-Martin Co. C-#22

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Telephone: 305/ 683-3033

15 May 1981
P503WD1

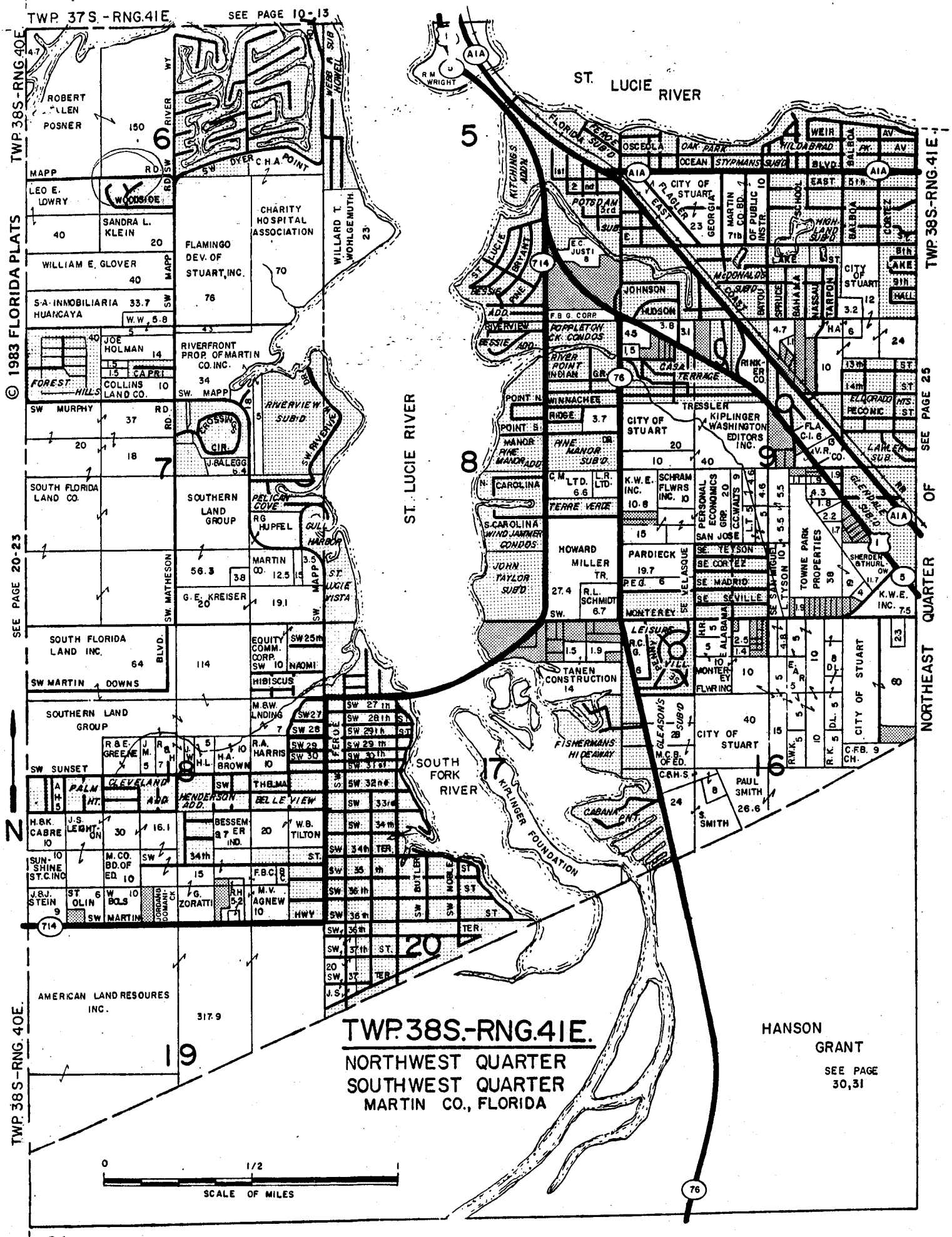
Mr. John Hoag
PO Box 65
Stuart, FL 33495

SUBJECT: Aquifer Performance Test at
Woodside Development

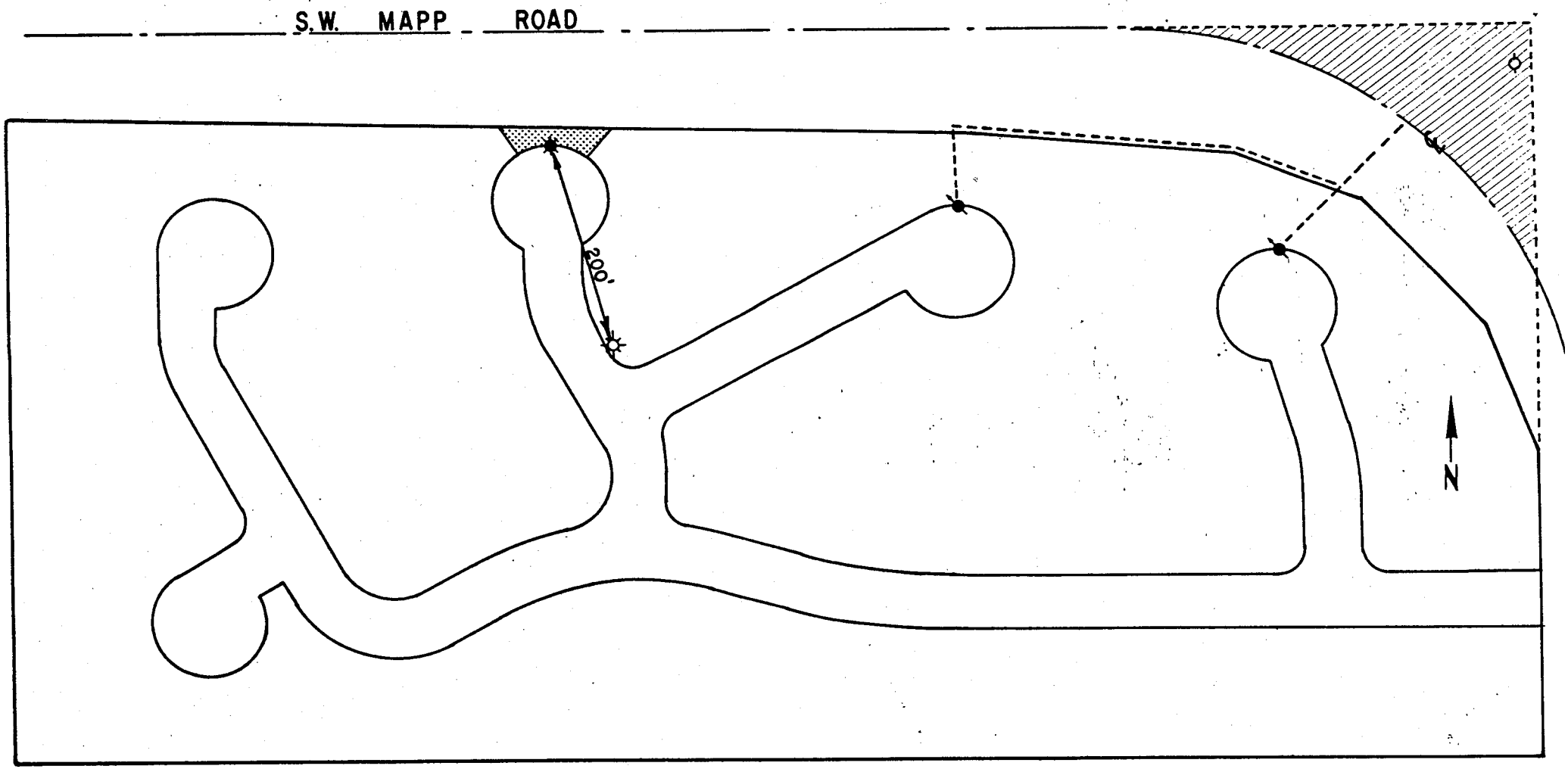
Dear Mr. Hoag:

On March 16, 1981, Geraghty & Miller, Inc., proposed to conduct and evaluate an aquifer performance test at the production well at Woodside Development. An aquifer test was requested by the South Florida Water Management District and had to be performed in order to obtain a water-use permit. Geraghty & Miller was authorized to proceed with the program on April 8, 1981. Based upon Geraghty & Miller's proposal, discussions were undertaken in April 1981 with technical personnel of the District to establish that all parties would be satisfied with test procedures and to establish acceptable locations and depths of the observation and salinity monitoring wells. This report contains the geologic logs of the observation and salinity monitoring wells, and description of the test procedures. The test data have been compiled and analyzed, and aquifer coefficients are presented. The well locations and aquifer test layout are shown on Attachment 1.

The two-inch-diameter observation and salinity monitoring wells were installed by the wash-boring method. Formation samples were collected after every five feet of drilling and at formation changes and evaluated. Copies of the geologic logs are given in Attachments 2 and 3. The logs of the observation and salinity monitoring wells generally compare to the driller's log (Attachment 4) of the 4-inch-diameter production well.


TWP. 37S.-RNG.41E
SEE PAGE 10-13
TWP. 38S.-RNG.40E
TWP. 38S.-RNG.41E.
ST. LUCIE RIVER
SOUTH FORK RIVER
SEE PAGE 20-23
SEE PAGE 25
NORTHEAST QUARTER OF
© 1983 FLORIDA PLATS
TWP. 38S.-RNG.41E.
NORTHWEST QUARTER
SOUTHWEST QUARTER
MARTIN CO., FLORIDA
HANSON GRANT
SEE PAGE 30,31
SCALE OF MILES
0
1/2
24

Geraghty & .ller, Inc.



LEGEND

- Production Well
- Observation Well
- Salinity Monitoring Well
- Discharge Points
- Discharge Drainage
- Water Plant
- Storm Water Retention Area

0 50 100 150 200
SCALE FEET

Attachment 1

Well Locations and Aquifer Test Layout

Woodside Development

Stuart, Florida

ATTACHMENT 2

GEOLOGIC LOG
SALINITY MONITORING WELL
WOODSIDE DEVELOPMENT
STUART, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND - light brown, medium-to fine-grained, quartzitic; abundant organics.	0-15	15
SAND - light brown, medium-to fine-grained, quartzitic; 20% silt and clay; trace organics.	15-25	10
SAND - off-white to light tan, medium fine-grained, quartzitic.	25-30	5
SAND - light tan, medium-to fine-grained, quartzitic.	30-35	5
SAND - light brown, medium-to fine-grained, quartzitic.	35-38	3
CLAY - olive gray, soft, pliable, 25% silt and clay.	38-41	3
SHELL - 75% shell fragments; 25% gray quartzitic sand, medium-to fine-grained.	41-46	5
SANDY CLAY - gray, soft, pliable; 80% clay; 20% sand, medium to fine-grained, quartzitic.	46-51	5
CLAY AND LIMESTONE - 50% clay, soft, pliable, gray; 50% limestone, sandy, hard, dense, crystalline.	51-56	5
CLAY - gray, soft, pliable.	56-61	5
COQUINA - light tan, well cemented, very sandy; sand, very fine-to medium-grained.	61-69	7

ATTACHMENT 3

GEOLOGIC LOG
OBSERVATION WELL
WOODSIDE DEVELOPMENT
STUART, FLORIDA

Sample Descriptions	Depth Interval (feet)	Thickness (feet)
SAND - brown, medium- to fine-grained quartzitic; abundant organics.	0- 5	5
SAND - light brown gray, medium-to fine-grained, quartzitic; abundant organics; trace of silt and clay particles.	5-10	5
SAND - light brown gray, medium-to fine-grained, quartzitic; trace organics, silt and clay material.	10-15	5
SAND - light brown gray, medium-to fine-grained, quartzitic; 10 to 15% silt and clay; trace of organics.	15-20	5
SAND - off-white, medium-to fine-grained, quartzitic.	20-30	10
SAND - dark tan, medium-to fine-grained; 10 to 15% silt and clay.	30-35	5
CLAY - olive grayish, soft, pliable; 25% sand, fine-grained, quartzitic.	35-41	6
SHELL - light gray, 75% shell fragments, 25% sand, quartzitic, medium-to fine-grained.	41-46	5
SHELL - light gray, 50% shell fragments, 50% sand, quartzitic, medium-to fine-grained.	46-56	10
CLAY - gray green, soft, pliable; trace sand, fine-grained, quartzitic.	56-62	6
COQUINA -light tan, shell fragments, loosely cemented.	62-69	7

ATTACHEMENT 4

DRILLER LOG
4-INCH PRODUCTION WELL
WOODSIDE DEVELOPMENT
STUART, FLORIDA

Sample Description	Depth Interval (feet)
Sand	0- 5
Sand, Red, Gray	10-15
Sand, Tan	15-25
Sand, Tan, Gray	25-30
Sand, Gray	30-35
Gray Sand, Broken Shell	35-40
Broken Shell	40-45
Coarse Sand; Shell	45-50
Gray Clay and Hardpan	50-53
Gray Rocks	54-56
Gray Stones	56-60
Shell, Stones Gray	60-65
Shell changing to fine Gray Sand	65-69

Note: Information obtained from Florida Department of Environmental Regulation, Well Completion Report, Permit Number WW43-13850.

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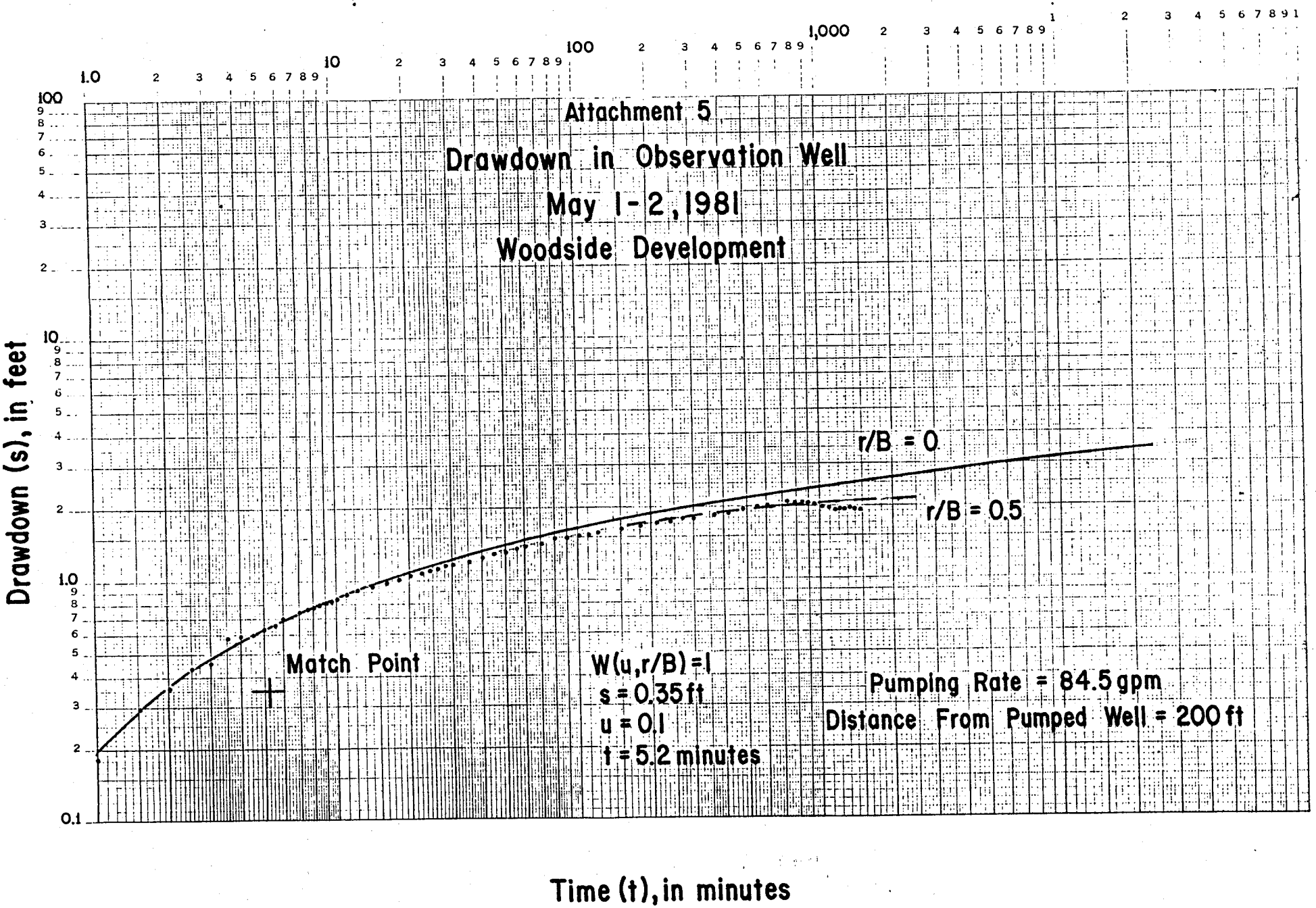

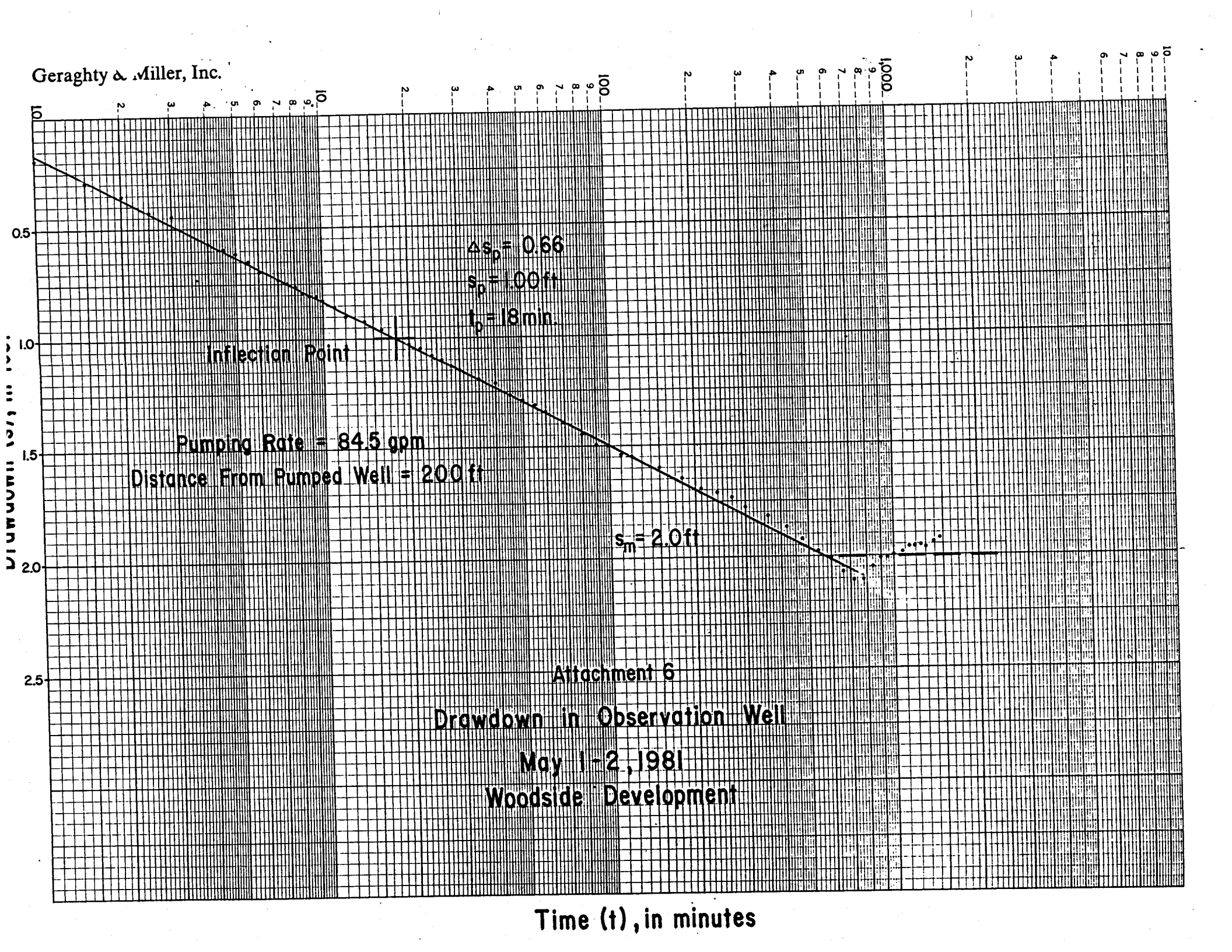
Geraghty & Miller, Inc.
1.0
0.5
1.0
1.5
2.0
2.5
10
100
1,000
Δs_p = 0.66
s_p = 1.00ft
t_p = 18 min.
Inflection Point
Pumping Rate = 84.5 gpm
Distance From Pumped Well = 200 ft
s_m = 2.0ft
Attachment 6
Drawdown in Observation Well
May 1-2, 1981
Woodside Development
Time (t), in minutes

ATTACHMENT 7

Aquifer Coefficients Calculated From Data Obtained During The Test of May 1-2, 1981 Woodside Development

Methods of Cooper (1963), and Hantush and Jacob (1955)

Transmissivity (gpd/ft)	27,667
Storage Coefficient (dimensionless)	1.3×10^{-4}
Leakance (gpd/ft^3)	1.7×10^{-3}

Method of Hantush (1956)

Transmissivity (gpd/ft)	30,755
Storage Coefficient (dimensionless)	1.1×10^{-4}
Leakance (gpd/ft^3)	1.7×10^{-3}

Average Aquifer Coefficients

Transmissivity (gpd/ft)	29,200
Storage Coefficient (dimensionless)	1.2×10^{-4}
Leakance (gpd/ft^3)	1.7×10^{-3}

Note: Pumping rate was 84.5 gpm

From land surface to a depth of 40 to 50 feet, unconsolidated material consisting of sand and shell with traces of clay is encountered. Below the sand and shells, a layer of sandy olive gray clay is encountered, ranging in thickness from 3 to 10 feet. Below 60 feet, the formation changes in character. The material becomes more lithified and more sandstone and limestone are encountered. The geologic conditions suggest that the water-producing zone below 60 feet exists as a leaky artesian aquifer, separated from the water-table aquifer by the olive gray clay.

Water samples were collected during the construction of the salinity monitoring well. The first water sample was collected at a depth of 42 feet below land surface, and the second was collected between 64 and 69 feet (the zone in which the production well is completed). After collection, the water samples were analyzed for chloride content by means of a Hach Kit. The results showed that the shallower sample had a chloride concentration of 30 mg/l (milligrams per liter) and the deeper sample, 38 mg/l.

The aquifer test was begun on May 1, 1981. The permanent centrifugal pump was used for the test. Two, two-inch-diameter gate valves and a totalizing flowmeter are located in the discharge line between the pump and the water treatment plant and were used so that at a constant pumping rate could be maintained throughout the test. Because the water system is already in place, the water had to be pumped through the treatment plant and distribution system. Discharge from the distribution system was by means of blowoff valves to the east of the pumping and observation wells. From the discharge points, the water was allowed to flow naturally into a nearby storm water retention area shown on Attachment 1. The well was pumped at a constant rate of 84.5 gpm (gallons per minute) for 24 hours.

The trend of pre-test water-level data indicates that water levels were changing very little before the commencement of pumping. The range in pre-test water-level fluctuations was less than 0.02 foot in the hour before the commencement of pumping. The pre-test water-level change is so small that it has been disregarded in the analysis of the test.

Test data analysis was made with due consideration for the conditions that existed in the vicinity of the production well; a leaky artesian aquifer overlain by a water- table

aquifer. Drawdown data collected from the observation well were plotted versus time on two graphs - one with logarithmic scales on both axes and the second with arithmetic scale on the drawdown axis and logarithmic scale on the time axis (Attachment 5 and 6). The data from the observation well indicated that during the first ten minutes of pumping the production well, drawdowns declined very rapidly. The rate of change slowed somewhat after the first ten minutes of pumping, but continued at a decreasing rate for about the first seven hours of pumping. After about seven hours, drawdowns changed very little for the balance of the test.

Two methods of analysis were used to determine the aquifer coefficients from the pump test data. The first method used equations derived by Cooper (U.S. Geological Survey Water-Supply Paper 1545-C, 1963, pp. C48-C55) and by M. S. Hantush and C. E. Jacob (American Geophysical Union Transactions, Volume 36, No. 1, 1955, pp. 95-100) to determine aquifer coefficients in an infinite leaky artesian aquifer where recharge to the aquifer is received from vertical leakage through a confining bed and the release of stored water from the confining bed is negligible. The results of these determinations are given on Attachment 7. The second method was developed by M. S. Hantush (American Geophysical Union Transactions, Volume 37, 1956, pp. 702-7140 and relies on the same assumptions as the first with more weight given to data collected in the latter part of the test. The results of this analysis method are also given in Attachment 7.

Findings

1. The geologic conditions beneath the Woodside Development appear to be very consistent with unconsolidated material, predominantly sand, to depths of 40 to 50 feet; overlaying a thin section of clay. The production well is screened opposite layers of cemented sands and shells below the clay.

2. In the vicinity of the production well, the production zone responds to pumping as a leaky artesian aquifer, with recharge by vertical leakage downward through the confining bed.

3. Comparison of the two methods used to calculate the aquifer coefficients indicates good agreement. Overall, transmissivity is estimated at 29,200 gpd/ft; storage

coefficient is estimated at 1.2×10^{-4}, and leakance is estimated at 1.7×10^{-3} gpd/ft^3.

4. Analysis of chloride content in the salinity monitoring well shows concentration to be less than 40 mg/l. In the best interest of Woodside Development, semiannual water sampling should be conducted on this well in order to to detect any changes of salinity in the aquifer.

The findings of this investigation are supported by the technical data obtained throughout. If you have additional questions about these findings, please let me know.

Respectfully Submitted,
GERAGHTY & MILLER, INC.

James A. Wheatley
Senior Hydrogeologist

JAW:dkm