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HYDROGEOLOGIC INVESTIGATION
OF
THE SAVANNAH CLUB
ST. LUCIE COUNTY, FLORIDA

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OF
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INTRODUCTION

On December 4, 1980, Geraghty & Miller, Inc., proposed to conduct a hydrogeologic investigation to assist the Savannah Club in obtaining a water-use permit from the South Florida Water Management District (SFWMD), and to respond to ground-water related questions that are elements of the application for development approval for the Savannah Club Development in St. Lucie County. Geraghty & Miller was authorized to proceed with the program on March 3, 1981. Based upon Geraghty & Miller's proposal, initial discussions were held with representatives of the SFWMD. Dr. Patrick Gleason, Director of the Districts' Water Use Division, concurred with the scope of the investigation. Copies of Geraghty & Miller's scope of investigation and the letter of approval from the SFWMD are contained in Appendix A.

Predicted impacts of development on the savannahs, a freshwater marsh, and on the ground-water system are given in this report as well as descriptions of geologic and hydrologic conditions in the project area and pertinent data. Predictions of impacts are based on data collected from the installation of a series of small-diameter test wells, a pumping test conducted on the Test-Production Well, and on published literature.

FINDINGS

1. The water-table aquifer extends to elevations of -20 feet NGVD to -40 feet NVGD. The water-table aquifer consists predominantly of fine-grained sand and shells. Below the water-table aquifer a layer of sandy clay occurs between -20 feet NGVD and -50 feet NGVD. The clay confines the shallow artesian aquifer, which extends from about an elevation of -50 feet to -115 feet.

2. A ground-water divide exists (April 16, 1981) approximately 4000 feet west of the savannahs with the flow moving downward and laterally toward the east and west at the divide, becoming horizontal near the savannahs.

3. The ground-water quality in the Savannah Club area is generally good. The water is treatable and a potable product can be delivered.

4. The chloride concentrations of the water in the water-table and shallow artesian aquifers adjacent to the North Fork of the St. Lucie River were less than 100 mg/l.

5. In the vicinity of the Test-Production Well, the aquifer responds to pumping as a leaky artesian one, with recharge by vertical leakage downward through a confining bed consisting of a sandy clay.

6. The aquifer coefficients are estimated as:

Transmissivity	= 7500 gpd/ft
Storage Coefficient	= 2.3×10^{-4}
Leakance	= 6.0×10^{-3} gpd/ft^3

7. With an average day demand of 0.45 million gallons, the one-half-foot drawdown contour would be 2400 feet from the edge of the modelled well field.

8. The edge of the modelled well field is in excess of 4000 feet from the savannahs and as such no measurable effects will be seen due to this diversion.

9. Considering the planned diversion, the salt-water intrusion potential at this site is low.

10. Much of the inflow to the savannahs is surface water.

11. A few feet of decline in savannahs water levels due to an inflow reduction can be stabilized by the reduction in outflow from the savannah caused by the decline.

12. Water levels in the savannahs could rise because the increase in surface runoff from developed areas might exceed the resulting reduction in ground-water inflow.

13. Limiting canal levels to 14.0 feet NGVD during the wet season may reduce ground-water inflow to the savannahs by about 3745 ft^3/day.

14. The impact of this 3745 ft^3/day inflow reduction on savannah water levels should not exceed 0.63 feet. This would not be significant except during a period of regional drought stress.

15. The annual loss of ground water to the atmosphere will be reduced by about 2×10^6 ft^3 by raising the land surface and clearing vegetation from one-tenth of the project area.

16. This increase in the supply of available ground water should allow canal water to be used for irrigation as planned without affecting ground-water outflow to the savannahs.

WELL-CONSTRUCTION METHODOLOGY

To determine geologic and hydrologic conditions in the project area, a total of 70 wells were installed during March and April 1981. Nineteen of the wells were installed by means of a post-hole digger by Geraghty & Miller. The other 51 wells were installed by the Persson Drilling Corporation of Fort Pierce, Florida. Of the 51 wells, all but the salt-water monitoring well were installed by means of mud-rotary drilling. Site and well locations are shown on Figures 1 and 2 and on Plate 1.

Except for the Test-Production Well, all wells were constructed with 2-inch-diameter PVC casing and screen. Each well was completed with a gravel pack around the screen and the casing was grouted in place. The Test-Production Well is a gravel-packed completion constructed with a 16-inch-diameter outer casing grouted in place. The inner casing is an 8-inch-diameter steel pipe attached to a 30-foot-long stainless steel screen. The Test-Production Well complies with rules of the Florida Department of Environmental Regulation (DER), Chapter 17-21--Water Wells in Florida, and Chapter 17-22--Water Supplies, and was permitted by DER. Construction details of the Test-Production Well are shown in Figure 3.

The salt-water monitor well was specially constructed at the request of the SFWMD to determine variations of ground-water quality with respect to depth in the vicinity of the North Fork

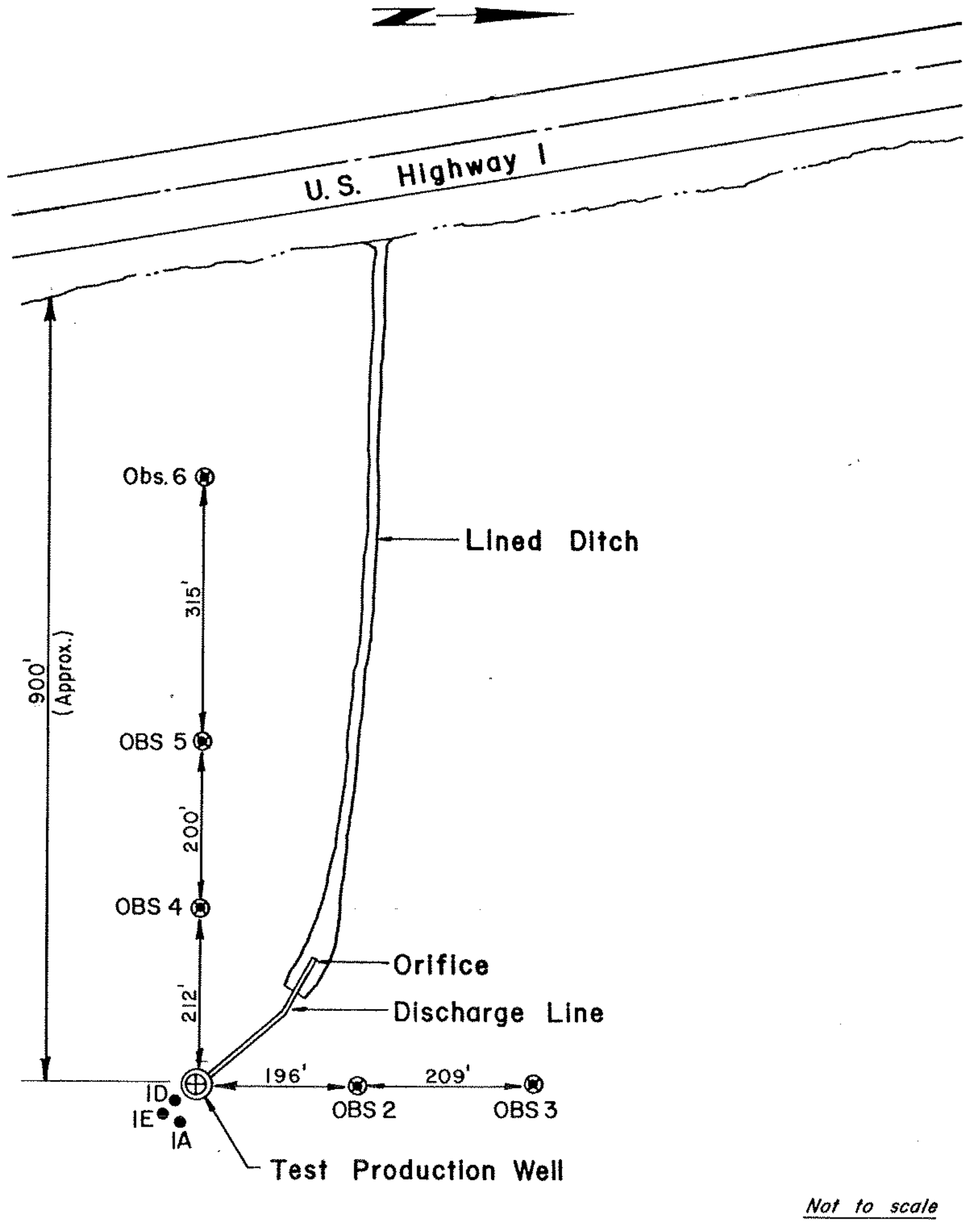

Figure 2 - Pumping Test Layout

Savannah Club

St. Lucie County, Florida

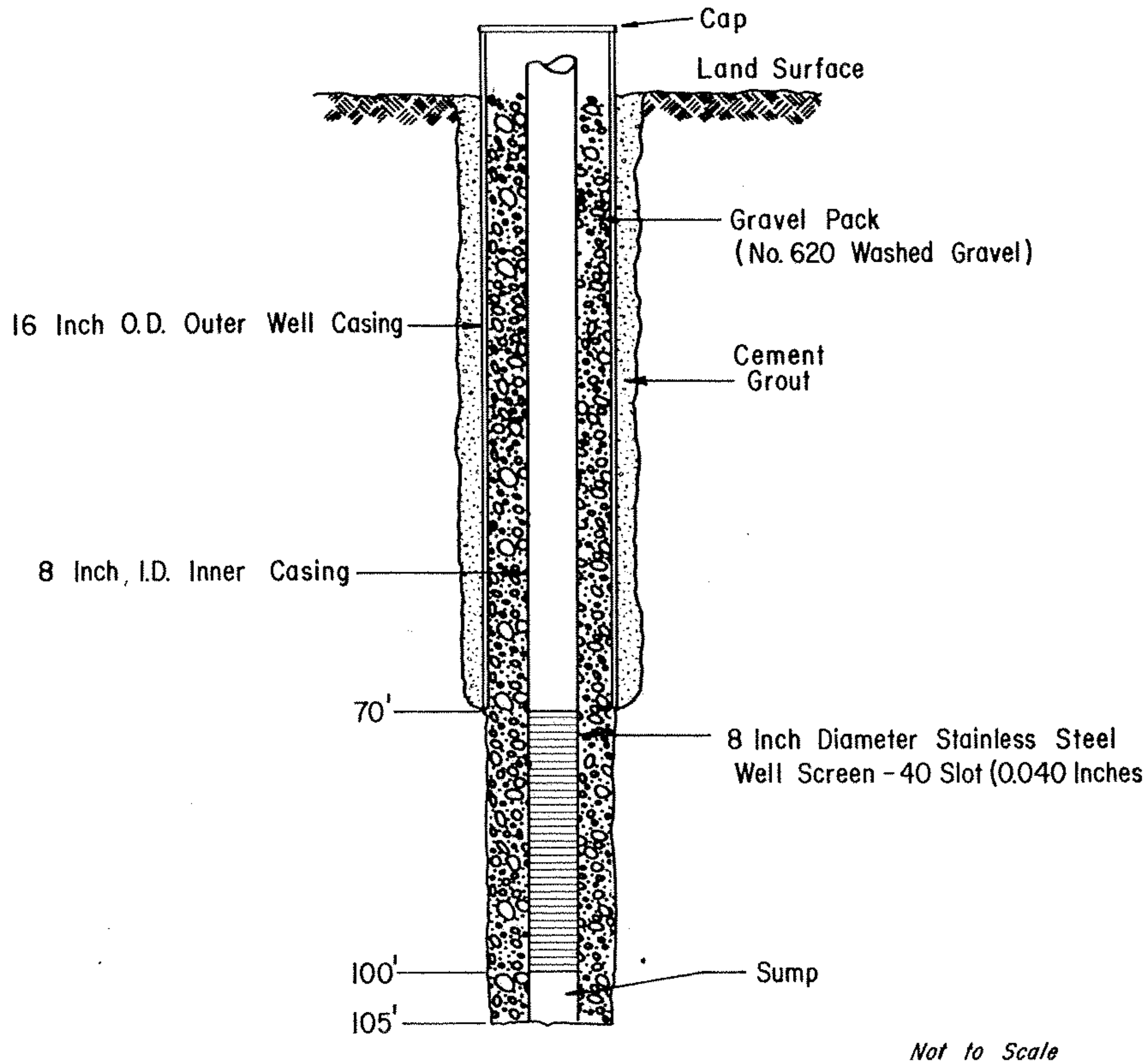

Figure 3 - Construction Details Of Test Production Well

Savannah Club

St. Lucie County, Florida

of the St. Lucie River. The well was installed by the drive-wash method to facilitate water sampling. Two-inch-diameter, open-ended, galvanized casing was driven in 21-foot sections. After each section was driven, the formation samples were collected by washing, and a water sample was collected by air-lift pumping. Upon completion, all wells were surveyed to determine their elevations referenced to National Geodetic Vertical Datum (NGVD).

HYDROGEOLOGIC CONDITIONS

The drilling of the seventy wells generated a large volume of geologic data. Geologic and driller's logs are given in Appendix B. A geologic cross-section is shown in Figure 4. The data reveal that a layer of hardpan, ranging in thickness from 1 foot to 5 feet, is encountered between 1.5 feet and 4 feet below present land surface under the entire development area. From the bottom of the hard pan to depths of 40 feet to 60 feet below land surface, the formation consists predominantly of fine-grained sand. Although thin beds of coarse-grained sand and shell fragments were encountered in this interval, the overall water-yielding capacity of the material is fairly low; high capacity wells cannot be completed in this section. Below 60 feet, the formation becomes finer and consists of a sandy clay. This clay, which varies in thickness from 5 to 18 feet, acts as a confining layer between the water-table aquifer and the shallow artesian aquifer. The shallow artesian aquifer consists of a medium- to coarse-grained, partly cemented sand and limestone ranging in thickness from 30 feet to 90 feet. Below this unit, at a depth of from 100 to 125 feet below land surface, the formation is a very fine-grained sand that grades downward to a grayish-olive clay. This sand and clay marks the base of the shallow artesian aquifer.

Geologic conditions at the location of the salt-water monitor well differ from those in the project area. No hardpan layer was found; instead a layer of interbedded sand and clay extends from land surface down to 21 feet.

After their installation, all wells were surveyed to determine their elevations referenced to NGVD. Periodic water-level elevations were measured during March and April 1981. From this data, a contour map of the water table was constructed and is shown as Plate 2. The map shows that, at the time of measurement (April 14, 1981), the ground-water divide on the

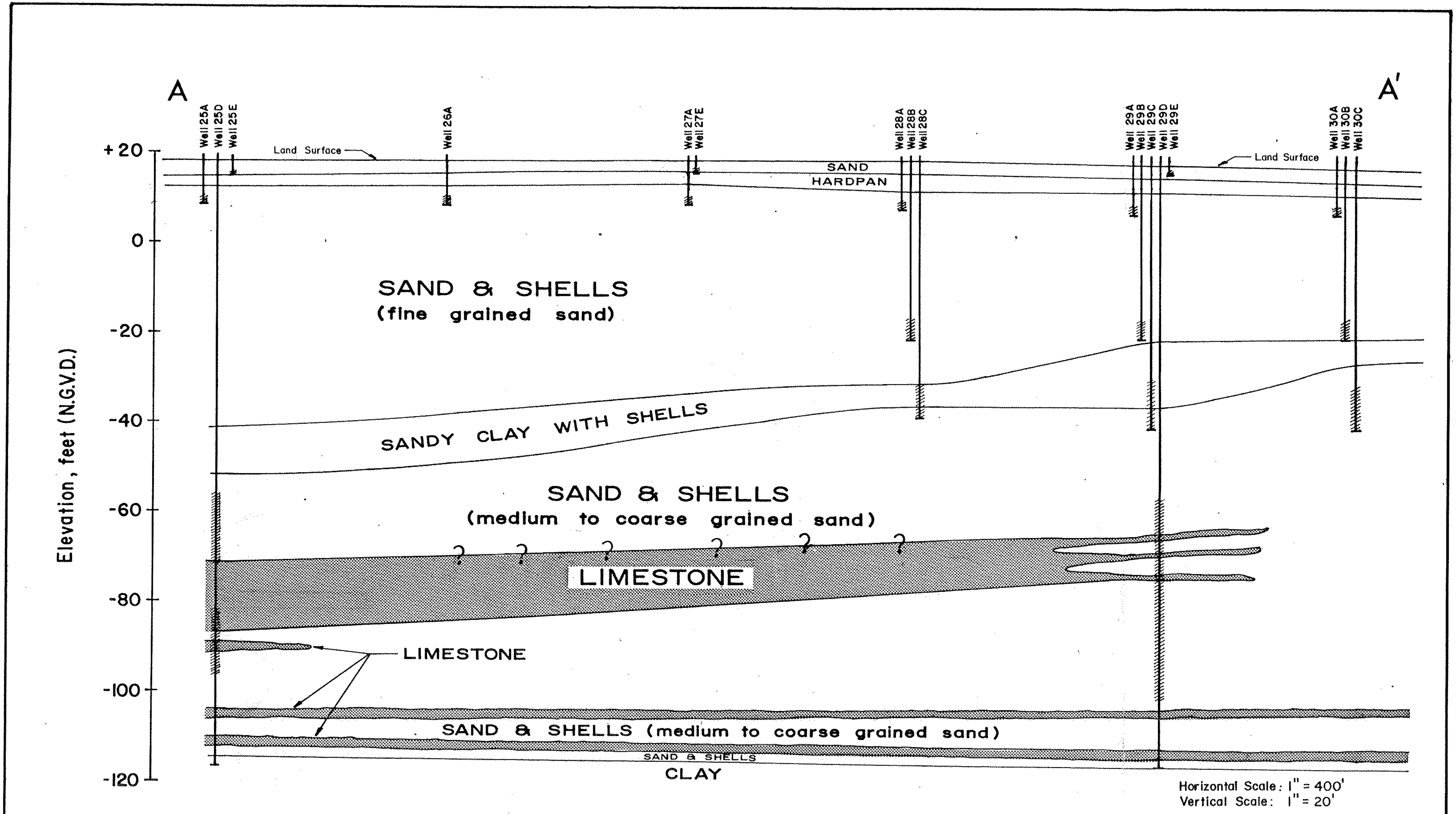

FIGURE 4 - GEOLOGIC CROSS SECTION A-A'

SAVANNAH CLUB, ST LUCIE COUNTY

property existed approximately 4000 feet west of the savannahs as shown on Plate 2. A ground-water flow section was also constructed from the data and is shown as Figure 5. On the flow section, it can be seen that the flow is downward and laterally toward the east and west at the divide (near Well 26A) and becomes more horizontal near the savannahs. Also on the flow section, it can be seen that during this period the water table existed between 5 feet and 8 feet below land surface. During March and April 1981, no water was found above the hardpan; all of the wells screened above this unit were dry.

WATER QUALITY

To determine if water available in the area of the Savannah Club was of a quality such that a potable product could be delivered with conventional treatment methods, water samples were collected for analysis from the Test-Production Well and the Salt-Water Monitor Well.

Test-Production Well

Analyses of two water samples collected from the Test-Production Well are listed in Appendix C. The early sample was obtained on April 22, 1981, after ten minutes of pumping and the second sample was collected approximately 43 hours later. No significant difference can be seen between the two. The water is of good quality. The chloride content of 24 mg/l falls well within the recommended limit of 250 mg/l for public water supplies. Total dissolved solids of 360 mg/l are about what one might expect for this area. Hardness of 258 mg/l is high, but typical. The iron concentration, although above recommended public health limits, is not excessive. Hardness and iron concentrations are treatable and a potable product can be delivered to the consumer.

Salt-Water Monitor Well

To determine the potential for salt-water intrusion into the ground-water system from the North Fork of the St. Lucie River, a salt-water monitor well was installed east of the project site in the river flood plain. Water samples were collected every 20 to 23 feet during the drilling, and analyzed for chloride content by field methods. The results of these analyses are given in the following table.

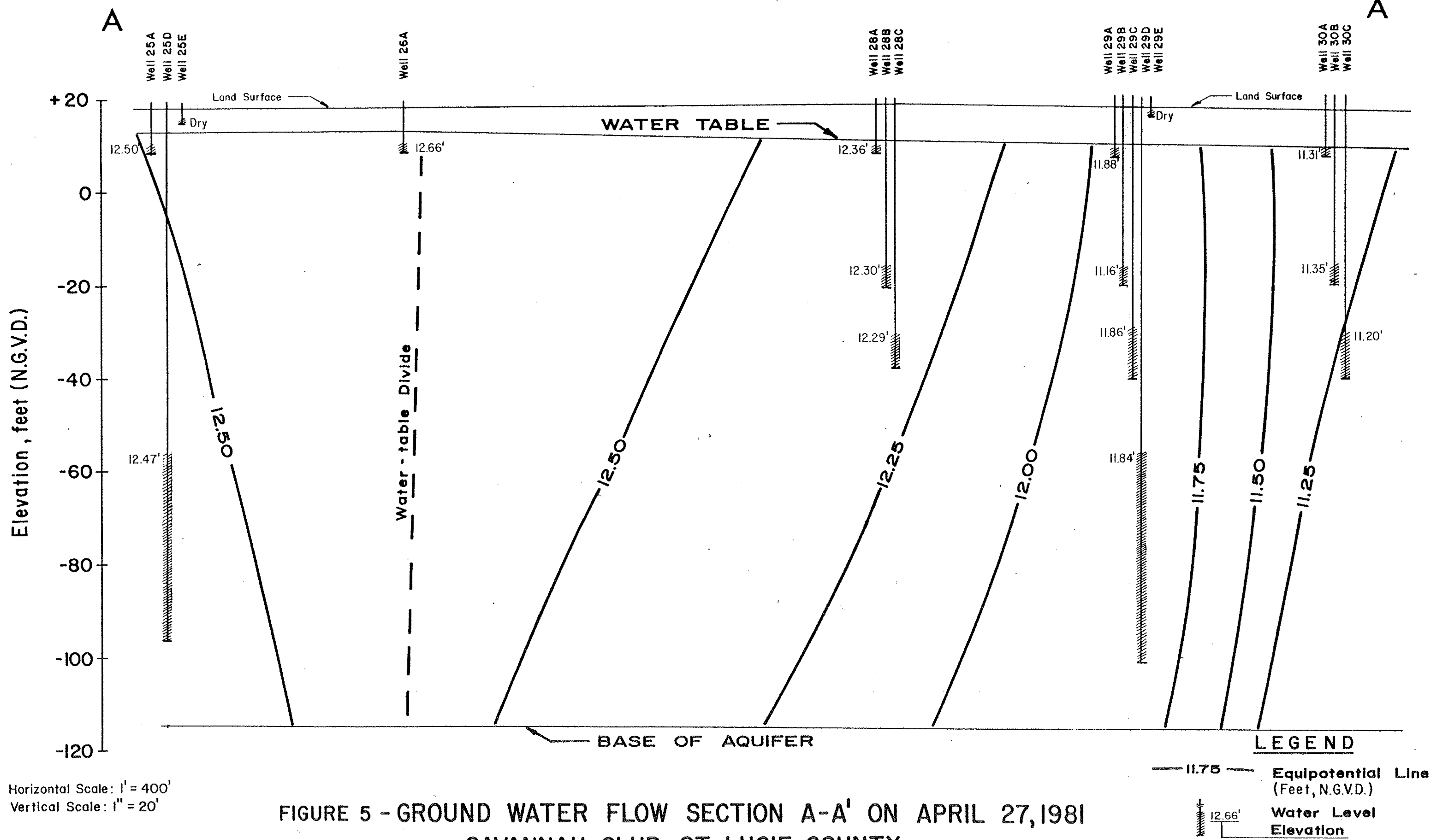

FIGURE 5 - GROUND WATER FLOW SECTION A-A' ON APRIL 27, 1981
SAVANNAH CLUB, ST. LUCIE COUNTY

April 8, 1981
Salt-Water Monitoring Well
Results of Chloride Analysis
Savannah Club, St. Lucie County, Florida

Interval Sampled (depth below land surface in feet)	Chloride Content (milligrams per liter as Cl-)
40 - 41	45
60 - 62	53
81 - 83	60
102 - 104	98
105 - 115	98

As can be seen in the table, chloride concentrations are less than 100 mgl to a depth of 115 feet below land surface. The base of the shallow aquifer at this location is at this depth and it is unlikely that saline water occurs within the water table or shallow artesian aquifer in this area.

PUMPING

A pumping test was conducted on the Test-Production Well to determine aquifer coefficients. These were used to estimate well yields and impacts of pumping. A sketch of the test layout is shown in Figure 2. Automatic water-level recorders were installed on Wells 5A, 5D, and 5E on April 16, 1981, 4000 feet to the east of the Test-Production Well. These instruments were operated throughout the test period until April 24, 1981. A barometer was installed on April 20, 1981, 3/4 mile away from the Test-Production Well at the North Port St. Lucie Water Plant No. 1. It was operated until April 24, 1981. A rain gauge was installed at the site on April 16, 1981.

On April 22, 1981, pump installation was complete and the well was pumped for 50 minutes to adjust the pump speed and valve setting for a constant rate test. The pump discharge was measured by means of a 3-inch by 6-inch orifice. The discharge was conducted to the U.S. #1 Highway road swale approximately 900 feet west of the Test-Production Well by means of a discharge pipe and a ditch lined with polyethylene sheeting. After the pump was shut off, recovery data were collected. Water-levels in the observation wells recovered to their pre-pumping position after approximately two and one-half hours. Three hours after the completion of the rate setting, the pumping test was started (1400 hours on April 22, 1981) and was run continuously for 43 hours. The pumping rate of 103 gpm (gallons per minute) was held constant throughout the test. It is expected that this well can yield 100 gpm on a long term basis and that other production wells installed in this area would also produce this amount of water.

Analysis of the water-level data recorded from Wells 5A, 5D, and 5E prior to testing indicated that no corrections were necessary for natural water-level fluctuations during the test. Also, no correction was made in the data for partial penetration as the screen in the Test-Production Well fully penetrates the aquifer at this location. No precipitation occurred during the test.

Test data analysis was made on the basis of observed geologic conditions and the response of water levels to pumping. Drawdown data collected from all observation wells were plotted for analysis and are presented in Appendix D.

Two methods of analysis were used to determine the aquifer coefficients. The first used equations derived by Cooper (U. S. Geological Survey Water-Supply Paper 1545-C, 1963, pp. C48-C55) and by M. S. Hantush and C. E. Jacob (American Geophysical Union Transactions, Volume 36, No. 1, 1955, pp. 95-100) to determine the coefficients of an infinite leaky artesian aquifer where recharge is derived from vertical leakage through a confining bed and the release of stored water from the confining bed is negligible. The results of these determinations are given on the first part of Table 1. The second method was developed by M. S. Hantush (American Geophysical Union Transactions, Volume 37, 1956, pp. 702-2140) and relies on the same assumptions as the first with more weight given to data collected in the latter part of the test. The results of this analysis method are given in the second part of Table 1. Values of 7500 gpd/ft for transmissivity, 6.0×10^{-3} gpd/ft^3 for leakance and 2.3×10^{-4} for a storage coefficient are considered to be representative of this aquifer.

IMPACTS

Ground-Water Diversion

An average-day demand of 0.45 million gallons is anticipated for the public water supply system (maximum day demand of 0.8 million gallons per day) planned for the development. The average day withdrawal has been modelled using a computer program that simulates the stress on a leaky artesian aquifer caused by pumping six wells at a constant rate. The model aquifer receives recharge by leakage through confining beds with no contribution from water in storage within the confining bed. Pumpage from six production wells has been simulated at an average rate of 53 gpm from each well to meet the average day demand. The model well field layout is shown on Plate 3. Based on the variations in values for transmissivity and leakance determined by testing, a transmissivity of 7500 gpd/ft and a leakance of 6×10^{-3} gpd/ft^3 have been used. The impact of the withdrawals on water levels in the producing zone tapped by the production wells is shown on Plate 3. Calculated drawdowns will exceed one foot only within about 1500 feet of any well. Beyond 2400 feet from any well, drawdowns will be less than one-half foot. Because the savannahs are located more than 4000 feet from the closest well, the diversion of .45 mgd will cause no measurable effect on the savannahs according to the data.

TABLE 1

AQUIFER COEFFICIENTS CALCULATED FROM
DATA OBTAINED DURING THE AQUIFER PERFORMANCE TEST
AT THE SAVANNAH CLUB
APRIL 22-24, 1981

Methods of Cooper (1963), and
Hantush and Jacob (1955) - Drawdown Data

Observation Well	Transmissivity (gpd/ft)	Storage Coefficient (dimensionless)	Leakance (gpd/ft^3)
OBS 2 (r=196 ft)	2950	3.1×10^{-4}	2.8×10^{-2}
OBS 3 (r=405 ft)	10264	2.3×10^{-4}	4.2×10^{-3}
OBS 4 (r=212 ft)	6380	1.7×10^{-4}	5.6×10^{-3}
OBS 5 (r=412 ft)	9836	3.5×10^{-3}	3.6×10^{-3}
OBS 6 (r=727 ft)	7333	3.1×10^{-4}	7.8×10^{-3}

Method of Hantush (1956) - Drawdown Data

Observation Well	Transmissivity (gpd/ft)	Storage Coefficient (dimensionless)	Leakance (gpd/ft^3)
OBS 2 (r=196 ft)	6045	2.3×10^{-4}	5.0×10^{-3}
OBS 3 (r=405 ft)	9051	2.3×10^{-4}	5.3×10^{-3}
OBS 4 (r=212 ft)	7370	1.6×10^{-4}	4.1×10^{-3}
OBS 5 (r=412 ft)	7915	2.3×10^{-4}	6.0×10^{-3}

NOTE: Pumping Rate 103 gpm

The only other users of ground water within the area of the half-foot drawdown contour are Spanish Lakes Mobile Home Park water supply system and a small shopping area on U. S. Highway 1. The effects of the diversion on these two users would be less than one foot of drawdown. This will not impair the use of those systems.

Salt-Water Intrusion Potential

The nearest saline surface water is the North Fork of the St. Lucie River located about 2300 feet west of the western boundary of the site and 3300 feet from the nearest well site. Depending on runoff and seasonal fluctuations in rainfall, the quality of the river at this point is highly variable. Studies on the North Fork of the St. Lucie River indicate that maximum chloride concentations in the river water in this area are between 6000 mg/l and 7000 mg/l.

The potential for intrusion from the river is small. Water-level decline in the shallow artesian aquifer beneath the river is forecast as less than 0.5 feet at the average-day diversion. When the salt-water monitoring well was drilled adjacent to the river, water samples obtained after every 20 feet of drilling contained only low chloride concentrations (less than 100 milligrams per liter), indicating that salt water does not presently exist in the shallow artesian aquifer in this area. Furthermore, clayey sediments were encountered for the first 21 feet of drilling in that well. These sediments probably extend beneath the river and would retard any downward migration of salt water into the ground-water system.

THE PROBABLE EFFECT OF PLANNED DEVELOPMENT ON THE WATER BALANCE OF THE SAVANNAHS

The savannahs are shallow, closed, topographic depressions adjacent to but higher in elevation than the Indian River. They are intermittently flooded, primarily because of precipitation in catchment areas to the west, including the project area. Much of the inflow is direct runoff of surface water via natural sloughs and drainage ditches. However, they also receive some ground water from the water-table aquifer by lateral flow of recharge also occurring in the surface-water catchment area to the west where the water table is higher in elevation. Only occasionally does the water level in the savannah rise above the level of any natural outlet, according to local observers, so surface-water discharge is negligible. Practically all of the outflow from the savannahs is by evaporation to the atmosphere and by ground-water discharge eastward to the Indian River via the water-table aquifer.

Because the savannahs are very shallow, they increase in area considerably when a few feet of water accumulates in them. This occurs when precipitation is sufficient for inflow to exceed outflow, causing water levels to rise. Conversely, they naturally shrink in area and sometimes dry up when inflow is less than the outflow.

Under natural conditions, savannah water levels decline from rainy season to dry season and from wet years to drought years as the inflow of runoff decreases. The water-level declines tend to be self-limiting because water-level declines also cause the losses by evaporation and leakage to decrease as they reduce pond area exposed to the atmosphere and reduce downard directed hydraulic gradients in the aquifer. This balancing mechanism tends to decrease outflows to compensate for the reduced inflow, thereby causing water levels to stabilize.

Residential development usually increases surface-water runoff. This should increase surface-water inflow to the savannahs and raise the water levels rather than dry them up. However, a study of changes in surface-water inflow that could occur due to redistribution of direct runoff by the planned development is beyond the scope of this investigation. It is assumed that the surface-water control facilities to be constructed will be designed and operated to maintain normal surface-water inflow to the savannahs. Therefore, resolution of the issue of whether planned development will impact the savannahs and the existing balancing mechanism rests upon the question of whether changes in ground-water inflow and outflow brought on by the development will be large enough to significantly affect the savannahs.

Effect of Canals on Ground-Water Inflow

Ground-water inflow from the project area will be reduced somewhat because the canals to be constructed for flood control purposes will not allow the driving head (the relatively higher water table in the watershed area) to rise to historic wet season levels. Using the only long-term data available (Figure

15A-4, General Development Engineering Company, June 1978) it can be seen that about one-quarter-mile south of the study area, the wet-season depth to the water table averages about 1.5 feet below land surface. Since land surface in the study area averages +17.5 feet NGVD, the wet-season water table is about +16 feet NGVD, whereas the water in the savannah averages about +13.5 feet NGVD (Figure 15A-2, General Development Engineering Company, June 1978). Accordingly this 2.5-foot driving head ordinarily in effect during the wet season will be reduced to about 0.5 feet because the project's drainage system will control canal water levels to +14.0 feet NGVD or less. Also, this lowering of the water table will cause a ground-water divide to develop about 1000 feet closer to the savannahs. Figure 6 shows pre-development and post-development ground-water profiles.

The ground-water inflow reduction to the savannahs under steady-state flow conditions can be calculated using a mathematical model developed by C. E. Jacob (1943). The model assumes the savannahs fully penetrate the water-table aquifer. Since the savannahs do not fully penetrate the aquifer, any inflow reduction calculated using the model will be greater than the actual reduction. Thus, water-level declines will be overestimated and if the calculated declines are acceptable, the actual declines must be also.

The model makes other assumptions, such as one-dimensional flow under constant head conditions, but these conform closely to the field situation. Constant head conditions may not prevail during dry periods because the water table will be free to fluctuate below the control altitudes. However, there is no need to calculate savannah inflow during those periods because the canals will not be effective as drains. The inflow calculations need only be made for the wet season when savannah inflow could be affected because of diversion via the canals, which will function as ground-water drains and maintain the water table at 14 feet msl when it tries to rise above that control elevation.

The model used to estimate inflow to the savannah does not actually calculate the inflow. Instead it calculates net recharge rate to that portion of the aquifer catchment area supplying the inflow (which lies between the water-table divide shown in Figure 6 and the savannahs) under the steady flow conditions that prevail when heads are constant. Since there is no change in aquifer storage under steady flow conditions, ground-water inflow to the savannahs will be equal to the calculated recharge rate.

The ground-water inflow to the savannahs is determined by using the following applicable mathematical model (Walton, 1970, p. 182) and aquifer transmissivity data developed during the investigation with information given in Figure 6 to calculate the recharge (W_r) in inches/year to the water-table aquifer. The inflow reduction (Q_i) will be the difference between the recharge under pre-development and post-development conditions.

$$W_r = \frac{T}{1.71 \times 10^{-3} [M (X/h_o) - (X^2/2h_o)]}$$

where

T = transmissivity of water-table aquifer (5000 gal/day/ft)

X = distance from savannah to point of head measurement (feet)

M = distance from savannah to divide (feet) 4000 feet before development; 3000 feet after development

h_o = estimated driving head above savannah (feet) 2.5 feet before development; 0.5 feet after development

When this is done, it can be seen that the net wet-season recharge rate to the water-table aquifer (W_r) over the affected area could decrease about 0.59 inches/year (from about 0.91 inches/year before development to about 0.32 inches/year after development). Since the area affected by the canals will be less than about one square mile (27.8×10^6 ft^2), the maximum average reduction of ground-water inflow (Q_i) to the savannahs during the normal wet season would be about

$$Q_i = 0.59 \text{ in/year} \times \frac{1}{12} \times \frac{1}{365} \times (27.8 \times 10^6) ft^2 =$$

$$3745 \ ft^3/day$$

The conclusions that can be reached from this finding are discussed below.

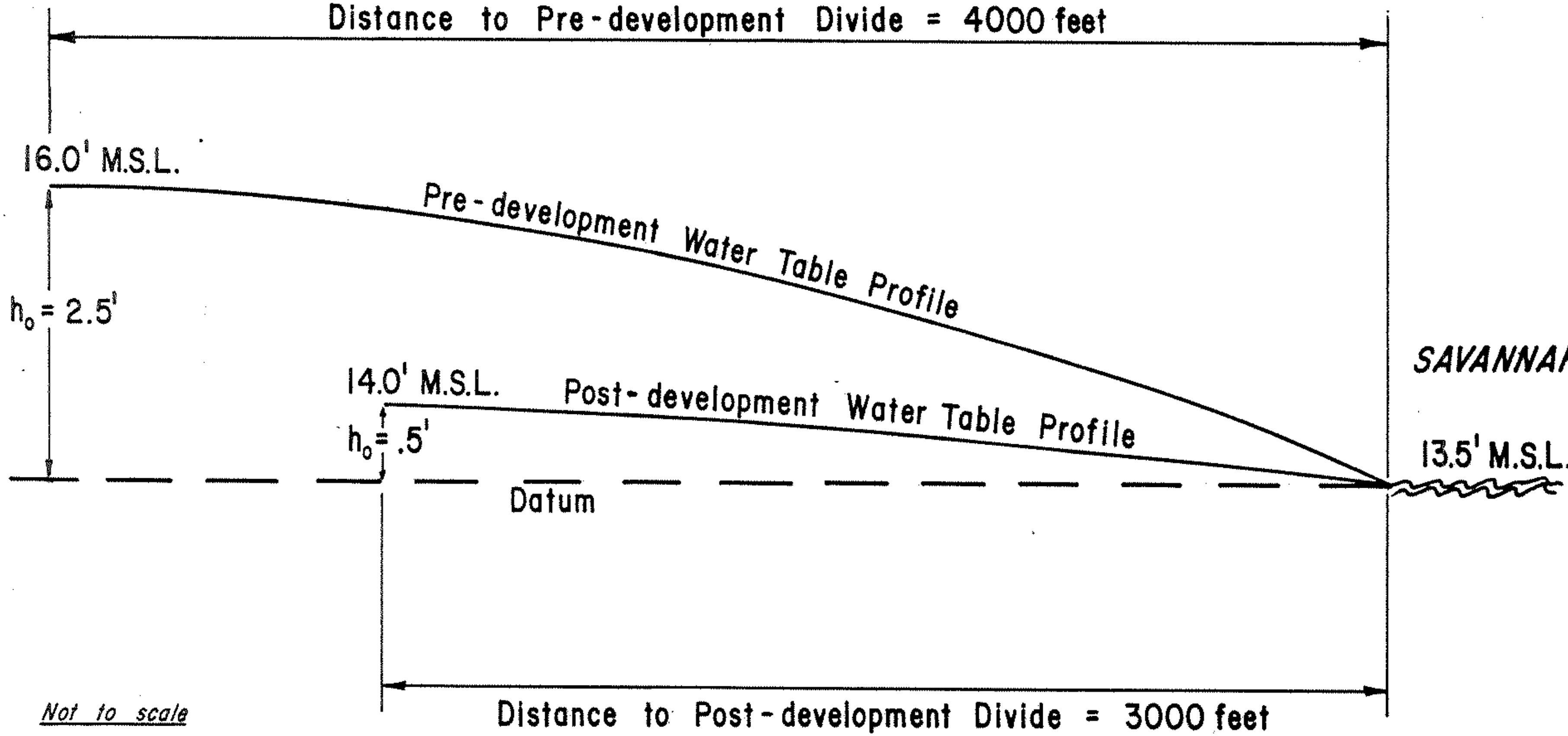

Figure 6 – Aquifer Catchment Area Supplying Savannah Inflow Under Pre-development And Post-development Conditions

Savannah Club
St. Lucie County, Florida

Effect of the Inflow Reduction on Savannah Water Levels

The lowering of the water table by the canals can have two effects. One is the reduction in evaporative discharge to the atmosphere from the project area which will be discussed in the next section. The other is lower savannah water levels due to reduced inflow. For the purpose of estimating the effect of reduced inflow, the savannahs must be treated as a one-mile-long string of isolated ponds fed by the adjoining project area. When this is not the situation, there can be no measurable impact on savannah water levels because they would be maintained by inflow from savannahs to the north and south. Areal photos show that the only time the savannahs are not a string of isolated ponds is during floods when levels are so high they all coalesce into one large body of water. The impact calculation is not accurate for this situation, but when it occurs, any impacts of canal diversions would be of no concern because they would limit the flooding and might be welcome.

As described earlier, when the ground-water inflow rate to the one-mile reach of savannah adjacent to the development is reduced, water levels will start to decline until outflow rate is reduced an equivalent amount. Since evaporation from open bodies of water during the wet season in south Florida averages about 0.014 ft/day and the savannahs average about 1200 feet in width, it will only require about a 50-foot shrinkage in width (a 25-foot regression of shore line on each side) to salvage the 3745 ft^3/day of evaporation loss needed to compensate for the maximum inflow reduction, as shown by the following calculation:

Salvage = evaporation from area dried up = 3745 ft^3/day =

0.014 ft/day (5280 ft)(total width dried up in feet)

$$\text{width dried up on each side} -- \frac{(1/2)(3745\ ft^3/day)}{(0.014\ ft/day)(5280\ feet)}$$

= 25 feet

The bottom slopes of the savannah are not known, but even if they averaged as steep as 5.0 feet/1000 feet, which seems high judging from the topographic maps, the impact would be negligible since a 0.125-foot water-level decline (5 ft/1000 ft x 25 ft shoreline regression) in the savannah would reduce evaporation losses enough to bring about the new equilibrium.

The above analysis assumes that evaporation losses become negligible in the area no longer flooded, which is not strictly true because water is still close to the surface. Therefore, the head impact will be somewhat greater than 0.125 foot. How much greater depends upon how much the subsurface leakage out the bottom of the savannah decreases when reduced inflow causes its water level to decline.

The leakage reduction required for equilibrium can be calculated. A reasonable assumption is that the rate of evaporation of savannahs' water from the twenty-five-foot-wide dewatered fringe around the pond perimeter will decline to 85 percent of the free water surface rate of 0.014 foot/day. This is reasonable because potential evaporation is about 85 percent of pan evaporation. This will require that leakage compensate by decreasing 0.85 x 3745 ft^3/day or about 3183 ft^3/day when the pond level drops 0.125 foot. When the level drops 0.125 foot, the head across the confining beds under the savannah through which leakage is occurring also decreases about 0.125 foot. Since the leakance factor of these beds has been measured by pumping tests in the project area as 0.006 gal/day/ft^3 (8×10^{-4} day^{-1}) the following modified form of Darcy's Law can be used to estimate how much the leakage will decrease.

Decrease in leakage = decrease in head x leakage factor x area

$$\text{Decrease in leakage} = 0.125 \text{ foot} \times \frac{8 \times 10^{-4}}{\text{day}} \times 1200 \text{ ft} \times 5280 \text{ ft}$$

$$= 632 \text{ ft}^3/\text{day}$$

Thus, the 0.125-foot decline in savannah levels will not provide the required 3183 ft^3/day additional reduction in outflow. However, it can be seen from the above relationship that about a 0.63 decline (0.125 ft x 3183/632) will provide more than enough. Therefore, it can be concluded that the impact of the development on savannah levels during the wet season should not exceed about 0.63 foot.

Effect of Pumping from the Canals

Although the above analysis shows that the canal system should have a negligible effect on wet-season water levels in the savannahs, there is the possibility that pumping from the drainage canals for irrigation during the dry season will establish a new equilibrium because the canals will be in hydraulic connection with the aquifer and will draw upon ground water in storage. It is anticipated that irrigation requirements during the dry season are about one inch per week for 16 weeks applied to the 70 acres of golf courses. Since about one-half of the irrigation water applied to sandy soils will become ground-water recharge, the net withdrawal rate from the aquifer will be:

$$0.50 \ \frac{\text{inch}}{\text{week}} \ \times \ 16 \text{ weeks} \times \frac{1 \text{ ft}}{12 \text{ inch}} \ \times \ 70 \text{ acres} \ \times$$

$$43560 \ \frac{\text{ft}^2}{\text{acre}} \ = \ 2.03 \times 10^6 \ \text{ft}^3$$

If natural discharge from the aquifer were not reduced, this withdrawal would be supplied by storage depletion, causing the water table to decline and reduce ground-water inflow to the savannah. It appears, however, that the water table during the dry season is presently within the root zone for much of the vegetation in the area, averaging about 4 feet below land surface of +13.5 feet NGVD (Figure 15A-3, General Development Engineering Company, June 1978). Therefore, there is significant natural discharge of ground water to the atmosphere by evapotranspiration during the dry season. This annual loss can be assumed as about 50 percent of the potential dry season evapotranspiration (Bouwer, 1978, Figure 8.27) or at least 15 inches, and that the loss will decrease to perhaps 3 inches when the land is cleared and the depth to water table is increased by raising the land surface.

This one-foot per year reduction in natural discharge of ground water, brought on by the development, could be sufficient to supply the $2.03 \times 10^6 \ \text{ft}^3$/year consumptive requirement. That is, pumpage from the canals could be water that would otherwise evaporate on site rather than water providing savannah inflow. Since one cubic foot of natural discharge would become available for every square foot of land cleared and raised, the $2.03 \times 10^6 \ \text{ft}^3$ consumptive requirement can be salvaged from evaporative losses to the atmosphere by raising the land surface and clearing deep-rooted vegetation from about $2.03 \times 10^6 \ \text{ft}^2$. Since this is only about one-tenth of the nearly one-square-mile project area available, there should be enough "new" water to satisfy irrigation requirements without impacting the savannah by diverting the ground-water inflow it receives from the project area.

Respectfully submitted,
GERAGHTY & MILLER, INC.

James A. Wheatley

Boris J. Bermes

Vincent P. Amy

June 24, 1981

REFERENCES

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APPENDIX A

PROJECT RELATED CORRESPONDENCE

Geraghty & Miller, Inc.
CONSULTING GROUND-WATER GEOLOGISTS AND HYDROLOGISTS

Forum III
Suite 404
1675 Palm Beach Lakes Boulevard
West Palm Beach, Florida 33401
Telephone: 305/ 683-3033

2 March 1981
P482SV1

Dr. Patrick Gleason
South Florida Water Management District
PO Box V
West Palm Beach, FL 33402

Dear Pat,

We have outlined below our program for the hydrogeologic investigation in the area of the Savannah Club PUD (Planned Unit Development). It includes comments received from you during our meeting on February 11. The investigation will provide technical data that will aid the Waterwood Homes Corporation in the following:

1. Obtaining a water-use permit from the South Florida Water Management District

2. Responding to pertinent portions of the questionnaire which is an element of the application for a development of regional impact

3. Answering anticipated questions from public agencies and the public at large relative to the impact of the development and on-site water supply, particularly on the Savannahs

A proper analysis of the impacts of the Savannah Club development on this area requires an adequate understanding of the local hydrogeologic system. To that end, Geraghty & Miller will draw upon much of the information in its own files, in those of public agencies, private firms, and individuals who have been studying this area for many years. Since little hydrogeologic data about the Savannah Club site itself are available, we have formulated a drilling and monitoring program in order to obtain that information. The elements of the investigation are listed below in outline form. As you requested, every effort will be made to obtain permission to install an off-site salt water monitoring well to the west of the property and U.S. Highway 1. In the event it is impossible to obtain permission, we may have to limit this part of the investigation to the extreme western portion of the property. We feel this will not seriously affect the results of our investigation.

I. Initial Site Investigation

   A. Site visit for overall reconnaissance and to locate potential well locations

   B. Obtain available data from public agencies (such as the U.S. Geological Survey and the South Florida Water Management District and local private sources)

      1. Information on water levels, water quality, water use, and precipitation

      2. Information on the Savannahs' hydrology

II. Install seven wells to approximate depth of 125 feet to obtain data on geologic conditions, water levels and water quality

   A. Necessary for understanding the flow system of the system of the shallow aquifer

   B. Will aid in locating potential well field area

III. Install 16 shallow observation wells at an approximate depth of 10 feet on a 1000-foot grid spacing

IV. Install three wells to an approximate depth of 60 feet and three well points to approximate depth of 40 feet at locations of the 10-foot deep wells in northeast corner of property east of the topographic divide

   A. Provide data for hydrogeologic system description of the development site and adjacent Savannahs

V. Install up to 16 piezometers above hard pan encountered at the locations of 10-foot deep wells in northeast corner of the property east of topographic divide

   A. Provide data on head differential across hard pan layers

VI. Monitoring

A. Weekly measurements of water levels

B. Rain Gauge

C. Staff gauge in Savannahs east of the site

VII. Salt Water Monitor Well
Off the property, adjacent to the St. Lucie River (if possible)

A. Approximately 125 feet deep

B. Formation samples

C. Water Samples at 20-feet intervals

D. Completion at base of aquifer or 250 mgl chloride water

VIII. Installation of test-production well and associated observation wells and perform pumping test (72 hours)

A. Provide information on aquifer characteristics

B. Provide data to aid in evaluating impacts of development on the Savannahs

C. Provide basis for design of well field production wells

IX. Impact Forecast

A. Analytical models will be used to predict the impacts

B. Documented by report with supporting data, maps, cross-sections, logs, etc.

A copy of a map showing the wells and borings is attached for your use. We estimate that about two to three months' time will be required to complete the investigation. Of course, this could vary depending on the skill of the drilling contractor and the weather. We would appreciate your comments as soon as possible. We plan to begin our field work immediately so we may collect the dry season information which we consider to be an extremely important part of the study. We look forward to your comments. Thank you for your cooperation.

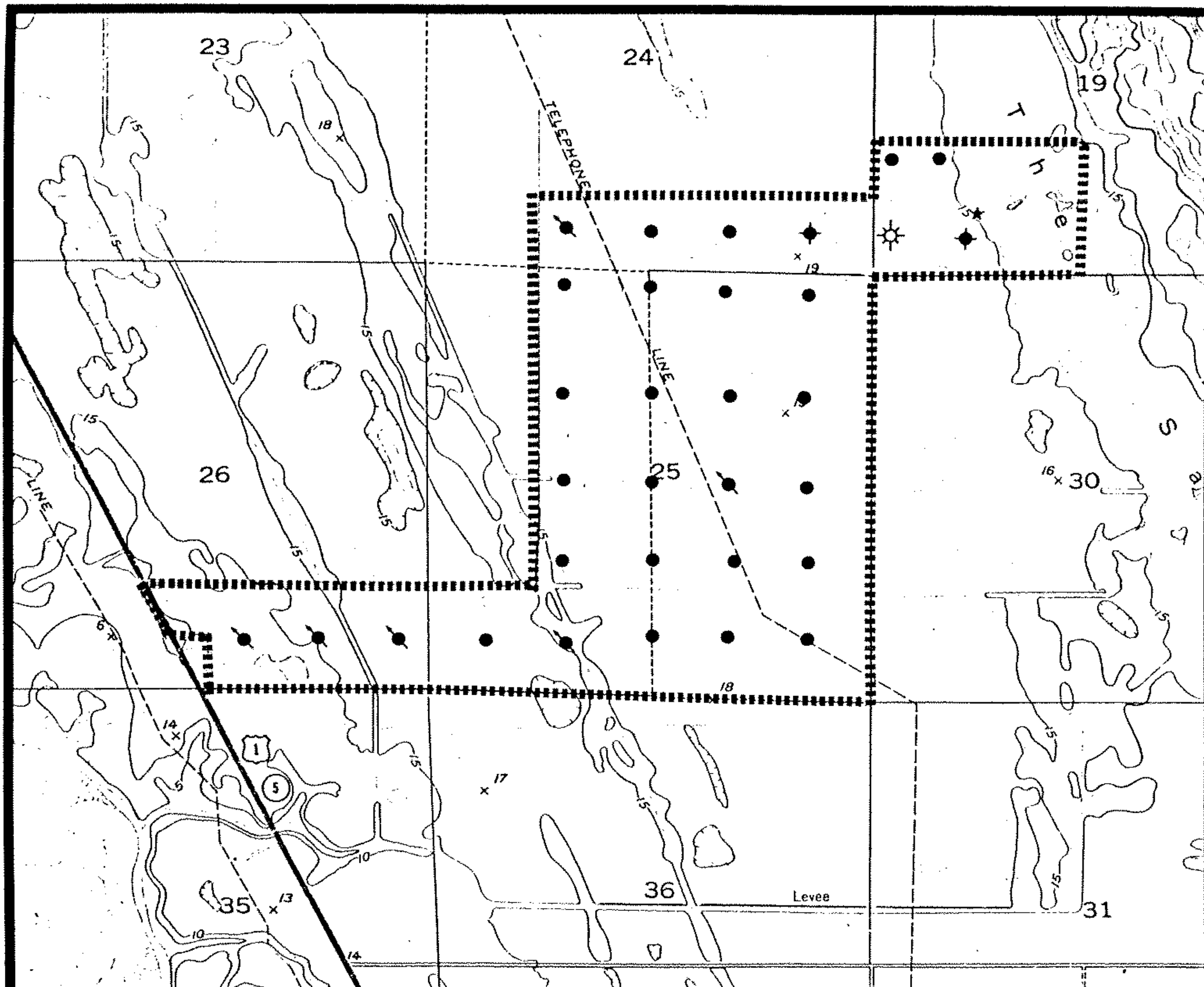
Sincerely,
GERAGHTY & MILLER, INC.

Vince

Vincent P. Amy

VPA:dkf

Enclosures



LEGEND

- 10' Wells
- 10' and 125' Wells
- 10', 40' and 60' Wells
- 10', 40', 60' and 125' Wells
- Staff Gauge
- Area of Field Investigation

2000 0 2000
scale feet

N

TENTATIVE LOCATIONS OF BORINGS AND OBSERVATION WELLS

THE SAVANNAH CLUB
ST. LUCIE COUNTY, FLORIDA

South Florida
Water Management District
Post Office Box V 3301 Gun Club Road
West Palm Beach, Florida 33402
Telephone (305) 686-8800
Florida WATS Line 1-800-432-2045

John R. Maloy, Executive Director

IN REPLY REFER TO: 7-126/DRI

RECEIVED
MAR 23 1981
GERAGHTY & MILLER, INC.

March 19, 1981

Mr. Vincent P. Amy
Geraghty & Miller
Forum III - Suite 404
1675 Palm Beach Lakes Boulevard
West Palm Beach, FL 33401

RE: Savannah Club DRI

Dear Vince:

Thank you for your letter of 2 March 1981 which contains a proposal for a hydrogeologic study of the Savannah Club DRI. I would like to emphasize several other points which the report should discuss and evaluate. First, the projected water use should consider not only public water supply but also golfcourse and individual household irrigation uses. Second, the evaluation of the impact of withdrawals should include impact on the Savannahs and other wetlands both inside and outside the limits of ownership, and impact on other existing users. Third, the study should reveal what impact the drainage system will have on the Savannahs if the drainage system will hold the water level elevation within the DRI below the water level of the Savannahs. With these additions we have no objection to the proposed scope of investigation.

If you have any further questions please do not hesitate to call or write.

Sincerely,

Pat

PATRICK J. GLEASON, Ph.D
Director, Water Use Division
Resource Control Department

PJG:njl

cc: Ms. Jeanne Hall
Mr. Alan Hall
Mr. Bob Goodrich
Mr. Marty Gauthier
Mr. John Massey-Norton
Mr. Rick Bower

APPENDIX B

GEOLOGIC AND DRILLER'S LOGS

GEOLOGIC LOG
TEST PRODUCTION WELL
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND AND ORGANICS - 85% sand, clear to frosted, very fine- to medium fine-grained, some yellowish orange grains, sub-angular; 15% silty organics, grayish brown, slightly lighter in color at 4.0'.	0- 5	5
SAND AND CLAY - 80% sand, clear to frosted, very fine- to medium fine-grained, sub-rounded, well sorted; 20% clay, pale yellowish brown, soft, cohesive, plastic, very sandy.	5- 15	10
SILTY SAND - clear to frosted, fine- to medium coarse-grained, with an occasional coarse-grain, slightly silty.	15- 27	12
SHELL AND SAND - 70% shell, medium dark gray to very pale orange, fine- to medium-fragments; 20% silty sand, clear to frosted, fine- to medium coarse with an occasional coarse grain; 10% sand, moderate brown, medium fine-grained, quartz.	27- 35	8
SHELL, CLAY, AND SAND - 60% shell, very pale orange to medium light gray, coarse to fine fragments; 30% clay, medium dark gray, soft, very sandy, plastic; 10% sand, clear, quartz, fine-grained.	35- 40	5

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SHELL, SAND, AND CLAY - 40% shell, medium gray to very pale orange, very fine to medium fragments; 25% sand, clear to frosted, fine- to medium-grained; 15% clay, medium dark gray, soft, very sandy, plastic, silty.	40- 45	5
CLAY, SAND, AND SHELL - 50 to 60% clay, medium dark gray, soft, very sandy, plastic, silty; 20 to 25% sand, clear to frosted, fine- to medium-grained; 15 to 20% shell, gray to very pale orange, very fine- to medium-fragments.	45- 50	5
CLAY, SAND, AND SHELL - 40 to 50% clay, medium dark gray, soft, very sandy, plastic; 30% sand, clear to lightly frosted, very fine- to medium-grained, sub-angular to sub-rounded, some grains cemented with fine calcarenite matrix; 20% shell, dark gray to very pale orange, fine- to medium coarse-fragments.	50- 60	10
LIMESTONE, CLAY, AND SHELL - 65% sandy limestone, soft, fine-grained, with fine shell fragments, low induration, fair to good porpsity; 20% clay, medium gray, sandy; 15% shell, gray, very coarse fragments, weathered.	60- 65	5
LIMESTONE, SHELL, AND SAND - 60% sandy limestone, dark gray to pale yellowish brown, medium hard to soft, very fine matrix and fine- to medium-grained constituents; 25% shell, very pale orange to medium gray, very fine to medium fragments; 15% sand, clear, very fine- to fine-grained, quartz.	65- 75	10

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
LIMESTONE, SHELL, AND SAND - 70% sandy limestone, medium dark gray to medium light gray, fine-grained, low porosity; 20% shell, medium dark gray to very pale orange, very coarse weathered fragments; 10% sand, clear, fine-grained, quartz.	75- 80	5
SHELL, LIMESTONE, AND SAND - 40% shell, medium dark gray to very pale orange, very fine to fine fragments; 30% sandy limestone, medium dark gray, fine-grained, moderately hard; 30% sand, clear to frosted, very fine- to medium coarse-grained, sub-angular to sub-rounded.	80- 85	5
LIMESTONE, SHELL, AND SAND - 50% limestone, sandy, medium dark gray, fine-grained, moderately hard; 30% shell, medium dark gray to very pale orange, very fine to fine fragments; 20% sand, clear to frosted, very fine- to medium coarse-grained, sub-angular to sub-rounded.	85- 90	5
SHELL, SANDY LIMESTONE, AND SAND - 50% shell, medium dark gray to very pale orange, very fine to fine fragments; 30% sandy limestone, medium dark gray fine-grained, moderately hard; 20% sand, clear to frosted, very fine- to medium coarse-grained, sub-angular to sub-rounded.	90-100	10
TOTAL DEPTH	100	

GEOLOGIC LOG OF
OBSERVATION WELL #1
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Description	Depth Interval (feet)	Thickness (feet)
SAND AND ORGANICS - 90% sand, clear to frosted, very fine- to medium fine-grained, sub-angular to sub-rounded; 10% organics, very fine-grained, consolidated, sandy.	0- 5	5
SAND AND CLAY - 50% sand, clear to frosted, fine- to medium fine-grained, quartz, well sorted, sub-rounded; with 50% clay, medium light gray, soft, sandy; trace of hard pan.	5-10	5
CLAY AND SAND - 60% clay, medium light gray, soft, sandy, trace of hard pan; 40% sand, clear to frosted, fine- to medium fine-grained, well sorted, sub-rounded.	10-15	5
SAND - clear to frosted, fine- to medium-grained, quartz, well sorted, sub-rounded, with 5% clay and trace of amber quartz grains.	15-20	5
SAND - clear to frosted, very fine- to medium fine-grained, quartz, sub-angular to sub-rounded; with trace of very fine amber quartz and black phosphate grains.	20-25	5
SAND - clear to frosted, very fine- to coarse-grained, quartz, sub-angular to sub-rounded; with trace of fine, very pale orange shell fragments at 29-30 feet.	25-30	5
SAND AND SHELL - 60% sand, clear to frosted (light gray overview), very fine- to medium-grained, quartz, 40% shell, medium gray to bleached (very pale orange), very fine to medium grained fragments.	30-35	5

Sample Description	Depth Interval (feet)	Thickness (feet)
SHELL AND SAND - 60% shell, medium gray to bleached (very pale orange), very fine to medium sized fragments; 40% sand, clear to frosted (light gray overview), very fine- to medium-grained, quartz.	35-40	5
SHELL AND SAND - 60% shell, medium gray to bleached (very pale orange), very fine to medium sized fragments; 40% sand, clear to frosted (light gray overview), very fine- to medium-grained, quartz; with 5% clay, medium gray.	40-45	5
SHELL, SAND AND CLAY - 60% shell medium gray to bleached (very pale orange), very fine to medium sized fragments; 40% sand, clear to frosted (light gray overview), very fine- to medium-grained, quartz; 15% clay, moderate dark gray.	45-50	5
CLAY WITH SHELL - 50% clay, medium dark gray soft, sandy; 40% shell, dark gray, medium fragments; 10% fine-grained quartz sand.	50-55	5
SHELL, SAND AND CLAY - 30% shell, medium dark gray, fine to medium fragments; 30% sand, clear to frosted, fine- to medium fine-grained, some cementation; 20% clay, soft, medium dark gray sandy, 20% limestone, medium light gray, fine-grained.	55-60	5
LIMESTONE - medium light to medium dark gray, moderately soft, fine-grained, fair porosity; trace of shell and fine quartz sand in matrix.	60-64	4
TOTAL DEPTH	64	

GEOLOGIC LOG OF
OBSERVATION WELL #2
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Description	Depth Interval (feet)	Thickness (feet)
SAND AND ORGANICS - 85% sand, clear to frosted, fine- to very fine-grained, sub-angular to sub-rounded; 15% organics, brownish black to grayish brown, very fine-grained, silty organics, semi-consolidated.	0- 5	5
SAND AND SILT - 95% sand, clear to frosted, fine-grained, sub-angular to sub-rounded; 5% silt, light gray.	5-10	5
SAND AND SILT - sand, clear to frosted, fine-grained, to sub-rounded, slightly less silty, light gray overview.	10-15	5
SAND AND CLAY - 90% sand, clear to frosted, fine-grained, sub-angular to rounded; 5 to 10% clay, very light gray, soft, plastic; trace silt.	15-20	5
SAND AND CLAY - 85% sand, clear to frosted, fine-grained, sub-angular to rounded; 15% clay, very light gray, soft, plastic.	20-25	5
SAND - clear to frosted, very fine- to medium fine-grained, sub-angular to rounded; trace fine bleached shell fragments; trace silt.	25-30	5
SAND AND SHELL - 85% sand, clear to frosted, sub-angular to rounded, very fine- to fine-grained, quartz; 15% shell, fine fragments, medium light gray to very pale orange; trace silt.	30-35	5

Sample Description	Depth Interval (feet)	Thickness (feet)
SHELL AND SAND - 80% shell, medium dark gray to very pale orange, fine fragments; 20% sand, clear to very frosted, fine- to medium-grained sub-angular to well rounded.	35-40	5
SAND, LIMESTONE AND SHELL - 70% sandy limestone, light to medium light gray, moderately soft, fine to medium coarse (sand in matrix) grained, fairly well cemented, calcitic; 20% shell, medium dark gray, fine fragments; 10% sand, fine quartz grains.	40-45	5
SANDY LIMESTONE - 70% sandy limestone, light to medium light gray, moderately soft, fine to medium coarse-grained, fairly well cemented, calcitic; 5-10% shell; very little free sand.	45-50	5
SAND, LIMESTONE AND SHELL - 60% sand, clear to frosted, very fine-grained, rounded, quartz; 20% sandy limestone, light to medium light gray, moderately soft, fine to medium coarse (sand) grained fairly well cemented; 10% shell, medium gray to natural, very pale orange,fragments.	50-55	5
LIMESTONE - medium dark gray, moderately hard, fine-grained, low porosity, good induration, sandy, very calcitic, with trace of shell, medium to gray to very pale orange; trace, sandy limestone, light gray, moderately soft, fine- to medium-grained, fairly well cemented.	55-60	5
LIMESTONE - medium dark gray, moderately hard, fine-grained, low porosity, good induration, sandy, very calcitic; 15% clay, greenish gray.	60-65	5

Sample Description	Depth Interval (feet)	Thickness (feet)
LIMESTONE AND CLAY - 50% limestone, medium dark gray, fine-grained, good induration; 50% clay, greenish gray to medium dark gray, soft, pliable.	65-70	5
LIMESTONE AND CLAY - 50% limestone, medium dark gray, fine-grained, good induration; 50% clay, greenish gray to medium dark gray, soft, pliable, with trace of shell.	70-75	5
LIMESTONE AND CLAY - 50% limestone, medium dark gray, fine-grained, good induration; 50% clay, greenish gray to medium dark gray, soft, pliable, with trace of shell fragments and limestone.	75-80	5
LIMESTONE - 60% limestone, very pale orange, very fine-grain-d, granular, moderatley soft, low porosity; 30% limestone, medium dark gray, fine-grained, crystal-line; 10% shell, very pale orange fragments.	80-85	5
LIMESTONE - 80% limestone, dark gray to very pale orange, very fine-grained, granular, moderately soft, low porosity; 20% shell.	85-90	5
SHELL AND LIMESTONE - 60% shell fragments, fine to medium, very pale orange to moderate brown; 30% limestone, gray, very pale orange, very fine-grained, granular, moderately soft, low porosity.	90-95	5
SHELL AND LIMESTONE - 70% shell fragments, fine to medium, very pale orange to moderate brown; 30% limestone, gray, very pale orange, very fine-grained, gran-ular, moderately soft, low porosity; 10% silty greenish gray clay.	95-100	5
TOTAL DEPTH	100	

GEOLOGIC LOG
OBSERVATION WELL #3
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND - clear to frosted, very fine- to fine-grained, sub-angular to sub-rounded, with trace of fine phosphate grains.	0- 5	5
SAND AND SILTY ORGANICS - 90% sand, clear to dusky yellow, very fine-grained; with grayish brown, very fine, silty organics, fairly consolidated.	5- 10	5
SILTY SAND - 90% sand, clear to dusky yellow, very fine- to fine-grained; 10% silt grains; trace organics, grayish brown; trace phosphate grains.	10- 30	20
SAND AND SHELL - 85% silty sand, dusky yellow, fine- to medium fine-grained, clear to frosted, silty; 10-15% shell, very pale orange (bleached), fine fragments.	30- 45	15
SAND AND LIMESTONE - 50% sand, clear to frosted, medium dark gray overview, fine-grained, sub-rounded; 20% shell, medium dark gray to very pale orange, fine fragments; 10% limestone, gray, moderately soft, fine grained; 10% limestone, sandy (cemented) quartz grains, very fine white matrix.	45- 50	5
SAND, LIMESTONE, AND SHELL - 50% sand, clear to frosted, fine- to medium-grained, sub-rounded; 20% sandy limestone, moderately soft, cemented quartz grains, fine white matrix;	50- 55	5

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
20% shell, very pale orange to moderate brown, fine fragments; 10% limestone, medium dark gray, fine-grained.		
SANDY LIMESTONE - medium to medium light gray, fine-grained, moderately hard, crystalline, sandy, fine quartz; trace , shell fragments trace, medium dark gray clay.	55- 70	15
LIMESTONE, CLAY, AND SHELL - 50% limestone, medium dark gray, fine-grained, moderately hard, sand and fine shell in matrix; 35% clay, greenish gray, soft, plastic; 15% shell, natural colors, medium coarse fragments.	70- 75	5
SAND AND SHELL - 90% sand, pale yellow brown, fine- to medium-grained, some frosted grains, quartz; 8% shell fragments, medium to fine fragments, mostly bleached; 2% trace phosphate, fine black grains.	75- 80	5
SHELLY SAND - 80% sand, dark yellow brown, fine- to medium-grained, rounded to sub-angular, poor induration, well sorted, quartz; 15% shell, coarse to fine fragments, mostly bleached; 5% phosphate, very fine rounded black grains.	80- 90	10
SHELL AND SAND - 50% sand, fine- to medium-grained, rounded to sub-angular, quartz, good consolidation, well sorted; 40% shell fragments, coarse to fine, broken, bleached; 10% phosphate, very fine black grains.	90-100	10
TOTAL DEPTH	100	

GEOLOGIC LOG
OBSERVATION WELL #4
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND AND ORGANICS - 80% sand, clear to frosted, very fine- to medium-grained, poorly sorted; 20% organics, grayish brown, very fine grained, consolidated.	0- 10	10
SILTY SAND AND CLAY - 85 to 90% sand, clear to frosted, fine- to medium fine-grained, fairly well sorted, sub-angular to sub-rounded, silty, phosphatic; 10 to 15% clay, medium light gray, sandy, soft, plastic.	10- 35	25
CLAY, SHELL, AND SAND - 40% clay, medium dark gray, soft, plastic, slightly sandy; 30% shell, very pale orange to medium gray, fine- to medium fine-fragments; 30% sand, clear to frosted, fine-to medium-grained, sub-angular to sub-rounded, quartz.	35- 55	20
CLAY - medium dark gray, soft, plastic, slightly sandy; 30% shell, medium dark gray, fine fragments.	55- 60	5
CLAY AND SAND - 50% clay, medium dark gray, soft, plastic; 50% sand, clear to light gray, fine- to medium fine-grained, fairly well sorted.	60- 70	10
SHELL, SAND, AND CLAY - 70% shell, very pale orange to light gray, fine fragments; 15% sand, clear to light gray, fine- to medium-grained, sub-angular; 15% clay, medium dark gray, soft, plastic.	70- 75	5

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SILTY SAND AND SHELL - 85% sand, clear to frosted, very fine- to fine-grained, well sorted, silty; 15% shell, fine bleached fragments.	75- 80	5
SAND AND SHELL - 70% sand, clear to slightly frosted, very fine- to fine-grained, sub-angular; 30% shell, bleached to medium dark gray, fine fragments.	80- 90	10
SHELL AND SILTY SAND - 80% shell, bleached, fine to medium coarse, fragments; 20% sand, clear to frosted very fine- to medium fine-grained, silty, quartzitic.	90-100	10
TOTAL DEPTH	100	

GEOLOGIC LOG
OBSERVATION WELL #5
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND AND ORGANICS - 85% sand, clear, very fine- to fine-grained, sub-angular, fairly well sorted, quartz; 15% organics, grayish brown, very fine-grained, consolidated with sand.	0- 10	10
SILTY SAND - 95% sand, clear to grayish yellow, very fine- to medium fine-grained, sub-angular to sub-rounded; 5% silt.	10- 20	20
SLIGHTLY SILTY SAND - sand, clear, very fine to medium grained, sub-angular to sub-rounded, slightly silty.	30- 35	5
CLAY AND SAND - 70-80% clay, medium dark gray, soft, plastic; 20-30% sand, clear to light gray, very fine- to fine-grained quartz.	30- 65	35
SHELL, SAND, CLAY - 60-70% shell, very pale orange, to very light gray, very fine to medium coarse fragments; 15 to 20% sand, clear to very light gray, very fine-grained, quartzitic; 10 to 15% clay, medium dark gray, soft, plastic.	65- 85	20
SHELL, SAND, AND LIMESTONE - 70% shell, very pale orange to medium light gray, very fine to medium coarse fragments; 15% sand, clear to very light gray, very fine- to medium-grained, quartzitic; 15% limestone, medium dark gray, fine-grained, sand and shell in matrix, trace of medium dark gray clay.	85-100	15
TOTAL DEPTH	100	

GEOLOGIC LOG
OBSERVATION WELL #6
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Description	Depth Interval (feet)	Thickness (feet)
SILTY SAND - 95% sand, clear to pale yellowish brown, very fine- to medium-grained; 5% silt.	0- 5	5
SAND - clear to frosted, fine- to medium-grained, sub-angular to sub-rounded, well sorted, slightly silty.	5- 10	5
SILTY SAND AND CLAY - 80-90% sand, clear to slightly frosted, very fine- to medium fine-grained, sub-angular to sub-rounded, fairly well sorted, silty; 10-20% clay, medium light gray, soft, plastic, sandy.	10- 25	15
SILTY SAND AND CLAY - 70% sand, clear to slightly frosted, very fine- to medium fine-grained, sub-angular to sub-rounded, fairly well sorted, silty; 30% clay, medium light gray, soft, plastic, sandy.	25- 30	5
CLAY - medium dark gray, soft, plastic, sandy.	30- 55	25
LIMESTONE, SAND, AND CLAY - 70% limestone, medium dark gray, fine-grained, moderately hard, granular, fine quartz sand and fine shell in matrix; 20% sand, clear to frosted, fine- to medium-grained; 10% clay, medium dark gray, soft, plastic.	55- 65	10
SANDY LIMESTONE, SHELL, AND SAND - 60-70% sandy limestone, medium dark to medium light, fine-grained, moderately hard, granular, sand and shell in matrix; 15-20% shell, natural to medium light	65-80	15

Sample Description	Depth Interval (feet)	Thickness (feet)
gray, very fine- to medium fine-grained, quartzitic; trace of clay, medium dark gray.		
SAND, SANDY LIMESTONE, AND SHELL -40% sand, very fine- to medium fine-grained, quartzitic; 40% sandy limestone, medium dark to medium light, fine-grained, moderately hard, granular, sand and shell in matrix; 20% shell, natural to medium light gray, very fine to medium coarse fragments.	80- 85	5
SHELL AND SAND - 70% shell, mostly bleached, fine to medium bleached, fine to medium fragments; 30% sand, very fine- to medium fine-grained, quartzitic; trace of gray limestone.	85-90	5
SHELL, LIMESTONE, AND SAND - 50% shell, natural to medium light gray, very fine to medium coarse fragments; 30% limestone, medium dark to medium light, fine-grained, moderately hard, granular, sand and shell in matrix; 20% sand, very fine- to medium fine-grained, quartzitic.	90-100	10
TOTAL DEPTH	100	

GEOLOGIC LOG OF
WELL #28C
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND AND ORGANICS - 95% sand, clear to amber, fine- to medium-grained, sub-angular to sub-rounded quartz; 5% organics, grayish brown, very fine-grained, poorly consolidated.	0- 5	5
SILTY SAND - 90% sand, clear to amber (light brown overview), very fine- to medium fine-grained, 10% medium brown silt; trace, organics.	5-15	10
SILTY SAND - sand, clear to amber (light brown overview), fine- to medium-grained, sub-angular to sub-rounded; trace, silt.	15-20	5
SILTY SAND - sand, deep amber (dark brown overview), fine- to medium-grained, sub-angular to sub-rounded, only slightly silty.	20-35	15
SILTY SAND WITH SHELL - 90% sand, very light gray to light brown (clear to amber grains), fine- to medium-grained, sub-rounded; 10% shell, bleached, fine fragments.	35-40	5
SILTY SAND WITH SHELL - 80% sand, clear to light amber, very fine- to medium-grained, sub-angular to sub-rounded, with fine light brown silt; 20% shell, bleached to very light gray, fine fragments.	40-50	10

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SANDY CLAY AND SHELL - 50% sandy clay, pale yellowish green to medium light gray, very fine-grained, cohesive, sandy, clear to amber grains; 50% shell, medium light gray to bleached, very fine to medium fragments; trace of gray limestone.	50-55	5
SAND AND SHELL - 50% sand, clear to very light amber, very fine- to medium-grained, slightly silty, quartz; 50% shell, medium light gray to bleached (very pale orange), very fine to medium fragments.	55-60	5
TOTAL DEPTH	60	

GEOLOGIC LOG OF
WELL #30C
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND, ORGANICS, AND SILT - sand, clear to dusky yellow, very fine- to medium fine-grained, quartz, with grayish brown, fine organics and silt.	0-10	10
SAND, ORGANICS, AND SILT - sand, clear to dusky yellow, fine-grained, sub-angular to sub-rounded; organics and silt, grayish brown, very fine-grained.	10-15	5
SAND AND SILT - sand, clear to dusky yellow, fine- to very fine-grained, pale brown overview.	15-25	10
SAND, ORGANICS, AND SILT - sand, clear to dusky yellow, fine-grained; pale brown organics and silt.	25-30	5
SAND, ORGANICS, AND SILT - sand, clear to dusky yellow, fine-grained; pale brown organics and silt.	30-35	5
SANDY CLAY, SAND, AND SHELL - 40% sandy clay, pale yellowish green to light gray, soft, plastic; 40% sand, clear to dusky yellow, fine-grained, sub-angular to sub-rounded; 20% shell, very pale orange, very fine fragments.	35-45	10
SHELL AND SAND - 80% shell, very pale to moderate brown, very fine to medium fragments; 20% sand, very fine-grained, clear, quartz.	45-50	5

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SHELL AND SAND - 80% shell, mostly bleached and very pale orange, very fine to medium fragments; 10% sand, fine-grained, quartz.	50-60	10
TOTAL DEPTH	60	

GEOLOGIC LOG OF
WELL #1D
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND AND ORGANICS -90% sand, very light gray to clear, very fine- to medium-grained, sub-angular to sub-rounded; 10% organics, very fine, black to moderate brown, consolidated.	0- 5	5
SAND AND ORGANICS -70% sand, very light gray to clear and frosted fine- to medium-grained, sub-rounded, quartz; 30% organics, very fine, black to moderate brown; lighter cuttings more silty, consolidated.	5-10	5
SAND - very fine-grained, quartz, very light gray to clear, sub-angular 15% organics, silty, black to moderate brown.	10-15	5
SAND - clear to frosted, fine-grained, well sorted, trace of clayey/silty material.	15-25	10
SAND AND SHELL - 60% sand, clear, very fine- to fine-grained, quartz; 40% shell, natural to dark gray, moderately coarse.	25-30	5
SAND AND SHELL - 50% sand, clear, very fine- to fine-grained, quartz; 40% shell, natural to dark gray, moderately coarse.	30-35	5
SHELL, SAND, AND CLAY - 50% sand, clear, very fine- to fine-grained; 35% shell, black to very pale orange to moderate brown, coarse fragments; 15% clay, moderate dark gray, sandy, silty, plastic.	35-40	5

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND, CLAY, AND SHELL - 50% sand, clear, very fine- to fine-grained; 30% clay, moderate dark gray, sandy, silty, plastic; 20% shell, black to natural color, coarse fragments.	40-45	5
SANDY CLAY AND SHELL - 80% sandy clay, moderate dark gray, silty, sandy, fine-grained, quartz, plastic; 20% shell, antural to dark gray, coarse fragments.	45-50	5
SANDY CLAY, SHELL AND SAND - 60% clay moderate dark gray, sandy, silty, plastic; 20% shell, black to very pale orange to moderate brown, coarse fragments; 20% sand, clear, fine-grained, loose grains.	50-55	5
SHELL AND SAND - 80% shell, moderate to dark gray, medium to coarse fragments, some whole pelecypods; 20% sand, clear to frosted, fine- to moderately coarse-grained, sub-rounded; trace of gray clay.	55-60	5
CLAY AND SHELL - 80% clay, moderate to dark gray, sandy, very fine-grained, quartz, plastic; 20% shell, medium gray to very pale orange, fine to medium shell fragments.	60-65	5
CLAY, SHELL, AND LIMESTONE - 70% clay, moderate to dark gray, sandy, very fine-grained, quartz, plastic; 20% shell, gray and natural, fine to medium shell fragments; 10% limestone, pinkish gray, poorly indurated, sandy, calcarenite.	65-70	5
SHELL AND LIMESTONE - 70% shell fragments, very pale orange, fine fragments; 15% limestone, very pale orange, soft, sandy, silty, low porosity; 15% sand, fine-grained, quartz.	70-75	5

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND, SHELL, AND LIMESTONE - 40% sand, clear, very fine-grained, quartz, well sorted; 40% shell, fine, very pale orange fragments; 20% limestone, very pale orange, fine-grained, sandy.	75- 80	5
SAND AND SHELL -60% sand, clear, very fine- to fine-grained, sub-angular, quartz, silty, phosphatic; 20% shell, fine bleached fragments; 20% limestone, grayish brown, moderately hard, very fine-grained, sandy, low porosity.	80- 90	10
SHELL AND SAND - 80% shell, very pale orange to moderate brown, bleached and gray, coarse to fine fragments; 20% sand, very fine- to fine-grained, clear, quartz, slightly silty.	90- 95	5
SHELL, LIMESTONE AND SAND - 70% shell, natural to gray, fine to coarse fragments; 20% limestone, medium dark gray, fine-grained, sandy, medium porosity; 10% sand, clear, very fine- to fine-grained, quartz.	95-100	5
SANDY LIMESTONE AND SHELL - 60% limestone, very light gray, fine-grained, moderately soft, low to medium porosity, sandy; 30% shell, very pale orange, very fine to medium fragments; 10% sand, very fine-grained, quartz.	100-105	5
LIMESTONE AND SHELL -80% limestone, very pale orange, soft, fine-grained, medium porosity, slightly silty; 20% shell, fine to medium fragments, very pale orange to moderate brown.	105-110	5

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
LIMESTONE AND SHELL - 80% sandy limestone, very pale orange to pinkish gray, fine-grained, very sandy, moderately soft, low porosity; 20% shell, very pale orange to medium light gray, coarse, fragments; trace of greenish limestone cuttings.	110-115	5
SANDY LIMESTONE AND CLAY - 75% sandy limestone, grayish olive green, fine-grained, very sandy, moderately soft, low pososity; 25% clay, grayish olive green, soft, sandy, plastic.	115-120	5
TOTAL DEPTH	120	

GEOLOGIC LOG OF
WELL #2D
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND AND ORGANICS - 90% sand, clear, fine to medium-grained, quartz; 10% organics, hardpan, very fine, grayish brown, semi-consolidated.	0- 10	10
SAND - 85% sand, clear to frosted, very fine- to fine-grained, a few amber, sub-angular; 15% light gray clay, very fine grain, sandy, plastic; trace organics.	10- 15	5
SANDY CLAY - light gray, very fine-grained, plastic, with very fine- to fine quartz-grains, very sandy.	15- 20	5
SAND AND CLAY - 75% sand, clear, very fine- to fine-grained, sub-angular to sub-rounded, quartz; 25% clay, light gray, soft, plastic, sandy.	20- 25	5
SAND - clear to frosted, very fine to moderately fine, sub-angular to sub-rounded, occasional milky frosted grains; trace grayish brown organics and light gray clay.	25- 30	5
SHELL AND SAND - 70% bleached, fine shell fragments; 30% sand, clear to frosted, fine- to medium coarse; trace of gray clay.	30- 40	10
SANDY CLAY AND SHELL - 85% clay, medium gray, very fine-grained, plastic, sandy, fine quartz grains; 15% shell, very pale orange, coarse fragments.	40- 55	15

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
CLAY - medium gray, soft, plastic, slightly sandy, trace of shell.	55- 60	5
CLAY AND SHELL - 85% clay, medium gray clay, very fine-grained, plastic, sandy, fine-grained, quartz; 15% shell, fine to medium, natural color, fragments.	60- 70	10
SANDY LIMESTONE AND SHELL - 50% to 60% sandy limestone, moderately hard, medium dark gray to medium light gray, fine-grained, sandy, fine quartz grains in matrix, low to medium porosity; 30 to 40% shell, very pale orange to moderate brown, fine to coarse fragments; 10% sand, fine- to medium coarse-grained, clear, quartz.	70- 75	5
SANDY LIMESTONE AND SHELL - 70% limestone, very pale orange, moderately hard, fine-grained matrix with very fine- to fine-grained sand, low to medium porosity; 30% shell, very pale orange to moderate brown, fine to medium fragments.	75- 80	5
SANDY LIMESTONE AND SHELL AND SAND - 50% limestone, very pale orange, moderately hard, fine-grained matrix with very fine to fine sand, quartz, grains, low to medium porosity; 30% shell, very pale orange to moderate brown, fine to medium fragments; 20% sand, clear, fine- to medium-grained, sub-angular to sub-rounded, quartz.	80- 85	5
SANDY LIMESTONE, SHELL AND SAND - 40% limestone, medium gray, moderately hard, fine-grained, sandy, fair porosity; 30% shell, very pale orange to moderate brown, fine fragments;	85- 90	5

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
30% sand, clear, fine- to medium-grained, quartz.		
SHELL, SAND, AND LIMESTONE - 50% shell, very pale orange to moderate brown, fine fragments; 30% sand, clear, fine- to medium-grained, quartz; 20% limestone, medium gray, moderately hard, fine-grained, sandy, fair porosity; trace of gray sandy clay.	90- 95	5
SANDY LIMESTONE, SHELL, AND SAND - 40% limestone, medium gray, moderately hard, fine-grained, sandy, fair porosity; 30% shell, very pale orange to medium brown, fine fragments; 30% sand, clear, fine- to medium-grained, quartz.	96-100	4
SANDY LIMESTONE, SHELL, AND SAND - 60% sandy limestone, very pale orange to light gray, soft, fine-grained, fine sand grains in matrix, low to fair porosity; 30% shell, very pale orange, fine fragments; 20% sand, clear, fine- to medium-grained.	100-118	18
CLAY - grayish olive green, plastic sandy with 10 to 15% moderate to light brown, shell fragments.	118-120	2
TOTAL DEPTH	120	

GEOLOGIC LOG
WELL #3D
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Description	Depth Interval (feet)	Thickness (feet)
SAND AND ORGANICS - 70% sand, clear to amber, fine- to medium fine-grained, sub-angular, quartz; 30% organics, black/brown, semi-consolidated, silty, "hardpan".	0- 5	5
SAND, ORGANICS, AND CLAY - 65% sand, clear to amber, fine- to medium fine-grained, sub-angular, quartz; 25% organics, black/brown, semi-consolidated, silty; 10% clay, light gray, soft, sandy, very fine-grained, plastic, cohesive.	5- 10	5
SAND AND SANDY CLAY - 70-80% sand, clear to amber, fine to medium fine quartz grains, sub-angular to sub-rounded; 20-30% sandy clay, light gray, very fine grained, cohesive, very sandy, silty.	10- 20	10
CLAY - light gray to pinkish gray, sandy, plastic.	20- 25	5
SAND - clear, fine- to medium fine-grained, yellowish brown, silty, some amber grains, sub-rounded, fairly well sorted, silty, trace clay.	25- 37	12
SAND AND SHELL - 70% sand, clear to very light gray, fine- to medium fine-grained, sub-rounded, quartz grains; 30% shell, natural to medium gray, fine fragments.	37- 40	3
SAND AND SHELL - 50% sand, clear to very light gray, fine- to medium fine-grained, sub-rounded, quartz grains; 50% shell, very pale orange to medium gray, fine fragments.	40- 45	5

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SHELL - 95% medium gray to natural, coarse, weathered, fragments; 5% sand, fine-grained, quartz.	45- 50	5
SAND AND SHELL - 85% sand, clear to frosted, fine- to coarse-grained, sub-angular to rounded, quartz; 15% shell, natural to gray, coarse, weathered fragments.	50- 55	5
CALCAREOUS SANDSTONE - sand, clear to frosted, fine- to medium-grained, cemented, with a very fine-grained, off white calcareous matrix, very calcitic; trace of shell fragments.	55- 58	3
SANDY LIMESTONE - medium to medium dark gray, fine- to medium-grained, sandy, fair porosity, medium hard, good induration, calcitic; trace of coarse shell fragments.	58- 60	2
SANDY LIMESTONE - medium gray to medium dark gray, fine- to medium-grained, sandy, fair porosity, medium hard, good induration, calcitic; trace of coarse shell fragments; trace of soft yellowish green clay.	60- 70	10
LIMESTONE - 50% limestone, medium gray to dark gray, fine-grained, hard, fairly dense, crystalline, calcitic, low to fair porosity; 25% limestone, very pale orange, moderately hard, fine-grained, granular, low porosity; 25% shell, medium gray to moderate brown to very pale orange, fine to medium fine fragments.	70- 75	5
LIMESTONE AND SHELL - 50% limestone, medium gray to medium dark gray, fine-grained, hard, fairly dense, crystalline, calcitic, low to fair porosity; 25% limestone,	75- 80	5

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
very pale orange, moderately hard, fine-grained, granular, low porosity; 25% shell, medium light gray, fine fragments.		
LIMESTONE, SHELL, AND SAND - 50% limestone light gray to medium dark gray, fine- to medium-grained, quartz, sand and shell fragments in matrix, calcitic; 30% shell, very pale orange to moderate brown, very fine to fine fragments and whole shells; 20% sand, clear, rounded, very fine- to medium fine-grained.	80- 85	5
SAND, SHELL, AND LIMESTONE - 40% sand, clear rounded, very fine- to medium fine-grained, quartz; 40% shell, very pale orange to moderate brown, very fine to fine fragments and whole shells; 20% limestone, light gray to medium dark gray, fine- to medium-grained, fine quartz in matrix, calcitic.	85- 95	10
SAND AND SHELL - 40% sand, clear, very fine to medium-grained, quartz, sub-angular to sub-rounded; 40% shell, very pale orange to moderate brown, medium fragments; 10 to 20% limestone, light gray to medium dark gray, fine- to medium-grained, fine quartz, sand and shell fragments in matrix, calcitic.	95-105	10
SHELL, LIMESTONE, AND SAND - 50% shell, very pale orange to moderate brown to medium light gray, fine fragments; 35% limestone, medium gray, fine-grained, sandy, phosphatic; 10 to 15% sand, clear, fine quartz grains.	105-110	5

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
LIMESTONE AND SHELL - 70% limestone, light gray to pale yellowish green, soft, medium-grained, fair porosity, friable; 30% shell, very pale orange to light brown, medium coarse fragments.	115-120	5
CLAY - pale yellowish green, very fine-grained, soft, plastic, sandy with 10% shell fragments.	120-125	5
TOTAL DEPTH	120	

GEOLOGIC LOG OF
WELL #5D
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND AND ORGANICS - 80% sand, clear to frosted, fine- to medium-grained, sub-angular to sub-rounded; 20% organics, grayish brown silty, semi consolidated to consolidated.	0- 5	5
SAND - sand, very fine- to medium fine-grained, clear to frosted, sub-angular to sub-rounded; trace of medium light gray silty clay.	5-10	5
SAND AND CLAY - sand, very fine- to medium fine-grained, clear to frosted, sub-angular to sub-rounded; 20% clay, medium light gray, silty.	10-15	5
SAND AND CLAY - sand, very fine- to medium fine-grained, clear to frosted, sub-angular to sub-rounded; 20 to 25% clay, medium light gray.	15-20	5
SAND AND CLAY - very fine- to medium fine-grained, clear to frosted, sub-angular to sub-rounded; 45% clay, medium light gray.	20-25	5
SANDY CLAY - medium gray to medium light gray, very fine-grained, plastic, very sandy, fine- to medium-grained, clear,quartz grains.	25-35	10
SAND AND SHELL - 75% sand, clear to very light gray to frosted, very fine- to medium fine-grained, sub-angular to sub-rounded; 25% shell, very pale orange to moderate brown, very fine fragments.	35-45	10

Sample Description	Depth Interval (feet)	Thickness (feet)
SHELL AND SAND - 50% shell, gray to natural, very fine to medium fine fragments, phosphatic; 25% sand, clear to frosted, fine- to medium-grained, quartz, sub-rounded; with phosphate grains and trace of gray limestone.	45-50	5
SAND, SHELL AND LIMESTONE - 50% sand, clear, fine-grained, quartz, fairly well consolidated with pale, fine matrix, calcitic; 40% shell, very pale orange to medium light gray, very fine to medium fine fragments, phosphatic; 10 to 20% limestone, medium dark gray, fine-grained, moderately hard.	50-60	10
SANDY LIMESTONE - light gray to medium gray, fine- to medium-grained, moderately hard, very sandy, quartz grains, and very calcitic.	60-65	5
SANDY LIMESTONE - light gray to medium gray, fine- to medium-grained, moderately hard, very sandy, quartz grains, and very calcitic.	65-70	5
SANDY LIMESTONE - light gray to medium gray, fine- to medium-grained, moderately hard, very sandy, quartz grains, very calcitic; 15% clay, pale gray blue, sandy, very fine-grained, soft, plastic.	70-75	5
LIMESTONE - light gray to medium gray, fine- to medium-grained, moderately hard, very sandy, quartz grains very calcitic; 10% clay, pale gray blue; 10% limestone, very pale orange, fine-grained, granular.	75-80	5

Sample Description	Depth Interval (feet)	Thickness (feet)
SAND, SHELL AND LIMESTONE - 60% sand, clear to amber, very fine- to medium fine-grained, quartz; 25% shell, very pale orange to moderate brown to medium light gray, fine fragments; 15% limestone, medium gray, crystalline.	80- 85	5
SAND AND SHELL - 75% sand, clear to amber, very fine- to medium fine-grained, quartz, sub-angular to sub-rounded; 25% shell, very pale orange to light gray, fine fragments.	85-100	15
LIMESTONE, SHELL AND SAND - 50% limestone, medium light to medium dark gray, fine-grained, crystalline, moderately hard, low to fair porosity; 30% shell, very pale orange to moderate brown, fine fragments; 20% sand, clear to amber very fine-grained.	100-105	5
LIMESTONE, SAND AND SHELL - 35-40% limestone, medium light to medium dark gray, fine-grained, crystalline, moderately hard, low to fair porosity; 30-35% sand, clear to amber, very fine-grained, quartz; 30% shell, very pale orange to moderate brown, fine fragments.	105-115	10
LIMESTONE AND SAND - 60% limestone, pale yellow green, soft, friable, very sandy; 40% sand, clear, very fine- to medium fine-grained, quartz; trace of shell.	115-120	5
CLAY - pale yellow green, soft, plastic, sandy with a 25% fine sand and trace of shell fragments.	120-125	5
TOTAL DEPTH	125	

GEOLOGIC LOG OF
SALINITY MONITOR WELL
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND AND CLAY - 60% sand, brown, silty, with organics, consolidated; 40% clay, gray, sandy; trace of shell.	0- 21	21
SAND AND LIMESTONE - 95% sand, medium gray fine-grained, silty, cemented, quartz; 5% limestone, medium light gray, hard, crystalline.	21- 42	21
LIMESTONE AND SAND - 50% sand, clear, partially cemented; 50% limestone, medium light gray; trace, silty clay and very coarse shell fragments.	42- 63	21
SAND - clear to medium light gray, fine-grained, silty, some clay size fines with very fine shell fragments.	63- 72	9
LIMESTONE - medium light gray, hard, very sandy, good induration with fine to medium coarse shell.	72- 85	13
SHELL AND LIMESTONE - 50% shell, very pale orange, coarse fragments and whole shells; 50% limestone, medium to light gray, fine-grained, very sandy with some shell in matrix, hard, well indurated.	85-105	20
SANDY LIMESTONE - grayish green, fine- to medium fine-grained, soft, calcarenite matrix, fair porosity.	105-119	14
CLAY - grayish olive green, soft, plastic with some quartz sand.	119-120	1
TOTAL DEPTH	120	

GEOLOGIC LOG OF
WELL #14D
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND AND ORGANICS - sand with organics, pale yellowish brown, coarse- to fine-grained, sub-angular to rounded, unconsolidated, poorly sorted.	0- 5	5
SAND - pale yellowish brown, fine- to medium-grained rounded to sub-rounded, quartz, poorly consolidated, well sorted.	5-15	10
SAND - dark yellowish brown, medium- to fine-grained, sub-rounded to rounded, poorly consolidated, clear grains, well sorted.	15-30	15
SAND - pale yellowish brown, medium- to fine-grained, sub-rounded to rounded, quartz, poorly consolidated, clear grains, moderate sorting.	30-45	15
SAND - pale yellowish brown, medium- to fine-grained, sub-rounded to rounded, quartz, poorly consolidated, clear grains; trace of shell fragments.	45-50	5
SILTY SAND AND SHELL - 60% silty sand, dark yellowish brown, very fine- to fine-grained, well rounded to sub-rounded, very well sorted, partially consolidated; 40% coarse to fine broken shell fragments.	50-65	15
SHELL AND SILTY SAND - 80% shell, coarse to fine, whole and broken fragments, bleached; 20% sand, very fine-grained, silt, sub-rounded, well sorted, medium consolidation.	65-70	5

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SHELL, CLAY, AND SILTY SAND - 70% shell, coarse to fine, whole and broken fragments, bleached; 20% clay, medium dark gray, soft, plastic; 10% sand, very fine-grained, sub-rounded, silty, well sorted, quartz.	70- 75	5
SHELLY LIMESTONE - 70% limestone, grayish green, very fine-grained, well cemented, moderately hard, well indurated; 20% whole and broken shell fragments, coarse to fine; 10% clay, medium dark gray.	75- 80	5
SHELLY LIMESTONE - 60% limestone, grayish green, very fine-grained, well cemented, moderately hard, well indurated; 30% shell, whole and broken fragments, coarse to fine; 10% sandy silt.	80- 90	10
SHELLY SAND WITH SILT - 60% sand, pale yellow brown, fine- to medium-grained, rounded to sub-rounded, quartz, good consolidation, silty, 40% shell, whole and broken fragments, colored and bleached.	90- 95	5
SHELLY SAND WITH SILT - 40% sand with silt, pale yellowish brown, fine- to medium-grained, rounded to sub-rounded, quartz, good consolidation; 40% shell, whole and broken fragments, colored and bleached; 20% clay, medium dark gray.	95-100	5
SHELL AND SANDY SILT - 80% shell, whole and broken fragments, colored and bleached; 20% sandy silt, very fine-grained, yellowish brown, well sorted.	100-125	25
TOTAL DEPTH	125	

GEOLOGIC LOG OF
WELL #25D
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND AND ORGANICS - 90% sand, clear to frosted, very fine- to medium fine-grained, quartz, sub-angular to sub-rounded; 10% organics, grayish brown, very fine-grained, consolidated.	0- 5	5
SAND WITH SILT AND ORGANICS - 80 to 85% sand, clear to frosted, very fine- to medium fine-grained, quartz, sub-angular to sub-rounded; 15 to 20% organics, grayish brown, very fine-grained, fairly well consolidated.	5-10	5
SAND - 95% sand, clear to dusky yellow to frosted, very fine- to medium fine-grained, sub-angular to sub-rounded, quartz; with very fine organics and silt; 5% medium light gray clay in 25 to 30 feet.	10-30	20
SAND WITH SILT AND CLAY - 70% sand, clear to dusky yellow to frosted, fine- to medium-grained, quartz, sub-angular to sub-rounded, silty; 25 to 30% clay, medium light gray, soft, plastic; trace, shell.	30-60	30
SHELL AND SANDY CLAY - 50% shell, gray to very pale orange, very fine to medium fragments; 40% sandy clay, medium dark gray to medium light gray, soft, plastic, sandy; 10% limestone, sandy, gray.	60-70	10

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
LIMESTONE, SHELL, AND SAND - 65% sandy limestone, medium light gray, moderately hard, sand and shell in matrix; 15% shell, gray to very pale orange, medium fragments; 20% sand, very fine-grained, quartzitic, with shell.	70-90	20
LIMESTONE - medium light gray, granular; trace, medium fine shell fragments and very fine- to fine-grained, quartz sand.	90-105	15
SHELL, LIMESTONE, AND SAND - 50% shell, very pale orange to medium dark gray, very fine to medium coarse fragments; 30% sandy limestone, medium dark gray to medium light gray, fine-grained, moderately hard, shell fragments in matrix; 20% sand, quartzitic with fine shell and limestone.	105-120	15
SHELL AND LIMESTONE - 50% shell, very pale orange to medium dark gray, very fine to medium fragments; 50% sandy limestone, medium dark to medium light gray, fine-grained, moderately hard, sandy; trace, shell in matrix.	120-125	5
LIMESTONE, SHELL, AND CLAY - 70% sandy limestone, medium light gray to light green gray, fine- to medium-grained, sandy, silty, poorly consolidated with very fine phosphate grains in matrix; 20% shell, very pale orange to moderate brown, very fine to medium fragments; 10% clay, grayish green, soft, sandy, plastic.	125-135	10
TOTAL DEPTH	135	

GEOLOGIC LOG
WELL #29D
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND - 95% sand, very pale orange to moderate brown, fine- to coarse-grained, angular to sub-rounded, quartz, poorly sorted, frosted grains, unconsolidated; 5% organics, brown, very fine.	0- 10	10
SAND AND CLAY - 80% sand, very pale orange to moderate brown, fine- to coarse-grained, angular to sub-rounded, quartz, frosted grains, unconsolidated; 20% clay, very fine grained, grayish brown, thin stringers, slightly plastic.	10- 20	10
SAND - 95% sand, very pale orange to moderate brown, fine- to medium-grained, quartz, sub-angular to sub-rounded, some frosting, sucrosic texture, unconsolidated; 5% organics.	20- 30	10
SANDY CLAY, SHELL, AND SAND - 40% sandy clay, medium light gray to pale yellowish green, soft, plastic, with quartz grains; 40% shell, very pale orange, medium to fine fragments; 25% sand, clear to frosted, fine-grained, quartz.	30- 40	10
SHELL AND SAND - 75% shell, very pale orange, medium fragments, angular to sub-angular, unbleached; 25% sand, clear to frosted, medium- to fine-grained, rounded to sub-angular.	40- 60	20

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND - 95% sand, moderate brown, coarse-grained, poorly sorted, some frosted grains, poorly consolidated; 5% shell fragments, mediun-grained.	60- 65	5
SHELL AND SAND - 80% shell, moderate gray to bleached, coarse- to fine fragments; 20% sand, fine- to medium-grained, very pale orange, poorly consolidated, quartz, trace phosphate, black grains.	65- 80	15
SHELL, SAND, AND CLAY - 60% shell, moderate gray to bleached, coarse to fine fragments, 20% sand, fine- to medium-grained, very pale orange, poorly consolidated, quartz, trace fines and phosphate, black grains; 20% clay, soft, plastic.	80- 95	15
SANDY SHELL - 70% shell, moderate gray and white, fragments, coarse to fine, some bleached, loosely compacted.	95-115	20
SHELLY LIMESTONE - 70% limestone, medium gray, medium- to fine-grained, good consolidation, moderately hard; 20% shell, broken and unbleached fragments, fair sorting, good porosity; 10% sand, fine- to medium-grained, brownish gray, well sorted	115-135	20
TOTAL DEPTH	135	

PERSSON DRILLING CORPORATION
4903 SEAGRAPE DRIVE • FORT PIERCE, FLORIDA 33450 • (305) 465-6797

BORING LOGS FOR SAVANNAH CLUB - SHALLOW WELLS

Well #	Surface Sands	Hardpan	Sands below Hardpan
1-A	0 - 3'	3 - 6'	6 - 10'
2-A	0 - 3'	3 - 5'	5 - 10'
3-A	0 - 3'	3 - 9'	9 - 13'
4-A	0 - 3.5'	3.5 - 6'	6 - 10'
5-A	0 - 3'	3 - 5'	5 - 10'
6-A	0 - 2.5'	2.5 - 5.5'	5.5 - 10'
7-A	0 - 3'	3 - 6.5'	6.5 - 11'
8-A	0 - 4'	4 - 6'	6 - 10'
9-A	0 - 4'	4 - 8'	8 - 12'
10-A	0 - 4.5'	4.5 - 5.5'	5.5 - 10'
11-A	0 - 3.5'	3.5 - 5.5'	5.5 - 10'
12-A	0 - 3.5'	3.5 - 5'	5 - 10'
13-A	0 - 3'	3 - 7'	7 - 11'
14-A	0 - 3'	3 - 5.5'	5.5 - 10'
15-A	0 - 2.5'	2.5 - 6'	6 - 10'
16-A	0 - 1.5'	1.5 - 4'	4 - 10'
17-A	0 - 2.5'	2.5 - 6'	6 - 10'
18-A	0 - 3.5'	3.5 - 5.5'	5.5 - 10'
19-A	0 - 3.5'	3.5 - 5'	5 - 10'
20-A	0 - 3'	3 - 7'	7 - 11'
21-A	0 - 2.7'	2.7 - 5.5'	5.5 - 10'
22-A	0 - 3'	3 - 8.5'	8.5 - 12.5'
23-A	0 - 2.75'	2.75 - 8'	8 - 12'
24-A	0 - 3.5'	3.5 - 7'	7 - 11'

PERSSON DRILLING CORPORATION
4903 SEAGRAPE DRIVE • FORT PIERCE, FLORIDA 33450 • (305) 465-6797

BORING LOGS FOR SAVANNAH CLUB - SHALLOW WELLS

Well #	Surface Sands	Hardpan	Sands below Hardpan
25-A	0 - 3.5'	3.5 - 6'	6 - 10'
26-A	0 - 3'	3 - 6'	6 - 10'
27-A	0 - 2.5'	2.5 - 5.5'	5.5 - 10'
28-A	0 - 3'	3 - 7'	7 - 11'
29-A	0 - 3'	3 - 6'	6 - 12'
30-A	0 - 3'	3 - 6'	6 - 12'
31-A	0 - 4'	4 - 9'	9 - 13'
32-A	0 - 2.5'	2.5 - 5'	5 - 10'

APPENDIX C

WATER QUALITY ANALYSIS

GEO TEC inc. 1602 CLARE AVENUE • WEST PALM BEACH, FL 33401 • 305/833-7280

RECEIVED
MAY 14 1981

LAB ID 86122

ANALYSIS REPORT

GERAGHTY & MILLER, INC.

SAMPLE NO. 14-108, 14-109

Geraghty & Miller
Attn: Jim Wheatley
1675 Palm BeachLakes Blvd. Suite 404
West Palm Beach, FL 33401

DATE REC'D 4/24/81

TIME REC'D

PROJECT NO.

DATE COLLECTED BY client TIME

LOCATION PURPOSE

Parameter	P482SVI early	P482SVI late
Total dissolved solids	362	360
Total hardness*	258	258
Total alkalinity*	234	246
Non-carbonate hardness*	24	12
Bicarbonate*	234	246
Carbonate*	0	0
Bicarbonate, HCO_3	285	300
Iron	0.43	0.43
Sulfate	3.5	2.4
Chloride	24	24
Calcium	103	98
Magnesium	less than 1	3
Fluoride	0.21	0.22

*expressed as $CaCO_3$
All values are mg/l

DATE 5/7/81 BY BMorton

GEO TEC

GEO TEC inc. 1602 CLARE AVENUE • WEST PALM BEACH, FL 33401 • 305/833-7280

LAB ID 86122

ANALYSIS REPORT

SAMPLE NO. 14-108,109

Geraghty & Miller
Attn: Jim Wheatley
1675 Palm Beach Lakes Blvd. - Suite 404
West Palm Beach, FL 33401

DATE REC'D 4/24/81

TIME REC'D

PROJECT NO.

DATE COLLECTED BY client TIME

LOCATION PURPOSE

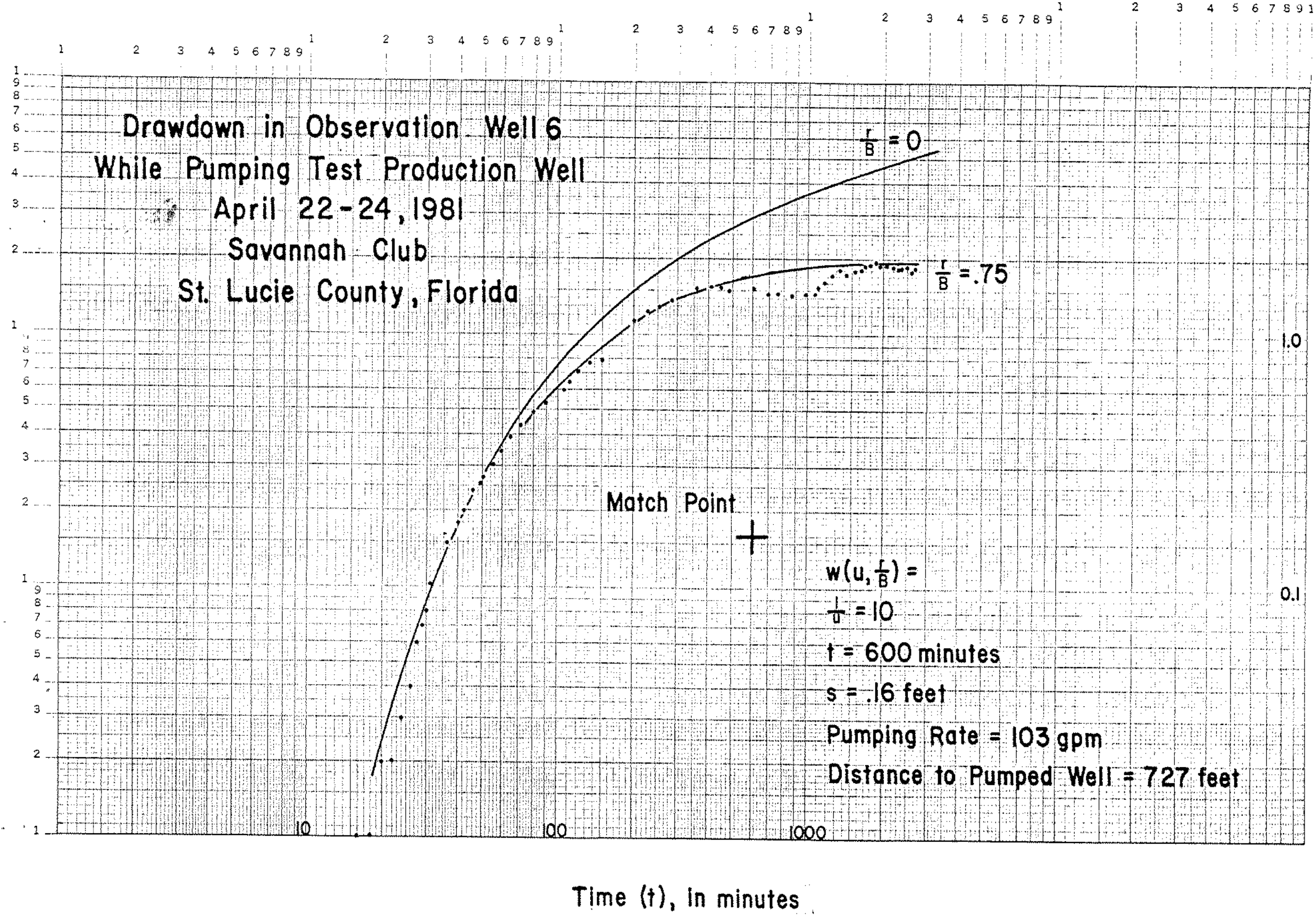
Parameter	P482SVI early	P482SVI late
Color, APHA	30	30
pH	6.9	7.1
pH_s	7.1	7.1
Stability index	7.3	7.1

DATE 5/7/81 BY [signature]

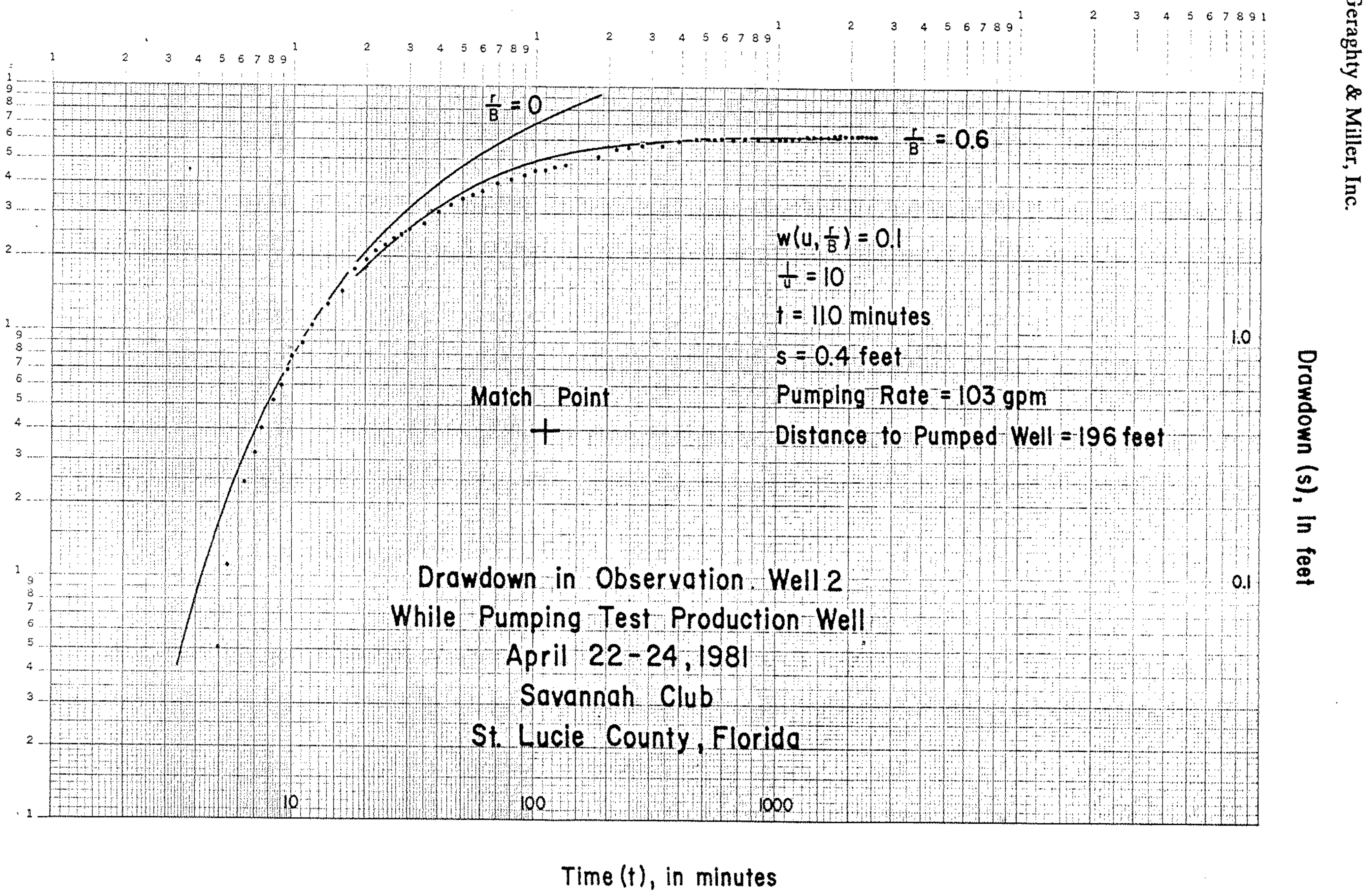
GEO TEC

APPENDIX D

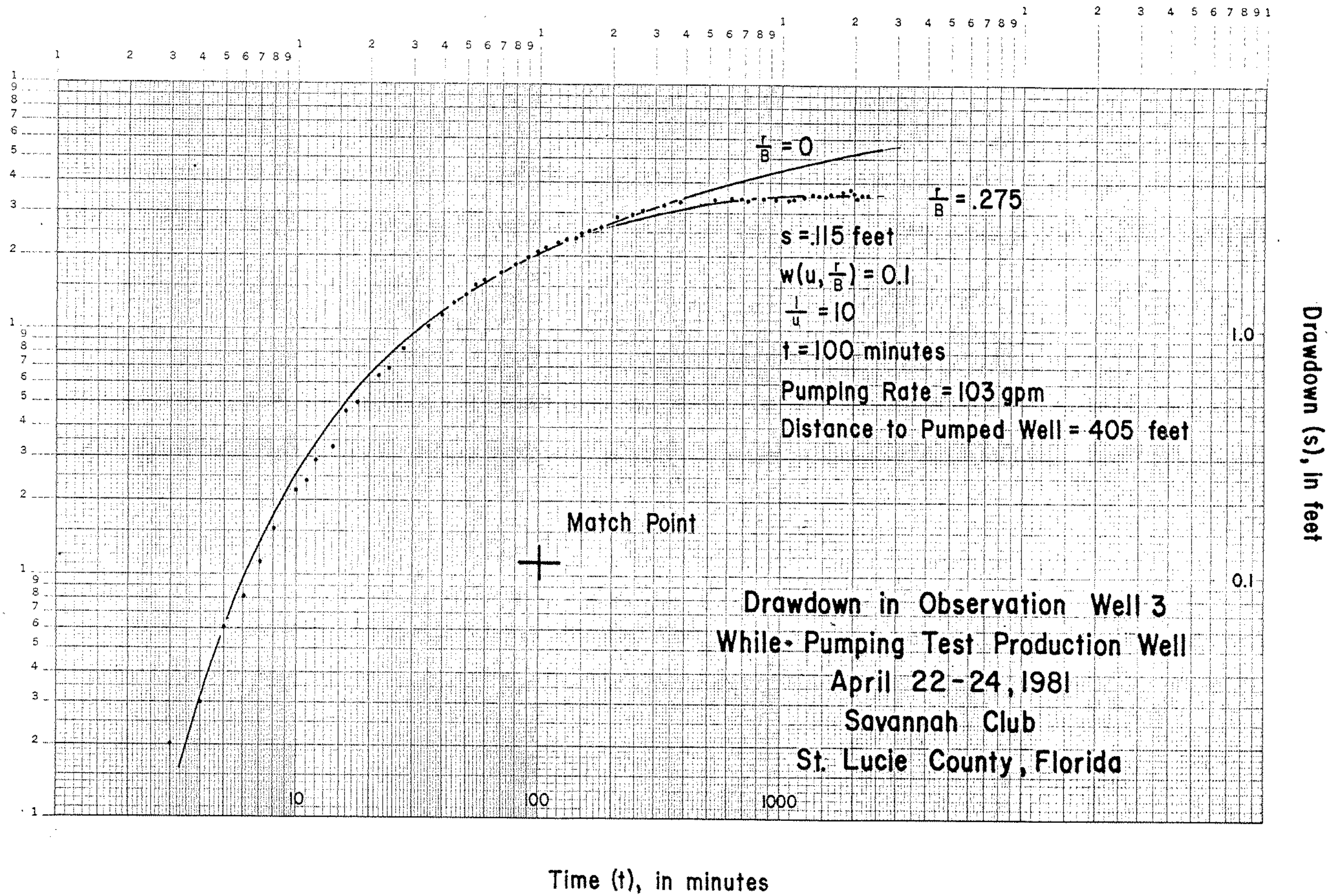
PUMPING TEST DATA PLOTS



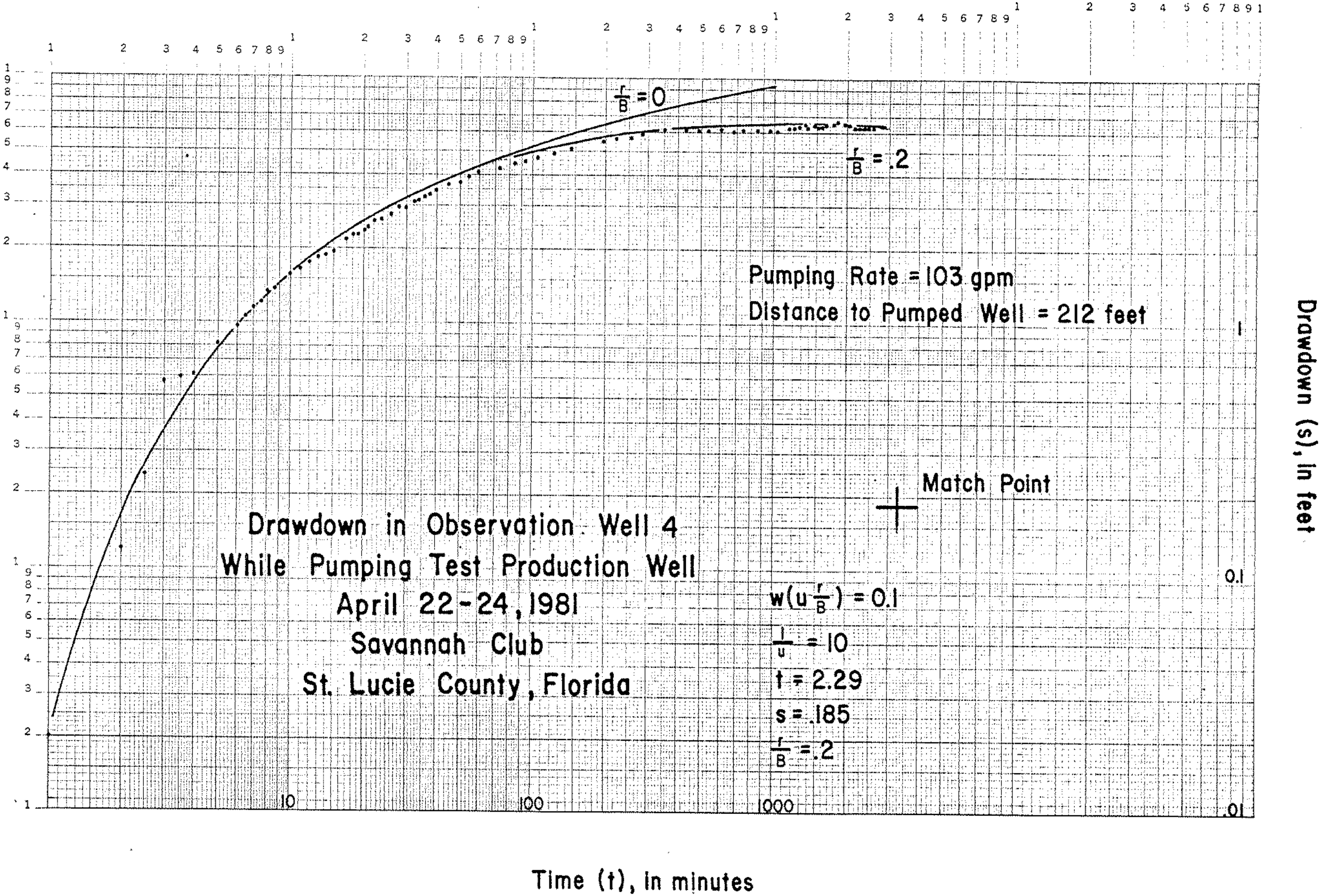
Geraghty & Miller, Inc.



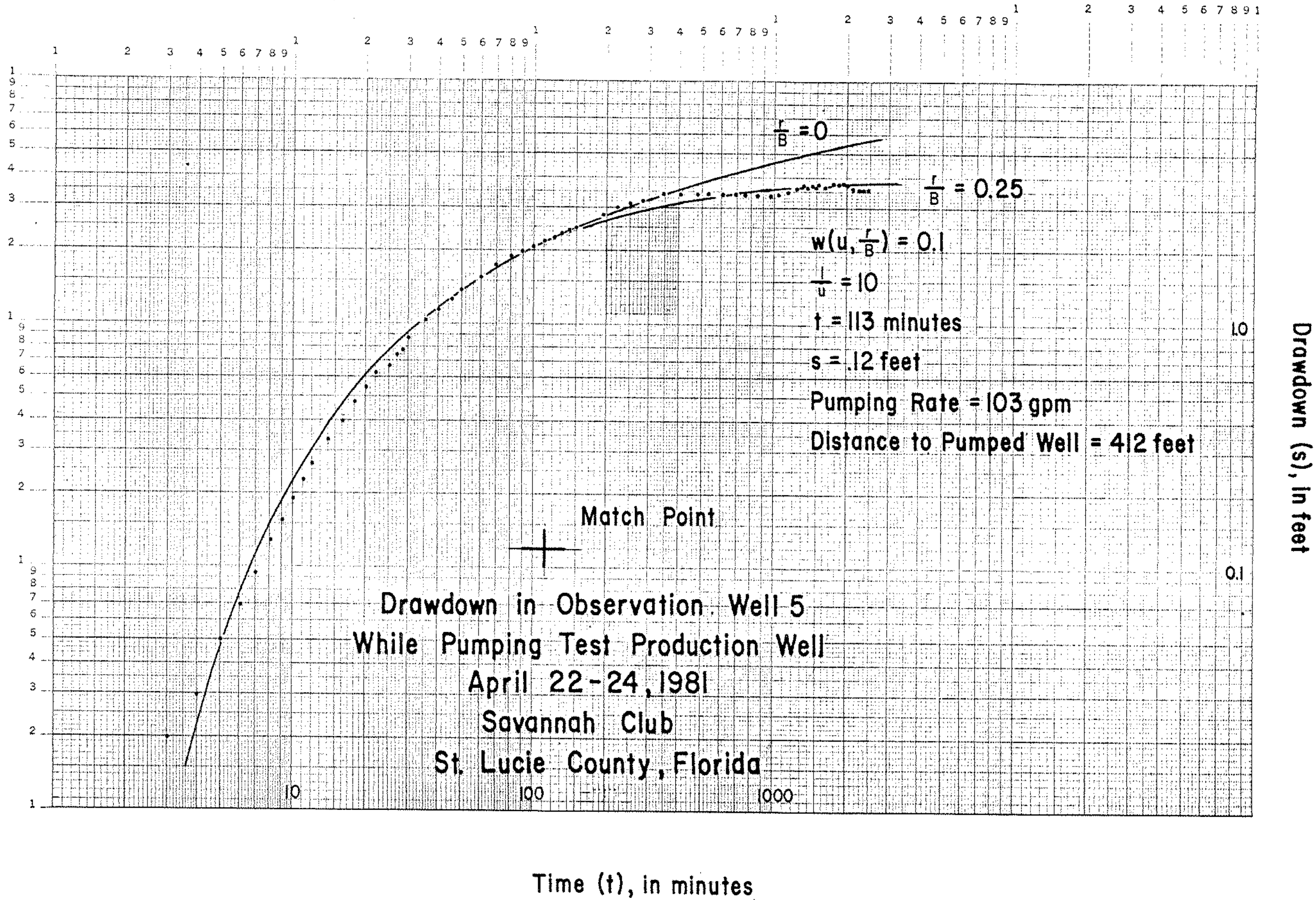
Geraghty & Miller, Inc.
r/B = 0
r/B = 0.6
w(u, r/B) = 0.1
1/u = 10
t = 110 minutes
s = 0.4 feet
Pumping Rate = 103 gpm
Distance to Pumped Well = 196 feet
Match Point
Drawdown in Observation Well 2
While Pumping Test Production Well
April 22-24, 1981
Savannah Club
St. Lucie County, Florida
10
100
1000
1.0
0.1
Drawdown (s), in feet
Time (t), in minutes



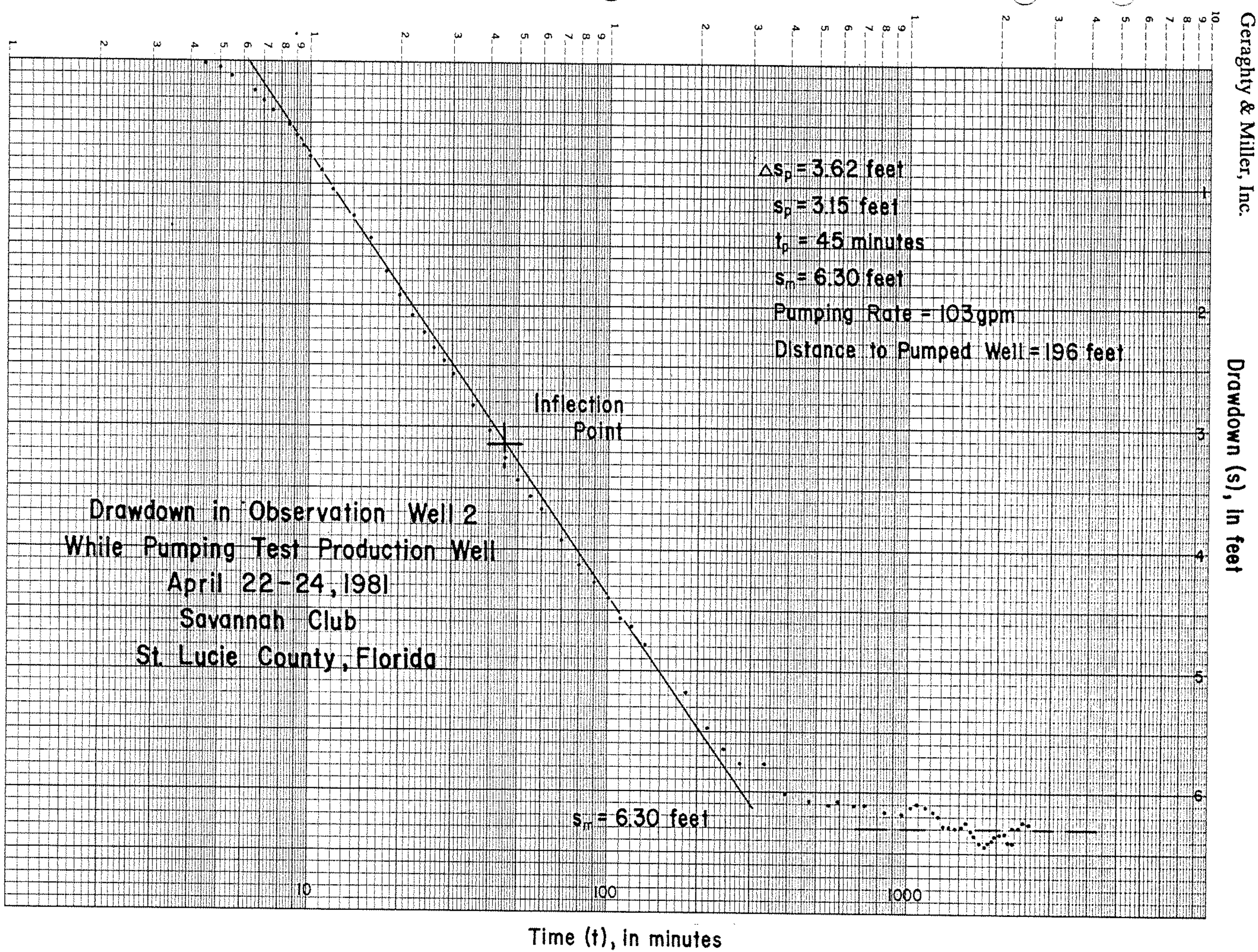
Geraghty & Miller, Inc.



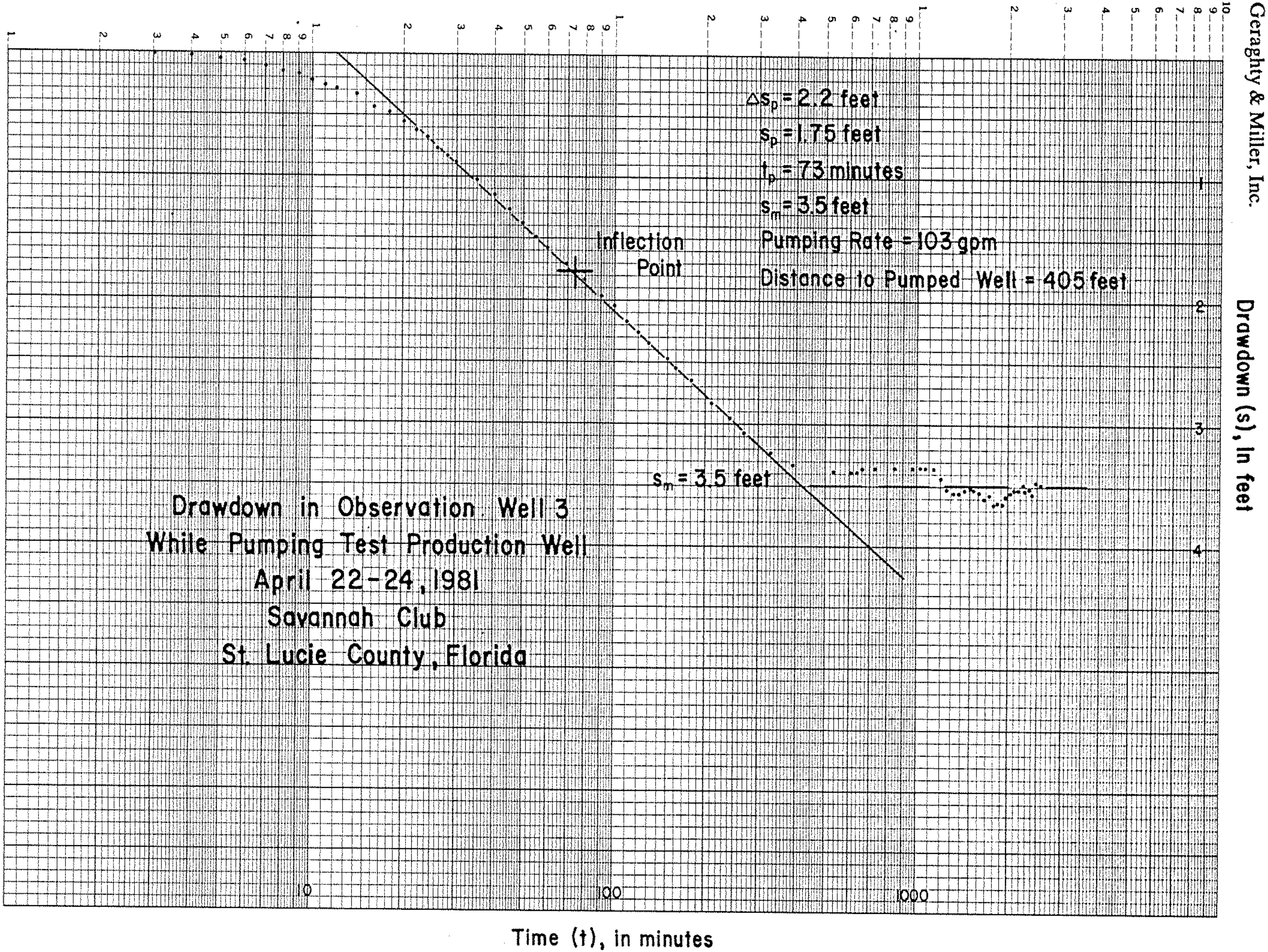
Geraghty & Miller, Inc.



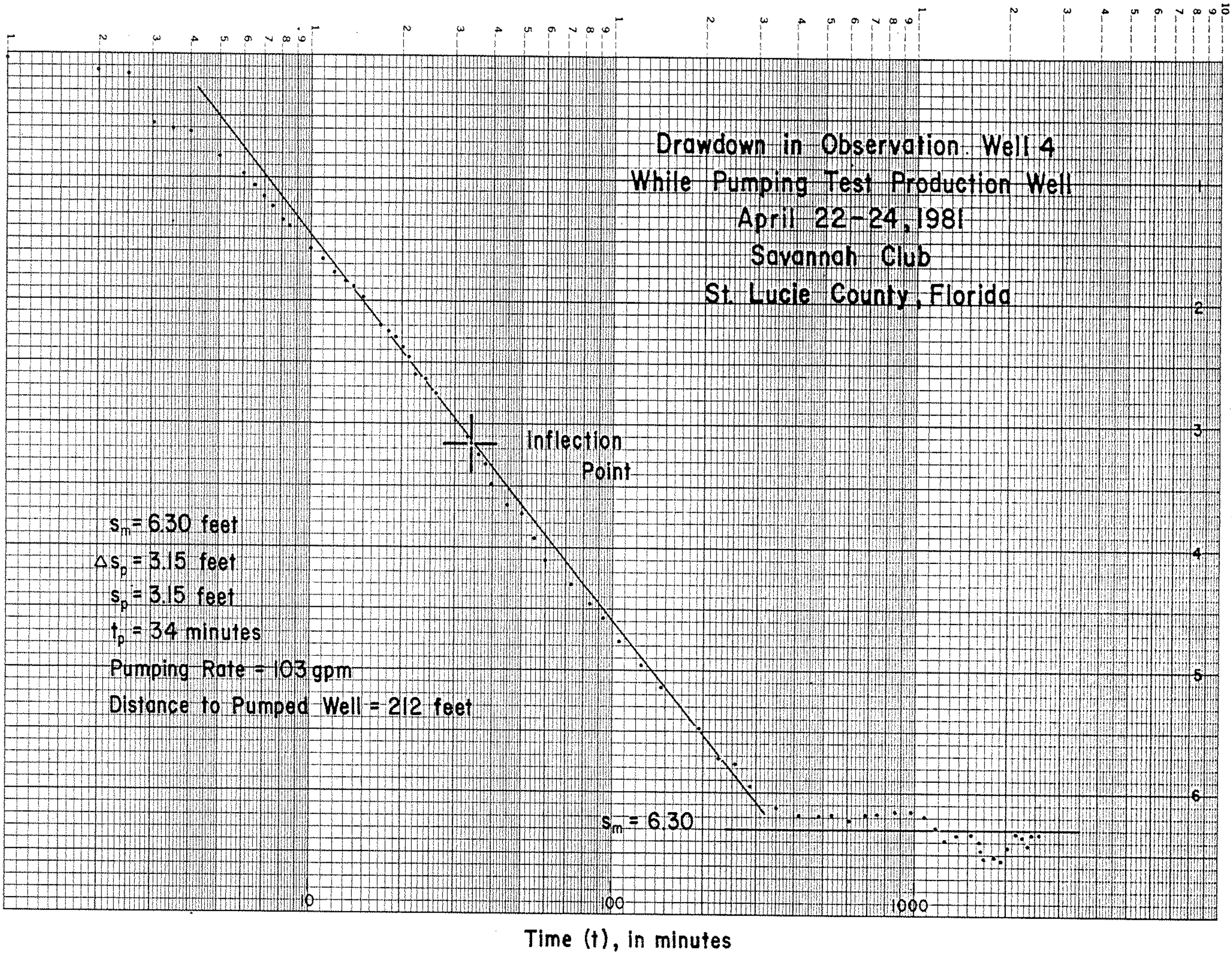
r/B = 0
r/B = 0.25
w(u, r/B) = 0.1
1/u = 10
t = 113 minutes
s = .12 feet
Pumping Rate = 103 gpm
Distance to Pumped Well = 412 feet
Match Point
Drawdown in Observation Well 5
While Pumping Test Production Well
April 22-24, 1981
Savannah Club
St. Lucie County, Florida
10
100
1000
1.0
0.1
Drawdown (s), in feet
Time (t), in minutes



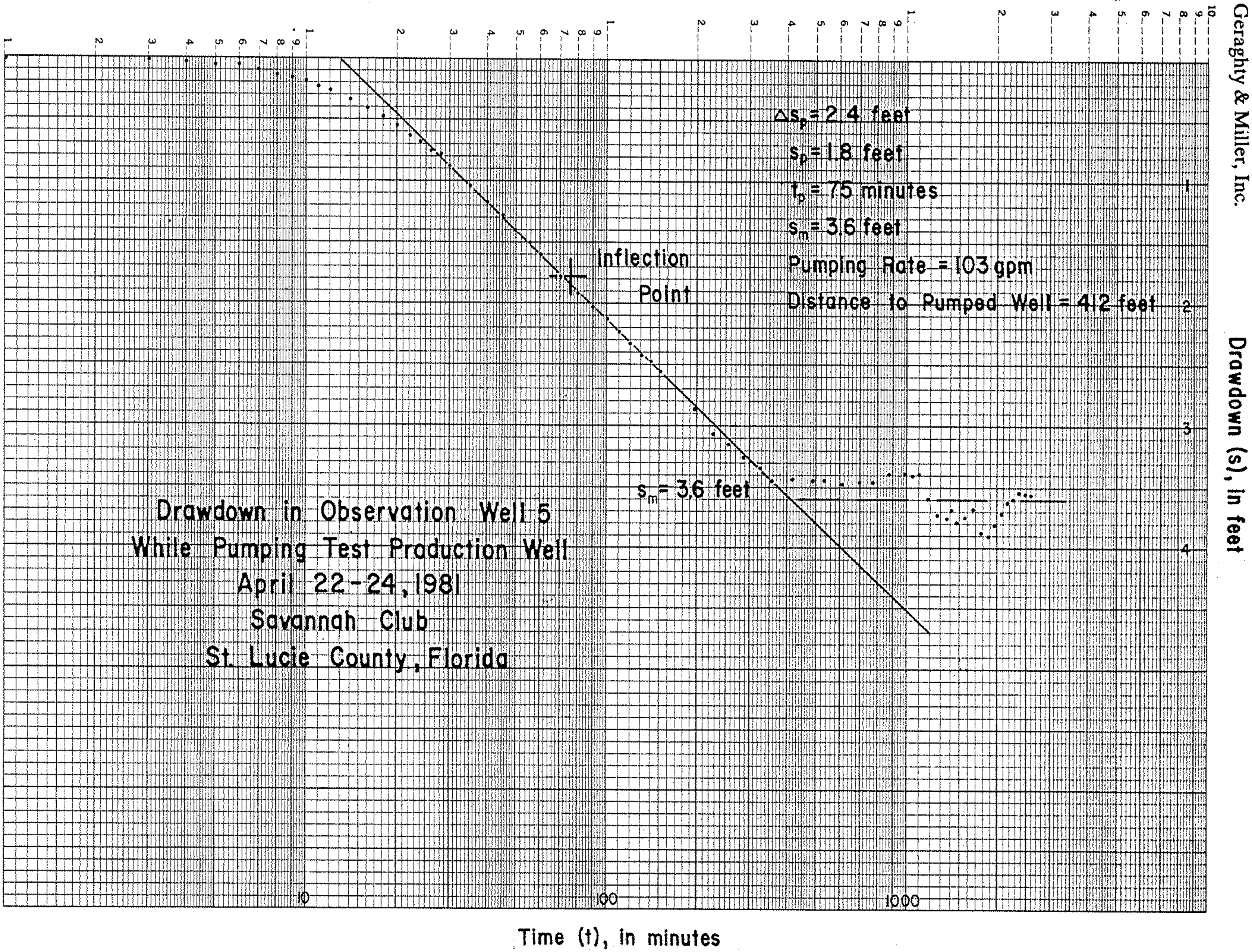
Drawdown in Observation Well 2
While Pumping Test Production Well
April 22-24, 1981
Savannah Club
St. Lucie County, Florida
△s_p = 3.62 feet
s_p = 3.15 feet
t_p = 45 minutes
s_m = 6.30 feet
Pumping Rate = 103 gpm
Distance to Pumped Well = 196 feet
Inflection Point
s_m = 6.30 feet
10
100
1000
Time (t), in minutes
Drawdown (s), in feet
Geraghty & Miller, Inc.



Geraghty & Miller, Inc.



Geraghty & Miller, Inc.



Geraghty & Miller, Inc.

PREPARED FOR

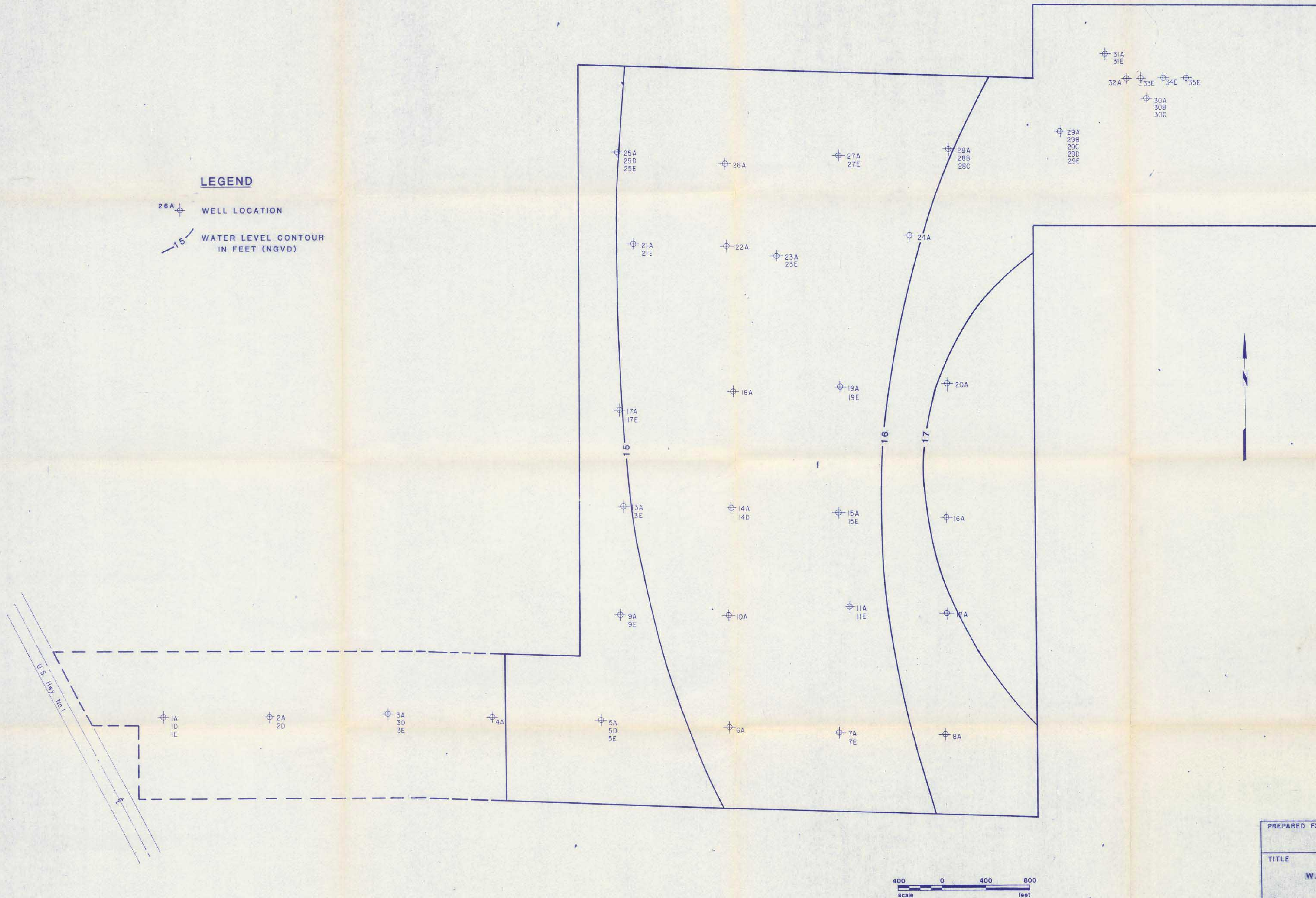
SAVANNAH CLUB

TITLE

MODEL WELL FIELD CONFIGURATION
AND PREDICTED DRAWDOWNS FROM
A DIVERSION OF 0.45 mgd
ST. LUCIE COUNTY, FLORIDA

COMPILED BY J. A. Wheatley	Geraghty & Miller, Inc. West Palm Beach, Florida	DATE June 24, 1981
DRAWN BY P.Q. Smith		REVISED
CHECKED BY J. A. Wheatley	SCALE 1 inch = 400 feet	PLATE 3


PROPERTY LINE
EDGE OF WETLANDS
31A 31E
32A
33E
34E
35E
30A 30B 30C
11.5
12.0
29A 29B 29C 29D 29E
25A 25D 25E
26A
27A 27E
28A 28B 28C
12.5
12.5
PROPERTY LINE
21A 21E
22A
23A 23E
24A
LEGEND
15A 15E
WELL LOCATION
9.5
WATER LEVEL CONTOUR IN FEET (N.G.V.D.)
Water - table Divide
18A
19A 19E
20A
17A 17E
13A 13E
14A 14D
15A 15E
16A
12.5
9A 9E
10A
12.5
11A 11E
12A
12.0
PROPERTY LINE
U.S. Hwy. No. 1
See figure 2 for Detail
1A 1D 1E
2A 2D
3A 3D 3E
4A
5A 5D 5E
6A
7A 7E
8A
9.5
10.0
10.5
11.0
11.5
PROPERTY LINE
N
400 0 400 800
scale feet
PREPARED FOR
SAVANNAH CLUB
TITLE
WATER-TABLE CONTOUR MAP
APRIL 13, 1981
ST. LUCIE COUNTY, FLORIDA
COMPILED BY J.A. Wheatley
DRAWN BY P.Q. Smith
CHECKED BY J.A. Wheatley
Geraghty & Miller, Inc.
West Palm Beach, Florida
DATE June 24, 1981
REVISED
SCALE 1 inch = 400 feet
PLATE 2



PREPARED FOR

SAVANNAH CLUB

TITLE

WATER-TABLE CONTOUR MAP
MARCH 3, 1983
ST. LUCIE COUNTY, FLORIDA

COMPILED BY J. Roland	Geraghty & Miller, Inc. West Palm Beach, Florida	DATE April 15, 1983
DRAWN BY P.Q. Smith		REVISED
CHECKED BY J.A. Wheatley	SCALE As Shown	

FT. PIERCE

FT. PIERCE SW

EDEN

PALM CITY

SCALE 1:24,000

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

DATE OF PHOTOGRAPHY: 1979

MARK HURD AERIAL SURVEYS INC

345 PENNSYLVANIA AVENUE SOUTH • MINNEAPOLIS, MINNESOTA 55426

N

State of Florida

ANKONA

987

WELL COMPLETION DATA
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Well	Depth Below Land Surface: Total Drilled Depth (feet)	Depth Below Land Surface: Screen Interval (feet)	Elevation (NGVD)
Test Production	105	70-100	15.390
obs-1	100	70-100	17.180
obs-2	100	70-100	17.120
obs-3	100	70-100	-
obs-4	100	70-100	-
obs-5	100	70-100	-
obs-6	100	70-100	-
1-A	10	7-10	16.830
1-D	119	40-75	17.070
1-E	3	2-3	17.320
2-A	10	7-10	19.156
2-D	120	70-115	18.926
3-A	13	10-13	18.455
3-D	123	50-100	18.955
3-E	3	2-3	19.285
4-A	10	7-10	-
5-A	10	7-10	16.759
5-D	125	47-83	16.559
5-E	3	2-3	16.069
6-A	10	7-10	19.675
7-A	11	8-11	20.215
7-E	3	2-3	20.155
8-A	10	7-10	19.843
9-A	12	9-12	18.177
9-E	4	3-4	18.127
10-A	10	7-10	20.014
11-A	10	7-10	19.849
11-E	3.5	2.5-3.5	19.889
12-A	10	7-10	20.055
13-A	11	9-11	20.428
13-E	3	2-3	20.498
14-A	10	7-10	-
14-D	125	80-125	-
15-A	10	7-10	19.789
15-E	2.5	1.5-2.5	19.849
16-A	10	7-10	20.135
17-A	10	7-10	19.407
17-E	2.5	1.5-2.5	19.827
18-A	10	7-10	20.173
19-A	10	7-10	20.231
19-E	3.5	2.5-3.5	20.321

WELL COMPLETION DATA
SAVANNAH CLUB
PORT ST. LUCIE, FLORIDA

Well	Depth Below Land Surface: Total Drilled Depth (feet)	Depth Below Land Surface: Screen Interval (feet)	Elevation (NGVD)
20-A	11	9-11	20.760
21-A	10	7-10	20.453
21-E	2.7	1.7-2.7	21.023
22-A	12.5	9.5-12.5	21.229
23-A	12	9-12	20.457
23-E	2.75	1.75-2.75	20.477
24-A	11	8-11	20.568
25-A	10	7-10	20.850
25-D	135	55-95	20.918
25-E	3.5	2.5-3.5	20.098
26-A	10	7-10	19.532
27-A	10	7-10	11.975
27-E	2.5	1.5-2.5	11.475
28-A	11	8-11	19.713
28-B	40	50-60	19.748
28-C	60	45-60	19.708
29-A	12	9-12	19.653
29-B	40	30-40	19.853
29-C	60	50-60	19.803
29-D	135	80-125	19.553
29-E	3	2-3	19.533
30-A	12	9-12	16.998
30-B	40	35-40	16.933
30-C	60	50-60	16.863
31-A	13	10-13	17.728
31-E	4	3-4	18.638
32-A	10	7-10	16.821
33-E	3	2-3	-
34-E	3	2-3	-
35-E	3	2-3	-

Geraghty & Miller, Inc.

PUMPING TEST FORM

PROJECT P4825U1 WELL 1A LOCATION Savannah Club PAGE 1 OF 2

SCREEN 7-10 feet M.P. toc HT. ABOVE G.S. ______ W.L. MEAS. W/ tape

r 6.75' PUMPING WELL Test Production @ 100gpm ORIFICE 3x6 WEATHER Cl/Hot

✓ DRAWDOWN ___ RECOVERY ___ LOCATION SKETCH

TEST START APRIL 22, 1981 END APRIL 24, 1981

DATE TIME	t	HELD	WET	D.T.W.	s			MANO-METER	Q	WATER TEMP.	
	0			9.59							
1400	5			9.52	0.07						
	10			8.96	0.63						
	15			8.92	0.67						
	25			8.92	0.67						
1430	30			8.99	0.60						
	35			8.95	0.64						
	40			8.99	0.60						
	45			8.95	0.60						
	50			8.92	0.67						
	55			8.94	0.65						
1500	60			8.94	0.65						
	70			8.92	0.67						
	80			8.91	0.68						
	90			8.91	0.68						
	100			8.93	0.66						
	110			8.93	0.66						
1600	120			8.93	0.66						
	141			8.94	0.65						
	173			8.94	0.64						
	198			8.97	0.62						
1750	230			8.98	0.61						
	260			8.96	0.63						
	292			9.02	0.57						
1945	345			9.03	0.56						
	396			9.05	0.54						
	468			9.04	0.55						
2300	540			9.04	0.55						
	595			9.03	0.56						
0056	656			9.04	0.55						
	747			9.04	0.55						
0420	860			9.06	0.53						
	976			9.08	0.51						
	1037			9.09	0.50						
0810	1090			9.08	0.51						
	1158			9.08	0.51						
	1212			9.08	0.51						
1110	1270			9.09	0.50						

1A

PUMPING TEST FORM

Geraghty & Miller, Inc.

PROJECT P482SUI WELL 1A LOCATION Savannah Club PAGE 2 OF 2

SCREEN 7-10feet M.P. toc HT. ABOVE G.S. ____ W.L. MEAS. W/ tape

r 6.75' PUMPING WELL Test Production 100gpm ORIFICE 3x6 WEATHER Cl/Hot

✓ DRAWDOWN __ RECOVERY __ LOCATION SKETCH TEST START April 22, 1981 END April 24, 1981

DATE TIME	t	HELD	WET	D.T.W.	s			MANO-METER	Q	WATER TEMP.	
1217	1337			9.08	0.51						
	1405			9.07	0.52						
1407	1462			9.08	0.51						
	1523			9.08	0.51						
	1589			9.08	0.51						
	1644			9.09	0.50						
1812	1707			9.11	0.48						
	1785			9.13	0.46						
	1815			9.12	0.47						
2121	1881			9.10	0.49						
	1934			9.14	0.45						
	1999			9.15	0.44						
0015	2055			9.17	0.42						
	2113			9.15	0.44						
	2177			9.15	0.44						
0320	2240			9.15	0.44						
	2298			9.15	0.44						
	2370			9.19	0.40						
0610	2410			9.18	0.41						
	2476			9.18	0.41						
0807	2527			9.17	0.42						

1A