FINAL REPORT: FLORIDAN AQUIFER SYSTEM TEST WELL PROGRAM AT LAKE LYTAL PARK, WEST PALM BEACH, FLORIDA

Technical Publication WS-5

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EXECUTIVE SUMMARY

Water supply plans developed for the Lower East Coast (LEC) Planning Area have identified the Floridan Aquifer System (FAS) as a possible water supply alternative. Based on these plans, the South Florida Water Management District (SFWMD or District) initiated a program of exploratory well construction, aquifer testing, and long-term monitoring to provide data needed to assess the FAS underlying the area. This report documents the results of construction and testing of two new FAS wells by the SFWMD. The wells were constructed within the city of West Palm Beach, just west of the District's headquarters in Palm Beach County, Florida. This site was selected to augment data available from other wells and to provide broad, spatial coverage within the District's LEC Planning Area. The purpose of the drilling and testing program was to assess the subsurface hydrogeologic and water quality properties and to evaluate the water resources potential of the FAS at the site.

The scope of the investigation consisted of constructing and testing two FAS wells. The first well was drilled to a total depth of 2,490 feet below land surface (bls). It was completed as a monitor well into three distinct hydrogeologic zones - an upper zone (PBF-3) between 1,050 and 1,252 feet bls, a middle zone (PBF-4) between 1,360 and 1,510 feet bls and a lower zone (PBF-5) between 2,340 and 2,490 feet bls. The second well (Well PBF-6) was constructed in stages to allow for the performance of pumping tests conducted at intervals corresponding to the open holes of PBF-3 and PBF-4.

The main findings of the construction and testing program are as follows:

- Surficial sediments extended from land surface to a depth of approximately 305 feet bls and the Hawthorn Group (upper confining unit) was found to extend to approximately 915 feet bls.
- Limestone comprising the uppermost FAS was identified at a depth of approximately 915 feet bls based on lithologic and hydrogeologic observations.
- An "upper" producing zone within the uppermost 200 feet of the FAS exhibited a transmissivity of 34,300 square feet per day (ft^2/day). Water sampled from that interval contained a chloride concentration of approximately 2,160 milligrams per liter (mg/L).
- An interval exhibiting somewhat lower hydraulic conductivity was identified between 1,200 and 1,300 feet bls.
- A "middle" producing zone was identified between 1,300 and 1,500 feet bls. This interval demonstrated a transmissivity of approximately 198,500 ft^2/day. Water collected from this zone contained a chloride concentration of 2,090 mg/L.
- The base of the Underground Source of Drinking Water (USDW) was identified by water quality analysis from straddle-packer

tests and geophysical log analysis to occur at approximately 1,800 feet bls at the site.

- A lower zone between 2,300 and 2,400 feet bls within the FAS exhibited a very low hydraulic conductivity (7 ft/day), indicating significant confinement at that depth.
- The unadjusted potentiometric surfaces of the upper and middle monitored FAS intervals (PBF-3 and PBF-4) during the period from April 1997 to March 2001 were approximately +47 feet above the National Geodetic Vertical Datum (NGVD) of 1929. The potentiometric surface of the lower monitored interval (PBF-5) was approximately +9 feet NGVD during the same period.
- Water levels fluctuated an average of 1 to 4 feet in monitored zones over a four-year period of record.
- When adjusted for density, the groundwater gradient between the upper and lower monitored FAS zones was upward.

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ACKNOWLEDGEMENTS

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INTRODUCTION

The South Florida Water Management District (SFWMD or District) constructed two test wells in the greater West Palm Beach area as part of a Floridan Aquifer System (FAS) exploratory drilling program. The wells are located in Lake Lytal Park, just north of Gun Club Road, adjacent to the District headquarters building in Palm Beach County, Florida. The site is located in Section 6 of Township 44 South, Range 43 East, at Latitude 26 degrees, 40’ 33" and Longitude 80 degrees north, 06’ 11". **Figure 1** presents the locations of all FAS test well sites in the District’s Lower East Coast (LEC) exploratory drilling program. The wells were constructed to obtain hydrogeologic and water quality data from the FAS within the LEC Planning Area. This information can be combined with data from other wells in the region to obtain a better understanding of the water resource potential of the FAS. In addition, this information will be used to assist in the conceptual development and calibration of regional ground water flow models. Aquifer storage and recovery (ASR) wells have been proposed by the United States Army Corps of Engineers (USACE) and the District in the Comprehensive Everglades Restoration Plan (CERP) for this initiative. Local FAS information obtained from these wells will be particularly useful.

A monitor well was first completed to a total depth of 2,490 feet below land surface (bls). The well taps three zones within the FAS - an upper zone (PBF-3, from 1,050 to 1,252 feet bls), a middle zone (PBF-4, from 1,360 to 1,510 feet bls) and a lower zone (PBF-5, from 2,340 to 2,490 feet bls). Well PBF-6 was later completed as a dual-zone test-production well. The purpose of Well PBF-6 was to facilitate performance of two aquifer performance tests (APTs) which were conducted to estimate hydraulic properties and water quality within different portions of the FAS. After the pumping tests were performed, Well PBF-6 was completed with an open hole between 1,360 and 1,510 feet bls.

District staff served as overall project manager during this investigation, preparing the well designs and technical specifications, and performing construction oversight of the drilling contractor. RST Partnership, Inc. (RST), of Fort Myers, Florida was selected as the low-bid contractor to construct the wells. A District drilling contract (C-7660) was executed in December 1995 and a Notice to Proceed was issued in May 1996. Construction began in June 1996 and was completed in April 1997. The contract included drilling, construction, and testing of Well PBF-3-4-5, and PBF-6, and installation of associated wellhead piping and appurtenances.

CONSTRUCTION DETAILS

Floridan Aquifer System wells were installed on the western edge of Lake Lytal Park, located just west of the District headquarters near the intersection of Kirk Road and the C-51 Canal. The locations of the wells relative to these landmarks are shown in **Figure 2**. The drilling schedule and well casing setting depths for each of the wells were designed to conform to the hydrogeologic features observed at the site. Data collected during construction and testing of the wells resulted in the interpretation of lithology, geophysical properties, water quality, water levels, transmissivity, storage and leakance coefficients

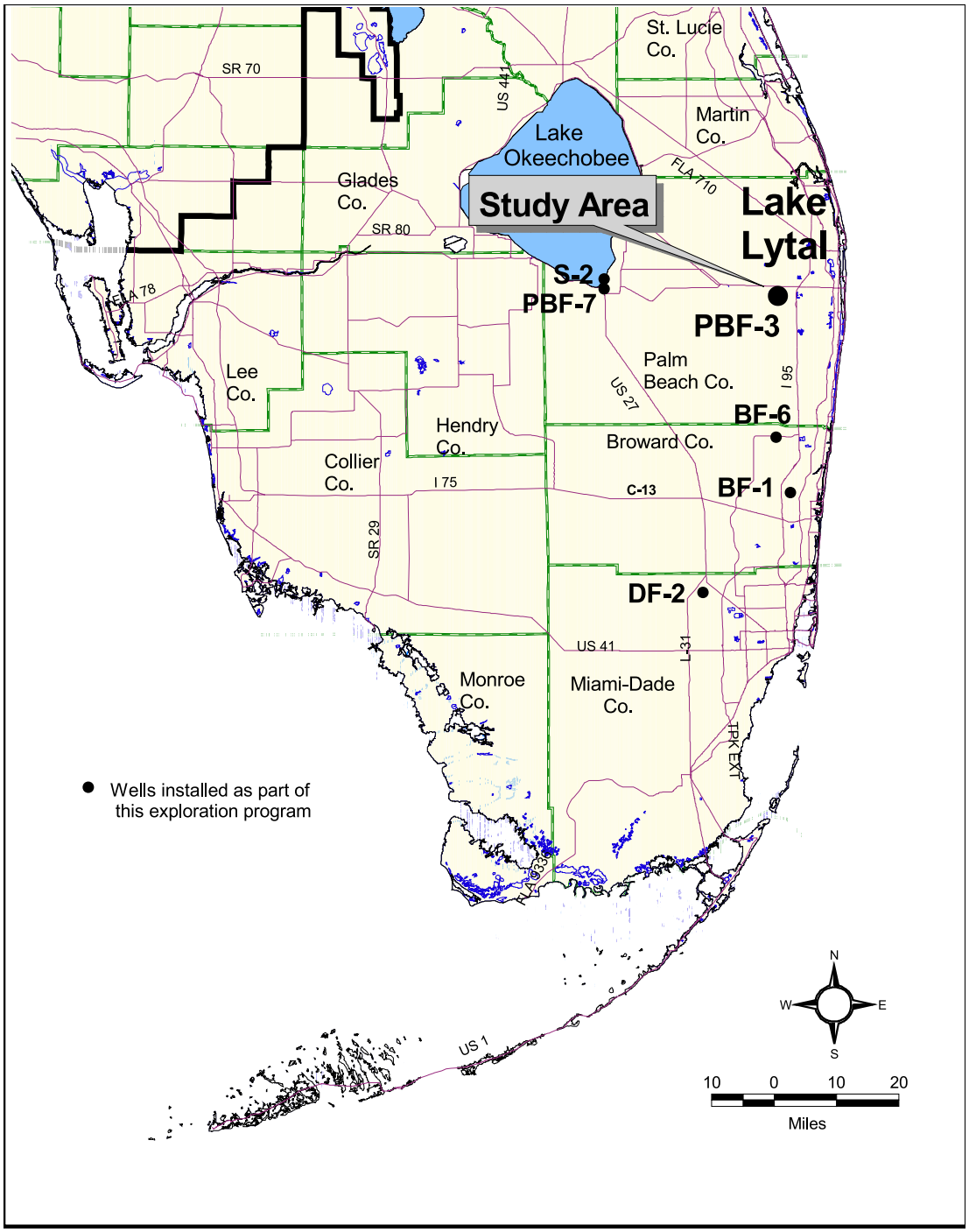

Figure 1. Lower East Coast Exploratory Drilling Program Site Locations.

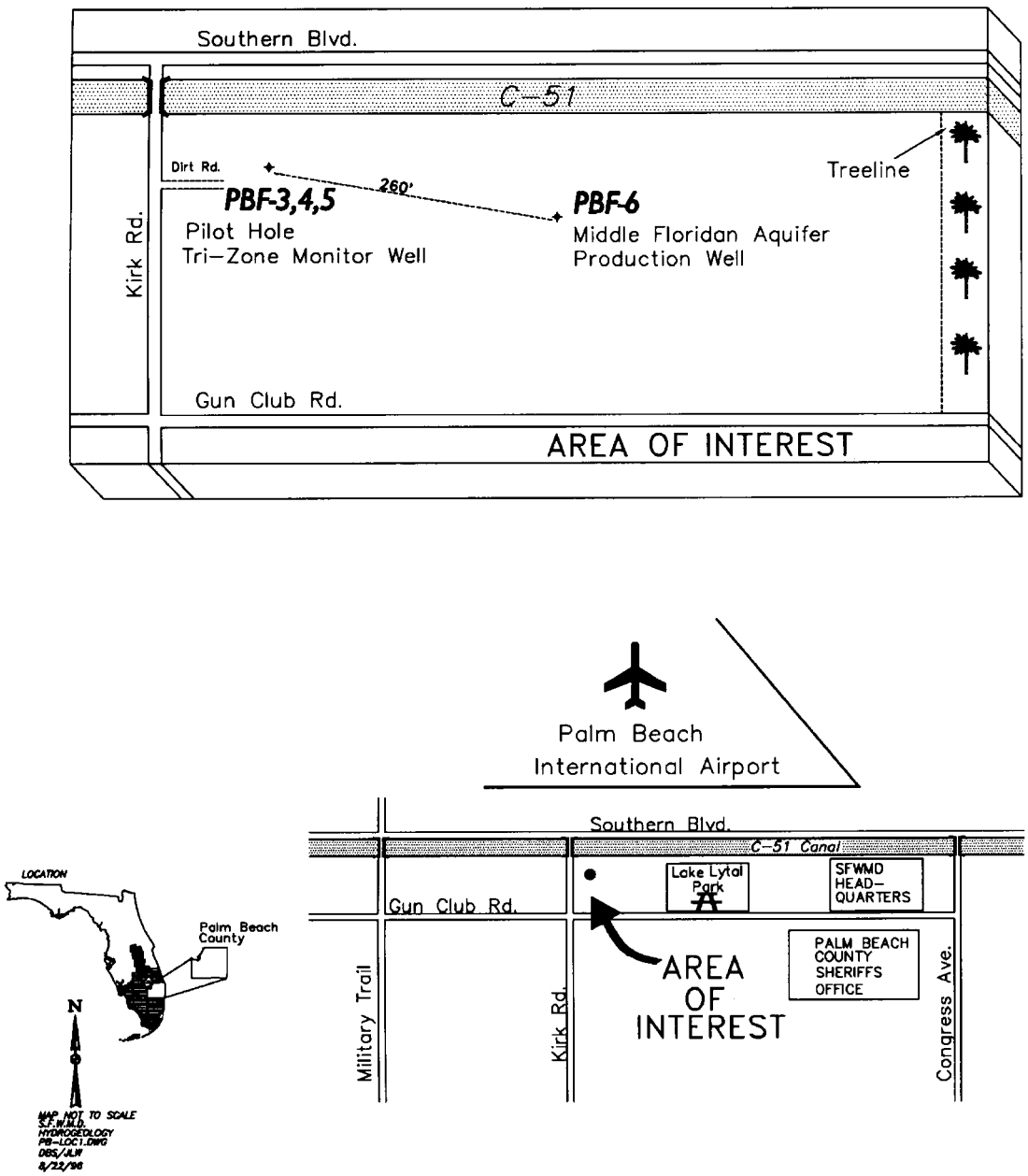

Figure 2. Project Location Map.

corresponding to the producing zones within the FAS. The data were obtained from collection and description of drill cuttings, borehole geophysical logs, straddle-packer pumping tests, and two APTs.

Well construction began in April 1995 with the rig positioned at the location of Well PBF-6, within the interior of the park. Intermediate casing was installed to a depth of 885 feet bls; however, reverse-air drilling failed to advance through silts and fine sands encountered between the depths of 890 to 960 feet bls. Drilling operations at Well PBF-6 were terminated and the rig was moved 260 feet west, closer to Kirk Road. A tri-zone monitor well (Well PBF-3-4-5) was then constructed and tested between August 1995 and March 1996. Once Well PBF-3-4-5 was completed, the rig was moved back to Well PBF-6, which was completed between April 1996 and July 1996.

Monitor Well Construction Summary

Construction of the tri-zone monitor well (PBF-3-4-5) was initiated in August 1995 and completed in March 1996. This well was drilled and tested to a total depth of 2,487 feet bls. The names corresponding to the upper, middle and deep FAS monitor zones were PBF-3-4-5, respectively. The upper monitor zone (PBF-3) was completed from 1,050 to 1,252 feet bls; the middle monitor zone (PBF-4) from 1,360 to 1,510 feet bls; and the lower monitor zone (PBF-5) was completed from 2,340 to 2,490 feet bls.

Construction included the installation of five concentric casings (24-, 18-, 12-, 7-, and 2-inch diameters). A 30-inch diameter hole was drilled initially, followed by the placement of 24-inch diameter pit casing to a depth of 40 feet bls. A nominal 12-inch diameter pilot hole was then drilled using the mud rotary method inside the pit casing to the top of the Hawthorn Group sediments to a total depth of 320 feet bls. The pilot hole then was reamed to a nominal 24-inch diameter and a caliper log was conducted. An 18-inch diameter steel casing was subsequently cemented in place to a depth of 320 feet bls. The casing was pressure grouted with neat cement containing 12 percent bentonite. Pilot hole drilling resumed using the mud-rotary method to a depth of 1,084 feet bls. Geophysical logs including the long and short-normal resistivity (LSN), gamma ray, temperature, fluid resistivity, spontaneous potential (SP), and caliper were then conducted. A casing setting depth of 1,050 feet bls was selected for the 12-inch diameter casing, based upon the presence of a hard, clean, competent limestone encountered at this depth.

The cuttings descriptions indicated that a limestone-bearing interval began at a depth of approximately 850 feet bls. This interval could represent a portion of the Arcadia Formation, positioned near the base of the Hawthorn Group. A copy of the lithologic description for Well PBF-3-4-5 provided by the Florida Geological Survey (FGS) is contained in **Appendix A**. The attenuated gamma ray log response indicated that the top of hard, clean, uniform limestone representing the upper FAS was present at a depth of 1,060 feet bls. This information was used to select the setting depth of 1,050 feet bls for 12-inch diameter casing.

The pilot hole was reamed to a nominal 18-inch diameter to a depth of 1,050 feet bls. The 12-inch diameter casing was installed to a depth of 1,050 feet bls and cemented to land surface. Once the cement cured, an 8-inch diameter pilot hole was advanced to a depth of 1,650 feet bls using the reverse-air drilling method. The drill pipe then was removed and the borehole (from 1,050 to 1,650 feet bls) was developed until discharge water was clear of sediments. Geophysical logging operations were conducted on December 18, 1995 by RST using Century Geophysics Inc. logging equipment, and included the following logs: gamma ray, LSN, SP, caliper, flowmeter, temperature, and fluid resistivity. The geophysical log traces are contained in **Appendix B**. Following the geophysical logging, Straddle-Packer Test No. 1 was conducted on the open-hole interval between 1,246 and 1,304 feet bls. The results of the straddle-packer testing are discussed in subsequent sections.

Following Straddle-Packer Test No. 1, 8-inch diameter pilot-hole drilling resumed using the reverse-air drilling method to a total depth of 2,490 feet. The drill pipe was again removed and geophysical logs were conducted between 1,050 feet bls and total depth: 2,490 feet bls. Logs included the natural gamma ray, LSN, SP, caliper, temperature, flowmeter, fluid resistivity, and borehole video survey. Results of these logs were used to identify permeable zones for additional packer testing. The intervals between 2,340 and 2,485 feet bls (Straddle-Packer Test No. 2), between 1,360 and 1,500 feet bls (Straddle-Packer Test No. 3), and between 1,050 and 1,190 feet bls (Straddle-Packer Test No. 4) then were tested. When the packer tests were complete, the drill pipe was withdrawn and the borehole was air-developed.

The straddle packer test results and geophysical logs were combined with other borehole data to establish the setting depths for both the 7- and 2-inch diameter casings. A nominal 12-inch diameter bit was used to ream the pilot hole to a depth of 1,360 feet bls. A caliper log was then conducted and a 7-inch diameter Schedule 80 polyvinyl chloride (PVC) casing was installed to a depth of 1,360 feet bls. The annular space around the lower-most 50 feet of the casing was pressure-grouted with neat cement. The remaining annular space to 1,252 feet bls then was cemented via the tremie method, resulting in creation of an upper monitor zone (PBF-3) between 1,050 and 1,252 feet bls. After the cement cured, the monitor zone was air-developed until discharge water was clear of suspended solids.

A nominal 6-inch diameter bit was then run through the 7-inch diameter PVC casing to clean out the borehole between 1,360 and 2,390 feet bls. Pea gravel was poured through the 7-inch casing to partially backfill the borehole between 2,390 and 2,340 feet bls. A caliper log was then conducted. The 2-inch diameter fiberglass reinforced polyethylene (FRP) final tubing was then installed to 2,340 feet bls and pressure grouted between 2,340 and 1,600 feet bls. The annular space between 1,600 feet and 1,510 feet bls was subsequently cemented via the tremie method, creating a middle monitor zone (PBF-4) between 1,360 and 1,510 feet bls. After the cement cured, it was tagged with a wire-line to verify depth. The open hole below the base of the final tubing was then cleaned and air-developed until discharge water was clear of suspended solids. The lower zone (PBF-5) was completed between 2,340 and 2,490 feet bls.

The wellhead was subsequently equipped with ports for measurement of potentiometric heads and water quality sampling of all three zones. The elevation of the monitoring ports and land surface were surveyed by the District after the rig moved off site. **Table 1** presents the elevation information from the surveyed wellhead. A reinforced concrete pad was then built around the wellhead and a chain-link fence with locking hinged gate was installed around the pad. As-built drawings for the wells completed during this project are shown in **Figure 3**. A photograph of the completed wellhead of PBF-3-4-5 is presented on **Figure 4**.

Table 1. Surveyed Wellhead Elevations of Well PBF-3, PBF-4, and PBF-5.

Measuring Point	Wellhead Elevation (in feet above NGVD, 1929)	
	1996 (old)	2001 (new)
Land Surface	+21.53	+21.53
PBF-3	+23.13	+24.63
PBF-4	+24.63	+24.28
PBF-5	+24.31	+23.13

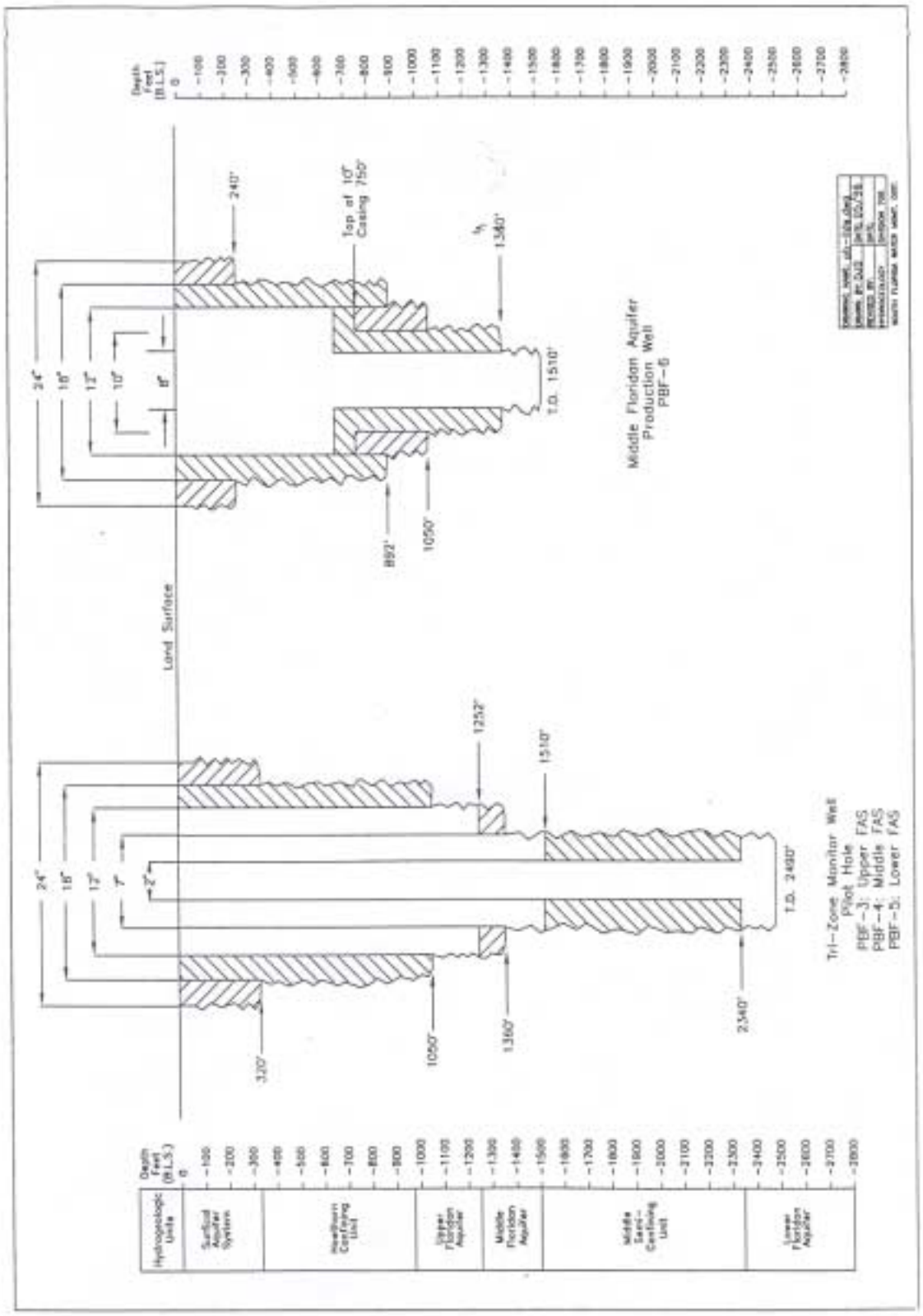

Figure 3. Well Completion Diagram.

Figure 4. Rebuilt (2001) Wellhead for Wells PBF-3, PBF-4, and PBF-5.

Production Well Construction Summary

Production Well PBF-6 was designed and constructed as a dual-zone test-production well. This configuration allowed for performance of aquifer performance pumping tests at depths corresponding to the monitor zones of Wells PBF-3 and PBF-4. The upper test zone of Well PBF-6 was completed between 1,050 and 1,252 feet bls. The middle zone was completed between 1,360 feet and 1,510 feet bls.

Construction began in May 1995 when the 24-inch-diameter pit casing was grouted in place to an approximate depth of 40 feet bls. A nominal 8-inch diameter hole then was drilled by the mud-rotary method to a depth of 320 feet bls followed by geophysical logging. The borehole was then reamed to a nominal 24-inch diameter bit to 240 feet bls. An 18-inch diameter steel surface casing then was installed to 240 feet bls and pressure grouted with neat cement to land surface.

After the cement cured, a nominal 8-inch diameter pilot hole was drilled inside the 18-inch casing using the mud-rotary method to a depth of 885 feet bls, where competent limestone was encountered. The drill rods were removed from the well and geophysical logs were conducted. At that time, it was thought that the upper FAS was penetrated at 885 feet bls based on the cuttings and geophysical logs. This later proved to be a limestone "stringer" within the lowermost Hawthorn Group.

Once logged, the open-hole between 240 and 892 feet bls was reamed using a nominal 18-inch diameter bit. A caliper log was conducted, then a 12-inch diameter steel casing was pressure grouted with neat cement from 892 feet bls to land surface. Reverse-air drilling then commenced; however, failed to advance the borehole through unconsolidated silts and fine sands encountered between 890 to 960 feet bls. Drilling operations were then terminated and the rig was moved 260 feet west, to the cluster monitor well site in August 1995.

The drill rig returned to Well PBF-6 site in April 1996. The open-hole was advanced using a nominal 12-inch diameter bit and mud circulation to a depth of 1,050 feet bls. A 10-inch-diameter steel casing was then pressure grouted using a 12 percent bentonite-cement slurry from 750 to 1,050 feet bls. After the cement cured, the borehole was drilled with a 10-inch diameter bit via the reverse-air method to a depth of 1,250 feet bls. This depth was selected for testing since it was near the base of the uppermost producing zone within the upper FAS. The open-hole interval between 1,050 and 1,250 feet bls then was developed until discharge was clear of particulates. On April 30, 1996, APT No. 1 was conducted over the open-hole interval from 1,050 to 1,250 feet bls.

Following APT No. 1, a nominal 10-inch diameter borehole was drilled with the closed-circulation reverse-air method to a depth of 1,360 feet bls. This depth corresponded to the middle FAS zone observed in Well PBF-6. An 8-inch diameter steel casing was installed between 650 and 1,360 feet bls. This final casing was pressure-grouted with neat cement containing 12 percent bentonite from 650 to 1,360 feet bls. After the cement cured, the borehole was advanced with an 8-inch diameter drill bit using the reverse-air, closed-circulation drilling method to a total depth of 1,510 feet bls. The drill pipe was then

withdrawn and the open hole was developed until discharge water was clear of particulates in preparation for APT No. 2.

On July 1, 1996, APT No. 2 was performed on the interval from 1,360 to 1,510 feet bls. Once APT No. 2 was complete, a 12-inch diameter iron yolk valve was installed at the wellhead and equipped with a monitoring port for measurement of piezometric heads and water quality sampling. The wellhead was completed with a reinforced concrete pad surrounded by a locked, chain-link fence. The contractor then restored the wellsite and demobilized in August 1996. A photograph of the completed wellhead is presented on **Figure 5**.

Figure 5. Well PBF-6 Completed Wellhead.

FORMATION TESTING PROGRAM

Cuttings Collection During Drilling

Lithologic samples (well cuttings) were circulated to land surface while drilling the pilot hole to the total depth of both wells constructed during this project. The mud-rotary drilling method was used from land surface to a depth of approximately 1,100 feet bls, below which the reverse-air method was utilized. During mud-rotary drilling, formation cuttings were circulated from the bottom of the drilled hole to land surface. The cuttings were collected at 10-foot intervals in a sieve that was suspended at the end of the mud discharge line. Cuttings then were rinsed with fresh water and described by the site geologist. The cuttings were compared with other information collected from the drilling process, such as penetration rate and wellhead flow rates to characterize of the penetrated geologic formations.

The pilot hole below 1,100 feet bls was drilled using the reverse-air drilling method. The drilled cuttings were collected at ten-foot intervals and/or at formation changes. Cuttings were described by the site geologist noting lithologic type, color, grain size, sorting, accessory minerals, fossils, etc. Observations of bit penetration rate, changes in flow rate observed at the discharge line, and miscellaneous drilling information, also were recorded.

After they were described, cuttings were bagged and hung to dry. At the end of each week, the cuttings were transported back to the District warehouse located in West Palm Beach. After processing, the cuttings were transferred to the FGS in Tallahassee, for detailed description. The detailed FGS lithologic description for Well PBF-3 (FGS Well No.W-17397) is available in the FGS geologic database, and is presented in **Appendix A**.

Geophysical Logging

Geophysical logs were conducted in the pilot holes of Wells PBF-3 and PBF-6 to correlate with formation samples collected during drilling, identify lithologic and formation boundaries, correlate formation boundaries between wells, and obtain data pertinent to the underlying stratigraphic formations and aquifers. These data then were used in the selection of the optimum straddle-packer test intervals and for the determination of casing setting depths. Geophysical logs were run by the drilling contractor (RST) using Century Geophysics logging equipment. A list of the geophysical logs performed on Well PBF-3 and PBF-6 is presented on **Table 2**.

The uses and interpretations of each of the logs is described as follows:

Caliper Log: measures the diameter of the borehole. This log is useful in identifying wash-outs, fractures and competency (mechanical strength) of the strata.

Table 2. Geophysical Log Summary.

Date	Geophysical Log Type	Casing Depth (feet bls)	Total Log Depth (feet bls)
Well PBF-3-4-5			
1995	Caliper	318	1,082
1995	Natural Gamma, LSN, SP, Temperature, Fluid Resistivity	318	1,082
12/18/95	Natural Gamma, LSN, SP, Temperature, Fluid Resistivity	1,055	1,656
12/18/95	Caliper, Flowmeter, Borehole Video	1,055	1,656
02/01/96	Caliper, Natural Gamma, LSN, SP, Temperature, Fluid Resistivity	1,597	2,489
02/01/96	Caliper, Flowmeter	1,597	2,460
Well PBF-6			
03/31/95	Natural Gamma, LSN, SP, Temperature, Fluid Resistivity	236	885
05/12/95	Caliper	236	885

Note: “LSN” denotes long and short Normal Resistivity. “SP” denotes Spontaneous Potential.

Gamma Ray Log: measures the natural gamma radiation produced by the rock, which is normally a function of the clay or phosphate content (in South Florida).

Spontaneous Potential (SP) Log: measures the natural potential fields that are created between borehole fluids and the ambient formation materials. These logs are used primarily for correlation purposes.

LSN/Electric Log: measures the electrical properties of the formation. The resistivity of the formation is affected by lithology, porosity, and water quality. These logs are comprised of "shallow" and "deep"-penetrating sondes that investigate at various distances from the borehole into the formation.

Temperature Log: measures the temperature of the borehole fluid and provides information about the movement of fluids within drilled boreholes. It is also used to determine the elevation of emplaced cement during casing installation.

Fluid Resistivity Log: provides a measurement of the borehole fluid resistivity, which is a general indicator of the chemical quality of the water within the borehole.

Borehole Video Log: provides a visual image of the borehole and casing.

Flowmeter Log: measures the relative contribution of water from various depth intervals of the drilled borehole. Useful in determining flow zones and confining units within the penetrated strata.

The majority of the Well PBF-3-4-5 borehole (between 1,050 and 2,460 feet bls) was enlarged to a diameter that exceeded 18 inches. This was due primarily to the "washing out" of the hole during reverse-air drilling. This large diameter borehole reduces the accuracy of the LSN-resistivity geophysical logs. Portions of the borehole that were not enlarged were intervals consisting of well-indurated and crystalline limestones and dolostones. In these intervals, the tool pads functioned within their design limits, and came in contact with the borehole wall, resulting in good geophysical log data. Geophysical log traces for the pilot-hole of Well PBF-3 are presented in **Appendix B**. A complete set of geophysical logs are on file at the District headquarters in West Palm Beach, Florida.

Water Sampling During Drilling

Flowing wellhead water samples were collected during reverse-air drilling at the end of each drill rod (usually at 30-foot intervals). Field water quality parameters including pH, specific conductance, and temperature were measured on these samples using a Hydrolab multi-parameter probe. Chloride concentrations also were determined using a Hach field titration kit. These test results were then recorded as part of the on-site drilling log.

Reverse-air drilling affords the opportunity to collect water samples from near the drill bit as it penetrates the aquifer system; however, these samples do not always accurately reflect the depth-specific water quality. Interpretation of water quality changes within the FAS must, therefore, be made using all available pilot-hole information, including the geophysical logs and confirmed using the water quality results from actual samples obtained during straddle-packer and APTs.

Straddle-Packer Pumping Tests

Four separate straddle-packer pumping tests were conducted on Well PBF-3 within the pilot hole between 1,050 to 2,485 feet bls. The purpose of packer testing was to identify hydraulic properties and confirm the water quality of discrete intervals within the pilot hole. Tested intervals were selected using all available field information including lithologic cuttings, reverse-air water sampling results, water-level observations and geophysical log data.

During a straddle-packer pumping test, two inflatable packers were attached to a perforated portion of drill pipe and lowered into the well to a preselected depth. Once the inflatable elements were positioned properly, they were inflated with a high-pressure nitrogen line from the surface. Water then entered the perforated portion of the drill pipe from within the isolated interval. A 4-inch diameter submersible pump then was lowered approximately 90 feet down into the pipe assembly. This pump had a maximum sustained pumping capacity of approximately 260 gallons per minute (gpm). A discharge hose

conveyed water from the pump through an in-line flowmeter and into storage tanks at the surface. Pressure transducers were then installed in the drill pipe below the static water level and remained submerged for the duration of the pumping tests. The transducer cables were connected to In-Situ Inc. data-loggers to record water levels as a function of time. Water levels also were manually recorded using a water level sensor for all transducers prior to pumping.

The submersible pump was energized to begin each test, and water level data were recorded. The pumped flow rate, as measured by the in-line flowmeter and manometer (recorded with pressure transducer), also was recorded manually to ensure that a constant pumping rate was maintained during the test. After three borehole volumes were purged from the pumped well, water samples were collected from the discharge line. These samples were collected using all applicable District Quality Assurance/Quality Control (QA/QC) standards and transported to the District lab for analysis. Major ions were analyzed by the District lab for all water samples.

After a steady-state water level was established and maintained for a period of 1 to 4 hours, the pump was shut down and a recovery period commenced. During the recovery period, water levels were measured and when water levels reached prepumping background conditions, the test was terminated and the packer assembly was removed. Water level data recorded during the straddle-packer tests are shown in **Appendix C**.

Aquifer Performance Tests (APTs)

Two APTs were conducted on the FAS at this site. During the first APT, Well PBF-6 served as the pumped well during the APT and Well PBF-3 served as the observation well. During the second APT, Well PBF-6 also served as the pumped well and PBF-4 served as the observation well. The APTs were conducted by installing a 10-inch diameter submersible pump into Well PBF-6. The test pump was lowered approximately 100 feet into the well on 10-inch diameter steel discharge pipe. Three-phase electricity was applied to the pump by an on-site generator. Flow rates were measured using a 10-inch diameter orifice weir with an 8-inch diameter orifice plate and verified by an in-line flowmeter.

The first APT was conducted to test the upper FAS producing zone from 1,050 feet bls and the open hole extended to 1,252 feet bls. That pumping test was conducted at a pumping rate of 1,630 gpm with a pumping duration of 72 hours.

The second APT was conducted to test the middle FAS producing zone from 1,360 feet bls to 1,510 feet bls. That pumping test was conducted at a rate of 1,320 gpm for a duration of 90 hours.

Background water levels were recorded for approximately one day prior to the start of each APT. During the tests, water levels were measured with an In-Situ Inc. pressure transducers (30 and 50 psi) connected to a Hermit Series 2000 data logger. All APT details are provided in **Appendix D**. A barometer also was used to measure

atmospheric pressure variations during the APTs to determine if a barometric correction to the data was warranted.

Water samples were collected after several hours of continuous pumping during each of the APTs to provide composite water quality data on the pumped interval. The samples were analyzed for standard field parameters with a Hydrolab water quality meter, then transported to the District's laboratory for further analysis.

SITE GEOLOGY

Strata encountered during the construction of Wells PBF-3-4-5 and PBF-6 range in age from middle Eocene (oldest) to Holocene (most recent). These stratigraphic units (in descending order) were as follows: undifferentiated Holocene, Pleistocene, and Pliocene age sediments; the Hawthorn Group of Miocene and late Oligocene age; the Suwannee Limestone of early Oligocene age, and the Ocala Group and Avon Park Formation of Eocene age. **Figure 6** presents a hydrostratigraphic summary of the site, including depths, lithologic column, geologic age, formation names, and hydrogeologic units. The stratigraphic interpretation was derived primarily from the formation samples of Well PBF-3, and described by the FGS provided in **Appendix A**.

Undifferentiated Holocene, Pleistocene, and Pliocene Series

From land surface to a depth of approximately 305 feet bls, the lithology consisted primarily of sand, shells, and limestone of the undifferentiated Holocene, Pleistocene, and Pliocene series. The uppermost 70 feet was primarily unconsolidated, medium- to coarse-grained quartz sand. From 70 to 305 feet bls, the lithology was primarily competent limestone (packstone to grainstone) with quartz sand. These deposits were identified as equivalents of the Pamlico Sand, the Anastasia Formation, and the Tamiami Formation. The top of the Hawthorn Group was identified at 305 feet bls.

Hawthorn Group

The Hawthorn Group was identified between the depths of 305 and 890 feet bls at the site. The upper boundary of the late Oligocene and Miocene-age Hawthorn Group is commonly characterized by a variable siliclastic and phosphate content, a gray to olive green color, and a relatively high gamma-ray log response. The Hawthorn Group as defined by Scott (1988) is divided into the Peace River Formation, which overlies the Arcadia Formation. Although these two formations were not distinguished during this project, the Hawthorn Group at the site was generally represented by an upper interval comprised of olive colored silty clay (between 305 feet and 800 feet bls) and a lower interval comprised of thinly bedded limestone, sand, and silt (between 800 and 890 feet bls).

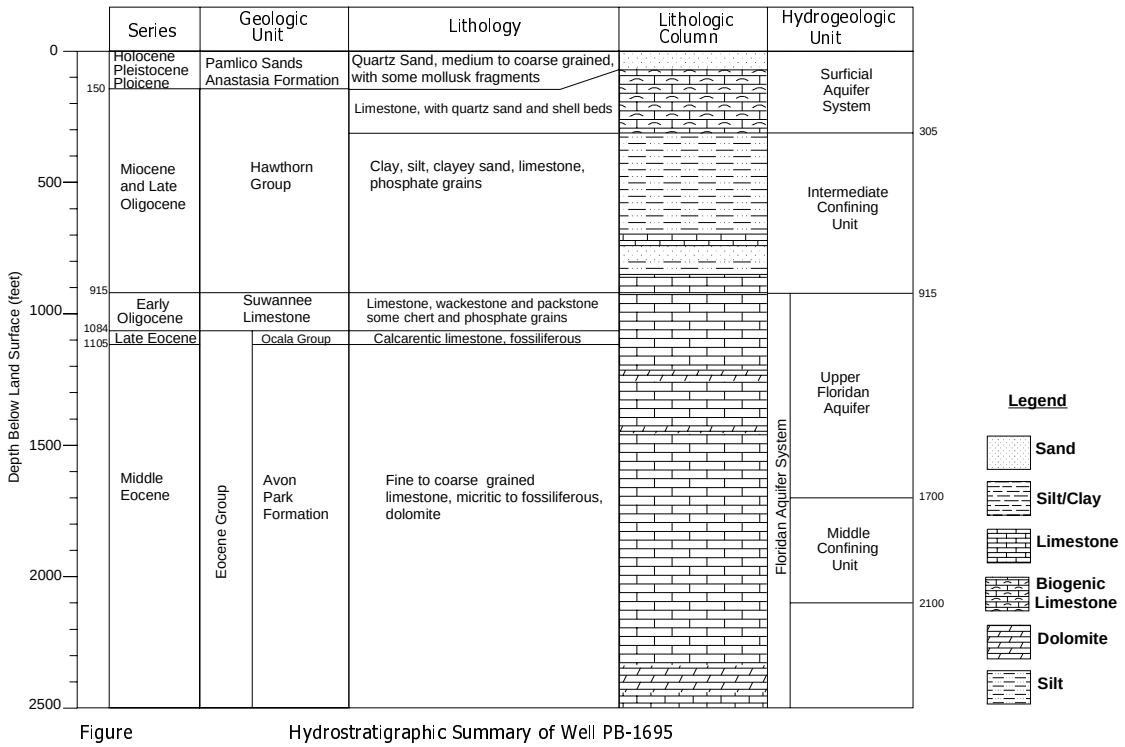

Figure Hydrostratigraphic Summary of Well PB-1695

Figure 6. Hydrostratigraphic Summary Diagram.

Suwannee Limestone

The Suwannee Limestone of early Oligocene age was identified from 890 to 1,084 feet bls based on lithologic descriptions by the District's site geologist and the FGS. The Suwannee Limestone at this site is generally described as yellowish-gray limestone (packstone to wackestone) with calcilutite matrix, with some fossils, chert, and phosphatic grains. This interval was included as part of the "Basal Hawthorn Unit" in Reese and Memberg, 2000.

Eocene Group

The boundary between the Suwannee Limestone and the Eocene Group at the site was determined at a depth of 1,084 feet bls, based on the FGS lithologic interpretation. Identification of distinct Eocene-aged geologic formations in South Florida is difficult due to similarities in lithology and geophysical log responses. Difficulties in differentiating individual formations within the Eocene section from well cuttings has long been recognized by workers in the area, and was most recently discussed by Powers and McNeal (2000). Therefore, these formations have been grouped together and are informally referred to as the "Eocene Group" in this report. Descriptions of the two uppermost (most recent) geologic units within the Eocene Group and their occurrence at the site are summarized below.

Ocala Limestone

Between the depths of 1,084 and 1,105 feet bls, a poorly indurated, yellowish gray, fossiliferous, calcarenitic limestone was described by the FGS from drill cuttings. This "transitional Ocala" interval probably represents reworked sediments as part of a regional unconformity that exists at the top of the Eocene section of South Florida. The first occurrence of a clean, competent limestone at the site was found at a depth of 1,060 feet bls. Generally, the lithology of the Ocala Limestone varies from micritic or chalky limestone, to a medium-grained calcarenitic or coquinoid limestone. It is characterized by abundant larger benthic foraminifera, such as *Operculinoids sp*., *Camerina sp*., and *Lepidocyclina sp*. (Peacock, 1983). *Lepidocyclina sp*. were observed in the cuttings by the FGS in the interval from 1,084 to 1,105 feet bls.

Avon Park Formation

The Avon Park Formation was identified at the site from 1,105 to the bottom of the pilot hole at 2,485 feet bls. The formation consists of fine- to coarse-grained, fossiliferous limestone, with interspersed layers of dolomite. It also occasionally contains a large percentage of fine to medium-grained, moderately to well-sorted carbonate sand. Characteristic foraminifera include *Dictyoconus cookei* and *Dictyoconous americanus*. The first occurrence of these indicator fossils at Well PBF-3 were at a depth of 1,105 feet bls.

FORMATION TESTING RESULTS

The formation testing program at the site included lithologic examination, measurements while drilling (e.g., rate of penetration, weight on bit, drilling characteristics, wellhead water flow), geophysical surveys, straddle packer pumping tests, APTs, water quality analyses, and subsequent measurements of water levels. Raw data and laboratory analyses are contained in the appendices of this report; a summary of the results is provided in this section.

Water Quality Profile with Drilled Depth

Water-quality samples were collected at the wellhead of Well PBF-3 at 30-foot intervals while reverse-air drilling through the FAS. The recorded data consisted of chloride concentration, specific conductivity, temperature and pH. The water quality data is presented on **Table 3**. A graph of chloride and conductivity concentrations as a function of depth is presented on **Figure 7**. Chloride concentration increased from 2,985 mg/L to 4,995 mg/L, then the between 1,766 to 1,799 bls the concentration increased again from 4,995 mg/L to 5,725 mg/L. Water quality data was not available in the interval between 1,600 feet bls and 1,900 feet bls; however, at the depth of 1,900 feet bls, the water exhibited a chloride concentration of approximately 4,000 mg/L. Using a relationship developed in Reese (1994), a chloride concentraton of 4,000 mg/L would correspond to a total dissolved solids concentration of approximately 10,000 mg/L. This data was used in combination with geophysical log interpretation to establish that the base of the USDW was present at a depth of 1,766 feet bls at the site.

Water between 1,766 and 2,050 feet bls exhibited chloride concentrations between 3,810 mg/L and 4,500 mg/L, which represented an interval of relatively poor quality water. Between the depths of 2,050 and 2,400 feet bls, the water became somewhat fresher, exhibiting chloride concentrations of approximately 2,500 mg/L. At a depth of 2,400 feet bls, a sharp transition in water quality is observed. Below 2,400 feet bls, the salinity of the water was near that of the concentration of seawater, exhibiting a chloride concentration of approximately 20,000 mg/L.

Geophysical Logs

Geophysical logs were conducted in Well PBF-3-4-5 and Well PBF-6 by the drilling contractor (using Century Geophysical logging equipment) to complement lithologic samples, identify formation boundaries, correlate between wells, and obtain specific information pertaining to the geologic formations and aquifers including delineation of producing zones. Geophysical log traces for several of the logging runs were digitized and are provided in **Appendix B**. Original geophysical log and video surveys are archived and available for review at the District headquarters in West Palm Beach.

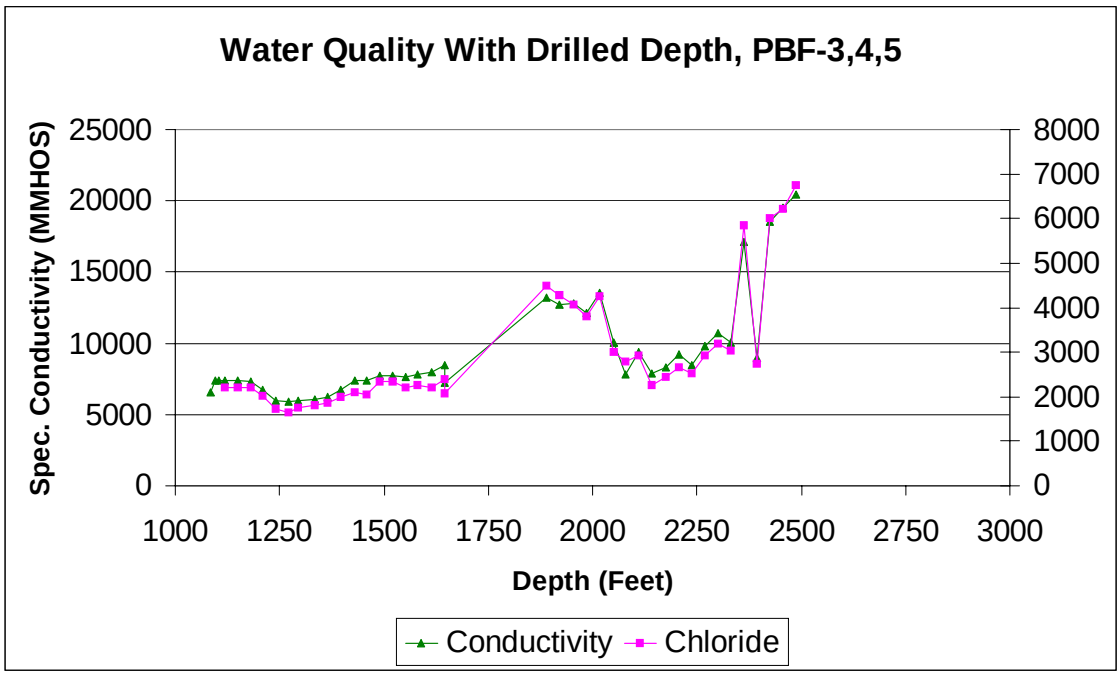

Figure 7. Water Quality as a Function of Depth.

Table 3. Water Quality with Depth Drilled.

Depth (feet) Kelly Down	Chloride (ppm)	Conductivity (mmhos)	Temperature ° C	pH
1,085		6,600		9.6
1,095		7,380	21.2	8.38
1,105		7,380	21.5	7.63
1,120	2,200	7,360	21.7	8.42
1,150	2,200	7,430	22	8.07
1,180	2,210	7,350	22.2	8.17
1,210	2,030	6,760	21.85	7.45
1,240	1,720	5,940	21.61	7.2
1,272	1,650	5,910	22.23	7.2
1,295	1,761	5,970	22.27	7.69
1,334	1,804	6,090	21.89	7.65
1,366	1,866	6,260	21.82	7.65
1,398	1,995	6,720	---	7.59
1,430	2,100	7,400	---	7.55
1,460	2,040	7,430	22.05	7.6
1,491	2,344	7,740	21.93	7.59
1,522	2,328	7,740	21.8	7.57
1,552	2,210	7,680	21.9	7.56
1,582	2,260	7,770	22	7.57
1,614	2,200	8,010	22.2	7.55
1,645	2,400	8,460	22	7.54
1,645	2,070	7,200	22	7.22
1,675	2,810	7,840	22.05	7.54
1,704	2,919	8,330	22.15	7.24
1,736	2,985	10,790	22.27	7.31
1,766	4,995	15,970	22.27	7.47
1,799	5,725	17,430	22.11	7.42
1,830	5,610	17,240*	21.89	7.44
1,860	5,740	16,950	21.84	7.30
1,890	4,500	13,240	21.77	7.29
1,922	4,270	12,720	22.37	7.37
1,956	4,072	12,820	21.79	7.41
1,986	3,810	12,120	21.73	7.41
2,017	4,250	13,560	17.95	7.54
2,050	2,995	10,010	22.68	7.4
2,080	2,803	7,770	22.14	7.43
2,111	2,917	9,400	22.59	7.47
2,143	2,269	7,930	22.33	7.44
2,175	2,440	8,320	22.2	7.25
2,206	2,650	9,180	21.85	7.47
2,237	2,530	8,490	22	7.46
2,269	2,932	9,790	21.63	7.48
2,300	3,200	10,700	21.82	7.48
2,332	3,030	10,060	21.73	7.48
2,363	5,850	17,110	---	---
2,394	2,750	9,010	21.8	7.46
2,424	6,000	18,510	21.75	7.46
2,455	6,225	19,500	21.78	7.35
2,487	6,750	20,450	21.75	7.35

*- average

Gamma-Ray Log

The gamma-ray log exhibits low counts (less than 50 API units) throughout the interval between 915 and 1,106 feet bls. This response is indicative of a relatively "clean" limestone, containing little clay or phosphate. Between 1,106 to 1,730 feet bls, counts are relatively higher (40 to 100 API) indicative of a dolomitic limestone interval. Below this dolomitic interval, from 1,730 to 2,489 feet bls, the gamma-ray counts indicate relatively clean limestone (less than 25 API) with the exception of a thin (dolomitic) interval between 2,150 to 2,250 and between 2,440 to 2,447 feet bls where they exceed 60 API.

Caliper Log

From the top of the FAS, to about 1,800 feet bls the caliper log of Well PBF-3-4-5 reflected a high level of definition and variability and ranged between 10 - 18 inches in diameter. The high definition indicated significant variability and bedding planes in the section. Below this depth, the borehole exhibited a smooth wall surface, consistent with softer limestone layers.

Formation Resistivity Logs

Within the FAS, the formation resistivity log tracked between approximately 10-20 ohm-meters through most of the open-hole section between 970 feet to 1,640 feet bls. This may be partially due to the washed out borehole. The Suwannee Limestone interval between 940 to 970 feet bls, displayed higher resistivity values between 25 to 75 ohm-meters, indicative of hard limestone. Field notes indicated bit penetration slowed considerably across this zone while drilling. Additional thin resistive (25 to 50 ohm-meters) beds are seen between the following intervals (in feet bls): 1,296 to 1,320; 1,390 to 1,395; 1,446 to 1,465; 1,565 to 1,578; 1,616 to 1,640; and 1,700 to 1,790. These thin beds are hard, dense, thinly-bedded limestone and dolomites. Below 1,790 feet bls, resistivity falls below 2 ohm-meters which corresponds with the degrading (higher salinity) water quality observed below the USDW (at 1,800 feet bls) while drilling.

Flowmeter and Fluid Resistivity Logs

The producing zones within the FAS are commonly characterized by secondary porosity features such as solution cavities and fracturing. Discrete flow zones exist within the vertical section of FAS wells which, cumulatively, contribute to the total flow observed at the wellhead. Logs particularly useful in delineating flow zones while the well is flowing include the down-hole video survey, flowmeter, fluid resistivity and temperature logs. Review of these logs indicated that flow zones in well PBF-3-4-5 occurred within the following intervals:

- 1,050 to 1,190 feet bls
- 1,220 to 1,304 feet bls
- 1,360 to 1,500 feet bls

Temperature Log

The temperature profile indicates a gradual decrease (cooling) from 72^{o} F at 1,055 feet bls to 67.3 ^{o}F at 2,489 feet bls. Subtle deviations from this gradual trend appear to coincide with flow zones.

Most of the flow zones were observed in the upper portion of the Eocene Group between 1,050 feet and 1,500 feet bls. A visual display of the depths at which the flow zones occurred, as well as an overall hydrogeologic interpretation summary of the site is presented in **Figure 8**.

Straddle-Packer Pumping Test Results

Straddle-packer pumping tests were conducted during drilling operations to isolate four selected FAS zones in Well PBF-3 as shown in **Figure 8**. Summaries of the packer test logistics and analyses are provided in **Tables 4** and **5**. Packer test field summary sheets and time drawdown plots are provided in **Appendix C**.

Table 4. Straddle Packer Pumping Test Logistics Summary.

Packer Test Number	Interval (ft. bls)	Date	Static Water Level (ft. NGVD)	Pumping Rate (gpm)	Total Pumping Time (min)
1	1,246 – 1,304	1/4/96	46.6	100	66
2	2,340 – 2,485	2/2/96	13.8	60	265
3	1,360 – 1,500	2/9/96	42.8	108	130
4	1,050 – 1,190	2/12/96	40.53	107	108

Static water level is reported uncorrected for equivalent freshwater head.
Land surface surveyed to 21.53 feet above NGVD 1929.

Table 5. Straddle Packer Test Hydraulic Summary.

Packer Test Number	Interval (ft. bls)	Test Interval Thickness (feet)	Pumping Rate (gpm)	Drawdown (feet)	Transmissivity (ft^2/day)	Hydraulic Conductivity (feet/day)
1	1,246 – 1,304	58	100	22	8,360	144
2	2,340 – 2,485	145	60	75	990	7
3	1,360 – 1,500	140	108	14	58,000	414
4	1,050 – 1,190	140	107	13	72,000	514

"ft. bls" denotes "feet below land surface"
"ft*/day" denotes "feet squared per day"
Transmissivity computed by the Theis recovery "straight-line" method

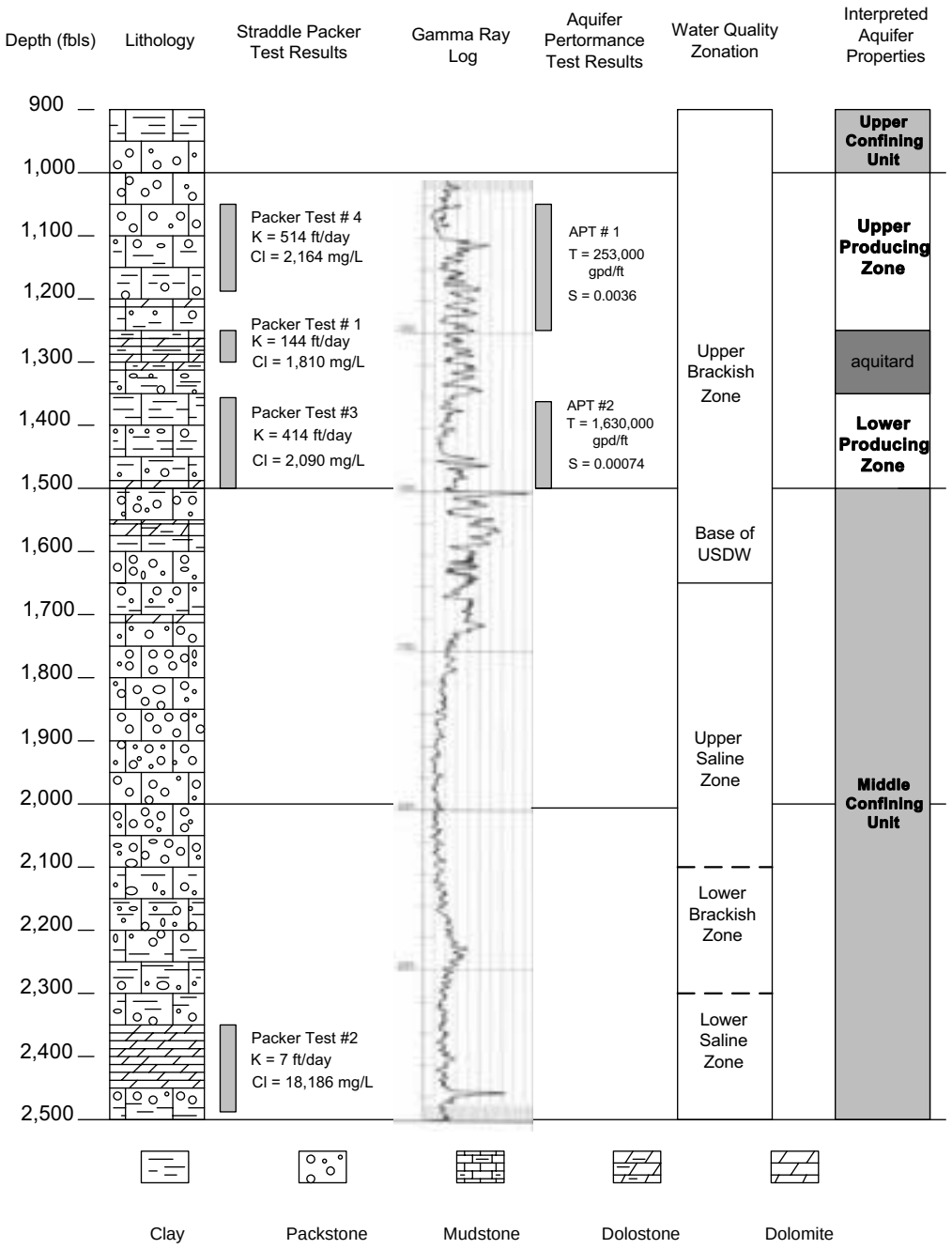

Figure 8. Hydrogeological Intrepretation and Aquifer Characteristics.

Straddle Packer Test No.1

This test was conducted on January 4, 1996, and consisted of pumping an interval between 1,246 and 1,304 feet bls (upper portion of FAS) in Well PBF-3. This interval was pumped for 1 hour at an average discharge rate of 100 gpm. The static water level prior to pumping the well was measured as 46.6 feet above NGVD at the site. The land surface at the site was surveyed at an elevation of approximately 21 feet above NGVD. The maximum measured drawdown while pumping was approximately 22 feet. The specific capacity was calculated as 5 gallons per minute per foot of drawdown (gpm/ft). A transmissivity of 8,360 ft^2/day was estimated using the "straight-line" Theis recovery method. Chloride and TDS concentrations in a water sample collected from the zone were 1,810 mg/L and 3,430 mg/L, respectively.

Straddle-Packer Test No.2

Packer Test No. 2 was conducted on February 2, 1996 and isolated an interval between 2,340 and 2,485 feet bls in PBF-3. The test was conducted by pumping this interval for 4.5 hours at an average rate of 60 gpm. The static water level was measured at 13.8 feet above NGVD. The water level was below land surface at the site. Maximum drawdown measured while pumping was 75 feet and the specific capacity calculated as less than 1 gpm/ft. A transmissivity of 990 ft^2/day was estimated using the "straight line" Theis recovery method. Chloride and TDS concentrations in water sampled from the zone were 18,185 mg/L and 30,900 mg/L, respectively.

Straddle-Packer Test No. 3

Packer Test No. 3 was conducted on February 9, 1996 and isolated the interval between 1,360 and 1,500 feet bls in PBF-3. The test was conducted by pumping this interval for 2 hours at a rate of 108 gpm. The static water level was measured at 42.8 feet above NGVD. The maximum drawdown was 14 feet and the specific capacity calculated as 8 gpm/ft. A transmissivity of 58,000 ft^2/day was using the Theis "straight-line" recovery method. Chlorides and TDS concentrations in water sampled from the zone were 2,090 mg/L and 4,150 mg/L, respectively.

Straddle-Packer Test No. 4

Packer Test No. 4 conducted on February 12, 1996 and isolated an interval between 1,050 and 1,190 feet bls in PBF-3. The test was conducted by pumping this interval for 2 hours at an average rate of 107 gpm. The static water level was measured as 40.53 feet above NGVD. The maximum measured drawdown was 13 feet and the specific capacity calculated as 8.2 gpm/ft. A transmissivity of 72,000 ft^2/day was using the Theis "straight line" recovery method. Chlorides and TDS concentrations in water sampled from the zone were 2,160 mg/L and 4,210 mg/L, respectively.

Aquifer Performance Tests (APTs)

Two APTs were conducted to evaluate subsurface hydraulics and water quality characteristics of the FAS. The results of these tests, including interval tested, static water level, maximum drawdown, pumping rate (Q), transmissivity, storage coefficient, and analytical methods are listed in **Table 6**. In addition, detailed APT summary sheets and time-drawdown plots are provided in **Appendix D**.

Table 6. Aquifer Performance Test Analysis Summary.

Well Name	Interval (ft. bls)	Static Water Level (NGVD 1929)	Maximum Drawdown (ft.)	Pumping Rate (gpm)	Transmissivity (ft^2/day)	Storage Coefficient	r/B	Method of Analysis
APT No. 1								
PBF - 6	1,050 – 1,250	53.2	12.2	1,640	33,800	nc	nc	Jacob
PBF - 3	1,050 – 1,250	-	2.2	-	40,300	2.6×10^{-3}	nc	Cooper-Jacob
PBF - 3	1,050 – 1,250	-	2.2	-	34,300	3.6×10^{-3}	0.2478	Hantush
APT No. 2								
PBF-6	1,360 – 1,510	-	-	1,320	196,000	nc	nc	Theis Recovery
PBF-4	1,360 – 1,510	44.3	1.1	-	231,300	6.5×10^{-4}	nc	Cooper-Jacob
PBF - 4	1,360 – 1,510	44.3	1.1	-	198,500	8.5×10^{-4}	0.1	Hantush

APT No.1

On April 30, 1996, APT No. 1 was conducted over the open-hole interval from 1,050 to 1,250 feet bls. This APT consisted of pumping Well PBF-6 for 60 hours at a constant discharge rate of 1,640 gpm, while monitoring water levels in PBF-3. The static water level in Well PBF-6 was measured as 53.2 feet above NGVD prior to the initiation of pumping. The specific capacity in the pumped well was estimated at 40 gpm/ft. The maximum drawdown during pumping recorded at the observation well (located 260 feet away) was 2.2 feet. A transmissivity of 34,300 ft^2/day and storage coefficient of 3.6×10^{-3} were estimated based on a log-log plot of the time-drawdown data (**Appendix D**) using the Hantush (1956) leaky analytical solution method. Since the tested interval had a thickness of 200 feet, a hydraulic conductivity of 1,720 feet per day was estimated. An r/B of 0.2478 was estimated using the Hantush (1956) method.

APT No.2

The second APT was conducted on July 1, 1996, and consisted of pumping the interval between 1,360 to 1,510 feet bls (middle portion of upper FAS) in Well PBF-6 for 69 hours at a constant discharge rate of 1,320 gpm, while monitoring water levels in Well

PBF-4. The static water level in Well PBF-6 was measured as 44.3 above NGVD prior to the initiation of pumping. The maximum drawdown measured in the observation well during pumping was 1.1 feet. A transmissivity of 198,500 ft^2/day and storage coefficient of 8.5 X 10^{-4} were estimated based on a semi-log plot of the time-drawdown data (**Appendix D**) using the Hantush (1956) method. Since the tested interval had a thickness of 150 feet, the hydraulic conductivity was estimated at 1,320 feet per day. A leakance of 0.257 gallons per day per cubic foot and an r/B of 0.1 was estimated using the Hantush (1956) method.

Water Quality from the Pumping Tests

Chlorides and TDS concentrations in water sampled from the zone between 1,050 and 1,252 feet bls during APT No. 1 were 2,160 mg/L and 4,050 mg/L, respectively. Chlorides and TDS concentrations in water sampled from the zone between 1,360 and 1,510 feet bls during APT No. 2 were 2,159 mg/L and 3,960 mg/L, respectively. **Table 7** lists the analytical results of water quality samples collected during the APTs and **Table 8** describes the results of water quality analyses from straddle-packer pumping tests. The data indicates that water in the upper and middle zones are very similar, however, water in the uppermost FAS is slightly more saline than water in the middle portion of the upper FAS.

Table 7. Summary of Water Quality Data from Aquifer Performance Tests.

APT Test Number	Well Name	Sample Depth	Na mg/L	K mg/L	Ca mg/L	Mg^{2+} mg/L	Cl mg/L	SO_4 mg/L	Alk. As $CaCO_3$ mg/L	F mg/L	TDS mg/L	pH s.u.	SC mmhos/cm
No. 1	PBF-6U	1,050-1,252	861	42	111	152	2,160	377	148	1.34	4,050	7.4	7,160
No. 2	PBF-6M	1,360-1,510	1,026	46	129	145	2,159	354	147	0.82	3,960	7.4	7,040

Table 8. Summary of Water Quality Data from the Straddle-Packer Pumping Test.

Sample Depth	Test Number	Na mg/L	K mg/L	Ca mg/L	Mg mg/L	Cl mg/L	SO_4 mg/L	Alk. As $CaCO_3$ mg/L	F mg/L	Sr mg/L	TDS mg/L	SC mmhos/cm
1,246-1,304	1	940	35	125	142	1,810	324	151	0.92	13.91	3,430	6,110
2,340-2,485	2	8,526	355	542	1,039	18,185	2,279	125	1.03	13.07	30,900	46,290
1,360-1,510	3	1,147	46	157	167	2,090	360	144	1.02	13.18	4,150	7,170
1,050-1,190	4	1,101	45	139	163	2,165	377	145	1.02	14.34	4,210	7,460

The chemical composition of groundwater within the FAS is influenced by several factors including lithology, flow patterns, presence of solution features, and residence time. The hydrochemical facies of groundwater can be classified on the basis of the dominant ions by means of a trilinear diagram and an ionic strength analysis described by Frazee (1982). **Table 9** presents the computation of the relative strengths of the major

cations and anions in the water samples collected during the straddle-packer tests. The analyses from Straddle Packer Tests Nos. 1, 3, and 4 indicated good agreement between the computed relative strength of positive and negatively charged ions. The analysis of the relative ionic balance from Packer Test No. 2 did not show good agreement, indicating that the accuracy of the laboratory results may be in question. This may be due to the high salinity of the water from this zone. Major ions from water samples obtained from Well PBF-6 during the APT's were plotted in the trilinear diagram shown in **Figure 9**. The points plotted in very similar positions on the diagram defined as "lateral intrusion or seawater origin" facies as defined in Frazee (1982), which is dominated primarily by the sodium and chloride ions.

Depth of the Base of the Underground Source of Drinking Water (USDW)

The base of the Underground Source of Drinking Water (USDW) is defined by the state of Florida as the depth to which water containing a TDS concentration of less than 10,000 mg/L extends. The concentration of TDS in water sampled between 2,340 feet and 2,485 feet bls during Packer Test No. 2 was 30,900 mg/L, placing it below the base of the USDW. The concentration of TDS sampled between 1,050 feet and 1,510 feet bls during Packer Test Nos. 1, 3, and 4 was between 3,430 and 4,210 mg/L, which is above the base of the USDW. The water quality results from these packer tests were used in combination with the geophysical log analysis and water sampled during reverse air drilling (**Table 3**) to determine that the base of the USDW was at a depth of approximately 1,766 feet bls at the site.

Water Levels

Water levels in PBF-3-4-5 were measured monthly during the period from April 1997 to March 2001 and used to develop the hydrograph shown in **Figure 10**. Water levels are referenced to NGVD of 1929. The hydrograph (**Figure 10**) shows how water levels (unadjusted for density) in the upper FAS are approximately 36 feet higher than in the lower FAS. Water from the lower FAS (PBF-5) is more saline and thus heavier than water in the upper FAS. The mean water level for the period of record (April 1997 to March 2001) for the upper and lower FAS zones at the site were approximately +46 feet and +10 feet NGVD, respectively. Since the elevation of land surface at the site is approximately +21 feet NGVD, the upper FAS zones flow naturally at land surface under approximately 25 feet of artesian pressure while the lower FAS zone does not. Water levels fluctuated within a range of approximately 2 feet above and below the average values during the period of record.

Geochemical Interpretation of Water from Pumping Tests at Lake Lytal Park, West Palm Beach, Florida

May and July, 1996

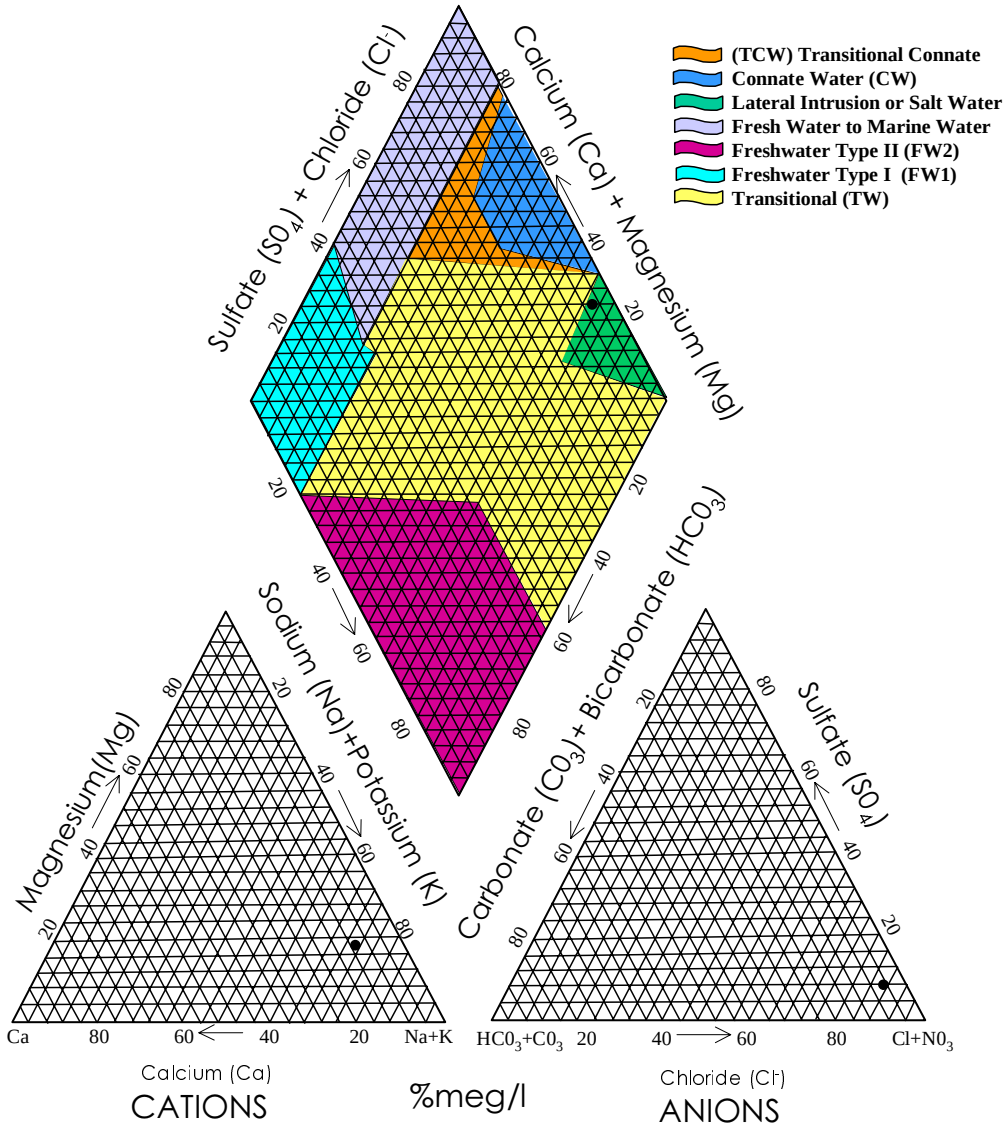

Figure 9. Trilinear Diagram of Data from Wells PBF-3, PBF-4, and PBF-5.

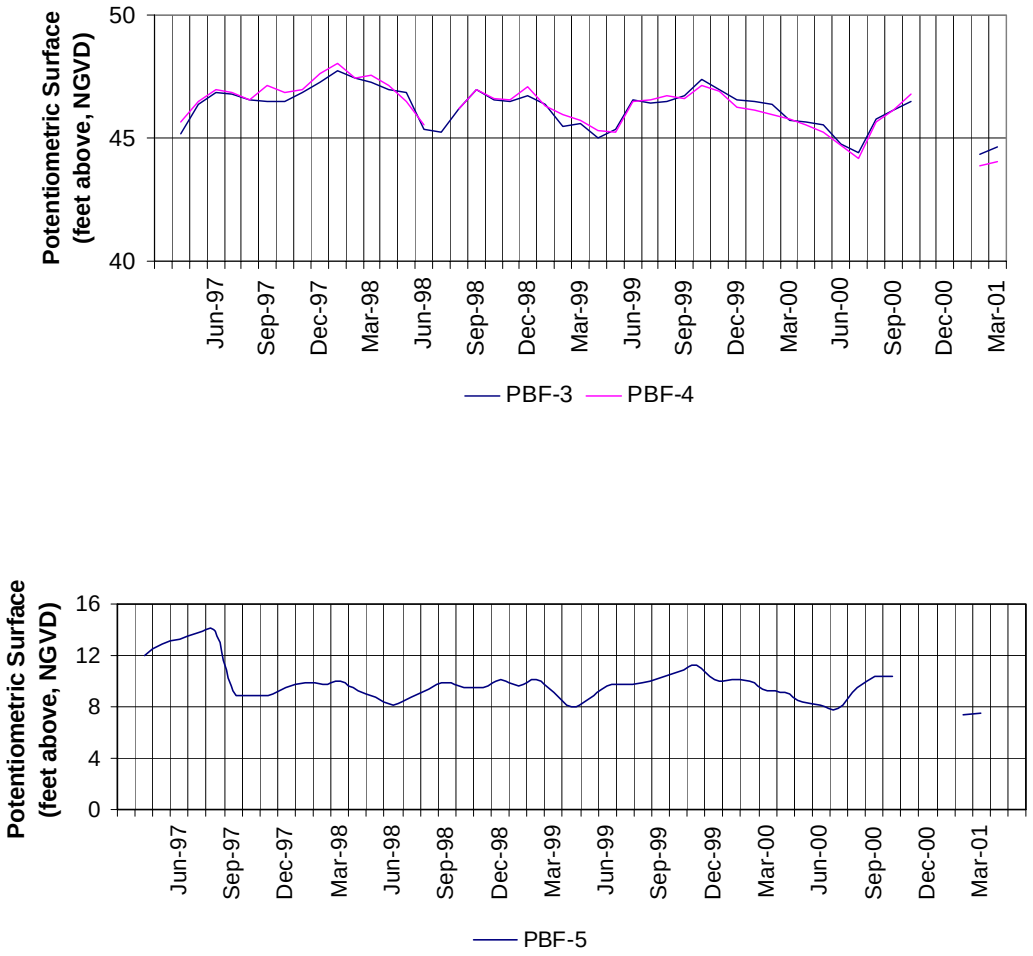

Figure 10. Hydrographs of Data from Wells PBF-3, PBF-4, and PBF-5.

Table 9. Ionic Balance Analysis.

	Ca	Mg	Na	K	Cation Total	Cl-	SO_4	$HC0_3$	$C0_3$	Anion Total
Packer Test No. 1 (1,246-1,304)										
mg/L	125	142.4	939.8	34.8		1,810.1	323.7	151.4	0	
meq/L	6.13	11.68	40.41	0.87	59.08	50.86	6.47	2.42	0	59.76
%	10.37	19.76	68.40	1.47	100	85.11	10.83	4.05	0	100
									Error %	-0.57
Packer Test No. 2 (2,340-2,485)										
mg/L	542.2	1,039.2	8,525.8	34.8		18,185.5	2,279.3	124.8	0	
meq/L	26.57	85.21	366.61	0.87	479.26	511.01	45.59	2.00	0	558.60
%	5.54	17.78	76.49	0.18	100	91.48	8.16	0.36	0	100
									Error %	-7.64
Packer Test No. 3 (1,360-1,510)										
mg/L	156.8	167.4	1,147.1	45.7		2,089.6	360.4	144.1	0	
meq/L	7.68	13.73	49.33	1.14	71.88	58.72	7.21	2.31	0	68.23
%	10.69	19.10	68.62	1.59	100	86.06	10.56	3.38	0	100
									Error %	2.60
Packer Test No. 4 (1,050-1,190)										
mg/L	138.9	162.9	1,100.7	44.6		2,164.5	377.4	144.7	0	
meq/L	6.81	13.36	47.33	1.12	68.61	60.82	7.55	2.32	0	70.69
%	9.92	19.47	68.99	1.63	100	86.05	10.68	3.28	0	100
									Error %	-1.49

Equivalent Freshwater Head Correction

The "raw" water levels recorded at the wellhead were converted to "equivalent freshwater heads" using the Ghyben-Herzberg method (Herzberg, 1901). To perform the correction, the specific gravity of the water collected from each of the monitor zones was computed, the results of which are presented in **Table 10**. Freshwater equivalent heads for the upper, middle, and lower FAS zones are shown in **Table 11**.

Table 10. Specific Gravity Calculation for Water from Well PBF-3, PBF-4, and PBF-5.

Monitor Zone	Total Dissolved Solids (mg/L)	Specific Gravity (g/cm^3)
PBF-3	4,590	1.0025
PBF-4	3,910	1.0025
PBF-5	32,200	1.0225

Table 11. Equivalent Freshwater Heads (September 1997).

Monitor Zone	Depth Interval (feet, bls)	Uncorrected Elevation (feet, NGVD)	Corrected Elevation (feet, NGVD)
PBF-3 (Upper FAS)	1,050 – 1,252	46.78	49.53
PBF-4 (Upper FAS)	1,360 – 1,510	47.13	51.02
PBF-5 (Lower FAS)	2,340 – 2,490	9.27	65.50

Examination of the density-corrected water levels indicates that the lower FAS actually exhibits higher water levels than those in the upper and middle zones. Water levels in the upper and middle zones are nearly identical. This infers that groundwater flow at the site is upward, from the lower FAS towards the upper FAS.

Depth to Top of Seawater

The concentration of TDS in water sampled from between 2,340 feet and 2,485 feet bls during Packer Test No. 2 was 30,900 mg/L, which was equivalent to that of sea water. To approximate the depth to the top of the salt water interface, the Ghyben-Herzberg equation (Herzberg, 1901) was utilized, wherein the depth to salt water can be approximated at 40 times the height of the fresh water above sea level. Since the equivalent freshwater heads in the upper FAS were approximately 47 feet above NGVD as shown on **Table 11**, the computed depth to the top of sea water at the site was estimated at approximately 1,880 feet NGVD.

SUMMARY

Two new wells were constructed in east-central Palm Beach County as part of a program to obtain hydrogeologic and water quality data from the FAS within the District's LEC Planning Area. Hydrogeologic information was obtained to a depth of 2,400 feet bls from the wells. The main findings of the construction and testing program were as follows:

Surficial sediments extended from land surface to a depth of 305 feet bls and the Hawthorn Group (upper confining unit) was found to extend to approximately 915 feet bls. Limestone comprising the uppermost portion of the FAS was identified at a depth of approximately 890 feet (bls) based on lithologic and hydrogeologic observations.

An "upper" producing zone between 1,050 to 1,250 feet bls exhibited a transmissivity of 34,300 ft^2/day. Water sampled from that interval exhibited a chloride concentration of approximately 2,160 mg/L. A "middle" producing zone was identified between 1,360 and 1,510 feet bls. This interval had a transmissivity of approximately 198,500 ft^2/day. Water collected from this zone also had a chloride concentration of 2,160 mg/L.

The base of the USDW was identified by water quality analysis during drilling, straddle-packer tests, and geophysical log analysis. This base was found to occur at approximately 1,766 feet bls at the site. The calculated depth to the top of salt water at the site was approximately 1,880 feet bls, based on the Geyben-Herzberg equation.

A zone between 2,340 and 2,485 feet bls within the FAS exhibited a very low hydraulic conductivity (7 feet/day), indicating significant confinement at that depth. It also had a chloride concentration of 18,185 mg/L, about that of seawater.

The unadjusted potentiometric surfaces of the upper and middle monitored FAS intervals (Wells PBF-3 and PBF-4) during the period from April 1997 to March 2001 were approximately 47 feet above the 1929 NGVD. The potentiometric surface of the lower monitored interval (Well PBF-5) was approximately 9 feet above NGVD during the same period. Water levels fluctuated approximately 2 feet in monitored zones over a period of nearly four years. When adjusted for density, the groundwater gradient between the upper and lower monitored FAS zones was upward. Density corrected heads in the lower FAS were approximately 15 feet higher than those measured in the upper FAS.

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APPENDIX A - LITHOLOGIC DESCRIPTION AND DRILLER'S LOG

LITHOLOGIC DESCRIPTION

LITHOLOGIC LOG: LAKE LYTAL TEST WELL
SOURCE – Florida Geological Survey

WELL NUMBER: W-17397 COUNTY - PALM BEACH
TOTAL DEPTH: 2485 FT. LOCATION: T.44S R.43E S.06

SAMPLE COUNT: 334 SAMPLES FROM 10 TO 2485 FT.

LATITUDE = 26D 40M 33S
LONGITUDE = 80D 06M 11S

COMPLETION DATE: 01/00/96 **ELEVATION:** 20 FT
OTHER TYPES OF LOGS AVAILABLE - NONE

OWNER/DRILLER: SFWMD/RST

WORKED BY: LANCE JOHNSON (FGS, 04/23/96--06/08/96)
SFWMD #PBF-3; 099-62
CONFLICTING DEPTHS FOR SOME SAMPLES, SAMPLES ARE DIRTY

0.0 - 150.0 121PCPC PLIOCENE-PLEISTOCENE
150.0 - 915.0 122HTRN HAWTHORN GROUP
915.0 - 1084.0 123SWNN SUWANNEE LIMESTONE
1084.0 - 1105.0 124OCAL OCALA GROUP
1105.0 - 2485.0 124AVPK AVON PARK FM.
0. - 10. 000NOSM NO SAMPLES
115. - 120. 000NOSM NO SAMPLES
690. - 800. 000NOSM NO SAMPLES

0 - 10 NO SAMPLES

10 - 25 SAND; WHITE
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
ROUNDNESS: SUB-ANGULAR TO ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
OTHER FEATURES: FROSTED

25 - 40 SAND; GRAYISH BROWN
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
ROUNDNESS: SUB-ANGULAR TO ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
MOLLUSKS AND FOSSIL FRAGMENTS DON'T EXIST FROM 25' TO 35'.

40 - 60 SHELL BED; YELLOWISH GRAY TO MODERATE GRAY
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
UNCONSOLIDATED
ACCESSORY MINERALS: QUARTZ SAND-30%
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

60 - 70 SANDSTONE; VERY LIGHT GRAY TO MODERATE LIGHT GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
ROUNDNESS: SUB-ANGULAR TO ROUNDED; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
ACCESSORY MINERALS: CALCITE-40%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

70 - 95 PACKSTONE; VERY LIGHT GRAY TO MODERATE LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
ACCESSORY MINERALS: QUARTZ SAND-30%, PHOSPHATIC SAND-01%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

95 - 110 PACKSTONE; VERY LIGHT GRAY TO LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
ACCESSORY MINERALS: QUARTZ SAND-30%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

110 - 115 PACKSTONE; YELLOWISH GRAY TO LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
ACCESSORY MINERALS: QUARTZ SAND-20%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, BRYOZOA, SPICULES, FOSSIL FRAGMENTS
PART OF SAMPLE IS UNCONSOLIDATED SHELL FRAGMENTS.

115 - 120 NO SAMPLES

120 - 145 GRAINSTONE; WHITE TO VERY LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, OOLITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
HAS VERY COARSE SHELL FRAGMENTS TO FINE SHELL FRAGMENTS OOLITES.

145 - 150 GRAINSTONE; WHITE TO MODERATE GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, OOLITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
PART OF SAMPLE IS UNCONSOLIDATED SHELL FRAGMENTS.

150 - 183 SHELL BED; YELLOWISH GRAY TO MODERATE LIGHT GRAY
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
UNCONSOLIDATED
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-02% SPAR-15%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, ECHINOID, FOSSIL FRAGMENTS, BRYOZOA
PLANKTONIC FORAMINIFERA
LARGER CONSOLIDATED LIMESTONE FRAGMENTS PRESENT.

183 - 190 GRAINSTONE; VERY LIGHT GRAY TO MODERATE LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, OOLITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-02%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

190 - 195 GRAINSTONE; YELLOWISH GRAY TO MODERATE LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
95% ALLOCHEMICAL CONSTITUENTS

GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
ACCESSORY MINERALS: QUARTZ SAND-10%, PHOSPHATIC SAND-02%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, ECHINOID, FOSSIL FRAGMENTS
SOME UNCONSOLIDATED SHELL FRAGMENTS.

195 - 205 SHELL BED; YELLOWISH GRAY TO MODERATE GRAY
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
UNCONSOLIDATED
ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC SAND-05%
SPAR-15%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, ECHINOID, BRYOZOA, FOSSIL FRAGMENTS

205 - 230 GRAINSTONE; YELLOWISH GRAY TO LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
ACCESSORY MINERALS: QUARTZ SAND-10%, PHOSPHATIC SAND-05%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

230 - 265 GRAINSTONE; YELLOWISH GRAY TO MODERATE LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
95% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
ACCESSORY MINERALS: QUARTZ SAND-15%, PHOSPHATIC SAND-06%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

265 - 275 SHELL BED; VERY LIGHT GRAY TO MODERATE LIGHT GRAY
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
UNCONSOLIDATED
ACCESSORY MINERALS: QUARTZ SAND-15%, PHOSPHATIC SAND-06%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
SOME POORLY CONSOLIDATED FRAGMENTS.

275 - 290 GRAINSTONE; YELLOWISH GRAY TO MODERATE LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT

ACCESSORY MINERALS: QUARTZ SAND-10%, PHOSPHATIC SAND-04%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

290 - 290 SHELL BED; YELLOWISH GRAY TO LIGHT GRAY
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
UNCONSOLIDATED
ACCESSORY MINERALS: QUARTZ SAND-15%, PHOSPHATIC SAND-05%
SPAR-15%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
SOME POORLY CONSOLIDATED FRAGMENTS OF SAME MATERIAL.

290 - 305 SHELL BED; YELLOWISH GRAY TO LIGHT GRAY
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
UNCONSOLIDATED
ACCESSORY MINERALS: QUARTZ SAND-15%, PHOSPHATIC SAND-02%
SPAR-15%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, BRYOZOA, FOSSIL FRAGMENTS

305 - 310 GRAINSTONE; YELLOWISH GRAY TO GREENISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
ACCESSORY MINERALS: QUARTZ SAND-15%, PHOSPHATIC SAND-03%
CALCILUTITE-05%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS
FOSSILS: MOLLUSKS, BRYOZOA, FOSSIL FRAGMENTS

310 - 320 PACKSTONE; GREENISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-15%, PHOSPHATIC SAND-06%
CLAY-01%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS
FOSSILS: SHARKS TEETH, MOLLUSKS, BRYOZOA, ECHINOID
FOSSIL FRAGMENTS

320 - 330 GRAINSTONE; YELLOWISH GRAY TO VERY LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
90% ALLOCHEMICAL CONSTITUENTS

GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
ACCESSORY MINERALS: QUARTZ SAND-20%, PHOSPHATIC SAND-04%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

330 - 355 PACKSTONE; YELLOWISH GRAY TO LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-25%, PHOSPHATIC SAND-06%
SPAR-05%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

355 - 365 SAND; YELLOWISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
ROUNDNESS: SUB-ANGULAR TO ROUNDED; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, SHELL-01%

365 - 375 PACKSTONE; WHITE TO GREENISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-30%, PHOSPHATIC SAND-07%
SPAR-05%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS

375 - 385 SAND; YELLOWISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
ROUNDNESS: SUB-ANGULAR TO ROUNDED; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, SHELL-01%

385 - 385 PACKSTONE; WHITE TO GREENISH GRAY
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, OOLITE
80% ALLOCHEMICAL CONSTITUENTS

GRAIN SIZE: COARSE; RANGE: MEDIUM TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-25%, PHOSPHATIC SAND-07%
SPAR-05%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

385 - 395 SAND; YELLOWISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
ROUNDNESS: SUB-ANGULAR TO ROUNDED; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, SHELL-01%

395 - 395 WACKESTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
30% ALLOCHEMICAL CONSTITUENTS
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, QUARTZ SAND-10%
CLAY-07%, SILT-05%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
SANDY, SILTY CALCILUTITE WACKESTONE.

395 - 405 SAND; YELLOWISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: FINE; RANGE: VERY FINE TO COARSE
ROUNDNESS: SUB-ANGULAR TO ROUNDED; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, SHELL-02%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

405 - 410 SAND; YELLOWISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: FINE; RANGE: VERY FINE TO COARSE
ROUNDNESS: SUB-ANGULAR TO ROUNDED; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, SHELL-03%
FOSSILS: PLANKTONIC FORAMINIFERA, BENTHIC FORAMINIFERA

410 - 415 WACKESTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL

25% ALLOCHEMICAL CONSTITUENTS
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, QUARTZ SAND-10%
CLAY-07%, SILT-05%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
SANDY, SILTY CALCILUTITE WACKESTONE.

415 - 425 SILT; LIGHT OLIVE
POROSITY: LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, CLAY-15%
QUARTZ SAND-05%, ANHYDRITE-1 %
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, FOSSIL FRAGMENTS
SANDY, SILTY, CLAY MUD (CALCILUTITE).

425 - 445 SILT; LIGHT OLIVE
POROSITY: LOW PERMEABILITY; MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-07%, CLAY-10%
QUARTZ SAND-05%
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
PLANKTONIC FORAMINIFERA
FEW SHELLS, CONTENT MOSTLY FINE PARTICLES, SAND, SILT
CLAY, AND CALCILUTITE

445 - 445 SAND; YELLOWISH GRAY
35% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN SIZE: COARSE; RANGE: VERY FINE TO GRAVEL
ROUNDNESS: ANGULAR TO ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: CALCILUTITE-10%, SHELL-05%
PHOSPHATIC SAND-06%
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS

445 - 530 SILT; LIGHT OLIVE
POROSITY: LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CALCILUTITE-15%, CLAY-20%
LIMESTONE-02%, PHOSPHATIC SAND-10%
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
ALSO CONTAINS 2% MICA.

530 - 550 SILT; YELLOWISH GRAY TO LIGHT OLIVE
POROSITY: LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-25%, PHOSPHATIC SAND-10%
CALCILUTITE-15%, QUARTZ SAND-05%
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA

MIXTURE OF SANDSTONE AND CLAY MUD AND CALCILUTITE, AND 2% MICA.

550 - 690 SILT; LIGHT OLIVE TO LIGHT OLIVE GRAY
POROSITY: LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-20%, PHOSPHATIC SAND-05%
CALCILUTITE-05%, QUARTZ SAND-05%
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
SMALL PERCENTAGE OF MICA.

690 - 800 NO SAMPLES

800 - 850 SILT; YELLOWISH GRAY TO OLIVE GRAY
POROSITY: LOW PERMEABILITY; MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: QUARTZ SAND-07%, PHOSPHATIC SAND-10%
CLAY-25%
FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA, SPICULES
CONTAINS SMALL PERCENTAGE OF MICA AND CHERT CHIPS SAND AND MUDSTONE FRAGMENTS SHOWING POSSIBLE REWORKING.

850 - 915 LIMESTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
75% ALLOCHEMICAL CONSTITUENTS
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-20%, PHOSPHATIC SAND-05%
SPAR-05%
FOSSILS: MOLLUSKS, BENTHIC FORAMINIFERA, SPICULES
FOSSIL FRAGMENTS
SANDY PHSOPHATIC LIMESTONE WITH CHERT FRAGMENTS FROM A CAVE-IN.

915 - 940 WACKESTONE; VERY LIGHT GRAY TO GREENISH GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CRYSTALS
15% ALLOCHEMICAL CONSTITUENTS
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
LEPIDOCYCLINA UNDULOSE & SP., CAVE-IN FRAGMENTS OF CHERT MICA, AND SANDY PHOSPHATIC LIMESTONE.

940 - 1040 PACKSTONE; YELLOWISH GRAY TO GREENISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
75% ALLOCHEMICAL CONSTITUENTS
MODERATE INDURATION

CEMENT TYPE(S): CALCILUTITE MATRIX
FOSSILS: BRYOZOA, MOLLUSKS, FOSSIL FRAGMENTS
LEPIDOCYCLINA UNDULOSE & SP., CAVE-IN FRAGMENTS OF CHERT
MICA, AND SANDY PHOSPHATIC LIMESTONE.

1040 - 1050 PACKSTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: PELLET, BIOGENIC, SKELETAL
70% ALLOCHEMICAL CONSTITUENTS
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT, CALCILUTITE MATRIX
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
LEPIDOCYCLINA UNDULOSE & SP., CAVE-IN FRAGMENTS OF CHERT
MICA, AND SANDY PHOSPHATIC LIMESTONE.

1050 - 1084 PACKSTONE; YELLOWISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: PELLET, BIOGENIC, SKELETAL
75% ALLOCHEMICAL CONSTITUENTS
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT, CALCILUTITE MATRIX
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, ECHINOID
LEPIDOCYCLINA SP., CAVE-IN FRAGMENTS OF CHERT, MICA, AND
SANDY PHOSPHATIC LIMESTONE.

1084 - 1105 CALCARENITE; YELLOWISH GRAY
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CRYSTALS
85% ALLOCHEMICAL CONSTITUENTS
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS
MEDIUM RECRYSTALLIZATION
FOSSILS: SPICULES, MOLLUSKS, FOSSIL FRAGMENTS, ECHINOID
LEPIDOCYCLINA SP., POORLY CONSOLIDATED, SAND SIZED
LIMESTONE FRAGMENTS WITH SOME WELL INDURATED FRAGMENTS OF
LIMESTONE. POSSIBLY OCALA LIMESTONE. LOOSE QUARTZ SAND 1%

1105 - 1115 PACKSTONE; YELLOWISH GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
85% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
OTHER FEATURES: CHALKY, CALCAREOUS, FOSSILIFEROUS
FOSSILS: SPICULES, BRYOZOA, BENTHIC FORAMINIFERA, MOLLUSKS
FOSSIL FRAGMENTS
CONES EXIST: DICTYOCONUS AMERICANUS, LEPIDOCYCLINA sp.

CRIBROLIMINA CUSHMANI. LOOSE QUARTZ SAND 1%

1115 - 1130 PACKSTONE; WHITE TO YELLOWISH GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
85% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
OTHER FEATURES: CALCAREOUS, CHALKY, FOSSILIFEROUS
MEDIUM RECRYSTALLIZATION
FOSSILS: SPICULES, BENTHIC FORAMINIFERA, CONES
DICTYOCONUS AMERICANUS, CRIBROLIMINA CUSHMANI; LOOSE QUARTZ SAND AND PHOSPHATIC SAND.

1130 - 1130 PACKSTONE; WHITE TO YELLOWISH GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
70% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT, CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, CHALKY, FOSSILIFEROUS
CRYSTALLINE
FOSSILS: CONES
DICTYOCONUS AMERICANUS. LOOSE QUARTZ SAND 1%

1130 - 1130 WACKESTONE; WHITE TO YELLOWISH GRAY
10% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
40% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, CHALKY, FOSSILIFEROUS
FOSSILS: CONES, BENTHIC FORAMINIFERA
DICTYOCONUS AMERICANUS, LEPIDOCYCLINA sp..

1130 - 1160 MUDSTONE; WHITE TO VERY LIGHT GRAY
POROSITY: PIN POINT VUGS, INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL
05% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
FOSSILS: FOSSIL MOLDS
THIS ROCK IS VERY WELL INDURATED CALCILUTITE.

1160 - 1170 PACKSTONE; WHITE TO VERY LIGHT GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
75% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT, CALCILUTITE MATRIX

FOSSILS: FOSSIL FRAGMENTS

1170 - 1170 MUDSTONE; VERY LIGHT ORANGE TO VERY LIGHT GRAY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
10% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SPAR-10%
OTHER FEATURES: HIGH RECRYSTALLIZATION, FOSSILIFEROUS
FOSSILS: CONES, FOSSIL FRAGMENTS, FOSSIL MOLDS
THERE ARE ABUNDANT FORAMS RADIAL SYMMETRY AND HOLLOW CENTERS WHICH ARE UNKNOWN.

1170 - 1180 MUDSTONE; VERY LIGHT ORANGE TO VERY LIGHT GRAY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
05% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SPAR-10%
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, FOSSIL MOLDS

1180 - 1190 LIMESTONE; WHITE TO YELLOWISH GRAY
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: SKELETAL, BIOGENIC
90% ALLOCHEMICAL CONSTITUENTS
UNCONSOLIDATED
ACCESSORY MINERALS: CALCILUTITE-10%
OTHER FEATURES: FOSSILIFEROUS, CALCAREOUS
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
THIS LAYER IS ALMOST EXCLUSIVELY BENTHIC FORAMS WHICH ARE UNCONSOLIDATED.

1190 - 1200 PACKSTONE; WHITE TO VERY LIGHT GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
80% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, SPARRY CALCITE CEMENT
ACCESSORY MINERALS: DOLOMITE-03%
OTHER FEATURES: FOSSILIFEROUS, LOW RECRYSTALLIZATION CALCAREOUS
FOSSILS: ECHINOID, MOLLUSKS, CONES
DICTYOCONUS AMERICANUS.

1200 - 1210 DOLOSTONE; WHITE TO GRAYISH BROWN
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
INTERCRYSTALLINE; 50-90% ALTERED; SUBHEDRAL
GRAIN SIZE: FINE; RANGE: FINE TO COARSE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-20%

OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, FOSSIL MOLDS, BRYOZOA
MEDIUM TO HIGH RANGE OF DOLOMITIZATION.

1210 - 1215 PACKSTONE; WHITE TO VERY LIGHT GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
PIN POINT VUGS
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
75% ALLOCHEMICAL CONSTITUENTS
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%, SPAR-02%
OTHER FEATURES: FOSSILIFEROUS, CALCAREOUS
FOSSILS: CONES, BENTHIC FORAMINIFERA
DICTYOCONUS AMERICANUS.

1215 - 1230 MUDSTONE; WHITE TO YELLOWISH GRAY
POROSITY: PIN POINT VUGS, INTERGRANULAR
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
05% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-05%
OTHER FEATURES: CALCAREOUS
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
POSSIBLE GRAINSTONE FRAGMENTS IN SAMPLE

1230 - 1245 PACKSTONE; VERY LIGHT ORANGE TO VERY LIGHT GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
85% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-03%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, CALCAREOUS
FOSSILS: CONES, BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
DICTYOCONUS AMERICANUS, POSSIBLE MUDSTONE FRAGMENTS, DARK GREY DOLOMITE FRAGMENTS PRESENT

1245 - 1260 MUDSTONE; WHITE TO LIGHT GRAY
POROSITY: PIN POINT VUGS, INTERGRANULAR
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
05% ALLOCHEMICAL CONSTITUENTS
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
FOSSILS: CONES, BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
DICTYOCONUS AMERICANUS.

1260 - 1268 WACKESTONE; YELLOWISH GRAY
15% POROSITY: INTERGRANULAR

GRAIN TYPE: SKELETAL, BIOGENIC
30% ALLOCHEMICAL CONSTITUENTS
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS
FOSSILS: BENTHIC FORAMINIFERA, CONES
DICTYOCONUS AMERICANUS.

1268 - 1272 DOLOSTONE; VERY LIGHT ORANGE TO GRAYISH BROWN
12% POROSITY: INTERCRYSTALLINE, VUGULAR; 90-100% ALTERED
SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CONES

1272 - 1276 DOLOSTONE; WHITE TO MODERATE GRAY
12% POROSITY: INTERCRYSTALLINE, VUGULAR; 50-90% ALTERED
SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS
SAMPLE IS ALSO ABOUT 40% REMNANT CALCILUTITE WITHIN
DOLOSTONE

1276 - 1280 PACKSTONE; VERY LIGHT ORANGE TO LIGHT GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO COARSE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-25%
OTHER FEATURES: FOSSILIFEROUS, CALCAREOUS, DOLOMITIC
FOSSILS: CONES, FOSSIL MOLDS
DICTYOCONUS AMERICANUS.

1280 - 1288 MUDSTONE; YELLOWISH GRAY
POROSITY: PIN POINT VUGS, INTERGRANULAR
GRAIN TYPE: SKELETAL; 02% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO GRAVEL
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-10%
OTHER FEATURES: CALCAREOUS, DOLOMITIC

1288 - 1295 DOLOSTONE; WHITE TO GRAYISH BROWN
12% POROSITY: INTERCRYSTALLINE, VUGULAR; 90-100% ALTERED
SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-10%
OTHER FEATURES: HIGH RECRYSTALLIZATION
ABOUT 5-10% OF SAMPLE IS REMNANT CALCAREOUS GRAINSTONE.

1295 - 1300 DOLOSTONE; VERY LIGHT ORANGE TO GRAYISH BROWN
12% POROSITY: INTERCRYSTALLINE, VUGULAR; 90-100% ALTERED
SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION

1300 - 1304 DOLOSTONE; WHITE TO GRAYISH BROWN
12% POROSITY: INTERCRYSTALLINE, VUGULAR; 50-90% ALTERED
SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-45%
OTHER FEATURES: HIGH RECRYSTALLIZATION, CALCAREOUS
FOSSILIFEROUS
FOSSILS: CONES
DICTYOCONUS AMERICANUS, ABOUT 40-50% OF SAMPLE IS
CALCAREOUS MUDSTONE WITH SOME GRAINSTONE FRAGMENTS.

1304 - 1305 MUDSTONE; WHITE TO GRAYISH BROWN
POROSITY: PIN POINT VUGS, INTERGRANULAR
GRAIN TYPE: SKELETAL, BIOGENIC
05% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO GRAVEL
ACCESSORY MINERALS: DOLOMITE-25%
OTHER FEATURES: FOSSILIFEROUS, DOLOMITIC
FOSSILS: CONES
DICTYOCONUS AMERICANUS.

1305 - 1306 DOLOSTONE; VERY LIGHT ORANGE TO GRAYISH BROWN
12% POROSITY: INTERCRYSTALLINE, VUGULAR; 50-90% ALTERED
SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-25%, QUARTZ SAND-01%
OTHER FEATURES: CALCAREOUS, HIGH RECRYSTALLIZATION

ABOUT 25% IS REMNANT CALCILUTITE WITHIN DOLOSTONE.

1306 - 1311 DOLOSTONE; VERY LIGHT ORANGE TO GRAYISH BROWN
12% POROSITY: INTERCRYSTALLINE, VUGULAR; 90-100% ALTERED
SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-04%
OTHER FEATURES: HIGH RECRYSTALLIZATION
REMNANT CALCILUTITE WITHIN DOLOSTONE.

1311 - 1312 PACKSTONE; VERY LIGHT GRAY TO YELLOWISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: SKELETAL, BIOGENIC
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: VERY FINE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS
FOSSILS: ECHINOID, CONES, BENTHIC FORAMINIFERA
DICTYOCONUS AMERICANUS.

1312 - 1314 MUDSTONE; WHITE TO VERY LIGHT ORANGE
POROSITY: PIN POINT VUGS, INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL
05% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-30%
OTHER FEATURES: FOSSILIFEROUS, CALCAREOUS, DOLOMITIC
MEDIUM RECRYSTALLIZATION
FOSSILS: CONES, FOSSIL FRAGMENTS
DICTYOCONUS AMERICANUS; LIMESTONE MOSTLY CALCILUTITE WITH
PACKSTONE FRAGMENTS.

1314 - 1319 PACKSTONE; YELLOWISH GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO VERY COARSE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-05%
OTHER FEATURES: FOSSILIFEROUS, CALCAREOUS
FOSSILS: CONES, BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
DICTYOCONUS AMERICANUS. SOME MUDSTONE FRAGMENTS.

1319 - 1322 MUDSTONE; WHITE TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: BIOGENIC, SKELETAL
10% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRANULE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%
DICTYOCONUS AMERICANUS.

1322 - 1323 WACKESTONE; WHITE TO YELLOWISH GRAY
10% POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: BIOGENIC, SKELETAL
50% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRAVEL
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%
OTHER FEATURES: FOSSILIFEROUS, CALCAREOUS
FOSSILS: CONES, FOSSIL FRAGMENTS
EXCELLENT SPECIMENS OF DICTYOCONUS AMERICANUS.

1323 - 1324 DOLOSTONE; YELLOWISH GRAY TO MODERATE GRAY
12% POROSITY: INTERCRYSTALLINE, VUGULAR; 50-90% ALTERED SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-15%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: CONES, BENTHIC FORAMINIFERA
15% OF SAMPLE IS A MICRITE CEMENTED PACKSTONE WITH CONES (DICTYOCONUS AMERICANUS AND FORAMS).

1324 - 1330 WACKESTONE; YELLOWISH GRAY TO VERY LIGHT GRAY
10% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY PIN POINT VUGS
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
35% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRAVEL
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-15%
OTHER FEATURES: FOSSILIFEROUS, CALCAREOUS, DOLOMITIC
MEDIUM RECRYSTALLIZATION
FOSSILS: CONES, FOSSIL MOLDS, FOSSIL FRAGMENTS
BENTHIC FORAMINIFERA
DICTYOCONUS AMERICANUS.

1330 - 1334 DOLOSTONE; VERY LIGHT GRAY TO LIGHT OLIVE GRAY

15% POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
VUGULAR; 50-90% ALTERED; SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-48%
OTHER FEATURES: DOLOMITIC, FOSSILIFEROUS, CALCAREOUS
HIGH RECRYSTALLIZATION
FOSSILS: CONES, FOSSIL FRAGMENTS
DICTYOCONUS AMERICANUS, 48% MICRITE MUDSTONE. DOLOSTONE HAS REMNANT CALCILUTITE WITHIN DOLOMITE. PACKSTONE AND DIRTY MUDSTONE PRESENT, BOTH CALCAREOUS.

1334 - 1350 PACKSTONE; YELLOWISH GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-10%
OTHER FEATURES: FOSSILIFEROUS, CALCAREOUS
MEDIUM RECRYSTALLIZATION
FOSSILS: CONES, FOSSIL FRAGMENTS, FOSSIL MOLDS
DICTYOCONUS AMERICANUS.

1350 - 1355 MUDSTONE; WHITE TO MODERATE GRAY
POROSITY: INTERCRYSTALLINE, VUGULAR
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
05% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
OTHER FEATURES: DOLOMITIC, HIGH RECRYSTALLIZATION
FOSSILIFEROUS, CALCAREOUS
FOSSILS: CONES, FOSSIL FRAGMENTS
DICTYOCONUS AMERICANUS.

1355 - 1375 WACKESTONE; WHITE TO YELLOWISH GRAY
10% POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
35% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRAVEL
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-05%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: CONES, FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA
DICTYOCONUS AMERICANUS, SOME FRAGMENTS ARE PART CALCILUTITE SOME ARE PACKSTONES.

1375 - 1385 MUDSTONE; YELLOWISH GRAY TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR, PIN POINT VUGS, LOW PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
05% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRANULE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, LOW RECRYSTALLIZATION
FOSSILS: CONES, FOSSIL FRAGMENTS, FOSSIL MOLDS
DICTYOCONUS AMERICANUS, ALMOST PURE MICRITE, COMPACTED AND HARD, MOST LOOKS SLIGHTLY RECRYSTALLIZED.

1385 - 1410 WACKESTONE; YELLOWISH GRAY
10% POROSITY: INTERGRANULAR, VUGULAR
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
30% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRAVEL
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, CONES, FOSSIL MOLDS, FOSSIL FRAGMENTS
DICTYOCONUS AMERICANUS.

1410 - 1420 PACKSTONE; WHITE TO YELLOWISH GRAY
15% POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
65% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRAVEL
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: CONES, FOSSIL MOLDS, BENTHIC FORAMINIFERA
FOSSIL FRAGMENTS
DICTYOCONUS AMERICANUS, SOME FRAGMENTS ARE PURE MICRITE.

1420 - 1435 PACKSTONE; YELLOWISH GRAY
15% POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
65% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRAVEL
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: CONES, FOSSIL MOLDS, MOLLUSKS, FOSSIL FRAGMENTS
DICTYOCONUS AMERICANUS, PART OF THE SAMPLE IS PURE MICRITE WHICH IS DENSE ANDSLIGHTLY RECRYSTALLIZED.

1435 - 1437 DOLOSTONE; YELLOWISH GRAY TO MODERATE YELLOWISH BROWN
12% POROSITY: INTERCRYSTALLINE, VUGULAR

POSSIBLY HIGH PERMEABILITY; 50-90% ALTERED; SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-20%
OTHER FEATURES: HIGH RECRYSTALLIZATION
20% CALCAREOUS MUDSTONE.

1437 - 1447 MUDSTONE; WHITE
POROSITY: VUGULAR, INTERGRANULAR
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
10% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO COARSE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CONES, FOSSIL MOLDS
FOSSIL FRAGMENTS
DICTYOCONUS AMERICANUS.

1447 - 1450 DOLOSTONE; GRAYISH BROWN
30% POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
VUGULAR; 90-100% ALTERED; SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION
REMNANT CALCILUTITE PARTICLES WITHIN DOLOSTONE

1450 - 1455 MUDSTONE; WHITE TO MODERATE LIGHT GRAY
POROSITY: INTERGRANULAR, VUGULAR
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
08% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO COARSE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS

1455 - 1460 WACKESTONE; YELLOWISH GRAY
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
VUGULAR
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
30% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO GRAVEL
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX

OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
MEDIUM RECRYSTALLIZATION
FOSSILS: CONES, BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
SAMPLE ALSO CONSISTS OF ARE GRAINSTONE AND MUDSTONE
DICTYOCONUS AMERICANUS.

1460 - 1470 MUDSTONE; WHITE TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, VUGULAR
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
10% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO COARSE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: CONES, BENTHIC FORAMINIFERA, FOSSIL MOLDS
FOSSIL FRAGMENTS
DICTYOCONUS AMERICANUS.

1470 - 1485 PACKSTONE; YELLOWISH GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO GRAVEL
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: CONES, BENTHIC FORAMINIFERA, FOSSIL MOLDS
FOSSIL FRAGMENTS
DICTYOCONUS AMERICANUS.

1485 - 1490 MUDSTONE; WHITE TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, VUGULAR
GRAIN TYPE: SKELETAL, BIOGENIC, PELLET
10% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO COARSE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: QUARTZ SAND-01%, DOLOMITE-01%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: CONES, BENTHIC FORAMINIFERA, FOSSIL MOLDS
MOLLUSKS
DICTYOCONUS AMERICANUS, SOME GRAINSTONE FRAGMENTS.

1490 - 1495 DOLOSTONE; VERY LIGHT ORANGE TO MODERATE GRAY
25% POROSITY: INTERCRYSTALLINE, VUGULAR
POSSIBLY HIGH PERMEABILITY; 90-100% ALTERED; SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION

CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION
VERY POROUS, LARGE VUGS, REMNANT CALCILUTITE PATCHES.

1495 - 1500 PACKSTONE; YELLOWISH GRAY
15% POROSITY: VUGULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL; GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%, SPAR-05%
OTHER FEATURES: CHALKY, FOSSILIFEROUS, CALCAREOUS
FOSSILS: CONES, BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
FOSSIL MOLDS, MOLLUSKS
DICTYOCONUS AMERICANUS.

1500 - 1505 WACKESTONE; YELLOWISH GRAY TO LIGHT GRAY
10% POROSITY: INTERGRANULAR, VUGULAR
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL; GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%, SPAR-05%
OTHER FEATURES: CHALKY, FOSSILIFEROUS, CALCAREOUS
FOSSILS: CONES, BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
FOSSIL MOLDS, MOLLUSKS

1505 - 1510 DOLOSTONE; VERY LIGHT ORANGE TO MODERATE GRAY
15% POROSITY: INTERCRYSTALLINE, VUGULAR; 50-90% ALTERED
SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-25%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: FOSSIL MOLDS, MOLLUSKS
REMNANT CALCILUTITE AND HIGHLY RECRYSTALLIZED LIMESTONE.

1510 - 1550 PACKSTONE; YELLOWISH GRAY TO LIGHT GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL; GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: SPAR-05%, ORGANICS-01%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: CONES, FOSSIL MOLDS, FOSSIL FRAGMENTS
BENTHIC FORAMINIFERA, MOLLUSKS

DICTYOCONUS AMERICANUS.

1550 - 1555 PACKSTONE; YELLOWISH GRAY TO MODERATE GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-05%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
MEDIUM RECRYSTALLIZATION
FOSSILS: CONES, FOSSIL MOLDS, FOSSIL FRAGMENTS
BENTHIC FORAMINIFERA
DICTYOCONUS COOKEI, DICTYOCONUS AMERICANUS, SOME FRAGMENTS ARE MUDSTONE.

1555 - 1561 DOLOSTONE; GRAYISH BROWN TO MODERATE DARK GRAY
15% POROSITY: INTERCRYSTALLINE, VUGULAR; 50-90% ALTERED SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-05%, CALCITE-45%
OTHER FEATURES: HIGH RECRYSTALLIZATION
SOME CALCILUTITE, LIGHTLY RECRYSTALLIZED CALCITE.

1561 - 1582 WACKESTONE; WHITE TO YELLOWISH GRAY
10% POROSITY: INTERGRANULAR, INTERCRYSTALLINE
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
30% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-10%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
DOLOMITIC, MEDIUM RECRYSTALLIZATION
FOSSILS: CONES, FOSSIL MOLDS, FOSSIL FRAGMENTS
DICTYOCONUS AMERICANUS, DICTYOCONUS COOKEI.

1582 - 1588 DOLOSTONE; WHITE TO YELLOWISH GRAY
15% POROSITY: INTERCRYSTALLINE, VUGULAR; 50-90% ALTERED SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-45%
OTHER FEATURES: CALCAREOUS, HIGH RECRYSTALLIZATION
REMNANT CALCILUTITE PATCHES.

1588 - 1590 DOLOSTONE; WHITE TO GRAYISH BROWN
15% POROSITY: INTERCRYSTALLINE, VUGULAR; 50-90% ALTERED
SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-15%
OTHER FEATURES: CALCAREOUS, HIGH RECRYSTALLIZATION
FOSSILIFEROUS, SPLINTERY
FOSSILS: FOSSIL MOLDS, FOSSIL FRAGMENTS
DICTYOCONUS AMERICANUS, DICTYOCONUS COOKEI, CALCILUTITE AND
SKELETAL FRAGMENTS.

1590 - 1600 WACKESTONE; WHITE TO GRAYISH BROWN
10% POROSITY: INTERGRANULAR, VUGULAR
GRAIN TYPE: BIOGENIC, SKELETAL, CRYSTALS
30% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO COARSE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-20%
OTHER FEATURES: DOLOMITIC, CALCAREOUS, FOSSILIFEROUS
HIGH RECRYSTALLIZATION, CHALKY
FOSSILS: CONES, FOSSIL MOLDS, VERTEBRATE
DICTYOCONUS AMERICANUS.

1600 - 1685 PACKSTONE; YELLOWISH GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CRYSTALS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: CORAL, FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA, CONES
DICTYOCONUS AMERICANUS.

1685 - 1702 MUDSTONE; YELLOWISH GRAY TO GRAYISH BROWN
POROSITY: INTERGRANULAR, INTERCRYSTALLINE
GRAIN TYPE: BIOGENIC, SKELETAL, CRYSTALS
10% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO GRAVEL
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
MEDIUM RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA, CONES, CORAL

DICTYOCONUS AMERICANUS, MUCH OF THIS HAS WELL FORMED
CRYSTALS (EUHEDRAL, MEDIUM), SOME FRAGMENTS OF GRAINSTONE.

1702 - 1707 DOLOSTONE; GRAYISH ORANGE TO GRAYISH BROWN
12% POROSITY: INTERCRYSTALLINE, VUGULAR; 50-90% ALTERED
EUHEDRAL
GRAIN SIZE: FINE; RANGE: VERY FINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: LIMESTONE-15%
OTHER FEATURES: DOLOMITIC, CRYSTALLINE
HIGH RECRYSTALLIZATION, FOSSILIFEROUS
FOSSILS: CONES, FOSSIL FRAGMENTS, FOSSIL MOLDS
DICTYOCONUS AMERICANUS, CALCILUTITE MUDSTONE FRAGMENTS.

1707 - 1725 PACKSTONE; YELLOWISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CRYSTALS
89% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY COARSE; RANGE: FINE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, FOSSIL FRAGMENTS
CONES
DICTYOCONUS AMERICANUS, HIGHLY FOSSILIFEROUS.

1725 - 1799 PACKSTONE; YELLOWISH GRAY TO WHITE
18% POROSITY: INTERGRANULAR, MOLDIC
POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT, CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA, CONES, MOLLUSKS
DICTYOCONUS AMERICANUS. MEDIUM TO GOOD INDURATION.

1799 - 1830 PACKSTONE; YELLOWISH GRAY TO WHITE
30% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO VERY COARSE
POOR INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT, CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY

FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA, CONES
MOLLUSKS
DICTYOCONUS AMERICANUS, MORE LOOSELY CONSOLIDATED
LEPIDOCYCLINA sp..

1830 - 2105 PACKSTONE; YELLOWISH GRAY
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY COARSE; RANGE: FINE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA, CONES
FOSSIL MOLDS
DICTYOCONUS AMERICANUS, LEPIDOCYCLINA sp.,POOR TO MEDIUM
CONSOLIDATON.

2105 - 2111 PACKSTONE; YELLOWISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CRYSTALS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%, SPAR-03%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA, CONES
FOSSIL MOLDS, MOLLUSKS
SOME FRAGMENTS ARE FINE GRAINED CRYSTALLINE LIMESTONE
DICTYOCONUS AMERICANUS.

2111 - 2113 PACKSTONE; YELLOWISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, CRYSTALS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%, SPAR-05%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, FOSSIL MOLDS, CONES
ABOUT 40% IS A FINE GRAINED CRYSTALLINE LIMESTONE
DICTYOCONUS AMERICANUS.

2113 - 2115 LIMESTONE; YELLOWISH GRAY TO WHITE
20% POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: CRYSTALS; 90% ALLOCHEMICAL CONSTITUENTS

GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS
HIGH RECRYSTALLIZATION, CRYSTALLINE
FOSSILS: FOSSIL FRAGMENTS, FOSSIL MOLDS, CONES
SAMPLE IS MIXTURE OF PACKSTONES AND MUDSTONES, CALCILUTITE CEMENTED, DICTYOCONUS AMERICANUS.

2115 - 2119 LIMESTONE; YELLOWISH GRAY
20% POROSITY: INTERCRYSTALLINE, POSSIBLY HIGH PERMEABILITY
VUGULAR
GRAIN TYPE: CRYSTALS; 90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: ORGANICS-01%
OTHER FEATURES: CALCAREOUS, HIGH RECRYSTALLIZATION
CRYSTALLINE
A FEW FRAGMENTS ARE SKELETAL PACKSTONES.

2119 - 2123 WACKESTONE; YELLOWISH GRAY
12% POROSITY: INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL
45% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: ORGANICS-01%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA
LEPIDOCYCLINA sp., SOME CLASTS ARE CRYSTALLINE LIMESTONE.

2123 - 2158 PACKSTONE; YELLOWISH GRAY
25% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY COARSE; RANGE: FINE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: ORGANICS-01%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA
LEPIDOCYCLINA sp., MANY MUDSTONE FRAGMENTS.

2158 - 2168 WACKESTONE; YELLOWISH GRAY
12% POROSITY: INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET

40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA
LEPIDOCYCLINA sp., SOME CRYSTALLINE CALCITE.

2168 - 2175 PACKSTONE; YELLOWISH GRAY TO YELLOWISH GRAY
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY COARSE; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA, CONES
SOME CRYSTALLINE CALCITE, LEPIDOCYCLINA sp., DICTYOCONUS AMERICANUS.

2175 - 2180 WACKESTONE; YELLOWISH GRAY
12% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
30% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY COARSE; RANGE: FINE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: ORGANICS-01%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA, CONES
LEPIDOCYCLINA sp..

2180 - 2240 PACKSTONE; YELLOWISH GRAY TO WHITE
20% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
89% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: COARSE; RANGE: MEDIUM TO VERY COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: FOSSIL FRAGMENTS, CONES, MOLLUSKS
BENTHIC FORAMINIFERA
MUDSTONE FRAGMENTS IN SAMPLE, MOLLUSKS, DICTYOCONUS AMERICANUS, LEPIDOCYCLINA SP.

2240 - 2270 WACKESTONE; YELLOWISH GRAY TO WHITE
12% POROSITY: INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
20% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA

2270 - 2280 PACKSTONE; YELLOWISH GRAY TO WHITE
20% POROSITY: POSSIBLY HIGH PERMEABILITY, INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA

2280 - 2290 WACKESTONE; YELLOWISH GRAY TO WHITE
12% POROSITY: INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
30% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA

2290 - 2310 PACKSTONE; YELLOWISH GRAY TO WHITE
20% POROSITY: POSSIBLY HIGH PERMEABILITY, INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA

2310 - 2330 WACKESTONE; YELLOWISH GRAY TO WHITE
12% POROSITY: INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
30% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA

2330 - 2340 PACKSTONE; MODERATE DARK GRAY TO WHITE
20% POROSITY: POSSIBLY HIGH PERMEABILITY, INTERGRANULAR
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
30% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRANULE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, SPARRY CALCITE CEMENT
ACCESSORY MINERALS: DOLOMITE-02%
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
LOW RECRYSTALLIZATION
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA
LEPIDOCYCLINA sp..

2340 - 2360 DOLOSTONE; VERY LIGHT ORANGE TO GRAYISH ORANGE
12% POROSITY: INTERCRYSTALLINE, VUGULAR; 50-90% ALTERED
SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: FINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: SHELL-10%, CALCILUTITE-10%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS, FOSSIL MOLDS
BENTHIC FORAMINIFERA

2360 - 2370 DOLOSTONE; VERY LIGHT ORANGE TO GRAYISH ORANGE
12% POROSITY: INTERCRYSTALLINE, VUGULAR; 90-100% ALTERED
SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: FINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-05%, SHELL-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL MOLDS
FOSSIL FRAGMENTS

2370 - 2405 DOLOSTONE; VERY LIGHT ORANGE TO GRAYISH ORANGE
12% POROSITY: INTERCRYSTALLINE, INTERGRANULAR
50-90% ALTERED; SUBHEDRAL

GRAIN SIZE: VERY FINE; RANGE: FINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-15%, SHELL-10%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
FOSSIL MOLDS, MOLLUSKS
REMNANT CALCILUTITE PATCHES EXIST.

2405 - 2440 DOLOSTONE; GRAYISH BROWN TO DARK YELLOWISH BROWN
12% POROSITY: INTERCRYSTALLINE, VUGULAR; 50-90% ALTERED
SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: FINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-10%, GLAUCONITE-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION, DOLOMITIC
FOSSILIFEROUS
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL MOLDS
FOSSIL FRAGMENTS
OPERCULIMOIDEA; POSSIBLE GLAUCONITE MARKER BED OF OLDSMAR
FORMATION, DUNCAN ET. AL. 1994.

2440 - 2450 DOLOSTONE; YELLOWISH GRAY TO GRAYISH BROWN
12% POROSITY: INTERCRYSTALLINE, INTERGRANULAR
50-90% ALTERED; SUBHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-30%, SHELL-10%
OTHER FEATURES: DOLOMITIC, HIGH RECRYSTALLIZATION
FOSSILIFEROUS, CHALKY
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
FOSSIL MOLDS
OPERCULIMOIDEA.

2450 - 2475 PACKSTONE; YELLOWISH GRAY
15% POROSITY: INTERGRANULAR, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRANULE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
FOSSIL MOLDS
OPERCULIMOIDEA.

2475 - 2485 WACKESTONE; YELLOWISH GRAY TO WHITE
10% POROSITY: INTERGRANULAR

GRAIN TYPE: BIOGENIC, SKELETAL, PELLET
20% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRANULE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CALCAREOUS, FOSSILIFEROUS, CHALKY
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
FOSSIL MOLDS
SAMPLE CONTAINS 30% MUDSTONE FRAGMENTS.

2485 TOTAL DEPTH

DRILLER'S LOG

ORIGINALS

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT PBC FAS Lake Lytal Park WELL NO. PBF- DATE 4-25-95

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
0-40'	30" Hole to set 24" casing 0-40'. Began collecting 4-24-95 PM
40'-2440'	12¾" Hole from 40' to Base SAS. Luke on site 4-25-95 Tues
	Tinsley driller. Cutting hole out of 40' casing had white v. thick mud/cement mix which created blockage in mud flow system. Sample may not be representative from 40'-60'.
0-25'	Sand; GY2 white, sugar sand, vF-F grained. Rare
25'-40'	Sand; GY2 tan-brown, F-m grained, slightly coarser grained
CASING	
40-50'	Sand and Shell: Sand; grey, vF-F grained mixed with cement from grouting. Shell: tan-wht & grey, broken, small. Cause for th harder drilling @ 48'
50-60'	Sand and Shell as above
60-70'	70% Limestone; grey, coarse grained, consolidated } B.4 chatter @ no 60
	20% Sand; grey, F-m grained, grey as above } Recorder sample
	10% Shell; 10% with sand
	Drilling stopped (power) down due to excessive grey sand buildup in the mud tank & hopper, time needed to circulate large volume of mu
70-80'	Limestone & Sand, grey
	Softer, Increased Sand component
80-85	Limestone as above 90%
	Sand as above 20%
85-87	Shell: tan-lt orange platy, hard drilling, chatter
	10% Grey Limestone: a.a.
87-90	Limestone, grey as above & Shell as above

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 26 Apr 95

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
90-95	Limestone 80% & Shell (20%); tr. calcite, prob. good perm
	Hard rock drilling, bit chatter
95-100	Limestone a.a. (50%)
	Shell a.a., wht-tan (50%)
100-105	Limestone and Shell a.a. tr. well dev. calcite crysta
	Prob solutioning; good perm
105-110	Limestone 60% a.a.
	Shell 35% a.a
	Sand 5% Tr. calcite crystals
	Drilled Soft as if in sand
110-115	Limestone 60% a.a.
	Shell 35% a.a
	Calcite crystals well developed on portion of solutioned tan shell. Good Perm
	Drilled Alt beds of rock (hard, chatter), soft shell/sand
115-120	Shell: 50% v.small, wht-tan, soft
	L.S.: wht-tan; granular, f-g grained, w/some calcilutite silts
	NO TR. calcite, Prob. Mod Perm
	Hard drilling @ 118-119', Soft 120-121'
105-110	FINES Sand
110	Fine shells & L.S.
118	Hard
120	Soft
K.D 120	0949 AM

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 4/26/95

14 3/4" hole

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
120 - 125	Limestone 85% Grey calcarenite, mod. indurated/ Oolitic (Pelsparite), Silty Mod. perm
	10% Shell pale orange-tan
	No calcite evident
	Interbedded hard, soft drilling
125-130	Limestone: 80% Mostly grey pelsparite a.a.
	5% Black pelsparite, poorly sorted, mod-well ii /
	10% Shell fragments; wht-pale orange
130-140	Limestone: a.a. TR. calcite replaced shell molds
	10% shell a.a.
140-145	Limestone: a.a + A. calcite nodules
	15% shell a.a, some small whole shell, pelecypods
	TR. black cryptocryst. limestone, hard
145-180	Limestone: 50% grey calcarenite poorly indurated/
	Shells 50% pale orange as above low perm
180-183	Silty Sand: green/grey, TR. phosphatic ≈ 80%
KD	Limestone & shell 20% aa
	143-146 - Hard chalky
	Green 7 pm

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 4/26-95

N 3/4" hole

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
183-190	Silty Sand & Clay (50%)
	Limestone (Mod. Ind = Calcarenite a.a) 40%
	Shell 10%
190-195	Silty Sand & Shells (30%)
	10% Limestone
195-200	Silty Sand: mod indurated, drill rate slow, no chatter
	Grey & lt, m-c grained, darker than above
	5% small shells.
200-205	Limestone 70% granular calcarenite, black & dk grey
	Silty Sand 10% a.a.
	Shells 10% small
205-213	Limestone (70%) granular f-v.c. grained mod. ind-pordy
KD	Silty sandy clay (25%) mod. plastic; pale green
	Shell (5%) a.a.
213-220	L.S; 80% pale grn, poorly ind, granular, cemented shell frags
	comprised of cemented heavy minerals, low perm,
	Shells 20% loose, unconsolidated
220-225	L.S; 50%, pale grn, mod-poorly ind, fined grey, low per
	siltstones; 20%, dark, platy, pelletoidal
	shells; 30%, loose,
225-230	L.S. 80%, grey to dark grey, f-grn, p-m ind,
	shells, 20%, light grey to pale orange, loosely consol
230-240	Limestone 70%, light to dk grey, cemented phosphatey,
	granular, poorly ind

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 4/26/95

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
230-240	shells; 30%, pale to pale orange, fragmented, loose "holds water", poorly sorted
240-245	L.S; 90%, grey to dark grey, poorly IND, cemented grn phosphatic, mod sorted, some solving, "good perm"
245 K.D. 245	L.S; 10%, olive grn, intergranular, poorly IND, phosphat
245-265	Limestone & Shell Grey-dk grey 70% Limestone, C. grained calcarenite, mod indurat silts and fines, low-mod perm. 20% shell hash, poorly sorted shell frags cemented together, mod indurated conglomerates, 10% Siltstone; pale olive, mod ind.
265-275	Silty grn L.S; 90%, olive green, phosphatic, V. low por pastey matrix, shells; 10%, small frags, poorly sorted,
K.D. 275	1434 hrs
275-290	Limestone; calcarenite 70%, poorly IND, olive grn, phosphatic, silty & limey Shells; 30%, pale to l. orange, fragmented, v. low. perm.
290-305	Silty grn limestones; 70%, olive grn, phosphatic, v. lo perm, fair plasticity; dense aggregat Shells; 30%, tan to pale orange, small,
NOTE:	
300-305	Lime & silt flaking up mud, in solution, v. few returns V.f.g unconsol. mat'l. Milkshake mud

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE _____

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
305-310	60% Limestone; pale green, mod. ind calcarenite
	blk & wht (salt & pepper) calcarenite
	20% : Silt & shells. Increasing suspended silts, limes
	in drilling mud. Phosphatic
310-320	Clay, Silt and Limestone
	@ 70% Clay, plastic, olive green, phosphatic
	30% Limestone & shells a.a.
	Abundant suspended silts, limes, phosphate in drillg mud.
320' TD	Set 18" Surface Casing 24" Ream

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 5-8-95

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
	17" Bit start @ 322'
	Surf Csg (18" steel) to 240' BLS. (Canal well) 320' in Tri-Zone well
	10,000 lbs on bit,
320-340	Sand and Silt : 90%, gray, phosphatic, vfg - mg sand extremely fine sand & silt component. tr. Siltstone
	Clay : 5%
	Shell & L.S : 10%
340-345	Sand, Silt ~~and~~ & : 40%, grey - pale green
	limestone; med grey, calcarenite, mg - fg,
	POOR - mod. indurated, tr. siltstone
	NOTE: Last 10' of hole noticeably greener
345-355	Sand & Silt : 60%, vfg - fg, grey - lt. olive green, phosphatic
	limestone : 15%, fg - mg, poorly - mod. indurated, calcarenite
	Shell : 20%, frags, lt. brown - tan to white
355-365	Silt and Sand : 85% Mostly silt, pale olive green to dk. grey, darker than above, phosphatic. Most of cutting up via sand shaker, v. little solids in net as consolidated portions
	Shell and Limestone 15% as above
365-375	Silt and Sand; vfg fg, pale olive green, phosphatic, slight plasticity 85%
	Shell and Limestone a.a. 10%.
	1 pc. solution riddled oyster shell. Sep. bag (honeycomb structure)

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 5-8-95

	DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
KD 406'	376-405	Silt & Sand: 95%, grey - lt. olive green, low perm; phosphatic
		Shells: 5%, gastropods, frags, wht-tan
6PM	405-415	Silt & Sand as above
KD 436	415-425	Silt & Some Clay & Sand; vfg., olive green, tr. phosphate
		Increasing plasticity & cohesiveness partially clay comp
		Shell @ ≈ 10% a.a.
	425-435	Clay & Silt; dk green, unconsolidated w/ some plasticity, phosphatic,
		Shell; ≈ 5% a.a.
	Note: Cuttings	are being circulated to surface every 10' for about 15 minutes. Where sample is too fine, cuttings are taken from the desander, bagged and dryed. Lots of silt & fine sand being separated from mud & desander the entire time.
KD 468	435-468	Clay; green, as above
		Shells; 5-10%, as above ENV DAY 5-8
MAY 9, 1995	468-470	Clay as above, no bagged sample
KD 500	470-500	Clay; green as above
		Shell; 5%
		limestone; trace, calcarenite poorly indurated grainstone, tan-grey
	K.D = 500'	
	500-510	Clay; green, pasty, adhesive, phosphatic
		Bill, Brad, Jerry TR; shells

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 5-10-95

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
510-520	clay; green, phosphatic, adhesive, silty
	TR. shells
520-530	same as above
K.D 530	
530-540	Clay; Olive grn to mud color, phosphatic, globular
540-550	Clay; L. olive grn to pale grey, phosphatic
550-560	Clay L. olive grn to muddy (pale grey), phosphatic,
K.D. =561½	TR. coal chips, black, fissile, platy,
560-570	clay; Green, phosphatic, adhesive, hydrous
	5% L.S. chips? (may be shells to dark outside to see)
570-590	clay; same as above; Rapid Drilling 3min 20sec/ft
K.D 592	
590-623	clay; as above
K.D=623	
620-630	clay; green, phosphatic, adhesive
630-640	clay; as above
640-650	clay; as above
K.D. 655	
650-665	clay; green phosphatic,
665-685	clay; as above
K.D- 686	
685-690	clay; Dark green, phosphatic,
690-715	clay; as above
K.D=716	
715-720	clay; dark green, silty, phosphatic

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 10 May 95

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
720-730	~~Clay~~; green dark, phosphatic
730-745	Clay; as above
K.D. 747.	
	MAY 11 (Thursday)
747-765	Clay, as above
765-780	Clay, as above; more dense than above, more cohesive, and slower drilling rate
KD 780	
780-790	Clay; as above, extremely cohesive
790-795	Clay; as above; *790-791'; rock encountered ~6" hed, returns show a trace of crypto crystaline, army green siltstone, v. hard, brittle and light weight
Tampa TOP	
795-800	lime; ~10% wht-lt grey, calcarenite, poorly indurated Clay; 1/2 green as above, 1/2 wht-tan clay; plastic, cohesive Siltstone ~10% as above, brittle, tr. sharks tooth
800-810	Clay; white-green mix as above 80% Sand & Silt; green ≈20% increasing volume coming out of desander, flooded the pit and overtopped berm.
KD 810	
	Siltstone; trace as above
810-820	Clay: 70% tan gray Sand & Silt: 20% ~~silt and fc~~ limestone ~~and shell~~ 10%, light grey, calcarenite, poorly indurated Shells; trace

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Beeper 824 7370

PROJECT Lake Lytal Park WELL NO. PBF-3 (NEW close to Rd) DATE 9-18-95

TD Pilot 1 = 885'

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
~~8000~~	Tri-Zone Pilot Hole #2 (Road well) start drill out @ 800'
	on Monday 9-18-95. Last T.D (Pilot = 885') Same well name
	PBF-3 applied to new (road) well.
	Cuttings taken 0-180' on new hole. None btwn 180-800
	Note: 815' Rock & Felt @ Bit
800-830	Clay; Green-olive, plastic, tr Limestone (OK)
830-845	Clay; as above; 30% Limestone; granular; wht-grey
* 845-866	Limestone; wht, gry, tan & Blk, granular; intergran ø,
	Clay; 10% a.a. poss. phosphate
866	Kelly Down
866-870	L.S; 40%; grey, angular; no visible ø, mottled, Sandy-vs IND,
	Clay; 40%; olive-grn, Plastic
	Shell L.S; 20%, Shell frags, parting soln'g
870-880	S.S.; 40%; tan-light grey, gry, poorly ind, f-grn,
	L.S; 30%; Light to dark grey, NO-VISIBLE ø, angular, mod in
	Clay; olive grn 30%, as above TR > Siltstones, Blk, Plat
880-896	S.S; 40%; l.grey, poorly IND; f-grn,
	L.S; 30%; l.grey, MOD IND, NO-VISIBLE ø;
	Clay; Olive grn, silty, pasty
K.D 896.43	
896-900	L.S.; 90%, L. grey, MOD-IND, rounded - shank tooth, cementation of particles,
	clay, 10%, L. olive grn, silty
	TR; Siltstones & S. Stones, (TAN, dry - NO water content)
900-910	same
910-915	same
915-928	Clay; muddy, silty, globular, olive grn. to grey some sand Cal
K.D 928	

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 5-11-95

TAMPA

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
820-830	Clay as above w/silt & sand 80%
	limestone; 15% as above
830-840	Clay as above 70%
	limestone; as above 30%
	~~decreasing limestone percentage~~ w/depth
840-850	Clay, limestone; silt & sand as above
NOTE: 857;	1st solid rock encountered, bit grabbing, grinding, hopping slight stop to circulate
850-857	limestone; 70% white-gray, phosphatic, friable
	Clay; 20%; wht-tan a.a.
	Shell frags & shark teeth; trace
	Siltstone; dk grey-blk, fissily, chips, angular, platy
	TR. crinoid stems, shark teeth
	Note: deeper sample shows abundant: m-c grained, oolitic, fossiliferous granular limestones (limesands).
857-870	limestone: 90%; as above, phosphatic, friable
	Sand & silt: 10%
	shark teeth, shell molds, shell frags, barnacles, crinoids, etc.
870-892	limestone: 100% as above
	Fossiliferous as above, to calcite
Set Casing to 892' 12" steel	End PBF-6

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 PBF 4, PBF 5 DATE 9-18-95

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
	L.S ; 20%, L.grey, poorly sorted, poorly IND, cemented grains,
928 - 935	Clay; 80% muddy, silty, globular, olive grn to grey to tan (sa
935 - 940	Same as above, 80% clay 20% L.S. granules
940 - 958	Clay; 60%; olive grn, silty
	L.S; 40% L.grey, no-visible ϕ, cemented grns, poor-mod-IND. Fo
958 - 960	L.S; 70%, L.grey, poor to mod, poorly sorted, angular, no-visible ϕ
	Med-grn
	clay; 30%, olive grn, silty, phosphatic, consolidated
K.D. = 960	
960 - 965	960', drilling rate slowed, prob. top of harder l.s. maybe
	Floridan
960 - 970	L.S; 90%, L.grey to white, mod-IND,
	fossils; splinters stems,
	Forams; leps. "swallnet" - Pectin frag, black
970 - 980	L.S. as above, leps, Forams
980 - 990	L.S : 60% a.a
	Clay : 30% dk grn, plastic, TR shell frags
K.D. = 991	
990 - 1000	L.S 90% wht-tan; granular, fg, mg,
	TR Dk-gry-brwn l.s.; platy, cryptocrystaline, hard
	leps, forams, gastropods, crinoids, TR. sand clay, tr shell
1000 - 1010	L.S. as above TR. shell & sandy clay a.a.
KD 1010 - 1023	L.S. as above, tr crinoids, leps, shell frags a.a.
1023 - 33	L.S wht - lt gry as above, some (10%) clay, grn. prob cavings fr above
	desander has lots of granular wht l.s coming out
	Stopped @ 1038' to circulate, hole taking fluid (mud) prob good
	perm.

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE _____

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
1033-52	Limestone a.a.
1052-1084	Limestone a.a. 9/19/95
KD 1084.66'	1052-1060; lots of mudcake in first slug up. Drilled fast rod in 8 mins. 1st catch up appeared muddy; prob mudcake
	Stopped at 1084.66' to run logs Tues 9/19/95
	Prob csg set ≈ 1050'

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 6-2-95

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
895	12" Casing Base
	Interval between 1085-1120. Flow zone.
	Before drilling not much Q. After ~400GPM@
	Kelly down connection

WELL DRILLER'S LOG

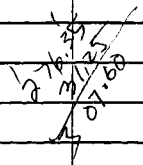
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 12-11-95

P = perm

RST Bit = 7⅝" diam

	DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
		1st day back to drilling since 9/8/95
		12" steel set to 1050', Pilot hole drilled to 1085'
	12/12/95	
UFAS	1085-1095	Arrived @ site 9AM. Circulating @ 1095 up tan lime sand
		L.S. tan, f-m grained unconsol. Tr lgst (1090-1093, Harder Li more wt. on bit req'd NOTE ↑)
400 GPM	1095-1105	L.S. as above
	1100-1110	L.S a.a
	1110-1120	L.S grey & tan, f-m grained. Calcarenite w thin bed
V	1120 KD	grey gran. ls, Forams & buttons present, Interbedded brwn vf-f grained and coarse grained limestone.
		Also color grades
	NOTE:	1120 KD Flowing quite a bit @ connection. Probably have
		1st major flow zone penetrated this stand.
		60' stand drilled between KD's.
		Flowing ~400 GPM see notes
	1120-1125	Limestone, grey and tan
	1125-1130	L.S. tan, coarser grained, drill sed slowed considerably here
		from above, then resumed high penetrate @ 1128.



WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE _____

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
1130-1140	L.S.; grey and tan, interbedded
P	mixed grainstone: 80% and crystalline 20%
	mostly grey l.s. is crystalline. 20% of sample is
	f-vf grained sandy silt l.s.
	Unconsolidated - sl. indurated grainstone
	~10% dk grey - blk l.s., more indurated w/ some xstaline
	tr. cones and possible small leps.
	Moderate - Good perm tr. crinoids, forams; sm.
	disk shape w/ some raising or 3-D convexity, shell molds
1140-1150	L.S. interbedded grey and tan, also blk mottled
KD	20% crypto crystalline mottled blk & tan l.s. w/ wormholes
	pinhole porosity, prob. good perm. Last 5' drilled
	slower, harder, tr. microfossils a.a. shell molds, sanddol
1150-1160	L.S as above mostly tan w/ some grey, mostly grainstone
	w/ interbeded hard cryptocrystalline tan l.s., fossiliferous
	sand dollars, crinoids 20% F-m grained & silt size
	lime mud.
1160-1165	L.S; charcoal grey, poorly-well indurated, grainstones interbeded
	w/ silty-sand like calcareous vuggs
1165-1170	L.S; tan, poor-mod. indurated, grainstone,

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE _____

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
1170-1180 KD	L.S. mostly white interbedded w/ cream colored orange crystalline crystalline & f grainstone.
1180-1190	L.S grey & tan; grainstone; vf-m grained poorly indurated, last 5' almost exclusively forams vF disc shape; tan-cream color.
1190-1200'	L.S tan and white; grainstone poor-well indurat oolitic
1200-1210 KD	L.S. interbeded with L.S. a.a 30% along with blk, grey and creamy brown limestone; crystalline, platy cleavage, hard, succosic ϕ
1210-1220	L.S. interbeded dark grey, tan, wht, blk grainstone 10% wht-grey cryptocrystaline, bioturbated, limestone hard, pinhole ϕ; wormholes
1220-1225	L.S; tan w/some gray & blk Both grainstone and cryptocrystaline Some silt/sand size Fraction of L.S. 15% Interbedded & variable, Bioturbated, wormholes
1225-1230	L.S. GRAY & BLK w/ some tan Bot grainstone & cryptoxstaline w/ abuse wormholes, bioturbated, pinhole ϕ

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 12-13-95

	DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
FAS3 P	1268-1272	Limestone and Dolomite
KD		Limestone: Tan – lt. Brown; hard, cryptocryst to (40%) solutioned sucrosic, Evidence of calcite Filled solution holes, platy
		1 (40%) BLK sucrosic limestone, excellent ø & perm honeycomb texture
		20% lt orange grainstone a.a.
	1272-1276	L.S.; BLK, cryptoxstaline, hard, platy, no vis ø
P	1276-1280	L.S.; cream pale orange grainstone; abundant Forams, cones silver dollars, tR of sucrosic high perm l.s
		Note ~1288' Hard drlg, bit hopping for 1'-2'.
* BASE OF FAS @ TOP CONFINEMENT		Unit 1 Flow zones
	1280-1288	L.S. Tan, cryptocrystaline, hard, no vis ø
	1288-1290	Dolomite, Brown-dark tan, cryptoxstline, minor bioturbation, no vis ø or perm Bottom 1' of this had Sucrosic dolomite; good perm, ø
	1290-1295	L.S; BLK, grey and tan, cryptocrystalline, hard bioturbated, cones, sand dollars, No vis ø
P	1295-1300	Dolomite; tan-lt. brown, mostly cryptocrystalline, hard, pla no vis ø with ~10% sucrosic, high ø & perm

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 12/13/95

	DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
KD JENS3	1300-1304	L.S.; poorly ind. grainstone, tan-wht, oolitic,
	JOHN↑	10% DOLOMITE as above
	Kevin↓	
~P	1304-1306	L.S. poorly indurated grainstone, grey-wht
		15% L.S. Sucrosic V w/ mod-good perm.
P	1305-1306	LS, grey to lt. Brown, Cryptocrystalline, hard to Mod. higher
		perm. Zone than above 50% grainstone, vugs & solutioning
		GOOD perm
~P	1306 1307	same as above, w/ Black cryptocrystalline fabric to Lt. tan
		LS. some vugs, mostly sucrosic
P	1307-1308	LS, cryptocrystalline, DK. Brown to Black
		platty w/ Bioturbation, Hard, some succrosic w/ calcite replacem
		FAIR-MOD perm
	1308-1309	LS well to Mod. indurated Lt. Brown to tan, cryptoxtral
		w/ some Vulgulary Pin holes, Mod to hard
	1309 1310	LS, tan to cream platty Micro xtralin, evidence
		of Bioturb. low to Mod. Perm.
	1310-1311	Dolomite, DK. Brown Cryptoxtral. hard 10% sucrosic
		No vis. porosity
V	1311-1312	LS. friable grainstone; tan f. c grained, fossil Frags,
		cones, forams no vis perm

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 12-13-95

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
1312-1314	L.S. f.m grained poor-mod indurated grainstone tan and grey, no vis. perm
1314-1319	LS fine to med grained, poorly indurated, Cream to Lt gray Cones are present as well as some forams ○ vf-f grain sized, Silty L.S. present Poor Perm
1319-1322	LS, Lt gray to Lt Cream, 10% cryptoxst; Mod to hard Biotur present, no vis. Ø or perm
1322-1323	SAME AS Above w/ more forams present
1323-1324	LS tan well indurated and grainy, to DK BROWN to Black Micro-crystalline to Crypto hard to V. hard Dolostone hard, no vis Ø or perm.
1324-1330	LS, Light tan to Lt. gray, grain stone, poorly indurated soft to Mod. Hard, grad's in V. Lt. tan to Orange V. well indurated, appears to have grain sized LS. that is very Soft and crumbably Friable. forams are present, Lots of silt. NO PERM
1330-1332	LS. DK Brown to GRAY to BLK, fine grained BLK appears to have Organic MAT. in it, Sub rounded This FN. grades to tan LS embedded into the DARK LS. NO PERM
1332-1334	LS, Lt. tan to cream to DK brown Dolostone. Soft to hard, This GRADES TO Lt gray to Blue, hard to Soft LS. fine grained to Micro crystalline forams are present NO PERM
1335.35 KD " 1366 – Next KD	

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 12/14/95

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
1335.5-1345	LS Tan to Lt. gray well indurated, Sand sized grains soft to hard fine grained, Lg Cones and forams present. NO PERM
1345-1350	LS Lt. gray to tan poorly indurated, Lg forams Present fine to Med. grained. No perm
1350-1355	L.S. gravel-like, grey, cryptoxst, no vis perm
1355-1360	LS Lt. Gray to DK gray, Poorly indurated w/som well ind Mod to hard, ≤ 10% Porosity, Forams, NO VIS. Perm
1360-1365	LS poorly-mod. indurated Lt. tan many forams present Fair Porosity (pinhole)
END of DR:	12/14/95
1365-	Next pg

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 12/14/95

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
1365-75	L.S. Tan → wht/lt; poorly indurated grainstone, no vis ø f-m grained, some cones and Forams drilled soft.
1375-85	L.S. Tan-cream; crypto-crystalline, hard, platy some bioturbation, fr. shell molds, worm holes, minor fossils
1385-1397 KD 1397	L.S. Tan-lt. cream; poor-mod ind. grainstone, fossiferous fr coral, gastropod shell, diatoms, cones
1397-1410	L.S. a.a.
1410-1420	L.S. a.a. more fines, unconsolidated, hit plugging intermittently confining layer
1420-1430 KD	L.S a.a.
1430-1435	L.S aa
1435-1437	Dolomite, brown-rust, sucrosic, great ø & perm also coral polyps & reef material
1437-1440	L.S.; white grainstone, poorly ind. no vis perm
1440-1445	L.S; white a.a fr. calcite chunks ½" dia., prob from upbole dolomite interval.
1445-1449 perm	Dolomite; DK tan, lt brown, choc. brown & blk. Some sucrosic, good ø, some crypto xstln no ø Coralline honeycomb structure to most

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 11/14/95

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
1449-1455	L.S. Gray, Dolomitic; hard, cryptoxstn, no vis Ø, pe gravel-like.
1455-1460	L.S Tan grainstone, poorly-mod. indurated, Forams, diatoms
1460-1461 KD	L.S. grey-blk grainstone a.a.
1461-1470	L.S.; tan grainstone interbedded with tan hard cryptoxstl ls, diatomaceous, 50% silt-sand size ls mud bit plugging common
1470-1475	L.S TAN grainstone, TRACE less interbeded tan cryptoxstn LS, diatomaceous. Mod to hard. Low Perm
1475-1480	LS Tan grainstone, As above to sand sized grains Cones present, Lep's present Appears to have more porosity than Above.
1480-1485	LS TAN grainstone, SAND sized grains, As above sample is more friable As above
1485-1487	LS; TAN, Crypto xstln, Mod to hard, forams, Cones present, some bioturbation, shell molds no vis Ø, perm Cones

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE ____

Kevs Descriptions

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
1487-1490	LS, TAN to BLK, cryptocrystln, BLK charcoal Deposits APPEAR TO be Organic, trace VLT. BROWN grainstone with LT tan diatoms. Some bioturbation Prob. low perm NO CALCITE IN SAMPLE bag
KD	
1490-1495	Dolostone? LT Brown to DK BROWN, sucrosic crystalline, high porosity. Moderately hard, friable, extreme black stain may be water induced, Good Perm!
1495-1500	LS tan-white, 70% grainstone; tr. Cones, 30% tan-wht cryptocryst L.S., shell molds, NO VIS Ø or perm
1500-1505	LS, Tan-grey, 90% Grainstone, poorly ind., cones low perm, 10% well indurated, bioturbated tan-grey L.S. NO VIS Ø or perm
1505-1510	Dolostone?; Black w/ tan brown; well indurated, oolitic grainstone, interbedded with tan-cream cryptocrystaline L.S., some Ø, low-mod perm, shell molds
1510-1515	LT Tan to cream grainstone, Microxtalline, Cones, forams present. V. granular appears to have good porosity
1515-1522	SAME AS Above
KD	

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 12/15/95 FRI

	DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
	JOHN ↓	
	1522-1530	L.S. Tan-cream; grainstone, poorly indurated, cones, forams, low perm
	1530-1540	L.S. Tan-cream grainstone a.a. w/some gravel-like grey-blk l.s. low-perm
KD	1540-1550	a.a.
	1550-1552	L.S.; tan-cream; poor-well indurated grainstone, some 10% blk L.S. No vis ø or perm
* P	1552-1555	L.S. mixed bag; tan and blk with grey and some wht mix of grainstone and sucrosic dolomite. Prob. blk staining from water in pores, (see below 1555-1560) mod-good perm
9' perm		
* P	1555-1561	Dolomite; rust brown, sucrosic mod-well indurated crystalline, tr. blk stainings, good perm & ø
	1561-70	L.S.; Lt. tan-white, grainstone 90% w/ TR. dolomite a TRACE CHALKY white clay, prob. low-no perm some cryptocrystalline L.S. of same variety.
	1570-1582 KD	L.S; wht-beige; grainstone, poorly indurated, tr. silty fossiliferous, low perm & ø

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 12/15/95

	DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
	1582 KD	
	1582-1588	L.S.; tan-cream, grainstone, poorly indurated, low Ø & perm
P	1588-1590	Dolomitic Limestone, lt. rust brown, sucrosic, fair-mod in fair-good Ø, prob. perm, thin bed
	1590-1600	Limestone; tan grainstone, poorly-mod indurated, cones low-no perm or Ø other than intergranular
	1600-1610	Limestone, tan, well indurated to cryptocryst. grainstone, no apparent perm or Ø
KD	1610-1614	Limestone, tan, poorly ind grainstone, abundant cones and forams, no vis perm or Ø.
KD	1614-1645	Limestone; tan; ½ grainstone, ½ cryptocrystaline, ¼ some bioturbation. No vis Ø or perm
	Log TD 1652' G.L.	

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 19 Jan 96

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
	0900 arrived on site starting depth 1675' Bobby collected first set of cuttings, drill bit 7 7/8" roller cone
1658-1665	L.S; 99.9%, Yellowish gray 5Y 7/2, m-w ind, patt well sorted, loosely packed, very perm.; Forams; buttons, cones 1%, tan
1665-1675	LS; 95%, Yellowish gray 5Y 7/2, m-w IND, as above chert; 5% Dusky Yellow 5Y 6/4, v. well IND, NO visible angular, loosely packed
1675-1680	L.S; Yellowish gray 5Y 7/2, mod ind, calcilutite, patt loosely packed, v. good perm, poorly sorted, TR; chert, angular, 5Y 7/2, mottled to gray striations.
1680-1685	LS; 99% Yellowish gray 5Y 7/2, P-M ind, m-c grn, calcilut (breaks up to v. f sand grns), loosely packed, v. perm. zone,
1685-1690	L.S; 90%, as above V good perm zone S.S; 10%, Moderate Yellowish brown 10YR 5/4, Quartzose, sparry, f grn, rounded, o TR; Mottled gray w-IND L.S.
1690-1695	L.S; AS above S.S; as above, becoming more abundant
1695-1697	L.S. 50% as above, Grst.S; V. light gray N8, gradated to d. gray, m-w Cemented Shell molds, Molds & Casts; V. light gray N8, w.

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 19 Jan 96

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
	0900 arrived on site starting depth 1675' Bobby collected first set of cuttings, drill bit 7 7/8" roller cone
1658-1665	L.S; 99.9%, Yellowish gray 5Y 7/2, m-w ind, pitt well sorted, loosely packed, very perm.;
	Forams; buttons, cones 1%, tan
1665-1675	LS; 95%, Yellowish gray 5Y 7/2, m-w IND, as above
	chert; 5% Dusky Yellow 5Y 6/4, v. well IND, NO visible angular, loosely packed
1675-1680	L.S; Yellowish gray 5Y 7/2, mod ind, calcilutite, patt loosely packed, v. good perm, poorly sorted,
	TR; chert, angular, 5Y 7/2, mottled to gray striations.
1680-1685	LS; 99% Yellowish gray 5Y 7/2, P-M ind, m-c grn, calcilut (breaks up to v. f sand grns), loosely packed,
	v. perm. zone,
1685-1690	L.S; 90%, as above v good perm zone
	S.S; 10%, Moderate Yellowish brown 10YR 5/4, Quartzose, sparry, f grn, rounded,
	TR; Mottled gray W-IND L.S.
1690-1695	L.S; AS above
	S.S; as above, becoming more abundant
1695-1697	L.S. 50% as above,
	Grst.S; V. light gray N8, gradated to d. gray, m-w. Cemented shell molds,
	Molds & Casts; V. light gray N8.

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 19 Jan 96

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
1697-1699	L.S; 60%, Yellowish gray, 5Y 7/2, m-IND, poorly sorted, loosely packed, good perm, some pitting ϕ
	Gray L.S; 35%, light gray N7, gradated to d.g N6, m-w IND, no visible ϕ
1699-1701	L.S; 99%, Yellowish gray 5Y 7/2, p-m ind, pitt loosely packed, v. good perm, poorly sorted
	TR; shell cast, tan to yellowish gray 5Y 7/2
1701-1702	L.S; 80% Yellowish gray 5Y7/2, m-ind, no visible ϕ, rounded, poorly sorted, loosely packed
	Dolomite; 20%, moderate olive brown 5Y 4/4, no visible ϕ
1702-1704	Dolomite; 70%, as above
	LS; 30%, Yellowish gray, 5Y 7/2, as above
K.B 1704	
1704-1707	Dolomite; 90% Dusky Yellow 5Y 6/4, grainitic, no visible ϕ, loosely packed
	LS; 10%, Yellowish gray 5Y 7/2, poorly ind, rounded, f-g, poorly sorted,
	TR; siltstone, black N1, platey, fissile,
1707-1710	LS; 100% Yellowish gray 5Y 7/2, grainy, m-c grn, loosely packed, p-m ind,
1710-1712	LS; AS above 95%, poorly sorted becoming packed
	Forams; 5%, yellowish gray 5Y 7/2, buttons & stems poorly sorted

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 19 Jan 96

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
1712-1715'	L.S; 75%, Yellowish gray 5Y 7/2, m-ind, m-c gr, slightly packed, poorly sorted, grainy, pitting
	Forams; 25%, stems, cones & buttons, color range from yellowish gray 5Y 7/2 to Moderate Yellow 5Y 7/6
1715-1720	L.S; 80%, as above
	Forams; 20%, as above
1720-1725	as above
1725-1735	as above
KD 1736	
1735-1740	L.S; 98%, Yellowish Gray 5Y 8/1, c-g, p-mod ind, no visible ϕ, cemented grains (intergranular, but having no visible properties of ϕ)
	Forams; 2% buttons with cemented L.S.
1740-1745	L.S; 98%, very pale orange to tan 10YR 8/2, m-c gr cemented grains, subrounded, no visible ϕ, p-m ind, loosely packed.
	Forams; 2% as above
1745-1755	as above
1755-1766	as above
K.D 1766	

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 19 JAN 96

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
1766-1770	L.S; 60%, very pale orange 10YR 8/2, grainstone,
	no visible ϕ, loosely packed, clean, p-IND,
	L.S; 40%, Grayish orange 10YR 7/4, pin-hole ϕ,
	mod IND, m-grn, rounded
1770-1775	L.S; 100%, Pale greenish yellow 10Y 8/2, grainstone
	m-grn, loosely pack, clean, m-ind
1775-1780	L.S; 100%, Grainstone, greenish yellow 10Y 8/2, m-grn
	loosely packed, clean, poorly sorted
1780-1782	L.S; 90% as above
	Dolomite; 10% grayish orange 10YR 7/4, sucrosic,
	m-w ind, looks like quartzose S.S, round
1782-1785	L.S; 100%, Yellowish gray 5Y 8/1, grainstone,
	rounded, poorly sorted, m-c grn, some intergranul
	ϕ, washed, TR; Chalk, white, clayey
1785-1799	L.S; 100%, Very pale orange 10YR 8/2, poorly IND,
	washed, loosely packed, m-grn, grainstone, roun
	Forams; Grayish yellow 5Y 8/4, Trace amounts, lepS
KD 1799	
1799-1805	L.S; 95%, Yellowish gray 5Y 7/2, Grainstone, poorly
	ind, m-grn, intergranular cemented, washed,
	well rounded, fairly well sorted
	Forams; buttons, ≤ 1mm in size, Grayish Yellow 5Y 8/
1805-1810	L.S; 95%, as above
	Forams; 5%, as above

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal Park WELL NO. PBF-3 DATE 19 Jan 96

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
1810-1815	L.S; 90%, Yellowish gray 5Y 7/12, well rounded, washed; grainy-grainstone, poorly ind, m-grn, loosely packed, (clean- no chalky or micritic type matrix), poorly sorted
	forams; 10%, cones & buttons, same color as l.s. above
1815-1820	L.S & forams as above 1810-1815
1520-1830	L.S; 80%, Yellowish gray 5Y 7/12, well rounded, washed grainstone, poorly ind, m-grn, loosely pack
	forams; 20%, buttons & cones,
E.O.H 1830	
1830-1835	L.S; 70%, yellowish gray 5Y 7/12, rounded, washed grainstone, poorly ind, m-grn loosely packed
	forams; 30%, cones
1835-1840	L.S; 50%, as above
	forams; buttons, 1-2mm, moderate yellow 5Y 7/6
	TR; echinoderms – sea biscuits, 4mm, Round
1840-1845	L.S; 85%, yellowish gray 5Y 7/2, well rounded, poorly ind, m-grn, grainstone, washed
	forams; 15%, buttons, moderate yellow 5Y 7/6
1845-1855	AS ABOVE
1855-1860	AS above
E.O.=1860	secure For the day
	S

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal FAS WELL NO. PBF-3 DATE 1-24-96

	DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
	1956-1986 KD	Limestone; lt grey to pale orange grainstone as above abundant forams, also abundant silty f.g carbonate sand as above.
	1986-2000	Limestone: as above
	2000-2017 KD	Limestone as above
		END OF DAY 5:30 PM
01/24/96 0851	2017-2025 KD	Limestone (100%); lt gray to pale orange ortan grainstone; poorly indurated w/ few well indurated; very abundant forams (~75%); some fu flakes
	2025-2032	- Limestone (60%); light gray to pale orange grainstone; Dolomite fragments (40%) dark gray moderate to well indurated; some forams; few silty fragments.
	2032-2050	- Limestone 100% lt gray to pale orange ortan grainstone; poorly to moderately indurated; abundant forams; fossils; few to no dolomite fragments silty fragments abundant.
1044	2050-2058 KD	Limestone; (100%) lt gray to pale orange grainstone; few well indurated; most poorly indurated fossils & abundant forams.

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lake Lytal FAS WELL NO. PBF-3 DATE 01/24/96

	DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
	2058-2062	Limestone as above.
	2062-2065	Limestone (70%), Lt gray to tan grainstone (poorly to moderately indurated)
		Dolomite (30%) Fragments dark gray & yellowish brown (well indurated);
		some fossils (forams)
	2065-2080	Limestone as above.
1200	2080-2088 KD	Limestone (100%); Lt gray to pale orange grainstone; poorly indurated; some fossils (forams)
	2088-2095	Limestone as above.
	2095-2105	Limestone (85%); Poorly indurated, light gray to pale or
		Dolomite (15%); well indurated; dark gray
		few fossils
1410	2105-2111	Dolomite 60%; well indurated, brown granular, lt. gray
		dk gray - Limestone (40%); poorly to
		moderately indurated, pale orange -
		few more fossils than above.
	211-2113 KD	Dolomite (80%); poorly indurated, dark brown, dk gray
		lt gray - Limestone (20%) lt. gray

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT LAKE LYTAL FAS WELL NO. PBF - 3 DATE 01/24/96

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
2113-2115	Dolomite (80%); well indurated, dk brown, dk gray Limestone (20%); lt gray
2115-2117	Dolomite (95%); very well indurated, dk brown limestone (5%), light gray - good permeability
2117-2119	Dolomite (50%); very well indurated dk brown limestone (50%); light gray; poorly indurated.
2119-2123	Limestone (80%) light gray to tan fossils (crushed) poorly indurated Dolomite (20%) fragments dark gray & light brown
2123-2133	Limestone as above.
2133-2143	Limestone as above.
1530 2143-2151 KD	Limestone (80%) Light gray to tan; some fossils; Dolomite (20%) crushed pieces; poorly to moderately indurated
2151-2158	Limestone as above
2158-2168	Limestone as above

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT RST 4th WELL NO. PBF 3 DATE 1-24 & 1-25-9

	DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
	2168-2175	Limestone as above; dolomite fragments
	KD	
	2175-2190	Limestone : as above
	2190-2206	Limestone as above
end 1/24	KD	
1/25/96	2206-2237	Limestone : as above
	KD	
	2237-2269	Limestone : as above , slightly ~~better~~ indurated, larger
	KD	aggregates.
	2269-2285	Limestone : as above , drilled v. soft even w/ decreased
		weight on the bit. Hardened back up ~2285
	2285-2300	Limestone : as above
	2300-2330	Limestone a.a.
	2330-2350	Limestone , harder, crystalline, platy
		finish in daylight
	2350-2362	Limestone ; 50% well indurated grainstone and
	KD	partially crystalline cryptocrypte
		Dolomite : 50% , cream-tan, cryptocrystalline , hard,
		platy, shell molds, tr. brown iron staining
		some and dolo. pieces, some ø, no vis solutioning
		* W.L : cond. increased to 17,000 in this zone
	2362-2376	Dolomite : 100% , cream- lt. brown to coffee color
		hard, cryptocryst, platy, shell molds, no obv. solut
		or Perm

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lytal WELL NO. PDF3 DATE 1-26-95

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
2370-2393 KD	Limestone: 60% grainstone, wht-pale org. poor-mod indurated; fossiliferous, soft, drilled soft, low-no perm WG back to 10K cond.
2393-2400	Limestone and (50%) dolomite interbedded / (50%) Dolo: brown, hard, dense, platy cuttings, cryptocrys, no vis ø or perm Limestone: 50% grainstone 50% chalky, soft, silty, wht-gray low-no perm clay like & plastic
2400-2405	Limestone: Chalky as above. plastic w/clay.
2405-2420	Dolomite: 100%, lt. brown, hard, dense, platy cryptocrystalline, no vis ø, perm Bit hopping intermediately
2420-2424 KD	Dolomite: 100%, slightly darker brown-chocolate color, hard, dense, cryptocrystaline, some evidence of fractures, some bioturbation, worm burrow casts shell molds, * iron staining evident, prob holds water fair-good perm
2424-2430	Dolomite: 80% (20%), lt-med brown interbedded w/ limestone, grainstone, f.m.g. bioturbated. Lime is embedded in dolo matrix. Little-no perm, NO FR. STAIN

WELL DRILLER'S LOG

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJECT Lytal WELL NO. PBF3 DATE 1-26-96

DEPTH	DESCRIPTION – ROCK TYPE, COLOR, HARDNESS, OTHER
2430-2440	Limestone - 90%; wht- lt. grey color; grainstone, poor - mod indurated, bioturbated shell molds, shell frags cemented in wl grainstone, Dolomite: 10% as above, tr iron staining
2440-2454 - KD	Limestone; wht - lt. cream, grainstone, as above 10% shell frags trace dolomite as above
2454-64	Limestone a.a
2464-2468	Dolomite or Chert; wht, tan, and grey. v hard, concoidal fractures v. dense no perm or Ø Bit chattered
2468-2487	Limestone a.a. grainstone, cream - tan grainston. poor - mod indurated, no vis perm, Ø
TD 2487	1-26-96 330 PM

APPENDIX B - GEOPHYSICAL LOGS

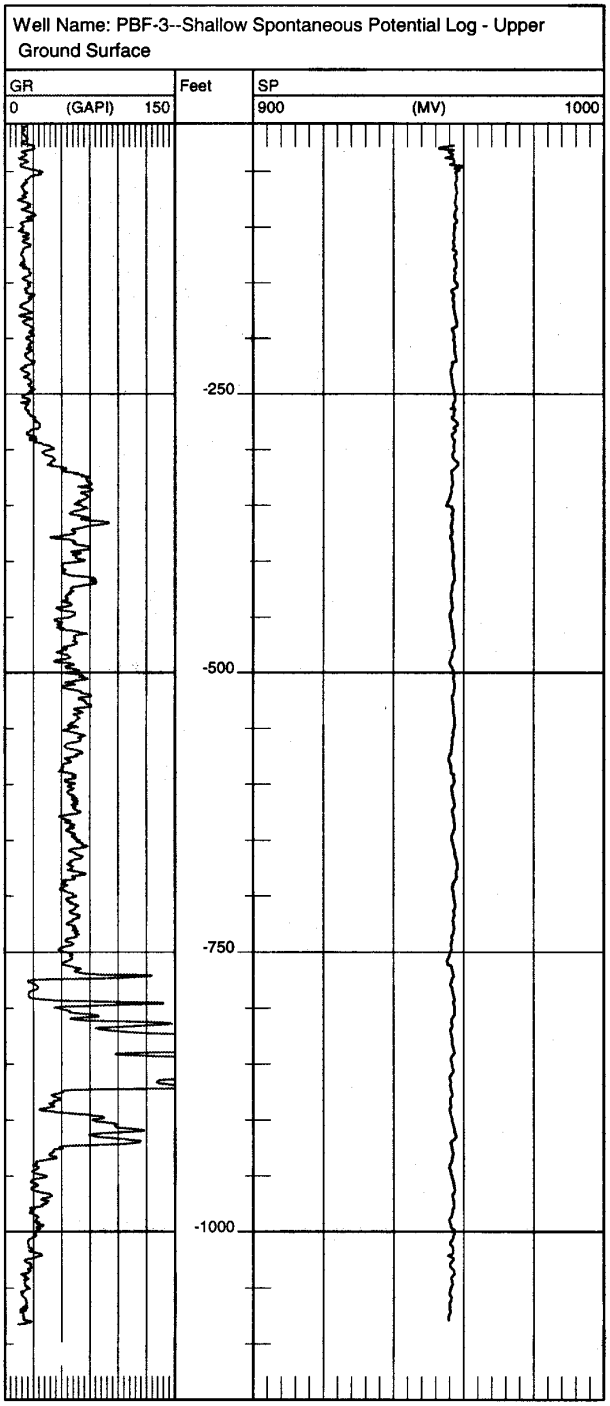


Figure B-1. PBF-3 Shallow Spontaneous Potential Geophysical Log (Ground Surface).

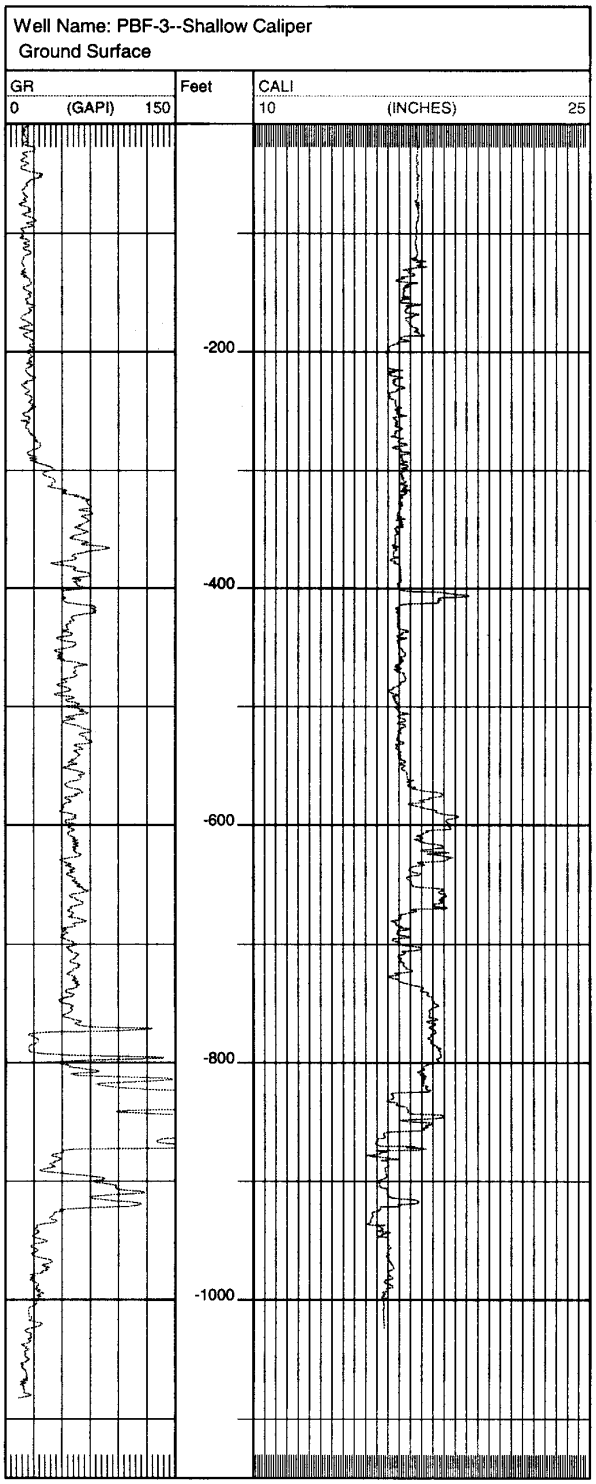


Figure B-2. PBF-3 Shallow Caliper Geophysical Log (Ground Surface).

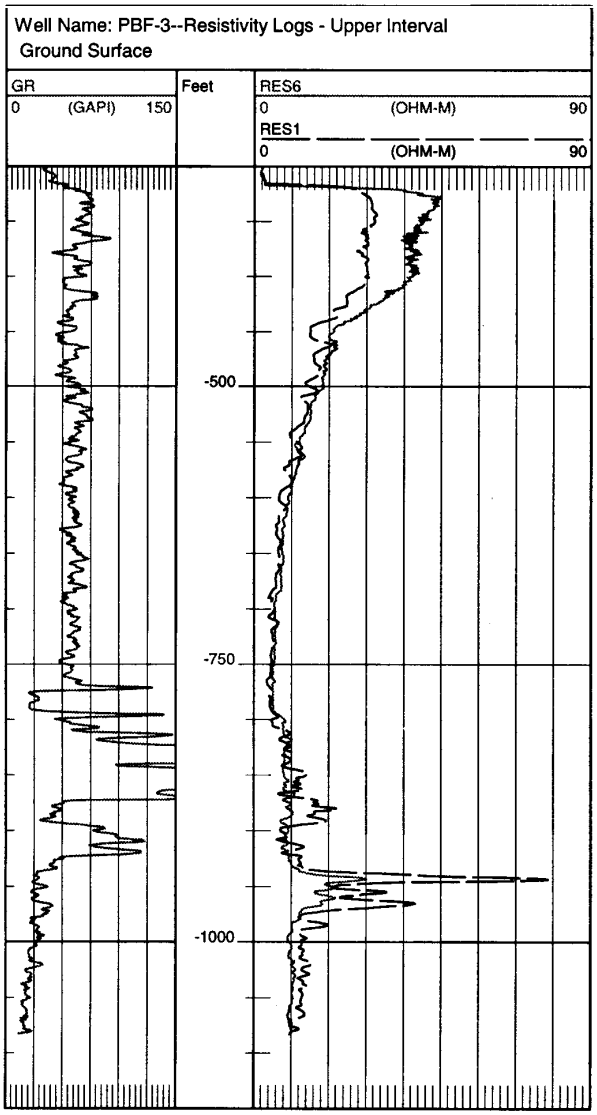


Figure B-3. PBF-3 Resistivity Geophysical Log - Upper Interval (Ground Surface).

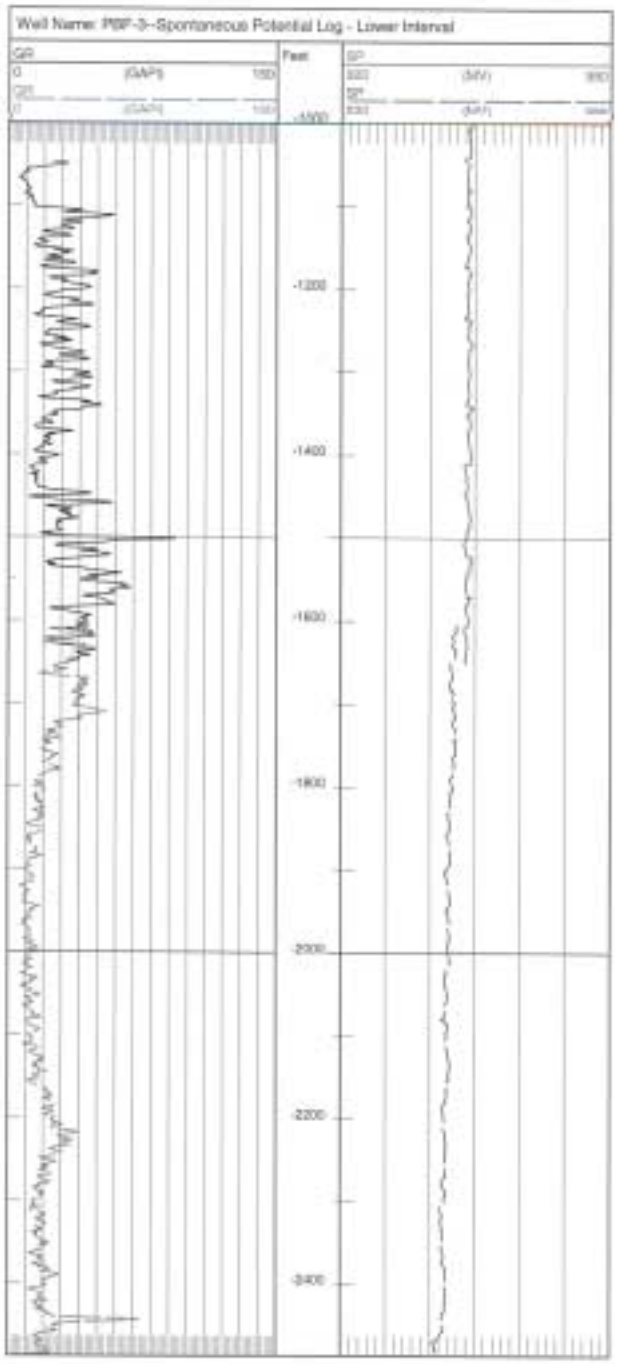


Figure B-4. PBF-3 Spontaneous Potential Geophysical Log (Lower Interval).

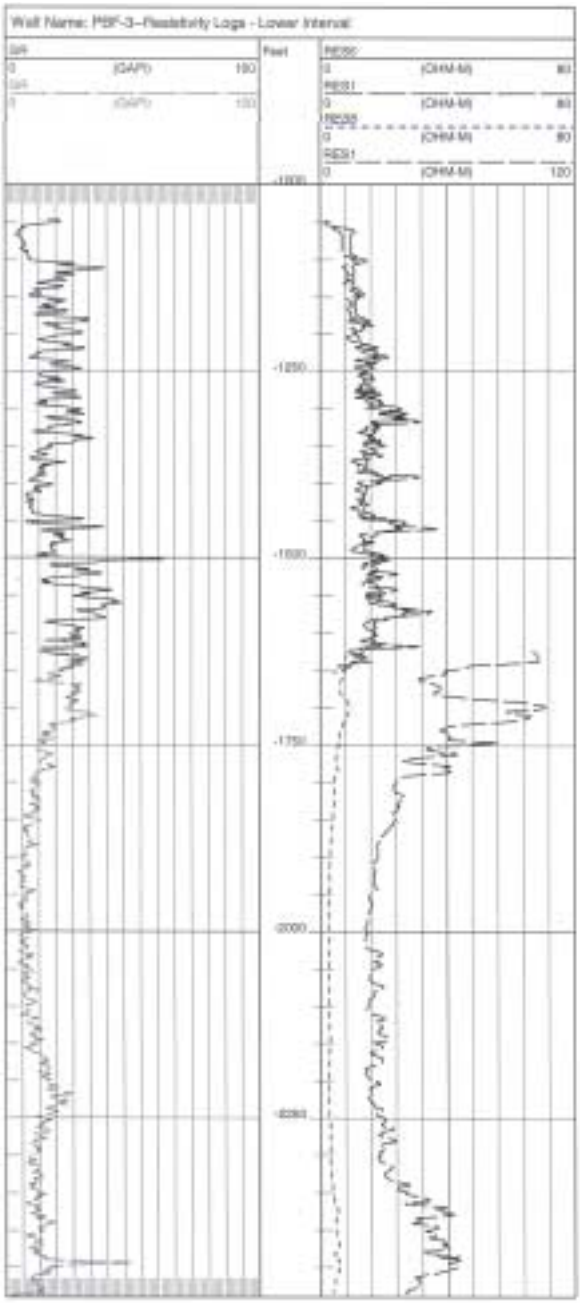


Figure B-5. PBF-3 Resistivity Geophysical Log (Lower Interval).

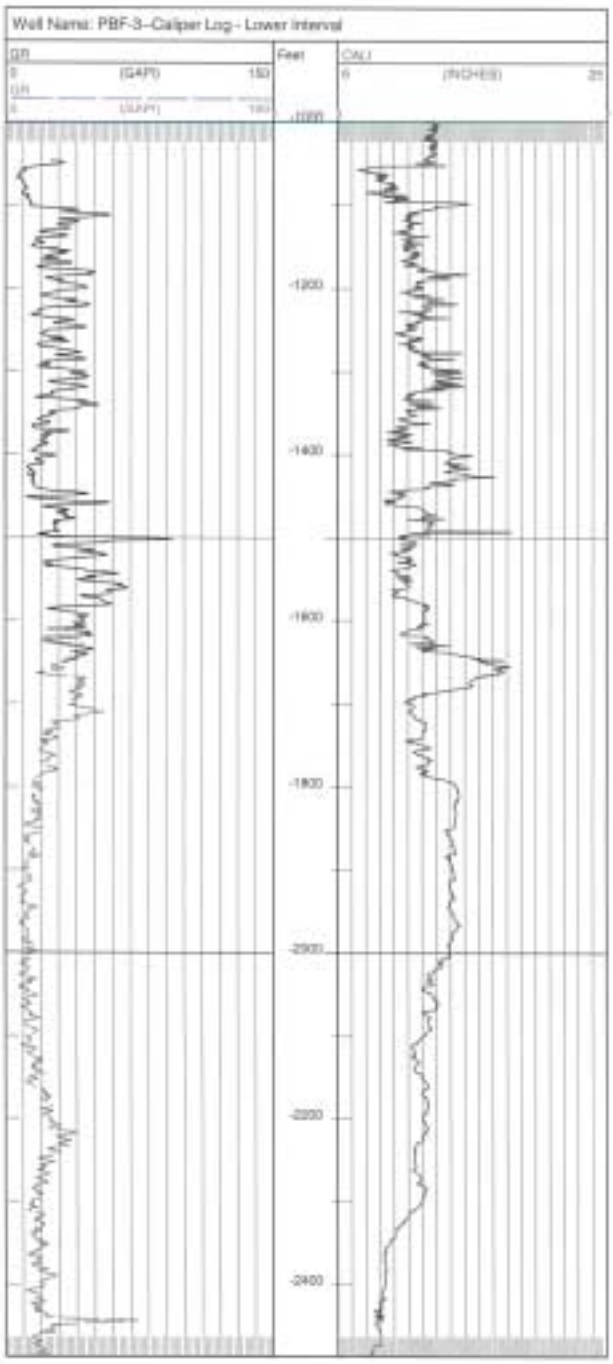


Figure B-6. PBF-3 Caliper Geophysical Log (Lower Interval).

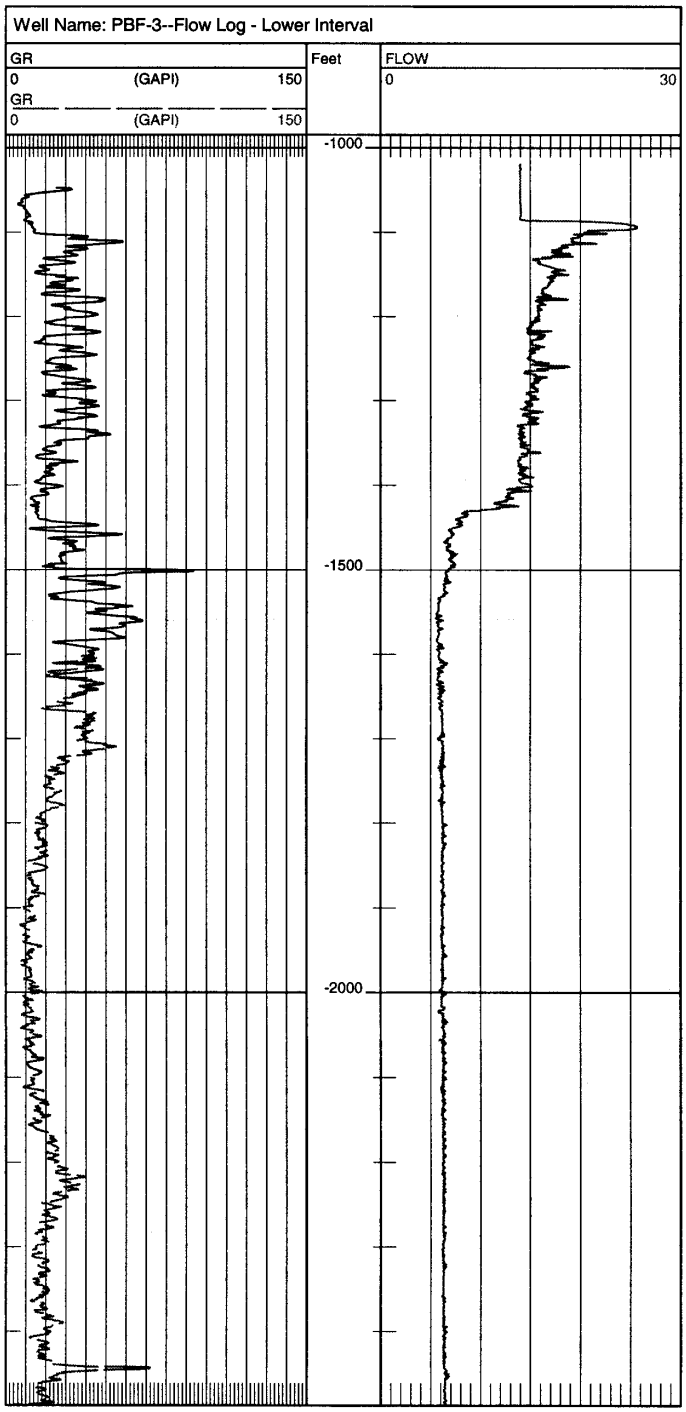


Figure B-7. PBF-3 Flow Log (Lower Interval).

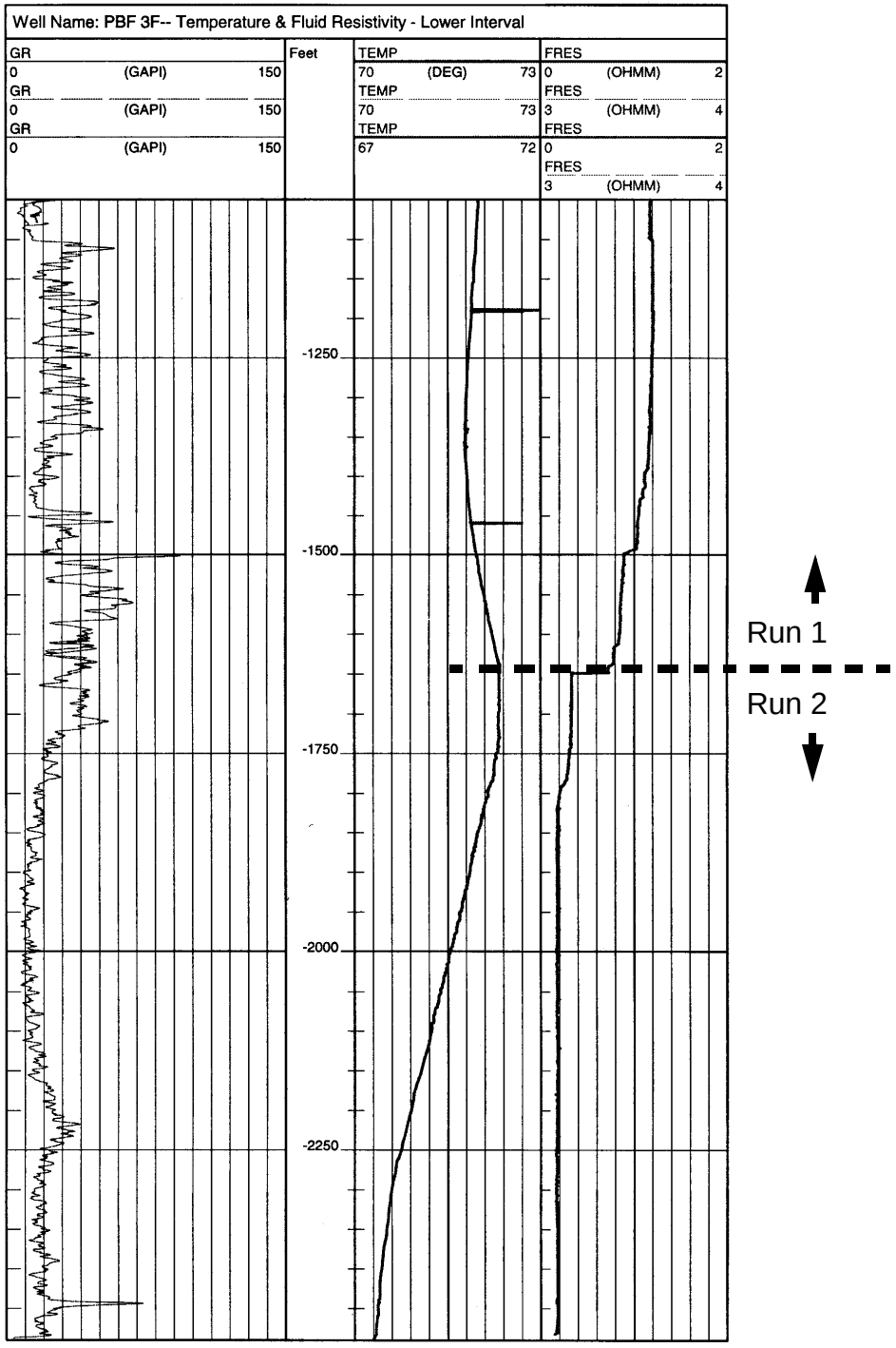


Figure B-8. PBF-3 Temperature and Fluid Resistivity (Lower Interval).

APPENDIX C - PACKER TEST DATA SHEETS AND ANALYSES

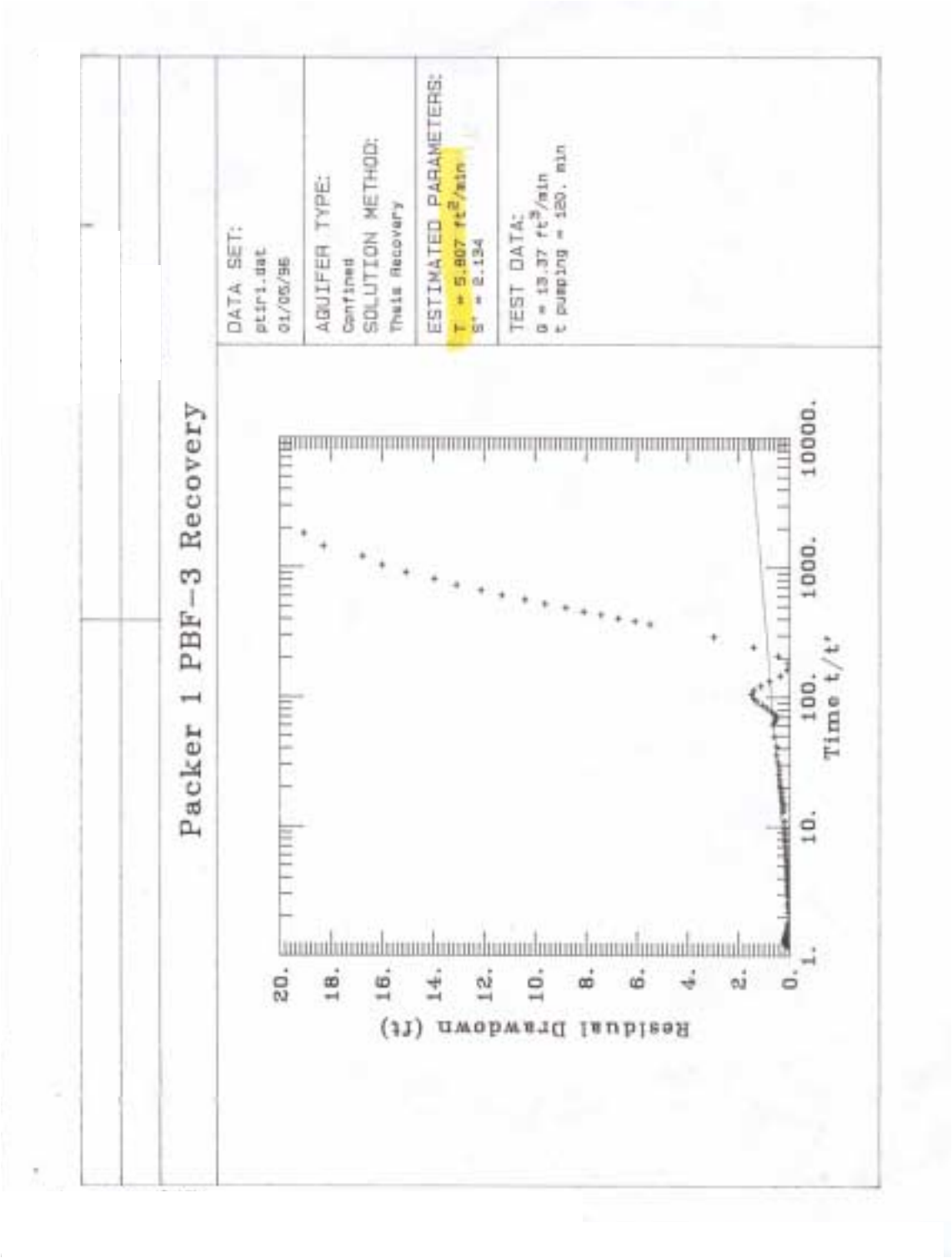


Figure C-1. Recovery Test Data and Analysis (Packer Test 1).

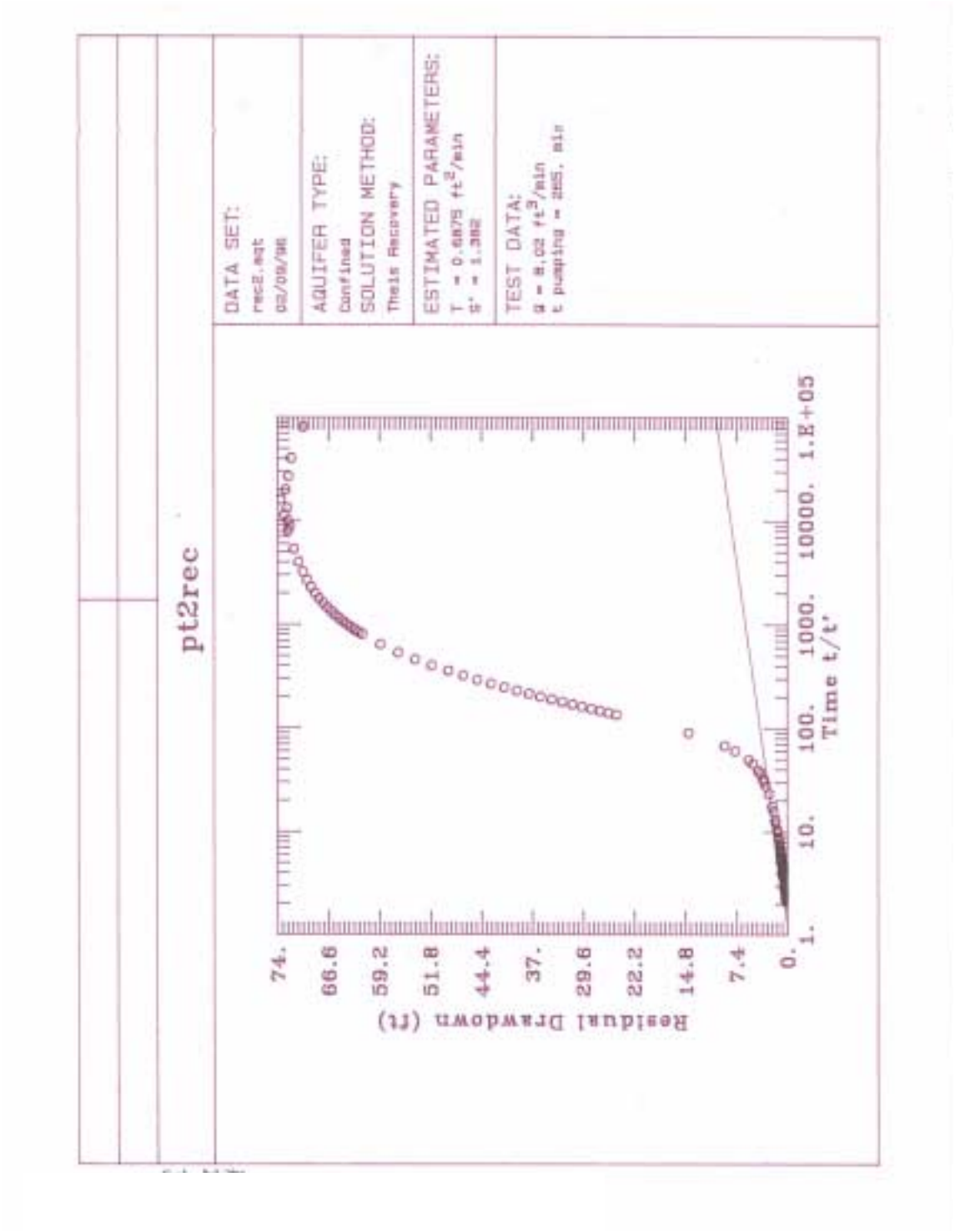


Figure C-2. Recovery Test Data and Analysis (Packer Test 2).

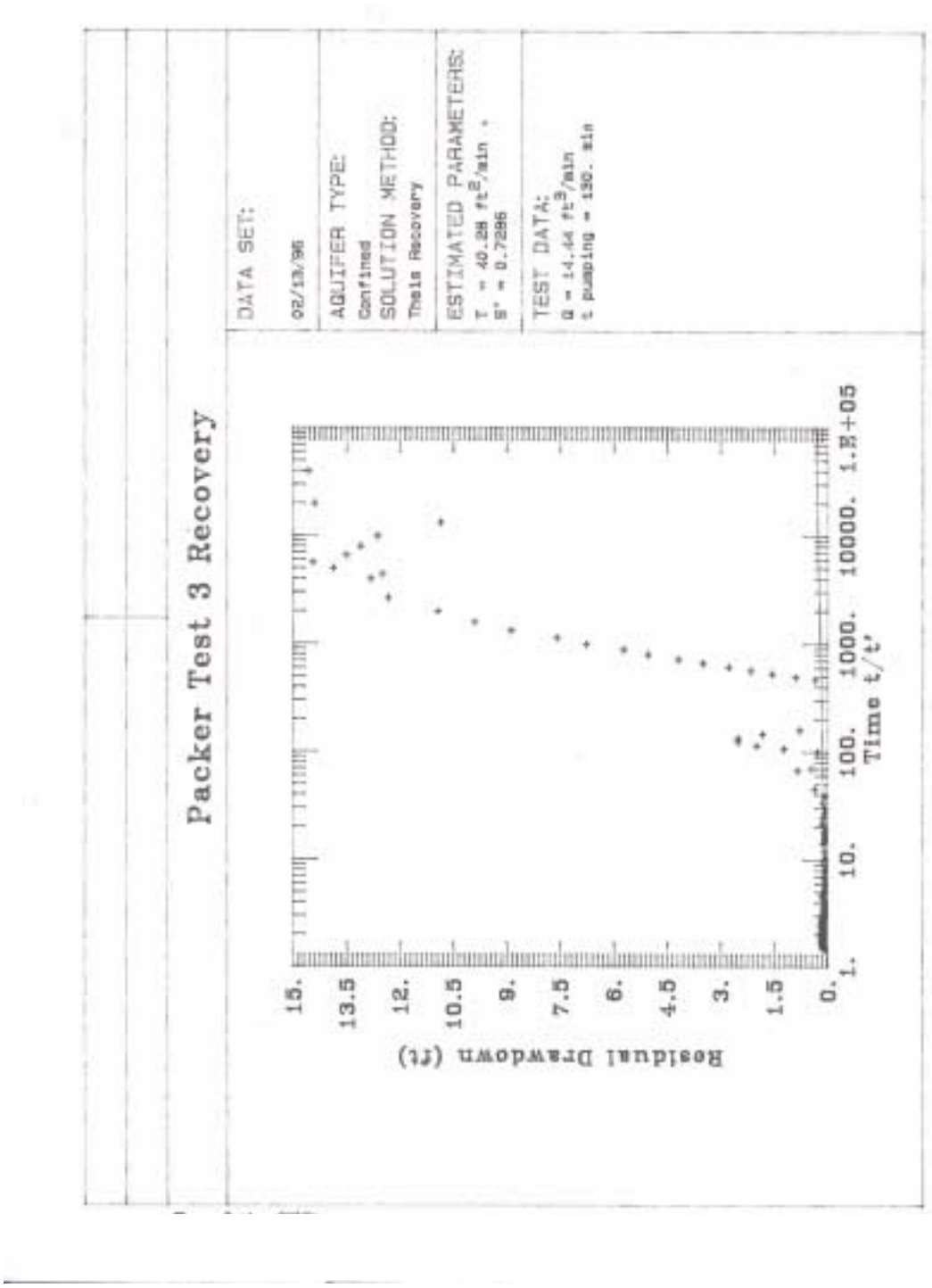


Figure C-3. Packer Test Recovery Data (Packer Test 3).

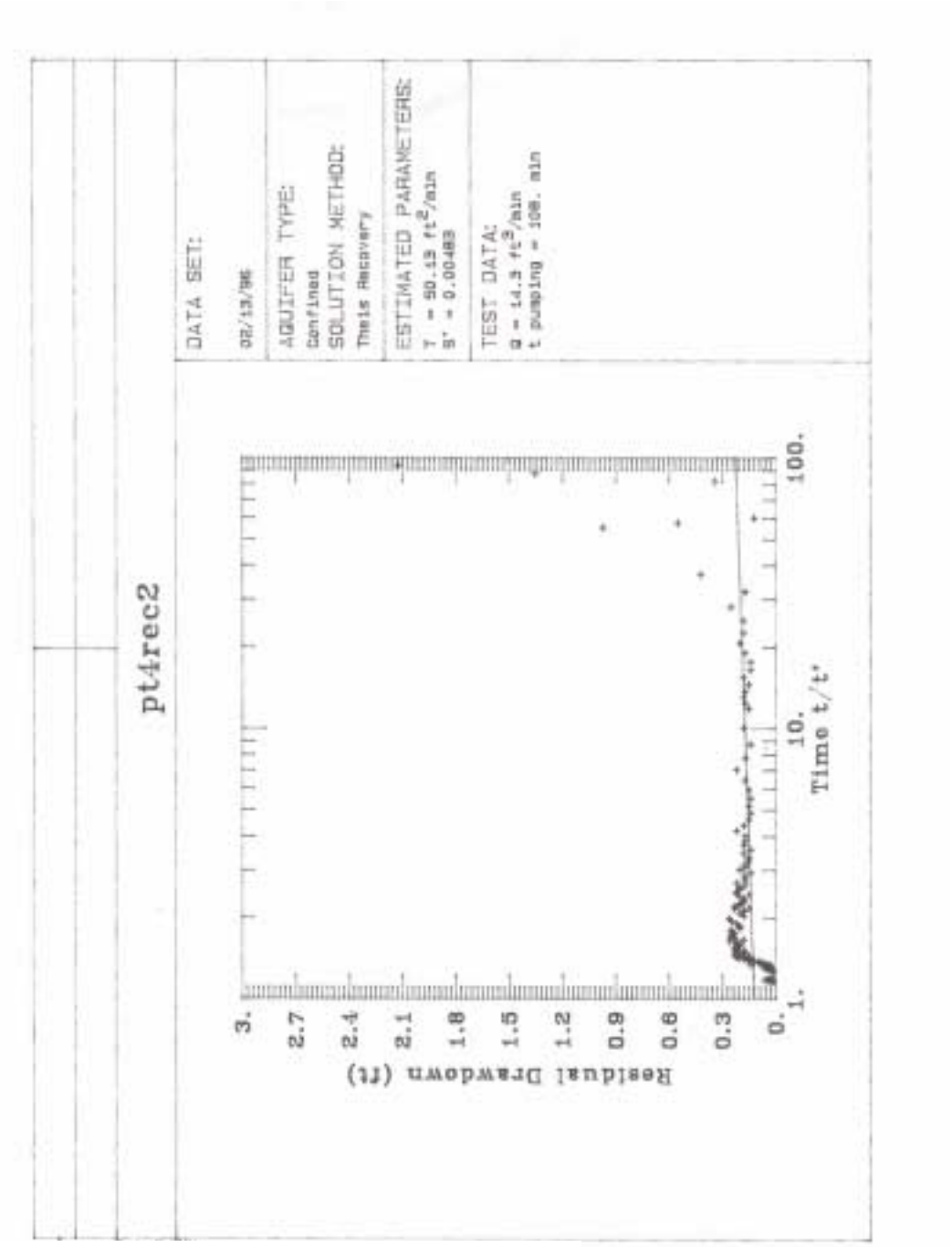


Figure C-4. Packer Test Recovery Data (Packer Test 4).

APPENDIX D - AQUIFER PERFORMANCE TEST DATA AND ANALYSES

AQUIFER PERFORMANCE TEST #1

1,050 - 1,252 feet

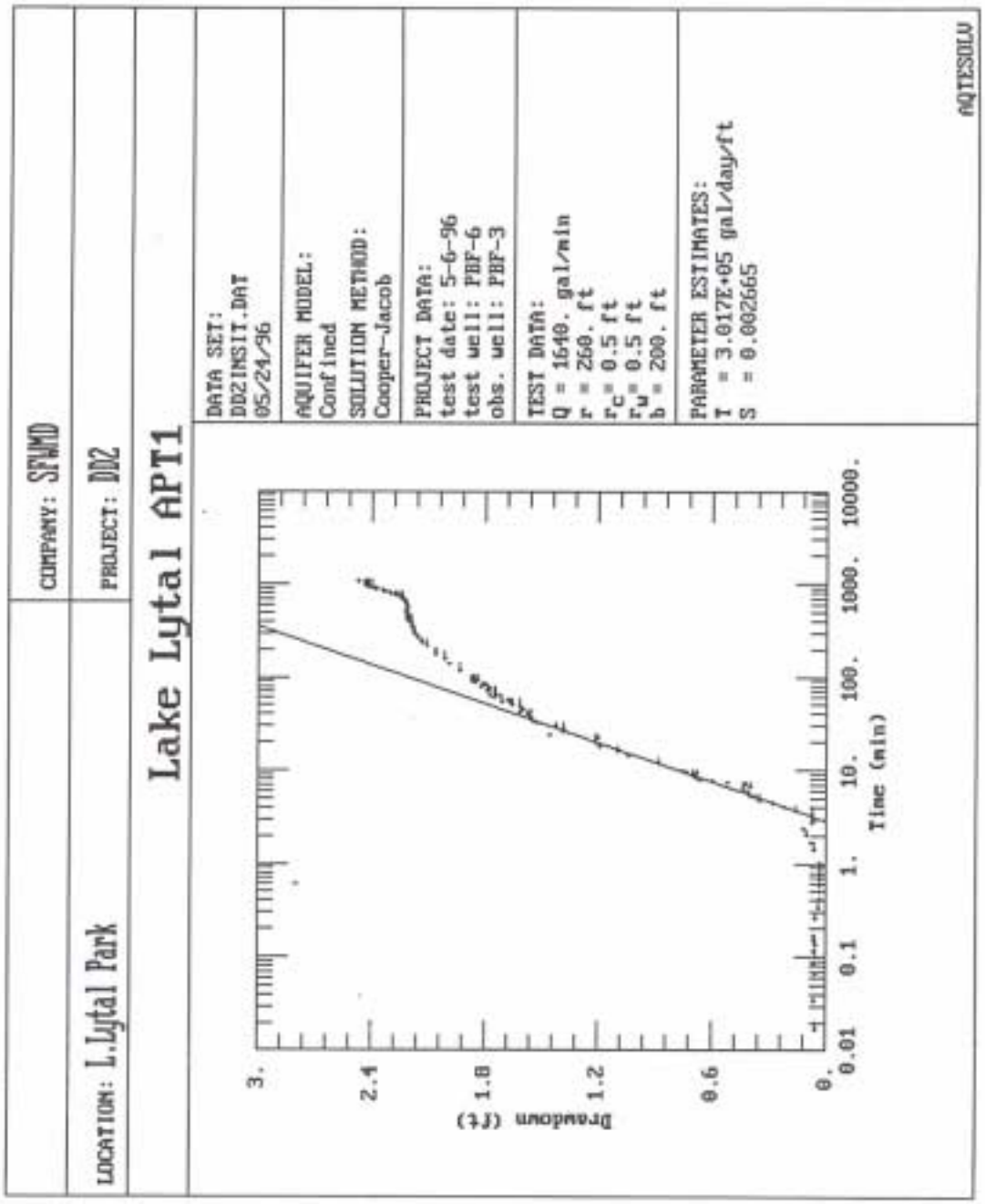


Figure D-1. APT No. 1 Drawdown Data (Cooper-Jacob Analysis).

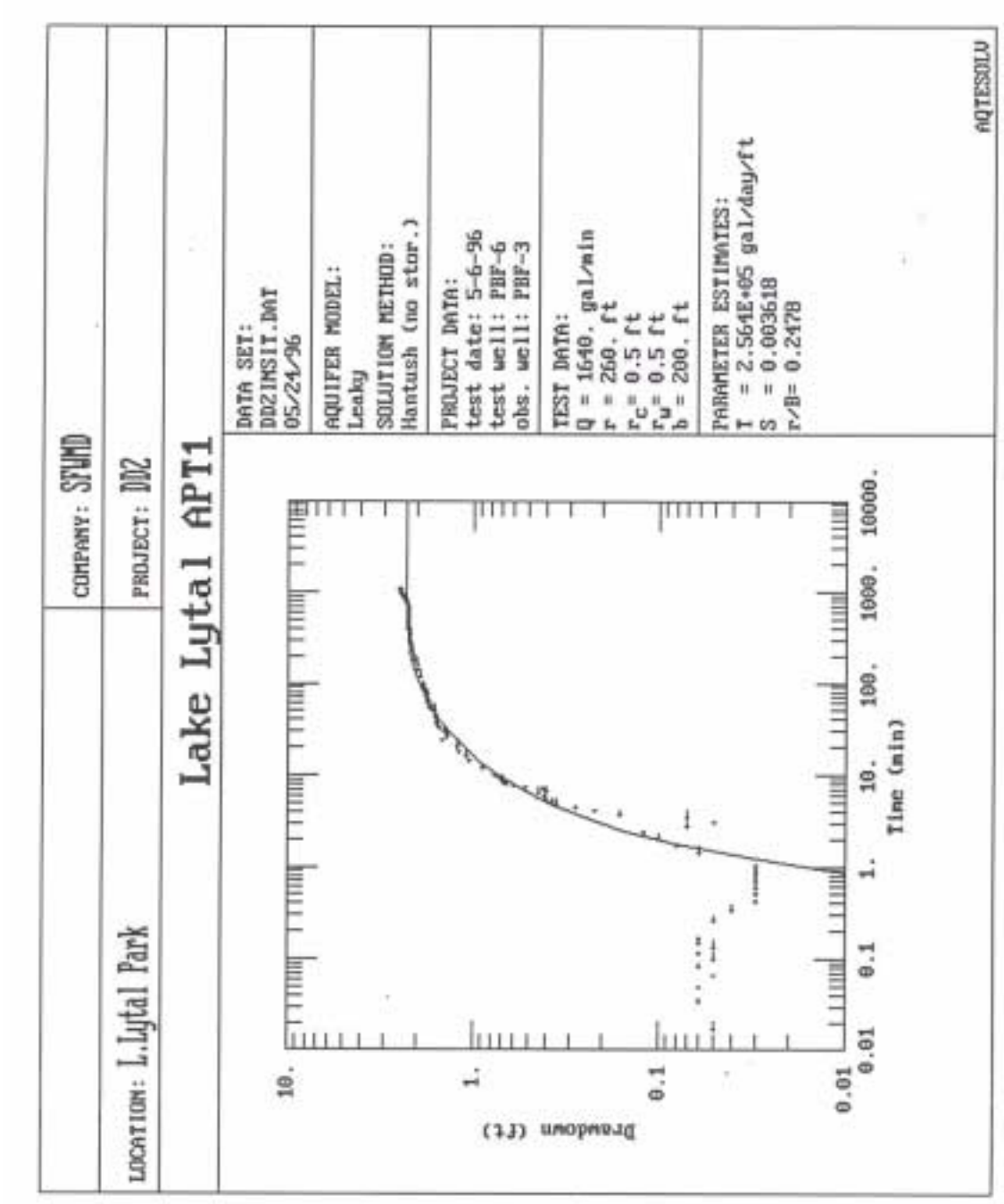


Figure D-2. APT No. 1 Drawdown Data (Hantush Analysis).

AQUIFER PERFORMANCE TEST #2

1,360 - 1,510 feet

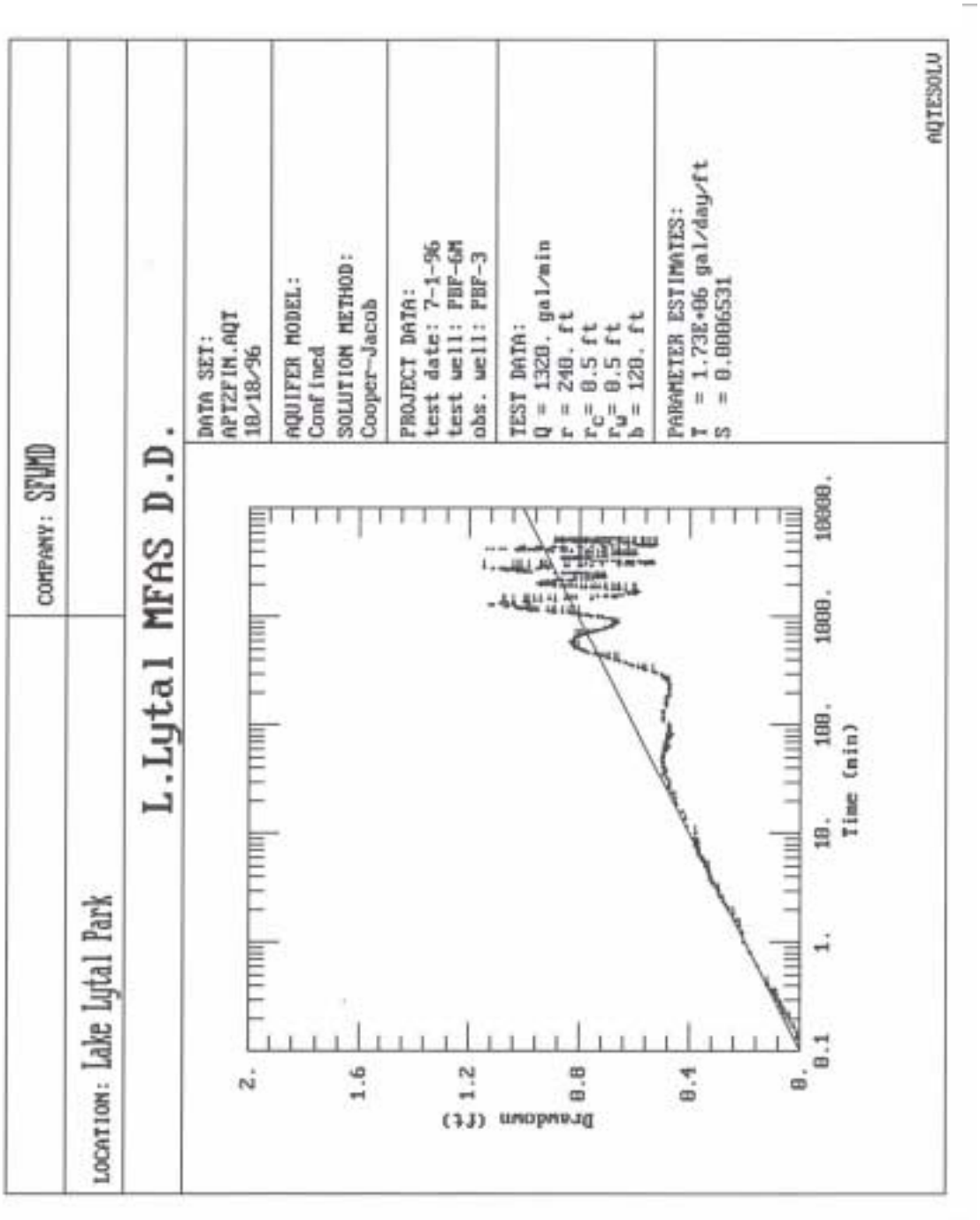


Figure D-3. APT No. 2 Drawdown Data (Cooper-Jacob Analysis).

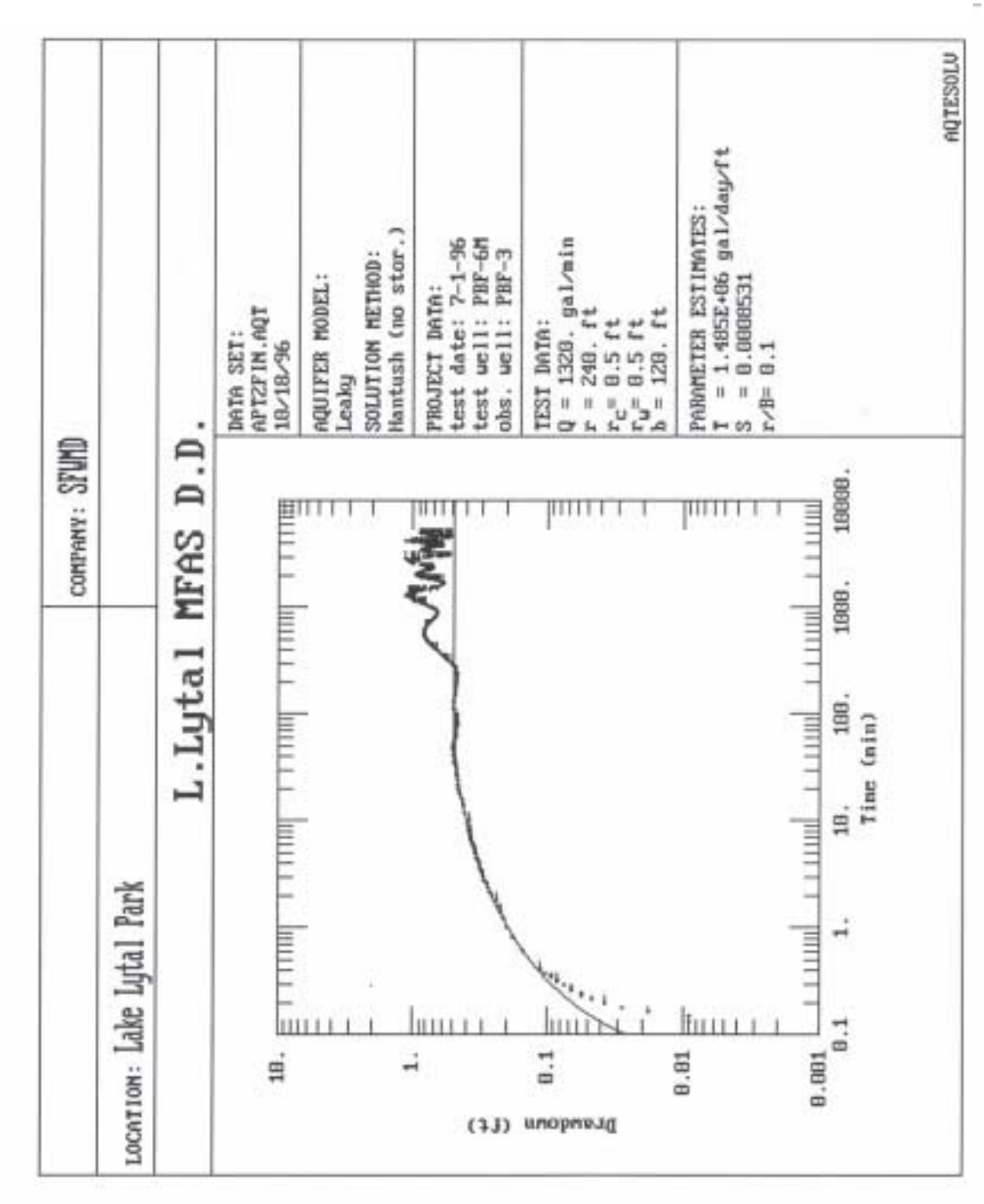


Figure D-4. APT No. 2 Drawdown Data (Hantush Analysis).

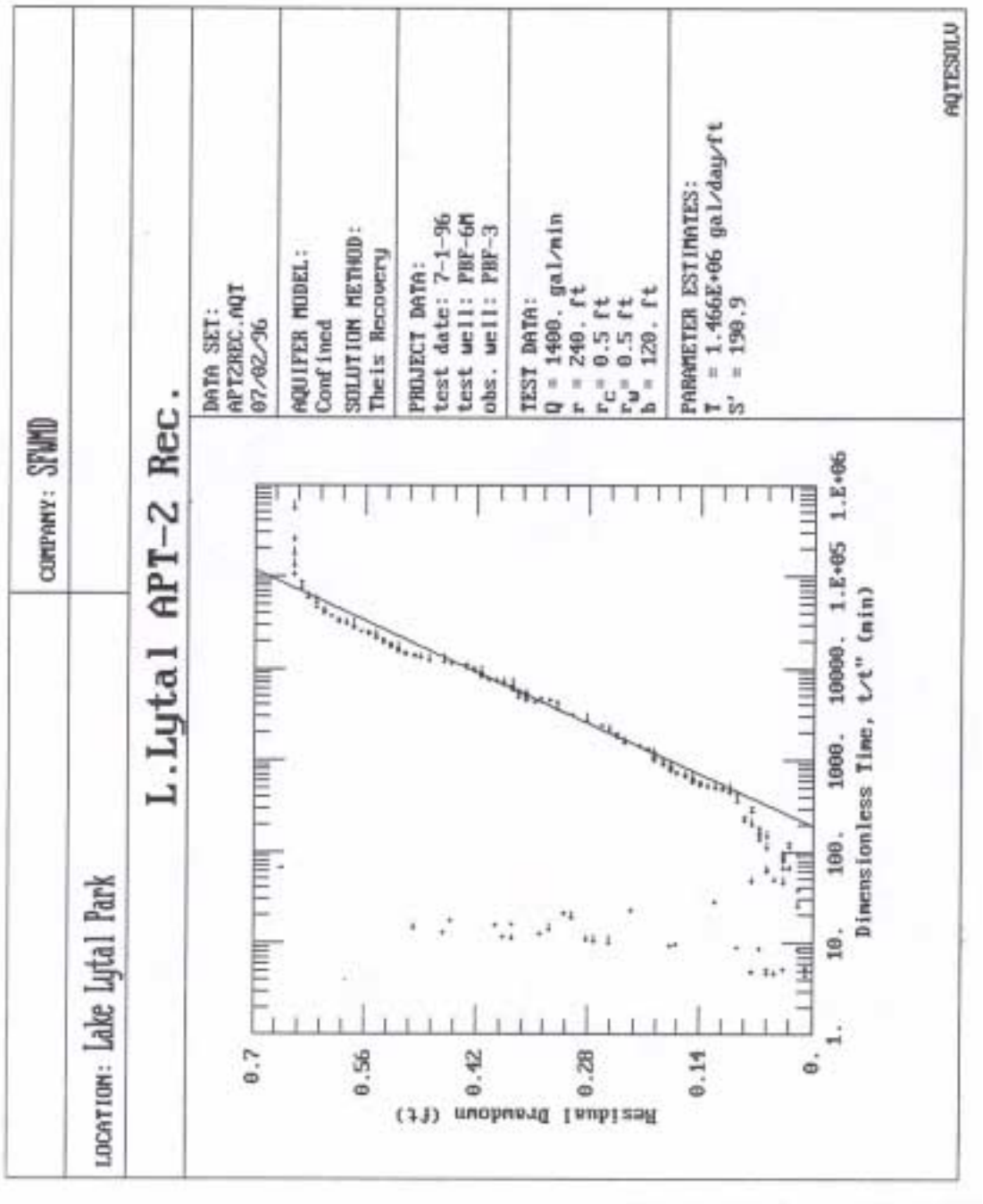


Figure D-5. APT No. 2 Recovery Data (Theis Recovery Analysis).