL DEPTH OF WELL:	2000.00'	

GROUT REQUIREMENT:
Inner casing shall be grouted bottom to top.
Outer casing shall be grouted bottom to top.

See additional conditions of permit on attached sheet.

We appreciate your assistance and cooperation in better managing the water resources of the District. If you have any questions on this matter, please call Ann-Marie Superchi at extension 6929.

Sincerely,

Steve D. Anderson, P.G., Supervising Professional
Water Use Division, Regulation Department

Attachment: Additional Conditions of Permit
c: MR. AL AIKENS-CH2M HILL
MERIDITH ASSOCIATES

Mailing Address: P.O. Box 24680, West Palm Beach, FL 33416-4680

South Florida Water Management District

3301 Gun Club Road, West Palm Beach, Florida 33406 • (407) 686-8800 • FL WATS 1-800-432-2045

CON 24-06

CH2M HILL
APR 08 [illegible]
ORLANDO

April 05, 1996

PERMITTEE
ORLANDO UTILITIES COMMISSION
500 SOUTH ORANGE AVENUE
ORLANDO, FL 32801

CONTRACTOR
FRIEDLANDER, EUGENE C.
2801 N.W. 6TH AVENUE
MIAMI, FL 33127
LICENSE NO:11033

WATER WELL CONSTRUCTION PERMIT # SF061495A
EXPIRATION DATE: October 05, 1996

PROJECT: ORANGE UTILITIES SOUTHEAST TEST WELL
TYPE OF USE: TEST/MONITOR
COUNTY: ORANGE SEC: 12 TWP: 24 RGE: 30

WELL CONSTRUCTION SPECIFICATIONS:	**INNER**	**OUTER**
CASING DIAMETER:	8"	16"
CASING DEPTH:	1100.00'	250.00'
SCREENED INTERVAL:	-	
OPEN HOLE INTERVAL:	1100' - 2000'	
TOTAL DEPTH OF WELL:	2000.00'	

GROUT REQUIREMENT:
Inner casing shall be grouted bottom to top.
Outer casing shall be grouted bottom to top.

See additional conditions of permit on attached sheet.

We appreciate your assistance and cooperation in better managing the water resources of the District. If you have any questions on this matter, please call Ann-Marie Superchi at extension 6929.

Sincerely,

Steve D. Anderson, P.G., Supervising Professional
Water Use Division, Regulation Department

Attachment: Additional Conditions of Permit
c: MR. AL AIKENS-CH2M HILL
MERIDITH ASSOCIATES

Appendix B
Lithologic Descriptions and Driller's Well Completion Report

WELL COMPLETION REPORT
FORM 0124
Rev. 11/90

WELL PERMIT NO. SF061495A
SFWMD WATER USE PERMIT NO. ______

Orlando Utilities Commission — Owner
500 S. Orange Ave., Orlando, Florida 32801 — Address / City / State / Zip

Contractor's Signature: ______
License No.: 11033
Completion Date: 3/96
Casing Depth: Inner 1090'x8" Outer 233'x16"
Total Depth: 2000'
Well #: /

TYPE OF WORK: Construct (X) Repair ( ) Abandon ( )
WELL USE: Domestic Well ( ) Public ( ) Monitor (X) Test (X)
Irrigation ( ) Fire Well ( ) Other ______
METHOD: Rotary with MUD (X) or Air (X) Cable Tool ( ), Jet ( )
Casing Driven ( ), Other ______
STATIC WATER LEVEL 34.6 Ft. below top of casing
PUMPING WATER LEVEL ____ Ft. after 1.5 Hrs. at 1020 GPM
PUMP SIZE 250 H.P. CAPACITY 1800 GPM
PUMP TYPE ______ INTAKE DEPTH ______ From top of ground

Grout	Casing & Screen		Depth (ft)		DRILL CUTTINGS LOG Examine cuttings every 20 ft. or at formation changes. Give color, grain size, and type of material. Note cavities, depth to producing zones.
Thickness & Depth	Diameter & Depth		From	To	
					SEE ATTACHED DESCRIPTIONS
Number of bags					

LOCATION

Located Near ______
County: Orange
¼ ¼ — Section: 12 — Township: 24 — Range: 30
Latitude-Longitude: ______

Cuttings sent to District? ( ) Yes (X) No

LOCATE IN SECTION

Note: PWS Wells attach a site map if well location is different from site location on permit application.

Casing: Black Steel (X) Galv. ( ) PVC ( ) Fiberglass ( )
Screen: Type ______ Slot size ______
Screened from ______ (ft.) to ______ (ft.)
Type of grout with % additives ______
Water: Clear ( ) Colored ( ) Sulphur ( ) Salty ( ) Iron ( )
Conductivity ______ Chlorides 35 mg/l

LITHOLOGIC DESCRIPTION FOR THE SOUTHEAST TEST WELL

Depth (Ft)	Description
0 - 30	Sand, fine grained, brown, angular, minor organic matter.
30 - 40	Sand, coarse grained, brown, angular, with silt, minor organic matter.
40 - 50	Sand, as above.
50 - 60	Sand, coarse grained, dark gray, angular, with silt.
60 - 70	Sand, coarse to fine grained, light gray, angular, with silty gray clay, overall plasticity low.
70 - 80	Clay, medium gray, overall plasticity high.
80 - 90	Sand, fine grained, medium gray, angular, with silt, phosphorite grains, clay cement.
90 - 100	Sand, fine grained, medium gray, angular, clay cement, with silt, phosphorite grains.
100 - 110	Shell and sand, fine grained, light gray, angular with clay cement, and silt.
110 - 120	Shell and sand, as above.
120 - 130	Shell and sand, as above.
130 - 140	Shell and sand, as above.
140 - 150	Shell, clay and sand, fine grained, dark gray, with phosphatic sand.
150 - 160	Shell, clay and sand, as above.
160 - 170	Shell, clay and sand, as above.
170 - 180	Shell with clay, dark brown, trace quartz and phosphatic sand.
180 - 190	Shell with clay, same as above.
190 - 200	Shell and clay, dark brown, trace quartz and phosphatic sand, trace limestone, light gray.
200 - 210	Limestone, very fine grained, creamy, pinpoint vugs, with marl, some shell fragments.
210 - 220	Limestone, as above.
220 - 230	Limestone, as above.
230 - 240	Limestone, as above, but with trace of echinoids.

LITHOLOGIC DESCRIPTION FOR THE SOUTHEAST TEST WELL

(Continued)

Depth (Ft)	Description
240 - 250	Limestone, as above
250 - 260	Limestone, as above
260 - 270	Limestone, very fine grained, creamy, pinpoint vugs, some marl and shell fragments, echinoids.
270 - 280	Limestone, as above.
280 - 290	Limestone, very fine grained, creamy, pinpoint vugs, marl, some shell fragments.
290 - 300	Limestone, as above.
300 - 310	Limestone, as above with echinoids.
310 - 320	Limestone, as above.
320 - 330	Limestone, as above.
330 - 340	Limestone, as above.
340 - 350	Limestone, as above.
350 - 360	Limestone, very fine grained, tan, pinpoint vugs, some marl.
360 - 370	Limestone, as above.
370 - 380	Limestone, as above.
380 - 390	Limestone, as above.
390 - 400	Limestone, as above.
400 - 410	Limestone, as above.
410 - 420	Limestone, as above.
420 - 430	Limestone, as above.
430 - 440	Dolomitic limestone, very fine grained, pale yellowish brown, siliceous cement.
440 - 450	Dolomitic limestone, as above.
450 - 460	Dolomitic limestone, as above.

LITHOLOGIC DESCRIPTION FOR THE SOUTHEAST TEST WELL

(Continued)

Depth (Ft)	Description
460 - 470	Dolomitic limestone, as above.
470 - 480	Dolomitic limestone, as above.
480 - 490	Dolomitic limestone, as above.
490 - 500	Dolomitic limestone, as above.
500 - 510	Limestone, very fine grained, tan, small vugs.
510 - 520	Limestone, as above.
520 - 530	Limestone, as above.
530 - 540	Limestone, as above.
540 - 550	Limestone, as above but with 10 percent dolomite
550 - 560	Limestone, as above.
560 - 570	Limestone, very fine grained, tan, small vugs.
570 - 580	Limestone, as above.
580 - 590	Limestone, as above.
590 - 600	Limestone, as above.
600 - 610	Limestone, as above.
610 - 620	Limestone, as above.
620 - 630	Limestone, as above.
630 - 640	Limestone, as above.
640 - 650	Limestone, as above.
650 - 660	Limestone, as above.
660 - 670	Limestone, as above.
670 - 680	Limestone, as above.
680 - 690	Limestone, as above.

LITHOLOGIC DESCRIPTION FOR THE SOUTHEAST TEST WELL

(Continued)

Depth (Ft)	Description
690 - 700	Limestone, as above.
700 - 710	Limestone, as above.
710 - 720	Limestone, as above.
720 - 730	Limestone, as above.
730 - 740	Limestone, as above.
740 - 750	Limestone, as above.
750 - 760	Limestone, as above.
760 - 770	Limestone, as above.
770 - 780	Limestone, as above.
780 - 790	Limestone, as above.
790 - 800	Limestone, as above.
800 - 810	Limestone, as above.
810 - 820	Limestone, as above.
820 - 830	Limestone, as above.
830 - 840	Limestone, as above.
840 - 850	Limestone, as above.
850 - 860	Limestone, as above.
860 - 870	Limestone, as above.
870 - 880	Limestone, as above.
880 - 890	Limestone, as above, but with some organics.
890 - 900	Limestone, as above.
900 - 910	Limestone, as above.
910 - 920	Limestone, as above.

LITHOLOGIC DESCRIPTION FOR THE SOUTHEAST TEST WELL

(Continued)

Depth (Ft)	Description
920 - 930	Limestone, as above.
930 - 940	Limestone, as above.
940 - 950	Limestone, as above.
950 - 960	Limestone, as above.
960 - 970	Limestone, as above.
970 - 980	Limestone, very fine grained, light tan, small vugs.
980 - 990	Limestone, as above.
990 - 1000	Limestone, as above.
1000 - 1010	Limestone, as above.
1010 - 1020	Limestone, as above.
1020 - 1030	Limestone, as above.
1030 - 1040	Limestone, as above.
1040 - 1050	Limestone, as above.
1050 - 1060	Limestone, as above.
1060 - 1070	Limestone, as above.
1070 - 1080	Limestone, as above.
1080 - 1090	Limestone, as above.
1090 - 1100	Limestone, as above.
1100 - 1110	Limestone, as above.
1110 - 1120	Limestone, as above.

LITHOLOGIC DESCRIPTION FOR THE SOUTHEAST TEST WELL

(Continued)

Depth (Ft)	Description
1120 - 1130	Dolomite, very fine grained, light gray, hard, some small vugs.
1130 - 1140	Dolomite, as above.
1140 - 1150	Dolomite, microcrystalline, light gray, some small vugs.
1150 - 1160	Dolomite, microcrystalline, light brown, some small vugs.
1160 - 1170	Dolomite, microcrystalline, yellow brown, some small vugs.
1170 - 1180	Dolomite, as above.
1180 - 1190	Dolomite, as above.
1190 - 1200	Dolomite, as above.
1200 - 1210	Dolomite, as above.
1210 - 1220	Dolomite, as above.
1220 - 1230	Dolomite, as above.
1230 - 1240	Dolomite, as above.
1240 - 1250	Dolomite, as above.
1250 - 1260	Dolomite, as above.
1260 - 1270	Dolomite, as above.
1270 - 1280	Dolomite, as above.
1280 - 1290	Dolomite, as above.
1290 - 1300	Dolomite, as above.
1300 - 1310	Dolomite, as above.
1310 - 1320	Dolomite, as above.
1320 - 1330	Dolomite, microcrystalline, light gray, some small vugs.
1330 - 1340	Dolomite, as above.

LITHOLOGIC DESCRIPTION FOR THE SOUTHEAST TEST WELL

(Continued)

Depth (Ft)	Description
1340 - 1350	Dolomite, as above.
1350 - 1360	Dolomite, as above.
1360 - 1370	Dolomite, as above.
1370 - 1380	Dolomite, as above.
1380 - 1390	Dolomite, as above.
1390 - 1400	Dolomite, as above.
1400 - 1410	Dolomite, as above.
1410 - 1420	Dolomite, as above.
1420 - 1430	Dolomite, as above.
1430 - 1440	Dolomite, as above.
1440 - 1450	Dolomite, as above.
1450 - 1460	Dolomite, as above.
1460 - 1470	Dolomite, as above.
1470 - 1480	Dolomite, as above.
1480 - 1490	Dolomite, as above.
1490 - 1500	Dolomite, microcrystalline, tan, some small vugs.
1500 - 1510	Dolomite, as above.
1510 - 1520	Dolomite, as above.
1520 - 1530	Dolomite, as above.
1530 - 1540	Dolomite, microcrystalline, dark brown, small vugs.
1540 - 1550	Dolomite, as above.
1550 - 1560	Dolomite, as above.

LITHOLOGIC DESCRIPTION FOR THE SOUTHEAST TEST WELL

(Continued)

Depth (Ft)	Description
1560 - 1570	Dolomite, as above.
1570 - 1580	Dolomite, as above.
1580 - 1590	Dolomite, as above.
1590 - 1600	Dolomite, as above.
1600 - 1610	Dolomite, as above.
1610 - 1620	Peat with dolomite fragments.
1620 - 1630	Peat with dolomite fragments.
1630 - 1640	Limestone with peat.
1640 - 1650	Limestone, fine grained, creamy, soft.
1650 - 1660	Peat with limestone fragments.
1660 - 1670	Limestone, fine grained, creamy, soft.
1670 - 1680	Limestone, as above.
1680 - 1690	Limestone, as above.
1690 - 1700	Limestone, as above.
1700 - 1710	Limestone, as above.
1710 - 1720	Limestone, as above.
1720 - 1730	Limestone, fine grained, light to dark gray
1730 - 1740	Limestone, as above.
1740 - 1750	Limestone, as above.
1750 - 1760	Limestone, as above.
1760 - 1770	Limestone, as above.
1770 - 1780	Limestone and dolomite, fine grained, light to dark gray
1780 - 1790	Limestone, fine grained, light to dark gray.

LITHOLOGIC DESCRIPTION FOR THE SOUTHEAST TEST WELL

(Continued)

Depth (Ft)	Description
1790 - 1800	Limestone, as above.
1800 - 1810	Limestone, as above.
1810 - 1820	Limestone, as above.
1820 - 1830	Limestone, as above.
1830 - 1840	Limestone, as above.
1840 - 1850	Limestone, as above.
1850 - 1860	Limestone, fine grained, creamy, small vugs.
1860 - 1870	Dolomitic limestone, microcrystalline, tan
1870 - 1880	Dolomitic limestone, as above.
1880 - 1890	Dolomitic limestone, as above.
1890 - 1900	Dolomite, microcrystalline, tan.
1900 - 1910	Dolomite, as above.
1910 - 1920	Dolomite, as above.
1920 - 1930	Dolomite, as above.
1930 - 1940	Dolomite, microcrystalline, tan, hard, some vugs.
1940 - 1950	Dolomite, as above.
1950 - 1960	Dolomite, as above.
1960 - 1970	Dolomite, as above.
1970 - 1980	Dolomite, as above.
1980 - 1990	Dolomite, as above.
1990 - 2000	Dolomite, as above.

WELL COMPLETION REPORT
FORM 0124
Rev. 11/90

WELL PERMIT NO. SF0614955
SFWMD WATER USE PERMIT NO. ______

Orlando Utilities Commission	500 S. Orange Ave., Orlando, Florida		32801
Owner	Address	City State	Zip

	11033	3/96	inner 1100'x8" outer 210'x16"	2002'	
Contractor's Signature	License No.	Completion Date	Casing Depth	Total Depth	Well #

TYPE OF WORK: Construct (X) Repair ( ) Abandon ( )
WELL USE: Domestic Well ( ) Public ( ) Monitor (X) Test (X)
Irrigation ( ) Fire Well ( ) Other ______
METHOD: Rotary with MUD (X) or Air (X), Cable Tool ( ), Jet ( )
Casing Driven ( ), Other ______
STATIC WATER LEVEL 34.6 Ft. below top of casing
PUMPING WATER LEVEL ______ Ft. after 18 Hrs. at 840 GPM
PUMP SIZE 150 H.P. CAPACITY 2800 GPM
PUMP TYPE ______ INTAKE DEPTH 100' From top of ground

Grout	Casing & Screen	Depth (ft)		DRILL CUTTINGS LOG Examine cuttings every 20 ft. or at formation changes Give color, grain size, and type of material Note cavities, depth to producing zones.
Thickness & Depth	Diameter & Depth	From	To	
				SEE ATTACHED DESCRIPTIONS
Number of bags				

LOCATION
Located Near ______
County Orange

		18	24	30
¼	¼	Section	Township	Range

Latitude-Longitude ______

LOCATE IN SECTION

Cuttings sent to District? ( ) Yes
(X) No

Note: PWS Wells attach a site map if well location is different from site location on permit application.

Casing: Black Steel (X) Galv. ( ) PVC ( ) Fiberglass ( )
Screen: Type ______ Slot size ______
Screened from ______ (ft.) to ______ (ft.)
Type of grout with % additives ______
Water: Clear ( ) Colored ( ) Sulphur (3) Salty ( ) Iron (
Conductivity ______ Chlorides ______ mg/l

LITHOLOGIC DESCRIPTION FOR THE ORANGE TEST WELL

Depth (Ft)	Description
0 - 10	Sand, coarse to fine grained, light gray, some silt and trace quartz.
10 - 20	Sand, as above.
20 - 30	Sand, as above.
30 - 40	Sand, as above.
40 - 50	Clayey sand, dark gray, some silt, overall plasticity - medium.
50 - 60	Clayey sand, dark gray, some shell, little silt, overall plasticity - medium.
60 - 70	Shell and clayey sand, overall plasticity - low.
70 - 80	Shell and sand, medium to fine grained, some silt.
80 - 90	Sand and clay, dark gray, some shell, overall plasticity - low.
90 - 100	Clay and sand, dark gray, little shell, overall plasticity - medium.
100 - 110	Clay and sand, as above.
110 - 120	Sand, fine grained, yellow green, trace silt.
120 - 130	Sand, as above.
130 - 140	Sand, as above.
140 - 150	Shell and sand, fine grained, yellow green, trace silt.
150 - 160	Shell and sand, as above.
160 - 170	Shell and sand, as above.
170 - 180	Shell and sand, as above.
180 - 190	Shell and sand, as above.
190 - 200	Limestone, very fine grained, creamy, some shell fragments, with silt, trace marl.
200 - 210	Limestone, very fine grained, creamy, pinpoint vugs, some shell fragments, with marl.
210 - 220	Limestone, very fine grained, creamy and tan, pinpoint vugs, with marl.
220 - 230	Limestone, as above, with echinoids, trace shell.

LITHOLOGIC DESCRIPTION FOR THE ORANGE TEST WELL

(Continued)

Depth (Ft)	Description
230 - 240	Limestone, as above.
240 - 250	Limestone, as above.
250 - 260	Limestone, very fine grained, creamy, pinpoint vugs, with marl, some echinoids.
260 - 270	Limestone, as above.
270 - 280	Limestone, very fine grained, tan, pinpoint vugs, with marl, some echinoids.
280 - 290	Limestone, very fine grained, tan and creamy, pinpoint vugs, with marl, some echinoids.
290 - 300	Limestone, very fine grained, tan, pinpoint vugs, with marl, some echinoids.
300 - 310	Limestone, very fine grained, creamy, pinpoint vugs, with marl, some echinoids.
310 - 320	Limestone, as above.
320 - 330	Limestone, as above.
330 - 340	Limestone, as above.
340 - 350	Limestone, as above.
350 - 360	Limestone, as above.
360 - 370	Limestone, as above.
370 - 380	Limestone, very fine grained, tan and creamy, pinpoint vugs.
380 - 390	Limestone, as above.
390 - 400	Limestone, very fine grained, creamy, pinpoint vugs, with marl, some echinoids.
400 - 410	Limestone, very fine grained, tan, pinpoint vugs.
410 - 420	Limestone, very fine grained, tan and creamy, pinpoint vugs.
420 - 430	Limestone, as above, with some echinoids.
430 - 440	Limestone, as above.
440 - 450	Limestone, very fine grained, tan and creamy, pinpoint vugs.

LITHOLOGIC DESCRIPTION FOR THE ORANGE TEST WELL

(Continued)

Depth (Ft)	Description
450 - 460	Limestone, very fine grained, tan, siliceous cement.
460 - 470	Limestone, very fine grained, tan and creamy, pinpoint vugs.
470 - 480	Limestone, very fine grained, light gray and tan, hard.
480 - 490	Dolomitic limestone, very fine grained, tan, vuggy, siliceous cement.
490 - 500	Dolomitic limestone, as above.
500 - 510	Dolomitic limestone, as above.
510 - 520	Dolomitic limestone, as above.
520 - 530	Limestone, fine grained, light gray and tan, vuggy.
530 - 540	Limestone, fine grained, tan, vuggy.
540 - 550	Limestone, very fine grained, creamy, pinpoint vugs.
550 - 560	Limestone, very fine grained, tan, pinpoint vugs.
560 - 570	Limestone, as above.
570 - 580	Limestone, as above.
580 - 590	Limestone, as above.
590 - 600	Limestone, as above.
600 - 610	Limestone, as above.
610 - 620	Limestone, as above.
620 - 630	Limestone, as above.
630 - 640	Limestone, as above.
640 - 650	Limestone, very fine grained, tan and creamy.
650 - 660	Limestone, as above.
660 - 670	Limestone, as above.
670 - 680	Limestone, as above.

LITHOLOGIC DESCRIPTION FOR THE ORANGE TEST WELL

(Continued)

Depth (Ft)	Description
680 - 690	Limestone, as above.
690 - 700	Limestone, as above.
700 - 710	Limestone, as above.
710 - 720	Limestone, as above.
720 - 730	Limestone, as above.
730 - 740	Limestone, as above.
740 - 750	Limestone, as above.
750 - 760	Limestone, as above.
760 - 770	Limestone, as above.
770 - 780	Limestone, as above.
780 - 790	Limestone, as above.
790 - 800	Limestone, as above.
800 - 810	Limestone, as above.
810 - 820	Limestone, as above.
820 - 830	Limestone, as above.
830 - 840	Limestone, as above.
840 - 850	Limestone, as above.
850 - 860	Limestone, as above.
860 - 870	Limestone, as above.
870 - 880	Limestone, as above.
880 - 890	Limestone, as above.
890 - 900	Limestone, as above.
900 - 910	Limestone, as above.

LITHOLOGIC DESCRIPTION FOR THE ORANGE TEST WELL

(Continued)

Depth (Ft)	Description
910 - 920	Limestone, as above.
920 - 930	No Sample.
930 - 940	Limestone, as above.
940 - 950	Limestone, as above.
950 - 960	Limestone, as above.
960 - 970	Limestone, very fine grained, creamy and tan, pinpoint vugs, with marl.
970 - 980	Limestone, very fine grained, tan, some vugs.
980 - 990	Limestone, as above.
990 - 1000	Limestone, as above.
1000 - 1010	Limestone, as above.
1010 - 1020	Limestone, as above.
1020 - 1030	Limestone, as above.
1030 - 1040	Limestone, as above.
1040 - 1050	Limestone, as above.
1050 - 1060	Limestone, as above.
1060 - 1070	Limestone, as above.
1070 - 1080	Limestone, as above.
1080 - 1090	Limestone, as above.
1090 - 1100	Limestone, as above.
1100 - 1110	Dolomite, microcrystalline, light brown, some vugs.
1110 - 1120	Dolomite, as above.

LITHOLOGIC DESCRIPTION FOR THE ORANGE TEST WELL

(Continued)

Depth (Ft)	Description
1120 - 1130	Dolomite, as above.
1130 - 1140	Dolomite, microcrystalline, dark brown, some vugs.
1140 - 1150	Dolomite, as above.
1150 - 1160	Dolomite, as above.
1160 - 1170	Dolomite, as above.
1170 - 1180	Dolomite, microcrystalline, light gray, some vugs.
1180 - 1190	Dolomite, microcrystalline, dark brown, some vugs.
1190 - 1200	Dolomite, as above.
1200 - 1210	Dolomite, as above.
1210 - 1220	Dolomite, as above.
1220 - 1230	Dolomite, as above.
1230 - 1240	Dolomite, as above.
1240 - 1250	Dolomite, as above.
1250 - 1260	Dolomite, as above.
1260 - 1270	Dolomite, as above.
1270 - 1280	Dolomite, as above.
1280 - 1290	Dolomite, as above.
1290 - 1300	Dolomite, as above.
1300 - 1310	Dolomite, as above.
1310 - 1320	Dolomite, as above.
1320 - 1330	Dolomite, as above.
1330 - 1340	Dolomite, as above.

LITHOLOGIC DESCRIPTION FOR THE ORANGE TEST WELL

(Continued)

Depth (Ft)	Description
1340 - 1350	Dolomite, as above.
1350 - 1360	No Sample.
1360 - 1370	Dolomite, as above.
1370 - 1380	Dolomite, as above.
1380 - 1390	Dolomite, micrycrystalline, light gray, some vugs.
1390 - 1400	Dolomite, as above.
1400 - 1410	Dolomite, as above.
1410 - 1420	Dolomite, as above.
1420 - 1430	Dolomite, as above.
1430 - 1440	Dolomite, microcrystalline, light brown, some small vugs.
1440 - 1450	Dolomite, as above.
1450 - 1460	Dolomite, as above.
1460 - 1470	Dolomite, as above.
1470 - 1480	Dolomite, as above.
1480 - 1490	Dolomite, as above.
1490 - 1500	Dolomite, as above.
1500 - 1510	Dolomite, microcrystalline, light gray, some vugs.
1510 - 1520	Dolomite, microcrystalline, dark brown, some vugs.
1520 - 1530	Chert, very fine grained, light gray, hard.
1530 - 1540	Dolomite, microcrystalline, brownish gray, some small vugs.
1540 - 1550	Peat with dolomitic fragments.
1550 - 1560	Peat, as above.

LITHOLOGIC DESCRIPTION FOR THE ORANGE TEST WELL

(Continued)

Depth (Ft)	Description
1560 - 1570	Peat, as above.
1570 - 1580	Dolomite, microcrystalline, light brown.
1580 - 1590	Dolomite, as above.
1590 - 1600	Peat with dolomitic fragments.
1600 - 1610	Dolomite, microcrystalline, light brown.
1610 - 1620	Limestone, fine grained, creamy, soft.
1620 - 1630	Limestone, fine grained, creamy and light gray, some small vugs.
1630 - 1640	Limestone, as above.
1640 - 1650	Limestone, fine grained, tan, vuggy.
1650 - 1660	Limestone, fine grained, creamy, vuggy.
1660 - 1670	Limestone, fine grained, light gray, some vugs.
1670 - 1680	Limestone, fine grained, creamy, pinpoint vugs.
1680 - 1690	Limestone, fine grained, light gray, pinpoint vugs.
1690 - 1700	Limestone, as above.
1700 - 1710	Limestone, as above.
1710 - 1720	Limestone, as above.
1720 - 1730	Limestone, as above.
1730 - 1740	Limestone, as above.
1740 - 1750	Limestone, as above.
1750 - 1760	Limestone, fine grained, creamy, pinpoint vugs with dolomitic fragments.
1760 - 1770	Limestone and dolomite, fine grained, light to dark gray.
1770 - 1780	Limestone and dolomite, as above.
1780 - 1790	Limestone and dolomite, as above.

LITHOLOGIC DESCRIPTION FOR THE ORANGE TEST WELL

(Continued)

Depth (Ft)	Description
1790 - 1800	Limestone and dolomite, as above.
1800 - 1810	Limestone, fine grained, light gray, pinpoint vugs.
1810 - 1820	Limestone and dolomite, fine grained, light to dark gray.
1820 - 1830	Limestone and dolomite, as above.
1830 - 1840	Limestone and dolomite, as above.
1840 - 1850	Dolomite, microcrystalline, dark brown.
1850 - 1860	Dolomite, as above.
1860 - 1870	Dolomite, as above.
1870 - 1880	Dolomite, as above.
1880 - 1890	Dolomite, microcrystalline, dark brown, vuggy.
1890 - 1900	Dolomite, as above.
1900 - 1910	Dolomite, as above.
1910 - 1920	Dolomite, as above.
1920 - 1930	Dolomite, as above.
1930 - 1940	Dolomite, as above.
1940 - 1950	Dolomite, as above.
1950 - 1960	Dolomite, as above.
1960 - 1970	Dolomite, as above.
1970 - 1980	Dolomite, microcrystalline, dark gray, some vugs.
1980 - 1990	Dolomite, as above.
1990 - 2000	Dolomite, microcrystalline, light to dark gray.

Appendix C
Step Drawdown Test Water Levels Data

Flow Rate = 1533 gpm
Drawdown = 2.29
Spec Capacity = 669 gpm/ft

Upper Floridan
AQUIFER TEST DATA

WELL NO.: Southeast
TEST NO.: Step No 1
JOB NO.: 94-036
PAGE.: 1
DATE: 10-12-95
JOB LOCATION: OUC - Southeast Site

RECORDED BY	TIME: DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
		6:30	0 sec	39.55				
			15					
			30	41.90				
			45	41.80				
		631	1 min	41.80				
			1:15					
			1:30	41.72				
			1:45					
		632	2 min	41.66				
			2:15					
			2:30					
			2:45					
		633	3 min	41.70				
			3:15					
			3:30					
		634	4 min	41.74				
			4:15					
			4:30					
			4:45					
		6:35	5 min	41.70				
			5:30					
		6:36	6 min	41.72				
			6:30					
		6:37	7 min	41.72				
			7:30					
			8 min	41.74				
			8:30					
		6:39	9 min	41.74				
			9:30					
			10 min	41.76				
			11	41.76				Collect Water
			12	41.78				
			13	41.78				
			14					
		6:45	15 min					
			16					
			17					
			18					
			19					
		6:50	20 min					
			21	41.76				
			22	41.76				
			23					
			24					
			25 min	41.78				
			26					
			27	41.78				
			28					
			29	41.78				
		7PM	30 min	41.78				
			35	41.78				
			40	41.78				
			45	41.78				
			50	41.78				
			55	41.80				
		7:30	60 min	41.80		94338 gal		1 HOUR Collect Water

Upper FL

AQUIFER TEST DATA

WELL NO.: SE
TEST NO.: Step No. 1
JOB NO.: 94-036
PAGE.: 2
DATE: 10-12
JOB LOCATION: OUC

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
			1hr15min	41.78				
			1:30	41.80				
			1:45	41.82				
		830	2hr	41.82		94430		Collect Water
			2:15	41.84				
			2:30	41.84				
			2:45	41.84				
		9:30	3hr	41.84		94522		Collect Water
			3:15					
			3:30					
			3:45					
			4hr					Collect Water
			4:15					
			4:30					
			4:45					
			5hr					Collect Water
			5hr30min					
			6hr					Collect Water
			6:30					
			7hr					Collect Water
			7:30					
			8hr					Collect Water
			8:30					
			9hr					Collect Water
			9:30					
			10hours					Collect Water

~~TAPE DATUM~~ DIFFERENT ^

Upper Floridan
AQUIFER TEST DATA

Flow Rate = 2200
Drawdown = 3.96
Spec Capacity = 555 gpm/ft

WELL NO.: Southeast
TEST NO.: Step No 2
JOB NO.: 94-036
PAGE.: 1
DATE: 10-12-95
JOB LOCATION: OUC-[illegible]

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
		10:45	0 Sec		41.54	0094562		
			15		44.40			
			30		46.70			
			45		48.00			
		10:46	1 min		45.00			
			1:15		44.80			
			1:30					
			1:45					
		10:47	2 min		50.8[illegible]			
			2:15					
15 sec			2:30	-	49.30			
			2:45					
		10:48	3 min		48.08			
			3:15					
			3:30					
		10:49	4 min	-	46.20			
			4:15					
			4:30					
			4:45		45.36			
		10:50	5 min					
			5:30		45.70			
		10:51	6 min		45.40			
			6:30		45.40			
30 sec		10:52	7 min		45.40			
			7:30		45.40			
		10:53	8 min		45.54			
			8:30		45.42			
		10:54	9 min		45.40			
			9:30		45.40			
		10:55	10 min		45.40			
			11		45.40			Collect Water
			12		45.40			
			13		45.40			
			14		45.40			
		11:00	15 min		45.40			
		11:01	16		45.40			
		11:02	17		45.50			
		11:03	18		45.50			
		11:04	19		45.50			
		11:05	20 min		45.50			
1 min		11:06	21		45.50			
		11:07	22		45.48			
		11:08	23		45.50			
		11:09	24		45.50			
		11:10	25 min		45.50			
		11:11	26		45.50			
		11:12	27		45.50			
		11:13	28		45.51			
		11:14	29		45.50			
		11:15	30 min		45.51			
		11:20	35		45.50			
		11:25	40		~~45~~.5[illegible]			
5		11:30	45		45.50			
		11:35	50		45.50			
		11:40	55		45.50			
		11:45	60 min		45.50	0094699 ✓		1 HOUR
								Collect Water

AQUIFER TEST DATA

WELL NO.:
TEST NO.: Step No. 2
JOB NO.: 94-036
PAGE.: 2
DATE:
JOB LOCATION: OUC

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
		12:00	1hr15min		45.50			
		12:15	1:30		45.50			
		12:30	1:45		45.50			
		12:45	2 hr		45.50			
		1:00	2:15		45.50	0094829		Collect Water
		1:15	2:30		45.50			
		1:30	2:45		45.50			
		1:45	3hr		45.50	00?4963		
			3:15					Collect Water
			3:30					
15 min			3:45					
			4hr					
			4:15					Collect Water
			4:30					
			4:45					
			5hr					
			5hr30min					Collect Water
			6hr					
			6:30					Collect Water
			7hr					
			7:30					Collect Water
			8hr					
			8:30					Collect Water
			9hr					
			9:30					Collect Water
			10hours					
								Collect Water

Upper Floridan
AQUIFER TEST DATA

Flow Rate = 2800
Drawdown =
Spec Capacity =

WELL NO.: Southeast
TEST NO.: Step No 3
JOB NO.: 94-036
PAGE: 1
DATE: 10-13-95
JOB LOCATION: OUC - SE

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
	10-13-95	2:00	0 sec	45.50		94943		
		~~2:15~~	15	47.44				
			30	47.74				
			45					
		2:01	1 min	47.88				
			1:15	47.80				
			1:30	47.80				
			1:45	47.80				
		2:02	2 min	47.74				
			2:15	47.74				
			2:30	47.80				
			2:45	47.82				
		2:03	3 min	47.84				
			3:15	47.88				
			3:30	47.74				
		2:04	4 min	47.84				
			4:15	47.90				
			4:30	47.88				
			4:45	47.88				
		2:05	5 min	47.88				
			5:30	47.88				
		2:06	6 min	47.88				
			6:30	47.84				
		2:07	7 min	47.88				
			7:30	47.86				
		2:08	8 min	47.88				
			8:30	47.86				
		2:09	9 min	47.86				
			9:30	47.88				
		2:10	10 min	47.86				
		2:11	11	47.88		95727		Collect Water
		2:12	12					
		2:13	13	47.88				
		2:14	14	47.86				
		2:15	15 min	47.86				
		2:16	16	47.88				
			17	47.88				
			18	47.84				
			19					
			20 min	47.86				
			21	47.86				
			22	47.86				
			23	47.86				
			24	47.86				
			25 min	47.88				
			26	47.88				
			27	47.88				
			28	47.88				
			29	47.88				
			30 min	47.88				
			35					
PB		2:[illegible]	40	47.83				
			45	47.84				
			50	47.86				
			55	47.86				
			60 min	47.86		95770		1 HOUR Collect Water

AQUIFER TEST DATA

WELL NO.:
TEST NO.: Step No. 3
JOB NO.: 94-036

PAGE.: 2
DATE:
JOB LOCATION: OUC

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
			1hr18min	47.90				
			1:30					
			1:45	47.92				
			2hr					
			2:15	47.90				Collect Water
		4:35	2:~~30~~35		95442			
			2:45					
		5:00	3hr	47.92				
			3:15					Collect Water
			3:30					
		5:32	3:45	—	98607			
			4hr					
			4:15					Collect Water
			4:30					
			4:45					
			5hr					
			5hr30min					Collect Water
			6hr					
			6:30					Collect Water
			7hr					
			7:30					Collect Water
			8hr					
			8:30					Collect Water
			9hr					
			9:30					Collect Water
			10hours					
								Collect Water

Lower Floridan

AQUIFER TEST DATA

Flow Rate = 633
Drawdown = 8.16
Spec Capacity = 78 gpm/ft

WELL NO.: Southeast
TEST NO.: Step No. 1
JOB NO.: 94-036
PAGE.: 1 of 2
DATE: 11-28-95
JOB LOCATION: OUC - Southeast Site

	RECORDED BY	TIME: DATE	TIME: CLOCK TIME ✓	TIME: ELAPSED TIME	WATER LEVEL DATA: READING ✓	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: ~~MANOMETER~~ READING ✓ gal	DISCHARGE DATA: RATE GPM	COMMENTS
15 sec			5:15	0 Sec	41.80		13988		
				15	48.60				
			✓	:30	47.40				
				45	46.36				
			✓ 5:16	1 min	46.90				
				1:15	47.12				
				1:30	47.12				
				1:45	47.08				
			5:17	2 min	47.14				
				2:15	47.12				
				2:30	47.20				
				2:45	47.18				
			5:18	3 min	47.24				
				3:15	47.24				
				3:30	47.24				
			5:19	4 min	47.26				
				4:15	47.34				
				4:30	49.60				
				4:45					
30 sec			5:20	5 min	49.30				
				5:30	49.72				
			5:21	6 min	49.34				
				6:30	49.46				
			5:22	7 min	49.50				adjusted pump rate to 607
				7:30	49.50				
			5:23	8 min	49.52				
				8:30					
			5:24	9 min	49.60				
				9:30					
60 sec			5:25	10 min	49.62				
			26	11	49.64		13994		
			27	12	49.70				Collect Water
			28	13	49.70				
			29	14	49.70				
			5:30	15 min	49.76				
			31	16	49.76				
			32	17	49.76				
			33	18	49.78				
			34	19	49.78				
			35	20 min	49.80				
			36	21	49.82				
			37	22	49.84				
			38	23	49.84				
			39	24	49.84				
			5:40	25 min	49.84				
			41	26	49.84				
			42	27	49.86				
			43	28	49.86				
			44	29					
5 min			5:45	30 min	49.88				
			5:50	35	49.88		14007		
			55	40	49.90				
			6PM	45	49.90				
			6:05	50	49.92				
			6:10	55	49.94				
			6:15	60 min	49.94				
							14026		
									1 HOUR
									Collect Water

Measurements taken from 2" PVC pipe

Lower Floridan

AQUIFER TEST DATA

WELL NO.: Southeast
TEST NO.: Step No. 1
JOB NO.: 94-036
PAGE: 2 of 2
DATE: 11-28
JOB LOCATION: OUC Southeast

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
		6:30	1hr15min	49.84				
		6 45	1:30	49.80				
		7PM	1:45	49.86				
		7:15	2hr	49.84		14064		Collect Water
		7:30	2:15	49.90				
		7:45	2:30	49.90				
		8PM	2:45	49.90				
		8:15	3hr	49.90		014103		Collect Water
		8:30	3:15	49.90				
		8 45	3:30	49.90				
		9PM	3:45	49.92				
		9:15	4hr	49.96		14141		Collect Water
		9 30	4:15	49.94				
		9 45	4:30	49.94				
		10PM	4:45	49.94				
		10:15	5hr	49.96		14178		Collect Water
		10 45	5hr30min					
		11:15	6hr					Collect Water
		11:30	6:30					
		12:15	7hr					Collect Water
			7:30					
			8 hr					Collect Water
			8:30					
			9 hr					Collect Water
			9:30					
			10 hours					Collect Water

15 min

1/2 hr

JDW

Lower Floridan Flow Rate = 885
Drawdown = 10.58
Spec Capacity = 78 gpm/ft

AQUIFER TEST DATA

WELL NO.: Southeast
TEST NO.: Step No. 2
JOB NO.: 94-036
PAGE.: 1
DATE: 11-28-95
JOB LOCATION: OUC - Southeast Site

RECORDED BY	DATE	CLOCK TIME ✓	ELAPSED TIME	READING ✓	WATER LEVEL CHANGE	~~MANOMETER~~ READING ✓ gal	RATE GPM	COMMENTS
		10:30	0 sec	49.96				
			15					
			30	~~49~~52.20				
			45	52.32				
		10 31	1 min	52.34				
			1:15	52.36				
			1:30					
			1:45	52.36				
		1032	2 min	52.36				
			2:15					
			2:30	52.38				
			2:45	52.38				
		1033	3 min	52.38				
			3:15	52.38				
			3:30	38				
		1034	4 min	52.38				
			4:15					
			4:30	52.38				
			4:45					
		1035	5 min	52.38				
			5:30	52.36				
		1036	6 min	52.38				
			6:30	52.38				
		37	7 min	52.32				
			7:30	52.36				
		38	8 min	52.38				
			8:30	52.38				
		39	9 min	52.38				
			9:30	52.38				
		1040	10 min	52.36				
		41	11	52.38		14198 ?		Collect Water
		42	12	52.40				
		43	13					
		44	14	52.38				
		45	15 min					
		46	16					
		47	17	52.38				
		48	18					
		49	19	52.38				
		50	20 min					
		51	21	52.38				
		52	22					
		53	23					
		10 54	24					
		55	25 min	52.40				
		56	26					
		57	27					
		58	28	52.38				
		59	29					
		11PM	30 min	52.38				
		11 05	35	52.38				
		11 10	40	52.38				
		11 15	45	52.38				
		11 20	50	52.38				
		11 25	55	52.38				
		11 30	60 min	52.38				
						14235		1 HOUR Collect Water

15 sec
30 sec
60 sec
5 min

52.38
41.78
9.90

49.96
41.78
8.18

AQUIFER TEST DATA

WELL NO.: Southeast
TEST NO.: Step No. 2
JOB NO.: 94-036
PAGE.: 2
DATE: 11-28-95
JOB LOCATION: OUC Southeast

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
		11:45	1hr15min	52.38				
		12 PM	1:30	52.38				
		12:15	1:45	52.38				
		12:30	2hr	52.38				
		12:45	2:15	52.38				
		1AM	2:30	52.38		14284	816	Collect Water
		1:15	2:45	52.38				
		1:30	3hr	52.32				
			3:15					
			3:30			14334	[illegible]	Collect Water
			3:45					
			4hr					
			4:15					
			4:30					Collect Water
			4:45					
			5hr					
			5hr30min					
			6hr					Collect Water
			6:30					
			7hr					Collect Water
			7:30					
			8 hr					Collect Water
			8:30					
			9hr					Collect Water
			9:30					
			10 hours					Collect Water
								Collect Water

15 min

1/2 hr

Lower Floridan

AQUIFER TEST DATA

Flow Rate = ~~~1100~~ ~~880~~ 841 gpm
Drawdown = 10.66'
Spec Capacity = 79 gpm/ft

14348 - 14395 × 1000 / 10 hr

WELL NO.: Southeast
TEST NO.: Step No. 3
JOB NO.: 94-036
PAGE.: 1
DATE: 11-29-95
JOB LOCATION: OUC - Southeast Site

RECORDED BY	DATE	TIME: CLOCK TIME ✓	TIME: ELAPSED TIME	WATER LEVEL DATA: READING ✓	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: ~~MANOMETER~~ READING ✓ gal	DISCHARGE DATA: RATE GPM	COMMENTS
		930	0 sec	41.70		14348		
			15	51.48				
			30					
			45	52.32				
		931	1 min	52.36				
			1:15	52.40				
			1:30	52.40				
			1:45	52.40				
		932	2 min	52.40				
			2:15	52.44				
			2:30	52.40				
			2:45	52.40				
		933	3 min	52.40				
			3:15	52.40				
			3:30	52.40				
		934	4 min	52.40				
			4:15	52.40				
			4:30	52.40				
			4:45	52.40				
		935	5 min	52.40				
			5:30	52.40				
		936	6 min	52.40				
			6:30	52.40				
		937	7 min	52.40				
			7:30	52.40				
		938	8 min	52.40				
			8:30	52.40				
			9 min					
			9:30					
		940	10 min					
		41	11			14 351	900	Collect Water
		42	12					
		43	13					
		44	14	52.32				
		45	15 min	52.32				
		46	16	[illegible]				
		47	17	52.36				
		48	18	52.36				
		49	19	52.36				
		950	20 min	52.36				
		51	21	52.36				
		52	22	52.36				
		53	23	52.36				
		54	24	52.36				
		955	25 min	52.36				
		56	26	52.36				
		57	27	52.36				
		58	28	[illegible]				
		59	29	[illegible]				
		10 AM	30 min	[illegible]				
		1005	35					
		10:10	40	52.36				
		1015	45					
		1020	50	52.36				
		1025	55					
		1030	60 min	52.36				
						14,399	850	1 HOUR Collect Water

15 sec
30 sec
60 sec
5 min

AQUIFER TEST DATA

WELL NO.: Southeast
TEST NO.: Step No. 3
JOB NO.: 94-036
PAGE.: 2
DATE: 11-29-95
JOB LOCATION: OUC Southeast

RECORDED BY	TIME: DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
		1045	1hr 15min					
		11AM	1:30	52.36				
		1115	1:45					
		1130	2hr	52.36				
		1145	2:15			14450	850	Collect Water
		1200	2:30	52.36				
		1215	2:45					
		1230	3hr	52.36				
		1245	3:15			14500	833	Collect Water H2S-OU
		1PM	3:30	52.36				
		1:15	3:45					
		1:30	4hr	52.36				
			4:15			14551	845	Collect Water H2S-OU
		200	4:30					
			4:45					
		2:30	5hr	52.36				
		300	5hr30min			14602	846.7	Collect Water H2S-OU
		330	6hr	52.36				
		400	6:30			14652	844.4	Collect Water H2S-OUC
		430	7hr	52.36				
		500	7:30			14703	845	Collect Water H2S-OUC
		530	8hr	52.36				
		600	8:30			14753	844	Collect Water H2S-OU
		630	9hr	52.36				
		700	9:30			14803	844	Collect Water H2S-OU
		7:30	10 hours	52.36				Collect Water

15 min

1/2 hr

UPPER FLORIDAN
AQUIFER TEST DATA

FLOW RATE – 1760 gpm
Drawdown – 16.2'
Specific Cond. – 109 gpm/ft.

WELL NO.: Pumped Well
TEST NO.: Step - 1
JOB NO.: 94-036
PAGE.: 1
DATE: 10-5-95
JOB LOCATION: OUC - Orange site

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
	745 15		0	33.5				
			15 Sec					
			30 Sec					
			45 Sec	46.2				
			1 min	46.8				
			1:15					
			1:30	47.1				
			1:45					
			2 min	47.6				
			2:15					
			2:30					
			2:45					
			3 min	47.8				
			3:15					
			3:30					
			3:45					
			4 min	48				
			4:15					
			4:30					
			4:45					
		750	5 min	48.0				
			5:30					
		751	6 min	48.0				
			6:30					
		752	7 min	48.12				
			7:30					
		753	8 min	48.18				
			8:30					
		754	9 min	48.34				
			9:30					
		755	10 min	48.36				Water Sample
		756	11	48.41				
		757	12					
		758	13	48.50				
		759	14	48.58				
		800	15	48.58				
		801	16					
		802	17					
		803	18					
		804	19					
		805	20					
		806	21					
		807	22	48.7				
		808	23	48.8				
		809	24	48.84				
		810	25	48.86				
		811	26	48.88				
		812	27					
		813	28					
		814	29					

ATD1.XLS

Note: Static WL on 10/4 was 33.3' below top of 16" casing
10/5 33.46'

AQUIFER TEST DATA

WELL NO.:
TEST NO.: step-1
JOB NO.:
PAGE.: 2
DATE: 10-5-96
JOB LOCATION: OUC-orange

RECORDED BY	DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
		815	30 min	49.08				H2S sample
		820	35					
		825	40					
		830	45	49.10				
		835	50	49.22				
		840	55	49.32				
		845	60 min	49.30	15.8	11844		water sample 11844
		9	1hr 15	49.5				
		915	1hr 30	49.48				
		930	1hr 45	49.50				
		945	2 hr	49.50	16.0			collect water
		10	2 hr 15	49.56				
		1015	2 hr 30	49.60				
		1030	2 hr 45	49.64				
		1045	3 hr	49.64	16.14			collect water
		11	3 hr 15	49.7				
		1115	3 hr 30	49.7				
		1130	3 hr 45	49.74				
		1145	4 hr	49.72	16.22	12187		collect water 12187
		1200	4 hr 15	49.72				
		1215	4 hr 30	49.7				
		1230	4 hr 45	49.72		12267		collect water 12267
		1245	5 hr	49.7	16.20			
			49.7					
			33.5			1758/16.2		= 109 gpm/ft
			16.2					

ATD1.XLS

Upper Floridan
AQUIFER TEST DATA

~~1500 gpm~~
1760

WELL NO. Monitor Well
TEST NO. STEP 1
JOB NO. 94-036
PAGE: 1
DATE: 10-5-95
JOB LOCATION: Orange Site

RECORDED BY	TIME: DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
	7:45	~~7:45~~	0 sec	36.0				
			15					
			30					
			45					
			1 min	~~37~~.0				
			1:15					
			1:30					
			1:45					
			2 min	36.3				
			2:15					
			2:30					
			2:45					
			3 min	36.8				
			3:15					
			3:30					
			4 min	37.1/2				
			4:15					
			4:30					
			4:45					
			5 min	37.0				
			5:30					Collect Water
			6 min	37.0				
			6:30					
			7 min	37.0				
			7:30					
			8 min	37.0				
			8:30					
			9 min	37.0				
			9:30					
	7:55	755	10 min	37.1				
			11					
			12					
			13					
			14					
			15					
			16					
			17					
			18					
			19					
		8:05	20 min	37.3 1/2				
			21					
			22					
			23					
			24					
			25					
			26					
			27					
			28					
			29					
	*	8:15	30 min	37.4				
			35	37.5				
			40	37.53				
			45	37.6				
			50	37.63				
			55					
	*	8:45	60 min.	~~37.1/2~~ 37.63				Collect Water

Note: Static Water Level on 10/4 was 35.9' Below top of 4" casing

Upper Floridan
AQUIFER TEST DATA

WELL NO.: Monitor Well
TEST NO.: STEP 1
JOB NO.:
PAGE: 2
DATE: 10-5-95
JOB LOCATION: Orange Site

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
		9 PM	1hr 15min	37.95				
		9 15	1hr 30min					
		9 30	1hr 45min	37.[illegible]				
		945 PM	2 hr					
		10 PM	2hr 15min	37.[illegible]				Collect Water
		10 15	2hr 30min	37.[illegible]				
		10 30	2hr 45min	[illegible]				
		1045	3hr	35.37				
		11 PM	3hr 15min	35.3				Collect Water
		11 15	3hr 30min	35.4				
		11 30	3hr 45min	35.9				
		1145	4hr	37.3	<			
	Midnight	12 00	4hr 15min	35.3				Collect Water
			4hr 30min	35.3				
			4hr 45min	35.3				
		1245	5hr	~~35.9~~ 37.8*				Collect Water
			5hr 30min					
		145	6hr					Collect Water
			6hr 30min					
		245	7hr					Collect Water
			7hr 30min					
		345	8hr					Collect Water
			8hr 30min					
		4 45	9hr					Collect Water
			9hr 30min					
		545	10hr					Collect Water

UPPER FLORIDAN
AQUIFER TEST DATA

FLOW Rate — 2240 gpm
Drawdown — 22.5'
Specific Cap. — 99 gpm/ft

WELL NO.: Pumped Well
TEST NO.: Step-2
JOB NO.: 94-036
PAGE.: 1
DATE: 10-5-95
JOB LOCATION: OUC-Orange

RECORDED BY	DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
		1:15	0 sec	49.70				
			15					
			30	51.6				
			45					
			1 min	51.3				
			1:15					
			1:30	51.3				
			1:45					
			2 min	52.48				
			2:15					
			2:30					
			2:45					
			3 min	52.48				
			3:15					
			3:30	53.6				
			3:45					
		1:19	4 min					
			4:15					
			4:30					
			4:45					
			5 min	53.7				
			5:30					
		1:21	6 min	53.7				
			6:30					
		1:22	7	53.78				
			7:30					
		1:23	8					
			8:30					
		1:24	9	53.8				
			9:30					
		1:25	10	53.8		12344		
			11					
			12					
			13					
			14					
		1:30	15	55.3				
		31	16					
		32	17					
		33	18					
		34	19	55.43				
		1:35	20	55.5				Collect water
		36	21					
		37	22					
		38	23					
		39	24	55.52				
		1:40	25					
		41	26	55.52				
		42	27	55.54				
		43	28					
		44	29					

UPPER FLORIDAN

AQUIFER TEST DATA

WELL NO.:
TEST NO.: Step - 2
JOB NO.:
PAGE.: 2
DATE:
JOB LOCATION: Dix - orange

RECORDED BY	DATE	TIME CLOCK TIME	TIME ELAPSED TIME	WATER LEVEL DATA READING	WATER LEVEL DATA WATER LEVEL CHANGE	DISCHARGE DATA MANOMETER READING	DISCHARGE DATA RATE GPM	COMMENTS
		1:45	30	55.62				
		1:50	35	55.64				
		1:55	40					
		2:00	45	55.7				
		2:05	50					
		2:10	55	55.76				
		2:15	60 mi	55.86	22.36			collect water
		2:30	1 hr 15	55.8		12488		
		245	1 hr 30	55.84				
		3	1:45	55.88				
		315	2 hr	55.86	22.36			collect water
		330	2:15	55.9				
		345	2:30					
		400	2:45	56.02	22.52			
		415	3:00	56.06	22.56			collect water
		430	315					
		445	330					
		500	345	56.04				
		515	400	56.06	22.56	12859		collect water
		530	415	56.04				
		545	430					
		600	445	56.06				
		615	5:00	56.04	22.54	12993		collect water

Upper Floridan
AQUIFER TEST DATA

~~2200~~
2240

WELL NO.: Monitor Well
TEST NO.: STEP 2
JOB NO.: 94-036
PAGE: 1
DATE:
JOB LOCATION: OUC Orange Site

RECORDED BY	TIME: DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
		1:15	0 sec					
			15					
			30					
			45					
		1:16	1 min					
			1:15					
			1:30					
			1:45					
		1:17	2 min	38.0				
			2:15					
			2:30					
			2:45					
		1:18	3 min	38.0				
			3:15					
			3:30					
			3:45					
		1:19	4 min	38.0				
			4:15					
			4:30					
			4:45					
		1:20	5 min	38.0				
			5:30					Collect Water
			6 min					
			6:30					
			7 min					
			7:30					
			8:					
			8:30					
			9 min					
			9:30					
		1:25	10 min	38.0				
			11					
			12					
			13					
			14					
			15					
			16					
			17					
			18					
			19					
		1:35	20 *	38.1				
			21					
			22					
			23					
			24					
			25					
			26					
			27					
			28					
			29					
		1:45	30 min	38.1				
		1:50	35					
		1:55	40					
		2PM	45					
		* 2:05	50	38.2				
			55					
		2:15 *	60 min	38.2				Collect Water

Upper Floridan
AQUIFER TEST DATA

WELL NO: Monitor Well Orange Site
TEST NO: STEP 2
JOB NO:
PAGE: 2
DATE:
JOB LOCATION: OUC Orange

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
		3:00Am	1hr15min	38.2				
			1hr30min					
			1hr45min					
		315	2hr	38.2				
			2hr15min					Collect Water
			2hr30min					
			2hr45min					
		415	3hr	38.2				
			3hr15min					Collect Water
			3hr30min					
			3hr45min					
		515	4hr	38.2				
			4hr15min					Collect Water
		5:30	4hr30min	38.2				
		615	5hr					
			5hr30min					Collect Water
			6hr					
			6hr30min					Collect Water
			7hr					
			7hr30min					Collect Water
			8hr					
			8hr30min					Collect Water
			9hr					
			9hr30min					Collect Water
			10hr					
								Collect Water

UPPER FLORIDAN

AQUIFER TEST DATA

Flow Rate — 2780

Drawdown — 31.1'

Spec. Capacity — 89 gpm/

WELL NO.: Pumped Well PAGE.: 1
TEST NO.: Step-3 DATE: 10-10-95
JOB NO.: 94-036 JOB LOCATION: OUC-Orange

RECORDED BY	DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
		1215	0	33.0				
			15	50.8				
			30	56.3				
			45	57.1				
		1216	1 min	57.5				
			1:15	57.8				
			1:30					
			1:45	58.3				
		1217	2:00	58.62				
			2:15					
			2:30	58.84				
			2:45					
		1218	3:00	59.1				
			3:15					
			3:30	59.32				
			3:45					
		1219	400	59.46				
			415					
			430	59.62				
			445					
		1220	5:00	59.72				
			5:30	59.88				
		1221	6:00	60.0				
			6:30	60.08				
		1222	700	60.18				
			7:30	60.30				
		1223	8:00	60.36				
			8:30					
		1224	900	60.62				
			930	60.7				
		1225	1000	60.72				
		1226	11	60.88				
		27	12	61.08				
		28	13	61.16				
		29	14	61.26				
		1230	15	61.47				
		31	16					collect water
		32	17					
		33	18	61.68				
		34	19	61.26				
		1235	20	61.78				
		36	21	61.78				
		37	22	61.84				
		38	23					
		39	24	62.06				
		1240	25	62.08				
		41	26					
		42	27					
		43	28	62.2				
		44	29	62.26				

ATD1.XLS

Change Discharge pipe from 6 to 12 inches. Allowed Greater flow Rate.

AQUIFER TEST DATA

WELL NO.:
TEST NO.: Step-3
JOB NO.: 94-036
PAGE.: 2
DATE: 10-10-95
JOB LOCATION: OUC-Orange

RECORDED BY	DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
		12:45	30	62.32		93704		
		1250	35	62.46				
		1255	40	62.6				
		1:00	45	62.7				
		105	50	62.84				
		110	55					
		115	60	63.02	30.02	93788		collect water
		130	1hr15	63.1				
		145	1:30	63.26				
		200	1:45	63.4				
		215	200	63.32	30.32	93954		collect water
		230	215	63.38				
		245	230	63.42				
		300	245	63.7				
		315	300	63.42	30.42	94120		collect water
		330	315	63.82				
		345	330	63.9				
		400	345	64.1				
		415	400	64.22	31.22	94288		collect water
		430	415	64.14				
		445	430	64.12				
		500	445	64.22				
		515	5hr	64.10	31.10	94455		collect water

ATD1.XLS

Cooling engine by pouring water over fan sensor. May have increased flow rate.

Flow Rate =
Drawdown =
Spec Capacity =

Upper Floridan
AQUIFER TEST DATA

WELL NO.: Monitor Well
TEST NO.: Step No. 3
JOB NO.: 94-036
PAGE.: 1
DATE: 10-10-95
JOB LOCATION: OUC - Orange Site

RECORDED BY	DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
		1215	0 Sec	35.62				
			15	35.70				
			30	35.90				
			45	36.10				
		1216	1 min	36.27				
			1:15	36.35				
			1:30	36.44				
			1:45					
15 sec		1217	2 min	36.53				
			2:15	36.57				
			2:30	36.65				
			2:45					
		1218	3 min					
			3:15	36.74				
			3:30	36.77				
		1219	4 min	36.82				
			4:15	36.79				
			4:30	36.83				
			4:45					
		1220	5 min	36.85				
			5:30	36.87				
		12 21	6 min	37.02				
			6:30	37.06				
30 sec		12:22	7 min	37.08				
			7:30	37.11				
		12:23	8 min	37.18				
			8:30	37.09				
		12:24	9 min	37.08				
			9:30	37.18				
		12:25	10 min	37.16				
		26	11	37.20				Collect Water
		27	12	37.21				
		28	13	37.27				
		29	14	37.30				
		12:30	15 min	37.34				
		31	16	37.35				
		32	17	37.35				
		33	18	37.46				
1 min		34	19	37.49				
		12:35	20 min	37.50				
		36	21	37.52				
		37	22	37.54				
		38	23	37.60				
		39	24	37.61				
		12:40	25 min	37.65				
		41	26	37.65				
		42	27	37.67				
		43	28	37.69				
		[illegible]	29	37.71				
		12:[illegible]	30 min	37.72				
		50	35	37.88				
		55	40	37.91				
5 min		1PM	45	37.96				
		1:05	50	38.01				
		1:10	55	38.07				
		1:15	60 min	38.11				
								1 HOUR Collect Water

Note 275' from pumped well

AQUIFER TEST DATA

WELL NO.:
TEST NO.: Step No. 3 PAGE.: 2
JOB NO.: 94-036 DATE: 10-10-95
JOB LOCATION: OUC Orange Site

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
		1:30	1hr 15min	38.12				
		1:45	1:30	38.27				
		2PM	1:45	38.30				
		2:15	2hr	38.35				Collect Water
		2:30	2:15	38.37				
15 min		2:45	2:30	38.37				
		3PM	2:45	38.40				
		3:15	3hr	38.40				Collect Water
		3:30	3:15	38.42				
		3:45	3:30	38.44				
		4PM	3:45	38.47				
		4:15	4hr	38.48				Collect Water
		4:30	4:15	38.50				
		4:45	4:30	38.51				
		5PM	4:45	38.51				
		5:15	5hr	38.50				Collect Water
		5:45	5hr30min					
		6:15	6hr					Collect Water
			6:30					
		7:15	7hr					Collect Water
			7:30					
			8hr					Collect Water
			8:30					
			9hr					Collect Water
			9:30					
			10hours					Collect Water

Lower FLORIDAN

FLOW Rate 467 gpm
Drawdown 3.96 ft
Spec. Capacity 118 gpm/ft

AQUIFER TEST DATA

WELL NO.: Orange Test Well
TEST NO.: Step-1
JOB NO.: 94-036
PAGE.: 1
DATE: 1-12-96
JOB LOCATION: OUC-Orange

RECORDED BY	TIME: DATE	CLOCK TIME	ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	RATE GPM	COMMENTS
	1-12-96	5:45	0	36.14				
			15					
			30	38.60				
			45					
		5:46	1 min	40.3				
			1:15					
			1:30	40.0				
			1:45					
		5:47	2:00	40.06				
			2:15					
			2:30	40.08				
			2:45					
		5:48	300	40.1				
			3:15					
			330	40.1				
		5:49	4 min					
			4:15	40.1				
			4:30					
			4:45	40.08				
		5:50	500					
			530	40.08				
		5:51	600	40.01				
			630	40.1				
		5:52	700	40.1				
			730	40.1				
		5:53	800	40.1				
			830	40.0				
		5:54	900	40.04				
			930	40.1				
		555	1000	40.1				Collect water
		556	11	40.1				
		557	12	40.1				
		558	13	40.08				
		559	14					
		600	15	40.1				
			16					
			17	40.1				
			18					
			19					
		6:05	20	40.1				
			21					
			22	40.1				
			23					
			24	40.1				
		610	25					
			26	40.12				
			27					
			28	40.1				
			29					
		6:15	30	40.12				

ATD1.XLS

AQUIFER TEST DATA

WELL NO.:
TEST NO.: Step-1
JOB NO.: 94-1036
PAGE.: 2
DATE: 1-12-96.
JOB LOCATION: OUC - Orange

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
		6:20	35	40.1				
		6:25	40	40.1				
		6:30	45	40.08				
		6:35	50	40.12				
		6:40	55	40.08				
		6:45	60	40.10	3.96	15197		Collect water
			1:15	40.1				
			130	40.08				
			145	40.1				
		745	200	40.1	3.96	15225		Collect water
			215	40.1				
			230	40.1				
			245	40.1				
		8:45	300	40.1	3.96	15253		Collect water

Lower Floridan Test
Upper Floridan Monitor Well

Open Hole 1098'-1400'
Flow Rate =
Drawdown =
Spec Capacity =

AQUIFER TEST DATA

WELL NO.: Orange Test Well
TEST NO.: Step No 1
JOB NO.: 94-036
PAGE: 1
DATE: 1/12/98
JOB LOCATION: OUC - Orange Site - Taft

15 sec / 30 sec / 1 min / 5 min

RECORDED BY	TIME: DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
		5:45pm	0 sec	37.0'				
			15					
			30					
			45					
		546	1 min	37.0'				
			1:15					
			1:30					
			1:45					
		547	2 min	37.0'				
			2:15					
			2:30					
			2:45					
		548	3 min	37.0'				
			3:15					
			3:30					
		549	4 min	37.0'				
			4:15					
			4:30					
			4:45					
		550	5 min	37.0'				
			5:30					
			6 min					
			6:30					
			7 min					
			7:30					
			8 min					
			8:30					
			9 min					
			9:30					
			10 min					
			11					
			12					Collect Water
			13					
			14					
	6PM 37.0'	5:30	15 min	37.0'				
			16					
			17					
			18					
			19					
			20 min					
			21					
			22					
			23					
			24					
			25 min					
			26					
			27					
			28					
			29					
	6:30 37.0'	~~5:45~~	30 min					
			35					
			40					
			45					
			50					
			55					
	6:45PM 37.0'	~~6:15~~ 37.0'	60 min					
								1 HOUR Collect Water

Static WL = 36.78' Below MP

AQUIFER TEST DATA

WELL NO.:
TEST NO.: Step No.
JOB NO.: 94-036
PAGE.: 2
DATE:
JOB LOCATION: OUC Orange Site Taft

15 min

1/2 hr

RECORDED BY	TIME: DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
			1hr15min					
			1:30					
			1:45					
		745	2hr					Collect Water
		370'	2:15					
			2:30					
			2:45					
		845	3hr					Collect Water
			3:15					
			3:30					
			3:45					
			4hr					Collect Water
			4:15					
			4:30					
			4:45					
			5hr					Collect Water
			5hr30min					
			6hr					Collect Water
			6:30					
			7hr					Collect Water
			7:30					
			8 hr					Collect Water
			8:30					
			9hr					Collect Water
			9:30					
			10hours					Collect Water

Flow Rate - 745 gpm
Drawdown - 8.98 ft
Spec Capacity - 83 gpm/ft

Lower FLORIDAN
AQUIFER TEST DATA

WELL NO.: Orange Test Well
PAGE: 1
TEST NO.: Step-2
DATE: 1-12-96
JOB NO.: 941-036
JOB LOCATION: OUC - Orange

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
		9:15	0	40.1				
			15					
			30	52.6				
			45					
		9:16	1:00	52.6				
			1:15					
			1:30	52.7				
			1:45					
		9:17	2:00	52.72				
			2:15					
			2:30	52.7				
			2:45					
		9:18	3:00	52.7				
			3:15					
			3:30	52.7				
		9:19	4:00	52.64				
			4:15					
			4:30	52.64				
			4:45					
		9:20	5:00	52.68				
			5:30					
		9:21	6:00	49.6				
			6:30					
		9:22	7:00	50.7				Adjusting Rate
			7:30					
		9:23	8:00	49.5				
			8:30	49.6				
		9:24	9:00	48.5				
			9:30	48.52				
		9:25	10:00	47.3				Collect Water
		9:26	11	47.38				
			12	46.6				
			13	45.0				
			14	45.3				
		9:30	15	45.3				
			16	45.3				
			17	45.26				
			18	45.2				
			19	45.26				
		9:35	20	45.2				
			21	45.22				
			22	45.2				
			23	45.14				
			24	45.2				
		9:40	25	45.2				
			26	45.18				
			27	45.2				
			28	45.18				
			29	45.18				
		9:45	30	45.18				

AQUIFER TEST DATA

WELL NO.:
TEST NO.:
JOB NO.:
PAGE:
DATE:
JOB LOCATION:

RECORDED BY	TIME: DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
			35	45.1				
			40	45.1				
		10:00	45	45.1				
			50	45.08				
			55	45.1				
		10:15	1 hr	45.1	8.96	15315		Collect water
			1:15	45.08				
			1:30	45.1				
			1:45	45.1				
		11:15	2:00	45.12	8.98	15359		Collect water
			2:15	45.12				
			2:30	45.18				
			2:45	45.12				
		12:15	3:00			15404.5		Collect Water

Lower Floridan Test
Upper Floridan Monitor Well

Open Hole 1098'-1400'
Flow Rate =
Drawdown =
Spec Capacity =

AQUIFER TEST DATA

WELL NO.: Orange Test Well
TEST NO.: Step No 2
JOB NO.: 94-036
PAGE: 1
DATE:
JOB LOCATION: OUC - Orange Site - Taft

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
		9:16	0 sec	37.08				
			15	37.02				
			30	37.03				
			45	37.04				
			1 min	37.01				
			1:15	37.01				
			1:30	37.01				
			1:45	37.01				
			2 min	37.01				
			2:15	37.01				
			2:30	37.01				
			2:45	37.01				
			3 min	37.01				
			3:15	37.01				
			3:30	37.01				
			4 min	37.01				
			4:15	37.01				
			4:30	37.01				
			4:45	37.01				
			5 min	37.01				
			5:30	37.01				
			6 min	37.01				
			6:30	37.01				
			7 min	37.01				
			7:30	37.01				
			8 min	37.01				
			8:30	37.01				
			9 min	37.01				
			9:30	37.01				
			10 min	37.01				
			11	37.01				
			12	37.01				Collect Water
			13	37.01				
			14	37.01				
			15 min	37.01				
			16	37.01				
			17	37.01				
			18	37.01				
			19	37.01				
			20 min	37.01				
			21	37.01				
			22	37.01				
			23	37.01				
			24	37.01				
			25 min	37.01				
			26	37.01				
			27	37.01				
			28	37.01				
			29	37.01				
			30 min	37.01				
			35	37.01				
			40	37.01				
			45	37.01				
			50	37.01				
			55	37.01				
			60 min	37.01				
								1 HOUR Collect Water

15 sec
30 sec
1 min
5 min

AQUIFER TEST DATA

WELL NO.:
TEST NO.: Step No.
JOB NO.: 94-036
PAGE: 2
DATE:
JOB LOCATION: OUC Orange Site Taft

15 min

1/2 hr

RECORDED BY	TIME			WATER LEVEL DATA		DISCHARGE DATA		COMMENTS
	DATE	CLOCK TIME	ELAPSED TIME	READING	WATER LEVEL CHANGE	MANOMETER READING	RATE GPM	
			1hr15min	37.01				
			1:30	37.01				
			1:45	37.01				
			2hr	37.01				Collect Water
			2:15	37.01				
			2:30	37.01				
			2:45	37.01				
			3hr	37.01				Collect Water
			3:15	37.01				
			3:30	37.01				
			3:45	37.01				
			4hr	37.01				Collect Water
			4:15	37.01				
			4:30	37.01				
			4:45	37.01				
			5hr	37.01				Collect Water
			5hr30min	37.01				
			6hr	37.01				Collect Water
			6:30	37.01				
			7hr	37.01				Collect Water
			7:30	37.01				
			8 hr	37.01				Collect Water
			8:30	37.01				
			9hr	37.01				Collect Water
			9:30	37.01				
			10 hours	37.01				Collect Water

Open hole - 1048' - 1400'
Flow Rate 1017 gpm
Drawdown 16.18 ft
Spec Capacity 63 gpm/ft

Lower Floridan
AQUIFER TEST DATA

WELL NO.: Orange test well
TEST NO.: Step - 3
JOB NO.: 94-036
PAGE: 1
DATE: 1-13-96
JOB LOCATION: OUC - Orange

RECORDED BY	DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
		1230	0	45.1				1100 gpm
			15					
			30	42.6				
			45					
		1231	100	52.78				
			115					
			130	52.12				
			145					
		1232	200	52.74				
			215					
			230					
			245					
		1233	300	52.74				
			315					
			330					
			345					
		1234	400	52.72				
			415					
			430					
			445					
		12:35	500	52.72				
			530					
		12:36	600	52.74				
			630					
		12:37	700	52.72				
			730					
		12:38	800	52.74				
			830					
		12:39	900	52.74				
			930					Adjusting down
		12:40	1000					Collect water
			11					
			12	52.7				
			13	52.72				
			14					
		12:45	15	52.72				
			16					
			17					
			18					
			19					
		12:50	20	52.7				
			21					
			22					
			23					
			24					
		12:55	25	52.65				
			26					
			27					
			28	52.26				
			29					

ATD1.XLS

AQUIFER TEST DATA

WELL NO.:
TEST NO.: Step - 3
JOB NO.:
PAGE.: 2
DATE: 1-13-96
JOB LOCATION: OUC- Orange

RECORDED BY	DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
		1 AM	30	52.26		15448		
			35	52.22				
			40	52.2				
			45					
			50					
			55					
		1:30	1 hr	52.20	16.06	15478		Collect water
			1:15					
			1:30	52.24				
			1:45					
		2:30	2 hr	52.22	16.08	15539		Collect water
			2:15					
			2:30					
			2:45					
		330	3:00	52.12	15.98	15600		Collect water
			3:30					
		430	4:00	52.12	15.98	15661		Collect water
			4:30					
		530	5:00	52.14	16.00	15722		collect water
			5:30					
		630	6:00	52.22	16.08	15783		collect water
			6:30					
		730	7:00	52.2	16.06	15843.5		Collect water
			7:30					
		830	8:00	52.3	16.16	15904.5		collect water
			8:30					
		930	9:00	52.38	16.24	15966		Collect water
			9:30					
		1030	10:00	52.32	16.18	16027		collect water
30 min		1105-6		stopped pump recovery				WL 52.32
		1135						36.40
			water has Sulfur Odor.					

ATD1.XLS

Lower Floridan Test
Upper Floridan Monitor Well

Open Hole 1098'-1400'
Flow Rate =
Drawdown =
Spec Capacity =

AQUIFER TEST DATA

WELL NO.: Orange Test Well
TEST NO.: Step No 3
JOB NO.: 94-036
PAGE: 1
DATE: 1/13/96
JOB LOCATION: OU2 - Orange Site - Taft

RECORDED BY	TIME: DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
15 sec		1230	0 sec	37.01				
			15					
			30					
			45					
			1 min	37.03				
			1:15					
			1:30					
			1:45					
			2 min	37.04				
			2:15					
			2:30					
			2:45					
			3 min	37.02				
			3:15					
			3:30					
			4 min	37.03				
			4:15					
			4:30					
			4:45					
30 sec		1235	5 min	37.02				
			5:30					
			6 min					
			6:30					
			7 min	37.02				
			7:30					
			8 min	37.02				
			8:30					
			9 min	37.02				
			9:30					
1 min		1240	10 min	37.02				
			11					Collect Water
			12					
			13					
			14					
			15 min	37.02				
			16					
			17					
			18					
			19					
		1250	20 min	37.02				
			21					
			22					
			23					
			24					
			25 min	37.02				
			26					
			27					
			28					
			29					
5 min		1 AM	30 min	37.02				
			35					
			40					
			45					
			50					
			55					
		130 AM	60 min	37.02				
								1 HOUR Collect Water

AQUIFER TEST DATA

WELL NO.:
TEST NO.: Step No. 1
JOB NO.: 94-036
PAGE.: 2
DATE:
JOB LOCATION: OUC Orange Site Taft

15 min

1/2 hr

RECORDED BY	TIME: DATE	TIME: CLOCK TIME	TIME: ELAPSED TIME	WATER LEVEL DATA: READING	WATER LEVEL DATA: WATER LEVEL CHANGE	DISCHARGE DATA: MANOMETER READING	DISCHARGE DATA: RATE GPM	COMMENTS
			1hr15min	37.02				
			1:30	37.02				
			1:45	37.02				
		230	2 hr	37.02				Collect Water
			2:15	37.02				
			2:30	37.02				
			2:45	37.02				
		330	3hr	37.02				Collect Water
			3:15	37.02				
			3:30	37.02				
			3:45	37.02				
		430	4hr	37.02				Collect Water
			4:15	37.02				
			4:30	37.02				
			4:45	37.02				
		530	5hr	37.02				Collect Water
			5hr30min	37.02				
		630	6hr	37.02				Collect Water
			6:30	37.02				
		730	7hr					Collect Water
			7:30					
		830	8 hr					Collect Water
			8:30					
		930	9hr					Collect Water
			9:30					
		1030 AM	10 hours	37.02				Collect Water

Appendix D
Water Quality Data

SOUTHEAST TEST WELL - CHLORIDE AND SPECIFIC CONDUCTANCE READINGS DURING DRILLING

BOREHOLE DEPTH (FT)	CHLORIDE (mg/l)	SPEC. COND. (umhos/cm)
300	20	410
310	25	390
320	20	200
330	20	1100
340	25	170
350	20	600
360	20	660
370	25	1000
380	20	170
390	20	150
400	20	650
410	25	125
420	20	270
430	25	380
440	25	390
450	25	380
460	25	400
470	25	402
480	25	393
490	25	378
500	25	399
510	25	388
520	25	368
530	25	376
540	25	388
550	25	402
560	25	400
570	25	414
580	25	412
590	25	407
600	25	402
610	25	400
620	25	388
630	25	393
640	25	360
650	25	385

SOUTHEAST TEST WELL - CHLORIDE AND SPECIFIC CONDUCTANCE READINGS DURING DRILLING

BOREHOLE DEPTH (FT)	CHLORIDE (mg/l)	SPEC. COND. (umhos/cm)
660	25	385
670	25	337
680	30	275
690	30	365
700	30	388
710	25	378
720	30	402
730	30	388
740	30	396
750	30	389
760	30	329
770	30	272
780	30	388
790	30	385
800	30	395
810	30	400
820	25	404
830	25	411
840	25	399
850	25	406
860	25	401
870	30	401
880	30	399
890	25	402
900	30	393
910	30	413
920	30	409
930	30	404
940	30	402
950	30	406
960	30	411
970	30	347
980	30	339
990	30	393
1000	30	306
1010	30	299

SOUTHEAST TEST WELL - CHLORIDE AND SPECIFIC CONDUCTANCE READINGS DURING DRILLING

BOREHOLE DEPTH (FT)	CHLORIDE (mg/l)	SPEC. COND. (umhos/cm)
1020	30	357
1030	30	275
1040	30	360
1050	30	343
1060	30	324
1070	30	403
1080	30	378
1090	30	415
1100	30	368
1110	25	451
1120	25	460
1130	25	485
1140	25	461
1150	25	450
1160	25	446
1170	25	446
1180	25	469
1190	30	461
1200	25	455
1210	25	440
1220	25	440
1230	25	444
1240	25	437
1250	25	442
1260	25	441
1270	25	440
1280	30	461
1290	30	471
1300	30	427
1310	30	451
1320	30	432
1330	15	438
1340	15	435
1350	15	440
1360	30	465
1370	25	432

SOUTHEAST TEST WELL - CHLORIDE AND SPECIFIC CONDUCTANCE READINGS DURING DRILLING

BOREHOLE DEPTH (FT)	CHLORIDE (mg/l)	SPEC. COND. (umhos/cm)
1380	25	432
1390	30	446
1400	20	440
1410		0
1420	30	453
1430	30	449
1440	30	451
1450	30	453
1460	25	442
1470	30	437
1480	30	456
1490	30	439
1500	30	440
1510	30	446
1520	30	446
1530	30	442
1540	30	446
1550	30	485
1560	30	540
1570	35	482
1580	30	459
1590	30	435
1600	30	445
1610	30	450
1620	35	438
1630	30	448
1640	30	429
1650	30	442
1660	30	437
1670	30	442
1680	30	446
1690	30	429
1700	30	440
1710	30	430
1720	30	444
1730	30	470

SOUTHEAST TEST WELL - CHLORIDE AND SPECIFIC CONDUCTANCE READINGS DURING DRILLING

BOREHOLE DEPTH (FT)	CHLORIDE (mg/l)	SPEC. COND. (umhos/cm)
1740	30	430
1750	30	430
1760	30	430
1770	35	429
1780	30	419
1790	30	471
1800	30	423
1810	30	427
1820	30	456
1830	30	422
1840	30	432
1850	30	466
1860	30	451
1870	30	426
1880	30	451
1890	30	457
1900	35	457
1910	35	457
1920	30	453
1930	30	455
1940	30	442
1950	35	456
1960	35	418
1970	35	438
1980	35	530
1990	40	578
2000	45	674

STEP DRAWDOWN TEST DATA

OUC ~~ORANGE~~ SOUTHEAST WTP - ~~LOWER~~ UPPER FLORIDAN

DATE	H2O DEPTH TO LEVEL	ELAPSED TIME	STEP 1 gpm	SPECIFIC CONDUCTANCE		CHLORIDE CONC.	HYDROGEN mg/l SULFIDE
10-12-95		15 min	1535	420	25°	25	0.30
		1 hr		420	25°	25	0.30
		2 hr		415	25°	25	0.50
		3 hr		415	25°	25	0.50

STEP DRAWDOWN TEST DATA

ST 2

OUC SOUTHEAST WTP - ~~LOWER~~ Upper FLORIDAN

DATE	H2O DEPTH TO LEVEL	ELAPSED TIME	STEP ~~1~~ 2 2300 gpm	SPECIFIC CONDUCTANCE	CHLORIDE CONC.	HYDROGEN SULFIDE
10-13-95	45.40	10 min	2200	28/455	30	0.3
	45.50	60 min		25.5/430	30	0.3
	45.50	2 hr.		26/435	30	0.5
	45.50	3 hr		25/430	30	0.5

$Cl^- = \#$ of drops x 5
H_2S = Seltzer paper cover 2 min wait check
Water to line

STEP DRAWDOWN TEST DATA

OUC SOUTHEAST WTP - ~~LOWER~~ Upper FLORIDAN

DATE	H2O DEPTH TO LEVEL	ELAPSED TIME	STEP #3 3 gpm	SPECIFIC CONDUCTANCE	CHLORIDE CONC.	HYDROGEN SULFIDE
10-13-95	47.88	10:00 min	2720	27/445	30 mg/l	0.3
	47.86	60		27.5/448	30	0.7
	47.90	120		26.5/445	35	.5-.7
	47.92	180		28/452	35	1.0

other bib

OUC-S3.XLS

STEP DRAWDOWN TEST DATA
OUC SOUTHEAST WTP - LOWER FLORIDAN

Step No. ST1
Rate ~~601~~ 633 gpm

DATE	H2O DEPTH TO LEVEL	ELAPSED TIME	STEP 1 gpm	SPECIFIC CONDUCTANCE Temp / S. Cond	CHLORIDE CONC.	HYDROGEN SULFIDE
11-28-95		10 min	635	26° / 455	30 mg/l	5 mg/l
		1 hr		25.5° / 455	30 mg/L	5 mg/L
		2 hr		26° / 455	30 mg/L	5 mg/L
		3 hr		25.5° / 455	35	5 mg/L
		4 hr		25° / 450	35	5 mg/L
		5 hr		25° / 450	35	5
		6 hr		/		
		7 hr		/		
		8 hr		/		
		9 hr		/		
		10 hr		/		

STEP DRAWDOWN TEST DATA

OUC SOUTHEAST WTP - LOWER FLORIDAN

Step No. 2
Rate ~~830~~ gpm

DATE	H2O DEPTH TO LEVEL	ELAPSED TIME	STEP ~~#~~ 2 gpm	SPECIFIC CONDUCTANCE Temp / S. Cond.	CHLORIDE CONC.	HYDROGEN SULFIDE
11-28-95		10 min	825	25 / 450	35	2.0
		1 hr		25 / 450	35	5.0
		2 hr		25 / 450	30	5.0
		3 hr		25 / 450	30	5.0
		4 hr		/		
		5 hr		/		
		6 hr		/		
		7 hr		/		
		8 hr		/		
		9 hr		/		
		10 hr		/		

STEP DRAWDOWN TEST DATA

Step No. 3

OUC SOUTHEAST WTP - LOWER FLORIDAN

Rate 840 gp

DATE	H2O DEPTH TO LEVEL	ELAPSED TIME	STEP # 3 gpm	SPECIFIC Temp / S Cond CONDUCTANCE	CHLORIDE CONC.	HYDROGEN mg/L SULFIDE
11-29-95		10 min	840	25 / 445	35	5.0
		1 hr		26 / 450	35	5.0
		2 hr		26.5 / 455	35	5.0
		3 hr		26.5 / 455	35	5.0
		4 hr		27 / 460	35	5.0
		5 hr		26.5 / 460	35	5.0
		6 hr		26 / 455	35	5.0
		7 hr		26 / 455	35	5.0
		8 hr		26 / 450	35	5.0
		9 hr		25 / 445	35	5.0
		10 hr		25 / 450	35	5.0

VL

ORANGE TEST WELL - CHLORIDE AND SPECIFIC CONDUCTANCE READINGS DURING DRILLING

BOREHOLE DEPTH (FT)	CHLORIDE (mg/l)	SPEC. COND. (umhos/cm)
220	25	498
230	25	506
240	25	460
250	25	465
260	25	469
270	25	469
280	25	464
290	25	458
300	25	460
310	25	456
320	25	460
330	25	456
340	30	461
350	25	460
360	30	464
370	30	454
380	30	460
390	30	460
400	30	450
410	30	455
420	30	451
430	30	456
440	30	446
450	30	442
460	30	445
470	25	450
480	30	440
490	30	440
500	30	440
510	30	407
520	30	439
530	30	443
540	30	435
550	30	437
560	25	425
570	30	444
580	30	425
590	30	445
600	30	440

ORANGE TEST WELL - CHLORIDE AND SPECIFIC CONDUCTANCE READINGS DURING DRILLING

BOREHOLE DEPTH (FT)	CHLORIDE (mg/l)	SPEC. COND. (umhos/cm)
610	30	440
620	30	440
630	30	435
640	30	440
650	30	440
660	30	445
670	30	449
680	30	447
690	30	428
700	25	447
710	25	447
720	25	446
730	30	446
740	25	446
750	25	445
760	30	444
770	30	449
780	30	449
790	30	443
800	25	438
810	25	438
820	25	439
830	25	449
840	30	442
850	30	449
860	30	444
870	30	420
880	30	456
890	30	441
900	30	449
910	30	442
920	30	440
930	30	430
940	30	430
950	30	440
960	30	440
970	30	430
980	30	440
990	30	450

ORANGE TEST WELL - CHLORIDE AND SPECIFIC CONDUCTANCE READINGS DURING DRILLING

BOREHOLE DEPTH (FT)	CHLORIDE (mg/l)	SPEC. COND. (umhos/cm)
1000	30	440
1010	25	439
1020	25	440
1030	25	440
1040	25	440
1050	30	446
1060	30	446
1070	25	446
1080	30	460
1090	25	450
1100	30	445
1110	40	436
1120	40	440
1130	40	439
1140	35	426
1150	35	422
1160	35	377
1170	35	380
1180	35	380
1190	35	376
1200	35	376
1210	35	383
1220	35	382
1230	35	385
1240	35	389
1250	35	385
1260	35	385
1270	40	345
1280	30	372
1290	35	377
1300	30	377
1310	30	377
1320	30	374
1330	30	360
1340	35	370
1350	35	380
1360	30	396
1370	30	380
1380	30	391

ORANGE TEST WELL - CHLORIDE AND SPECIFIC CONDUCTANCE READINGS DURING DRILLING

BOREHOLE DEPTH (FT)	CHLORIDE (mg/l)	SPEC. COND. (umhos/cm)
1390	30	387
1400	30	395
1410	25	394
1420	20	388
1430	20	386
1440	25	399
1450	20	399
1460	20	395
1470	20	385
1480	20	378
1490	20	392
1500	20	388
1510	20	388
1520	20	390
1530	20	393
1540	20	403
1550	20	402
1560	15	399
1570	15	397
1580	20	392
1590	15	390
1600	15	387
1610	15	387
1620	15	395
1630	15	399
1640	15	396
1650	15	393
1660	20	394
1670	20	392
1680	20	399
1690	15	392
1700	15	392
1710	15	394
1720	15	390
1730	15	395
1740	15	395
1750	20	394
1760	25	388
1770	15	384

ORANGE TEST WELL - CHLORIDE AND SPECIFIC CONDUCTANCE READINGS DURING DRILLING

BOREHOLE DEPTH (FT)	CHLORIDE (mg/l)	SPEC. COND. (umhos/cm)
1780	20	395
1790	15	394
1800	15	395
1810	20	392
1820	20	398
1830	20	404
1840	20	398
1850	15	385
1860	15	385
1870	15	392
1880	20	398
1890	20	400
1900	15	402
1910	15	394
1920	15	402
1930	15	405
1940	25	397
1950	25	398
1960	20	415
1970	25	405
1980	25	405
1990	25	405
2000	25	405

STEP DRAWDOWN TEST DATA

OUC ORANGE WTP - UPPER FLORIDAN

DATE	H2O DEPTH TO LEVEL	ELAPSED TIME	STEP 1 gpm	SPECIFIC CONDUCTANCE	CHLORIDE CONC.	HYDROGEN mg/l SULFIDE
10-5-95		10 min	1760	25°C 450	20 mg/L	1.0
		1 hr		24 445	20	1.0
		2 hr		24 445	25	1.0
		3 hr		24 445	25	1.0
		4 hr		24 440	30	1.0
		5 hr		23.5 420	25	1.0

STEP DRAWDOWN TEST DATA

OUC ORANGE WTP - UPPER FLORIDAN

DATE	H2O DEPTH TO LEVEL	ELAPSED TIME	STEP X 2 gpm	SPECIFIC CONDUCTANCE	CHLORIDE CONC.	HYDROGEN SULFIDE
10-5-96		20 Min	2240	24°c 445	30 mg/L	1.0
		1 hr		24 445	30	1.0
		2 hr		24 440	35	1.0
		3 hr		25 440	30	1.0
		4 hr		25 445	30	1.0
		5 hr		24 445	30	1.0

STEP DRAWDOWN TEST DATA

OUC ORANGE WTP - UPPER FLORIDAN

DATE	H2O DEPTH TO LEVEL	ELAPSED TIME	STEP ~~X~~ 3 gpm	SPECIFIC CONDUCTANCE	CHLORIDE CONC.	HYDROGEN SULFIDE
10-10-95		15 min	2780	27°C 450	25	1.0
		1hr		26 455	30	1.0
		2hr		26° 455	30	1.0
		3hr		26° 455	30	1.0
		4hr		26° 455	30	1.0
		5hr		26 455	30	1.0

STEP DRAWDOWN TEST DATA

OUC ORANGE WTP - LOWER FLORIDAN

DATE	H2O DEPTH TO LEVEL	ELAPSED TIME	STEP 1 gpm	SPECIFIC CONDUCTANCE	CHLORIDE CONC.	HYDROGEN mg/l SULFIDE
1-12-96		10 min	465	20°C 355	30 mg/L	5.0
		1 hr		23 390	30	5.0
		2 hr		23 385	30	5.0
		3 hr		22.5 380	30	5.0

STEP DRAWDOWN TEST DATA

OUC ORANGE WTP - LOWER FLORIDAN

DATE	H2O DEPTH TO LEVEL	ELAPSED TIME	STEP ~~1~~ 2 gpm	SPECIFIC CONDUCTANCE	CHLORIDE CONC.	HYDROGEN mg/l SULFIDE
1/12/96		10 min	745	21°C 365	35 mg/L	5.0
		1 hr		23 385	30	5.0
		2 hr		23 385	30	5.0
		3 hr		24 390	30	5.0

OUC-S2.XLS

Orange Site Lower Floridan

JDW

STEP DRAWDOWN TEST DATA

OUC ORANGE WTP - LOWER FLORIDAN

Step No. 3
Rate 1000 gpm

DATE	H2O DEPTH TO LEVEL	ELAPSED TIME	STEP ~~1~~ 3 gpm	SPECIFIC Temp / S. Cond. CONDUCTANCE	CHLORIDE CONC.	HYDROGEN mg/l SULFIDE
		10 min	1015	24°C / 390	30	5.0 mg/l
1-13-96		1 hr		24 / 390	30	5.0
		2 hr		24 / 390	35	5.0
		3 hr		24 / 395	35	5.0
		4 hr		23.5 / 390	35	5.0
		5 hr		23.5 / 385	30	5.0
		6 hr		24 / 390	35	5.0
		7 hr		24 / 385	30	5.0
		8 hr		24 / 390	30	5.0
		9 hr		24 / 390	30	5.0
		10 hr		24 / 390	30	5.0

CH2M HILL

NOV 10 1995

ORLANDO

ORLANDO UTILITIES COMMISSION

500 SOUTH ORANGE AVENUE • P. O. BOX 3193 • ORLANDO, FLORIDA 32802 • 407/423-9100

November 9, 1995

Mr. Al Aikens
CH2M-Hill Engineers
225 East Robinson Street
Suite 405
Orlando, Florida 32801

Dear Mr. Aikens:

Attached are the analytical results for the Orange Avenue and Southeast test wells.

If there are any questions please call me at 894-5375.

Sincerely,

Richard A. Dunham

Richard A. Dunham
Manager
Water Quality Laboratory

cc: C.A. Russell

RAD/ltd

ORLANDO UTILITIES COMMISSION
WATER QUALITY LABORATORY

RESULTS OF ANALYSIS

	ORANGE AVENUE TEST WELL		SOUTHEAST TEST WELL	
Date Sampled	10/10/95		10/13/95	
Date Received	10/11/95		10/16/95	
Lab ID #	WQL960108		WQL960130	
Primary Inorganics				
Antimony	<0.002	mg/L	<0.002	mg/L
Arsenic	<0.002	mg/L	<0.002	mg/L
Barium	0.039	mg/L	0.011	mg/L
Beryllium	<0.0001	mg/L	<0.0001	mg/L
Cadmium	<0.0002	mg/L	<0.0002	mg/L
Chromium	<0.0002	mg/L	<0.0002	mg/L
Lead	<0.001	mg/L	0.001	mg/L
Nickel	<0.020	mg/L	<0.020	mg/L
Selenium	<0.004	mg/L	<0.004	mg/L
Sodium	15.7	mg/L	16.5	mg/L
Thallium	<0.001	mg/L	<0.001	mg/L
Nitrate	<0.060	mg/L	<0.060	mg/L *
Nitrite	<0.020	mg/L	<0.020	mg/L *

* Sample was past 48 hour maximum holding time when delivered.

	ORANGE AVENUE TEST WELL		SOUTHEAST TEST WELL	
Secondary Inorganics				
Aluminum	0.004	mg/L	0.032	mg/L
Chloride	16.3	mg/L	14.8	mg/L
Color	11	Pt-Co Units	16	Pt-Co Units
Copper	<0.020	mg/L	<0.030	mg/L
Fluoride	<0.10	mg/L	<0.10	mg/L
Iron	0.070	mg/L	<0.050	mg/L
Manganese	<0.020	mg/L	<0.020	mg/L
Odor	1	T.O.N.	1	T.O.N.
pH	Field Parameter		Field Parameter	
Silver	<0.0001	mg/L	<0.0001	mg/L
Sulfate	12.8	mg/L	1.6	mg/L
TDS	286	mg/L	272	mg/L
Zinc	<0.010	mg/L	<0.010	mg/L
Other Inorganics				
Calcium	67.2	mg/L	64.0	mg/L
Magnesium	15.3	mg/L	13.9	mg/L
Potassium	1.7	mg/L	1.9	mg/L
Total Hardness	218	mg/L	199	mg/L
Carbonate Hardness	195	mg/L	196	mg/L

Non-Carbonate Hardness	23	mg/L	3	mg/L
Total Alkalinity	195	mg/L	196	mg/L
Phosphate	<0.10	mg/L	<0.10	mg/L
Molybdenum	<0.002	mg/L	<0.002	mg/L
Turbidity	2.0	NTU	9.9	NTU
Conductivity	459	µS	435	µS
Bromide	0.10	mg/L	0.09	mg/L
T.O.C.	2.93	mg/L	3.74	mg/L
DBP's/VOC's				
EDB	<0.020	ug/L	<0.020	ug/L
DBCP	<0.020	ug/L	<0.020	ug/L
Diquat	<0.090	ug/L	*	
Glyphosate	<10	ug/L	*	
Endothall	<100	ug/L	<100	ug/L

* Not sampled in appropriate container

VOC's				
Trichloroethylene	<0.48	ug/L	<0.48	ug/L
Tetrachloroethylene	<0.50	ug/L	<0.50	ug/L
Carbon Tetrachloride	<0.49	ug/L	<0.49	ug/L
Vinyl chloride	<0.49	ug/L	<0.49	ug/L
1,1,1-Trichloroethane	<0.48	ug/L	<0.48	ug/L
1,2-Dichloroethane	<0.48	ug/L	<0.48	ug/L
Benzene	<0.38	ug/L	<0.38	ug/L
p-Dichlorobenzene	<0.47	ug/L	<0.47	ug/L
1,1-Dichloroethylene	<0.47	ug/L	<0.47	ug/L
cis-1,2-Dichloroethylene	<0.49	ug/L	<0.49	ug/L
1,2-Dichloropropane	<0.46	ug/L	<0.46	ug/L
Ethylbenzene	<0.50	ug/L	<0.50	ug/L
Chlorobenzene	<0.42	ug/L	<0.42	ug/L
o-Dichlorobenzene	<0.34	ug/L	<0.34	ug/L
Styrene	<0.44	ug/L	<0.44	ug/L
Toluene	<0.47	ug/L	<0.47	ug/L
trans-1,2-Dichloroethylene	<0.44	ug/L	<0.44	ug/L
Total Xylenes	<0.48	ug/L	<0.48	ug/L
Dichloromethane	<0.38	ug/L	<0.38	ug/L
1,2,4-Trichlorobenzene	<0.43	ug/L	<0.43	ug/L
1,1,2-Trichloroethane	<0.48	ug/L	<0.48	ug/L
Group II Unregulated Contaminants				
Bromobenzene	<3.0	ug/L	<3.0	ug/L
Bromodichloromethane	<0.54	ug/L	<0.54	ug/L
Bromoform	<1.13	ug/L	<1.13	ug/L
Bromomethane	<1.04	ug/L	<1.04	ug/L
Chloroethane	<1.19	ug/L	<1.19	ug/L
Chloroform	<1.09	ug/L	<1.09	ug/L
Chloromethane	<0.76	ug/L	<0.76	ug/L
Dibromochloromethane	<0.92	ug/L	<0.92	ug/L
Dichlorodifluoromethane	<1.61	ug/L	<1.61	ug/L

p-Chlorotoluene	<0.49	ug/L	<0.49	ug/L
Dibromomethane	<0.77	ug/L	<0.77	ug/L
1,1-Dichloroethane	<0.33	ug/L	<0.33	ug/L
1,3-Dichloropropene	<1.77	ug/L	<1.77	ug/L
1,3-Dichloropropane	<0.71	ug/L	<0.71	ug/L
2,2-Dichloropropane	<0.37	ug/L	<0.37	ug/L
Trichlorofluoromethane	<0.66	ug/L	<0.66	ug/L
1,2,3-Trichloropropane	<0.66	ug/L	<0.66	ug/L
m-Dichlorobenzene	<0.67	ug/L	<0.67	ug/L
1,1,1,2-Tetrachloroethane	<0.25	ug/L	<0.25	ug/L
1,1,2,2-Tetrachloroethane	<0.66	ug/L	<0.66	ug/L
Methyl tert-Butyl Ether	N.D.		N.D.	
1,1-Dichloropropene	<0.97	ug/L	<0.97	ug/L
o-Chlorotoluene	<0.50	ug/L	<0.50	ug/L

N.D. = Not Determined

THM Formation Potential - 7 day	169	mg/L	193	mg/L
Haloacetic Acid Formation Potential 7-day	116	mg/L	145	mg/L

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

2846 Industrial Plaza Drive (32301) • P.O. Box 13056 • Tallahassee, FL 32317-3056 • (904) 878-3994 • Fax (904) 878-9504

LOG NO: T5-13059

Received: 17 OCT 95

Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Project: OUC-Orange Test Well/Upper Floridan Test
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13059-1	OUC-Southeast Test Well-Upper Floridan	10-13-95

PARAMETER	13059-1
Organophosphorous Pesticides (507)	
Alachlor, ug/l	<1.0
Atrazine, ug/l	<1.0
Butachlor, ug/l	<1.0
Metolachlor, ug/l	<1.0
Metribuzin, ug/l	<1.0
Simazine, ug/l	<1.0
Date Extracted	10.23.95
Date Analyzed	10.25.95

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Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13059-1	OUC-Southeast Test Well-Upper Floridan	10-13-95

PARAMETER	13059-1
Chlorinated Pesticides (508)	
Aldrin, ug/l	<0.010Q
Chlordane, ug/l	<0.10Q
Dieldrin, ug/l	<0.020Q
Endrin, ug/l	<0.020Q
Heptachlor, ug/l	<0.010Q
Heptachlor epoxide, ug/l	<0.020Q
Hexachlorobenzene, ug/l	<0.050Q
Hexachlorocyclopentadiene, ug/l	<0.050Q
Gamma-BHC (Lindane), ug/l	<0.010Q
Propachlor, ug/l	<1.0Q
Toxaphene, ug/l	<1.0Q
PCB-1016, ug/l	<0.50Q
PCB-1221, ug/l	<0.50Q
PCB-1232, ug/l	<0.50Q
PCB-1242, ug/l	<0.50Q
PCB-1248, ug/l	<0.50Q
PCB-1254, ug/l	<0.50Q
PCB-1260, ug/l	<0.50Q
Surrogate-DBC	102 %
Date Extracted	10.23.95
Date Analyzed	10.24.95

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LOG NO: T5-13059

Received: 17 OCT 95

Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Project: OUC-Orange Test Well/Upper Floridan Test
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13059-1	OUC-Southeast Test Well-Upper Floridan	10-13-95

PARAMETER	13059-1
Chlorinated Acids Herbicides (515.1)	
2,4-D, ug/l	<0.50
Dicamba, ug/l	<0.50
Dalapon, ug/l	<10
Dinoseb, ug/l	<0.50
Pentachlorophenol, ug/l	<1.0
Picloram (4-Amino-3,5,6-trichloropicolinic acid), ug/l	<0.50
2,4,5-TP Silvex, ug/l	<0.50
Date Extracted	10.23.95
Date Analyzed	10.25.95
Primary Organics - BN (525.2)	
Benzo(a)pyrene, ug/l	<0.20Q
Bis(2-ethyl hexyl)adipate, ug/l	<2.0Q
bis(2-Ethylhexyl) phthalate, ug/l	<2.0Q
Hexachlorobenzene, ug/l	<1.0Q
Hexachlorocyclopentadiene, ug/l	<1.0Q
Date Extracted	10.23.95
Date Analyzed	10.24.95
Primary Organics - Carbamates (531.1)	
Carbofuran, ug/l	<1.0
Oxamyl, ug/l	<1.0
Date Analyzed	10.24.95

SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

2846 Industrial Plaza Drive (32301) • P.O. Box 13056 • Tallahassee, FL 32317-3056 • (904) 878-3994 • Fax (904) 878-9504

LOG NO: T5-13059

Received: 17 OCT 95

Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Project: OUC-Orange Test Well/Upper Floridan Test
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13059-1	OUC-Southeast Test Well-Upper Floridan	10-13-95

PARAMETER	13059-1
Group I Unregulated Carbamates (531.1)	
Aldicarb, ug/l	<0.050
Aldicarb Sulfone, ug/l	<0.050
Aldicarb Sulfoxide, ug/l	<0.050
Carbaryl, ug/l	<1.0
3-Hydroxycarbofuran, ug/l	<1.0
Methomyl, ug/l	<1.0
Date Analyzed	10.24.95
Group III Unregulated AE (625)	
2-Chlorophenol, ug/l	<10Q
2-Methyl-4,6-dinitrophenol, ug/l	<50Q
Phenol, ug/l	<10Q
2,4,6-Trichlorophenol, ug/l	<10Q
Date Extracted	10.23.95
Date Analyzed	10.25.95
Group III Unregulated BN (625)	
Butylbenzylphthalate, ug/l	<10Q
Di-n-butylphthalate, ug/l	<10Q
Diethylphthalate, ug/l	<10Q
Dimethylphthalate, ug/l	<10Q
2,4-Dinitrotoluene, ug/l	<10Q
Di-n-octylphthalate, ug/l	<10Q
Isophorone, ug/l	<10Q
Date Extracted	10.23.95
Date Analyzed	10.25.95
Cyanide (335.3)	
Cyanide, Total (9010), mg/l	<0.010
Date Analyzed	10.19.95

LOG NO: T5-13059

Received: 17 OCT 95

Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Project: OUC-Orange Test Well/Upper Floridan Test
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13059-1	OUC-Southeast Test Well-Upper Floridan	10-13-95

PARAMETER	13059-1
Mercury (245.1)	
Mercury, mg/l	<0.00020
Prep or Extraction Date	10.23.95
Date Analyzed	10.23.95
Foaming Agents (MBAS - SM5540C)	
Surfactants (MBAS-EPA 425.1), mg/l	<0.10Q
Date Analyzed	10.17.95
Time Analyzed	1325
Gross Alpha Radioactivity (9310/900.0)	
Gross Alpha, pCi/l	<3.0
Prep or Extraction Date	10.19.95
Date Analyzed	10.19.95
Gross Beta Radioactivity (9310/900.0)	
Gross Beta, pCi/l	<4.0
Prep or Extraction Date	10.19.95
Date Analyzed	10.19.95

Method: EPA/600/R-92/129
Method: 40 CFR 136
HRS Certification No. 81291
FDEP CompQAP No. 890142G

Q=Samples were extracted or analyzed out of hold time.

Elizabeth L. Schneider
Elizabeth L. Schneider

Serial Number 21163

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: (334) 666-6633 Fax: (334) 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	OUC-Southeast Test Well Upper Floridan Test
PROJECT NO.	
P.O. NUMBER	
PROJECT LOC. (State)	FL
SAMPLER(s) NAME	Patrick Barnes - BFA
PHONE	407/896-8608
FAX	407/896-1822
CLIENT NAME	CH2M Hill / OUC
CLIENT PROJECT MANAGER	Al Aikens
CLIENT ADDRESS (CITY, STATE, ZIP)	225 E. Robinson St, Ste. 405, Orlando, FL 32801

PAGE 1 OF 1

☒ 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	Cyanide	Gross Alpha/Beta	MBAS	Mercury	Reg+UnReg Pest. 531.1	Reg+UnReg Pest. 507	Reg+UnReg Pest 508	Reg+UnReg Herb. 515.1	Reg BNA 525.1	UnReg BNA 625	REMARKS
10/13/95	5:00 to 5:30pm		OUC-Southeast Test Well-Upper Floridan	X				1	1	1	1	1	2	2	2	2	2	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	9-12-95	1730				Murdock Munroe	10-16-95	
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
EMPTY CONTAINERS								

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
[signature]	10-17-95	0800	☐ YES ☑ NO		75-13059	INCOMPLETE RELINQUISHED/RECEIVED SIGNATURES ANALYSIS NOT LISTED ON CONTAINERS SAMPLE ID MIS-MATCH WITH BOTTLE LABELS

RECEIVED 11 TOTAL LITER AMB — COC INDICATES 10

LOG NO: T5-13520
Received: 01 DEC 95
Reported: 19 DEC 95

Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Purchase Order: 0326-0024-7

Project: OUC-Lower Floridan-Southeast
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13520-1	OUC-Southeast L. Floridan	11-29-95

PARAMETER	13520-1
Primary Metals by ICP (200.7)	
Barium, mg/l	0.054
Beryllium, mg/l	<0.0040
Cadmium, mg/l	<0.0050
Chromium, mg/l	<0.010
Nickel, mg/l	<0.040
Sodium, mg/l	11
Prep or Extraction Date	12.05.95
Date Analyzed	12.06.95
Antimony (SM3113B)	
Antimony, mg/l	<0.0050
Prep or Extraction Date	12.04.95
Date Analyzed	12.06.95
Arsenic (SM3113B)	
Arsenic, mg/l	<0.010
Prep or Extraction Date	12.04.95
Date Analyzed	12.04.95
Lead (SM3113B)	
Lead, mg/l	<0.0050
Prep or Extraction Date	12.04.95
Date Analyzed	12.04.95
Selenium (SM3113B)	
Selenium, mg/l	<0.010
Prep or Extraction Date	12.04.95
Date Analyzed	12.04.95

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

2846 Industrial Plaza Drive (32301) • P.O. Box 13056 • Tallahassee, FL 32317-3056 • (904) 878-3994 • Fax (904) 878-9504

LOG NO: T5-13520
Received: 01 DEC 95
Reported: 19 DEC 95

Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Purchase Order: 0326-0024-7

Project: OUC-Lower Floridan-Southeast
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13520-1	OUC-Southeast L. Floridan	11-29-95

PARAMETER	13520-1
Thallium (200.9)	
Thallium, mg/l	<0.0020
Prep or Extraction Date	12.04.95
Date Analyzed	12.05.95
Mercury (245.1)	
Mercury, mg/l	<0.00020
Prep or Extraction Date	12.04.95
Date Analyzed	12.04.95
Carbonate Hardness, mg/l as CaCO3	190
Fluoride (EPA 340.2)	
Fluoride, mg/l	<0.20
Date Analyzed	12.06.95
Nitrite-N (SM4500NO3 E)	
Nitrite-N, mg/l	<0.050
Date Analyzed	12.01.95
Time Analyzed	1110
Nitrate-N (SM4500NO3 F)	
Nitrate-N, mg/l	<0.050
Date Analyzed	12.01.95
Time Analyzed	1110
Cyanide (335.2)	
Cyanide (EPA 335.2), mg/l	<0.010
Date Analyzed	12.05.95

SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

2846 Industrial Plaza Drive (32301) • P.O. Box 13056 • Tallahassee, FL 32317-3056 • (904) 878-3994 • Fax (904) 878-9504

LOG NO: T5-13520
Received: 01 DEC 95
Reported: 19 DEC 95

Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Purchase Order: 0326-0024-7

Project: OUC-Lower Floridan-Southeast
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13520-1	OUC-Southeast L. Floridan	11-29-95

PARAMETER	13520-1
Organophosphorous Pesticides (507)	
Alachlor, ug/l	<1.0
Atrazine, ug/l	<1.0
Butachlor, ug/l	<1.0
Metolachlor, ug/l	<1.0
Metribuzin, ug/l	<1.0
Simazine, ug/l	<1.0
Date Extracted	12.05.95
Date Analyzed	12.07.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13520-1	OUC-Southeast L. Floridan	11-29-95

PARAMETER	13520-1
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	12.05.95
Date Analyzed	12.11.95

LOG NO: T5-13520
Received: 01 DEC 95
Reported: 19 DEC 95

Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Purchase Order: 0326-0024-7

Project: OUC-Lower Floridan-Southeast
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13520-1	OUC-Southeast L. Floridan	11-29-95

PARAMETER	13520-1
Chlorinated Acids Herbicides (515.1)	
2,4-D, ug/l	<0.50
Dicamba, ug/l	<0.50
Dalapon, ug/l	<10
Dinoseb, ug/l	<0.50
Pentachlorophenol, ug/l	<1.0
Picloram (4-Amino-3,5,6-trichloropicolinic acid), ug/l	<0.50
2,4,5-TP Silvex, ug/l	<0.50
Date Extracted	12.06.95
Date Analyzed	12.07.95
Primary Organics - Carbamates (531.1)	
Carbofuran, ug/l	<1.0
Oxamyl, ug/l	<1.0
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	12.07.95
Primary Organics - Glyphosate (547)	
Glyphosate, ug/l	<150
Date Analyzed	12.12.95
Primary Organics - Endothall (548.1)	
Endothall, ug/l	<10
Date Extracted	12.06.95
Date Analyzed	12.11.95

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LOG NO: T5-13520
Received: 01 DEC 95
Reported: 19 DEC 95

Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Purchase Order: 0326-0024-7

Project: OUC-Lower Floridan-Southeast
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13520-1	OUC-Southeast L. Floridan	11-29-95

PARAMETER	13520-1
Primary Organics - Diquat (549.1)	
Diquat, ug/l	<1.0
Date Extracted	12.04.95
Date Analyzed	12.05.95
Microextractables (504)	
1,2-Dibromoethane (EDB), ug/l	<0.020
1,2-Dibromo-3-chloropropane, ug/l	<0.020
Date Analyzed	12.04.95
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	12.04.95
Date Analyzed	12.08.95
Group III Unregulated AE (625)	
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	12.04.95
Date Analyzed	12.06.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13520-1	OUC-Southeast L. Floridan	11-29-95

PARAMETER	13520-1
Group III Unregulated BN (625)	
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	12.04.95
Date Analyzed	12.06.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13520-1	OUC-Southeast L. Floridan	11-29-95

PARAMETER	13520-1
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	12.09.95

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Project: OUC-Lower Floridan-Southeast
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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13520-1	OUC-Southeast L. Floridan	11-29-95

PARAMETER	13520-1
Volatile Organic Compounds (524.2)	
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
o-Chlorotoluene, ug/l	<0.50
4-Chlorotoluene, ug/l	<0.50
Dibromochloromethane, ug/l	<0.50
Dibromomethane, ug/l	<0.50
1,3-Dichlorobenzene, ug/l	<0.50
Dichlorodifluoromethane, ug/l	<0.50
1,1-Dichloroethane, ug/l	<0.50
1,3-Dichloropropane, ug/l	<0.50
2,2-Dichloropropane, ug/l	<0.50
1,1 Dichloropropene, ug/l	<0.50
cis-1,3-Dichloropropene, ug/l	<0.50
trans-1,3-Dichoropropene, ug/l	<0.50
Methyl-tert-butyl ether (MTBE), ug/l	<0.50
1,1,1,2-Tetrachloroethane, ug/l	<0.50
1,1,2,2-Tetrachloroethane, ug/l	<0.50
Trichlorofluoromethane, ug/l	<0.50
1,2,3-Trichloropropane, ug/l	<0.50
Date Analyzed	12.09.95

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Project: OUC-Lower Floridan-Southeast
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13520-1	OUC-Southeast L. Floridan	11-29-95

PARAMETER	13520-1
Turbidity (180.1)	
Turbidity (180.1), NTU	1.4
Date Analyzed	12.01.95
Time Analyzed	1505
Gross Alpha Radioactivity (9310/900.0)	
Gross Alpha, pCi/l	<3.0
Prep or Extraction Date	12.15.95
Date Analyzed	12.17.95
Gross Beta Radioactivity (9310/900.0)	
Gross Beta, pCi/l	<4.0
Prep or Extraction Date	12.15.95
Date Analyzed	12.17.95
Secondary Metals (200.7)	
Aluminum, mg/l	<0.20
Copper, mg/l	<0.025
Iron, mg/l	0.065
Manganese, mg/l	<0.010
Silver, mg/l	<0.010
Zinc, mg/l	<0.020
Prep or Extraction Date	12.05.95
Date Analyzed	12.06.95
Chloride (EPA 325.3)	
Chloride, mg/l	15
Date Analyzed	12.07.95
Sulfate as SO4 (EPA 375.3)	
Sulfate, mg/l	71
Date Analyzed	12.06.95

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Purchase Order: 0326-0024-7

Project: OUC-Lower Floridan-Southeast
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13520-1	OUC-Southeast L. Floridan	11-29-95

PARAMETER	13520-1
Bromide	
Bromide, mg/l	<2.0
Date Analyzed	12.11.95
Organic Carbon, Total (EPA 415.1)	
Total Organic Carbon (415.1), mg/l	2.1
Date Analyzed	12.07.95
Color (SM2120B)	
Color, PCU	<5
Date Analyzed	12.01.95
Time Analyzed	1523
Odor, T.O.N.	128
pH (150.1)	
pH, units	7.5
Date Analyzed	12.01.95
Time Analyzed	1500
Total Dissolved Solids (160.1)	
Total Dissolved Solids (160.1), mg/l	290
Date Analyzed	12.01.95
Foaming Agents (MBAS - SM5540C)	
Surfactants (MBAS-EPA 425.1), mg/l	<0.10
Date Analyzed	12.01.95
Time Analyzed	1125

Serial Number 004

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: (334) 666-6633 Fax: (334) 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: Lower Floridan OUC-Southeast Site
PROJECT NO.:
P.O. NUMBER: 0326-0024-7
PROJECT LOC. (State): FL
SAMPLER(s) NAME: Murdock Monroe - BFA
PHONE: 407/896-8608
FAX: 407/896-1822
CLIENT NAME: CH2M Hill
CLIENT PROJECT MANAGER: Al Aikens
CLIENT ADDRESS (CITY, STATE, ZIP): 225 E. Robinson St. Ste. 405, Orlando, FL 32801

PAGE ___ OF ___

☒ 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	Glyphosate (547)	Fluoride/Sulfate	EDB/DBCP (504)	Reg+Unreg Vol. (524.2)	Endothall (548)	Reg+Unreg Pest (507)	Reg+Unreg Pest (508)	Reg+Unreg Herb (515.1)	Reg. BNA (525.1)	Unreg BNA (625)	REMARKS
11/29/95	7:30PM		OUC-Southeast S-11 L. Floridan	X				1										
↓	↓		S-12	X					1									
			S-13	X						2								
			S-14	X							3							
			S-15	X								2						
			S-16	X									2					
			S-17	X										2				
			S-18	X											2			
			S-19	X												2		
			S-20	X													2	
				X														
				X														
				X														

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	9/10/95	1400	John Watson - BFA	11/29/95	9AM			
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
John Watson - BFA	10/12/95	1200	Murdock Monroe	11/29/95	9Am	Murdock Monroe	11/30/95	10 Am

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
[signature]	12/1/95	0800	☐ YES ☒ NO		T5-13520	Incomplete sample relinquished / received signatures. Received trip blank not listed on

Serial Number 31005

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
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PROJECT REFERENCE: Lower Floridan OUC-Southeast Site
PROJECT NO.:
P.O. NUMBER: 0326-0024-7
PROJECT LOC. (State): FL
SAMPLER(s) NAME: Murdock Monroe - BFA
PHONE: 407/896-8608
FAX: 407/896-1822
CLIENT NAME: CH2M Hill
CLIENT PROJECT MANAGER: Al Aikens
CLIENT ADDRESS (CITY, STATE, ZIP): 225 E. Robinson St. Ste. 405, Orlando, FL 32801

MATRIX TYPE: AQUEOUS (WATER) / SOLID OR SEMISOLID / AIR / NONAQUEOUS LIQUID (oil, solvent, etc)

REQUIRED ANALYSES — PAGE OF

☒ STANDARD REPORT DELIVERY
☐ EXPEDITED REPORT DELIVERY (surcharge)
Date Due:

NUMBER OF CONTAINERS SUBMITTED

SAMPLE DATE	SAMPLE TIME	SL NO.	SAMPLE IDENTIFICATION	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID	Color/pH/TDS/Turb	Cyanide	Gross Alpha/Beta	Primary + Sec. Metals	MBAS	DIQUAT	NO3/NO2	Mercury	Odor	Reg. Unreg. Pest. (531.1)	REMARKS
11/29/95	7:30 PM		OUC-Southeast S-1 L. Floridan	X				1										
			S-2	X					1									
			S-3	X						1								
			S-4	X							1							
			S-5	X								1						
			S-6	X									1					
			S-7	X										1				
			S-8	X											1			
			S-9	X												1		
			S-10	X													1	
			~~S-11~~	X														
			~~S-12~~	X														
			~~S-13~~	X														

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	10/10/95	1400	John Watson BFA	11/29/95	9AM			
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
John Watson - BFA	10/12/95	1200	Murdock Monroe	11/29/95	9AM	Murdock Monroe	11/30/95	10AM

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
[signature]	12/1/95	0800	☐ YES ☒ NO		T5-13520	Incomplete sample relinquished/received signatures.

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

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Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Purchase Order: 0326-0024-7

Project: OUC-Lower Floridan-Southeast
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
13520-2	Method Blank
13520-3	Accuracy (% Recovery)

PARAMETER	13520-2	13520-3
Primary Metals by ICP (200.7)		
Barium, mg/l	<0.010	111 %
Beryllium, mg/l	<0.0040	98 %
Cadmium, mg/l	<0.0050	96 %
Chromium, mg/l	<0.010	100 %
Nickel, mg/l	<0.040	98 %
Sodium, mg/l	<0.50	98 %
Prep or Extraction Date	12.05.95	12.05.95
Date Analyzed	12.06.95	12.06.95
Antimony (SM3113B)		
Antimony, mg/l	<0.0050	86 %
Prep or Extraction Date	12.04.95	12.04.95
Date Analyzed	12.06.95	12.06.95
Arsenic (SM3113B)		
Arsenic, mg/l	<0.010	98 %
Prep or Extraction Date	12.04.95	12.04.95
Date Analyzed	12.04.95	12.04.95
Lead (SM3113B)		
Lead, mg/l	<0.0050	101 %
Prep or Extraction Date	12.04.95	12.04.95
Date Analyzed	12.04.95	12.04.95
Selenium (SM3113B)		
Selenium, mg/l	<0.010	114 %
Prep or Extraction Date	12.04.95	12.04.95
Date Analyzed	12.04.95	12.04.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
13520-2	Method Blank
13520-3	Accuracy (% Recovery)

PARAMETER	13520-2	13520-3
Thallium (200.9)		
Thallium, mg/l	<0.0020	98 %
Prep or Extraction Date	12.04.95	12.04.95
Date Analyzed	12.05.95	12.05.95
Mercury (245.1)		
Mercury, mg/l	<0.00020	106 %
Prep or Extraction Date	12.04.95	12.04.95
Date Analyzed	12.04.95	12.04.95
Carbonate Hardness, mg/l as CaCO3	<3.3	96 %
Fluoride (EPA 340.2)		
Fluoride, mg/l	<0.20	108 %
Date Analyzed	12.06.95	12.06.95
Nitrite-N (SM4500NO3 E)		
Nitrite-N, mg/l	<0.050	106 %
Date Analyzed	12.01.95	12.01.95
Time Analyzed	1110	1110
Nitrate-N (SM4500NO3 F)		
Nitrate-N, mg/l	<0.050	97 %
Date Analyzed	12.01.95	12.01.95
Time Analyzed	1110	1110
Cyanide (335.2)		
Cyanide (EPA 335.2), mg/l	<0.010	94 %
Date Analyzed	12.05.95	12.05.95

LOG NO: T5-13520
Received: 01 DEC 95
Reported: 19 DEC 95

Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Purchase Order: 0326-0024-7

Project: OUC-Lower Floridan-Southeast
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
13520-2	Method Blank
13520-3	Accuracy (% Recovery)

PARAMETER	13520-2	13520-3
Organophosphorous Pesticides (507)		
Alachlor, ug/l	<1.0	101 %
Atrazine, ug/l	<1.0	109 %
Butachlor, ug/l	<1.0	104 %
Metolachlor, ug/l	<1.0	102 %
Metribuzin, ug/l	<1.0	105 %
Simazine, ug/l	<1.0	114 %
Date Extracted	12.05.95	12.05.95
Date Analyzed	12.07.95	12.07.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
13520-2	Method Blank
13520-3	Accuracy (% Recovery)

PARAMETER	13520-2	13520-3
Chlorinated Pesticides (508)		
Aldrin, ug/l	<0.010	81 %
Chlordane, ug/l	<0.10	---
Dieldrin, ug/l	<0.020	90 %
Endrin, ug/l	<0.020	104 %
Heptachlor, ug/l	<0.010	92 %
Heptachlor epoxide, ug/l	<0.020	91 %
Hexachlorobenzene, ug/l	<0.050	62 %
Hexachlorocyclopentadiene, ug/l	<0.050	65 %
Gamma-BHC (Lindane), ug/l	<0.010	86 %
Methoxychlor, ug/l	<0.50	96 %
Propachlor, ug/l	<1.0	85 %
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	12.05.95	12.05.95
Date Analyzed	12.11.95	12.11.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
13520-2	Method Blank
13520-3	Accuracy (% Recovery)

PARAMETER	13520-2	13520-3
Chlorinated Acids Herbicides (515.1)		
2,4-D, ug/l	<0.50	109 %
Dicamba, ug/l	<0.50	88 %
Dalapon, ug/l	<10	75 %
Dinoseb, ug/l	<0.50	41 %
Pentachlorophenol, ug/l	<1.0	85 %
Picloram (4-Amino-3,5,6-trichloropicolinic acid), ug/l	<0.50	109 %
2,4,5-TP Silvex, ug/l	<0.50	107 %
Date Extracted	12.06.95	12.06.95
Date Analyzed	12.07.95	12.07.95
Primary Organics - Carbamates (531.1)		
Carbofuran, ug/l	<1.0	88 %
Oxamyl, ug/l	<1.0	80 %
Group I Unregulated Carbamates (531.1)		
Aldicarb, ug/l	<0.50	82 %
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	12.06.95	12.06.95
Primary Organics - Glyphosate (547)		
Glyphosate, ug/l	<150	80 %
Date Analyzed	12.12.95	12.12.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
13520-2	Method Blank
13520-3	Accuracy (% Recovery)

PARAMETER	13520-2	13520-3
Primary Organics - Endothall (548.1)		
Endothall, ug/l	<10	80 %
Date Extracted	12.06.95	12.06.95
Date Analyzed	12.11.95	12.11.95
Primary Organics - Diquat (549.1)		
Diquat, ug/l	<1.0	102 %
Date Extracted	12.04.95	12.04.95
Date Analyzed	12.05.95	12.05.95
Microextractables (504)		
1,2-Dibromoethane (EDB), ug/l	<0.020	98 %
1,2-Dibromo-3-chloropropane, ug/l	<0.020	100 %
Date Analyzed	12.04.95	12.04.95
Primary Organics - BN (525.2)		
Benzo(a)pyrene, ug/l	<0.20	91 %
Bis(2-ethyl hexyl)adipate, ug/l	<2.0	42 %
bis(2-Ethylhexyl) phthalate, ug/l	<2.0	79 %
Hexachlorobenzene, ug/l	<1.0	57 %
Hexachlorocyclopentadiene, ug/l	<1.0	78 %
Date Extracted	12.04.95	12.04.95
Date Analyzed	12.08.95	12.08.95
Group III Unregulated AE (625)		
2-Chlorophenol, ug/l	<10	93 %
2-Methyl-4,6-dinitrophenol, ug/l	<50	---
Phenol, ug/l	<10	92 %
2,4,6-Trichlorophenol, ug/l	<10	---
Date Extracted	12.04.95	12.04.95
Date Analyzed	12.06.95	12.06.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
13520-2	Method Blank
13520-3	Accuracy (% Recovery)

PARAMETER	13520-2	13520-3
Group III Unregulated BN (625)		
Butylbenzylphthalate, ug/l	<10	---
Di-n-butylphthalate, ug/l	<10	---
Diethylphthalate, ug/l	<10	---
Dimethylphthalate, ug/l	<10	---
2,4-Dinitrotoluene, ug/l	<10	90 %
Di-n-octylphthalate, ug/l	<10	---
Isophorone, ug/l	<10	---
Date Extracted	12.04.95	12.04.95
Date Analyzed	12.06.95	12.06.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
13520-2	Method Blank
13520-3	Accuracy (% Recovery)

PARAMETER	13520-2	13520-3
Primary Organics - Volatiles (524)		
Vinyl chloride, ug/l	<0.50	101 %
Benzene, ug/l	<0.50	95 %
Carbon tetrachloride, ug/l	<0.50	91 %
1,2-Dichloroethane, ug/l	<0.50	95 %
Trichloroethylene, ug/l	<0.50	95 %
1,4-Dichlorobenzene, ug/l	<0.50	98 %
1,1-Dichloroethene, ug/l	<0.50	91 %
1,1,1-Trichloroethane, ug/l	<0.50	96 %
cis-1,2-Dichloroethene, ug/l	<0.50	96 %
1,2-Dichloropropane, ug/l	<0.50	97 %
Ethylbenzene, ug/l	<0.50	96 %
Chlorobenzene, ug/l	<0.50	97 %
1,2-Dichlorobenzene, ug/l	<0.50	95 %
Styrene, ug/l	<0.50	91 %
Tetrachloroethene, ug/l	<0.50	101 %
Toluene, ug/l	<0.50	93 %
trans-1,2-Dichloroethene, ug/l	<0.50	100 %
Xylenes, ug/l	<0.50	90 %
Methylene chloride (Dichloromethane), ug/l	<0.50	95 %
1,2,4-Trichlorobenzene, ug/l	<0.50	95 %
1,1,2-Trichloroethane, ug/l	<0.50	97 %
Date Analyzed	12.09.95	12.09.95

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Project: OUC-Lower Floridan-Southeast
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
13520-2	Method Blank
13520-3	Accuracy (% Recovery)

PARAMETER	13520-2	13520-3
Volatile Organic Compounds (524.2)		
Bromobenzene, ug/l	<0.50	100 %
Bromodichloromethane, ug/l	<0.50	88 %
Bromoform, ug/l	<0.50	75 %
Bromomethane, ug/l	<0.50	---
Chloroethane, ug/l	<0.50	---
Chloroform, ug/l	<0.50	100 %
Chloromethane, ug/l	<0.50	94 %
o-Chlorotoluene, ug/l	<0.50	99 %
4-Chlorotoluene, ug/l	<0.50	99 %
Dibromochloromethane, ug/l	<0.50	81 %
Dibromomethane, ug/l	<0.50	96 %
1,3-Dichlorobenzene, ug/l	<0.50	94 %
Dichlorodifluoromethane, ug/l	<0.50	82 %
1,1-Dichloroethane, ug/l	<0.50	98 %
1,3-Dichloropropane, ug/l	<0.50	94 %
2,2-Dichloropropane, ug/l	<0.50	87 %
1,1 Dichloropropene, ug/l	<0.50	---
cis-1,3-Dichloropropene, ug/l	<0.50	90 %
trans-1,3-Dichoropropene, ug/l	<0.50	89 %
Methyl-tert-butyl ether (MTBE), ug/l	<0.50	---
1,1,1,2-Tetrachloroethane, ug/l	<0.50	92 %
1,1,2,2-Tetrachloroethane, ug/l	<0.50	93 %
Trichlorofluoromethane, ug/l	<0.50	103 %
1,2,3-Trichloropropane, ug/l	<0.50	121 %
Date Analyzed	12.09.95	12.09.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
13520-2	Method Blank
13520-3	Accuracy (% Recovery)

PARAMETER	13520-2	13520-3
Turbidity (180.1)		
Turbidity (180.1), NTU	<0.10	104 %
Date Analyzed	12.01.95	12.01.95
Time Analyzed	1505	1505
Gross Alpha Radioactivity (9310/900.0)		
Gross Alpha, pCi/l	<3.0	112 %
Prep or Extraction Date	12.10.95	12.10.95
Date Analyzed	12.14.95	12.14.95
Gross Beta Radioactivity (9310/900.0)		
Gross Beta, pCi/l	<4.0	115 %
Prep or Extraction Date	12.10.95	12.10.95
Date Analyzed	12.14.95	12.14.95
Secondary Metals (200.7)		
Aluminum, mg/l	<0.20	115 %
Copper, mg/l	<0.025	100 %
Iron, mg/l	<0.050	100 %
Manganese, mg/l	<0.010	98 %
Silver, mg/l	<0.010	110 %
Zinc, mg/l	<0.020	96 %
Prep or Extraction Date	12.05.95	12.05.95
Date Analyzed	12.06.95	12.06.95
Chloride (EPA 325.3)		
Chloride, mg/l	<1.0	93 %
Date Analyzed	12.07.95	12.07.95
Sulfate as SO4 (EPA 375.3)		
Sulfate, mg/l	<5.0	104 %
Date Analyzed	12.06.95	12.06.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
13520-2	Method Blank
13520-3	Accuracy (% Recovery)

PARAMETER	13520-2	13520-3
Bromide		
Bromide, mg/l	<2.0	100 %
Date Analyzed	12.11.95	12.11.95
Organic Carbon, Total (EPA 415.1)		
Total Organic Carbon (415.1), mg/l	<1.0	106 %
Date Analyzed	12.07.95	12.07.95
Color (SM2120B)		
Color, PCU	<5.0	---
Date Analyzed	12.01.95	---
Time Analyzed	1523	---
Odor, T.O.N.	<1.0	---
pH (150.1)		
pH, units	7.6	---
Total Dissolved Solids (160.1)		
Total Dissolved Solids (160.1), mg/l	<5.0	96 %
Date Analyzed	12.01.95	12.01.95
Foaming Agents (MBAS - SM5540C)		
Surfactants (MBAS-EPA 425.1), mg/l	<0.10	82 %
Date Analyzed	12.01.95	12.01.95
Time Analyzed	1125	1125

Method: EPA 600/R-92/129
HRS Certification No. 81291
FDEP CompQAP No. 890142G

Elizabeth L. Schneider

Elizabeth L. Schneider, Project Manager

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LOG NO: T5-13029

Received: 12 OCT 95

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Project: OUC-Orange Test Well/Upper Floridan Test
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13029-1	UOC-Orange Test Well-Upper Floridan	10-10-95

PARAMETER	13029-1
Organophosphorous Pesticides (507)	
Alachlor, ug/l	<1.0
Atrazine, ug/l	<1.0
Butachlor, ug/l	<1.0
Metolachlor, ug/l	<1.0
Metribuzin, ug/l	<1.0
Simazine, ug/l	<1.0
Date Extracted	10.16.95
Date Analyzed	10.17.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13029-1	UOC-Orange Test Well-Upper Floridan	10-10-95

PARAMETER	13029-1
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	10.16.95
Date Analyzed	10.17.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13029-1	UOC-Orange Test Well-Upper Floridan	10-10-95

PARAMETER	13029-1
Chlorinated Acids Herbicides (515.1)	
2,4-D, ug/l	<0.50
Dicamba, ug/l	<0.50
Dalapon, ug/l	<10
Dinoseb, ug/l	<0.50
Pentachlorophenol, ug/l	<1.0
Picloram (4-Amino-3,5,6-trichloropicolinic acid), ug/l	<0.50
2,4,5-TP Silvex, ug/l	<0.50
Date Extracted	10.20.95
Date Analyzed	10.25.95
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	10.12.95
Date Analyzed	10.17.95
Primary Organics - Carbamates (531.1)	
Carbofuran, ug/l	<1.0
Oxamyl, ug/l	<1.0
Date Analyzed	10.19.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13029-1	UOC-Orange Test Well-Upper Floridan	10-10-95

PARAMETER	13029-1
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	10.19.95
Group III Unregulated AE (625)	
2-Chlorophenol, ug/l	<10Q
2-Methyl-4,6-dinitrophenol, ug/l	<50Q
Phenol, ug/l	<10Q
2,4,6-Trichlorophenol, ug/l	<10Q
Date Extracted	10.24.95
Date Analyzed	10.26.95
Group III Unregulated BN (625)	
Butyl benzyl phthalate, ug/l	<10Q
Di-n-Butyl phthalate, ug/l	<10Q
Diethyl phthalate, ug/l	<10Q
Dimethyl phthalate, ug/l	<10Q
2,4-Dinitrotoluene, ug/l	<10Q
Di-n-Octyl phthalate, ug/l	<10Q
Isophorone, ug/l	<10Q
2,3,7,8-TCDD, ug/l	<10*F49Q
Date Extracted	10.24.95
Date Analyzed	10.26.95

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13029-1	UOC-Orange Test Well-Upper Floridan	10-10-95

PARAMETER	13029-1
Cyanide (335.3)	
Cyanide, Total (9010), mg/l	<0.010
Prep or Extraction Date	335.3
Date Analyzed	10.16.95
Mercury (245.1)	
Mercury, mg/l	<0.00020
Prep or Extraction Date	10.17.95
Date Analyzed	10.17.95
Foaming Agents (MBAS - SM5540C)	
Surfactants (MBAS-EPA 425.1), mg/l	<0.10
Date Analyzed	10.12.95
Time Analyzed	1415
Gross Alpha Radioactivity (9310/900.0)	
Gross Alpha, pCi/l	<3.0
Prep or Extraction Date	10.19.95
Date Analyzed	10.21.95
Gross Beta Radioactivity (9310/900.0)	
Gross Beta, pCi/l	<4.0
Prep or Extraction Date	10.19.95
Date Analyzed	10.21.95

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2846 Industrial Plaza Drive (32301) • P.O. Box 13056 • Tallahassee, FL 32317-3056 • (904) 878-3994 • Fax (904) 878-9504

LOG NO: T5-13029

Received: 12 OCT 95

Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Project: OUC-Orange Test Well/Upper Floridan Test
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
13029-1	UOC-Orange Test Well-Upper Floridan	10-10-95

PARAMETER	13029-1

Method: EPA 40 CFR Part 126
HRS Certification No. E81005
FDEP CompQAP No. 890142G

*F49=The compound 2,3,7,8-TCDD was not detected by qualitative GC/MS screening analysis; reported results are estimated.

Q=Samples were extracted out of hold due to batch QC failures in the orgininal in-hold extraction.

Elizabeth L. Schneider

Elizabeth L. Schneider

Final Page Of Report

Serial Number 21162

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: (334) 666-6633 Fax: (334) 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: OUC-Orange Test Well Upper Floridan Test
PROJECT NO.:
P.O. NUMBER:
PROJECT LOC. (State): FL
SAMPLER(s) NAME: John Watson-BFA
PHONE: 407/896-8608
FAX: 407/896-1822
CLIENT NAME: CH2M Hill / OUC
CLIENT PROJECT MANAGER: Al Aikens / Keith Browning
CLIENT ADDRESS (CITY, STATE, ZIP): 225 E. Robinson St. Ste. 405 Orlando, FL 32801

PAGE ___ OF ___

☒ 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	Cyanide	Gross Alpha/Beta	MBAS	Mercury	Reg.+UnReg. Pest. 531.1	Reg+UnReg Pest. 507	Reg+UnReg Pest. 508	Reg.+UnReg Herb. 515.1	Reg BNA 525.1	UnReg BNA 625	REMARKS
10-10-95	6PM		OUC-Orange Test Well-Upper Floridan	X				1	1	1	1	1	2	2	2	2	2	
				X														
				X														
				X														
				X														
				X														
				X														
				X														
				X														
				X														

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	9-12-95	1730	John Watson-BFA	10-11-95	4PM			
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
John Watson-BFA	9-15-95	4PM	[signature]	10-11	5PM			

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
[signature]	10/12/95	1000	☒ YES ☐ NO		T5-13029	

LOG NO: T6-10118
Received: 15 JAN 96
Reported: 02 FEB 96

Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Project: OUC-Lower Floridan-Orange Test Well
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
10118-1	OUC Orange Site-Lower Floridan (S-1 through S-21)	01-13-96

PARAMETER	10118-1
Primary Metals by ICP (200.7)	
Barium, mg/l	0.12
Beryllium, mg/l	<0.0040
Cadmium, mg/l	<0.0050
Chromium, mg/l	<0.010
Nickel, mg/l	<0.040
Sodium, mg/l	9.6
Prep or Extraction Date	01.22.96
Date Analyzed	01.24.96
Antimony (SM3113B)	
Antimony, mg/l	<0.0050
Prep or Extraction Date	01.18.96
Date Analyzed	01.26.96
Arsenic (SM3113B)	
Arsenic, mg/l	<0.010
Prep or Extraction Date	01.18.96
Date Analyzed	01.19.96
Lead (SM3113B)	
Lead, mg/l	<0.0050
Prep or Extraction Date	01.18.96
Date Analyzed	01.22.96
Selenium (SM3113B)	
Selenium, mg/l	<0.010
Prep or Extraction Date	01.18.96
Date Analyzed	01.23.96

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LOG NO: T6-10118
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Project: OUC-Lower Floridan-Orange Test Well
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
10118-1	OUC Orange Site-Lower Floridan (S-1 through S-21)	01-13-96

PARAMETER	10118-1
Thallium (200.9)	
Thallium, mg/l	<0.0020
Prep or Extraction Date	01.18.96
Date Analyzed	01.23.96
Mercury (245.1)	
Mercury, mg/l	<0.00020
Prep or Extraction Date	01.17.96
Date Analyzed	01.17.96
Secondary Metals (200.7)	
Aluminum, mg/l	<0.20
Copper, mg/l	<0.025
Iron, mg/l	0.17
Manganese, mg/l	<0.010
Silver, mg/l	<0.010
Zinc, mg/l	<0.020
Prep or Extraction Date	01.22.96
Date Analyzed	01.24.96
Color, PCU	5
pH (150.1)	
pH, units	7.8
Date Analyzed	01.15.96
Time Analyzed	1112
Total Dissolved Solids (160.1)	
Total Dissolved Solids (160.1), mg/l	240
Date Analyzed	01.17.96

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
10118-1	OUC Orange Site-Lower Floridan (S-1 through S-21)	01-13-96

PARAMETER	10118-1
Turbidity (180.1)	
Turbidity (180.1), NTU	0.11
Dilution factor	1.0
Date Analyzed	01.15.96
Time Analyzed	0930
Odor, T.O.N.	16
Foaming Agents (MBAS - SM5540C)	
Surfactants (MBAS-EPA 425.1), mg/l	<0.10
Date Analyzed	01.15.96
Time Analyzed	1050
Fluoride (EPA 340.2)	
Fluoride, mg/l	0.23
Date Analyzed	01.18.96
Sulfate as SO4 (EPA 375.3)	
Sulfate, mg/l	61
Date Analyzed	01.17.96
Chloride (EPA 325.3)	
Chloride, mg/l	16
Date Analyzed	01.18.96
Nitrate-N (SM4500NO3 F)	
Nitrate-N, mg/l	<0.050
Date Analyzed	01.17.96
Time Analyzed	0955
Nitrite-N (SM4500NO3 E)	
Nitrite-N, mg/l	<0.050
Date Analyzed	01.15.96
Time Analyzed	0925

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Project: OUC-Lower Floridan-Orange Test Well
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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
10118-1	OUC Orange Site-Lower Floridan (S-1 through S-21)	01-13-96

PARAMETER	10118-1
Cyanide (335.2)	
Cyanide (EPA 335.2), mg/l	<0.010
Date Analyzed	01.17.96
Total Organic Carbon (415.1)	
Total Organic Carbon, mg/l	3.0
Date Analyzed	01.19.95
Time Analyzed	0930
Gross Alpha Radioactivity (9310/900.0)	
Gross Alpha, pCi/l	7.0+/-4.2
Prep or Extraction Date	01.24.96
Date Analyzed	01.24.96
Gross Beta Radioactivity (9310/900.0)	
Gross Beta, pCi/l	<4.0
Prep or Extraction Date	01.24.96
Date Analyzed	01.26.96

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
10118-1	OUC Orange Site-Lower Floridan (S-1 through S-21)	01-13-96

PARAMETER	10118-1
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	01.22.96

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
10118-1	OUC Orange Site-Lower Floridan (S-1 through S-21)	01-13-96

PARAMETER	10118-1
Volatile Organic Compounds (524.2)	
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
o-Chlorotoluene, ug/l	<0.50
4-Chlorotoluene, ug/l	<0.50
Dibromochloromethane, ug/l	<0.50
Dibromomethane, ug/l	<0.50
1,3-Dichlorobenzene, ug/l	<0.50
Dichlorodifluoromethane, ug/l	<0.50
1,1-Dichloroethane, ug/l	<0.50
1,3-Dichloropropane, ug/l	<0.50
2,2-Dichloropropane, ug/l	<0.50
1,1-Dichloropropylene, ug/l	<0.50
cis-1,3-Dichloropropene, ug/l	<0.50
trans-1,3-Dichoropropene, ug/l	<0.50
Methyl-tert-butyl ether (MTBE), ug/l	<0.50
1,1,1,2-Tetrachloroethane, ug/l	<0.50
1,1,2,2-Tetrachloroethane, ug/l	<0.50
Trichlorofluoromethane, ug/l	<0.50
1,2,3-Trichloropropane, ug/l	<0.50
Date Analyzed	01.22.96

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
10118-1	OUC Orange Site-Lower Floridan (S-1 through S-21)	01-13-96

PARAMETER	10118-1
Microextractables (504)	
1,2-Dibromoethane (EDB), ug/l	<0.020
1,2-Dibromo-3-chloropropane, ug/l	<0.020
Date Analyzed	01.29.96
Organophosphorous Pesticides (507)	
Alachlor, ug/l	<1.0
Atrazine, ug/l	<1.0
Butachlor, ug/l	<1.0
Metolachlor, ug/l	<1.0
Metribuzin, ug/l	<1.0
Simazine, ug/l	<1.0
Date Extracted	01.16.96
Date Analyzed	01.23.96

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
10118-1	OUC Orange Site-Lower Floridan (S-1 through S-21)	01-13-96

PARAMETER	10118-1
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	01.16.96
Date Analyzed	01.20.96

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
10118-1	OUC Orange Site-Lower Floridan (S-1 through S-21)	01-13-96

PARAMETER	10118-1
Chlorinated Acids Herbicides (515.1)	
2,4-D, ug/l	<0.50
Dicamba, ug/l	<0.50
Dalapon, ug/l	<10
Dinoseb, ug/l	<0.50
Pentachlorophenol, ug/l	<1.0
Picloram (4-Amino-3,5,6-trichloropicolinic acid), ug/l	<0.50
2,4,5-TP Silvex, ug/l	<0.50
Date Extracted	01.16.96
Date Analyzed	01.24.96
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	01.17.96
Date Analyzed	01.22.96
Group III Unregulated AE (625)	
2-Chlorophenol, ug/l	<10
2-Methyl-4,6-dinitrophenol, ug/l	<5
Phenol, ug/l	<10
2,4,6-Trichlorophenol, ug/l	<10
Date Extracted	01.16.96
Date Analyzed	01.18.96

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
10118-1	OUC Orange Site-Lower Floridan (S-1 through S-21)	01-13-96

PARAMETER	10118-1
Group III Unregulated BN (625)	
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	01.16.96
Date Analyzed	01.18.96
Primary Organics - Endothall (548.1)	
Endothall, ug/l	<10
Date Extracted	01.17.96
Date Analyzed	01.24.96
Primary Organics - Glyphosate (547)	
Glyphosate, ug/l	<150
Date Analyzed	01.31.96
Primary Organics - Diquat (549.1)	
Diquat, ug/l	<1.0
Date Extracted	01.18.96
Date Analyzed	01.19.96
Primary Organics - Carbamates (531.1)	
Carbofuran, ug/l	<1.0
Oxamyl, ug/l	<1.0
Date Analyzed	01.30.96

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10118-1	OUC Orange Site-Lower Floridan (S-1 through S-21)	01-13-96

PARAMETER	10118-1
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	01.30.96
ICP-Scan (200.7)	
Calcium, mg/l	53
Magnesium, mg/l	12
Potassium, mg/l	1.3
Sodium, mg/l	9.6
Strontium, mg/l	2.6
Prep or Extraction Date	01.22.96
Date Analyzed	01.24.96
Hardness as CaCO3 (SM2340B)	
Hardness as CaCO3, mg/l	180
Prep or Extraction Date	01.22.96
Date Analyzed	01.24.96
Carbonate Hardness, mg/l as CaC03	130
Alkalinity (310.1)	
Alkalinity (to pH 4.5) as CaC03, mg/l	130
Date Analyzed	01.17.96
Carbonate Alkalinity as CaCO3, mg/l	<1.0
Bicarbonate as HCO3, mg/l as HC03	130

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Project: OUC-Lower Floridan-Orange Test Well
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
10118-2	Method Blank
10118-3	Accuracy (% Recovery)

PARAMETER	10118-2	10118-3
Primary Metals by ICP (200.7)		
Barium, mg/l	<0.010	101 %
Beryllium, mg/l	<0.0040	99 %
Cadmium, mg/l	<0.0050	97 %
Chromium, mg/l	<0.010	99 %
Nickel, mg/l	<0.040	99 %
Sodium, mg/l	<0.50	100 %
Prep or Extraction Date	01.22.96	01.22.96
Date Analyzed	01.24.96	01.24.96
Antimony (SM3113B)		
Antimony, mg/l	<0.0050	105 %
Prep or Extraction Date	01.18.96	01.18.96
Date Analyzed	01.26.96	01.26.96
Arsenic (SM3113B)		
Arsenic, mg/l	<0.010	100 %
Prep or Extraction Date	01.18.96	01.18.96
Date Analyzed	01.19.96	01.19.96
Lead (SM3113B)		
Lead, mg/l	<0.0050	104 %
Prep or Extraction Date	01.18.96	01.18.96
Date Analyzed	01.22.96	01.22.96
Selenium (SM3113B)		
Selenium, mg/l	<0.010	86 %
Prep or Extraction Date	01.18.96	01.18.96
Date Analyzed	01.23.96	01.23.96

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
10118-2	Method Blank
10118-3	Accuracy (% Recovery)

PARAMETER	10118-2	10118-3
Thallium (200.9)		
Thallium, mg/l	<0.0020	89 %
Prep or Extraction Date	01.18.96	01.18.96
Date Analyzed	01.23.96	01.23.96
Mercury (245.1)		
Mercury, mg/l	<0.00020	102 %
Prep or Extraction Date	01.17.96	01.17.96
Date Analyzed	01.17.96	01.17.96
Secondary Metals (200.7)		
Aluminum, mg/l	<0.20	100 %
Copper, mg/l	<0.025	100 %
Iron, mg/l	<0.050	100 %
Manganese, mg/l	<0.010	99 %
Silver, mg/l	<0.010	99 %
Zinc, mg/l	<0.020	98 %
Prep or Extraction Date	01.22.96	01.22.96
Date Analyzed	01.24.96	01.24.96
Color, PCU	<5	---
pH (150.1)		
pH, units	7.4	---
Date Analyzed	01.15.96	---
Time Analyzed	1040	---
Total Dissolved Solids (160.1)		
Total Dissolved Solids (160.1), mg/l	<5.0	94 %
Date Analyzed	01.17.96	01.17.96

LOG NO: T6-10118
Received: 15 JAN 96
Reported: 02 FEB 96

Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Project: OUC-Lower Floridan-Orange Test Well
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
10118-2	Method Blank
10118-3	Accuracy (% Recovery)

PARAMETER	10118-2	10118-3
Turbidity (180.1)		
Turbidity (180.1), NTU	<0.10	102 %
Dilution factor	1.0	1.0
Date Analyzed	01.15.96	01.15.96
Time Analyzed	0930	0930
Odor, T.O.N.	<1	---
Foaming Agents (MBAS - SM5540C)		
Surfactants (MBAS-EPA 425.1), mg/l	<0.10	99 %
Date Analyzed	01.15.96	01.15.96
Time Analyzed	1050	1050
Fluoride (EPA 340.2)		
Fluoride, mg/l	<0.20	96/97 %
Date Analyzed	01.18.96	01.18.96
Sulfate as SO4 (EPA 375.3)		
Sulfate, mg/l	<5.0	104 %
Date Analyzed	01.17.96	01.17.96
Chloride (EPA 325.3)		
Chloride, mg/l	<1.0	102 %
Date Analyzed	01.18.96	01.18.96
Nitrate-N (SM4500NO3 F)		
Nitrate-N, mg/l	<0.050	92 %
Date Analyzed	01.17.96	01.17.96
Time Analyzed	0955	0955
Nitrite-N (SM4500NO3 E)		
Nitrite-N, mg/l	<0.050	92 %
Date Analyzed	01.15.96	01.15.96
Time Analyzed	0925	0925

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LOG NO: T6-10118
Received: 15 JAN 96
Reported: 02 FEB 96

Al Aikens
CH2M Hill
225 E. Robinson Street, Suite 405
Orlando FL 32801

Project: OUC-Lower Floridan-Orange Test Well
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
10118-2	Method Blank
10118-3	Accuracy (% Recovery)

PARAMETER	10118-2	10118-3
Cyanide (335.2)		
Cyanide (EPA 335.2), mg/l	<0.010	103 %
Date Analyzed	01.17.96	01.17.96
Total Organic Carbon (415.1)		
Total Organic Carbon, mg/l	<1.0	106 %
Date Analyzed	01.19.96	01.19.96
Gross Alpha Radioactivity (9310/900.0)		
Gross Alpha, pCi/l	<3.0	102 %
Prep or Extraction Date	01.24.96	01.24.96
Date Analyzed	01.25.96	01.26.96
Gross Beta Radioactivity (9310/900.0)		
Gross Beta, pCi/l	<4.0	111 %
Prep or Extraction Date	01.24.96	01.24.96
Date Analyzed	01.25.96	01.26.96

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LOG NO: T6-10118
Received: 15 JAN 96
Reported: 02 FEB 96

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225 E. Robinson Street, Suite 405
Orlando FL 32801

Project: OUC-Lower Floridan-Orange Test Well
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
10118-2	Method Blank
10118-3	Accuracy (% Recovery)

PARAMETER	10118-2	10118-3
Primary Organics - Volatiles (524)		
Vinyl chloride, ug/l	<0.50	87 %
Benzene, ug/l	<0.50	93 %
Carbon tetrachloride, ug/l	<0.50	105 %
1,2-Dichloroethane, ug/l	<0.50	98 %
Trichloroethylene, ug/l	<0.50	96 %
1,4-Dichlorobenzene, ug/l	<0.50	99 %
1,1-Dichloroethene, ug/l	<0.50	96 %
1,1,1-Trichloroethane, ug/l	<0.50	107 %
cis-1,2-Dichloroethene, ug/l	<0.50	99 %
1,2-Dichloropropane, ug/l	<0.50	93 %
Ethylbenzene, ug/l	<0.50	91 %
Chlorobenzene, ug/l	<0.50	98 %
1,2-Dichlorobenzene, ug/l	<0.50	102 %
Styrene, ug/l	<0.50	90 %
Tetrachloroethene, ug/l	<0.50	103 %
Toluene, ug/l	<0.50	93 %
trans-1,2-Dichloroethene, ug/l	<0.50	96 %
Xylenes, ug/l	<0.50	97 %
Methylene chloride (Dichloromethane), ug/l	<0.50	95 %
1,2,4-Trichlorobenzene, ug/l	<0.50	93 %
1,1,2-Trichloroethane, ug/l	<0.50	93 %
Date Analyzed	01.22.96	01.22.96

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LOG NO: T6-10118
Received: 15 JAN 96
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Project: OUC-Lower Floridan-Orange Test Well
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
10118-2	Method Blank
10118-3	Accuracy (% Recovery)

PARAMETER	10118-2	10118-3
Volatile Organic Compounds (524.2)		
Bromobenzene, ug/l	<0.50	91 %
Bromodichloromethane, ug/l	<0.50	99 %
Bromoform, ug/l	<0.50	102 %
Chloroethane, ug/l	<0.50	---
Chloroform, ug/l	<0.50	102 %
Chloromethane, ug/l	<0.50	81 %
o-Chlorotoluene, ug/l	<0.50	102 %
4-Chlorotoluene, ug/l	<0.50	104 %
Dibromochloromethane, ug/l	<0.50	96 %
Dibromomethane, ug/l	<0.50	100 %
1,3-Dichlorobenzene, ug/l	<0.50	105 %
Dichlorodifluoromethane, ug/l	<0.50	84 %
1,1-Dichloroethane, ug/l	<0.50	109 %
1,3-Dichloropropane, ug/l	<0.50	93 %
2,2-Dichloropropane, ug/l	<0.50	108 %
cis-1,3-Dichloropropene, ug/l	<0.50	110 %
trans-1,3-Dichoropropene, ug/l	<0.50	96 %
Methyl tert-butyl ether (MTBE), ug/l	<0.50	---
1,1,1,2-Tetrachloroethane, ug/l	<0.50	84 %
1,1,2,2-Tetrachloroethane, ug/l	<0.50	90 %
Trichlorofluoromethane, ug/l	<0.50	89 %
1,2,3-Trichloropropane, ug/l	<0.50	99 %
Microextractables (504)		
1,2-Dibromoethane (EDB), ug/l	<0.020	101 %
1,2-Dibromo-3-chloropropane, ug/l	<0.020	103 %
Date Analyzed	01.29.96	01.29.96

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LOG NO: T6-10118
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Project: OUC-Lower Floridan-Orange Test Well
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
10118-2	Method Blank
10118-3	Accuracy (% Recovery)

PARAMETER	10118-2	10118-3
Organophosphorous Pesticides (507)		
Alachlor, ug/l	<1.0	87 %
Atrazine, ug/l	<1.0	99 %
Butachlor, ug/l	<1.0	89 %
Metolachlor, ug/l	<1.0	63 %
Metribuzin, ug/l	<1.0	89 %
Simazine, ug/l	<1.0	87 %
Date Extracted	01.16.96	01.16.96
Date Analyzed	01.23.96	01.23.96

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
10118-2	Method Blank
10118-3	Accuracy (% Recovery)

PARAMETER	10118-2	10118-3
Chlorinated Pesticides (508)		
Aldrin, ug/l	<0.010	70 %
Chlordane, ug/l	<0.10	---
Dieldrin, ug/l	<0.020	83 %
Endrin, ug/l	<0.020	89 %
Heptachlor, ug/l	<0.010	71 %
Heptachlor epoxide, ug/l	<0.020	78 %
Hexachlorobenzene, ug/l	<0.050	59 %
Hexachlorocyclopentadiene, ug/l	<0.050	63 %
Gamma-BHC (Lindane), ug/l	<0.010	74 %
Methoxychlor, ug/l	<0.50	90 %
Propachlor, ug/l	<1.0	82 %
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	01.16.96	01.16.96
Date Analyzed	01.20.96	01.20.96

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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
10118-2	Method Blank
10118-3	Accuracy (% Recovery)

PARAMETER	10118-2	10118-3
Chlorinated Acids Herbicides (515.1)		
2,4-D, ug/l	<0.50	97 %
Dicamba, ug/l	<0.50	83 %
Dalapon, ug/l	<10	61 %
Dinoseb, ug/l	<0.50	48 %
Pentachlorophenol, ug/l	<1.0	109 %
Picloram (4-Amino-3,5,6-trichloropicolinic acid), ug/l	<0.50	60 %
2,4,5-TP Silvex; ug/l	<0.50	50 %
Date Extracted	01.16.96	01.16.96
Date Analyzed	01.24.96	01.24.96
Primary Organics - BN (525.2)		
Benzo(a)pyrene, ug/l	<0.20	82 %
Bis(2-ethyl hexyl)adipate, ug/l	<2.0	77 %
bis(2-Ethylhexyl) phthalate, ug/l	<2.0	100 %
Hexachlorobenzene, ug/l	<1.0	106 %
Hexachlorocyclopentadiene, ug/l	<1.0	62 %
Date Extracted	01.17.96	01.17.96
Date Analyzed	01.22.96	01.22.96
Group III Unregulated AE (625)		
2-Chlorophenol, ug/l	<10	81 %
2-Methyl-4,6-dinitrophenol, ug/l	<50	---
Phenol, ug/l	<10	82 %
2,4,6-Trichlorophenol, ug/l	<10	---
Date Extracted	01.16.96	01.16.96
Date Analyzed	01.18.96	01.18.96

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Project: OUC-Lower Floridan-Orange Test Well
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
10118-2	Method Blank
10118-3	Accuracy (% Recovery)

PARAMETER	10118-2	10118-3
Group III Unregulated BN (625)		
Butylbenzylphthalate, ug/l	<10	---
Di-n-butylphthalate, ug/l	<10	---
Diethylphthalate, ug/l	<10	---
Dimethylphthalate, ug/l	<10	---
2,4-Dinitrotoluene, ug/l	<10	104 %
Di-n-octylphthalate, ug/l	<10	---
Isophorone, ug/l	<10	---
Date Extracted	01.16.96	01.16.96
Date Analyzed	01.18.96	01.18.96
Primary Organics - Endothall (548.1)		
Endothall, ug/l	<10	113 %
Date Extracted	01.17.96	01.17.96
Date Analyzed	01.24.96	01.24.96
Primary Organics - Glyphosate (547)		
Glyphosate, ug/l	<150	84 %
Date Analyzed	01.31.96	01.31.96
Primary Organics - Diquat (549.1)		
Diquat, ug/l	<1.0	73 %
Date Extracted	01.18.96	01.18.96
Date Analyzed	01.18.96	01.19.96
Primary Organics - Carbamates (531.1)		
Carbofuran, ug/l	<1.0	75 %
Oxamyl, ug/l	<1.0	80 %
Date Analyzed	01.30.96	01.30.96

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LOG NO: T6-10118
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Project: OUC-Lower Floridan-Orange Test Well
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES
10118-2	Method Blank
10118-3	Accuracy (% Recovery)

PARAMETER	10118-2	10118-3
Group I Unregulated Carbamates (531.1)		
Aldicarb, ug/l	<0.50	61 %
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	01.30.96	01.30.96
ICP-Scan (200.7)		
Calcium, mg/l	<0.50	100 %
Magnesium, mg/l	<0.50	98 %
Potassium, mg/l	<1.0	96 %
Sodium, mg/l	<0.50	100 %
Strontium, mg/l	<0.010	100 %
Prep or Extraction Date	01.22.96	01.22.96
Date Analyzed	01.24.96	01.24.96
Alkalinity (310.1)		
Alkalinity (to pH 4.5) as CaCO3, mg/l	<1.0	106 %
Date Analyzed	01.17.96	01.17.96
Carbonate Alkalinity as CaCO3, mg/l	<1.0	106 %
Bicarbonate as HCO3, mg/l as HCO3	<1.0	106 %

Method: EPA 600/R-92/129
HRS Certification #: 81291
FDEP CompQAP No.: 890142G

Elizabeth L. Schneider

Serial Number 31000

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: (334) 666-6633 Fax: (334) 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: Lower Floridan OUC Orange Test Well
PROJECT NO.:
P.O. NUMBER: 0326-0024-7
PROJECT LOC. (State): FL
SAMPLER(s) NAME: John Watson
PHONE: 407/896-8608
FAX: 407/896-1822
CLIENT NAME: CH2MHill-Orlando
CLIENT PROJECT MANAGER: Al Aikens
CLIENT ADDRESS (CITY, STATE, ZIP): 225 E. Robinson St, Ste. 405, Orlando, FL 32801

PAGE 1 OF 3

MATRIX TYPE: AQUEOUS (WATER) / SOLID OR SEMISOLID / AIR / NONAQUEOUS LIQUID (oil, solvent, etc)

REQUIRED ANALYSES — NUMBER OF CONTAINERS SUBMITTED

☒ STANDARD REPORT DELIVERY
☐ EXPEDITED REPORT DELIVERY (surcharge)
Date Due:

DATE	TIME	SL NO.	SAMPLE IDENTIFICATION	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID	Color/pH/TDS Turb.	Cyanide	Gross Alpha / Beta	Primary + Secondary Metals	MBAS	DIQUAT	NO3/NO2	Mercury	Odor	Rest Unreg. Pest (531.1)	REMARKS
1/13/96	11AM		OUC Orange Site S-1 Lower Floridan					1X										
↓	↓		" S-2 "						1X									
↓	↓		" S-3 "							1X								
↓	↓		" S-4 "								1X							
↓	↓		" S-5 "									1X						
↓	↓		" S-6 "										1X					
↓	↓		" S-7 "											1X				
↓	↓		" S-8 "												1X			
↓	↓		" S-9 "													1X		
↓	↓		" S-10 "														1X	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	10/12/95	1400	John Watson	1/14/96	12:30			
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
John Watson - BFA	10/12/95	1200						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
[signature]	1/15/96	0800	☒ YES ☐ NO		T6-10118	

Serial Number 30563

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634 Phone: (813) 885-7427 Fax: (813) 885-7049
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ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

PROJECT REFERENCE: Lower Floridan OUC Orange Test Well
PROJECT NO.:
P.O. NUMBER: 0326-0024-7
PROJECT LOC. (State): FL
SAMPLER(s) NAME: John Watson
PHONE: 407/896-8608
FAX: 407/896-1822
CLIENT NAME: CH2M Hill Orlando
CLIENT PROJECT MANAGER: Al Aikens
CLIENT ADDRESS (CITY, STATE, ZIP): 225 E. Robinson St, Ste. 405, Orlando FL 32801

PAGE 2 OF 3

☑ 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	Glyphosate	Floride/Sulfate	EDB/DBCP (504)	Reg+Unreg Vol (524.2)	Endothall (548)	Reg+Unreg Pest. (507)	Reg+Unreg Pest (508)	Reg+Unreg Herb. (515.1)	Reg BNA (525.1)	Unreg BNA (625)	REMARKS
1/13/96	11 AM		OUC Orange Site S-11 Lower Floridan	X				1										
↓	↓		" S-12	X					1									
			" S-13	X						2								
			" S-14	X							3							
			" S-15	X								2						
			" S-16	X									2					
			" S-17	X										2				
			" S-18	X											2			
			" S-19	X												2		
			" S-20	X													2	
			"															
			"															

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	1/9/97	1400				John Watson	1/14/96	12:30
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
John Watson	10/12/95	1200						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
[signature]	1/15/96	0800	☑ YES ☐ NO		T6-10118	

Serial Number 3?624

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

PROJECT REFERENCE: Lower Floridan OUC Orange Test Well
PROJECT NO.:
P.O. NUMBER: 0326-0024-7
PAGE 3 OF 3

PROJECT LOC. (State): FL
SAMPLER(s) NAME: John Watson
PHONE: 407/896-8608
FAX: 407/896-1822

CLIENT NAME: CH2M Hill-Orlando
CLIENT PROJECT MANAGER: Al Aikens
CLIENT ADDRESS (CITY, STATE, ZIP): 225 E. Robinson St, Ste. 405, Orlando, FL 32801

MATRIX TYPE: AQUEOUS (WATER) / SOLID OR SEMISOLID / AIR / NONAQUEOUS LIQUID (oil, solvent, etc)

REQUIRED ANALYSES: Carbonate + Non Carbonate Hardness; Ca, Na, Mg, K, Sr, Cl, CO3, HCO3, SO4, TDC

☒ 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	Carbonate + Non Carbonate Hardness	Ca, Na, Mg, K, Sr, Cl, CO3, HCO3, SO4, TDC									REMARKS
1/13/96	11AM		S-21 OUC Orange Site, Lower FL	X				1										1 Liter Amber Glass
"	"		S-22 " " "						1									1/2 gal. Plastic Bottle

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	10/12/95	1400				John Watson	1/14/96	12:30
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
John Watson - BFA	10/12/96	1200						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SL LOG NO.	LABORATORY REMARKS:
[signature]	1/15/96	0800	☐ YES ☒ NO		T6-10118	Did not receive sample S-22 (1/2 gallon plastic) Received sample S-21 (1/2 gallon plastic + Liter amber glass) Received (6) 40ml Vials labeled Trip Blank.

Appendix E
Geophysical Logs