Gerhardt M.
Witt
& Associates, Inc.

Seminole Golf Club, Inc.
Floridan Aquifer Production Well
Well Completion Report

Hydrogeology, Geology, and Water Resources

Gerhardt M.
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Sent via: **HAND DELIVERED**

December 9, 2002

Mr. Hal Hicks
Golf Course Superintendent
Seminole Golf Club, Inc.
901 Seminole Boulevard
Juno Beach, Florida 33408-2599

**RE: SEMINOLE GOLF CLUB, INC.
FLORIDAN AQUIFER PRODUCTION WELL
WELL COMPLETION REPORT**

Dear Mr. Hicks:

Enclosed are five (5) originals of the above-referenced report. We have also delivered four (4) originals of same to Mr. Thomas Colios of the South Florida Water Management District.

Should you have any questions, please feel free to call.

Respectfully submitted,

GERHARDT M. WITT & ASSOCIATES, INC.

Gerhardt M. Witt, P.G. 12-09-02
Principal Hydrogeologist #347

c: Thomas Colios, South Florida Water Management District
Jorg Menningman, Sanitaire Water Equipment Technologies
Anne Dodd, Gerhardt M. Witt & Associates, Inc.
Michael Caglioni, Gerhardt M. Witt & Associates, Inc.

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Seminole Golf Club, Inc.
Floridan Aquifer Production Well
Well Completion Report

Prepared for:

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901 Seminole Boulevard
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December 09, 2002

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INTRODUCTION

1.0 INTRODUCTION

Gerhardt M. Witt & Associates, Inc. ("GMW&A") was contracted by the Seminole Golf Club, Inc. ("Seminole") to assist with the installation of one (1), new, Floridan aquifer well (**Figure 1-1: Floridan Well Location Map**). Seminole is currently permitted to withdraw 161 million gallons per year total, all of which may come from Floridan aquifer sources. The raw water from the Floridan well will be processed through a reverse osmosis plant. Approximately 75% of the raw water will become product water (permeate), and 25% will become concentrate (reject). The concentrate will be disposed of through an infiltration trench (FDEP Permit No. FLA290262). Production from the Floridan aquifer will reduce or eliminate the need to utilize the seven (7) Surficial aquifer wells (currently limited by permit to 80 million gallons per year) for irrigation purposes and therefore constitutes a reasonable and beneficial use of the State's resources. GMW&A's work included technical well specifications, assistance with the well head design, bidding services, hydrogeologic field services, and preparation of the well completion report.

Seminole Location Map

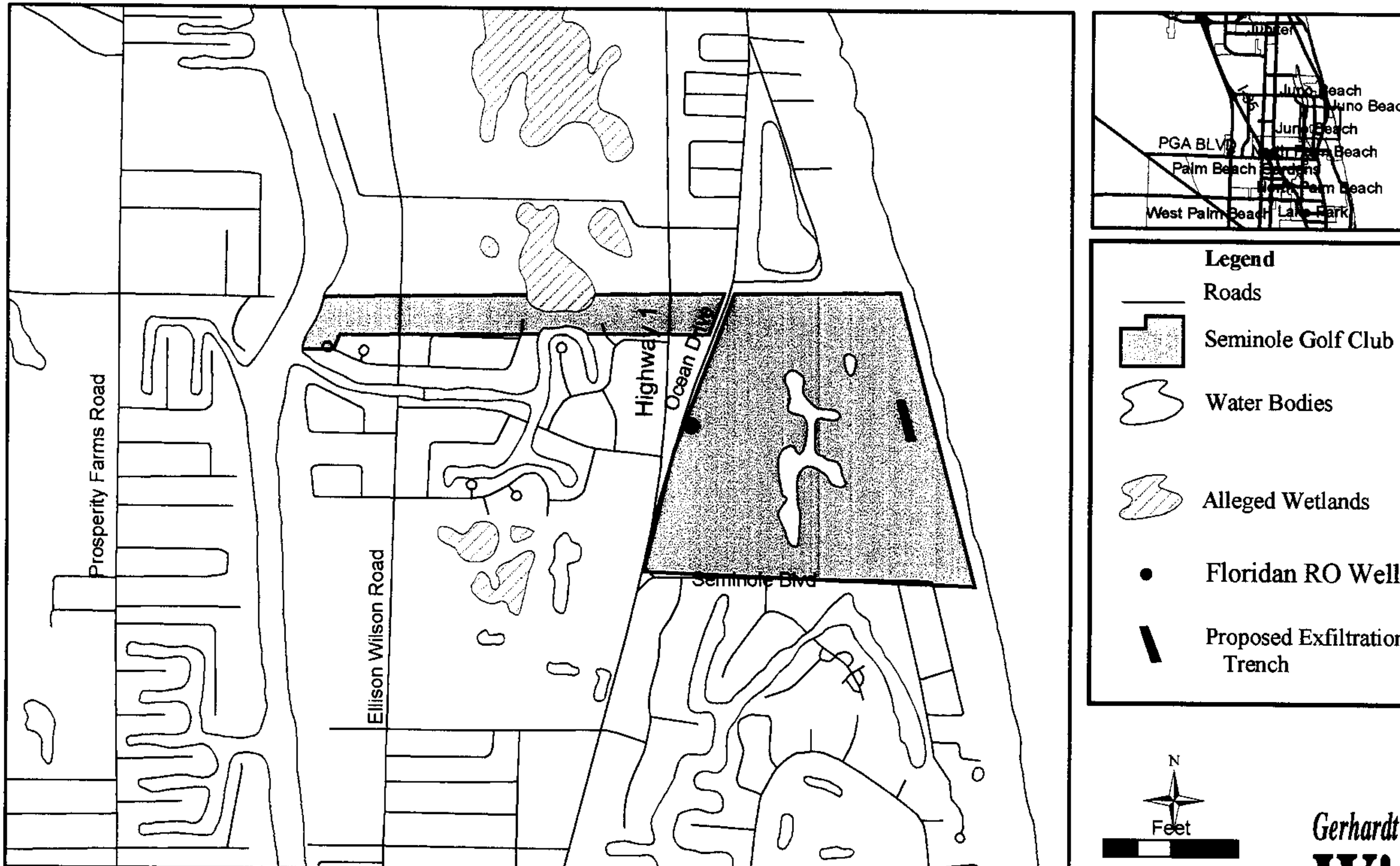

Figure 1-1

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SECTION 2

GEOLOGY AND HYDROGEOLOGY

SECTION 2

GEOLOGY AND HYDROGEOLOGY

2.0 REGIONAL GEOLOGY AND HYDROGEOLOGY

The geology of southeast Florida consists of approximately 16,000 vertical feet of sedimentary rocks ranging in age from Holocene (recent) to Cretaceous (140 million years in age). Underlying the sedimentary rock is a complex sequence of older igneous and metamorphic rock that makes up the base (or basement complex) of the Florida Peninsula. Since the geology occurring within 4,000 feet below land surface ("bls") is the unit of primary interest to the people in southeast Florida, this geologic section is briefly described.

Generally, in northeastern Palm Beach County, the first 350 feet bls consist of a series of Late Pleistocene to Miocene formations composed of limestone, sandstone, sand, and clay. The formations consist (from top to bottom) of the Pamlico Sand, the Anastasia Formation, and the upper portion of the Tamiami Formation. These formations comprise the Surficial (Biscayne) aquifer, which serves as a source of most irrigation and potable water for the people of Palm Beach County.

Underlying the Surficial Aquifer System is a Miocene aquiclude/aquitard consisting of the lower units of the Tamiami and the Hawthorn Formations, referred to as the Hawthorn Group. The aquiclude consists of clay, marl, limestone, and chert from depths of approximately 350 to 900 feet bls. The major significance of this unit is that it is the confining bed sequence that separates the Surficial Aquifer System from the Floridan Aquifer System.

The upper Floridan Aquifer System is composed of several geologic units of Eocene age, the most prominent being (from top to bottom) the Ocala Group, the Avon Park Limestone, and the Lake City Limestone. Current convention is that the upper aquifer extends from 900 feet bls to a depth of approximately 2,300 feet bls. Underlying the Lake City Limestone is the Eocene Oldsmar Formation, which consists of two (2) units, the upper Oldsmar (2,300 to 3,000 feet bls) and the lower Oldsmar (from 3,000 to 4,000 feet bls). The upper Oldsmar is a confining unit that separates the upper Floridan aquifer from the lower Oldsmar Formation and the lower Floridan aquifer. The lower Oldsmar, commonly called the Boulder Zone, is highly transmissive, contains non-potable water, and has been used for the disposal of waste products such as industrial by-products (including RO concentrate) and treated wastewater. Below the lower Oldsmar is the Paleocene Cedar Keys Limestone that acts as a lower confining unit for the Boulder Zone. **Figure 2-1: General Lithology** shows the lithology of the Palm Beach County area.

General Lithology
Palm Beach County Area

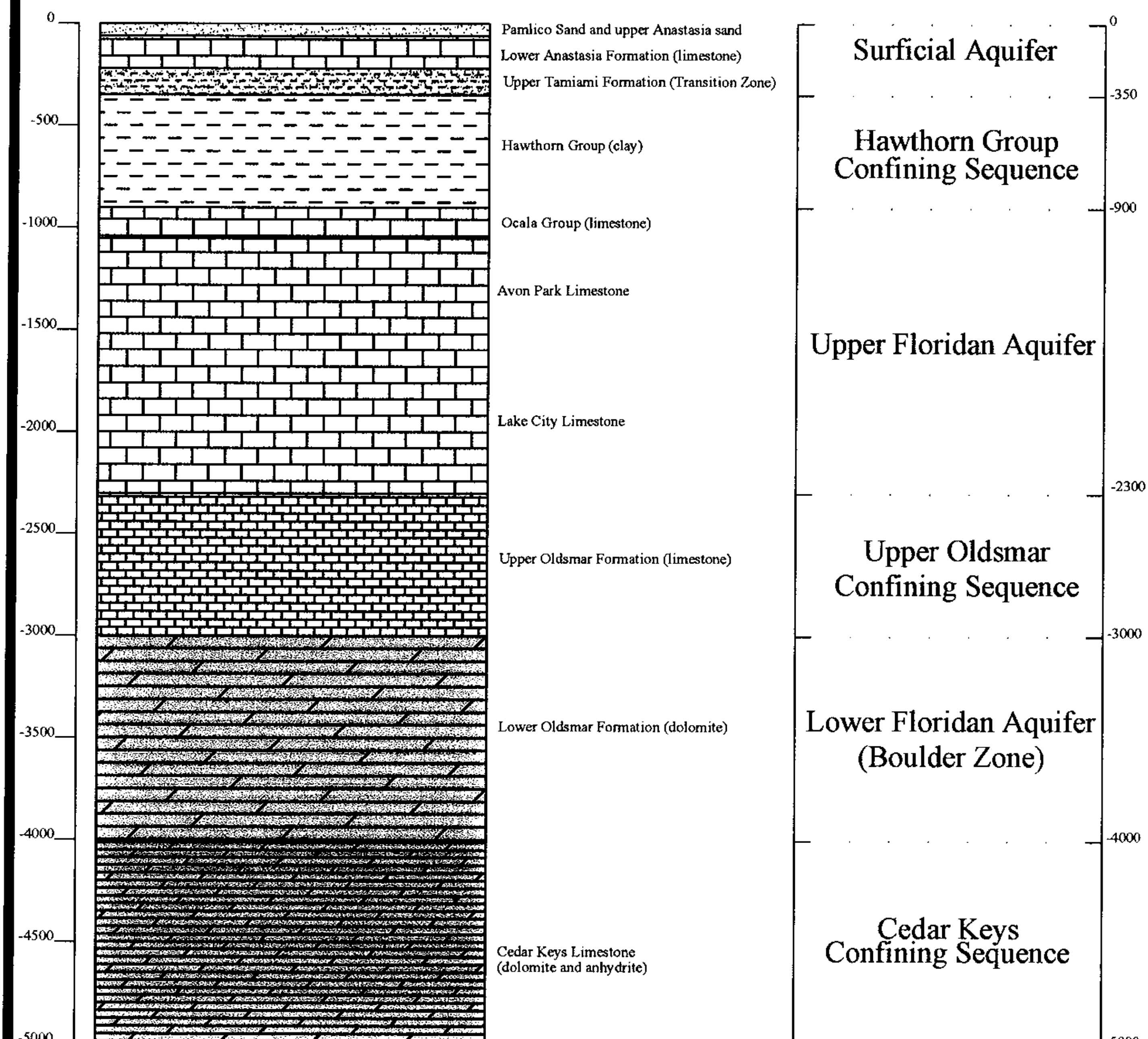

Figure 2-1

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2.1 SURFICIAL AQUIFER SYSTEM

The Surficial Aquifer System in the Seminole area is considered a water table aquifer exhibiting a delayed yield response. This means that the aquifer is stratified and that water moves faster laterally than vertically (downward and/or upward). Therefore, total drawdown of the aquifer is "delayed" as water moves vertically through the aquifer. Drawdown in a Surficial aquifer well will continue until the cone of depression/impression reaches a recharge boundary such as the Intracoastal Waterway and/or the Atlantic Ocean.

The Surficial aquifer water at the site contains fresh, brackish, and saline water. The aquifer exists from approximately two (2) feet bls to approximately 350 feet bls. Because water levels change in the Surficial aquifer, thereby affecting the saturated thickness of the aquifer, the aquifer's characteristics (transmissivity, specific yield, storage coefficient, and delayed yield) change with time. However, these changes are small and for the most part are considered negligible.

The Surficial Aquifer System at Seminole is used for withdrawal of irrigation water. Current wells in the Surficial aquifer consist of seven (7), water supply wells. Three (3) of these wells are located on the west side of Highway US1, and four (4) wells are on the dune ridge on the east side of Highway US1. The three (3) wells on the west side have been alleged to have impacted an alleged wetland area owned by Palm Beach County. Of the four (4) remaining wells, one (1) is restricted in withdrawal quantities because of a nearby gas station remediation project. It is proposed to use the saline portions of the Surficial aquifer near the Atlantic Ocean to dispose of reverse osmosis concentrate through an exfiltration gallery.

Coastal communities must be aware of the potential threat of saltwater encroachment (intrusion) from both the Atlantic Ocean and/or Intracoastal Waterway. The potential for saltwater encroachment can be best described as follows: If fresh ground water is adjacent to saline ground water, the difference in the density between the two (2) fluids becomes significant. The density of saline water (ρ_s) is greater (has a higher specific gravity) than the density of fresh water (ρ_f) (lower specific gravity). Saline water is found adjacent to fresh water in oceanic, coastal areas such as Florida and oceanic islands along the coast of Florida. At island locations, the fresh water forms a lens (bubble) that floats on the more dense, saline water. In addition, the fresh ground water beneath the land is discharging near the coast and mixing with the saline ground water. The total volume of fresh water held on the island is finite, that is, as more water is added (recharged), the water that is currently stored is discharged to sea. Although credit is given to Ghyben and Herzberg, this simplified assumption was addressed by Joseph DuCommun in 1828 when he observed that in unconfined coastal aquifers, the depth to which fresh water extends below sea level is approximately 40 times the height of the water table above the sea level (**Figure 2-2: Ghyben-Herzberg Principle**). Seminole is located on a barrier island with the Atlantic ocean to the east, the

Ghyben-Herzberg Principle in a porous island

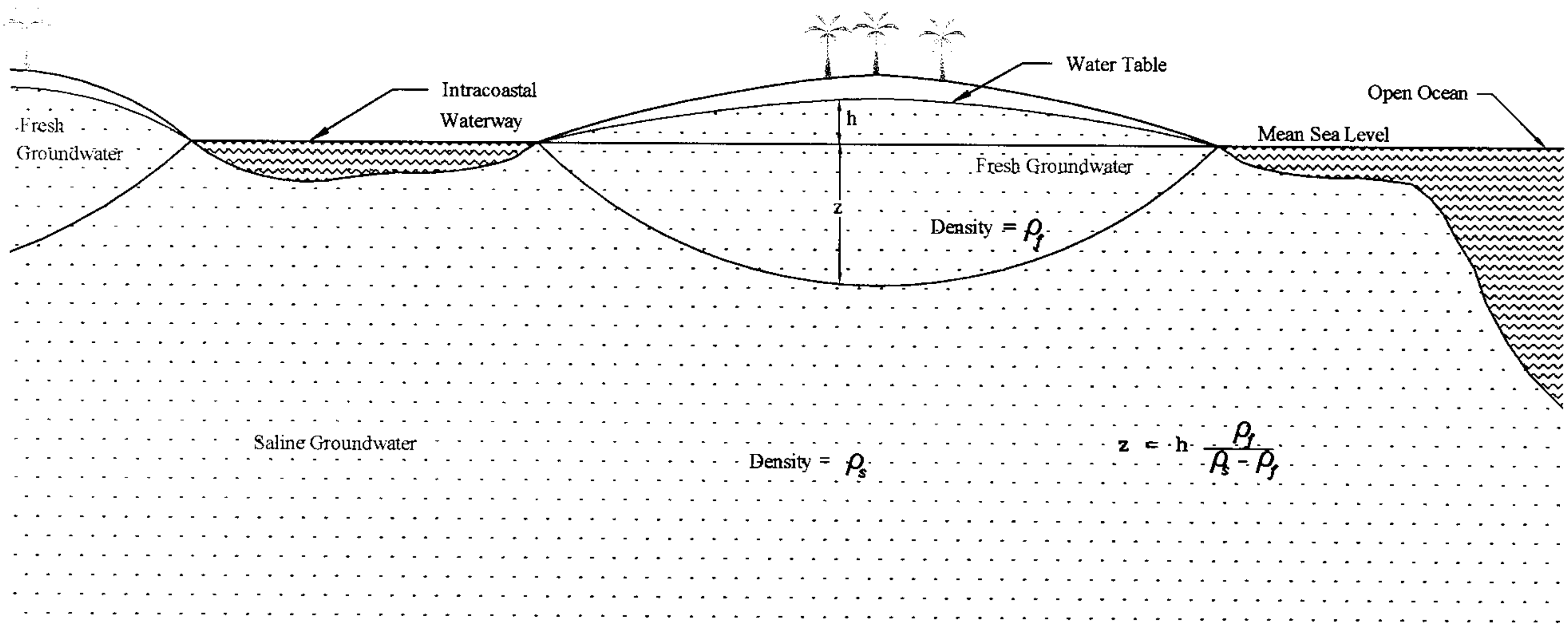

Figure 2-2

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Intracoastal Waterway to the west, Jupiter Inlet to the north, and Little Lake Worth, Lake Worth, and Lake Worth Inlet to the south. Therefore, Seminole is surrounded by saltwater bodies.

2.2 FLORIDAN AQUIFER SYSTEM

The Floridan aquifer is considered a leaky artesian aquifer. In essence, this means that the aquifer is under artesian pressure. In the case of the Seminole well, the pressure is significant enough that under non-pumping conditions, the well water level should rise to approximately 35 feet above mean sea level ("msl"). Since the elevation of Seminole's Floridan well will be approximately 25 feet above msl, this well should flow under non-pumping conditions. Therefore, the flowing conditions in the well <u>must be controlled or suppressed at all times</u>.

In the leaky artesian, Floridan aquifer, the drawdown in a well will continue until flow from the aquifer and the amount of leakance (water leaking in from above and below) is equal to the amount being removed (pumped). The cone of depression, widening and deepening, will continue outward until equilibrium is met.

The water in the Floridan aquifer is brackish, with a chloride concentration of 1,700 mg/L, sulfates of 390 mg/L, and total dissolved solids of 3,500 mg/L in the new Seminole well.

SECTION 3

WELL CONSTRUCTION

SECTION 3

WELL CONSTRUCTION

3.0 WELL CONSTRUCTION

Seminole obtained bids from three (3), licensed, water well contractors. Diversified Drilling Corporation ("Diversified") was the low, responsible bidder. The Floridan aquifer well was constructed by Diversified between August and October 2002. The maximum monthly raw water allocation for Seminole is 23.5 million gallons, or approximately 544 gallons per minute ("gpm"). However, the Seminole Club water treatment plant will run for only 12 hours each day, thereby necessitating a well design for twice the capacity to be pumped for one half the duration. Therefore, the well was designed for 1,088 gpm, or approximately 1,100 gpm. A chronology of well construction events is given in **Appendix A: Well Construction Chronology**.

Using mud rotary techniques, Diversified drilled a 42-inch diameter hole to 63 feet below land surface ("bls") and set the 36-inch outside diameter, 0.375-inch wall thickness, steel surface casing to 54.5 feet bls. A 10 ⅝-inch diameter pilot hole was drilled from 63 feet to 305 feet bls, and the pilot hole was reamed with a 35-inch diameter bit. After geophysically logging the hole, the 24-inch outside diameter, 0.375-inch wall thickness, steel casing was installed to 297 feet bls. The 24-inch diameter casing was cemented in place using 510 bags (831.3 cubic feet) of Type II cement with four percent (4%) bentonite (11 to 200 feet bls) and 100 bags (126 cubic feet) of Type II neat cement (200 to 300 feet bls). A 10 ⅝-inch diameter pilot hole was drilled from 305 to 1,175 feet bls. After geophysical logging, the hole was reamed to 1,084 feet bls with a 23-inch diameter bit. The 12-inch diameter (12.750-inch outside diameter, 11.070-inch minimum inside diameter), SDR 17, PVC casing was installed to a depth of 1,075 feet bls and cemented in place using 72 bags (90.72 cubic feet) of Type II, neat cement and 668 bags (1583.16 cubic feet) of Type II cement with 12% bentonite. The two (2)-inch diameter, monitor tube was set to approximately 100 feet bls. The open hole was drilled with a 10⅝-inch diameter bit using mud rotary drilling methods to 1,175 feet bls and then drilled with a 10⅝-inch diameter bit using reverse air drilling methods to 1,237 feet bls. The well was geophysically logged and television surveyed. **Figure 3-1: Floridan Aquifer Well** shows the construction details for the production well. The well was disinfected prior to installing the well head.

The theoretical volume of the annular space between the 24-inch outside diameter casing and the 35-inch diameter borehole to a depth of 297 feet bls was calculated to be approximately 1,050 cubic feet. Diversified used 957.30 cubic feet of cement to grout the 24-inch diameter casing in place. The slightly less than theoretical volume of cement used may have been due to swelling of the

Seminole Golf Club
Floridan Aquifer R.O. Well
Well Construction Details

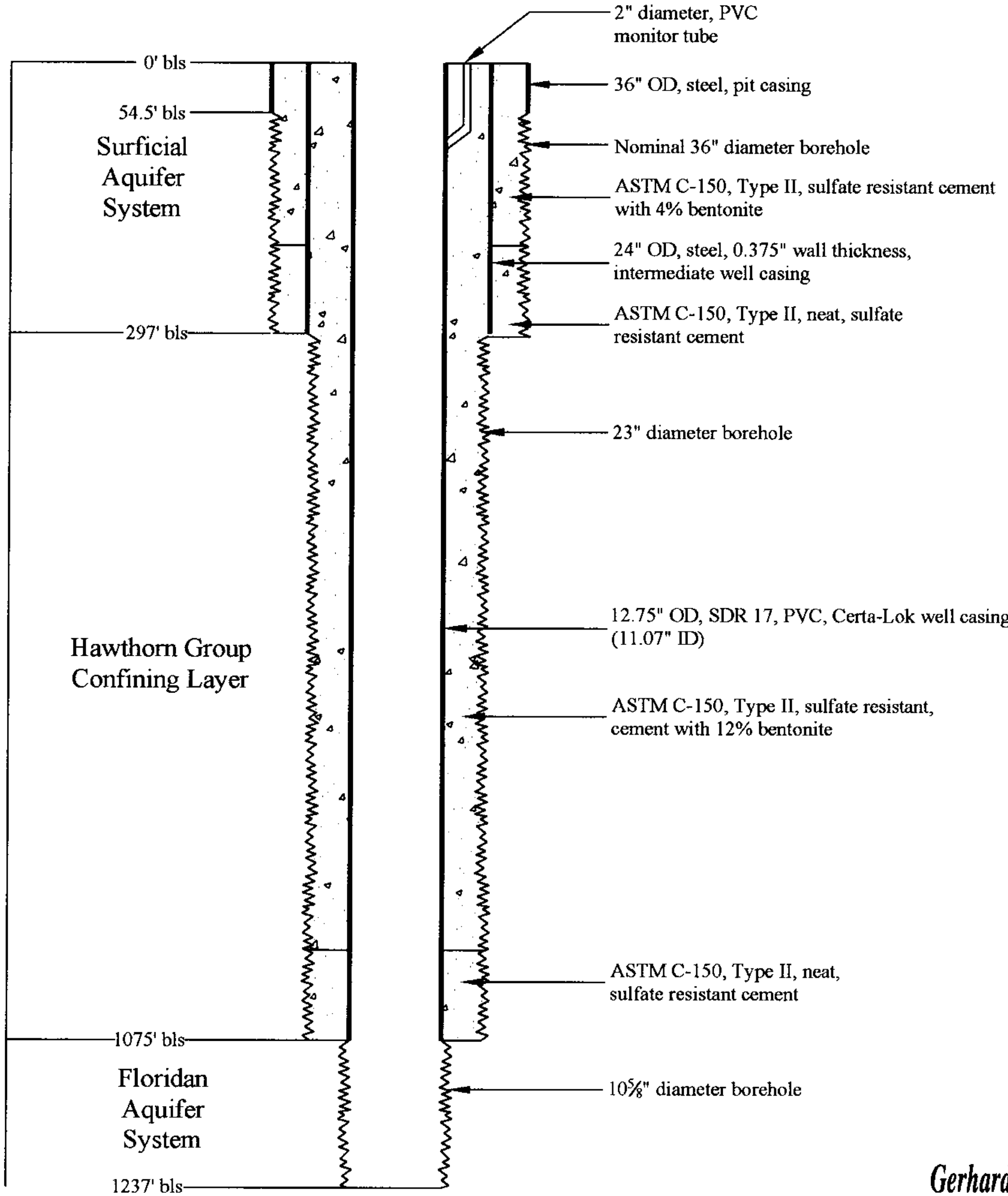

Figure 3-1

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borehole walls while the casing was being installed. The less than theoretical volume of cement used should not affect the integrity of the well.

The theoretical volume of the annular space between the 12-inch diameter casing and the 23-inch diameter borehole to a depth of 1,075 feet bls was calculated to be approximately 2,150 cubic feet. Diversified used 1,673.88 cubic feet of cement to grout the 12-inch diameter casing in place. The less than theoretical volume of cement used may have been due to swelling of the borehole walls while the casing was being installed. The less than theoretical volume of cement used should not affect the integrity of the well.

3.1 WELL DEVELOPMENT

The well was developed using compressed air during drilling of the open hole using reverse-air methods, centrifugal pump, natural artesian flow, and the submersible test pump until the well was free of sand (based on visual observations). The compressed air method consisted of using the drill-rig mounted, air compressor. Over pumping of the well as a means of development was limited to the submersible pump due to the volume of flow naturally issuing from the formation.

The geologist's estimate of development time was 80 hours for development. Seventy-nine hours of pump development occurred prior to and during well testing. This development time was one (1) hour under the original estimate for the well.

SECTION 4

WELL TESTING

SECTION 4

WELL TESTING

4.0 WELL TESTING

Testing of the pilot hole consisted of collection of geologic samples and geophysical logging. Testing of the new production well consisted of step-drawdown, sand concentration, silt density index, water quality, and microbiological testing, as well as geophysical logging and color television surveying.

4.1 GEOLOGIC LOGGING

Geologic logging consisted of the collection of lithologic samples at ten (10) foot intervals throughout the drilling of the pilot hole. The samples were described to compile a geologic log and to obtain the physical characteristics of the rock.

The geology encountered during the drilling of the Floridan aquifer irrigation well at the Seminole Golf Club consisted of fine- to coarse-grained quartz sand from 0 to 60 feet bls. No formation sample was obtained in the interval 60 to 70 feet bls due to the presence of cement from the grouting process. From 70 to 120 feet bls, the geology consisted of shell fragments with fine- to coarse-grained quartz sand. From 120 to 485 feet bls, the geology consisted of varying percentages of shell fragments, limestone, and quartz sand. The interval 0 to 485 feet bls is considered the Surficial aquifer. From 485 to 605 feet bls, the geology consisted of clayey silt. From 605 to 645 feet bls, the geology indicated the presence of shell fragments within the clayey silt. From 645 to 890 feet bls, the geology consisted of silty clay. The interval 485 to 890 feet bls comprises the Hawthorn Group. From 890 to 1,050 feet bls, the geology consisted of clayey silt and limestone, indicating a transition into the upper Floridan aquifer. From 1,050 to 1,230 feet bls, the geology consisted of limestone with varying percentages of foraminifera, indicative of the upper Floridan aquifer.

A generalized, geologic cross-section has been drawn from the lithologic information obtained during the drilling of the pilot holes and is presented in **Figure 4-1: Floridan Well Lithology**. Detailed geologic logs are provided in **Appendix B: Geologic Logs**.

4.2 GEOPHYSICAL LOGGING

After each pilot hole was drilled, the hole was geophysically logged by Southern Resource Exploration, Inc. of Gainesville, Florida. The open hole interval of the completed well was also logged by Southern Resource Exploration. Geophysical logging included natural gamma ray,

Seminole Golf Club
Floridan R.O. Well
Generalized Lithology

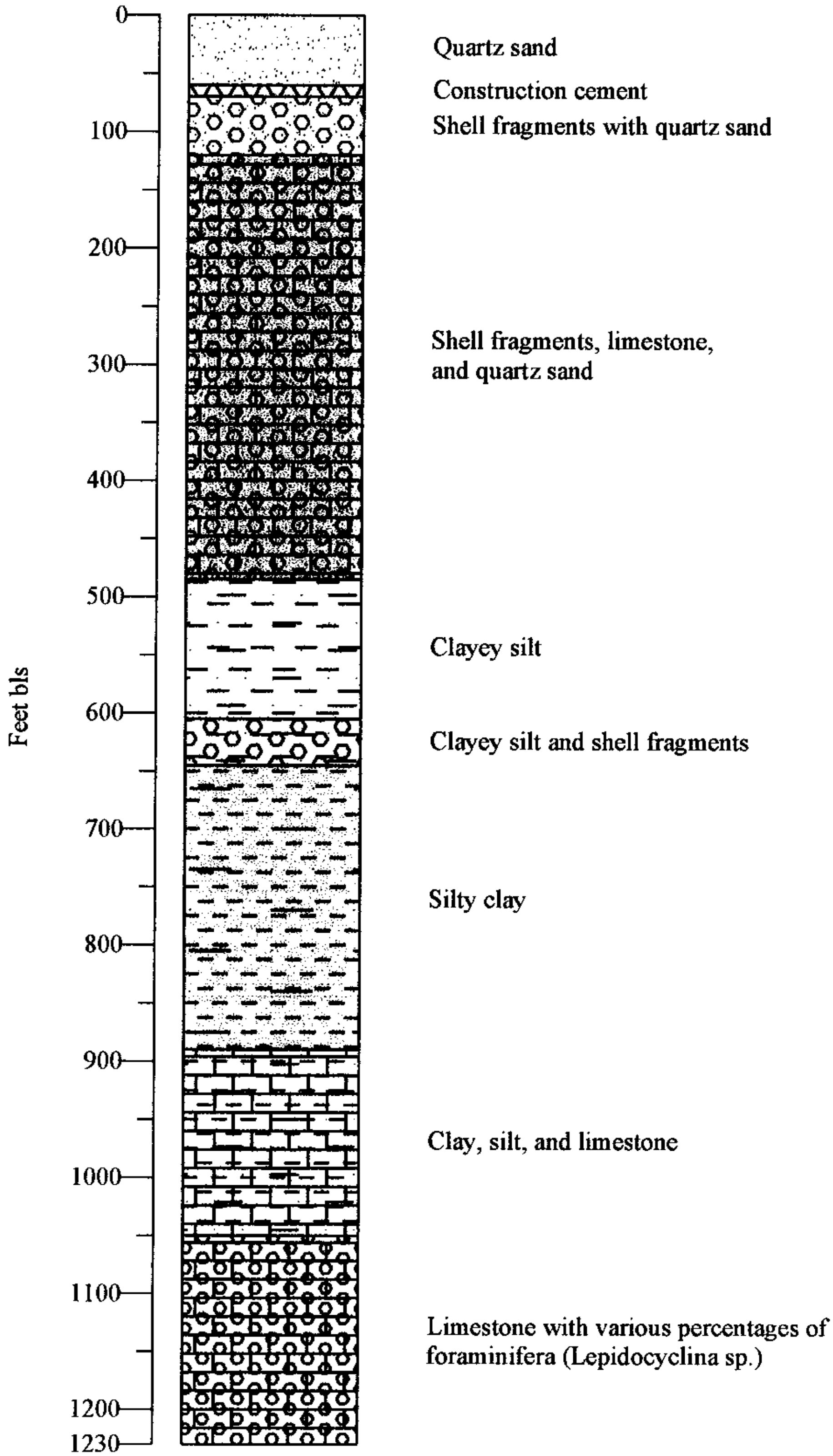

Figure 4-1

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electric (spontaneous potential, single point resistivity, short normal resistivity, long normal resistivity, dual induction, and focus guard), temperature(static and flowing), fluid resistivity (static and flowing), flow meter (static and flowing), and caliper logs. The geophysical logs are included as **Appendix C: Geophysical Logs**. Geophysical logging was completed October 7, 2002.

4.2.1 GEOPHYSICAL LOGS

Geophysical well logging (testing) uses a sensing device, lowered into a well and/or borehole, to record various physical parameters. The physical parameters/measurements indicate characteristics of the rock, the fluid contained in the rock and borehole, and/or the construction characteristics of the well. The following is a brief technical description of the function of each geophysical log and its purpose in the logging program of this project.

Caliper Log - The caliper log is a tool that determines the average gauge of the borehole, i.e., measures the diameter of the borehole. The caliper tool is used to find cavities, washouts, and fractures in the borehole. The log can be used to determine the proper casing seat for the well and to determine more accurate volumetric calculations for cementing and gravel packing of a well. The log can also be used to assist in finding holes, splits, and separations in well casings. The caliper tool measurement in these logs is in inches.

Gamma Ray Log - The gamma ray log measures the amount of radioactivity naturally present in the formation. Gamma radiation is emitted from formation material such as clays and sands with heavy phosphatic constituents. The gamma ray log is usually effective in determining formation breaks and may be utilized in stratigraphic correlation over relatively areally extensive areas. Gamma ray logs are measured in gamma ray counts, recorded as API-GR (American Petroleum Institute-Gamma Ray) units.

Electric Logs - The electric logs are a suite of logs consisting, in this case, of spontaneous potential, single point resistivity, and long and short normal resistivity.

Spontaneous Potential Log - The spontaneous potential (S.P.) is a small electric voltage generated at the boundaries of permeable rock units, especially between such strata and less permeable units. The contact between drilling mud and formation fluid is another area where S.P. may be generated. Generally, in limestones and sandstones of similar water quality in the Biscayne/Turnpike aquifer, the S.P. log generates little useful or correlatable data. The logging tool can pick up clay units that might otherwise not be noted during the drilling of the formation. Spontaneous potential log readings are in millivolts ("MV").

Resistivity Logs - The electric resistivity of a rock (resistance per unit volume) depends primarily on the amount of fluid contained in the rock and its electrical resistance and/or ionic characteristics. The amount of fluid in the rock is a function of the porosity, hence the porosity of the rock is related to its resistivity. Therefore, a formation with less porosity would be more resistive than a formation with a greater porosity, assuming the water quality was the same in both formations. A porous rock with saline water would have a low resistivity, while the same rock unit invaded by drilling mud might imitate high resistivity and therefore, low porosity. Resistivity is the inverse of conductivity. To measure resistivity, three (3) types of resistivity logs were used:

a. Single Point Resistivity Log: The single point resistivity log sends an electrical impulse into the formation and receives it back at the same point. The current therefore measures resistivity of the formation at the face of the borehole wall. This log is acceptable in a clean borehole uncontaminated by drilling muds. The single point resistivity readings are in ohms (OHM).

b. Short Normal Resistivity Log: The short normal resistivity log sends an electrical impulse at one (1) point and receives the signal back at a receiver located 16 inches above the transmitter, hence, the electrical current transmits beyond the borehole wall and into the formation. The short normal resistivity readings are in ohm-meters (OHM-M).

c. Long Normal Resistivity Log: The long normal resistivity log behaves as the short normal, except that the spacing between the transmitter and the receiver is 64 inches. This allows determination of the resistance at a considerable distance from the borehole. The long normal resistivity readings are in ohm-meters (OHM-M).

Dual Induction Log - In induction logging, the rocks surrounding the tool are energized by an induced electromagnetic field. Secondary effects of the electromagnetic field that are related to the resistivity of the strata are measured, producing a log of the formation resistivities. The induction log tool sends electrical energy into the strata horizontally and therefore measures only the resistivity of the strata opposite the instrument. The induction logging systems can provide resistivity measurements regardless of whether or not a conductive medium exists between the instrument and the formation. They can be used to provide resistivity measurements in oil-based drilling muds, air, and fresh mud as well as in conductive fluids like saline water. Three (3) different measures are taken by the dual induction tool:

a. RLL3: This log measures the borehole wall conductivities where the maximum sensitivity of the tool is at a distance of approximately three (3) feet from the tool.

b. RILM: The radial induction log medium measures formation conductivities in a four (4) foot to six (6) foot radius from the tool.

c. RILD: The radial induction log deep measures formation conductivities in a four (4) foot to ten (10) foot radius from the tool.

Focus Guard Log - The focus guard log is yet another system for measuring electrical conductivity and resistance of the formation. Focus guard probes use guard electrodes above and below the current electrode to direct the flow of the electrical current as it leaves the probe. These guard electrodes act to focus the electric current into the formation. This system can provide high resolution and penetration under conditions where other resistivity systems may fail.

Temperature Log - The temperature log senses the ambient temperature of the fluid in the borehole and well casing. The temperature is a function of the water temperature in the formation. Usually the ambient temperature of ground water increases with depth at a fairly constant rate of one degree Celsius (1 °C) per 100 meters (0.5° Fahrenheit ("F") per 100 feet). However, in the Floridan aquifer there exists a negative temperature gradient. If naturally occurring flow exists between two (2) units of different temperatures, then the temperature log will detect the change in temperature between the two (2) zones of flow. Therefore temperature logs are useful for determining the locations of flow zones in the well. Temperature logs may also be used to determine leaks in casings and/or flow behind casings. Measurements are in degrees Fahrenheit and/or degrees Celsius. Under pumping conditions, the temperature log should show a constant temperature from the bottom of the borehole to land surface, provided there is water moving throughout the entire length of the borehole and no significant quantities of water are entering or leaving the borehole at a specific point or interval.

Fluid Resistivity/Conductivity Log - The fluid resistivity/conductivity log is used to determine the resistance/conductance of the fluid in the borehole. Fluid resistivity/ conductivity is a measurement of the ionic potential (relative concentration) of the fluid. The readings are indicative of the concentration of Total Dissolved Solids such as chlorides, sulfates, sulfides, etc. The log is useful for determining water quality concerns independent of the porosity of the formation. The fluid conductivity log is also useful for identifying zones of flow (both in to and out of the borehole), especially of differing qualities of water.

Fluid resistivity/conductivity logs can be run in cased holes and may be used to locate holes in the casing. Fluid resistivity/conductivity is measured in ohm meters (ohm-m).

Flow Meter Log - The flow meter log measures fluid movement within a borehole and/or well casing. The flow meter log uses an impeller which is run down the borehole (well) at a constant speed. The impeller reflects a constant revolutions per minute ("rpm"). Any change in the rpm, provided the speed of the tool is the same, the borehole is of the same diameter, and flow is kept constant, indicates flow in to or out of the borehole. Such data reveals zones contributing water to a well, flow from one (1) stratum to another within a well, hydraulic differences between aquifers intersected by a well, and/or casing leaks. Flow meter logs can yield quantitative and/or qualitative data, depending on the type of flow meter. Since a flow meter measures velocity, which is dependent on the size of the borehole, the flow meter logs must be compared to caliper logs to obtain a quantitative flow.

4.2.2 GEOPHYSICAL LOG INTERPRETATIONS

Pilot Hole Geophysics

Diversified drilled a 10⅝-inch diameter pilot hole to a depth of 1,170 feet. The geophysical logs performed on September 12, 2002, were caliper, gamma ray, and electric logs.

Caliper log: The caliper log indicates the pilot hole ranges from 10⅝ to 14 inches in diameter from the bottom of the pilot hole at 1,170 feet bls to a depth of 349 feet bls. At 348 feet bls to 347 feet bls, the caliper log indicates a borehole diameter to 21 inches. From 347 to 312 feet bls, the borehole diameter is 12 inches. From 312 feet bls until the caliper log enters the 24-inch diameter steel casing at 297 feet bls, the caliper log increases from 12 inches to 24 inches in diameter. The caliper log remains gauged inside the 24-inch diameter steel casing to land surface.

Gamma ray log: The gamma ray ("GR") log from 1,154 to 1,012 feet bls indicates readings in the range of 18 to 28 American Petroleum Institute gamma ray ("API-GR") units. From 1,012 to 1,008 feet bls, the GR log increases to 86 API-GR units then decreases to 30 API-GR units at 1,006 feet bls. From 1,006 to 970 feet bls, the GR log remains fairly stable with readings from 18 to 40 API-GR units. In the interval 970 to 950 feet bls, the GR log shows a general increase with readings from 90 to 155 API-GR units. From 950 to 910 feet bls, the GR log indicates stable readings in the range of 40 to 70 API-GR units. From 910 to 864 feet bls, the GR log indicates increased readings ranging from: peaks of greater than 200 API-GR units (off-scale) from 906 to 900 feet bls, 178 API-GR units at 892 feet bls, and 175 API-GR units at 870 feet bls. In this same interval the lowest GR points occurred at 897 feet bls with a reading of 90 API-GR units and 886 feet bls with a reading of 53 API-GR units. The two (2) intervals where the GR log indicates significantly greater or off-scale readings were expected and indicate high phosphate zones (rubble zones) within the Hawthorn Group. The bottom of the lower rubble zone is the transgressive sequence overlying the unconformity at the top of the Floridan Aquifer System. From a reading of 25 API-GR units at 864 feet bls, the GR log generally increases to 120 API-GR units at 895 feet bls then decreases to 70 API-GR units at 890 feet bls. From 890 feet bls to 310 feet bls, the GR log remains fairly stable with readings from 40 to 118 API-GR units. From 310 to 297 feet bls, the GR log decreases from 50 to 20 API-GR units as it enters the 24-inch diameter steel casing. From 297 feet bls to land surface, the GR log remains stable in the range of 18 to 40 API-GR units.

Electric logs: The electric logs, consisting of single point resistivity, short normal resistivity, and long normal resistivity logs, provide insight to the water quality and potential porosity of the formation.

The electric logs stabilize in the interval 1,166 to 1,150 feet bls. From 1,150 to 1,120 feet bls, the electric logs have the following readings: single point resistivity ranges from 23 to 25 OHM, the short normal resistivity ranges from 11 to 12 OHM-M, and the long normal resistivity ranges from 14 to 15 OHM-M. In the interval 1,120 to 1,080 feet bls, the resistivity logs indicate an increase in resistivity with the following readings: single point resistivity ranges from 23 to 24 OHM, short normal resistivity ranges from 13 to 15.5 OHM-M, and the long normal resistivity ranges from 15.5 to 18 OHM-M. The slight increases in resistivity in the interval 1,120 to 1,080 feet bls indicate a potential water bearing formation of relatively better quality water. From 1,080 to 970 feet bls, the resistivity logs remain stable with readings of 23 OHM for the single point, 17.5 OHM-M for short normal, and 16 OHM-M for long normal resistivities. The resistivities decrease in the interval 970 to 945 feet bls with readings from 24 to 21 OHM for the single point, 16 to 7.5 OHM-M for short normal, and 18 to 11 OHM-M for long normal resistivity. In the interval 945 to 850 feet bls, the resistivities increase (then decrease to the previous readings) with the following maximum readings obtained at a depth of 902 feet bls: single point to 28 OHM, short normal to greater than 25 OHM-M (off scale), and long normal to 22.5 OHM-M. This interval with the highest resistivities correlates to the gamma ray peaks that were off scale, indicating the greater porosities of the phosphate rubble zones. From 850 to 330 feet bls, the resistivities gradually increase from 21 to 24 OHM for the single point resistivity, from seven (7) to 14 OHM-M for the short normal resistivity, and from eight (8) to 16.5 OHM-M for the long normal resistivities. From 330 feet bls until the electric log tool enters the 24-inch diameter steel casing at 297 feet bls, the resistivities decrease to 16 OHM for the single point, 2.5 OHM-M for the short normal, and four (4) OHM-M for the long normal resistivities. The electric logs do not provide accurate data when inside a casing; therefore, the remaining electric log data is useless. The spontaneous potential log provides little information in this borehole.

Well Casing Seat Selection

GMW&A's recommended casing seat was 1,065 to 1,075 feet bls. This selection was based on being well below (55 to 65 feet) the last gamma ray peak and in an area of higher resistivity (greater potential porosity and water quality). The caliper log showed a fairly tight formation and a nearly gauged hole, indicating competent rock for setting the casing.

Production Well Geophysics

Caliper log: From the bottom of the well at 1,234 feet bls to 1,214 feet bls, the borehole size ranges from 11 to 12 inches in diameter. The borehole size then increases slightly to 14 inches in diameter at 1,213 feet bls before decreasing to 11 inches at 1,210 feet bls. From 1,210 to 1,190 feet bls, the borehole size averages 11 inches in diameter. From 1,190 to 1,160 feet bls, the borehole size increases slightly to 12 inches in diameter then decreases to 11 inches at 1,157 feet bls. From 1,157 to 1,153 feet bls, the borehole size increases to 16 inches in diameter then decreases to 14 inches in diameter at 1,150 feet bls to 1,142 feet bls. The borehole diameter then increases slightly to 16 inches in diameter at 1,140 feet bls, and decreases to 13 inches in diameter at 1,139 feet bls. The caliper log indicates a relatively gauged hole from 1,139 to 1,079 feet bls, with the borehole size ranging from 13 to 14 inches in diameter. From 1,079 to 1,076 feet bls, the borehole size increases from 13 to 16 inches in diameter, just below the casing seat. The caliper log then decreases to the inside diameter of the PVC well casing, approximately 11 inches. The caliper log remains this diameter inside the well casing to the end of the log at 50 feet bls.

Gamma ray log: The GR log starts near the bottom of the well at 1,228 feet bls with a reading of 40 API-GR units. From 1,228 to 1,192 feet bls, the GR log slightly decreases to 15 API-GR units. From 1,192 to 1,080 feet bls, the GR log remains fairly stable with a range of ten (10) to 18 API-GR units. The GR log then increases to 45 API-GR units at the casing seat depth of 1,075 feet bls. In the interval 1,075 to 1,058 feet bls, the GR log shows a general increase to an average of 45 API-GR units. The change in GR readings in the open borehole can be correlated with the caliper log, which indicates a larger borehole that attenuates the GR readings. From 1,058 to 1,013 feet bls, the GR log indicated readings from 20 to 40 API-GR units. The lower GR peak indicates that the base of the Hawthorn Group occurs at 1,010 feet bls, with a maximum reading of 60 API-GR units. The reminder of the GR log is as described in the pilot hole section and will be attenuated because of hole size and well casing.

Electric logs: The electric logs start at 1,230 feet bls and remain fairly stable to 1,120 with the following ranges: single point from 17 to 19 OHM (one (1) spike at 1,054 feet bls to 20.5 OHM), short normal from eight (8) to 18 OHM-M, and long normal resistivity from 13 to 20 OHM-M. The single point spike at 1,054 feet bls can be correlated to the caliper log, which indicated harder rock (gauged hole) at this point. From 1,120 to 1,081 feet bls (just below the casing seat at), the single point resistivity increased from 18 to 20.5 OHM, the short normal resistivity increased from 13 to 21 OHM-M, and the long normal increased from 20 to 42 OHM-M. The production well open hole resistivities indicated potentially fairly stable porosity and water quality. The slightly higher resistivities just below the casing seat indicate this interval may produce the best quantity and quality of water.

Fluid logs: The fluid logs performed on the completed well were: static flow meter (up and down runs), pumping flow meter, static fluid resistivity and temperature, and pumping fluid resistivity and temperature. These logs were run from the bottom of the well to 910 feet bls.

The static flow meter down run ranges from 50 to 70 rotations per minute ("rpm"). The static flow meter up run ranges from 45 to 55 rpm. While the static flow meter logs show slight changes in rate of rotation, the data provides no interpretable information.

The pumping flow meter indicates the greatest rpm's from 1,210 to 1,150 feet bls with a rate of 480 to 540 rpm. From 1,150 to 1,078 feet bls, the pumping flow meter ranges from 310 to 420 rpm. The flow then increases as the water enters the well casing at 1,075 feet bls and ranges from 480 to 540 rpm to 910 feet bls.

Flow meter Analysis: When performing flow meter analyses, borehole size (caliper log) must be correlated. A tighter (smaller) borehole would cause an increase in flow, all else being equal. Conversely, a larger borehole would cause a decrease in flow. The flow meter analysis indicates an average pumped flow of 1,300 gallons per minute ("gpm") for the open hole interval. The greatest amount of flow (greater than 1,500 gpm) occurs in the interval 1,153 to 1,150 feet bls.

The static and pumped fluid resistivity logs indicate steady readings of 0.9 OHM-M for the entire measured interval (1,210 to 900 feet bls) and are unremarkable.

The static temperature log stabilizes at 1,212 feet bls with a temperature of 72.54 degrees Fahrenheit (° F) and slightly increases through the measured interval 1,212 to 900 feet bls to 72.65 ° F.

The pumped temperature log stabilizes at 1,210 feet bls and remains a constant 72.50 ° F to the end of the log at 900 feet bls.

Cement Temperature Log

On Friday, September 20, 2002, Diversified performed Stage 1 cementing of the 12-inch diameter, PVC casing installed to 1,075 feet bls. Stage 1 cementing was performed using the Halliburton pressure grout method. On Saturday, September 21, 2002, Diversified installed the cement tremie pipe in the annular space to a depth of 460 feet bls, where the tremie pipe would penetrate no deeper. (The cement tag was expected at approximately 710 feet bls.) Diversified removed the tremie pipe and installed it in the annular space on the opposite side of the well casing to verify the cement tag. On this second attempt, the tremie pipe would not penetrate deeper than 400 feet bls. Diversified, with GMW&A's concurrence, theorized that the Hawthorn Group clays were squeezing into the borehole. Stage 2 cement was pumped though the tremie pipe set at a depth of 400 feet bls on September 21, 2002. On Monday, September 23, 2002, the hardened cement from Stage 2 was tagged at a depth of 142 feet. Stage 3 cementing was performed with visual conformation of cement grout return at the surface.

In order to confirm the presence or absence of cement grout in the annular space, GMW&A requested Diversified perform a cement temperature log at no cost to the Owner. On Tuesday, September 24, 2002, Diversified subcontracted Southern Resource Exploration to perform a temperature log of the well casing. The following describes the temperature log.

The cement temperature log begins at a depth of 975 feet bls with a temperature of 87.1 ° F and increases to 87.5 ° F at 966 feet bls. From 966 to 925 feet bls, the temperature decreases to 87.0 ° F. From 925 to 840 feet bls, the temperature increases to 89.5 ° F. From 840 to 750 feet bls, the temperature decreases to 87.1 ° F. From 750 to 496 feet bls, the temperature continues to gradually decrease to 85.0 ° F. The above described portion of the temperature log confirms the presence of Stage 1 cement grout as it cooled. From 496 to 472 feet bls, the temperature is constant at 85.0 ° F. This 24 foot interval indicates the coolest temperature of the entire temperature log and may indicate the absence of cement grout in this interval. However, the log does not confirm the absence of cement grout and may only be an indication that the annulus is not gauged but is less than gauged. From a temperature of 85.0 ° F at 472 feet bls, the temperature gradually increases to 87.0 ° F at 330 feet bls.

The temperature continues to increase at a greater rate in the interval 330 to 270 feet bls from 87.0 to 99.0 ° F. This increase is due to Stage 2 cement entering the 24-inch diameter steel casing which is acting as an insulator. The temperature continues to gradually increase to 102.0 ° F at 212 feet bls. The temperature then decreases to 94.8 ° F at 126 feet bls. This cooling trend is the top of Stage 2. The temperature then increases drastically to 118.0 ° F at 105 feet bls due to Stage 3 cement placed 16 hours prior to logging. The temperature log then indicates gradual cooling of Stage 3 cement to 115.0 ° F at 10 feet below land surface. A copy of correspondence to SFWMD personnel regarding this concern is included as **Appendix D: Cement Temperature Log Correspondence**.

4.3 STEP-DRAWDOWN TESTING

Step-drawdown testing was performed on the production well in conjunction with sand testing. The purpose of step-drawdown testing is to evaluate the performance of the well. A step-drawdown test is performed on a well in order to determine aquifer characteristics and to quantify the deterioration in well performance over time. Step-drawdown tests yield information regarding well efficiency, well development, and well screen/borehole clogging. The results also help determine possible rehabilitative procedures and optimum pumping rates. The data collected during the step-drawdown tests are used in the evaluation of the performance, efficiency, and specific capacity of the well at the different pumping rates, and for the calculation of the transmissivity of the aquifer.

Step-drawdown testing involves pumping a well for a predetermined amount of time (approximately 60 minutes), until water level stabilization is reached, at each of three (3) increasing pumping rates. Ideally the three (3) rates should be at 50, 100, and 150 percent of the design pumping rate. For instance, if the design production rate is 1,400 gpm, then the three (3) rates for the step-drawdown test would be 700 gpm, 1,400 gpm, and 2,100 gpm. Before each increase in pumping rate, water levels are allowed to recover to static levels for at least the same amount of time as the well was pumped. The changes in water levels within the well are measured with an electric water level probe ("M-scope") during both the drawdown and recovery periods. The time increments for measurements are as follows: one (1) minute readings for the first ten (10) minutes, two (2) minute readings from 10 to 20 minutes, and five (5) minute readings from 20 to 60 minutes and/or the end of the test. For the Seminole well, a pressure transducer/data logger was used to measure the water levels. The time increment for the readings from the data logger was two (2) seconds. **Appendix E: Step-Drawdown Test Results** gives the step-drawdown testing results for the newly installed production well at 30 second intervals. Please note that because the Floridan aquifer is artesian, the static water levels are measured above land surface ("als").

4.3.1 DRAWDOWN

The total drawdown (measured in the field) in a well is a function of the drawdown due to aquifer characteristics and the drawdown due to the loss of efficiency from the well. Total drawdown(s) can be written as the following equation (Dawson and Istok, 1991):

$$s = BQ + CQ^2 \tag{4.1}$$

where:	s	=	drawdown in the well casing, feet
	B	=	(264/T) log [(0.3Tt) / (r^2S)], gallons per day per foot
	Q	=	pumping rate, gallons per minute
	C	=	well loss coefficient, $second^2$ per $foot^5$
	T	=	transmissivity, gallons per day per foot
	t	=	time, minutes
	r	=	radius of the well, feet
	S	=	storage coefficient, dimensionless

Because the transmissivity and storage coefficient of an artesian aquifer and a leaky aquifer are constant, the *BQ* term in the equation does not affect the determination of well loss using the Jacob method discussed in equation 4.4. Assuming that the well is not developing, the total drawdown can be used to determine transmissivity. However, this method gives lower transmissivity values than those calculated without accounting for drawdown due to well loss. The drawdowns observed in the Seminole well are shown in **Table 4-1: Step-Drawdown Test Results**.

4.3.2 SPECIFIC CAPACITY

The productivity (quantity of water produced) of a production well can be expressed in terms of specific capacity. The specific capacity of a well is defined as the ratio of the pumping rate to the drawdown at a given time:

$$C_s = \frac{Q}{s} \tag{4.2}$$

where: C_s = specific capacity of the well, gallons per minute per foot of drawdown at a unit of time
Q = pumping rate, gallons per minute
s = drawdown, feet

Estimating the specific capacity of a well requires determining the drawdown from a static water level to a pumping water level within the well at a known pumping rate after a known span of time. Specific capacity is measured in gallons per minute per foot of drawdown at a given period of time (gpm/ft at a unit of time) and is used to calculate well efficiency. The higher the specific capacity, the more efficient the well, as long as all other factors are equal. Specific capacity changes in a non-linear fashion with increased pumping rates because a well cannot, in reality, be one-hundred percent (100%) efficient. Slight decreases in the specific capacity with increased pumping rates are to be expected in wells that have been fully stabilized and are no longer developing. Specific capacities increasing at higher pumping rates indicate that the well is developing. The specific capacities for the well are shown in **Table 4-1: Step-Drawdown Test Results**. These data indicate that the well was not developing during the step-drawdown test.

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Table 4-1

Step-Drawdown Test Results

Well Number	Floridan		
Step	1	2	3
Pumping Rate (gpm)	605	1,116	1,688
Drawdown (ft)	5.56	14.17	27.00
Specific Capacity (gpm/ft at 60 min)	108.81	78.79	62.52
Well Loss 1 and 2 (sec^2/ft^5)	1.3806118		
Well Loss 2 and 3 (sec^2/ft^5)	1.0407303		
Well Loss (1+2) and 3 (sec^2/ft^5)	1.1625480		
Well Loss 1 and (2+3) (sec^2/ft^5)	1.2654387		
Average Well Loss Constant (sec^2/ft^5)	1.2123		
Well Loss (ft)	2.20	7.50	17.15
Well Efficiency (%)	60.38	47.08	36.48

4.3.3 WELL LOSS COEFFICIENT

Well loss is defined as head loss attributable to well inefficiency due to the turbulent flow of water through the well screen and/or inside the casing to the pump intake (Jacob, 1946.) Well loss can be expressed as a well loss constant (C) and the well loss in feet (S_w).

The well loss constant is derived from a comparison of the drawdown data at the various pumping rates of the step-drawdown test. This constant is in turn expressed as well loss in feet or as well efficiency. The value of C may be computed from step-drawdown test data using the following equation (Jacob, 1946):

$$C = \frac{(\Delta s^{i}/\Delta Q_i) - (\Delta s^{i-1}/\Delta Q_{i-1})}{\Delta Q_{i-1} + \Delta Q_i} \qquad (4.3)$$

where:

C	=	well loss constant, second^2 per feet^5
i	=	any given pumping step
Δs^i	=	incremental drawdown associated with step i, feet
ΔQ_i	=	incremental pumping that produces incremental drawdown (s^i) associated with step i, feet^3 per second

Changes in C values are affected by changes in discharge rates, shifting of the gravel outside the wells, and/or development of the formation.

Equation 4.3 assumes that the production well is stable and that the value of C does not change during the well production test. New wells, improperly designed and/or constructed wells, and old wells can be unstable, and the calculated value of C can be affected by changes in the discharge rate. The value of C calculated for steps 1 and 2 of the step-drawdown test may be greater or less than that calculated for steps 2 and 3. Sand and gravel often shift outside the production well during discharge periods under the influence of high discharge rates. This may result in either the development or clogging of the pores of the well face. If the value of C for steps 2 and 3 is considerably less than the value of C for steps 1 and 2, it is probable that development has occurred during the well production (step-drawdown) test. A large increase in the value of C with higher discharge rates indicates clogging has occurred during the production well test. Clogging may be a function of a number of items: fine-grained material clogging boreholes, the presence of bacteria, and/or formation collapse. Formation collapse may be an indication of sink hole formation. Negative C values indicate that the well was developing during testing. If the production well is unstable, C may be calculated with Equation 4.3 and data from steps 1+2 and 3, or 2+3 and 1.

Borehole clogging due to incomplete well development or well deterioration by bacteria or other concerns is generally negligible when C is less than 5.0 sec^2/ft^5. Values of C between 5.0 and 10.0 sec^2/ft^5 indicate mild clogging or well deterioration, and clogging or well deterioration is severe when C is greater than 40.0 sec^2/ft^5 (Walton, 1962, p. 27). Deteriorated wells may be returned to near original yields by one (1) of several rehabilitation methods. The success of the rehabilitation can be appraised with the results of well production tests conducted prior to and after rehabilitation.

The average well loss coefficient for Seminole's Floridan Well was 1.2123 sec^2/ft^5. The values of C for the well are presented in **Table 4-1: Step-Drawdown Test Results**. Results of the well loss calculations indicate that the well is not developing or clogging at the pumping rates tested.

4.3.4 WELL LOSS

Well loss in feet is the approximate head loss in feet due to the well's inefficiency. Well loss in feet may be computed using the following equation (Jacob, 1946):

$$s_w = CQ^2 \qquad \textbf{(4.4)}$$

where:

s_w	=	well loss, feet
C	=	well loss coefficient, $second^2$ per $feet^5$
Q	=	production well discharge, $feet^3$ per second

Well loss is used to calculate the well efficiency. The well losses for Seminole's Floridan well at each tested rate are shown in **Table 4-1: Step-Drawdown Test Results**. The well loss for the Floridan well was 8.6 feet at 1,116 gpm.

4.3.5 WELL EFFICIENCY

Well efficiency is defined as the percentage of total drawdown that is attributable to well loss. This number can be obtained by dividing the theoretical drawdown by the total drawdown, and multiplying by 100 percent.

$$\frac{s_t}{s} \times 100 = Percent\ Efficiency \qquad \textbf{(4.5)}$$

where:

s_t	=	theoretical drawdown, feet
s	=	actual drawdown, feet

The theoretical drawdown is calculated as the total (measured) drawdown minus the well loss. The name "well efficiency," in this context, can be misleading because is does not confer that the efficiency (productivity) is due to both the well characteristics (well loss) and aquifer characteristics (theoretical drawdown). Therefore, wells with lower well efficiencies should not be thought of as necessarily inferior to wells with higher well efficiencies. Well efficiencies of greater than 100% indicate that the wells are developing. The well efficiencies for Seminole's Floridan well are shown in **Table 4-1: Step-Drawdown Test Results**. The well efficiencies for the Floridan well decrease as the pumping rate increases, as expected, indicating that the well was not developing during testing.

4.3.6 AQUIFER TRANSMISSIVITY

From the data gathered during the step-drawdown tests, it is possible to calculate aquifer transmissivity using the Jacob method (also called the Cooper-Jacob method). The criteria for this method are as follows:

1. Flow is entirely horizontal, radial, and laminar.
2. The well fully penetrates the aquifer.
3. There are no vertical components of flow.
4. No water is stored in the well (i.e., drawdown and recovery data are not affected by well storage capacity).
5. The uniformly porous aquifer is overlain and underlain by aquicludes, with negligible vertical hydraulic conductivity (except in a water table aquifer that is of uniform grain size, i.e., no delayed-yield response. Under this condition the Jacob method can apply to water table conditions).
6. The aquifer is homogenous, isotropic, infinite in areal extent, and has a constant thickness throughout.
7. Wells have infinitesimal diameter, and discharge is constant.
8. There are no boundaries and/or discontinuities.
9. Before pumping, the piezometric surface is horizontal.
10. There is no recharge to the aquifer.
11. The groundwater density and viscosity are constant.

12. Groundwater flow can be described by Darcy's Law.

13. Head losses through the well screen and pump intake are negligible.

14. The aquifer is compressible and completely elastic.

These conditions must be met during the duration of the pumpage and in the area of influence of the well(s) during the time of pumpage, and/or corrections must be made to account for conditions not met. The following remarks note for each criterion how the aquifer and/or well(s) meet the conditions and/or how corrections were made:

1. The majority of flow during the duration of pumping is horizontal, radial, and laminar.

2. The wells fully penetrate the producing unit of the aquifer.

3. The vertical components of flow are a delayed yield response and are seen "instantaneously" in the production well.

4. The water stored in the well is negligible compared to the amount withdrawn.

5. This statement is valid.

6. For the area tested, over the duration of the test, this statement is valid, as evidenced by the drawdown data.

7. Discharge was constant. Well diameter does not effect the calculation of the transmissivity in this equation, only the storage coefficient.

8. No boundary conditions are indicated in the drawdown data during the duration of the test.

9. Because the hydraulic gradient is negligible (based on regional canal elevations and flow data), this statement is valid.

10. Based on the step-drawdown data, recharge was negligible.

11. Based on chemical analysis, this does not appear to be a concern.

12. This statement is valid.

13. The head losses are constant at a given pumping rate and therefore do not affect the calculation of transmissivity, i.e., head losses do not affect the change in drawdown, Δs, between log cycles.

14. This statement is valid, based on the information available.

The Jacob method uses the equation:

$$T = \frac{264Q}{\Delta s} \tag{4.6}$$

where:

T = transmissivity, gallons per day per foot
Q = pumping rate, gallons per minute
Δs = the slope of the time-drawdown graph expressed as the change in drawdown between any two values of time on the log scale whose ratio is 10.

Recovery data was used to determine the transmissivity results. The time-drawdown graphs are shown in **Appendix F: Step-Drawdown Graphs.** Transmissivity values are given in **Table 4-2: Transmissivity Results.**

Table 4-2

Transmissivity Results

Well Number	Step	Rate (gpm)	Transmissivity (gpd/ft)
Floridan	1	605	273,421
	2	1,116	200,275
	3	1,688	160,258
		Average	211,318

4.4 SAND TESTING

Sand testing was performed on the production well in conjunction with step-drawdown testing. Testing was performed using and a Lakos Laval Sand Separator. Although the Rossum Sand Tester is the American Water Works Association ("AWWA") standard to measure sand concentration, GMW&A has found the Lakos Laval Sand Separator to provide a more accurate sand concentration due to the greater volume of water that flows through the separator. GMW&A used a Lakos Laval Sand Separator to obtain sand concentration data discussed in this report.

The purpose of sand testing is to determine the amount of sand being pumped from a well. This is important because sand, especially quartz sand, can adversely affect the longevity of pumps, motors, column pipes, and pipe lines due to its ability to abrade steel. The abrasion then has the ability to create points of potential corrosion by both electrolysis and bacteria. In a membrane plant, sand can also clog pre-filters (if present in the plant, or the membranes themselves if no pre-filters exist), and therefore sand production should be avoided.

4.4.1 SAND STANDARDS

Under normal operating conditions, the concentration of sand produced by a water supply well should be less than the AWWA Standard for Water Wells A100-97 of 5.0 mg/L. Any recommendations for limiting sediment concentration must take into account the water use, the method of treatment, the type of sediment, and the source of the sediment. The U.S. Environmental Protection Agency and the National Water Well Association (1975) have recommended the following limits:

A. 1 mg/L — water to be used directly in contact with, or in the processing of, food and beverages.

B. 5 mg/L — water for homes, institutions, municipalities, and industries.

C. 10 mg/L — water for sprinkler irrigation systems, industrial evaporative cooling systems, and other uses where a moderate amount of sand is not especially harmful.

D. 15 mg/L — water for flood-type irrigation and where the nature of the water-bearing formations and the overlying strata are such that pumping this amount of sand will not seriously shorten the useful life of the well.

The limits suggest reasonable goals that can be achieved if good well design, construction, and development practices are followed. In older wells or wells in problem aquifers, a well may pump unacceptable amounts of sediment. If the well cannot be redeveloped by conventional techniques, a special sand separator can be installed as a permanent part of the well system. Although sand separators are efficient, they may not remove all sediment and should not be used as a substitute for good well design and construction practices. In addition, removal of sufficient sand could cause catastrophic collapse of the formation.

There is no current standard for sand production for a membrane process well. However, the amount of sand can adversely impact the life expectancy of the pre-filters. Good well design and velocity control (less than 2.5 fps in a membrane plant, and less than 5.0 fps in a non-membrane pant) may limit sand production in a well. GMW&A recommends sand concentration to be maintained below 1.0 mg/L for production wells.

4.4.2 LAKOS LAVAL SAND SEPARATOR

While the Rossum Sand Tester is the method accepted by the AWWA, GMW&A's experience has indicated that the use of a Lakos Laval Sand Separator provides a better method of quantifying sand produced from a well. This is primarily due to the larger volumes of water tested over a greater period of time with the Lakos Laval sand separator. In this procedure, sand testing was performed in conjunction with step-drawdown testing. Approximately ten (10) to 15 gallons per minute of water were diverted through the sand separator during each step of the step-drawdown test. Upon completion of each step, the sand was removed from the sand separator. These sand samples were dried and analyzed for weight.

4.4.2.1 CALCULATIONS

The amount of sand produced in milligrams per liter for each individual pumping rate is determined by the following equation:

$$S = \frac{S_{wt}(1000)}{3.785Qt} \qquad \textbf{(4.7)}$$

where:

	S	=	sand content, milligrams per liter
	S_{wt}	=	weight of sand, grams
	1000	=	equation constant, milligrams per gram
	3.785	=	equation constant, liters per gallon
	Q	=	rate through the sand separator, gallons per minute
	t	=	time, minutes

The amount of sand that the well pumps during the step-drawdown test should increase with each increase in the pumping rate. Upon the completion of recovery of the final pumping step of the step tests, the well was pumped at its design rate for two (2) hours, and sand samples were collected at 5, 30, 60, and 120 minutes without stopping the pumping. The amount of sand pumped during normal operation is reflected in the fourth (120 minutes) sand sample. This sample is a realistic figure for the quantity of sand which will be produced during normal well operations.

Large discrepancies in the amount of sand collected at the five (5)-minute sample as compared to the amount of the 120-minute sample are of concern and are an indication of water hammer to the formation. Therefore, it is imperative that appropriate engineering is provided in the well pump and valving design to mitigate these concerns.

It should be noted that the Lakos Laval Sand Separator only removes sand particles in the range of 6.35 mm to 74 microns, with ninety-eight percent (98%) efficiency. This means that particles less than 74 microns will pass through the sand separator and into a pre-filter in a membrane plant, which screens particles that are greater than 5.0 microns in size.

4.4.3 RESULTS OF SAND TESTING

The sand tests were performed on Seminole's Floridan well during step-drawdown testing using a Lakos Level Sand Separator. The sand concentration was less than one (1) mg/L at steps 1 and 2, and 1.18 mg/L at step 3. As expected, the two (2)-hour sand test showed a higher sand concentration during the first five (5) minutes (7.81 mg/L) of pumping than at 120 minutes (0.27 mg/L). Although some of these sand concentrations are greater than desired for a membrane water production well, the amount of sand can be controlled through the use of a slow opening and slow closing valve and not pumping the well above the design rate of 1,100 gpm.

Table 4-3: Sand Test Results presents the quantities of sand collected during sand testing on the production well.

Table 4-3

Sand Test Results

Test Number	Pumping Rate (gpm)	Sand Concentration (mg/L)
Step 1	605	0.63
Step 2	1,116	0.59
Step 3	1,688	1.18
5 min	1,173	7.81
30 min	1,173	1.06
60 min	1,173	0.44
120 min	1,173	0.27

4.5 SILT DENSITY INDEX TESTING

Silt Density Index ("SDI") testing, ASTM Standard D-4189, is an empirical measurement to test for the potential of silt, colloidals, bacteria, and other substances to foul a membrane. SDI testing is used to predict the tendency of a water supply to foul membranes.

The SDI test simply measures the decay in flow rate through a 47-millimeter ("mm") diameter, 0.45-micron ("µm") pore size membrane. The 0.45-micron membrane is used because it is more susceptible to clogging from colloidal matter than from hard particles such as sand and scale. Furthermore, the 0.45-micron size is smaller than the 5.0-micron size of the pre-filter and therefore measures particles that would pass through the pre-filter and clog the membrane. (The membrane is approximately 0.5 microns in size.) The measured decay in flow rate is converted to a number between 1 and 100.

The SDI number is a function of the rate at which the filter (membrane) clogs with colloidal material. The larger the SDI number, the greater the fouling tendency of the water. "*Generally, RO systems operating on feed water supplies with SDI values less than 1 run for years without problems, and those operating on supplies with SDI values less than 3 run for months without need of membrane cleaning. However, systems operating on supplies with values between 3 and 5 are cleaned regularly and are often considered problem systems. SDI values greater than 5 are not acceptable at this time.*" (Amjad, 1993)

During SDI testing of the production well, a colloidal filter was installed and SDI's were taken before and after the water had passed through the colloidal filter. The filter pore spaces are 5.0 microns in size. This filter size allows the capture of most clay- and silt-sized particles.

4.5.1 CALCULATIONS

In order to calculate the SDI of a given water, the following formula is used:

$$SDI = \left(1 - \frac{T_1}{T_F}\right) \times 100 \div T_T \qquad \textbf{(4.8)}$$

where:	SDI	=	Silt Density Index (an empirical number between 1 and 100)
	T_I	=	the initial time to fill 500 milliliters, seconds
	T_F	=	the final time to fill 500 milliliters, seconds
	T_T	=	the total time test is performed, minutes

4.5.2 RESULTS OF SDI TESTING

SDI's were performed on the new production well throughout the well testing. SDI's were obtained both before and after water passed through the 5.0 micron colloidal filter. **Table 4-4: SDI Results** presents the results of the SDI testing.

Pre- and post-colloidal filter SDI's were obtained during each of the three (3) steps during the step-drawdown testing and during the two (2)-hour pump test. SDI values were above the desired 3.00 in each pre-filter test, with the exception step 2. The SDI's ranged from 1.95 to 6.04. The post-colloidal SDI values ranged from 1.57 to -0.08. The high value of 1.57 occurred during step 3, the test performed at the highest pumping rate. The SDI values of the pre-colloidal filter test compared to the corresponding post-colloidal filter test indicate that the size of the great majority of the particles flowing through the testing apparatus is greater than 5.0 microns.

Based on the SDI test results, membrane fouling due to these silt sized particles may be a significant concern if pre-filters are not used to trap these particles prior to their entering the membrane. Continued development of the well as it is pumped may decrease the SDI values, however this will not be certain until the well has been in production for some time.

4.5.3 UPHOLE VELOCITY

One method of controlling the SDI is through the regulation of the uphole velocity of water in the well. Decreasing the velocity will decrease the SDI of the water. For membrane processes, an uphole velocity of less than 2.5 feet per second ("fps") is recommended. The following formula is used to calculate the uphole velocity (Heald, 1994):

$$V = \frac{.4085\ Q}{d^2} \qquad \textbf{(4.9)}$$

where:	V	=	uphole velocity, feet per second
	Q	=	pumpage rate, gallons per minute
	d	=	inner diameter of the well, inches

Using the design pumping rate of 1,100 gpm and a pipe minimum inner diameter of 11.070 inches, the calculation yields an uphole velocity of 3.67 fps for the new production well. In order for the velocity not to rise above the recommended 2.5 fps for a membrane plant, the pumpage rate should not be greater than 750 gpm. This reduction of rate should be implemented only if high SDI values become a concern.

Table 4-4

SDI Results

Test Number	Pre / Post Filter	SDI
Step 1, Test 1	Pre	5.51
Step 1, Test 2	Post	0.20
Step 1, Test 3	Pre	4.80
Step 2, Test 1	Pre	1.95
Step 2, Test 2	Post	-0.08
Step 3, Test 1*	Post	1.57
Step 3, Test 2*	Pre	6.04
1	Pre	4.64
2	Post	0.49
3	Pre	4.54
4	Post	-0.02

* A pressure of 30 psi was not able to be obtained for this SDI test; therefore, results may be inaccurate.

4.6 WATER QUALITY TESTING

Field water quality sampling was performed during the drilling of the open hole section of the well. The samples were analyzed for temperature in degrees Centigrade ("°C"), conductivity in micro-Siemens ("μS"), and salinity in parts per thousand ("ppt"). The results of these tests are presented in **Table 4-5: Field Water Quality**.

Additional composite water quality field testing for the Floridan well were obtained on October 3, 2002 and October 4, 2002. The samples were analyzed for temperature (°C), specific conductance and conductivity (μS), salinity (ppt), and iron, chloride, hydrogen sulfide and sulfate (milligrams per liter ("mg/l")). These results are presented in **Table 4-6: Additional Field Water Quality**.

Table 4-5

Field Water Quality

Depth (ft)	Temperature (°C)	Salinity (ppt)	Conductivity (μS)
1,115	25.2	2.3	4,313
1,145	24.1	2.3	4,313
1,175	24.3	2.4	4,511
1,205	23.9	2.6	4,930
1,237	25.6	3.2	6,000
Composite No. 1	24.2	3.2	5,400
Composite No. 2	24.5	3.1	5,640

Table 4-6

Additional Field Water Quality

Parameter	October 3, 2002	October 4, 2002
Temperature (°C)	26.9	24.0
Salinity (ppt)	3.1	3.2
Specific Conductance (μS/cm)	5,720	5,830
Conductivity (μS/cm)	5,800	5,730
Iron (mg/L)	N/A	.08
Chloride (mg/L)	2,000	2,000
Hydrogen Sulfide (mg/L)	N/A	5.75
Sulfate (mg/L)	>200	>200

Water samples obtained at depth differ from composite samples. The water samples obtained at depth relate specifically to the water produced at that portion of the water bearing formation. Composite water samples, those obtained once the well was allowed to flow, are a mixture of the water produced from all of the water bearing rock in the open hole.

In general, water quality decreases deeper into the Floridan aquifer (see **Figure 4-2: Field Water Quality**). Water samples obtained at 1,237 feet bls showed a decrease in water quality as compared to those obtained from shallower depths. At 1,205 feet bls the specific conductance of the sample was 4,930 μS/cm, whereas at 1,237 feet bls the specific conductance increased to 6,000 μS/cm. This was accompanied by an increase in salinity from 2.6 ppt at 1,205 feet to 3.2 ppt at 1,237 feet. Increased salinity and related increase in conductivity of water samples indicate a decrease in water quality. Drilling was stopped at 1,237 feet in anticipation of further decreasing water quality below 1,237 feet.

Water chemistry measurements conducted on composite samples obtained on October 3, 2002, and October 4, 2002, showed comparatively high concentrations of hydrogen sulfide and sulfates, but this is typical of the Floridan aquifer.

A raw water sample from the production well was obtained and analyzed by Envirodyne, Inc., a licensed, Florida Department of Environmental Protection ("FDEP") certified laboratory. Of the parameters tested, the following were above the maximum contaminant level ("MCL") for primary or secondary drinking water standards: total dissolved solids, chloride, sulfates, odor, and turbidity. All other tested parameters were below the MCL for each parameter. High levels of chloride, sulfate, and total dissolved solids are expected in this aquifer and will be managed by membrane treatment. Odor may be due to the presence of hydrogen sulfide. Odor and turbidity will also be reduced by the treatment process. The raw water contains barium, strontium, and radium, although none are above the MCL. However, these radioactive elements will be concentrated in the reject and may cause permitting problems with disposal of the concentrate. The water is slightly encrusting (non-corrosive). This water is not for human consumption and therefore does not need to meet drinking water standards. However, for aesthetic concerns and because of the potential for human contact, the water quality should be monitored and maintained.

The results of the water quality tests performed by Envirodyne, Inc. are presented in **Appendix G: Envirodyne Water Quality Results**.

4.7 MICROBIOLOGICAL TESTING

On October 16, 2001, personnel from GMW&A collected one (1) water sample from Seminole's Floridan well. The sample was collected aseptically and delivered to Micrim Labs, Inc. ("Micrim") for analysis. Results of the microbiological sampling are included in **Appendix H: Microbiological Sample Results**.

Seminole Golf Club
Well F-1
Field Water Quality

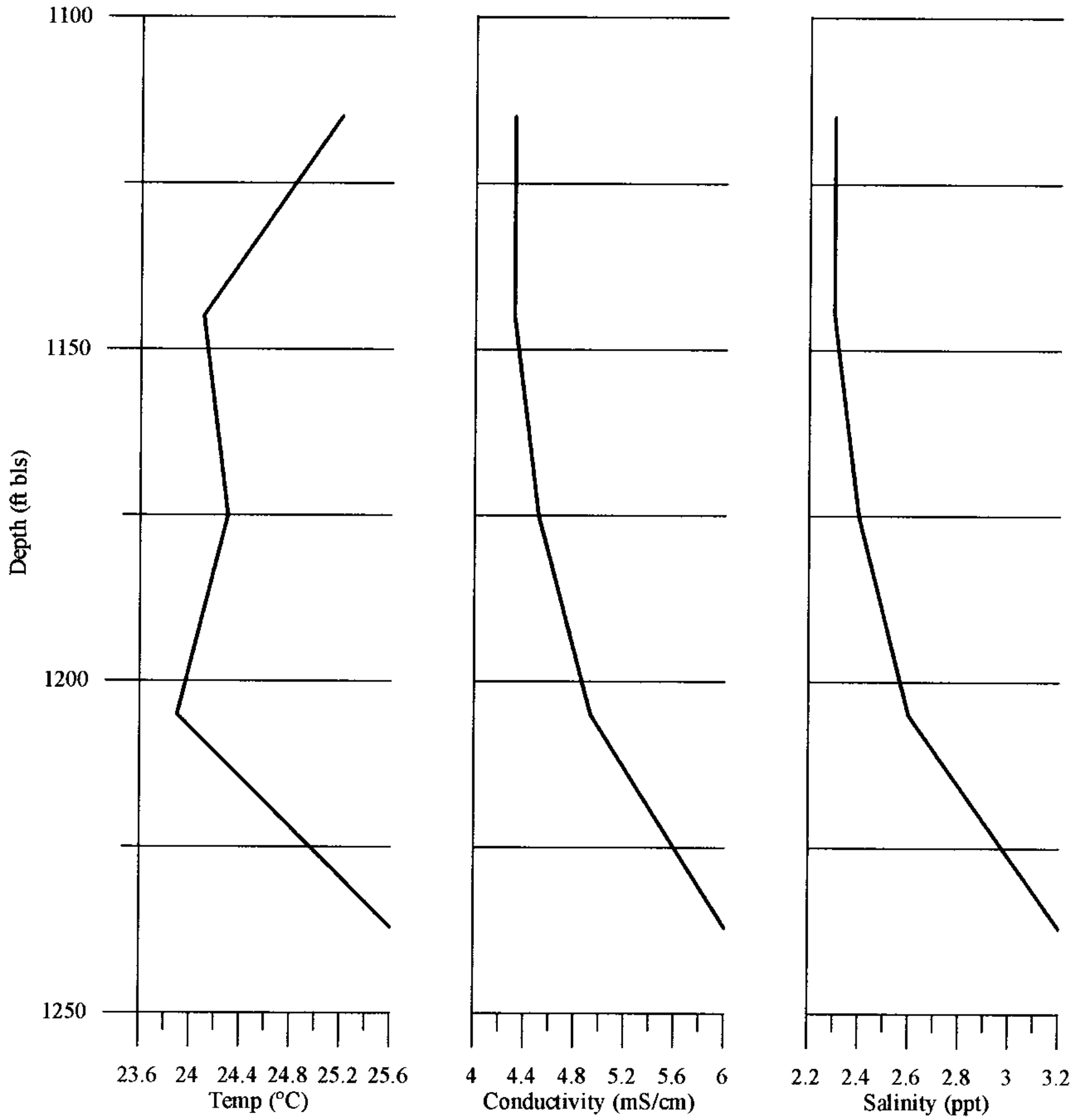

Figure 4-2

Gerhardt M.
Witt
& Associates, Inc.

4.7.1 EXPLANATION OF MICROBIOLOGICAL TEST PARAMETERS

HPC: Heterotrophic Plate Count. This is an estimate of the number of heterotrophic bacteria found in the water sample. Heterotrophic bacteria are bacteria that utilize organic substances as principal sources of energy for growth and reproduction. This includes most bacteria encountered in nature. The HPC is reported in colony forming units per milliliter ("CFU/mL") and represents the number of viable organisms per milliliter of water. (*Standard Methods* 9215B)

TCC: Total Coliform Count. This is an estimate of the number of coliform bacteria present in the water sample. Coliform bacteria are defined as bacteria capable of fermenting lactose to acid and gas within 48 hours at 35°C (95°F). The presence of coliform bacteria indicates the presence of contaminating waste in the water sample. The TCC is measured in colony forming units per 100 milliliters of water ("CFU/100mL"). (*Standard Methods* 9222B)

FCC: Fecal Coliform Count. This is an estimate of the number of fecal coliform bacteria present in the water sample. Fecal coliform bacteria are differentiated from total coliform bacteria by the fermentation of lactose to acid and gas within 24 hours at 44.5°C (112°F). The most widely known and often isolated fecal coliform is *Escherichia coli* (*"E. coli"*). Fecal coliforms are an indication of fecal contamination of the water sample. The FCC is measured in colony forming units per 100 milliliters of water ("CFU/100mL"). (*Standard Methods* 9222D)

Bacterial I.D.: This is a list of all of the bacterial species that were isolated (grown) from the sample.

TFC: Total Fungal Count. This is an estimate of the number of the fungal organisms found in the water sample. The TFC is measured in colony forming units per 100 milliliters of water ("CFU/100mL"). (*Standard Methods* 9215D)

Fungal I.D.: This is a list of all of the fungal species that were isolated from the sample. Certain types of fungi are considered pathogenic organisms.

Algal I.D.: This is a list of the algal morphologies that were identified by direct microscopic examination of the sample. The presence of algae in a water sample from a well usually indicates that there is a direct connection between the well and a surface water source. In addition to algae, bacterial species that are difficult to grow in the laboratory environment but are distinguishable by microscopic examination (such as the iron bacteria *Gallionella ferruginea* and *Sphaerotilus natans*) will also be identified in this section, if noted in the sample.

4.7.2 MICROBIOLOGICAL SAMPLE RESULTS

Five (5) bacterial species were isolated from the water sample. Two (2) of the bacterial species isolated, *Aeromonas hydrophila* and *Pseudomonas aeruginosa*, are considered opportunistic pathogens capable of causing disease in debilitated or susceptible people. Four (4) of the bacterial species isolated, *Pseudomonas aeruginosa*, *Pseudomonas alcaligenes*, *Pseudomonas fluorescens*, and *Pseudomonas stutzeri*, are considered biofouling organisms capable of producing biofilms by the production of extracellular polymeric substances such as alginate and capsules. Several significant problems can be caused by the presence of these biofilms (Characklis and Marshall, 1990):

1. Reduced Flow

   Biofilms can form in distribution pipes, column pipes, membranes, wellscreens, and the formation. The presence of biofilms in these locations will restrict water flow, thereby increasing energy costs for water withdrawal and transport.

2. Increased Capital Cost

   There are several ways that biofouling may lead to increased capital costs. First, additional extraction wells will be required to compensate for reduced flow. Second, unscheduled downtime and extended turnaround times to clean biofouled equipment will result in the use of expensive, temporary measures to compensate. Third, and most important, replacement of equipment due to biofouling and/or corrosion will be required prematurely. For example, a nuclear power plant had to replace a condenser after approximately six (6) years of operation because of severe corrosion due, in part, to microbial action (Geesey, et. al., 1994). The presence of biofilms can initiate and increase the rate of corrosion of certain materials, especially ferrous materials such as iron and stainless steel. Listed below are the main mechanisms of microbiologically influenced corrosion (Videla, 1996).

A. Production of corrosive metabolites: Certain bacteria directly and/or indirectly produce acids or other corrosion enhancing products as a by-product of metabolism. These products can include hydrogen sulfide produced by sulfur-reducing bacteria (Cullimore, 1993), strong acids such as sulfuric acid produced by sulfur-oxidizing bacteria, weak organic acids produced by some *Pseudomonas* and *Clostridium* species, and ferric and manganic chlorides produced by iron-oxidizing bacteria such as *Sphaerotilus natans*. The biofilm will trap and concentrate these corrosive by-products near the metal surface, thereby enhancing their corrosive action on the metal.

B. Establishment of differential aeration cells: As a biofilm matures, the areas around and beneath the biofilm will become depleted of oxygen. Areas of depleted oxygen will become anodic and will release metal ions to cathodic regions (oxygenated regions). In addition, the areas of depleted oxygen will be suitable environments for destructive anaerobic bacteria such as the sulfur-reducing bacteria.

3. Health Issues

Certain bacterial species that form biofilms are pathogenic to humans. The nature of the biofilm helps prevent the effective action of biocides and allows potentially harmful bacteria to flourish in biofouled systems.

The microbiological sample from Seminole's Floridan aquifer well had an HPC of 11 CFU/mL, and a TCC and FCC of less than one (<1) CFU/100mL These bacterial counts do not indicate a significant presence of organisms in the well. However, the well should be routinely monitored and disinfected as outlined in Section 5 of this report.

4.8 TELEVISION SURVEYING

On October 16, 2002, a downhole, color, television video of the well was performed by MV Geophysical using a downhole and side view camera. The survey was performed under static and flowing conditions. The water clarity was excellent throughout the well under both static and flowing conditions. The video begins at approximately land surface, inside the well casing (11.07-inch inside diameter PVC). Beginning at land surface, the well casing is marked and scratched as a result of the drill pipe rubbing against the inside of the well casing. This does not compromise the integrity of the well. At approximately 101 feet bls, the port for the two (2)-inch diameter sample tube is observed and appears to be in good condition. The well casing and joints appear to be in satisfactory condition, and no problems were apparent. Visual observation indicates some grout visible around the casing seat. Under flowing conditions, no sand or debris was observed entering the well from the casing seat, indicating a good grout seal.

The open hole from the bottom of the casing at 1,074 feet bls to the bottom of borehole at approximately 1,234 feet bls appears to be tight and relatively gauged. Smaller fractures are apparent immediately below the bottom of the casing and at 1,091 feet bls. A large fracture is obvious in the interval 1,211 to 1,215 feet bls.

Once at the bottom of the borehole, the well was allowed to flow as the video camera ascended. The water appeared cloudy from the bottom of the borehole up to the large fracture at 1,211 to 1,215 feet bls. A significant amount of water appears to be entering the borehole from the large fracture, and the picture cleared (the water became less cloudy) after passing the fracture. No other areas of significant flow or areas of sand production were apparent to the top of the well.

This television survey presents the condition of the well at the time of installment and should be used for comparison when future video surveys are performed. A copy of the video survey is presented in **Appendix I: Television Video Survey**.

SECTION 5

WELLFIELD MAINTENANCE AND OPERATION

SECTION 5

WELLFIELD MAINTENANCE AND OPERATION

5.0 WELLFIELD MAINTENANCE AND OPERATION

In order to maintain well performance and increase well life, Seminole should monitor and evaluate the performance of its new well through specific testing procedures and regular maintenance. It is important that Seminole staff recognize changes in the well and notify the appropriate personnel of these changes.

5.1 RECOMMENDED TESTING AND MAINTENANCE PROCEDURES

GMW&A strongly recommends that Seminole's regular maintenance program include the following testing and preventative maintenance procedures to enhance well life and well efficiency:

5.1.1 MONTHLY

Each month Seminole staff should:

A. On each well, maintain records such as static water level, drawdown, and water quality (as per Hach field test kits).

B. Physically inspect the well to determine the following:

1. Flow meters are functioning properly.
2. All valves are operating under design parameters.
3. No leaks and/or damage to the well has occurred.
4. All pressure gauges are operating as designed.
5. Any and all repairs are noted and reported to supervisors.
6. SDI's and in-house bacterial counts (HPC's) are taken on wells where water may go to a membrane processing system.

C. Run a bacterial scan for coliform and fecal coliform bacteria in the production well.

D. Record static water levels in the well. (Seminole should obtain a proper measuring device [pressure transducer].)

E. Record the drawdowns from the static water levels after 60 minutes of continuous pumping at the design pumping rate of the production well.

F. Record the pumping rate of the well (gpm).

G. Calculate the specific capacity using the following formula:

$$\textit{Specific Capacity (gpm/ft)} = \textit{Pumping Rate (gpm)} \div \textit{drawdown (feet)} \qquad \textbf{(5.1)}$$

The original specific capacity of Seminole's Floridan well was 78.79 gpm per foot of drawdown after 60 minutes of pumping at 1,116 gpm. If the specific capacity drops by 20% or more of the original specific capacity, then Seminole staff should:

1. Contact a hydrogeologist.
2. Take water samples as described in this report to be analyzed for total bacterial (including total coliform), algal, and fungal, as performed by Micrim Labs, Inc. of Fort Lauderdale, Florida.
3. Perform a step-drawdown test as described in this report.
4. Perform a sand test as described in this report.
5. Perform Silt Density Index testing as described in this report.
6. Send all data to a qualified hydrogeologist for analysis.

5.1.2 YEARLY

Each year Seminole staff should:

A. Take water samples from the well to be analyzed for total bacterial (including total coliform), algal and fungal, as performed by Micrim Labs, Inc. of Fort Lauderdale, Florida.

B. Take water samples from the well to be analyzed for Priority Pollutants.

C. Perform a step-drawdown test on the well.

D. Perform a sand test on the well.

E. Shock chlorinate the well with a 6,000 mg/L solution of calcium hypochlorite and dispose to waste. Chlorine **must not** come in contact with the membranes.

5.1.3 EVERY FIVE YEARS

Every five (5) years Seminole staff should:

A. Pull and visually inspect the well pump for wear/corrosion.

B. Television survey the well.

It should be noted that this procedure should be considered minimal. Operational data on the well will further determine how frequently disinfection and certain tests are performed. It is imperative that Seminole staff maintain records as scheduled testing is done.

5.2 RECORD KEEPING

It is extremely important for Seminole staff to maintain records on step-drawdown testing and specific capacity, sand concentration, silt density index, microbiological, and water quality testing.

Seminole should maintain an individual file on the well. This file should contain all records of work/maintenance performed on the well.

SECTION 6

CONCLUSIONS, RECOMMENDATIONS, AND SUMMARY

SECTION 6

CONCLUSIONS, RECOMMENDATIONS, AND SUMMARY

6.0 CONCLUSIONS, RECOMMENDATIONS, AND SUMMARY

Based on the findings submitted in this report, GMW&A has made conclusions and recommendations regarding the Seminole Golf Club's new, Floridan aquifer production well.

6.1 CONCLUSIONS

The following is the summary of relevant findings of this project.

1. The drilling of the production well proceeded as expected. The well was constructed in accordance with AWWA and FDEP standards.

2. Geologic, television, and geophysical logging did not indicate any unusual or unexpected occurrences.

3. Step-drawdown testing indicated that the well is relatively stable and should function as expected at the design pumping rate. The average transmissivity calculated from the step-drawdown testing is 211,318 gpd/ft.

4. The sand concentration results meet the standard of less than 1.0 mg/L after 60 minutes of pumping at the design rate.

5. Based on the SDI test results, membrane fouling due to silt sized particles may be a concern. However, the amount of silt-sized particles should decrease with well use.

6. An uphole velocity of 3.67 fps was calculated for the new production well. In order for the velocity not to rise above the required 2.5 fps for a membrane plant, the pumpage rate should not be greater than 750 gpm.

7. The following constituents are above the maximum contaminant level ("MCL") for primary or secondary drinking water standards: total dissolved solids, chlorides, sulfates, odor, and turbidity. However, these parameters should diminish with treatment.

8. There is no significant population of bacteria present in the well.

9. The well should be able to function withing its design parameters.

6.2 RECOMMENDATIONS

GMW&A recommends Seminole take the following actions:

1. The pumping rate should be lowered if high SDI values become a concern.

2. The well should be sampled every six (6) months to determine the presence of any potentially problematic bacterial species.

3. The well pump and appurtenances should be exercised regularly.

4. As a minimum, Seminole should perform the recommended testing and maintenance procedures outlined in Section 5 of this report. Routine maintenance and testing will most likely detect a possible problem before it causes failure of the well, the wellfield, and/or the water production system.

6.3 SUMMARY

The well as constructed by Diversified Drilling Corporation should function within the final design parameters of the well, provided the Seminole Golf Club maintains, operates, and tests the well as recommended.

This report is respectfully submitted to the Seminole Golf Club. GMW&A wants to express our thanks to the Seminole Golf Club for the opportunity to provide our knowledge and expertise to this project.

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APPENDIX A

WELL CONSTRUCTION CHRONOLOGY

July 17, 2002	Hold preconstruction meeting with personnel from Seminole Golf Club, Inc. ("Seminole"), Diversified Drilling Corporation ("Diversified"), and Gerhardt M. Witt & Associates, Inc. ("GMW&A").
July 23, 2002	Diversified signs the contract with Seminole.
August 9, 2002	Diversified begins mobilization.
August 20, 2002	Drill 42-inch diameter borehole to 47 feet bls. Installation of 36-inch diameter casing obstructed by debris at 25 feet bls.
August 22, 2002	Re-drill 42-inch diameter borehole to 63 feet bls.
August 22-23, 2002	Install and cement 36-inch diameter steel surface casing to 54.5 feet bls with 142 sacks of Portland Type I, neat cement.
August 26, 2002	Drill 35-inch diameter borehole to 126 feet bls.
August 27, 2002	Drill 35-inch diameter borehole to 250 feet bls.
August 28, 2002	Drill 35-inch diameter borehole to 305 feet bls.
August 29, 2002	Install 24-inch diameter steel casing to 297 feet bls. Cement to 85 feet bls with 100 sacks of Portland Type II, neat cement and 300 sacks of Portland Type II cement with 4% bentonite.
August 30, 2002	Cement 24-inch diameter steel casing to surface with 210 sacks of Portland Type II cement with 4% bentonite.
September 3, 2002	Set-up to drill out cement plug with 23-inch bit.
September 4, 2002	Drill to 317 feet bls with 23-inch bit to remove cement plug and prepare for drilling pilot hole.
September 5, 2002	Drill 10 ⅝-inch diameter pilot hole to 590 feet bls.
September 6, 2002	Assemble blow-out preventer.
September 7, 2002	Drill 10 ⅝-inch diameter pilot hole to 830 feet bls.

September 9-10, 2002	Repair mud pump.
September 11, 2002	Drill 10 ⅝-inch diameter pilot hole to 1,084 feet bls.
September 12, 2002	Drill 10 ⅝-inch diameter pilot hole to 1,175 feet bls. Southern Resource Exploration performs geophysical logging of pilot hole.
September 13-18, 2002	Ream 10 ⅝-inch diameter pilot hole with 23-inch bit to 1,084 feet bls.
September 19, 2002	Install 12-inch diameter, CertainTeed, Certa-Lok casing to 1,075 feet bls with two (2)-inch monitor tube to 100 feet bls.
September 20, 2002	Begin cementing 12-inch diameter casing (Stage I) with 72 sacks of Portland, Type II, neat cement and 281 sacks of Portland, Type II cement with 12% bentonite.
September 21, 2002	Cement 12-inch diameter casing (Stage II) with 248 sacks of Portland, Type II cement with 12% bentonite.
September 23, 2002	Cement 12-inch diameter casing to surface (Stage III) with 139 sacks of Portland, Type II cement with 12% bentonite.
September 24, 2002	Southern Resource Exploration performs temperature log.
September 25-30, 2002	Drill 10 ⅝-inch diameter borehole to 1,105 feet bls.
October 1, 2002	Drill 10 ⅝-inch diameter borehole to 1,237 feet bls while obtaining water quality sample every 30 feet.
October 2, 2002	Begin well development. Obtain field water quality sample.
October 3, 2002	Continue development. Obtain field water quality sample.
October 4, 2002	Continue development. Obtain field water quality sample.
October 7, 2002	Southern Resource Exploration performs geophysical logging.
October 14-15, 2002	Conduct step-drawdown, sand concentration, SDI, and constant rate testing. Envirodyne collects samples for laboratory water quality analyses.

October 16, 2002	Perform television survey and collect water samples for microbiological analysis.
October 25, 2002	Diversified completely demobilized from the site.

APPENDIX B

GEOLOGIC LOGS

Geologic Log

Seminole Golf Club

Well No. F-1

15 To 25 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/20/2002

65 % SAND	**Color:**	10YR 7/4 grayish orange	**Roundness:**	Round -- Angular
	Mineral:	Quartz	**Sphericity:**	Moderate
	Size:	Fine -- Coarse	**Frosting:**	Mixed
35 % SANDSTONE	**Color:**	10YR 7/4 grayish orange		**Clasts**
	Matrix:	Calcium Carbonate	**Mineral:**	Quartz
	Texture:	Sandy	**Size:**	Fine -- Coarse
	Porosity:	Fair	**Roundness:**	Round -- Subangular
	Cementation:	Good	**Sphericity:**	Moderate
	Hardness:	Moderately Hard	**Frosting:**	Mixed

Comments: Loosely consolidated sandstone cemented together with carbonate cement. 5% of sandstone is well consolidated with carbonate cement.

25 To 33 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/20/2002

40 % SAND	**Color:**	10YR 7/4 grayish orange	**Roundness:**	Round -- Subangular
	Mineral:	Quartz	**Sphericity:**	Moderate
	Size:	Fine -- Coarse	**Frosting:**	Mixed
<1 % FOSSILS (Fragments)	**Type:**	N/A	**Weathering:**	Extreme
60 % SANDSTONE	**Color:**	10YR 7/4 grayish orange		**Clasts**
	Matrix:	Calcium Carbonate	**Mineral:**	Quartz
	Texture:	Sandy	**Size:**	Fine -- Medium
	Porosity:	Fair	**Roundness:**	Round -- Subangular
	Cementation:	Fair	**Sphericity:**	Moderate
	Hardness:	Moderately Hard	**Frosting:**	Mixed

Comments: Loosely consolidated sandstone, cemented with carbonate cement. 5% of sandstone is well consolidated with carbonate cement.

35 To 45 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/20/2002

80 % SAND	**Color:**	10YR 7/4 grayish orange	**Roundness:**	Round -- Subangular
	Mineral:	Quartz	**Sphericity:**	Moderate
	Size:	Fine -- Coarse	**Frosting:**	Mixed
3 % FOSSILS (Fragments)	**Type:**	N/A	**Weathering:**	Extreme
17 % SANDSTONE	**Color:**	10YR 7/4 grayish orange		**Clasts**
	Matrix:	Calcium Carbonate	**Mineral:**	Quartz
	Texture:	Sandy	**Size:**	Fine -- Medium
	Porosity:	Not Discernible	**Roundness:**	Round -- Subangular
	Cementation:	Fair	**Sphericity:**	Moderate
	Hardness:	Moderately Hard	**Frosting:**	Mixed

Comments: Sandstone is loosely consolidated with carbonate cement

Geologic Log

Seminole Golf Club

Well No. F-1

45 To 48 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/20/2002

80 % SAND

Color:	10YR 7/4 grayish orange	**Roundness:**	Round -- Subangular
Mineral:	Quartz	**Sphericity:**	Moderate
Size:	Fine -- Coarse	**Frosting:**	Mixed

3 % FOSSILS (Fragments)

Type:	N/A	**Weathering:**	Extreme

17 % SANDSTONE

Color:	10YR 7/4 grayish orange		**Clasts**
Matrix:	Calcium Carbonate	**Mineral:**	Quartz
Texture:	Sandy	**Size:**	Fine -- Medium
Porosity:	Not Discernible	**Roundness:**	Round -- Subangular
Cementation:	Fair	**Sphericity:**	
Hardness:	Moderately Hard	**Frosting:**	Mixed

Comments: Sandstone is loosely consolidated with carbonate cement

50 To 60 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/22/2002

60 % SAND

Color:	10YR 7/4 grayish orange	**Roundness:**	Round -- Subangular
Mineral:		**Sphericity:**	Moderate
Size:	Fine -- Coarse	**Frosting:**	Mixed

35 % FOSSILS (Fragments)

Type:	Various shell	**Weathering:**	Extreme

5 % SANDSTONE

Color:	10YR 7/4 grayish orange		**Clasts**
Matrix:	Calcium Carbonate	**Mineral:**	Quartz
Texture:	Silty	**Size:**	Fine -- Medium
Porosity:	Poor	**Roundness:**	Round -- Subangular
Cementation:	Fair	**Sphericity:**	Moderate
Hardness:	Moderately Hard	**Frosting:**	Mixed

Comments: Sandstone cemented with calcium carbonate cement

70 To 80 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

10 % SAND

Color:	5Y 8/1 yellowish gray	**Roundness:**	Round -- Subangular
Mineral:	Quartz	**Sphericity:**	Moderate
Size:	Fine -- Coarse	**Frosting:**	Mixed

25 % FOSSILS (Fragments)

Type:	Various shell	**Weathering:**	Moderate -- Extreme

60 % LIMESTONE

Color:	5Y 8/1 yellowish gray	**Porosity:**	Poor
Matrix:	Micrite	**Cementation:**	Good
Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
Texture:	Sandy		

Comments: Distinct formation change with presence of well cemented limestone, large shell fragments, and construction cement.

Geologic Log

Seminole Golf Club

Well No. F-1

80 To 90 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

40 % SAND	**Color:**	5Y 8/1 yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Quartz	**Sphericity:**	Moderate
	Size:	Fine -- Coarse	**Frosting:**	Mixed
30 % FOSSILS (Fragments)	**Type:**	Various shell	**Weathering:**	Moderate -- Extreme
25 % LIMESTONE	**Color:**		**Porosity:**	Poor
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Sandy		

Comments: Construction cement present from up-hole plug.

90 To 100 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

30 % SAND	**Color:**	10YR 8/2 very pale orange	**Roundness:**	Round -- Subangular
	Mineral:	Quartz	**Sphericity:**	Moderate
	Size:	Fine -- Coarse	**Frosting:**	Mixed
40 % FOSSILS (Fragments)	**Type:**	Various shell	**Weathering:**	Moderate -- Extreme
15 % LIMESTONE	**Color:**	10YR 8/2 very pale orange	**Porosity:**	Poor
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Cement present for up-hole plug.

100 To 110 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

40 % SAND	**Color:**	10YR 8/2 very pale orange	**Roundness:**	Round -- Angular
	Mineral:	Quartz	**Sphericity:**	Moderate
	Size:	Fine -- Coarse	**Frosting:**	Mixed
40 % FOSSILS (Fragments)	**Type:**	Various shell	**Weathering:**	Moderate -- Extreme
20 % LIMESTONE	**Color:**	10YR 8/2	**Porosity:**	Fair
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Rounded, large limestone pebbles seen in sample.

Geologic Log

Seminole Golf Club

Well No. F-1

110 To 120 Feet — **Drilling Method:** Mud Rotary — **Bit Type:** Toothed — **Date Collected:** 8/26/2002

40 % SAND	**Color:**	10YR 8/2 very pale orange	**Roundness:**	Round -- Angular
	Mineral:	Quartz	**Sphericity:**	Moderate
	Size:	Fine -- Coarse	**Frosting:**	Mixed
40 % FOSSILS (Fragments)	**Type:**	Various shell	**Weathering:**	Moderate -- Extreme
20 % LIMESTONE	**Color:**	10YR 8/2	**Porosity:**	Fair
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Rounded, large limestone pebbles seen in sample.

120 To 130 Feet — **Drilling Method:** Mud Rotary — **Bit Type:** Toothed — **Date Collected:** 8/26/2002

40 % SAND	**Color:**	5YR 7/2 grayish orange pink	**Roundness:**	Round -- Subangular
	Mineral:	Quartz	**Sphericity:**	Moderate
	Size:	Fine -- Coarse	**Frosting:**	Mixed
5 % FOSSILS (Fragments)	**Type:**	Various shell	**Weathering:**	None -- Extreme
55 % LIMESTONE	**Color:**	N7 light gray	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Distinct formation change; sample composed primarily of limestone.

130 To 140 Feet — **Drilling Method:** Mud Rotary — **Bit Type:** Toothed — **Date Collected:** 8/26/2002

40 % SAND	**Color:**	5YR 7/2 grayish orange pink	**Roundness:**	Round -- Subangular
	Mineral:	Quartz	**Sphericity:**	Moderate
	Size:	Fine -- Coarse	**Frosting:**	Mixed
5 % FOSSILS (Fragments)	**Type:**	Various shell	**Weathering:**	None -- Extreme
55 % LIMESTONE	**Color:**	N7 light gray	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Distinct formation change; sample composed primarily of limestone.

Geologic Log

Seminole Golf Club

Well No. F-1

140 To 150 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

5 % SAND	**Color:**	5YR 7/2 grayish orange pink	**Roundness:**	Subround -- Angular
	Mineral:	Quartz	**Sphericity:**	Low
	Size:	Very Fine -- Medium	**Frosting:**	Mixed
10 % FOSSILS (Fragments)	**Type:**	Shells	**Weathering:**	None -- Extreme
5 % FOSSILS (Whole)	**Type:**	Shells	**Weathering:**	Moderate
80 % LIMESTONE	**Color:**	N7 light gray	**Porosity:**	Not Discernible
	Matrix:	Sparite	**Cementation:**	Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Hard
	Texture:	Sandy		

Comments:

150 To 160 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

5 % SAND	**Color:**	5YR 7/2 grayish orange pink	**Roundness:**	Subround -- Angular
	Mineral:	Quartz	**Sphericity:**	Low
	Size:	Very Fine -- Medium	**Frosting:**	Mixed
10 % FOSSILS (Fragments)	**Type:**	Shells	**Weathering:**	None -- Extreme
5 % FOSSILS (Whole)	**Type:**	Shells	**Weathering:**	Moderate
80 % LIMESTONE	**Color:**	N7 light gray	**Porosity:**	Not Discernible
	Matrix:	Sparite	**Cementation:**	Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Hard
	Texture:	Sandy		

Comments:

160 To 170 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

35 % SAND	**Color:**	5YR 7/2 grayish orange pink	**Roundness:**	Subround -- Angular
	Mineral:	Quartz, calcium carbonate	**Sphericity:**	Low -- Moderate
	Size:	Very Fine -- Medium	**Frosting:**	Mixed
5 % FOSSILS (Fragments)	**Type:**	Shells	**Weathering:**	Extreme
60 % LIMESTONE	**Color:**	5YR 7/2 grayish orange pink	**Porosity:**	Fair
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Trace of very fine material.

Geologic Log

Seminole Golf Club

Well No. F-1

170 To 180 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

40 % SAND	**Color:**	5YR 7/2 grayish orange pink	**Roundness:**	Subround -- Angular
	Mineral:	Quartz. calcium carbonate	**Sphericity:**	Low -- Moderate
	Size:	Very Fine -- Medium	**Frosting:**	Mixed
30 % FOSSILS (Fragments)	**Type:**	Shells	**Weathering:**	Extreme
30 % LIMESTONE	**Color:**		**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Trace of very fine material.

180 To 190 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

40 % SAND	**Color:**	5YR 7/2 grayish orange pink	**Roundness:**	Subround -- Angular
	Mineral:	Quartz, calcium carbonate	**Sphericity:**	Low -- Moderate
	Size:	Very Fine -- Medium	**Frosting:**	Mixed
30 % FOSSILS (Fragments)	**Type:**	Shells	**Weathering:**	Extreme
30 % LIMESTONE	**Color:**		**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Trace phosphate.

190 To 200 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

40 % SAND	**Color:**	5YR 6/1 light brownish gray	**Roundness:**	Subround -- Angular
	Mineral:	Carbonate and quartz	**Sphericity:**	Moderate
	Size:	Very Fine -- Medium	**Frosting:**	Mixed
20 % FOSSILS (Fragments)	**Type:**	Shells	**Weathering:**	Moderate -- Extreme
40 % LIMESTONE	**Color:**	5YR 6/1 light brownish gray	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Sandy		

Comments: (Reacts strongly with acid) all samples above too; trace phosphate.

Geologic Log

Seminole Golf Club

Well No. F-1

200 To 210 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

30 % SAND	**Color:**	5YR 6/1 light brownish gray	**Roundness:**	Subround -- Angular
	Mineral:	Carbonate and quartz	**Sphericity:**	Moderate
	Size:	Very Fine -- Medium	**Frosting:**	Mixed
20 % FOSSILS (Fragments)	**Type:**	Shells	**Weathering:**	Moderate -- Extreme
50 % LIMESTONE	**Color:**	5YR 6/1 light brownish gray	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Sandy		

Comments: Reacts strongly with acid; trace phosphate.

210 To 220 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

30 % SAND	**Color:**	5YR 6/1 light brownish gray	**Roundness:**	Subround -- Angular
	Mineral:	Carbonate and quartz	**Sphericity:**	Moderate
	Size:	Very Fine -- Medium	**Frosting:**	Mixed
20 % FOSSILS (Fragments)	**Type:**	Shells	**Weathering:**	Moderate -- Extreme
50 % LIMESTONE	**Color:**	5YR 6/1 light brownish gray	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Sandy		

Comments: Reacts strongly with acid; trace phosphate; trace of foraminifera

220 To 230 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

20 % SAND	**Color:**	5YR 6/1 light brownish gray	**Roundness:**	Subround -- Angular
	Mineral:	Carbonate and quartz	**Sphericity:**	Moderate
	Size:	Very Fine -- Medium	**Frosting:**	Mixed
20 % FOSSILS (Fragments)	**Type:**	Shells	**Weathering:**	Moderate -- Extreme
60 % LIMESTONE	**Color:**	5YR 6/1 light brownish gray	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Sandy		

Comments: Reacts strongly with acid; trace phosphate; trace of foraminifera

Geologic Log

Seminole Golf Club

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230 To 240 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

30 % **SAND**	**Color:**	5YR 7/2 grayish orange pink	**Roundness:**	Subround -- Angular
	Mineral:	quartz/calcium carbonate	**Sphericity:**	Moderate
	Size:	Fine -- Medium	**Frosting:**	Mixed
15 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
55 % **LIMESTONE**	**Color:**	5YR 7/2 grayish orange pink	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Sandy		

Comments: Reacts strongly with HCl.

240 To 250 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

30 % **SAND**	**Color:**	5YR 7/2 grayish orange pink	**Roundness:**	Subround -- Angular
	Mineral:	quartz/calcium carbonate	**Sphericity:**	Moderate
	Size:	Fine -- Medium	**Frosting:**	Mixed
15 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
55 % **LIMESTONE**	**Color:**	5YR 7/2 grayish orange pink	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Sandy		

Comments: Reacts strongly with HCl.

250 To 260 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

30 % **SAND**	**Color:**	5YR 7/2 grayish orange pink	**Roundness:**	Subround -- Angular
	Mineral:	quartz/calcium carbonate	**Sphericity:**	Moderate
	Size:	Very Fine -- Medium	**Frosting:**	Mixed
15 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
55 % **LIMESTONE**	**Color:**	5YR 7/2 grayish orange pink	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Sandy		

Comments: Reacts strongly with HCl; trace phosphate.

Geologic Log

Seminole Golf Club

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260 To 270 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 8/26/2002

5 % **SAND**	**Color:**	5YR 7/2 grayish orange pink	**Roundness:**	Subround -- Angular
	Mineral:	quartz/calcium carbonate	**Sphericity:**	Moderate
	Size:	Very Fine -- Medium	**Frosting:**	Mixed
5 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
90 % **LIMESTONE**	**Color:**	5YR 7/2 grayish orange pink	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Sandy		

Comments: Reacts strongly with HCl; trace phosphate.

270 To 280 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 8/26/2002

15 % **SAND**	**Color:**	5YR 7/2 grayish orange pink	**Roundness:**	Subangular -- Angular
	Mineral:	quartz/calcium carbonate	**Sphericity:**	Moderate
	Size:	Silt -- Fine	**Frosting:**	Mixed
5 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
80 % **LIMESTONE**	**Color:**	5YR 7/2 grayish orange pink	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Reacts strongly with HCl.

280 To 290 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 8/26/2002

20 % **SAND**	**Color:**	5YR 7/2 grayish orange pink	**Roundness:**	Subangular -- Angular
	Mineral:	quartz/calcium carbonate	**Sphericity:**	Moderate
	Size:	Silt -- Fine	**Frosting:**	Mixed
5 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
75 % **LIMESTONE**	**Color:**	5YR 7/2 grayish orange pink	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Silty		

Comments: Reacts strongly with HCl.

Geologic Log

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290 To 300 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

15 % SAND	**Color:**	5Y 6/1 light olive gray	**Roundness:**	Round -- Angular
	Mineral:	Calcium carbonate/quartz	**Sphericity:**	Moderate
	Size:	Very Fine -- Fine	**Frosting:**	Mixed
10 % FOSSILS (Fragments)	**Type:**	Shell	**Weathering:**	Extreme
75 % LIMESTONE	**Color:**	5Y 6/1 light olive gray	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Reacts strongly with HCl; trace phosphate.

300 To 305 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 8/26/2002

15 % SAND	**Color:**	5Y 6/1 light olive gray	**Roundness:**	Round -- Angular
	Mineral:	Calcium carbonate/quartz	**Sphericity:**	Moderate
	Size:	Very Fine -- Fine	**Frosting:**	Mixed
10 % FOSSILS (Fragments)	**Type:**	Shell	**Weathering:**	Extreme
75 % LIMESTONE	**Color:**	5Y 6/1 light olive gray	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Reacts strongly with HCl; trace phosphate.

350 To 360 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/5/2002

60 % SAND	**Color:**	5Y 6/1 light olive gray	**Roundness:**	Subround -- Angular
	Mineral:	Calcium carbonate/quartz	**Sphericity:**	Low
	Size:	Clay -- Fine	**Frosting:**	Mixed
10 % FOSSILS (Fragments)	**Type:**	Shells	**Weathering:**	Extreme
30 % LIMESTONE	**Color:**	5Y 8/1 yellowish gray	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts	**Hardness:**	Soft -- Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Construction cement present in sample (300' steel casing cement); calcareous clay, silt, and sand reacts strongly with HCl; trace of phosphate present.

Geologic Log

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365 To 395 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 9/5/2002

60 % SAND	**Color:**	5Y 6/1 light olive gray	**Roundness:**	Subround -- Angular
	Mineral:	Calcium carbonate/quartz	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Fine	**Frosting:**	Mixed
10 % FOSSILS (Fragments)	**Type:**	shell	**Weathering:**	Extreme
30 % LIMESTONE	**Color:**	5Y 6/1 light olive gray	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts	**Hardness:**	Soft -- Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Construction cement present in sample; calcareous clay, silt, and sand reacts strongly with HCl.

395 To 425 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 9/5/2002

90 % SAND	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subround -- Angular
	Mineral:	Calcium carbonate/quartz	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Very Fine	**Frosting:**	Mixed
5 % FOSSILS (Fragments)	**Type:**	Shell	**Weathering:**	Extreme
5 % LIMESTONE	**Color:**	10Y 6/2 pale olive	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard -- Hard
	Texture:	Silty		

Comments: Construction cement present in sample; calcareous sand and silt/clay reacts strongly with HCl; trace of phosphate seen.

425 To 455 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 9/5/2002

90 % SAND	**Color:**	10Y 6/2 pale olive	**Roundness:**	Round -- Angular
	Mineral:	(Ooids) calcium carbonate, quartz	**Sphericity:**	Moderate -- High
	Size:	Clay -- Fine	**Frosting:**	Mixed
5 % FOSSILS (Fragments)	**Type:**	Shells	**Weathering:**	Extreme
5 % LIMESTONE	**Color:**	10Y 6/2 pale olive	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard -- Hard
	Texture:	Silty		

Comments: Ooids, compose vast fine sized particles of sample; HCl reaction with clay and silt fines; 10% very fine quartz sand; construction cement seen in sample.

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485 To 515 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 9/5/2002

95 % **SAND**	**Color:**	10Y 6/2 pale olive	**Roundness:**	Round -- Angular
	Mineral:	(Ooids), calcium carbonate, quartz, phosphate	**Sphericity:**	Low -- High
	Size:	Clay -- Fine	**Frosting:**	Mixed
5 % **FOSSILS (Fragments)**	**Type:**	Shells and formainifera	**Weathering:**	Extreme

Comments: Trace of phosphate.

515 To 545 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 9/5/2002

100 % **SAND**	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Very Fine	**Frosting:**	Mixed

Comments: Sample 5% phosphate; (calcite) calcareous silt and clay strong reaction with HCl.

545 To 575 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 9/5/2002

100 % **SAND**	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Very Fine	**Frosting:**	Mixed

Comments: Calcareous silt and clay strong reaction with HCl; 5% phosphate

575 To 590 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 9/5/2002

100 % **SAND**	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Low
	Size:	Clay -- Very Fine	**Frosting:**	Clear
<1 % **FOSSILS (Fragments)**	**Type:**	Foraminifera	**Weathering:**	Moderate -- Extreme

Comments: Calcareous silt and clay reacts strongly with HCl; trace of foraminifera.

590 To 605 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 9/5/2002

100 % **SAND**	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Fine	**Frosting:**	Mixed
<1 % **FOSSILS (Fragments)**	**Type:**	Shells and foraminifera	**Weathering:**	Extreme

Comments: Trace of foraminifera seen in shells; silt and clay reacts strongly with HCl.

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605 To 615 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 9/5/2002

95 % **SAND**	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Low
	Size:	Clay -- Very Fine	**Frosting:**	Clear
5 % **FOSSILS (Fragments)**	**Type:**	shells	**Weathering:**	Extreme

Comments: Trace of foraminifera (unidentified) seen; calcareous silt and clay reacts strongly with HCl.

615 To 645 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 9/5/2002

90 % **SAND**	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Very Fine	**Frosting:**	Clear
10 % **FOSSILS (Fragments)**	Type:	Shell	**Weathering:**	Extreme

Comments: Formation change with increased number of shells from 605-615'; HCl reaction.

645 To 675 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 9/7/2002

95 % **SAND**	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Low
	Size:	Clay -- Fine	**Frosting:**	Clear
5 % **FOSSILS (Fragments)**	**Type:**	Shells	**Weathering:**	Extreme

Comments: Calcareous clay and silt reacts strongly with HCl.

675 To 705 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 9/7/2002

100 % **SAND**	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subround -- Angular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Fine	**Frosting:**	Clear

Comments: Calcium carbonate clay and silt HCl reaction; trace shells seen

705 To 735 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 9/7/2002

100 % **SAND**	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subround -- Angular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Very Fine	**Frosting:**	Clear

Comments: Calcareous clay and silt reacts strongly with HCl; trace of shells seen.

735 To 765 Feet **Drilling Method:** Mud Rotary **Bit Type:** Toothed **Date Collected:** 9/7/2002

100 % **SAND**	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subround -- Angular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Very Fine	**Frosting:**	Clear

Comments: Calcareous clay and silt reacts strongly with HCl; trace of shells seen.

770 To 800 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/7/2002

100 % SAND				
	Color:	10Y 6/2 pale olive	**Roundness:**	Subround -- Angular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Very Fine	**Frosting:**	Clear

Comments: Calcareous clay and silt reacts strongly with HCl.

800 To 830 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/7/2002

100 % SAND				
	Color:	5Y 5/2 light olive gray	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Very Fine	**Frosting:**	Clear

Comments: Calcareous clay and silt reacts strongly with HCl.

830 To 860 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/11/2002

100 % SAND				
	Color:	10Y 6/2 pale olive	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Very Fine	**Frosting:**	Clear

Comments: Calcareous clay and silt reacts strongly with HCl.

860 To 880 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/11/2002

100 % SAND				
	Color:	10Y 6/2 pale olive	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Very Fine	**Frosting:**	Clear

Comments: Calcite clay and silt reacts strongly with HCl; trace of phosphate seen.

880 To 890 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/11/2002

100 % SAND				
	Color:	5Y 8/4 yellowish gray	**Roundness:**	Angular
	Mineral:	Calcium carbonate	**Sphericity:**	Low
	Size:	Clay -- Silt	**Frosting:**	Clear

Comments: Calcite clay and silt reacts strongly with HCl.

890 To 920 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/11/2002

100 % SAND				
	Color:	5Y 8/4 yellowish gray	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Very Fine	**Frosting:**	Clear

Comments: Trace of phosphate seen; calcareous clay and silt reacts strongly with HCl.

920 To 935 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/11/2002

100 % SAND				
	Color:	5Y 8/4 yellowish gray	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Very Fine	**Frosting:**	Clear

Comments: Trace of phosphate seen; calcareous clay and silt reacts strongly with HCl.

Geologic Log

Seminole Golf Club

Well No. F-1

935 To 950 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/11/2002

95 % SAND	**Color:**	5Y 7/2 yellowish gray	**Roundness:**	Subround -- Angular
	Mineral:	Calcium carbonate	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Fine	**Frosting:**	Mixed
5 % LIMESTONE	**Color:**		**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty		

Comments: Trace of phosphate seen; strong HCl reaction

970 To 985 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/11/2002

90 % SAND	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subround -- Angular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Fine	**Frosting:**	Mixed
10 % LIMESTONE	**Color:**		**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Hard
	Texture:	Silty		

Comments: Clay/silt strong HCl reaction.

985 To 1000 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/11/2002

90 % SAND	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subround -- Angular
	Mineral:	Calcium carbonate	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Fine	**Frosting:**	Mixed
10 % LIMESTONE	**Color:**		**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Hard
	Texture:	Silty		

Comments: Grading out of clay into limestone; silt and clay shows strong HCl reaction.

1000 To 1020 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/11/2002

40 % SAND	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subround -- Angular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Very Fine	**Frosting:**	Mixed
60 % LIMESTONE	**Color:**		**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: HCl reaction.

Geologic Log

Seminole Golf Club

Well No. F-1

1020 To 1050 Feet — **Drilling Method:** Mud Rotary — **Bit Type:** Toothed — **Date Collected:** 9/11/2002

30 % **SAND**	**Color:**	10Y 6/2 pale olive	**Roundness:**	Subround -- Angular
	Mineral:	Calcium carbonate	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Very Fine	**Frosting:**	Mixed
70 % **LIMESTONE**	**Color:**		**Porosity:**	Not Discernible
	Matrix:	Sparite -- Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: HCl reaction with limestone and silt/clay

1050 To 1070 Feet — **Drilling Method:** Mud Rotary — **Bit Type:** Toothed — **Date Collected:** 9/11/2002

10 % **SAND**	**Color:**	5Y 8/1 yellowish gray	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Very Fine	**Frosting:**	Mixed
35 % **FOSSILS (Fragments)**	**Type:**	Foraminifera (Lepidocyclina)	**Weathering:**	Moderate -- Extreme
55 % **LIMESTONE**	**Color:**	5Y 8/1 yellowish gray	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts	**Hardness:**	Soft -- Moderately Hard
	Texture:	Silty		

Comments: Distinct formation change with abundance of foraminifera present; strong HCl reaction

1070 To 1080 Feet — **Drilling Method:** Mud Rotary — **Bit Type:** Toothed — **Date Collected:** 9/11/2002

5 % **SAND**	**Color:**	5Y 8/1 yellowish gray	**Roundness:**	Subround -- Angular
	Mineral:	Calcium carbonate	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Fine	**Frosting:**	Mixed
40 % **FOSSILS (Fragments)**	**Type:**	Foraminifera (Lepidocyclina)	**Weathering:**	Moderate -- Extreme
55 % **LIMESTONE**	**Color:**		**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts	**Hardness:**	Soft -- Moderately Hard
	Texture:	Silty		

Comments: Strong HCl reaction

1085 To 1100 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/12/2002

20 % **SAND**	**Color:**	5Y 8/1 yellowish gray	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Very Fine	**Frosting:**	Mixed
5 % **FOSSILS (Fragments)**	**Type:**	Foraminifera (Lepidocyclina)	**Weathering:**	Moderate -- Extreme
75 % **LIMESTONE**	**Color:**	5Y 8/1 yellowish gray	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair -- Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Strong HCl reaction

1100 To 1115 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/12/2002

20 % **SAND**	**Color:**	5Y 8/1 yellowish gray	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Very Fine	**Frosting:**	Mixed
15 % **FOSSILS (Fragments)**	**Type:**	Foraminifera (Lepidocyclina)	**Weathering:**	None -- Extreme
65 % **LIMESTONE**	**Color:**	5Y 8/1 yellowish gray	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair -- Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Strong HCl reaction

1115 To 1130 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Toothed | **Date Collected:** 9/12/2002

20 % **SAND**	**Color:**	5Y 8/1 yellowish gray	**Roundness:**	Subangular -- Angular
	Mineral:	Calcium carbonate	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Very Fine	**Frosting:**	Mixed
15 % **FOSSILS (Fragments)**	**Type:**	Foraminifera (Lepidocyclina)	**Weathering:**	None -- Extreme
65 % **LIMESTONE**	**Color:**	5Y 8/1 yellowish gray	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair -- Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Strong HCl reaction

Geologic Log

Seminole Golf Club

Well No. F-1

1130 To 1145 Feet	Drilling Method: Mud Rotary	Bit Type: Toothed	Date Collected: 9/12/2002
10 % SAND	**Color:** 5Y 8/1 yellowish gray	**Roundness:** Subangular -- Angular	
	Mineral: Calcium carbonate	**Sphericity:** Low -- Moderate	
	Size: Silt -- Very Fine	**Frosting:** Mixed	
15 % FOSSILS (Fragments)	**Type:** Foraminifera (Lepidocyclina)	**Weathering:** None -- Extreme	
75 % LIMESTONE	**Color:** 5Y 8/1 yellowish gray	**Porosity:** Not Discernible	
	Matrix: Micrite	**Cementation:** Fair -- Good	
	Clasts: Intraclasts	**Hardness:** Moderately Hard	
	Texture: Silty -- Sandy		

Comments: Strong HCl reaction

1145 To 1160 Feet	Drilling Method: Mud Rotary	Bit Type: Toothed	Date Collected: 9/12/2002
10 % SAND	**Color:** 5Y 8/1 yellowish gray	**Roundness:** Subangular -- Angular	
	Mineral: Calcium carbonate	**Sphericity:** Low -- Moderate	
	Size: Silt -- Fine	**Frosting:** Mixed	
10 % FOSSILS (Fragments)	**Type:** Foraminifera (Lepidocyclina)	**Weathering:** None -- Extreme	
80 % LIMESTONE	**Color:** 5Y 8/1 yellowish gray	**Porosity:** Not Discernible	
	Matrix: Micrite	**Cementation:** Poor -- Fair	
	Clasts: Intraclasts	**Hardness:** Soft -- Moderately Hard	
	Texture: Silty -- Sandy		

Comments: HCL reaction

1160 To 1175 Feet	Drilling Method: Mud Rotary	Bit Type: Toothed	Date Collected: 9/12/2002
10 % SAND	**Color:** 5Y 8/1 yellowish gray	**Roundness:** Subangular -- Angular	
	Mineral: Calcium carbonate	**Sphericity:** Low -- Moderate	
	Size: Silt -- Fine	**Frosting:** Mixed	
10 % FOSSILS (Fragments)	**Type:** Foraminifera (Lepidocyclina)	**Weathering:** None -- Extreme	
80 % LIMESTONE	**Color:** 5Y 8/1 yellowish gray	**Porosity:** Not Discernible	
	Matrix: Micrite	**Cementation:** Poor -- Fair	
	Clasts: Intraclasts	**Hardness:** Soft -- Moderately Hard	
	Texture: Silty -- Sandy		

Comments: HCL reaction

Geologic Log

Seminole Golf Club

Well No. F-1

1175 To 1180 Feet | **Drilling Method:** Reverse air | **Bit Type:** Toothed | **Date Collected:** 10/1/2002

25 % **FOSSILS (Fragments)**	**Type:**	Foraminifera (Lepidocyclina) and shell fragments	**Weathering:**	None -- Extreme
75 % **LIMESTONE**	**Color:**	10YR 7/4 grayish orange	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts	**Hardness:**	Soft -- Moderately Hard
	Texture:	Sandy		

Comments: Oolitic limestone

1180 To 1190 Feet | **Drilling Method:** Reverse air | **Bit Type:** Toothed | **Date Collected:** 10/1/2002

15 % **FOSSILS (Fragments)**	**Type:**	Foraminifera (Lepidocyclina)	**Weathering:**	None -- Extreme
85 % **LIMESTONE**	**Color:**	10YR 8/2	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Fair
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard
	Texture:	Silty -- Sandy		

Comments: Oolitic limestone present in sample

1190 To 1200 Feet | **Drilling Method:** Reverse air | **Bit Type:** Toothed | **Date Collected:** 10/1/2002

5 % **FOSSILS (Fragments)**	**Type:**	Foraminifera (Lepidocyclina)	**Weathering:**	Moderate -- Extreme
95 % **LIMESTONE**	**Color:**	10YR 8/2 very pale orange	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard -- Hard
	Texture:	Silty		

Comments: Limestone reacts strongly with HCl.

1200 To 1210 Feet | **Drilling Method:** Reverse air | **Bit Type:** Toothed | **Date Collected:** 10/1/2002

<1 % **SAND**	**Color:**	10YR 8/2 very pale orange	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, ooids	**Sphericity:**	Moderate -- High
	Size:	Very Fine -- Fine	**Frosting:**	Mixed
25 % **FOSSILS (Fragments)**	**Type:**	Foraminifera (Lepidocyclina)	**Weathering:**	Extreme
75 % **LIMESTONE**	**Color:**	10YR 8/2 very pale orange	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard -- Hard
	Texture:	Silty		

Comments:

Geologic Log

Seminole Golf Club

Well No. F-1

1210 To 1220 Feet — **Drilling Method:** Reverse air — **Bit Type:** Toothed — **Date Collected:** 10/1/2002

<1 % **SAND**	**Color:**	10YR 8/2 very pale orange	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, ooids	**Sphericity:**	Moderate -- High
	Size:	Very Fine -- Fine	**Frosting:**	Mixed
25 % **FOSSILS** (Fragments)	**Type:**	Foraminifera (Lepidocyclina)	**Weathering:**	Extreme
75 % **LIMESTONE**	**Color:**	10YR 8/2 very pale orange	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard -- Hard
	Texture:	Silty		

Comments:

1220 To 1230 Feet — **Drilling Method:** Reverse air — **Bit Type:** Toothed — **Date Collected:** 10/1/2002

25 % **FOSSILS** (Fragments)	**Type:**	Foraminifera (Lepidocyclina)	**Weathering:**	Extreme
75 % **LIMESTONE**	**Color:**	10YR 8/2 very pale orange	**Porosity:**	Not Discernible
	Matrix:	Micrite	**Cementation:**	Good
	Clasts:	Intraclasts	**Hardness:**	Moderately Hard -- Hard
	Texture:	Silty -- Chalky		

Comments:

APPENDIX C

GEOPHYSICAL LOGS

Report: **Seminole Golf Club, Inc., Floridan Aquifer Production Well, Well Completion Report**

Appendix	Log Name	Date	Depths	
			Bottom	Top
C	Caliper, Gamma Ray	09/12/2002	1169	0002
	Flowmeter	10/07/2002	1234	0018
D	Cement Temperature	08/26/1992	1300	2512

Southern Resource Exploration

P.O. Box 14311
Gainesville, Florida 32604
Phone 352-3725950

F-1

COMPANY	: DIVERSIFIED DRILLING			OTHER SERVICES:	
WELL	: F-1				
LOCATION/FIELD	: SEMINOLE GOLF CLUB				
COUNTY	: PALM BEACH				
STATE	: FL				
SECTION	: .	TOWNSHIP	: .	RANGE	: ..
DATE	: 09/12/02	PERMANENT DATUM	: -		
DEPTH DRILLER	: 1175'			KB	:
LOG BOTTOM	: 1169.00	LOG MEASURED FROM	: GL	DF	:
LOG TOP	: 2.20	DRL MEASURED FROM	: GL	GL	:
CASING DIAMETER	: 24	LOGGING UNIT	: BWT		
CASING TYPE	: STEEL	FIELD OFFICE	: GVL		
CASING THICKNESS	: .675	RECORDED BY	: MAF		
BIT SIZE	: 10.625	BOREHOLE FLUID	: MUD	FILE	: ORIGINAL
MAGNETIC DECL.	:	RM	:	TYPE	: 9041A
MATRIX DENSITY	:	RM TEMPERATURE	:		
NEUTRON MATRIX	:	MATRIX DELTA T	:	THRESH:	5000

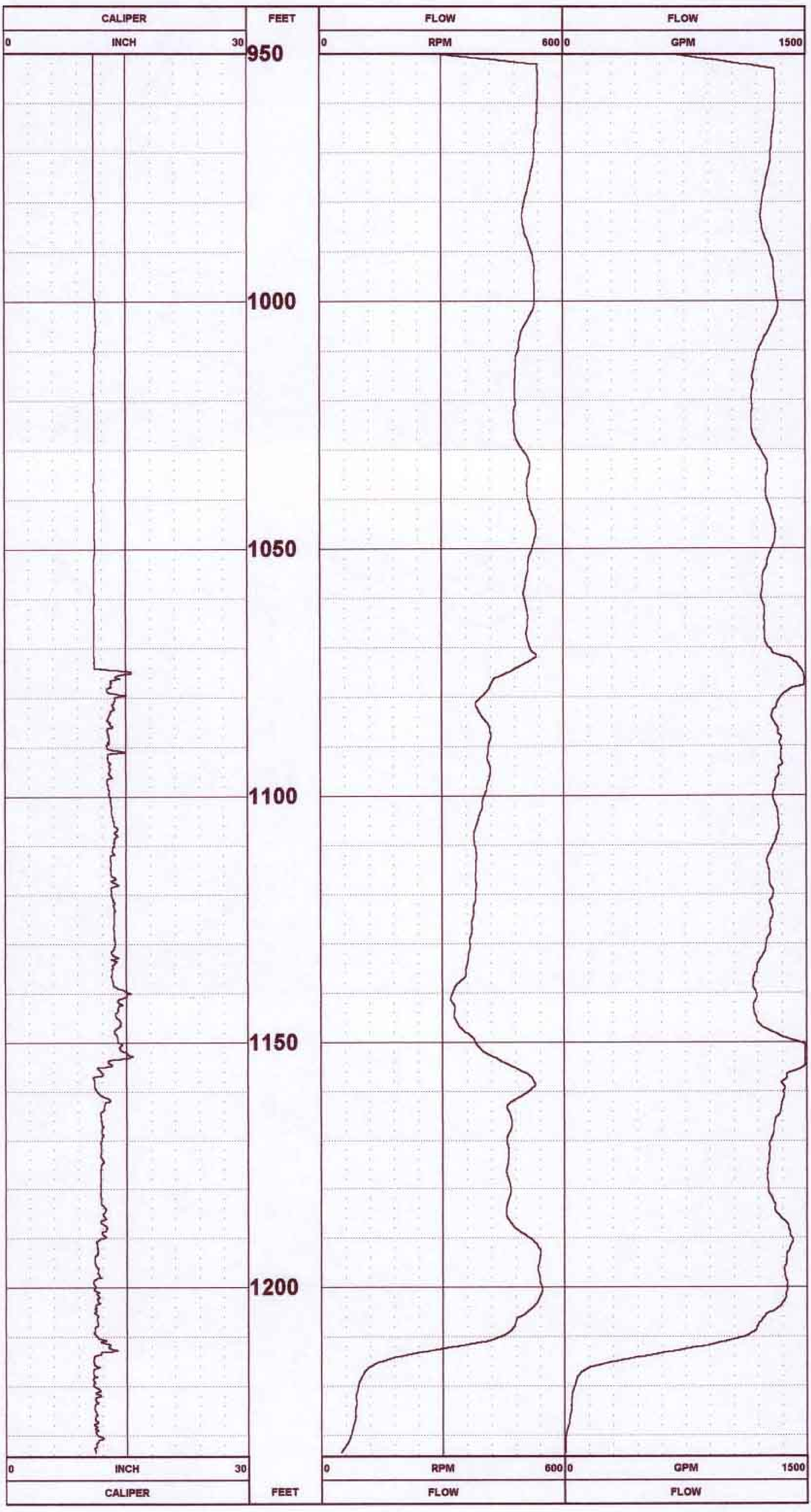
ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

Southern Resource Exploration

P.O. Box 14311
Gainesville, Florida 32604
Phone 352-3725950

FLOWMETER ANALYSIS

COMPANY	: DIVERSIFIED DRILLING			OTHER SERVICES:	
WELL	: F-1				
LOCATION/FIELD	: SEMINOLE GOLF CLUB				
COUNTY	: PALM BEACH				
STATE	: FL				
SECTION	: ..	TOWNSHIP	: .	RANGE	: ..
DATE	: 10/07/02	PERMANENT DATUM	: -		
DEPTH DRILLER	: 1237'			KB	:
LOG BOTTOM	: 1234.80	LOG MEASURED FROM:	GL	DF	: +10
LOG TOP	: 18.00	DRL MEASURED FROM:	GL	GL	: 0
CASING DIAMETER	: 12	LOGGING UNIT	: BWT		
CASING TYPE	: PVC	FIELD OFFICE	: GVL		
CASING THICKNESS:	.	RECORDED BY	: MAF		
BIT SIZE	: 10.625	BOREHOLE FLUID	: WATER	FILE	: PROCESSED
MAGNETIC DECL.	:	RM	:	TYPE	: 9065A1
MATRIX DENSITY	:	RM TEMPERATURE	:		
NEUTRON MATRIX	:	MATRIX DELTA T	:		
				THRESH:	5000



Southern Resource Exploration

P.O. Box 14311
Gainesville, Florida 32604
Phone 352-3725950

F-1

COMPANY	: DIVERSIFIED DRILLING			OTHER SERVICES:	
WELL	: F-1				
LOCATION/FIELD	: SEMINOLE GOLF CLUB				
COUNTY	: PALM BEACH				
STATE	: FL				
SECTION	: ..	TOWNSHIP	: .	RANGE	: ..
DATE	: 10/07/02	PERMANENT DATUM	: -		
DEPTH DRILLER	: 1237'			KB	:
LOG BOTTOM	: 1234.80	LOG MEASURED FROM	: GL	DF	: +10
LOG TOP	: 18.00	DRL MEASURED FROM	: GL	GL	: 0
CASING DIAMETER	: 12	LOGGING UNIT	: BWT		
CASING TYPE	: PVC	FIELD OFFICE	: GVL		
CASING THICKNESS	: .	RECORDED BY	: MAF		
BIT SIZE	: 10.625	BOREHOLE FLUID	: WATER	FILE	: PROCESSED
MAGNETIC DECL.	:	RM	:	TYPE	: 9041A
MATRIX DENSITY	:	RM TEMPERATURE	:		
NEUTRON MATRIX	:	MATRIX DELTA T	:	THRESH:	5000

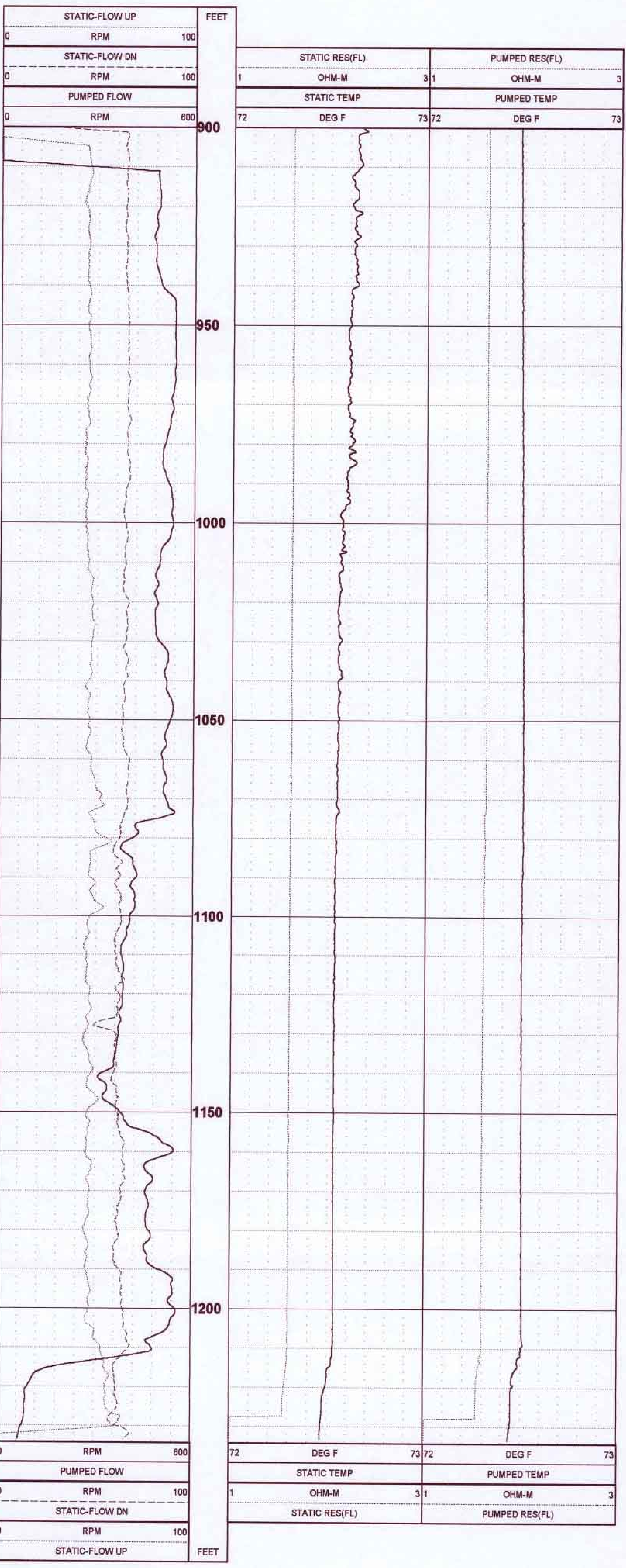
Southern Resource Exploration

P.O. Box 14311
Gainesville, Florida 32604
Phone 352-3725950

FLUID LOGS

COMPANY	: DIVERSIFIED DRILLING			OTHER SERVICES:	
WELL	: F-1				
LOCATION/FIELD	: SEMINOLE GOLF CLUB				
COUNTY	: PALM BEACH				
STATE	: FL				
SECTION	: ..	TOWNSHIP	: .	RANGE	: ..
DATE	: 10/07/02	PERMANENT DATUM	: -		
DEPTH DRILLER	: 1237'			KB	:
LOG BOTTOM	: 1237.80	LOG MEASURED FROM:	GL	DF	: +10
LOG TOP	: 45.60	DRL MEASURED FROM:	GL	GL	: 0
CASING DIAMETER	: 12	LOGGING UNIT	: BWT		
CASING TYPE	: PVC	FIELD OFFICE	: GVL		
CASING THICKNESS:	.675	RECORDED BY	: MAF		
BIT SIZE	: 10.625	BOREHOLE FLUID	: WATER	FILE	: PROCESSED
MAGNETIC DECL.	:	RM	:	TYPE	: 9041A
MATRIX DENSITY	:	RM TEMPERATURE	:		
NEUTRON MATRIX	:	MATRIX DELTA T	:		
				THRESH:	5000

Flow logs run @ 40'/min..



APPENDIX D

CEMENT TEMPERATURE LOG CORRESPONDENCE

Southern Resource Exploration

P.O. Box 14311
Gainesville, Florida 32604
Phone 352-3725950

F-1

COMPANY	: DIVERSIFIED DRILLING			OTHER SERVICES:	
WELL	: F-1				
LOCATION/FIELD	: SEMINOLE GOLF CLUB				
COUNTY	: PALM BEACH				
STATE	: FL				
SECTION	: .	TOWNSHIP	: .	RANGE	:
DATE	: 09/24/02	PERMANENT DATUM	: -		
DEPTH DRILLER	: 1075'			KB	: 10
LOG BOTTOM	: 975.00	LOG MEASURED FROM	: GL	DF	:
LOG TOP	: 0.00	DRL MEASURED FROM	: GL	GL	: .
CASING DIAMETER	: 12	LOGGING UNIT	: LWT		
CASING TYPE	: PVC	FIELD OFFICE	: GVL		
CASING THICKNESS	: -	RECORDED BY	: MAF		
BIT SIZE	: -	BOREHOLE FLUID	: WATER	FILE	: ORIGINAL
MAGNETIC DECL.	:	RM	:	TYPE	: MTMP
MATRIX DENSITY	:	RM TEMPERATURE	:		
NEUTRON MATRIX	:	MATRIX DELTA T	:		
				THRESH:	5000

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

Gerhardt M.
Witt
& Associates, Inc.

MEMORANDUM

To: File 100-1-1.5

From: Gerhardt M. Witt, P.G., Principal Hydrogeologist
Gerhardt M. Witt & Associates, Inc.

Subject: Seminole Golf Club
PVC Casing Cement and 12-inch Diameter Casing

Date: October 3, 2002

On Wednesday, September 25, 2002, Gerhardt M. Witt, P.G. discussed with Mr. Steven Bell, P.G. of the South Florida Water Management District ("SFWMD") (the assigned SFWMD representative for the Seminole Golf Club permit) the possibility of a gap existing in the cement surrounding the PVC casing. Mr. Witt explained that based on the temperature log, a gap in the cement appears to exist in an approximate 20-foot interval in the middle of the Hawthorn Group. Mr. Witt and Mr. Bell discussed the logic and rationale of cement placement. Mr. Bell and Mr. Witt concurred that the cement procedure as performed was acceptable and that the geophysical data and information should be included in the well completion report.

c: Steven Bell, South Florida Water Management District
Hal Hicks, Seminole Golf Club
Michael Caglioni, Gerhardt M. Witt & Associates, Inc.

APPENDIX E

STEP-DRAWDOWN TEST RESULTS

Seminole Golf Club
Well No. F-1
Step Drawdown Test

	Step 1 Drawdown		Step 1 Recovery		Step 2 Drawdown		Step 2 Recovery		Step 3 Drawdown		Step 3 Recovery	
Elapsed Time (sec)	Time	Drawdown (ft)	Time	Drawdown (ft)	Time	Drawdown (ft)	Time	Drawdown (ft)	Time	Drawdown (ft)	Time	Drawdown (ft)
0	12:15:51	0	13:16:03	5.45	14:16:35	-0.235	15:16:43	14.156	16:18:19	-0.378	17:18:31	26.976
30	12:16:21	7.848	13:16:33	1.495	14:17:05	18.701	15:17:13	2.716	16:18:49	22.389	17:19:01	-2.86
60	12:16:51	6.963	13:17:03	1.111	14:17:35	16.602	15:17:43	2.043	16:19:19	23.882	17:19:31	4.032
90	12:17:21	7.264	13:17:33	0.872	14:18:05	14.025	15:18:13	1.666	16:19:49	24.91	17:20:01	3.232
120	12:17:51	6.481	13:18:03	0.728	14:18:35	11.477	15:18:43	1.376	16:20:19	26.101	17:20:31	2.732
150	12:18:21	5.11	13:18:33	0.628	14:19:05	11.151	15:19:13	1.201	16:20:49	26.389	17:21:01	2.384
180	12:18:51	5.29	13:19:03	0.559	14:19:35	12.571	15:19:43	1.088	16:21:19	26.64	17:21:31	2.12
210	12:19:21	5.093	13:19:33	0.504	14:20:05	12.691	15:20:13	0.969	16:21:49	27.11	17:22:01	1.91
240	12:19:51	5.091	13:20:03	0.46	14:20:35	12.802	15:20:43	0.473	16:22:19	27.283	17:22:31	1.742
270	12:20:21	5.076	13:20:33	0.423	14:21:05	12.955	15:21:13	0.438	16:22:49	27.415	17:23:01	1.599
300	12:20:51	5.1	13:21:03	0.244	14:21:35	13.009	15:21:43	0.451	16:23:19	27.525	17:23:31	1.481
330	12:21:21	5.087	13:21:33	0.22	14:22:05	13.073	15:22:13	0.431	16:23:49	27.669	17:24:01	1.381
360	12:21:51	5.269	13:22:03	0.216	14:22:35	13.092	15:22:43	0.433	16:24:19	23.553	17:24:31	1.294
390	12:22:21	5.213	13:22:33	0.212	14:23:05	13.197	15:23:13	0.42	16:24:49	23.433	17:25:01	1.215
420	12:22:51	5.429	13:23:03	0.211	14:23:35	13.149	15:23:43	0.407	16:25:19	23.245	17:25:31	1.147
450	12:23:21	5.204	13:23:33	0.223	14:24:05	13.218	15:24:13	0.409	16:25:49	23.128	17:26:01	1.085
480	12:23:51	5.176	13:24:03	0.276	14:24:35	13.248	15:24:43	0.414	16:26:19	23.155	17:26:31	1.028
510	12:24:21	5.293	13:24:33	0.17	14:25:05	13.362	15:25:13	0.401	16:26:49	23.164	17:27:01	0.976
540	12:24:51	5.232	13:25:03	0.248	14:25:35	13.314	15:25:43	0.443	16:27:19	23.815	17:27:31	0.926
570	12:25:21	5.307	13:25:33	0.232	14:26:05	13.404	15:26:13	0.402	16:27:49	24.038	17:28:01	0.88
600	12:25:51	5.414	13:26:03	0.223	14:26:35	13.403	15:26:43	0.39	16:28:19	24.124	17:28:31	0.836
630	12:26:21	5.273	13:26:33	0.209	14:27:05	13.424	15:27:13	0.354	16:28:49	24.238	17:29:01	0.797
660	12:26:51	5.252	13:27:03	0.195	14:27:35	13.469	15:27:43	0.33	16:29:19	25.967	17:29:31	0.758
690	12:27:21	5.407	13:27:33	0.185	14:28:05	13.428	15:28:13	0.317	16:29:49	25.554	17:30:01	0.719
720	12:27:51	5.35	13:28:03	0.172	14:28:35	13.47	15:28:43	0.293	16:30:19	25.633	17:30:31	0.688
750	12:28:21	5.31	13:28:33	0.171	14:29:05	13.515	15:29:13	0.274	16:30:49	25.63	17:31:01	0.653
780	12:28:51	5.292	13:29:03	0.157	14:29:35	13.46	15:29:43	0.259	16:31:19	25.629	17:31:31	0.627
810	12:29:21	5.362	13:29:33	0.15	14:30:05	13.571	15:30:13	0.247	16:31:49	25.777	17:32:01	0.596
840	12:29:51	5.451	13:30:03	0.14	14:30:35	13.541	15:30:43	0.235	16:32:19	25.847	17:32:31	0.574
870	12:30:21	5.387	13:30:33	0.132	14:31:05	13.574	15:31:13	0.189	16:32:49	25.8	17:33:01	0.548
900	12:30:51	5.346	13:31:03	0.121	14:31:35	13.581	15:31:43	0.186	16:33:19	25.937	17:33:31	0.519
930	12:31:21	5.366	13:31:33	0.114	14:32:05	13.606	15:32:13	0.172	16:33:49	25.928	17:34:01	0.496
960	12:31:51	5.43	13:32:03	0.107	14:32:35	13.68	15:32:43	0.162	16:34:19	25.944	17:34:31	0.472
990	12:32:21	5.215	13:32:33	0.102	14:33:05	13.653	15:33:13	0.141	16:34:49	25.97	17:35:01	0.448
1020	12:32:51	5.324	13:33:03	0.093	14:33:35	13.652	15:33:43	0.128	16:35:19	26.02	17:35:31	0.427
1050	12:33:21	5.432	13:33:33	0.086	14:34:05	13.781	15:34:13	0.123	16:35:49	25.939	17:36:01	0.409
1080	12:33:51	5.295	13:34:03	0.081	14:34:35	13.626	15:34:43	0.114	16:36:19	26.138	17:36:31	0.387
1110	12:34:21	5.285	13:34:33	0.073	14:35:05	13.692	15:35:13	0.096	16:36:49	26.145	17:37:01	0.372
1140	12:34:51	5.485	13:35:03	0.069	14:35:35	13.68	15:35:43	0.086	16:37:19	26.097	17:37:31	0.354
1170	12:35:21	5.622	13:35:33	0.06	14:36:05	13.646	15:36:13	0.078	16:37:49	26.07	17:38:01	0.334
1200	12:35:51	5.458	13:36:03	0.054	14:36:35	13.706	15:36:43	0.061	16:38:19	26.158	17:38:31	0.319
1230	12:36:21	5.326	13:36:33	0.049	14:37:05	13.715	15:37:13	0.051	16:38:49	26.171	17:39:01	0.302
1260	12:36:51	5.351	13:37:03	0.044	14:37:35	13.786	15:37:43	0.041	16:39:19	26.143	17:39:31	0.286
1290	12:37:21	5.435	13:37:33	0.038	14:38:05	13.766	15:38:13	0.03	16:39:49	26.146	17:40:01	0.27
1320	12:37:51	5.412	13:38:03	0.031	14:38:35	13.842	15:38:43	0.023	16:40:19	26.227	17:40:31	0.258
1350	12:38:21	5.238	13:38:33	0.025	14:39:05	13.758	15:39:13	0.008	16:40:49	26.238	17:41:01	0.242
1380	12:38:51	5.445	13:39:03	0.022	14:39:35	13.789	15:39:43	0.003	16:41:19	26.198	17:41:31	0.229
1410	12:39:21	5.472	13:39:33	0.015	14:40:05	13.824	15:40:13	-0.007	16:41:49	26.315	17:42:01	0.214
1440	12:39:51	5.455	13:40:03	0.01	14:40:35	13.782	15:40:43	-0.012	16:42:19	26.308	17:42:31	0.203
1470	12:40:21	5.435	13:40:33	0.004	14:41:05	13.801	15:41:13	-0.024	16:42:49	26.303	17:43:01	0.191
1500	12:40:51	5.475	13:41:03	-0.003	14:41:35	13.859	15:41:43	-0.032	16:43:19	26.286	17:43:31	0.176
1530	12:41:21	5.52	13:41:33	-0.006	14:42:05	13.816	15:42:13	-0.039	16:43:49	26.363	17:44:01	0.168
1560	12:41:51	5.518	13:42:03	-0.01	14:42:35	13.868	15:42:43	-0.044	16:44:19	26.435	17:44:31	0.156
1590	12:42:21	5.485	13:42:33	-0.013	14:43:05	13.83	15:43:13	-0.05	16:44:49	26.384	17:45:01	0.144
1620	12:42:51	5.518	13:43:03	-0.019	14:43:35	13.875	15:43:43	-0.059	16:45:19	26.449	17:45:31	0.131
1650	12:43:21	5.515	13:43:33	-0.024	14:44:05	13.915	15:44:13	-0.069	16:45:49	26.438	17:46:01	0.117
1680	12:43:51	5.43	13:44:03	-0.025	14:44:35	13.915	15:44:43	-0.075	16:46:19	26.481	17:46:31	0.104
1710	12:44:21	5.492	13:44:33	-0.03	14:45:05	13.894	15:45:13	-0.082	16:46:49	26.47	17:47:01	0.097
1740	12:44:51	5.447	13:45:03	-0.032	14:45:35	13.958	15:45:43	-0.087	16:47:19	26.454	17:47:31	0.084
1770	12:45:21	5.579	13:45:33	-0.037	14:46:05	13.929	15:46:13	-0.097	16:47:49	26.446	17:48:01	0.073
1800	12:45:51	5.402	13:46:03	-0.042	14:46:35	13.888	15:46:43	-0.1	16:48:19	26.475	17:48:31	0.064
1830	12:46:21	5.592	13:46:33	-0.048	14:47:05	13.945	15:47:13	-0.112	16:48:49	26.529	17:49:01	0.058

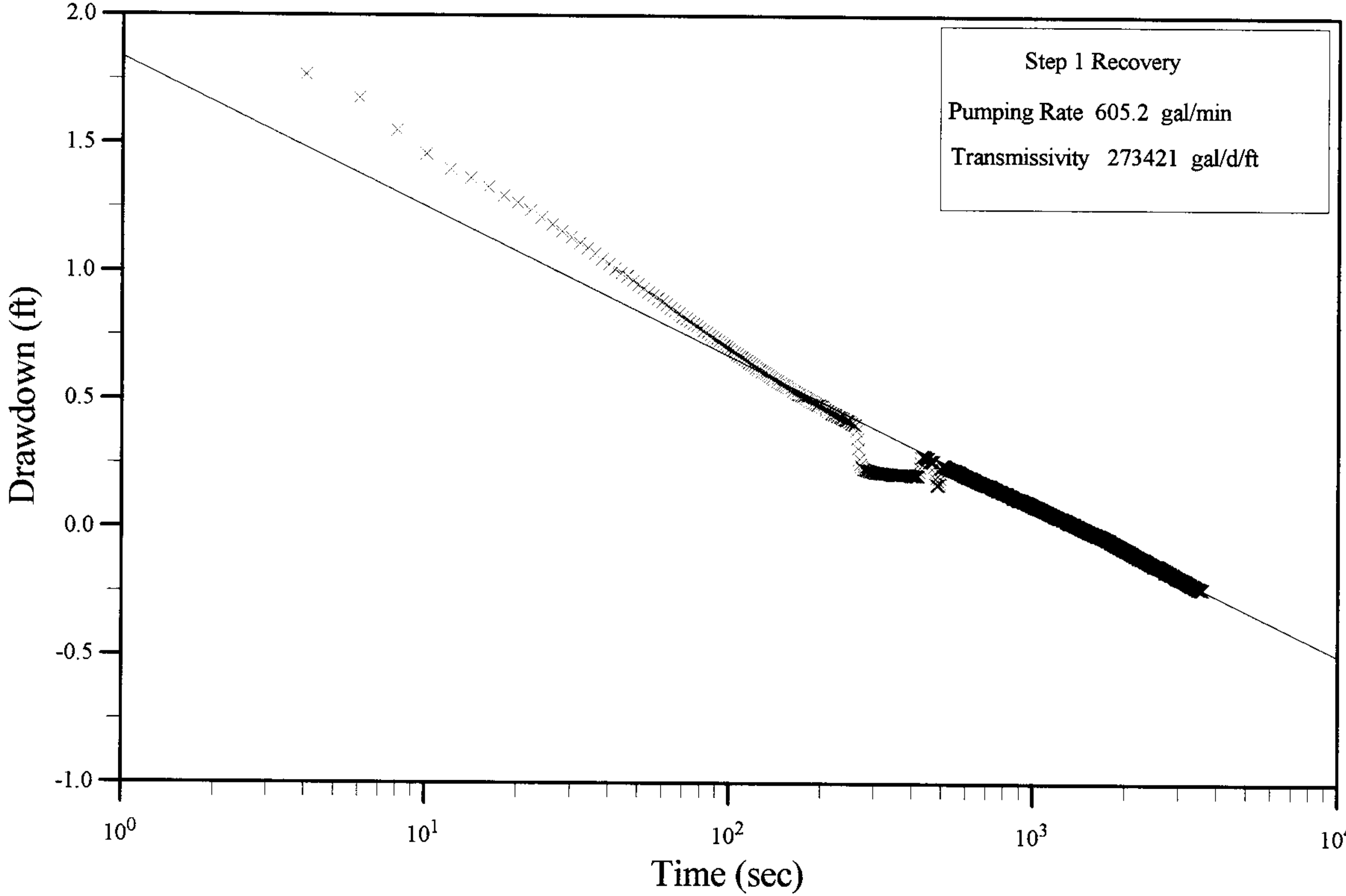
Seminole Golf Club
Well No. F-1
Step Drawdown Test

Elapsed Time (sec)	Step 1 Drawdown Time	Step 1 Drawdown Drawdown (ft)	Step 1 Recovery Time	Step 1 Recovery Drawdown (ft)	Step 2 Drawdown Time	Step 2 Drawdown Drawdown (ft)	Step 2 Recovery Time	Step 2 Recovery Drawdown (ft)	Step 3 Drawdown Time	Step 3 Drawdown Drawdown (ft)	Step 3 Recovery Time	Step 3 Recovery Drawdown (ft)
1860	12:46:51	5.386	13:47:03	-0.054	14:47:35	13.914	15:47:43	-0.117	16:49:19	26.494	17:49:31	0.046
1890	12:47:21	5.467	13:47:33	-0.057	14:48:05	13.953	15:48:13	-0.123	16:49:49	26.593	17:50:01	0.038
1920	12:47:51	5.581	13:48:03	-0.062	14:48:35	13.967	15:48:43	-0.133	16:50:19	26.535	17:50:31	0.028
1950	12:48:21	5.437	13:48:33	-0.068	14:49:05	13.95	15:49:13	-0.137	16:50:49	26.594	17:51:01	0.019
1980	12:48:51	5.592	13:49:03	-0.07	14:49:35	13.963	15:49:43	-0.146	16:51:19	26.586	17:51:31	0.013
2010	12:49.21	5.447	13:49:33	-0.077	14:50:05	13.922	15:50:13	-0.154	16:51:49	26.513	17:52:01	0.005
2040	12:49:51	5.41	13:50:03	-0.08	14:50:35	13.989	15:50:43	-0.157	16:52:19	26.596	17:52:31	-0.002
2070	12:50:21	5.748	13:50:33	-0.083	14:51:05	13.994	15:51:13	-0.164	16:52:49	26.634	17:53:01	-0.009
2100	12:50:51	5.475	13:51:03	-0.087	14:51:35	13.952	15:51:43	-0.17	16:53:19	26.641	17:53:31	-0.015
2130	12:51:21	5.435	13:51:33	-0.092	14:52:05	13.934	15:52:13	-0.177	16:53:49	26.655	17:54:01	-0.022
2160	12:51:51	5.634	13:52:03	-0.096	14:52:35	13.951	15:52:43	-0.179	16:54:19	26.589	17:54:31	-0.028
2190	12:52:21	5.465	13:52:33	-0.1	14:53:05	13.953	15:53:13	-0.184	16:54:49	26.628	17:55:01	-0.035
2220	12:52:51	5.468	13:53:03	-0.103	14:53:35	14.002	15:53:43	-0.188	16:55:19	26.649	17:55:31	-0.044
2250	12:53:21	5.592	13:53:33	-0.11	14:54:05	14.029	15:54:13	-0.19	16:55:49	26.562	17:56:01	-0.048
2280	12:53:51	5.424	13:54:03	-0.111	14:54:35	13.966	15:54:43	-0.193	16:56:19	26.603	17:56:31	-0.055
2310	12:54:21	5.508	13:54:33	-0.115	14:55:05	14.022	15:55:13	-0.197	16:56:49	26.657	17:57:01	-0.061
2340	12:54:51	5.513	13:55:03	-0.116	14:55:35	14.047	15:55:43	-0.201	16:57:19	26.682	17:57:31	-0.068
2370	12:55:21	5.425	13:55:33	-0.122	14:56:05	14.004	15:56:13	-0.203	16:57:49	26.722	17:58:01	-0.073
2400	12:55:51	5.458	13:56:03	-0.125	14:56:35	14.101	15:56:43	-0.206	16:58:19	26.629	17:58:31	-0.081
2430	12:56:21	5.434	13:56:33	-0.129	14:57:05	14.015	15:57:13	-0.209	16:58:49	26.657	17:59:01	-0.088
2460	12:56:51	5.404	13:57:03	-0.132	14:57:35	14.097	15:57:43	-0.217	16:59:19	26.675	17:59:31	-0.095
2490	12:57:21	5.551	13:57:33	-0.135	14:58:05	14.021	15:58:13	-0.222	16:59:49	26.766	18:00:01	-0.1
2520	12:57:51	5.526	13:58:03	-0.14	14:58:35	14.041	15:58:43	-0.229	17:00:19	26.72	18:00:31	-0.103
2550	12:58:21	5.473	13:58:33	-0.142	14:59:05	14.13	15:59:13	-0.24	17:00:49	26.805	18:01:01	-0.113
2580	12:58:51	5.614	13:59:03	-0.144	14:59:35	14.006	15:59:43	-0.249	17:01:19	26.795	18:01:31	-0.114
2610	12:59:21	5.528	13:59:33	-0.149	15:00:05	14.113	16:00:13	-0.249	17:01:49	26.794	18:02:01	-0.121
2640	12:59:51	5.449	14:00:03	-0.149	15:00:35	14.026	16:00:43	-0.254	17:02:19	26.833	18:02:31	-0.131
2670	13:00:21	5.487	14:00:33	-0.15	15:01:05	14.093	16:01:13	-0.257	17:02:49	26.778	18:03:01	-0.134
2700	13:00:51	5.412	14:01:03	-0.157	15:01:35	14.141	16:01:43	-0.26	17:03:19	26.795	18:03:31	-0.139
2730	13:01:21	5.588	14:01:33	-0.163	15:02:05	14.075	16:02:13	-0.26	17:03:49	26.894	18:04:01	-0.146
2760	13:01:51	5.561	14:02:03	-0.16	15:02:35	14.136	16:02:43	-0.268	17:04:19	26.764	18:04:31	-0.152
2790	13:02:21	5.515	14:02:33	-0.168	15:03:05	14.067	16:03:13	-0.273	17:04:49	26.837	18:05:01	-0.153
2820	13:02:51	5.617	14:03:03	-0.167	15:03:35	14.094	16:03:43	-0.274	17:05:19	26.841	18:05:31	-0.16
2850	13:03:21	5.612	14:03:33	-0.172	15:04:05	14.136	16:04:13	-0.281	17:05:49	26.824	18:06:01	-0.161
2880	13:03:51	5.516	14:04:03	-0.174	15:04:35	14.105	16:04:43	-0.283	17:06:19	26.864	18:06:31	-0.166
2910	13:04:21	5.544	14:04:33	-0.174	15:05:05	14.082	16:05:13	-0.286	17:06:49	26.795	18:07:01	-0.166
2940	13:04:51	5.616	14:05.03	-0.181	15:05:35	14.079	16:05:43	-0.291	17:07:19	26.893	18:07:31	-0.173
2970	13:05.21	5.624	14:05:33	-0.184	15:06:05	14.126	16:06:13	-0.297	17:07:49	26.924	18:08:01	-0.176
3000	13:05.51	5.435	14:06:03	-0.187	15:06.35	14.079	16:06:43	-0.301	17:08:19	26.854	18:08:31	-0.18
3030	13:06.21	5.399	14:06:33	-0.189	15:07:05	14.117	16:07:13	-0.306	17:08:49	26.866	18:09:01	-0.183
3060	13:06:51	5.467	14:07:03	-0.194	15:07:35	14.079	16:07:43	-0.309	17:09:19	26.918	18:09:31	-0.186
3090	13:07:21	5.48	14:07:33	-0.194	15:08:05	14.08	16:08:13	-0.314	17:09:49	26.904	18:10:01	-0.193
3120	13:07:51	5.645	14:08:03	-0.196	15:08:35	14.112	16:08:43	-0.318	17:10:19	26.92	18:10:31	-0.195
3150	13:08:21	5.591	14:08:33	-0.199	15:09:05	14.148	16:09:13	-0.32	17:10:49	26.941	18:11:01	-0.199
3180	13:08:51	5.473	14:09:03	-0.199	15:09:35	14.141	16:09:43	-0.325	17:11:19	26.883	18:11:31	-0.203
3210	13:09:21	5.579	14:09:33	-0.203	15:10:05	14.121	16:10:13	-0.33	17:11:49	26.922	18:12:01	-0.208
3240	13:09:51	5.508	14:10:03	-0.208	15:10:35	14.189	16:10:43	-0.334	17:12:19	26.932	18:12:31	-0.212
3270	13:10:21	5.477	14:10:33	-0.211	15:11:05	14.179	16:11:13	-0.339	17:12:49	26.939	18:13:01	-0.217
3300	13:10:51	5.54	14:11:03	-0.213	15:11:35	14.148	16:11:43	-0.344	17:13:19	26.928	18:13:31	-0.218
3330	13:11:21	5.591	14:11:33	-0.219	15:12:05	14.179	16:12:13	-0.346	17:13:49	26.893	18:14:01	-0.222
3360	13:11:51	5.645	14:12:03	-0.216	15:12:35	14.159	16:12:43	-0.349	17:14:19	26.949	18:14:31	-0.223
3390	13:12:21	5.616	14:12:33	-0.218	15:13:05	14.175	16:13:13	-0.352	17:14:49	26.925	18:15:01	-0.225
3420	13:12.51	5.627	14:13:03	-0.223	15:13:35	14.175	16:13:43	-0.356	17:15:19	26.948	18:15:31	-0.232
3450	13:13:21	5.602	14:13:33	-0.225	15:14:05	14.105	16:14:13	-0.361	17:15:49	26.934		
3480	13:13:51	5.386	14:14:03	-0.225	15:14:35	14.163	16:14:43	-0.363	17:16:19	26.947		
3510	13:14:21	5.581	14:14:33	-0.23	15:15:05	14.195	16:15:13	-0.366	17:16:49	26.917		
3540	13.14:51	5.402	14:15:03	-0.232	15:15:35	14.165	16:15:43	-0.37	17:17:19	26.947		
3570	13:15:21	5.472	14:15:33	-0.232	15:16:05	14.197	16:16:13	-0.369	17:17:49	26.938		
3600	13:15:51	5.564	14:16:03	-0.232	15:16.35	14.165	16:16:43	-0.372	17:18:19	27.024		

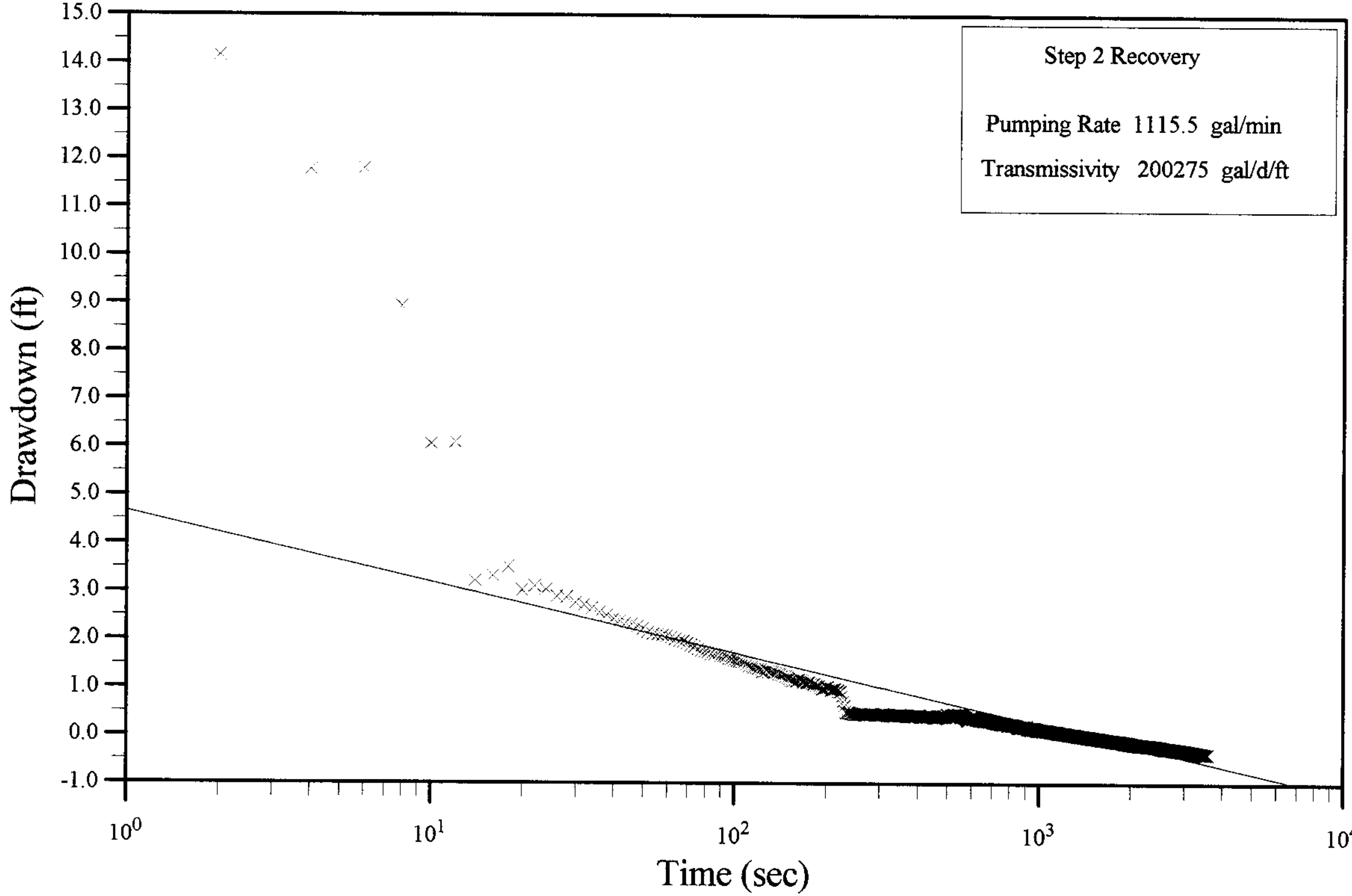
APPENDIX F

STEP-DRAWDOWN GRAPHS

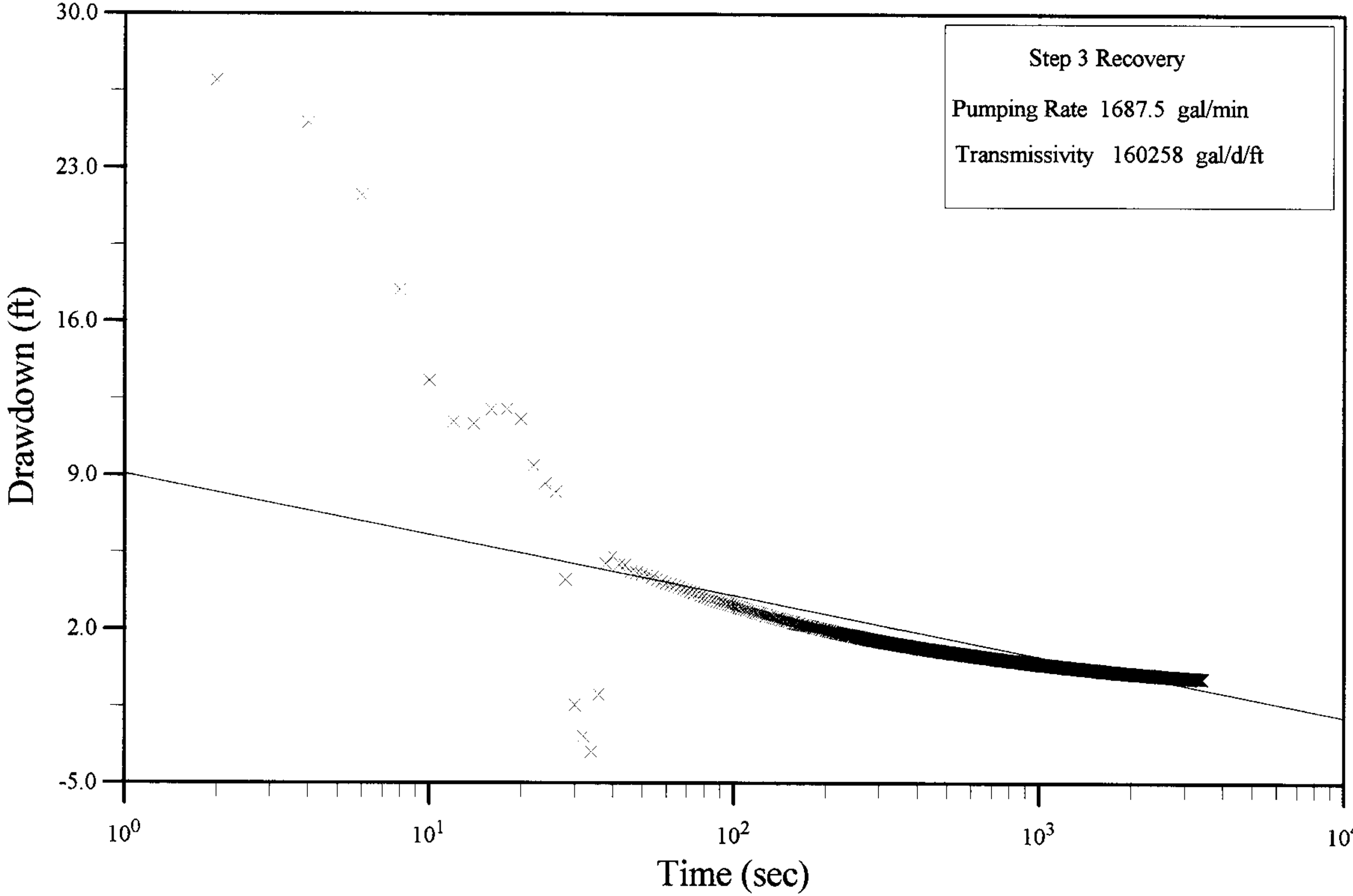
Seminole Golf Club Floridan Well



Seminole Golf Club Floridan Well



Seminole Golf Club Floridan Well



APPENDIX G

ENVIRODYNE WATER QUALITY RESULTS

Envirodyne Inc.

4805 N.W. 2nd Avenue
Boca Raton, FL 33431
561-989-5225
edyne@bellsouth.net

CERTIFICATE OF ANALYSIS

Diversified Drilling Corporation
P.O.Box 290699
Tampa, FL 33687-0699

October 31, 2002
Report: 2002/10329B Amended
Sample No: 2002/10329- 1

Attention: Dan Ringdahl

Project: Seminole Golf Club Inc.
State Road A1A Juno Beach, FL

SAMPLE ID: Well Water

Collected by: Randy K. Potter

Collected on: 10/14/02
Received on: 10/14/02

PARAMETER	RESULT	METHOD	DL UNITS	DATE	ANALYST
2,3,7,8-TCDD (Dioxin)	BDL	1613B	0.00003 μg/L	10/26/02	E87769
Aluminum	BDL	200.7	0.10 mg/L	10/16/02	JDD
Aluminum, Dissolved	BDL	200.7	0.10 mg/L	10/16/02	JDD
Barium	0.013	200.7	0.010 mg/L	10/16/02	JDD
Beryllium	BDL	200.7	0.0030 mg/L	10/16/02	JDD
Cadmium	BDL	200.7	0.0040 mg/L	10/16/02	JDD
Calcium	99	200.7	1.00 mg/L	10/16/02	JDD
Chromium	BDL	200.7	0.010 mg/L	10/16/02	JDD
Copper	BDL	200.7	0.010 mg/L	10/16/02	JDD
Iron	0.16	200.7	0.010 mg/L	10/16/02	JDD
Iron, Dissolved	0.10	200.7	0.010 mg/L	10/16/02	JDD
Magnesium	110	200.7	0.500 mg/L	10/16/02	JDD
Manganese	BDL	200.7	0.010 mg/L	10/16/02	JDD
Manganese, Dissolved	BDL	200.7	0.010 mg/L	10/16/02	JDD
Nickel	BDL	200.7	0.010 mg/L	10/16/02	JDD
Potassium	34	200.7	0.50 mg/L	10/16/02	JDD
Silver	BDL	200.7	0.010 mg/L	10/16/02	JDD
Sodium	1200	200.7	100 mg/L	10/17/02	JDD

Analysis Performed in Accordance with E.P.A. Methods
Laboratory Certification No. E86188

QA/QC Review
BDL=Below Detection Limit
DL=Detection Limit

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PARAMETER	RESULT	METHOD	DL UNITS	DATE	ANALYST
Strontium	6.5	200.7	0.010 mg/L	10/16/02	JDD
Zinc	0.019	200.7	0.010 mg/L	10/16/02	JDD
Thallium	BDL	200.9	0.0010 mg/L	10/16/02	JDD
Mercury	BDL	245.1	0.00020 mg/L	10/17/02	JDD
Dibromochloropropane (DBCP)	BDL	EPA 504.1	0.020 µg/L	10/24/02	CMM
1,2-Dibromoethane (EDB)	BDL	EPA 504.1	0.020 µg/L	10/24/02	CMM
Benzo(a)pyrene	BDL	EPA 525.2	0.20 µg/L	10/19/02	SPH
Di(2-ethylhexyl)adipate	BDL	EPA 525.2	1.0 µg/L	10/19/02	SPH
Di(2-ethylhexyl)phthalate	BDL	EPA 525.2	1.0 µg/L	10/19/02	SPH
Carbofuran	BDL	EPA 531.1	0.50 µg/L	10/22/02	E84129
Oxamyl (Vydate)	BDL	EPA 531.1	0.50 µg/L	10/22/02	E84129
Glyphosate	BDL	EPA 547	10 µg/L	10/16/02	E84129
Endothall	BDL	EPA 548.1	20 µg/L	10/29/02	E84129
Diquat	BDL	EPA 549.2	1.0 µg/L	10/17/02	E84129
Alkalinity, Total	160	310.1	1.0 mg/L	10/21/02	JMJ
Asbestos, in Water	BDL	EPA 100.2	0.18 MFL	10/15/02	E86772
Bicarbonate	160	SM2320	0.01 mg/L	10/21/02	JMJ
Biological ID - See Attached	Report			10/24/02	E86773

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PARAMETER	RESULT	METHOD	DL UNITS	DATE	ANALYST
Carbon Dioxide	140	SM4500CO2D	mg/L	10/21/02	JMJ
Carbonate	0.67	SM2320	0.010 mg/L	10/21/02	JMJ
Chloride	1700	SM4500CL-B	10 mg/L	10/16/02	JCB
Chlorine, Free	BDL	330.5	0.1 mg/L	10/14/02	RKP
Color	BDL	110.2	5 CU	10/15/02	DNS
Specific Conductance (Field)	4800	120.1	µmhos/cm	10/14/02	RKP
Cyanide, Total	BDL	335.4	0.0040 mg/L	10/22/02	DNS
Dissolved Oxygen	1.2	360.1	0.1 mg/L	10/14/02	RKP
Fluoride	0.74	SM4500F-C	0.10 mg/L	10/21/02	DNS
Gross Alpha	6.0±6.0	900.0	1.0 pCi/L	10/22/02	E84088
Hardness, Total	700	SM2340B	1 mg/L	10/16/02	JDD
Hydrogen Sulfide	1.5	9030/376.2	0.080 mg/L	10/21/02	DNS
Iron, Ferrous	BDL	SM3500FE-D	0.10 mg/L	10/22/02	DNS
Surfactants (as LAS, MW=340)	0.058	425.1	0.010 mg/L	10/15/02	DNS
Nitrite, as Nitrogen	BDL	353.2	0.020 mg/L	10/16/02	DNS
Nitrate, as Nitrogen	BDL	353.2	0.020 mg/L	10/16/02	DNS
Nitrate-Nitrite, as Nitrogen	BDL	353.2	0.020 mg/L	10/16/02	DNS
Odor	100	SM2150B	1 T.O.N.	10/15/02	DNS

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PARAMETER	RESULT	METHOD	DL UNITS	DATE	ANALYST
pH (Field)	8.4	150.1	pH Units	10/14/02	RKP
Radium 226	3.4±0.2	903.1	0.1 pCi/L	10/28/02	E84088
Radium 228	0.5±0.5	RA-05	0.5 pCi/L	10/25/02	E84088
Silica, Dissolved	14	370.1	2.0 mg/L	10/22/02	DNS
Silica, Total	14	SM3120B	0.5 mg/L	10/22/02	JDD
Lead	BDL	SM3113B	0.0050 mg/L	10/16/02	JDD
Antimony	BDL	SM3113B	0.0050 mg/L	10/16/02	JDD
Arsenic	BDL	SM3113B	0.010 mg/L	10/16/02	JDD
Selenium	BDL	SM3113B	0.010 mg/L	10/16/02	JDD
Sulfate	390	375.4	100 mg/L	10/15/02	JMJ
Total Dissolved Solids	3500	160.1	10 mg/L	10/21/02	JCB
Temperature	29.6	170.1	°C	10/14/02	RKP
Total Organic Carbon	BDL	415.1	1.0 mg/L	10/17/02	JCB
Phosphorus, Total	BDL	365.4	0.010 mg/L	10/21/02	JCB
Turbidity-Field	4.1	180.1	0.10 ntu	10/14/02	RKP

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Date of Analysis: 10/22/02
Date of Extraction: 10/18/02

508 ORGANOHALIDE PESTICIDES 62-550.310(2)(c) FAC

PARAMETER	RESULT	DL	UNITS	ANALYST
Chlordane	BDL	0.50	µg/L	CMM
Endrin	BDL	0.10	µg/L	CMM
Heptachlor	BDL	0.10	µg/L	CMM
Heptachlor epoxide	BDL	0.10	µg/L	CMM
Hexachlorobenzene	BDL	0.10	µg/L	CMM
Lindane	BDL	0.10	µg/L	CMM
Methoxychlor	BDL	0.20	µg/L	CMM
Toxaphene	BDL	3.0	µg/L	CMM
PCB 1016	BDL	0.50	µg/L	CMM
PCB-1221	BDL	0.50	µg/L	CMM
PCB 1240	BDL	0.50	µg/L	CMM
PCB 1242	BDL	0.50	µg/L	CMM
PCB 1248	BDL	0.50	µg/L	CMM
PCB 1254	BDL	0.50	µg/L	CMM
PCB 1260	BDL	0.50	µg/L	CMM

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508.1 CHLORINATED PESTICIDES (62-550 FAC)

PARAMETER	RESULT	DL	UNITS	ANALYST
Alachlor	BDL	0.10	µg/L	CMM
Atrazine	BDL	3.0	µg/L	CMM
Hexachlorocyclopentadiene	BDL	0.10	µg/L	CMM
Simazine	BDL	3.0	µg/L	CMM

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Date of Analysis: 10/22/02
Date of Extraction: 10/21/02

515.1 HERBICIDES (62-550 FAC)

PARAMETER	RESULT	DL	UNITS	ANALYST
Dalapon	BDL	0.50	µg/L	CMM
Dinoseb	BDL	0.50	µg/L	CMM
Pentachlorophenol	BDL	0.50	µg/L	CMM
Picloram	BDL	0.50	µg/L	CMM
2,4-D	BDL	0.50	µg/L	CMM
2,4,5-TP (Silvex)	BDL	0.10	µg/L	CMM

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SAMPLE ID: Well Water

Date of Analysis: 10/15/02

524.2 TRIHALOMETHANES (THM'S)

PARAMETER	RESULT	DL	UNITS	ANALYST
Bromodichloromethane	BDL	0.5	µg/L	SKS
Bromoform	BDL	0.5	µg/L	SKS
Chloroform	BDL	0.5	µg/L	SKS
Dibromochloromethane	BDL	0.5	µg/L	SKS
Total Trihalomethanes	BDL		µg/L	SKS

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524.2 VOLATILE ORGANIC COMPOUNDS (62-550)

PARAMETER	RESULT	DL	UNITS	ANALYST
Benzene	BDL	0.5	µg/L	SKS
Carbon tetrachloride	BDL	0.5	µg/L	SKS
Chlorobenzene	BDL	0.5	µg/L	SKS
1,2-Dichlorobenzene	BDL	0.5	µg/L	SKS
1,4-Dichlorobenzene	BDL	0.5	µg/L	SKS
1,2-Dichloroethane	BDL	0.5	µg/L	SKS
1,1-Dichloroethene	BDL	0.5	µg/L	SKS
cis-1,2-Dichloroethene	BDL	0.5	µg/L	SKS
trans-1,2-Dichloroethene	BDL	0.5	µg/L	SKS
Dichloromethane	BDL	0.5	µg/L	SKS
1,2-Dichloropropane	BDL	0.5	µg/L	SKS
Ethylbenzene	BDL	0.5	µg/L	SKS
Styrene	BDL	0.5	µg/L	SKS
Tetrachloroethylene	BDL	0.5	µg/L	SKS
Toluene	BDL	0.5	µg/L	SKS
1,2,4-Trichlorobenzene	BDL	0.5	µg/L	SKS
1,1,1-Trichloroethane	BDL	0.5	µg/L	SKS
1,1,2-Trichloroethane	BDL	0.5	µg/L	SKS
Trichloroethylene	BDL	0.5	µg/L	SKS
Vinyl chloride	BDL	0.5	µg/L	SKS
Xylenes, Total	BDL	0.5	µg/L	SKS

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Date of Analysis: 10/19/02
Date of Extraction: 10/17/02

8081A ORGANOCHLORINE PESTICIDES

PARAMETER	RESULT	DL	UNITS	ANALYST
Aldrin	BDL	0.10	µg/L	CMM
alpha-BHC	BDL	0.10	µg/L	CMM
beta-BHC	BDL	0.10	µg/L	CMM
delta-BHC	BDL	0.10	µg/L	CMM
gamma-BHC (Lindane)	BDL	0.10	µg/L	CMM
Chlordane	BDL	1.0	µg/L	CMM
4,4'-DDD	BDL	0.10	µg/L	CMM
4,4'-DDE	BDL	0.10	µg/L	CMM
4,4'-DDT	BDL	0.10	µg/L	CMM
Dieldrin	BDL	0.10	µg/L	CMM
Endosulfan I	BDL	0.10	µg/L	CMM
Endosulfan II	BDL	0.10	µg/L	CMM
Endosulfan sulfate	BDL	0.10	µg/L	CMM
Endrin	BDL	0.10	µg/L	CMM
Endrin aldehyde	BDL	0.10	µg/L	CMM
Endrin ketone	BDL	0.10	µg/L	CMM
Heptachlor	BDL	0.10	µg/L	CMM
Heptachlor epoxide	BDL	0.10	µg/L	CMM
Methoxychlor	BDL	1.0	µg/L	CMM
Toxaphene	BDL	2.0	µg/L	CMM

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8260B VOLATILE ORGANIC COMPOUNDS

PARAMETER	RESULT	DL	UNITS	ANALYST
Acetone	BDL	40	µg/L	SKS
Acrolein	BDL	40	µg/L	SKS
Acrylonitrile	BDL	40	µg/L	SKS
Benzene	BDL	1.0	µg/L	SKS
Benzyl Chloride	BDL	1.0	µg/L	SKS
Bromobenzene	BDL	1.0	µg/L	SKS
Bromochloromethane	BDL	1.0	µg/L	SKS
Bromodichloromethane	BDL	1.0	µg/L	SKS
Bromoform	BDL	1.0	µg/L	SKS
Bromomethane	BDL	1.0	µg/L	SKS
n-Butylbenzene	BDL	1.0	µg/L	SKS
sec-Butylbenzene	BDL	1.0	µg/L	SKS
tert-Butylbenzene	BDL	1.0	µg/L	SKS
Carbon disulfide	BDL	1.0	µg/L	SKS
Carbon tetrachloride	BDL	1.0	µg/L	SKS
Chlorobenzene	BDL	1.0	µg/L	SKS
Chloroethane	BDL	1.0	µg/L	SKS
2-Chloroethyl vinyl ether	BDL	1.0	µg/L	SKS
Chloroform	BDL	1.0	µg/L	SKS
Chloromethane	BDL	1.0	µg/L	SKS
2-Chlorotoluene	BDL	1.0	µg/L	SKS
4-Chlorotoluene	BDL	1.0	µg/L	SKS
Dibromochloromethane	BDL	1.0	µg/L	SKS
1,2-Dibromo-3-chloropropane	BDL	1.0	µg/L	SKS
1,2-Dibromoethane	BDL	1.0	µg/L	SKS
Dibromomethane	BDL	1.0	µg/L	SKS
1,2-Dichlorobenzene	BDL	1.0	µg/L	SKS
1,3-Dichlorobenzene	BDL	1.0	µg/L	SKS
1,4-Dichlorobenzene	BDL	1.0	µg/L	SKS
trans-1,4-Dichloro-2-Butene	BDL	1.0	µg/L	SKS
Dichlorodifluoromethane	BDL	1.0	µg/L	SKS

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8260B VOLATILE ORGANIC COMPOUNDS

PARAMETER	RESULT	DL	UNITS	ANALYST
1,1-Dichloroethane	BDL	1.0	µg/L	SKS
1,2-Dichloroethane	BDL	1.0	µg/L	SKS
1,1-Dichloroethene	BDL	1.0	µg/L	SKS
cis-1,2-Dichloroethene	BDL	1.0	µg/L	SKS
trans-1,2-Dichloroethene	BDL	1.0	µg/L	SKS
1,2-Dichloropropane	BDL	1.0	µg/L	SKS
1,3-Dichloropropane	BDL	1.0	µg/L	SKS
2,2-Dichloropropane	BDL	1.0	µg/L	SKS
1,1-Dichloropropene	BDL	1.0	µg/L	SKS
cis-1,3-Dichloropropene	BDL	1.0	µg/L	SKS
trans-1,3-Dichloropropene	BDL	1.0	µg/L	SKS
Diethyl ether	BDL	1.0	µg/L	SKS
Ethylbenzene	BDL	1.0	µg/L	SKS
Hexachlorobutadiene	BDL	1.0	µg/L	SKS
Hexachloroethane	BDL	1.0	µg/L	SKS
Iodomethane	BDL	1.0	µg/L	SKS
Isopropylbenzene	BDL	1.0	µg/L	SKS
p-Isopropyltoluene	BDL	1.0	µg/L	SKS
Methyl Butyl Ketone	BDL	1.0	µg/L	SKS
Methyl Ethyl Ketone	BDL	1.0	µg/L	SKS
Methyl Isobutyl Ketone	BDL	1.0	µg/L	SKS
Methylene chloride	BDL	5.0	µg/L	SKS
Naphthalene	BDL	1.0	µg/L	SKS
Nitrobenzene	BDL	1.0	µg/L	SKS
n-Propylbenzene	BDL	1.0	µg/L	SKS
Styrene	BDL	1.0	µg/L	SKS
1,1,1,2-Tetrachloroethane	BDL	1.0	µg/L	SKS
1,1,2,2-Tetrachloroethane	BDL	1.0	µg/L	SKS
Tetrachloroethylene	BDL	1.0	µg/L	SKS
Toluene	BDL	1.0	µg/L	SKS
1,2,3-Trichlorobenzene	BDL	1.0	µg/L	SKS

Analysis Performed in Accordance with E.P.A. Methods
Laboratory Certification No. E86188

QA/QC Review
BDL=Below Detection Limit
DL=Detection Limit

Envirodyne Inc.

4805 N.W. 2nd Avenue
Boca Raton, FL 33431
561-989-5225
edyne@bellsouth.net

CERTIFICATE OF ANALYSIS

Diversified Drilling Corporation
P.O.Box 290699
Tampa, FL 33687-0699

October 31, 2002
Report: 2002/10329B Amended
Sample No: 2002/10329- 1

Attention: Dan Ringdahl

Project: Seminole Golf Club Inc.
State Road A1A Juno Beach, FL

Collected by: Randy K. Potter

Collected on: 10/14/02
Received on: 10/14/02

SAMPLE ID: Well Water

Date of Analysis: 10/15/02

8260B VOLATILE ORGANIC COMPOUNDS

PARAMETER	RESULT	DL	UNITS	ANALYST
1,2,4-Trichlorobenzene	BDL	1.0	µg/L	SKS
1,1,1-Trichloroethane	BDL	1.0	µg/L	SKS
1,1,2-Trichloroethane	BDL	1.0	µg/L	SKS
Trichloroethylene	BDL	1.0	µg/L	SKS
Trichlorofluoromethane	BDL	1.0	µg/L	SKS
1,2,3-Trichloropropane	BDL	1.0	µg/L	SKS
1,2,4-Trimethylbenzene	BDL	1.0	µg/L	SKS
1,3,5-Trimethylbenzene	BDL	1.0	µg/L	SKS
Vinyl chloride	BDL	1.0	µg/L	SKS
Xylenes, Total	BDL	1.0	µg/L	SKS

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SAMPLE ID: Well Water

Collected by: Randy K. Potter

Collected on: 10/14/02
Received on: 10/14/02

Date of Analysis: 10/22/02
Date of Extraction: 10/15/02

8270C SEMIVOLATILE ORGANIC COMPOUNDS

PARAMETER	RESULT	DL	UNITS	ANALYST
Acenaphthene	BDL	1.0	µg/L	SPH
Acenaphthylene	BDL	1.0	µg/L	SPH
Aldrin	BDL	1.0	µg/L	SPH
Anthracene	BDL	1.0	µg/L	SPH
Benzidine	BDL	1.0	µg/L	SPH
Benzo(a)anthracene	BDL	1.0	µg/L	SPH
Benzo(b)fluoranthene	BDL	1.0	µg/L	SPH
Benzo(k)fluoranthene	BDL	1.0	µg/L	SPH
Benzo(g,h,i)perylene	BDL	1.0	µg/L	SPH
Benzo(a)pyrene	BDL	1.0	µg/L	SPH
Benzyl butyl phthalate	BDL	1.0	µg/L	SPH
alpha-BHC	BDL	1.0	µg/L	SPH
beta-BHC	BDL	1.0	µg/L	SPH
delta-BHC	BDL	1.0	µg/L	SPH
gamma-BHC (Lindane)	BDL	1.0	µg/L	SPH
Bis(2-chloroethyl)ether	BDL	1.0	µg/L	SPH
Bis(2-chloroethoxy)methane	BDL	1.0	µg/L	SPH
Bis(2-ethylhexyl)phthalate	BDL	1.0	µg/L	SPH
Bis(2-chloroisopropyl) ether (DCIP)	BDL	1.0	µg/L	SPH
4-Bromophenyl phenyl ether	BDL	1.0	µg/L	SPH
Chlordane	BDL	1.0	µg/L	SPH
4-Chloro-3-methylphenol	BDL	1.0	µg/L	SPH
2-Chloronaphthalene	BDL	1.0	µg/L	SPH
2-Chlorophenol	BDL	1.0	µg/L	SPH
4-Chlorophenyl phenyl ether	BDL	1.0	µg/L	SPH
Chrysene	BDL	1.0	µg/L	SPH
4,4'-DDD	BDL	1.0	µg/L	SPH
4,4'-DDE	BDL	1.0	µg/L	SPH
4,4'-DDT	BDL	1.0	µg/L	SPH
Dibenzo(a,h)anthracene	BDL	1.0	µg/L	SPH
Di-n-butyl phthalate	BDL	1.0	µg/L	SPH

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SAMPLE ID: Well Water

Collected by: Randy K. Potter

Collected on: 10/14/02
Received on: 10/14/02

Date of Analysis: 10/22/02
Date of Extraction: 10/15/02

8270C SEMIVOLATILE ORGANIC COMPOUNDS

PARAMETER	RESULT	DL UNITS	ANALYST
1,2-Dichlorobenzene	BDL	1.0 µg/L	SPH
1,3-Dichlorobenzene	BDL	1.0 µg/L	SPH
1,4-Dichlorobenzene	BDL	1.0 µg/L	SPH
3,3'-Dichlorobenzidine	BDL	1.0 µg/L	SPH
2,4-Dichlorophenol	BDL	1.0 µg/L	SPH
Dieldrin	BDL	1.0 µg/L	SPH
Diethyl phthalate	BDL	1.0 µg/L	SPH
Dimethyl phthalate	BDL	1.0 µg/L	SPH
2,4-Dimethylphenol	BDL	1.0 µg/L	SPH
2,4-Dinitrophenol	BDL	1.0 µg/L	SPH
2,4-Dinitrotoluene	BDL	1.0 µg/L	SPH
2,6-Dinitrotoluene	BDL	1.0 µg/L	SPH
Di-n-octyl phthalate	BDL	1.0 µg/L	SPH
1,2-Diphenylhydrazine	BDL	1.0 µg/L	SPH
Endosulfan I	BDL	1.0 µg/L	SPH
Endosulfan II	BDL	1.0 µg/L	SPH
Endosulfan sulfate	BDL	1.0 µg/L	SPH
Endrin	BDL	1.0 µg/L	SPH
Endrin aldehyde	BDL	1.0 µg/L	SPH
Fluoranthene	BDL	1.0 µg/L	SPH
Fluorene	BDL	1.0 µg/L	SPH
Heptachlor	BDL	1.0 µg/L	SPH
Heptachlor epoxide	BDL	1.0 µg/L	SPH
Hexachlorobenzene	BDL	1.0 µg/L	SPH
Hexachlorobutadiene	BDL	1.0 µg/L	SPH
Hexachlorocyclopentadiene	BDL	1.0 µg/L	SPH
Hexachloroethane	BDL	1.0 µg/L	SPH
Indeno(1,2,3-c,d)pyrene	BDL	1.0 µg/L	SPH
Isophorone	BDL	1.0 µg/L	SPH
2-Methyl-4,6-dinitrophenol	BDL	1.0 µg/L	SPH
1-Methylnaphthalene	BDL	1.0 µg/L	SPH

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Date of Extraction: 10/15/02

8270C SEMIVOLATILE ORGANIC COMPOUNDS

PARAMETER	RESULT	DL	UNITS	ANALYST
2-Methylnaphthalene	BDL	1.0	µg/L	SPH
Naphthalene	BDL	1.0	µg/L	SPH
Nitrobenzene	BDL	1.0	µg/L	SPH
2-Nitrophenol	BDL	1.0	µg/L	SPH
4-Nitrophenol	BDL	1.0	µg/L	SPH
n-Nitrosodimethylamine	BDL	1.0	µg/L	SPH
n-Nitrosodi-n-propylamine	BDL	1.0	µg/L	SPH
n-Nitrosodiphenylamine	BDL	1.0	µg/L	SPH
PCB-1016	BDL	1.0	µg/L	SPH
PCB-1221	BDL	1.0	µg/L	SPH
PCB-1232	BDL	1.0	µg/L	SPH
PCB-1242	BDL	1.0	µg/L	SPH
PCB-1248	BDL	1.0	µg/L	SPH
PCB-1254	BDL	1.0	µg/L	SPH
PCB-1260	BDL	1.0	µg/L	SPH
Pentachlorophenol	BDL	1.0	µg/L	SPH
Phenanthrene	BDL	1.0	µg/L	SPH
Phenol	BDL	1.0	µg/L	SPH
Pyrene	BDL	1.0	µg/L	SPH
Pyridine	BDL	1.0	µg/L	SPH
Toxaphene	BDL	1.0	µg/L	SPH
1,2,4-Trichlorobenzene	BDL	1.0	µg/L	SPH
2,4,6-Trichlorophenol	BDL	1.0	µg/L	SPH

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CERTIFICATE OF ANALYSIS

Analysis contained herein conform to EPA, Standard Methods and DEP approved methods per Envirodyne Comprehensive Quality Assurance Plan No. 890041. Subcontracted analyses are denoted by certification number in the analyst column. All relevant quality assurance samples were within specified control limits unless otherwise stated. Uncertainties for test results are available upon request. Envirodyne certifies its test results meet all requirements of the NELAC Standards, where applicable. For questions, please call the project manager at the number listed above.

This is the last page of the report. See bottom of page for total pages.

Project Manager

Quality Assurance Director

Analysis Performed in Accordance with E.P.A. Methods
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APPENDIX H

MICROBIOLOGICAL SAMPLE RESULTS

MICRIM LABS, INC.
800 N.E. 62ND STREET, SUITE 202
FT. LAUDERDALE, FLORIDA 33334
TEL: (954) 776-9479
FAX: (954) 776-9481

REPORT NUMBER: 02J1678
02J1679
02J1680
02J1681
02J1682
02J1683

DATE RECEIVED: 10-16-02
SAMPLE ID: SEM F1-01-101602
MATERIAL: WATER
PROJECT LOCATION: JUNO BEACH
SAMPLE SOURCE: WELL F-1

LAB I.D. CLIA # 10D0282547
HRS: 900001156
HRS: E86773

GERHARDT M. WITT & ASSOCIATES, INC.
1495 FOREST HILL BLVD. SUITE F.
WEST PALM BEACH, FL. 33406, 6073

TEL: (561) 642-9923
FAX: (561) 642-3327

COMMENTS OR FINDINGS

PARAMETER	RESULTS	UNITS	METHOD
TCC:	TCC – < 1 CFU / 100 ML		
HPC:	TCC - 11 CFU / ML		
BACTERIAL ID:	PSEUDOMONAS AEUROGINOSA PSEUDOMONAS STUTZERI AEROMONAS HYDROPHILA PSEUDOMONAS FLUORESCENS PSEUDOMONAS ALCALIGENES		

NO FUNGAL GROWTH ISOLATED

NO ALGAL MORPHOLOGIES SEEN

FCC: FCC - < 1 CFU/100 ML

SET UP DATE/TIME	ANALYSIS DATE	ANALYST
10-16-02 1:05 P.M.	10 - 24 - 02	

APPENDIX I

TELEVISION VIDEO SURVEY