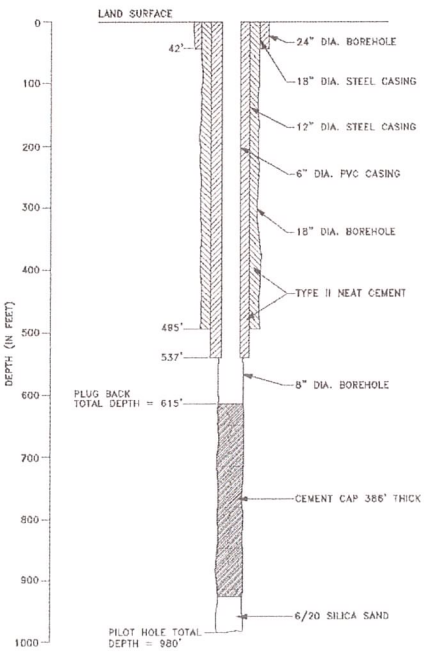
Completion Report for:

Lee County Utilities
Observation Well #1 (LM-6208)
at the North Reservoir Site, Lee County, Fl.

LEE COUNTY
SOUTHWEST FLORIDA



Prepared for:

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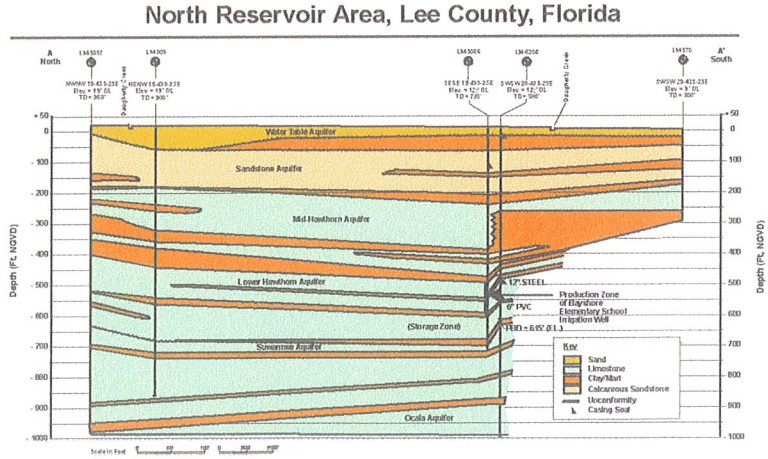
North Reservoir Area, Lee County, Florida



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In conjunction with:

HAZEN AND SAWYER
Environmental Engineers & Scientists

COMPLETION REPORT FOR LEE COUNTY UTILITIES OBSERVATION WELL #1 (LM-6208) AT THE NORTH RESERVOIR SITE LEE COUNTY, FLORIDA

Prepared for:

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6202 Presidential Court
Fort Myers, Florida 33919

February, 1999

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Project No. 01-03892.H0

Daniel J. Acquaviva 3/1/99

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I. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

The following conclusions are made as a result of this investigation.

- Zone III of the Lower Hawthorn member of the Arcadia formation, encountered between the depths of 529 and 619 feet in Observation Well #1 (LM-6208), is a suitable zone for storage of potable water at the site.

- Zone I of the Ocala formation, encountered between the depths of 904 and 977 feet in Observation Well #1 (LM-6208), is a potentially useable storage zone at the site.

- Zone II of the Lower Hawthorn member of the Arcadia formation, encountered between the depths of 480 and 518 feet in Observation Well #1 (LM-6208), which flowed at a rate of 1225 gallons per minute, is a potential source of supply for a membrane process water treatment plant.

B. Recommendations

The following recommendations are made as a result of this investigation:

- A pilot ASR well should be installed at the site and completed using an open-hole design in Lower Hawthorn Zone III.

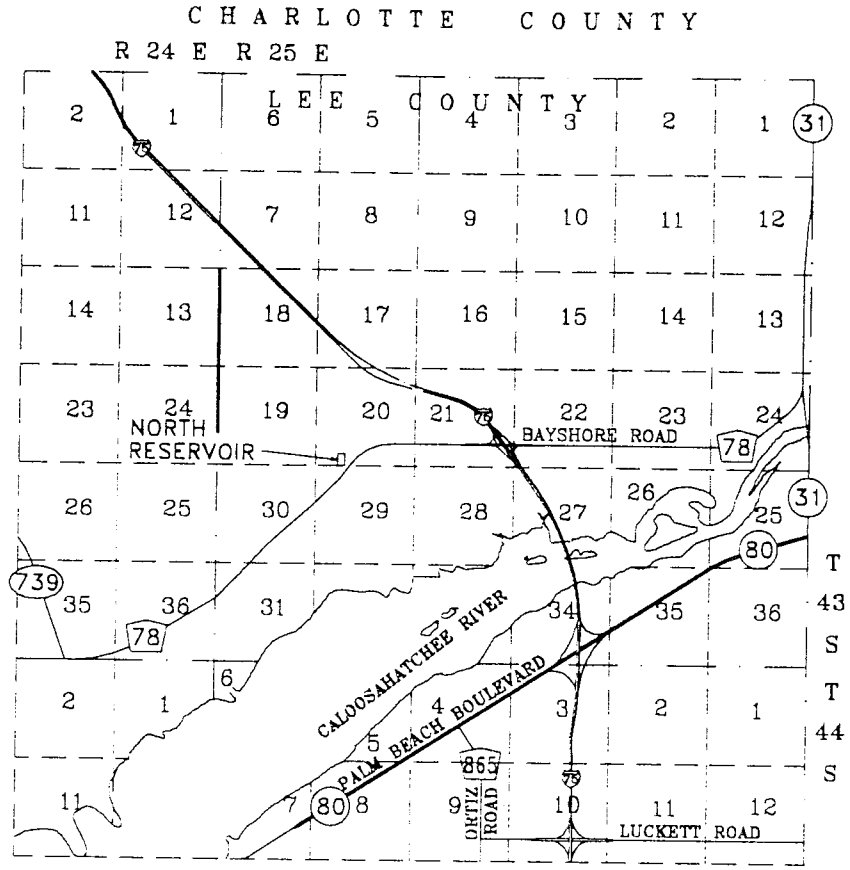
- Observation Well #1 (LM-6208) should be utilized to monitor water level drawdowns and water quality changes in the storage zone during extended duration pumping and cyclical testing of the pilot ASR well.

II. INTRODUCTION

A. Purpose and Scope of Investigation

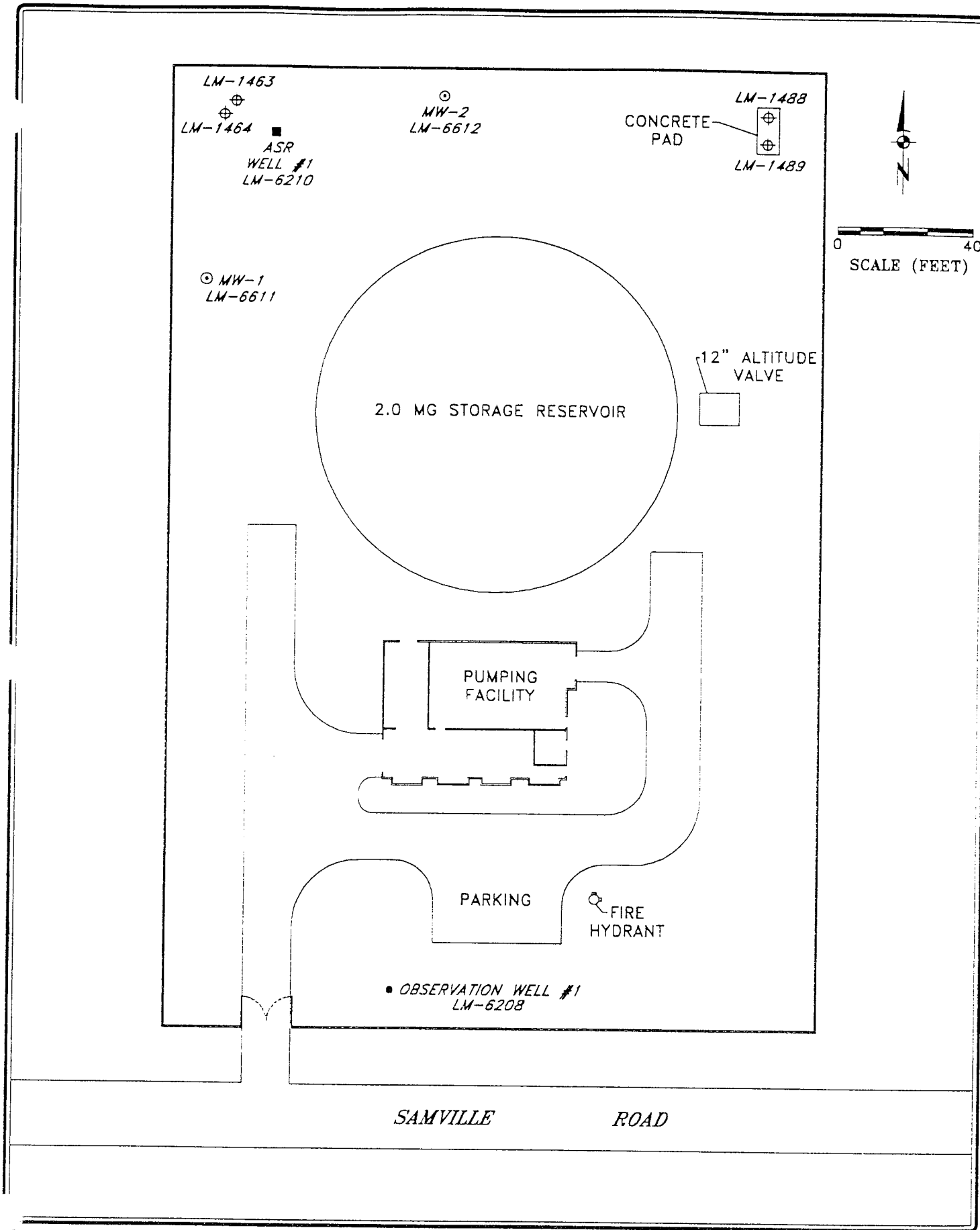
This document is intended as the completion report for the initial exploratory well at the Lee County Utilities' North Reservoir Site (Figure 2-1). The purpose of the investigation conducted at that this site was to determine the feasibility of constructing an aquifer storage and recovery (ASR) system. The North Reservoir is an approximate 1.38 acre site on which is located a two million gallon (MG) ground storage tank (Figure 2-2). Since ASR has been shown to be a more cost effective means of storage of large volumes of treated water than construction of above ground storage tanks or reservoirs, a successful ASR project at the North Reservoir site would provide Lee County Utilities (LCU) with considerable operational flexibility for supplying the northern portion of its service area.

The scope of the investigation included the installation and testing of one exploratory well. This well, referred to as Observation Well #1 or LM-6208, was drilled to a depth of 980 feet and several zones in the Upper Floridan aquifer were tested as drilling proceeded. Based upon the testing, described in more detail herein, a suitable zone for storage and recovery of potable water was selected. ASR zone selection criteria, which included eight hydrologic variables, were delineated in a previous report prepared for LCU (ViroGroup, 1998A). Thereafter, the exploratory well was backplugged and a final string of casing was set to complete the well open-hole in the selected ASR zone. This well is to be used as an observation or monitoring well during testing of an ASR production well which is to be installed at the site. A subsequent report will describe the installation of the initial ASR well; long-term aquifer testing, including cyclical injection, storage, and recovery operations; and plans for a fully operational ASR wellfield in the vicinity of the North Reservoir site.



Water Resource Solutions	PROJECT NAME: NORTH RESERVOIR	DWG. NUMBER: A-013892LM-1
	PROJECT NUMBER: 01-03892.HO	DATE: 3/10/99

FIGURE 2-1. GENERAL SITE LOCATION MAP.



Water Resource Solutions	PROJECT NAME: LCU/HMA RESERVOIR	DWG. NUMBER: A-013892SI-1
	PROJECT NUMBER: 01-03892.HO	DATE: 3/10/99

FIGURE 2-2. NORTH RESERVOIR SITE MAP.

B. Background

The present investigation is an endeavor jointly funded by Lee County Utilities and the South Florida Water Management District (SFWMD). The Lee County Regional Water Supply Authority (LCRWSA) was the agent through which the funding application to the SFWMD was made and through which results of the work are reported to the SFWMD.

Although the selection of the North Reservoir site for an ASR project was based primarily on LCU's logistical and operational considerations, previous subsurface mapping conducted as part of another project for LCU (ViroGroup, 1998) tended to indicate that the site had potentially favorable hydrogeological characteristics in the Upper Floridan aquifer. An Area of Review (Appendix A) was prepared by Water Resource Solutions (ViroGroup, 1998B) as part of the ASR well construction application submitted by Hazen & Sawyer to the Florida Department of Environmental Protection (FDEP). The Area of Review contains a tabulation of pertinent characteristics of wells located in a nine square mile area surrounding the site. It also contains a subsurface cross-section through the site. Prior to drilling the exploratory well at the site, a well prognosis (Appendix B) was prepared. This prognosis was based upon available information, including the Area of Review, and some semi-regional subsurface mapping.

III. TEST WELL DRILLING AND AQUIFER TESTING

A. Test Well Installation

Observation Well #1 (LM-6208) was spudded on November 17, 1998. Eighteen inch diameter steel surface casing was set at 42 feet. All drilling to intermediate casing setting depth was performed by the mud rotary method. Between the depths of 482 and 485 feet (Lower Hawthorn Zone II) extensive solution porosity was encountered and the well flowed at a rate of approximately 1225 gallons per minute (gpm). After killing the well with heavy mud and regaining circulation, open-hole geophysical logs were run. The hole was then reamed to 18-inch diameter. A caliper log and deviation surveys were run and thereafter 12-inch diameter steel intermediate casing was set at a depth of 495 feet.

Subsequent to setting intermediate casing, all drilling was done by the reverse air rotary method. An eight inch diameter pilot hole was advanced to a depth of 980 feet. Seven potential storage zones were encountered, five of which were evaluated by aquifer testing. A more detailed description of the aquifer testing is provided in a subsequent portion of this report. Daily drilling reports are provided in Appendix C.

Based upon an analysis of the geology and aquifer test data, Lower Hawthorn Zone III, between the depths of 529 and 620 feet, was selected as the storage zone. Observation well #1 was then back plugged from its total depth of 980 feet to 615 feet by emplacing 20/60 grade sand from 980 to 925 feet and thereafter emplacing neat cement between the depths of 925 to 615 feet. The borehole was then filled with 20/60 grade sand between the depths of 615 and 520 feet. The 8-inch diameter pilot hole was then reamed to 12-inch diameter to a depth of 539 feet and 6-inch diameter Schedule 80 PVC casing was set at a depth of 537 feet, (casing mill slips are provided in Appendix D). Thereafter, the sand back plug was removed by drilling a six-inch diameter borehole by reverse air rotary to a depth of 615 feet. The well was then developed for 10 hours and shut in. The wellhead was temporarily completed with a flange and a hose bib. This well will be used

as an observation well to record water level drawdowns during the constant-rate extended duration pumping test of the ASR well to be installed at the site. A schematic illustration of well construction details is provided as Figure 3-1.

B. Site Hydrogeology

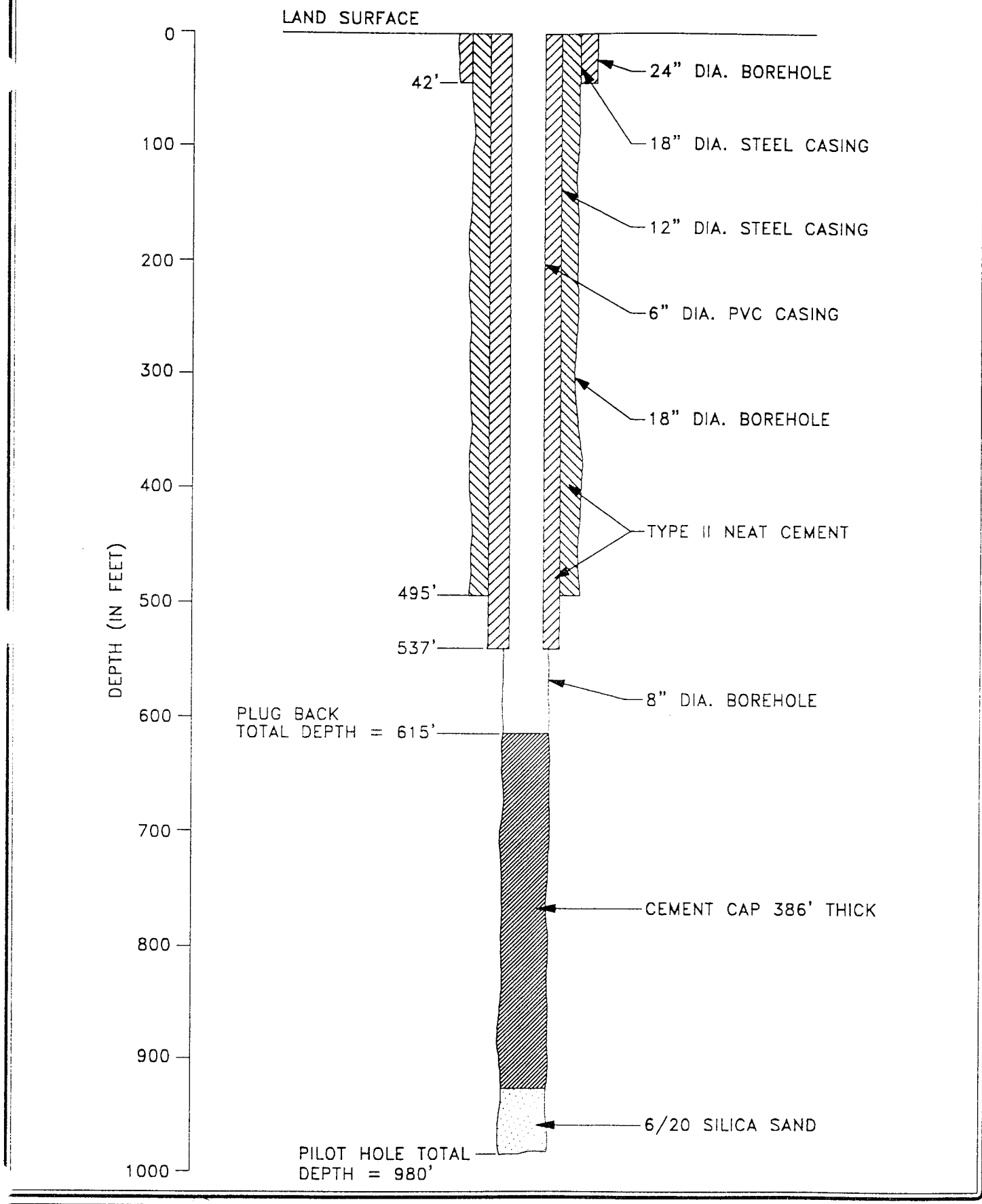
The general hydrogeology of northern Lee County was previously described in the Area of Review (Appendix A) and other recent reports prepared for LCU (ViroGroup, 1998). A generalized hydrostratigraphic column for north Lee County is presented as Figure 3-2.

Throughout the drilling and testing of Observation Well #1 (LM-6208) a WRS geologist was present on-site to supervise drilling operations and compile a detailed log of lithology based upon analysis of the drill cuttings. A lithologic log is provided in Appendix E. The strip log (Appendix F) compiled from the lithologic analysis and the drilling penetration rate was used to select discrete zones within the Floridan aquifer for testing.

A suite of geophysical logs was run in the open-hole section of the well prior to setting of intermediate casing. A more comprehensive suite of geophysical logs, including both sonic and flowmeter logs, was run at total depth. Copies of the geophysical logs are provided in Appendix G.

Based on analyses of the lithology and the geophysical logs, a comparison of anticipated (i.e. from the well prognosis) to actual stratigraphic tops is provided on Table 3-1.

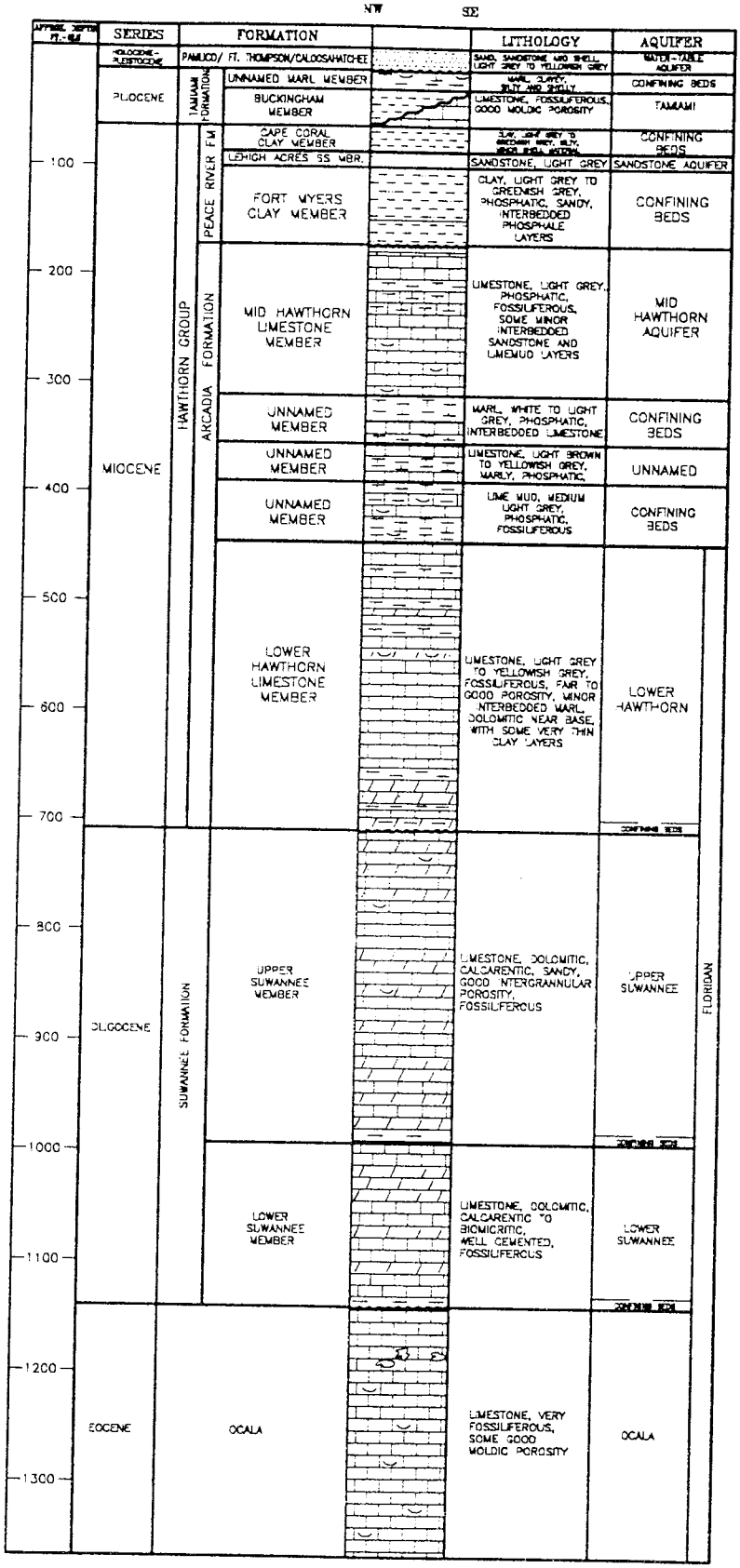
As can be noted from Table 3-1, from a structural aspect Observation Well #1 (LM-6208) was approximately 15 feet high to prognosis at the top of the Mid Miocene (approximately 17 to 22 million years ago) Arcadia formation (Mid-Hawthorn Zone I), approximately 57 feet high to prognosis at the top of the Lower Miocene (23.5 to 26 mya) Lower Hawthorn Zone I, and approximately 75 feet high at the top of the Oligocene (29 to 37 mya) Suwannee formation. The progressive increase in structural relief with depth indicates a



Water Resource Solutions	PROJECT NAME: NORTH RESERVOIR ASR	DWG. NUMBER: A-013892F8-2
	PROJECT NUMBER: 01-03892.HO	DATE: 1/18/99

FIGURE 3-1. SCHEMATIC ILLUSTRATION OF CONSTRUCTION DETAILS FOR NORTH RESERVOIR ASR OBSERVATION WELL #1 (LM-6208).

GENERAL HYDROSTRATIGRAPHIC COLUMN FOR NORTH RESERVOIR AREA



Water Resource Solutions	PROJECT NAME: N. RESERVOIR	DWG. NUMBER: A-013892HC-1
	PROJECT NUMBER: 01-03892.HO	DATE: 3/10/99

FIGURE 3-2. GENERALIZED HYDROSTRATIGRAPHIC COLUMN FOR NORTH RESERVOIR AREA.

TABLE 3-1. COMPARISON OF PREDICTED VERSUS ACTUAL STRATIGRAPHIC TOPS FOR OBSERVATION WELL #1 (LM-6208)

Stratigraphic Top	Predicted Depth (ft-BLS)	Actual Depth (ft-BLS)
Pamlico/Ft. Thompson	Surface	Surface
Cape Coral Clay	30	40
Lehigh Acres Sandstone	75	64
Fort Myers Clay	215	170
Mid-Hawthorn Zone I	245	230
Unnamed Marl/Clay	390	360
Mid-Hawthorn Zone II	410	385
Unnamed Marl/Clay	425	395
Unnamed Limestone	440	416
Unnamed Marl/Clay	480	430
Lower Hawthorn Zone I	505	448
Unnamed Mar/Clay	555	465
Lower Hawthorn Zone II	570	480
Unnamed Marl/Clay	610	518
Lower Hawthorn Zone III	620	529
Unnamed Marl/Clay	690	619
Suwannee Zone I	715	640
Unnamed Marl/Clay	755	703
Suwannee Zone II	775	723
Unnamed Marl/Clay	900	803
Suwannee Zone III	905	828
Unnamed Marl Clay	970	887
Ocala Zone I		904

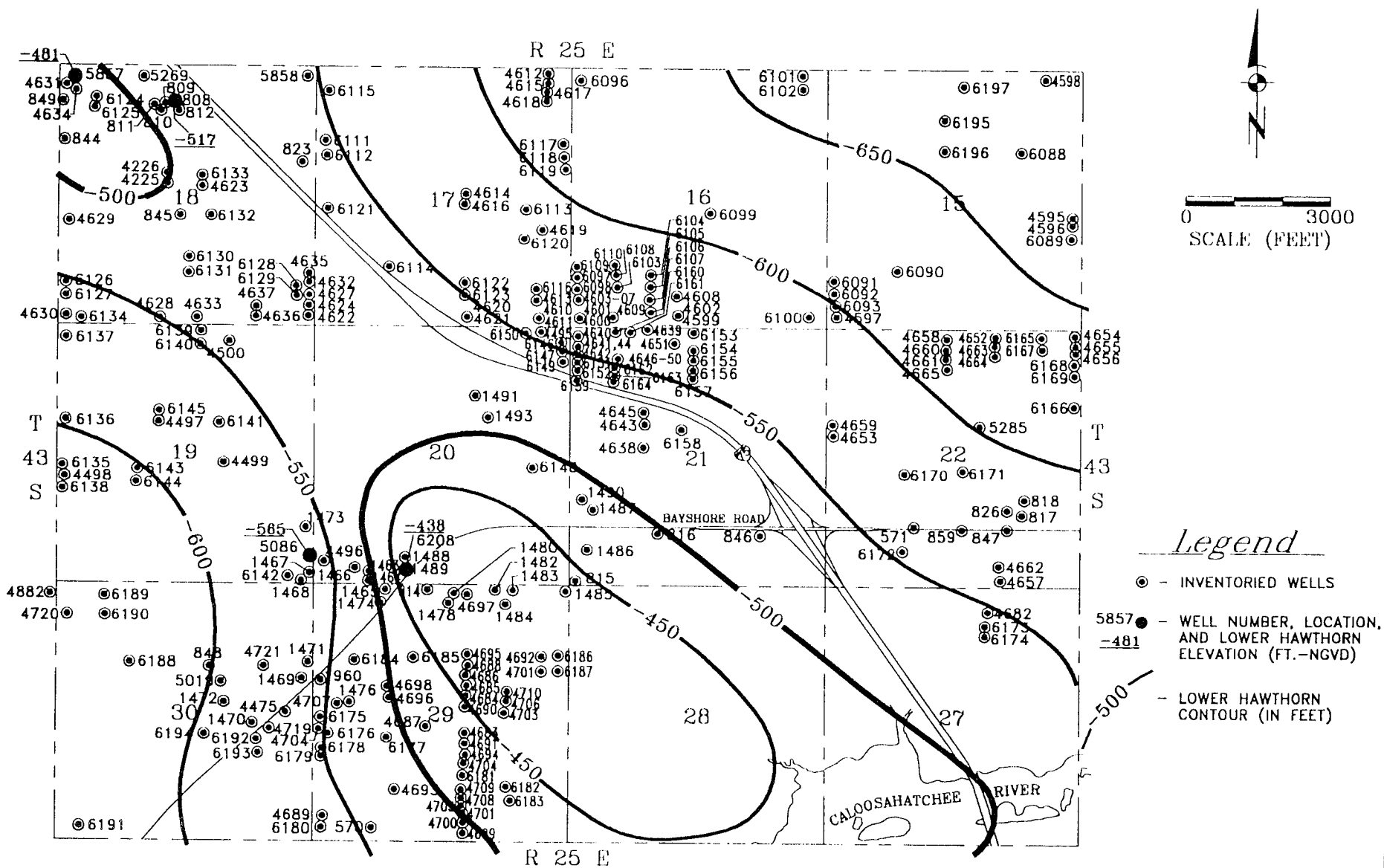
large deep seated closed anticlinal structure (i.e. four way dip) at the site. Such a structure was previously mapped as part of an earlier project for LCU (see Plate 32, ViroGroup, 1998). The site-specific stratigraphic data has been utilized to construct a structural contour map on the top of the Lower Hawthorn at the site (Figure 3-3) and a revised version of Cross-Section A-A' (Figure 3-4) originally prepared for the Area of Review.

C. Aquifer Testing

Seven potential storage zones were encountered in Observation Well #1 (LM-6208) five of which were evaluated by aquifer testing. Specific capacity pumping tests were conducted of Lower Hawthorn Zone II, Lower Hawthorn Zone III, Suwannee Zone I, Suwannee Zone III, and Ocala Zone I. In each case drilling was stopped when the underlying confining unit was encountered. The test of Lower Hawthorn Zone II was conducted in the open hole below intermediate casing. The other four tests were conducted using a single packer set at the top of interval to be tested. Plots of the specific capacity test data are provided on Figures 3-5 and 3-9. The raw specific capacity data is provided in Appendix H. A summary of the aquifer test information is provided on Table 3-2.

D. Water Quality Data

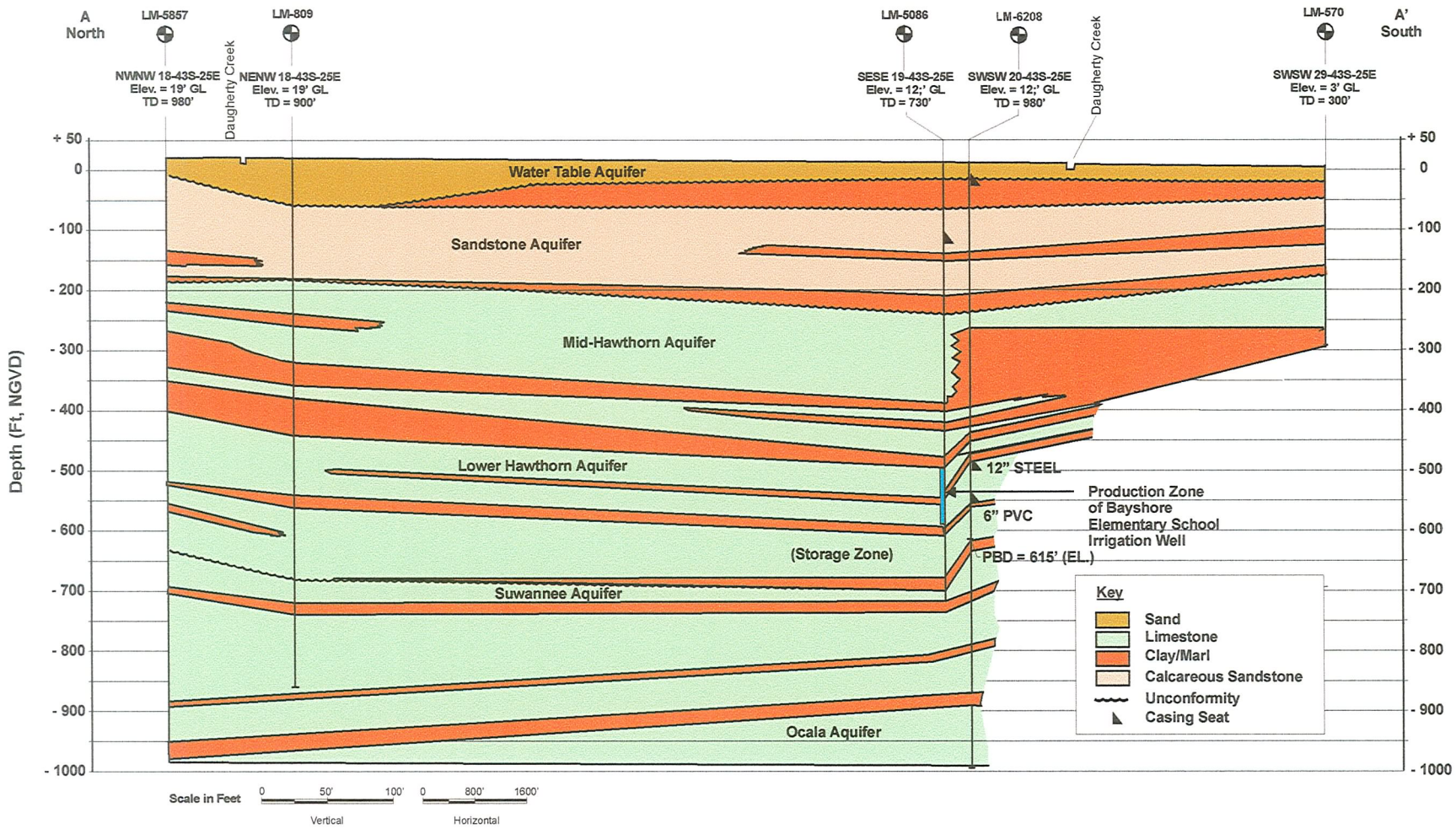
Water samples were collected at approximate 30 foot intervals throughout the reverse air drilling process. Water samples were also collected during the aquifer testing. These samples were analyzed by WRS for dissolved chloride concentrations and conductivity. The raw water quality data is provided in Appendix I. A chloride profile for Observation Well #1 (LM-6208) is provided on Figure 3-10.



Water Resource Solutions	PROJECT NAME: LEE CTY. - N. RESERVOIR PILOT ASR	DWG. NUMBER: A-013892SS-1
	PROJECT NUMBER: 01-03892.HO	DATE: 3/10/99

FIGURE 3-3. SUBSURFACE STRUCTURE MAP ON TOP OF LOWER HAWTHORN MEMBER OF ARCADIA FORMATION.

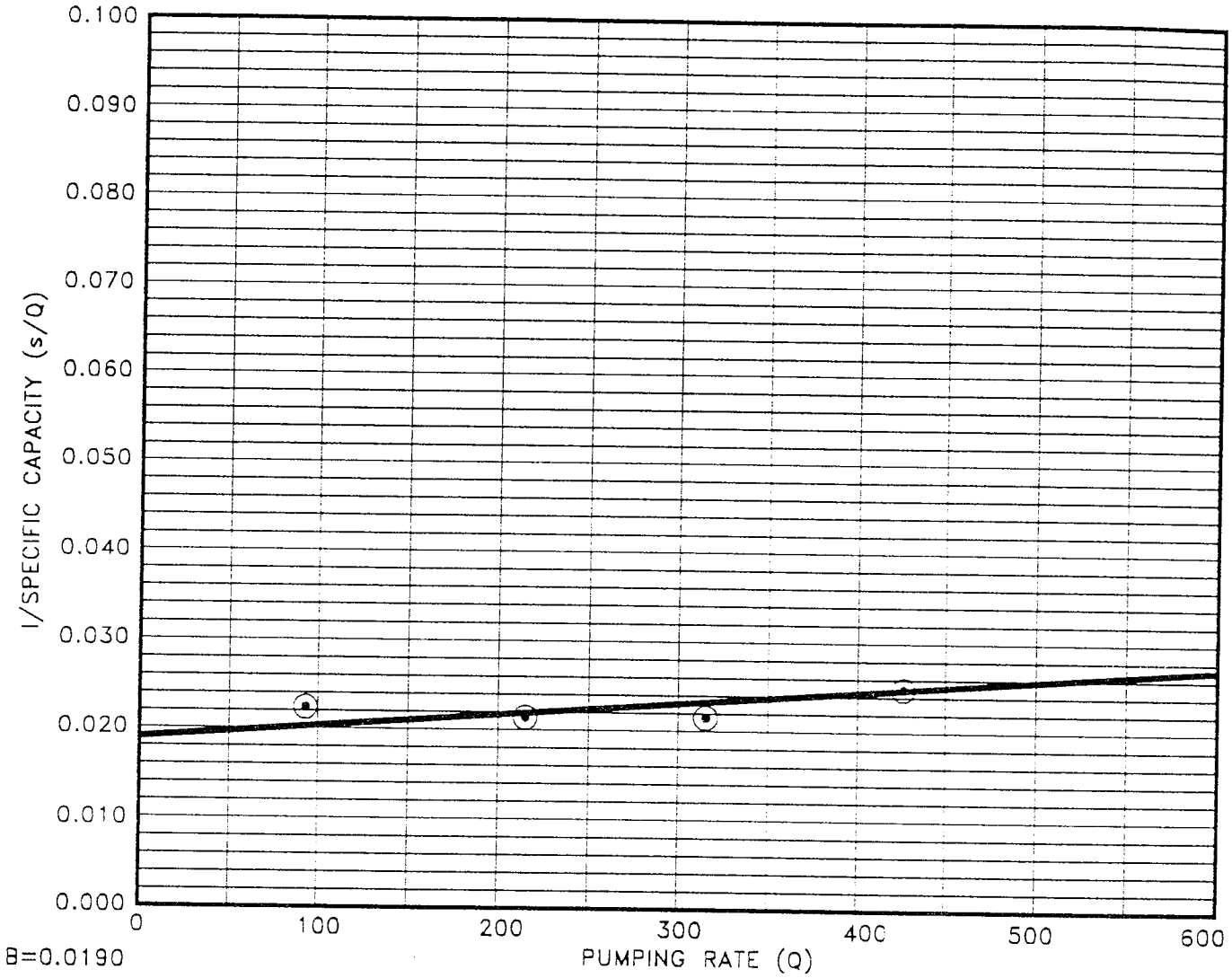
North Reservoir Area, Lee County, Florida



Water Resource Solutions	PROJECT NAME: NORTH RESERVOIR	DWG. NUMBER: A-013892N1-1
	PROJECT NUMBER: 01-03892.HO	DATE: 4/9/99

FIGURE 3-4. CROSS-SECTION A-A' SHOWING NORTH RESERVOIR OBSERVATION WELL #1 (LM-6208).

LM-6208
NORTH RESERVOIR TEST #1
WELL EFFICIENCY
$s = BQ + CQ^2$ or $s/Q = B + CQ$
WHERE s = WELL DRAWDOWN
BQ = FORMATION LOSS
CQ^2 = WELL LOSS



Q (GPM)	DRAWDOWN s(FEET)	s/Q	FORMATION LOSS (FT.)	WELL LOSS (FT.)	WELL EFFICIENCY (%)	ESTIMATED TRANSMISSIVITY (gpd/ft)
92	2.07	.0225	1.75	.320	84.5	108,000
222	4.62	.0208	4.22	.400	91.3	
327	6.93	.0212	6.21	.720	89.6	
430	10.40	.0242	8.17	1.710	78.6	

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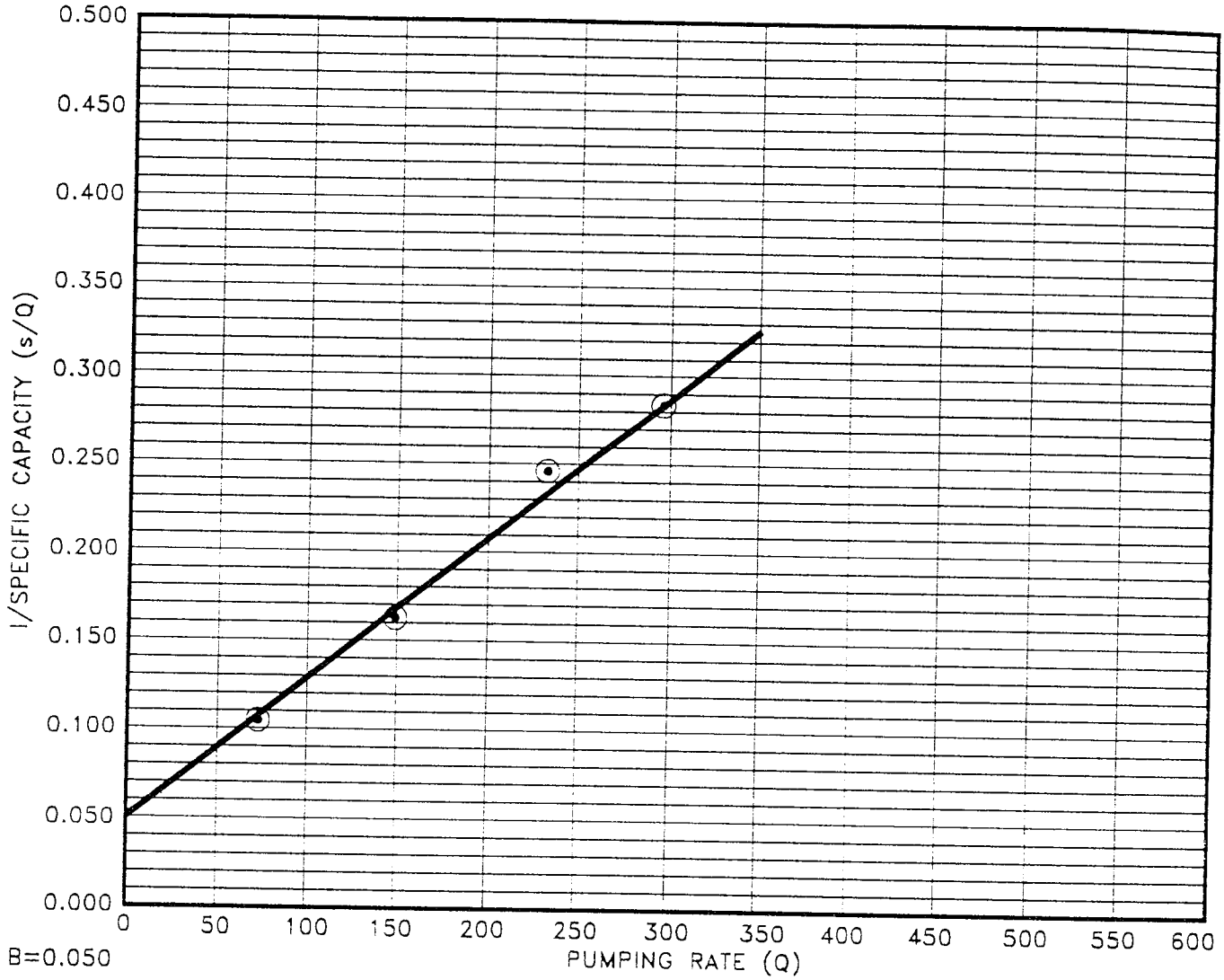
PROJECT NUMBER: 01-03892.H0	DATE: 3/10/99

FIGURE 3-5. SUMMARY OF SPECIFIC CAPACITY DATA AND ANALYSES FOR NORTH RESERVOIR TEST WELL (LM-6208) FOR LOWER HAWTHORN ZONE II (480-518').

LM-6208
NORTH RESERVOIR TEST #2 (PACKER TEST #1)
WELL EFFICIENCY

$s = BQ + CQ^2$ or $s/Q = B + CQ$

WHERE s = WELL DRAWDOWN
BQ = FORMATION LOSS
CQ^2 = WELL LOSS



Q (GPM)	DRAWDOWN s(FEET)	s/Q	FORMATION LOSS (FT.)	WELL LOSS (FT.)	WELL EFFICIENCY (%)	ESTIMATED TRANSMISSIVITY (gpd/ft)
73	7.50	.103	3.65	3.85	48.7	39,000
149	22.52	.151	7.45	15.07	33.1	
230	56.05	.244	11.50	44.55	20.5	
295	83.16	.282	14.75	68.41	17.7	

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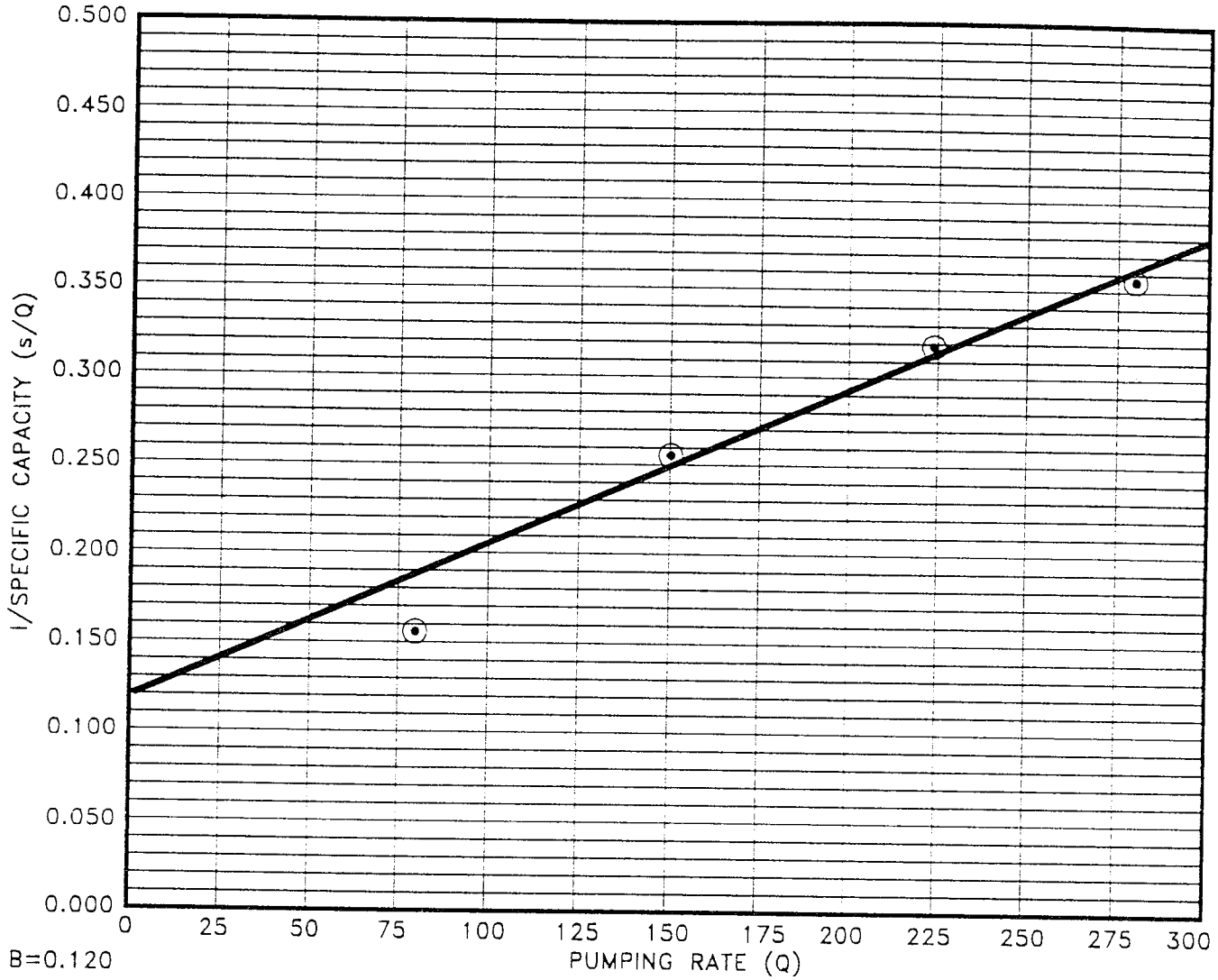
PROJECT NAME: LCU N. RESERVOIR	DWG. NUMBER: A-013892F4-1
PROJECT NUMBER: 01-03892.HQ	DATE: 12/21/98

FIGURE 3-6. SUMMARY OF SPECIFIC CAPACITY DATA AND ANALYSES FOR NORTH RESERVOIR TEST WELL (LM-6208) FOR LOWER HAWTHORN ZONE III (529-619').

LM-6208
NORTH RESERVOIR PACKER TEST #2
WELL EFFICIENCY
$s = BQ + CQ^2$ or $s/Q = B + CQ$
WHERE s = WELL DRAWDOWN
BQ = FORMATION LOSS
CQ^2 = WELL LOSS



Q (GPM)	DRAWDOWN s(FEET)	s/Q	FORMATION LOSS (FT.)	WELL LOSS (FT.)	WELL EFFICIENCY (%)	ESTIMATED TRANSMISSIVITY (gpd/ft)
79	12.01	.152	9.48	2.53	78.9	15,250
150	38.20	.255	18.00	20.20	47.1	
221	68.30	.309	26.52	41.78	38.8	
281	98.71	.351	33.72	64.99	34.2	

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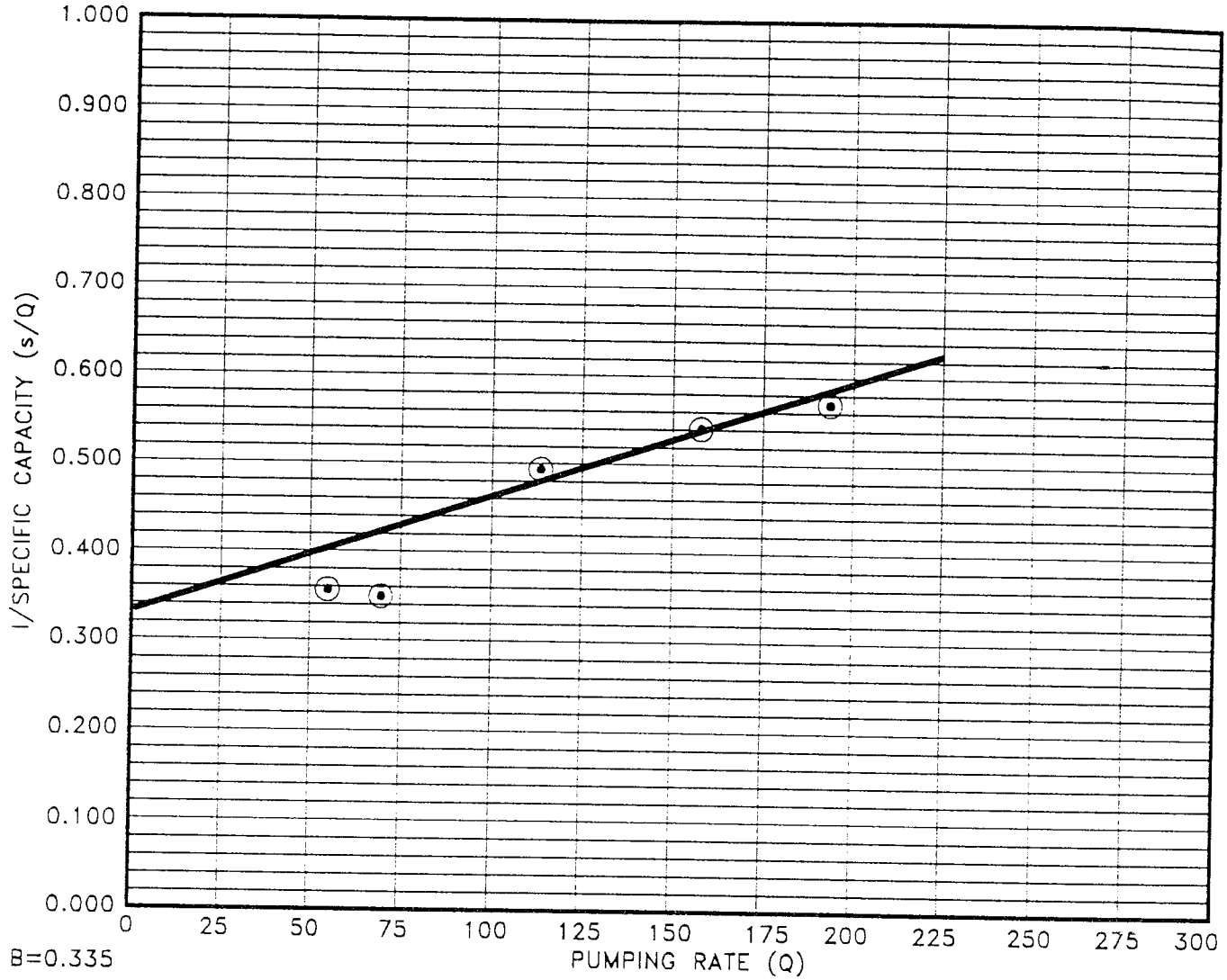
	PROJECT NUMBER: 01-03892.HO	DATE: 12/21/98

FIGURE 3-7. SUMMARY OF SPECIFIC CAPACITY DATA AND ANALYSES FOR NORTH RESERVOIR TEST WELL (LM-6208) FOR SUWANNEE ZONE I (640-703').

LM-6208
OW-1 NORTH RESERVOIR PACKER TEST #3
WELL EFFICIENCY
$s = BQ + CQ^2$ or $s/Q = B + CQ$
WHERE s = WELL DRAWDOWN
BQ = FORMATION LOSS
CQ^2 = WELL LOSS



Q (GPM)	DRAWDOWN s(FEET)	s/Q	FORMATION LOSS (FT.)	WELL LOSS (FT.)	WELL EFFICIENCY (%)	ESTIMATED TRANSMISSIVITY (gpd/ft)
55	19.63	.357	18.43	1.20	88.3	5,100
70	24.25	.346	23.45	0.80	90.9	
115	57.08	.496	38.53	18.55	63.5	
158	84.68	.536	52.93	31.75	58.8	
190	106.88	.563	63.65	43.23	56.0	

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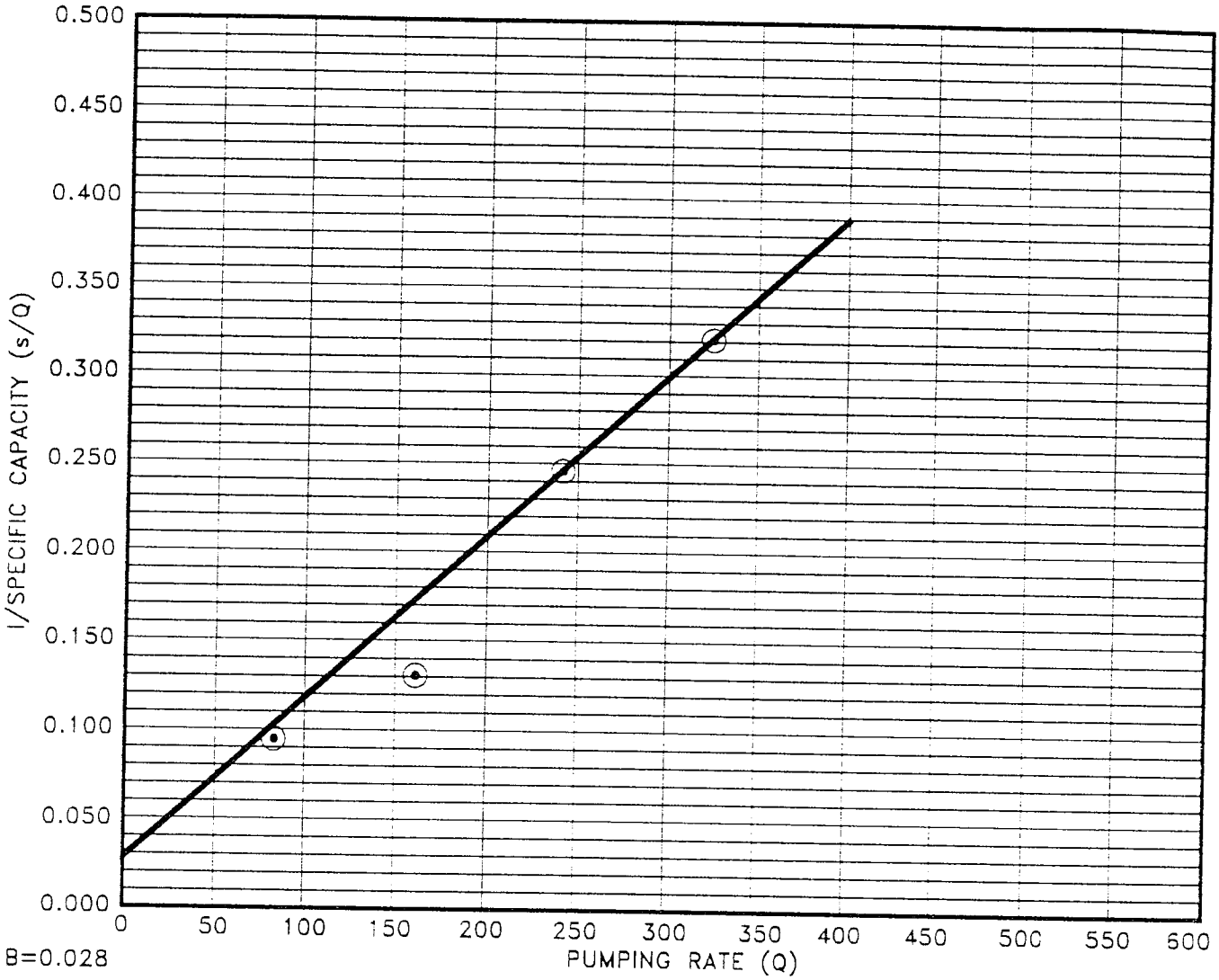
PROJECT NUMBER: 01-03892.HO	DATE: 3/10/99

FIGURE 3-8. SUMMARY OF SPECIFIC CAPACITY DATA AND ANALYSES FOR NORTH RESERVOIR TEST WELL (LM-6208) FOR SUWANNEE ZONE II (808-890').

LM-6208
OW-1 NORTH RESERVOIR PACKER TEST #4
WELL EFFICIENCY
$s = BQ + CQ^2$ or $s/Q = B + CQ$
WHERE s = WELL DRAWDOWN
BQ = FORMATION LOSS
CQ^2 = WELL LOSS



Q (GPM)	DRAWDOWN s(FEET)	s/Q	FORMATION LOSS (FT.)	WELL LOSS (FT.)	WELL EFFICIENCY (%)	ESTIMATED TRANSMISSIVITY (gpd/ft)
85	8.08	.095	2.38	5.70	29.5	71,700
160	20.79	.130	4.48	16.31	21.5	
240	58.76	.245	6.72	52.06	11.4	
322	103.39	.321	9.02	94.37	8.7	

Water Resource Solutions

PROJECT NAME: LCU N. RESERVOIR	DWG. NUMBER: A-013892F7-2
PROJECT NUMBER: 01-03892.HO	DATE: 3/10/99

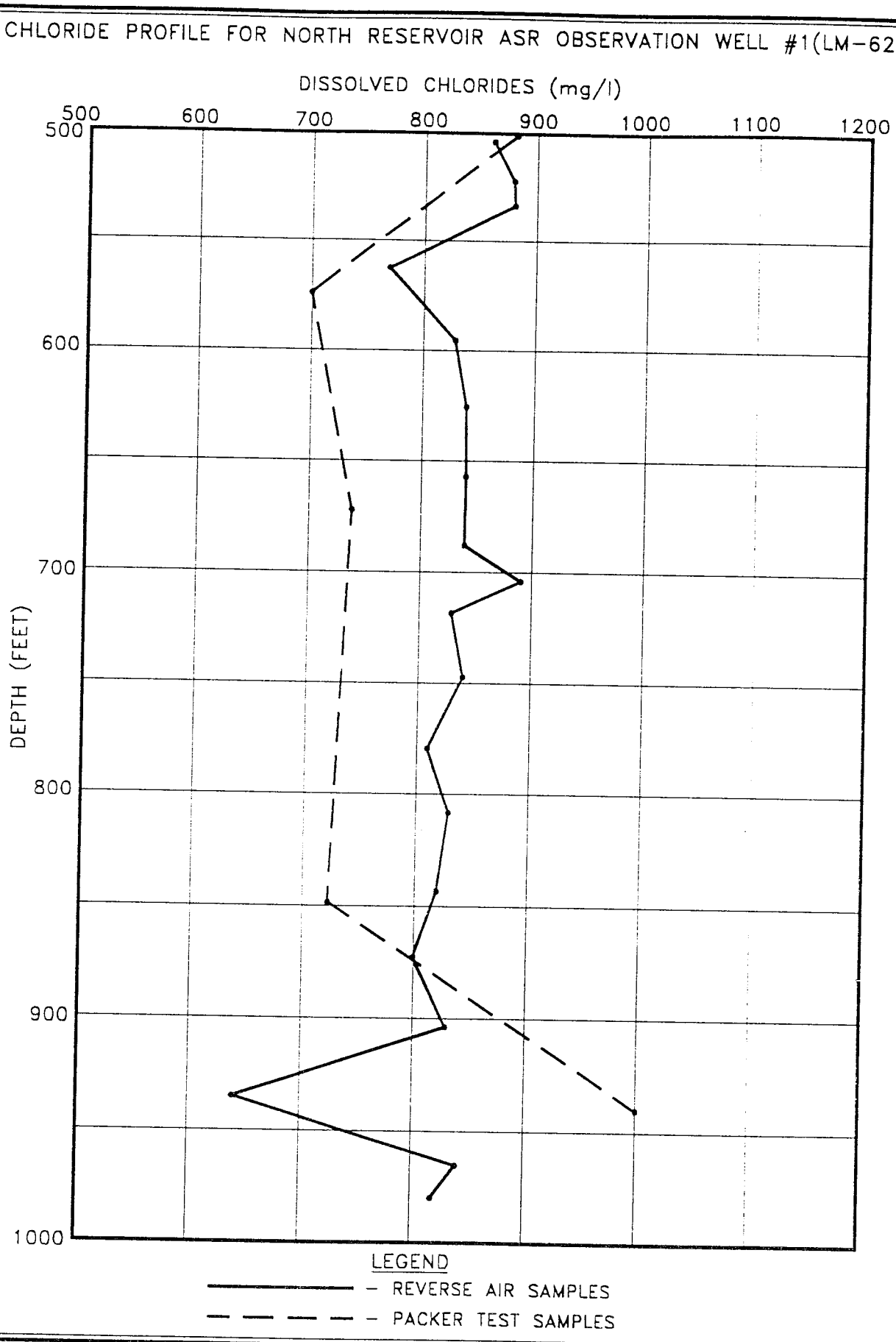
FIGURE 3-9. SUMMARY OF SPECIFIC CAPACITY DATA AND ANALYSES FOR NORTH RESERVOIR TEST WELL (LM-6208) FOR OCALA ZONE 1 (904-977').

TABLE 3-2.

SUMMARY OF NORTH RESERVOIR OBSERVATION WELL #1
TEST DATA

Test #	Zone	Static Water Level (ft ALS)	Dissolved Chlorides (mg/l)	Estimated Transmissivity (gpd/ft)	Overlying Confinement Thickness (ft)	Underlying Confinement Thickness (ft)	Comments
	Lower Hawthorn Zone I (448 - 465')	ND	ND	Not Tested	16	15	Relatively Low Permeability; Used By Wells LM-814 & 4496
1	Lower Hawthorn Zone II (480 - 518')	24.84	880	108,000	15	11	Flowed 1225 gpm; May Be Used By Wells LM-814 & 4496
2	Lower Hawthorn Zone III (529 - 619')	31.33	700	39,000	11	21	
3	Suwannee Zone I (640 - 703')	32.36	740	15,000	21	20	
	Suwannee Zone II (723 - 803')	ND	ND	Not Tested	20	5	Relatively Low Overall Permeability
4	Suwannee Zone III (808-890')	33.00	720	5,000	5	14	
5	Ocala Zone I (904 - 977')	32.91	1000	72,000	14		

ND = No Data



Water Resource Solutions	PROJECT NAME: NORTH RESERVOIR ASR	DWG. NUMBER: A-013892F0-1
	PROJECT NUMBER: 01-03892.H0	DATE: 3/10/99

FIGURE 3-10. CHLORIDE PROFILE FOR NORTH RESERVOIR ASR OBSERVATION WELL #1 (LM-6208).

IV. ASR ZONE SELECTION

A. Selection Criteria

Evaluation criteria utilized herein for potential ASR zones were delineated in a previous report prepared for LCU (ViroGroup, Inc., 1998B). These criteria include: (1) confinement characteristics of the storage zone, (2) areal extent of the storage zone, (3) thickness of the storage zone, (4) hydraulic conductivity (i.e. permeability) of the storage zone, (5) transmissivity of the storage zone (i.e. hydraulic conductivity times thickness), (6) background water quality of the storage zone, (7) general structural characteristics of the storage zone proximal to the injection site, and (8) other existing users of the storage zone. Each of these criteria is discussed in more detail below.

Confinement

Good confinement, above and below a potential storage zone, is an important consideration. The thicker the low permeability confining units, the lower the potential for vertical intrusion of groundwater from adjacent (i.e. above and below) aquifers.

Areal Extent

The required areal extent of the storage zone is dependent not only on its hydraulic characteristics and thickness, but also on the required storage capacity. Required storage capacity is a project-specific parameter that has yet to be determined for this project.

Thickness

The optimum thickness of a storage zone, based upon previous studies in Southwest Florida, is between 40 and 100 feet. Computer simulations of ASR performance using a range of aquifer thickness values indicates that thinner zones result in better recovery efficiencies.

Hydraulic Conductivity

In order to minimize plugging of pore space and also reduce the operating pressure requirements, a bulk hydraulic conductivity in the range of 250 to 600 gallons per day per square foot (gpd/ft^2) is optimal. It is desirable that the permeability be as uniform as possible vertically across the storage interval. The presence of large solution channels or fractures can drastically reduce recovery efficiencies.

Transmissivity

Based upon the thickness and hydraulic conductivity parameters delineated above, as well as on operational testing experience, a transmissivity in the range of 20,000 to 70,000 gallons per day per foot (gpd/ft) is optimal. For large volumes and high rates of injection and recovery, higher transmissivity values may be appropriate.

Native Water Quality

Because some mixing of the injected water with the native groundwater will occur in the storage zone, a native water that is either relatively fresh or slightly brackish is preferred. An upper limit of about 1200 milligrams per liter (mg/l) of dissolved chlorides is preferred.

Structure

The optimum storage site from a structural standpoint is in an anticlinal feature with four way structural closure. Density segregation of the ambient groundwater, and its influence on the injected water, would tend to minimize both migration and diffusion at such a site.

Other Users

Even if the seven preceding evaluation parameters are met for a particular storage zone at a particular site, if a potential storage zone is being utilized nearby for water supply purposes, it may have no value for ASR purposes. In this evaluation, a minimum distance of one mile from any existing user was utilized. Computer impact modelling integrating withdrawal volumes and aquifer parameters will be necessary for more detailed evaluations of interference potential.

B. Evaluation of Zones Encountered at the North Reservoir

A brief description of each of the zones encountered in Observation Well #1 (LM-6208) is provided below. A decision matrix which evaluates each zone relative to the above - described selection criteria is provided on Table 4-1.

Lower Hawthorn Zone I

This zone, found between the depths of 450 and 465 feet in Observation Well #1 (LM-6208), was judged to be too thin and to have a permeability too low to warrant testing. In addition, this zone is used for irrigation supply purposes at the Bayshore Elementary School well (LM-4496) about 1200 feet to the northwest and at the R&D Agricultural property (LM-814) about 900 feet to the southeast.

Lower Hawthorn II

This zone, found between the depths of 480 and 518 feet in Observation Well #1 (LM-6208), had a very high flow rate, estimated to be approximately 1225 gpm. Very good solution porosity was encountered between the depths 482 and 485 feet. In an attempt to restrict this flow, intermediate casing was set 15 feet into this zone at a depth of 495 feet. However, flow from this zone continued throughout the drilling process at high rate.

Lower Hawthorn Zone II interval may be open in either or both nearby off-site wells LM-4496 and LM-814. No lithologic or geophysical logs exist for either well. Well LM-4496 was drilled to a depth of 600 feet and open hole completed between the depths of 300 and 600 feet. That well flowed 15 gpm.

According to the best available information, well LM-814 was drilled in 1944. This well is used to feed a stock pond at a 10 acre parcel south of Bayshore Road that includes a stable. It appears from a review of historical aerial photographs that the pond was enlarged in the early 1980's. According to the owner, in 1981 an approximate 150 foot deep (i.e. Sandstone aquifer) on-site domestic supply well was plugged due to high

TABLE 4-1

DECISION MATRIX FOR SELECTION OF AQUIFER STORAGE AND RECOVERY ZONE
FOR NORTH RESERVOIR SITE

Potential Storage Zone	Confinement Characteristics	Areal Extent	Thickness (40 - 100 feet)	Hydraulic Conductivity (250 - 600 gpd/ft^2)	Transmissivity (20,000 - 70,000 gpd/ft)	Native Water Quality (<1200 mg/l Cl^-)	Structure (High)	Other Users (None)
Lower Hawthorn Zone I (448 - 465')	X	X				X	X	
Lower Hawthorn Zone II (480 - 518')	X	X				X	X	
Lower Hawthorn Zone III (529 - 619')	X	X	X	X	X	X	X	X
Suwanee Zone I (640 - 703')	X	X	X			X	X	X
Suwannee Zone II (723 - 803')	X	X	X			X	X	X
Suwannee Zone III (808 - 890')	X	X	X			X	X	X
Ocala Zone I (904 - 977')	X	X	X			X	X	X

X = Favorable

chloride concentrations. Based upon this information it is concluded that well LM-814 was probably 'short cased' at a depth shallower than 150 feet. This would account for the increase in chloride concentrations in the on-site domestic well. The relatively low static water level (i.e. 24.84 feet above land surface) measured in LM-6208 in this zone at the North Reservoir site, compared to the static water levels in the deeper zones at the site, may also be evidence of nearby use.

Lower Hawthorn Zone III

This zone, found between the depths of 529 and 619 feet in the test well, meets all of the evaluation criteria outlined prior to drilling for an ASR zone. The transmissivity, hydraulic conductivity, and background water quality determined by packer testing are all within an acceptable range. No known users within a two mile radius have been identified. The relatively high static water level tends to confirm that there are no nearby users. This zone was considered the primary ASR target zone prior to drilling.

Suwannee Zone I

This zone, found between the depths of 640 and 703 feet in the test well, was packer tested and found to have a transmissivity below the criteria for an adequate storage zone.

Suwannee Zone II

This zone, found between the depths of 723 and 803 feet in the test well, was judged to have an overall permeability too low to warrant packer testing. Several thin clay zones were present within this interval.

Suwannee Zone III

This zone, found between the depths of 808 and 890 feet in the test well, was packer tested and found to have a transmissivity too low for an adequate storage zone.

Ocala Zone I

This zone, found between the depths of 904 and 977 feet in the test well, was packer tested. Cavernous porosity, typical of that in the Ocala where it is encountered on structural high areas, was present between the depths of 911 and 914 feet. In addition, dolomitization was extensive in the upper part of this unit. Selective dolomitization is a diagenetic occurrence that usually results in porosity enhancement relative to that present in the originally deposited limestone unit.

The transmissivity determined from the packer testing of this interval was slightly above the range previously established for a suitable storage interval. The calculated hydraulic conductivity (i.e. permeability to water) similarly exceeded the high range set for that parameter. Since drilling was terminated in the underlying confining unit in order to perform a packer test, the thickness of the lower confinement was not established. This zone may warrant further evaluation in the future as either a water supply or storage zone at the site.

C. Recommended Storage Zone

Based upon the lithologic, geophysical log, and aquifer test information, it is recommended that Lower Hawthorn Zone III be utilized for the aquifer storage and recovery zone at the North Reservoir site.

V. REFERENCES

ViroGroup, Inc. 1998A, North Reservoir Area of Review, prepared for Hazen and Sawyer, 18p.

ViroGroup, Inc. 1998B, North Lee County Water Treatment Facilities, Task 1.2.1.9 Preliminary Source Water Evaluation Report, prepared for Montgomery Watson Americas, Inc.

APPENDIX A

AREA OF REVIEW

II. AREA OF REVIEW

A - AREA OF REVIEW

The Area of Review conducted for the proposed Lee County North Reservoir pilot ASR well program encompasses twelve square miles (Figure 2-1) with the proposed pilot ASR well at the approximate center.

B - HYDROGEOLOGIC SETTING

The geologic section which will be penetrated by the proposed pilot ASR well (Figure 2-2) ranges in age from Holocene (less than 10,000 years before present) in the near surface to Oligocene (approximately 37 million years ago) at the proposed total depth of 980 feet. A brief description of the lithologic and hydrologic characteristics of each of the formations expected to be penetrated is presented below. In order to show schematically the subsurface geological relationships at the site, a cross-section was constructed. Figure 2-3 shows the line of cross-section, and Plate 1 presents the cross-section.

1. Undifferentiated Holocene Deposits

The undifferentiated Holocene deposits consist of unconsolidated sand, silt, shell, and clay. This stratigraphic unit is approximately 30 feet thick at the site.

2. Tamiami Formation

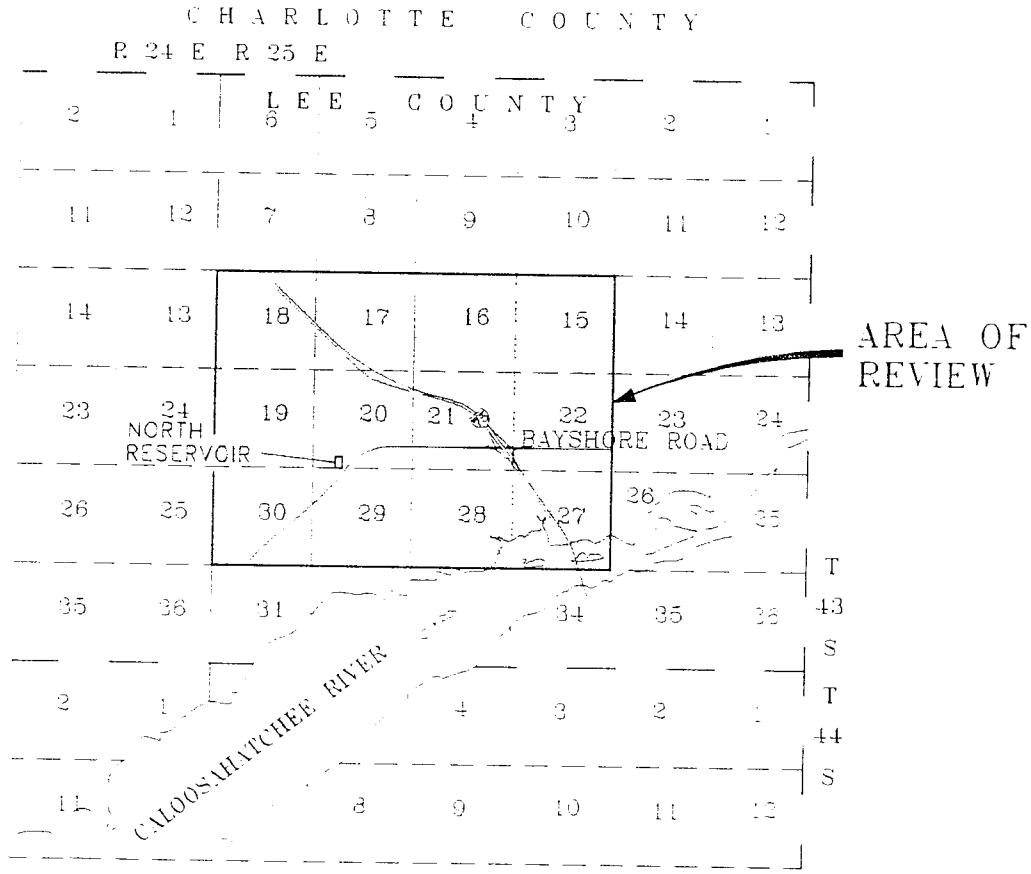
The Tamiami Formation, consists of sandy limestone and clay of Pliocene age (approximately 3.5 to 4.6 million years ago). This stratigraphic unit is about 50 feet thick at the site.

3. Peace River Formation (of Hawthorn Group)

The Peace River formation, which unconformably underlies the Tamiami formation deposits, is the uppermost formation of the Hawthorn Group. The Peace River formation consists of variably indurated phosphatic and calcareous sandstone, unconsolidated sands, silty clays, and sandy limestones. The Peace River formation is Middle Miocene in age (approximately 12 to 15 million years ago) and is up to 140 feet thick at the site.

4. Arcadia Formation (of Hawthorn Group)

The Arcadia formation (of the Hawthorn Group) is, in contrast to overlying stratigraphic units, a predominantly carbonate unit. It consists of interbedded fossiliferous and phosphatic limestones,



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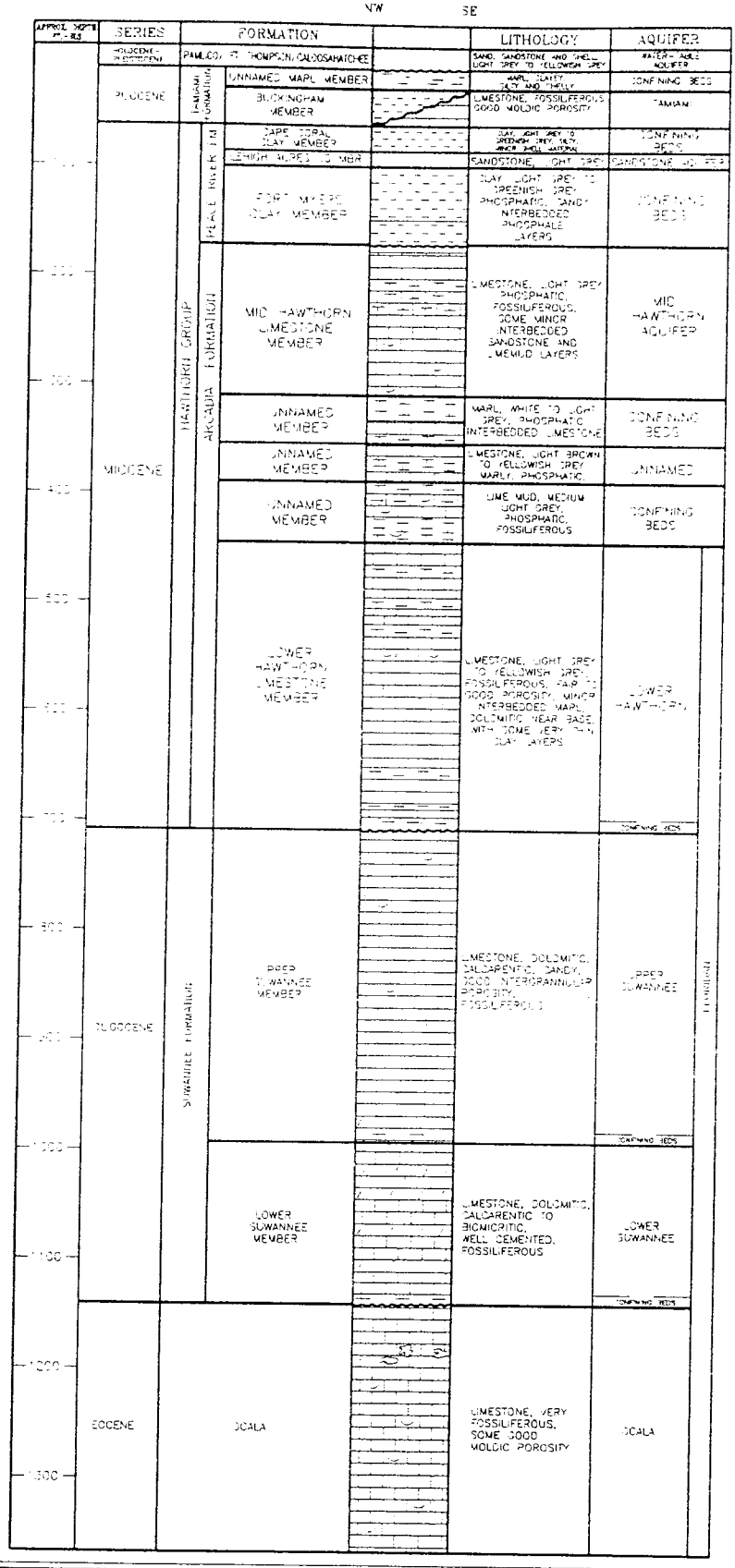
DRN. BY: G.D.S. DWG. NO. A-P108136A4-1 DATE: 05/05/98

PROJECT NAME: LEE COUNTY – NORTH RESERVOIR PILOT ASR NUMBER: P8-10813.01

FIGURE 2-1. MAP SHOWING AREA OF REVIEW.

GENERAL HYDROSTRATIGRAPHIC COLUMN FOR NORTH RESERVOIR AREA



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DRN BY: G.O.S. DWG. NO. A-P10813CA-1 DATE: 04/17/98

PROJECT NAME: LEE COUNTY – NORTH RESERVOIR PILOT ASR NUMBER: P8-10813.01

FIGURE 2-2. GENERALIZED HYDROSTRATIGRAPHIC COLUMN FOR NORTH RESERVOIR AREA.

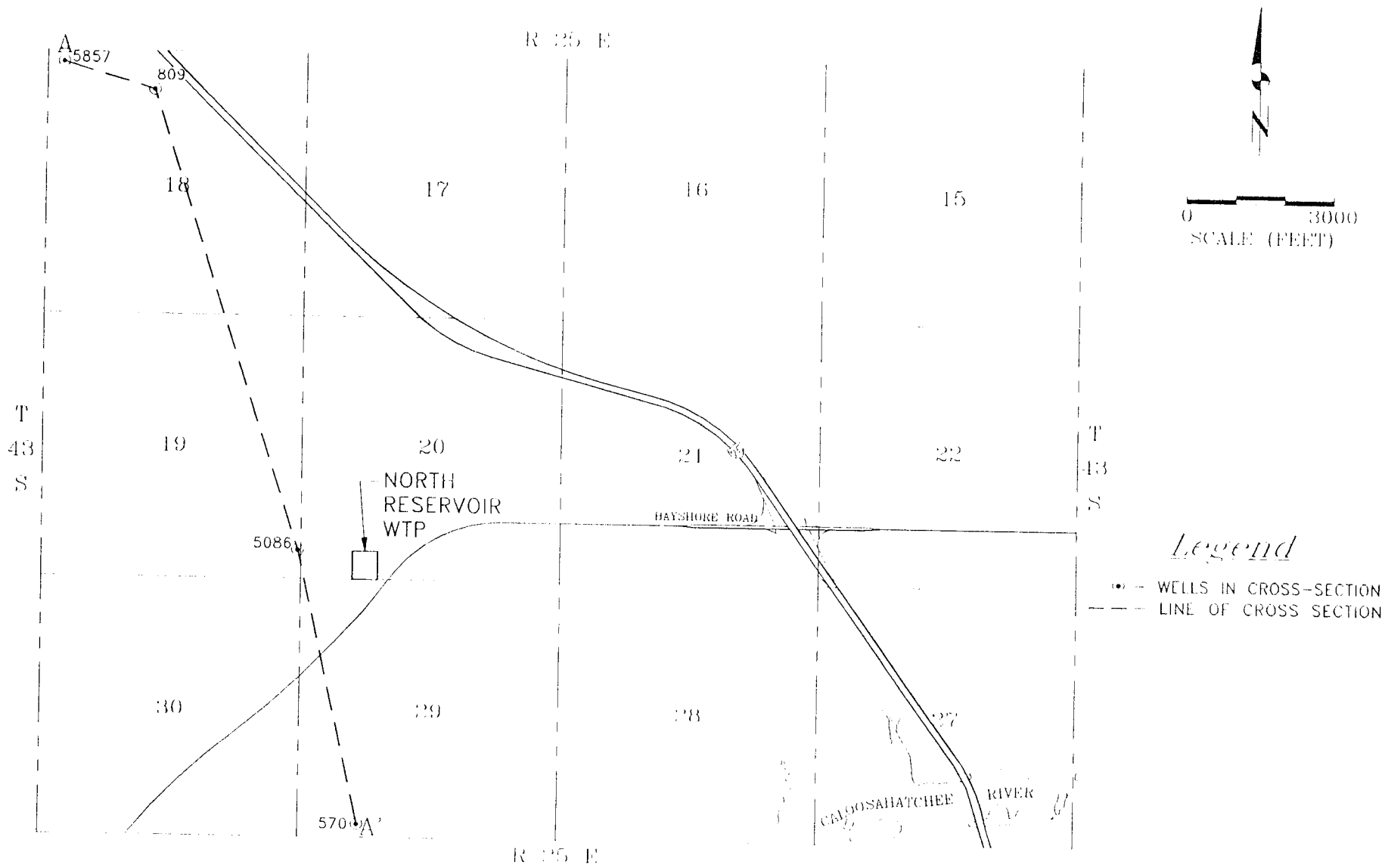

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FIGURE 2-3. MAP SHOWING LINE OF CROSS SECTION.

clays, and marls. The Arcadia formation is Early Miocene in age (17 to 26 million years ago) and is approximately 465 feet thick at the site. The limestones of the lower part of the Arcadia formation exhibit relatively good porosity in western Lee County and comprise the Lower Hawthorn or 'Tampa' aquifer. These limestones are thinner and less transmissive in eastern Lee County. An unconformity is present at the top of the Arcadia formation.

5. Suwannee Formation

The Suwannee formation consists of Oligocene age (29 to 37 mya) fossiliferous, sandy, calcarenitic limestones with some interbedded clays, marls, and dolomite units. The top of the Suwannee formation represents a major unconformity, with a period of approximately 3.5 million years not represented in the stratigraphic record in Southwest Florida. The Suwannee formation is about 475 feet thick at the proposed ASR site.

C - EXISTING LEGAL GROUNDWATER USERS PROXIMAL TO THE PROPOSED ASR SITE

Existing permitted users of groundwater within the area of review are shown on Figure 2-4. Pertinent information for these permits is provided on Table 2-1. All existing permitted users rely upon the water-table, Sandstone, and Mid-Hawthorn aquifers.

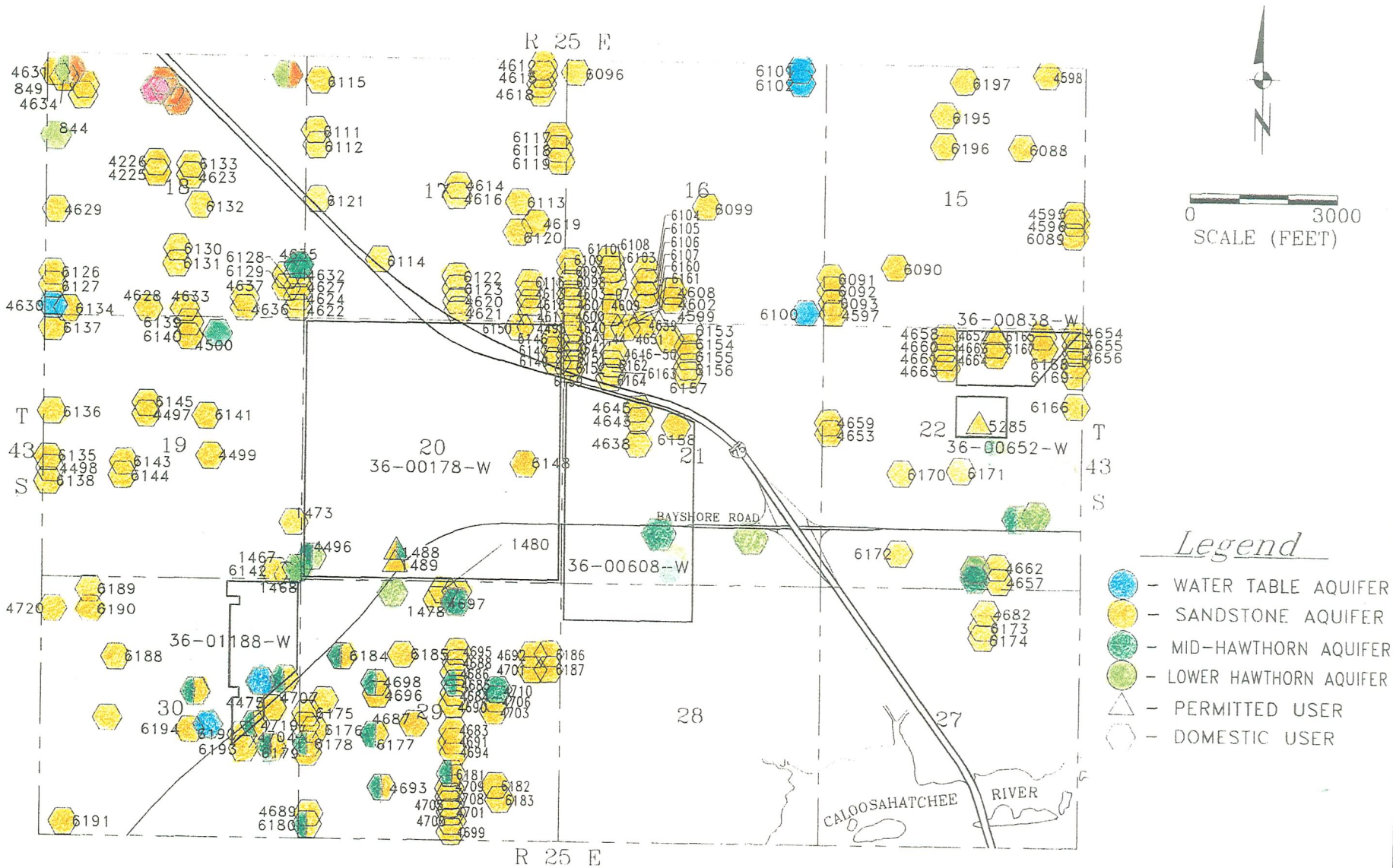
A summary of the pertinent characteristics of all of the inventoried wells is presented on Table 2-2. The location of each of these wells is shown on Figure 2-5.

D - DELINEATION OF THE USDW

The base of the underground source of drinking water (USDW), defined in applicable state and federal regulations as less than 10,000 milligram per liter (mg/l) total dissolved solids (TDS), has not been delineated in any of the deep wells drilled within the area of review (Figure 2-6), but is anticipated to occur at an approximate depth of 1700 feet in the lower part of the Avon Park formation at the proposed Lee County North Reservoir pilot ASR well site. This depth is significantly deeper than the current water production zones at depths above 600 feet at the site. Water quality below 1800 feet at the site is anticipated to deteriorate rapidly with depth and approach seawater quality. Water quality in the prospective ASR zones is anticipated to be essentially slightly brackish, with dissolved chloride concentrations of approximately 800 mg/l and TDS concentrations of about 2000 mg/l.

E - CONFINING BEDS

The confining beds above and below the prospective ASR zones consist of low permeability clays and marls. The precise thickness of these units will be determined during the exploratory drilling program.



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DRN. BY: G.C.S. DWG. NO. A-P10813KC-1 DATE: 05/05/98

PROJECT NAME: LEE COUNTY – NORTH RESERVOIR PILOT ASR PROJECT NUMBER: P8-10813.01

FIGURE 2-4. MAP SHOWING PERMITTED AND OTHER WATER USERS WITHIN THE AREA OF REVIEW.

TABLE 2 - 1 SUMMARY OF NEARBY PERMITTED USERS

Permit #	Permittee	Project	S-T-R	Avg. Day Alloc.	Max Day Alloc.	Aquifer	Water Body	# of Wells	USE
36-00178-W	Lee County Utilities	N. Ft. Myers Wellfield	20-43-25		0.20	SS/MH		2	PWS
36-00608-W	Bonita 75	Bayshore Park	21-43-25		0.05		On-Site Lakes		IRR
36-00652-W	C. Chastain		22-43-25	0.01	0.05	SS		1	AGR
36-00838-W	J. Mason		22-43-25	0.02	0.08	SS		1	AGR
36-01188-W	First Florida Bank	Rainbow Farms Grove	30-43-25	0.10	0.45	WT		2(p)	AGR

TABLE 2 - 2 SUMMARY OF PERTINENT CHARACTERISTICS OF WELLS WITHIN THE AREA OF REVIEW

VGI #	USGS #	SFWMD #	LOCATION	SORT	T.D. (ft.)	C.D. (ft.)	AQUIFER	LITH LOG	GEOPHY LOG	COND	CHLOR	USE	SOURCE	COMMENTS
4595			NE SE 15-43-25	432515	89		SS			900	92	DOM	LCWR	
4596			NE SE 15-43-25	432515	85		SS				172	DOM	LCWR	
4597			SW SW 15-43-25	432515	105		SS				160	IRR	LCWR	
4598			NE NE 15-43-25	432515	100		SS				428	DOM	LCWR	
6195			NE NW 15-43-25	432515	90	73	SS				194	DOM	LCWR	
6196			SE NW 15-43-25	432515	120	75	SS				195	IRR	LCWR	
6197			NW NE 15-43-25	432515	110	74	SS				194	IRR	LCWR	
6088			SE NE 15-43-25	432515	95	60	SS				265	DOM	LCWR	
6089			NE SE 15-43-25	432515	100	60	SS				138	IRR	LCWR	
6090			SE SW 15-43-25	432515	96	72	SS				221	IRR	LCWR	
6091			SW SW 15-43-25	432515	90	70	SS					IRR	LCWR	
6092			SW SW 15-43-25	432515	80	64	SS				168	IRR	LCWR	
6093			SW SW 15-43-25	432515	85	65	SS				180	IRR	LCWR	
4599			SE SW 16-43-25	432516	160		SS				50	DOM	LCWR	
4600			SW SW 16-43-25	432516	115		SS			1300		DOM	LCWR	
4601			SW SW 16-43-25	432516	95		SS			1000	161	DOM	LCWR	
4602			SE SW 16-43-25	432516	95		SS			1000	154	DOM	LCWR	
4603			SW SW 16-43-25	432516	80		SS				161	DOM	LCWR	
4604			SW SW 16-43-25	432516	90		SS				174	DOM	LCWR	
4605			SW SW 16-43-25	432516	92		SS				156	DOM	LCWR	
4606			SW SW 16-43-25	432516	93		SS				146	DOM	LCWR	
4607			SW SW 16-43-25	432516	115		SS				198	DOM	LCWR	
4608			SE SW 16-43-25	432516	90		SS				136	DOM	LCWR	
4609			SW SW 16-43-25	432516	90		SS				144	DOM	LCWR	
6096			NW NW 16-43-25	432516	84	75	SS				170	DOM	LCWR	
6097			SW SW 16-43-25	432516	90	70	SS				190	DOM	LCWR	
6098			SW SW 16-43-25	432516	95	70	SS				210	DOM	LCWR	
6099			NW SE 16-43-25	432516	95	75	SS				142	IRR	LCWR	
6100			SE SE 16-43-25	432516	48	46	WT				200	IRR	LCWR	
6101			NE NE 16-43-25	432516	23	15	WT				10	IRR	LCWR	
6102			NE NE 16-43-25	432516	20	17	WT				40	IRR	LCWR	
6103			SW SW 16-43-25	432516	115	75	SS					IRR	LCWR	
6104			SE SW 16-43-25	432516	120	80	SS				162	DOM	LCWR	
6105			SE SW 16-43-25	432516	110	85	SS					DOM	LCWR	
6106			SE SW 16-43-25	432516	120	80	SS				136	DOM	LCWR	
6107			SE SW 16-43-25	432516	115	75	SS				138	DOM	LCWR	
6108			SW SW 16-43-25	432516	95	80	SS				161	DOM	LCWR	

TABLE 2 - 2 SUMMARY OF PERTINENT CHARACTERISTICS OF WELLS WITHIN THE AREA OF REVIEW

VGI #	USGS #	SFWMD #	LOCATION	SORT	T.D. (ft.)	C.D. (ft.)	AQUIFER	LITH LOG	GEOPHY LOG	COND	CHLOR	USE	SOURCE	COMMENTS
6109			SW SW 16-43-25	432516	90	70	SS				140	DOM	LCWR	
6110			SW SW 16-43-25	432516	100	80	SS				190	DOM	LCWR	
4610			SE SE 17-43-25	432517	92		SS				730	DOM	LCWR	
4611			SE SE 17-43-25	432517	100		SS			2800	600	DOM	LCWR	
4612			NE NE 17-43-25	432517	95		SS			1700	310	DOM	LCWR	
4613			SE SE 17-43-25	432517	120		SS			1500	336	DOM	LCWR	
4614			NW SE 17-43-25	432517	120		SS			1500	326	DOM	LCWR	
4615			NE NE 17-43-25	432517	125		SS			1100	160	DOM	LCWR	
4616			NW SE 17-43-25	432517	110		SS				385	DOM	LCWR	
4617			NE NE 17-43-25	432517	100		SS				114	DOM	LCWR	
4618			NE NE 17-43-25	432517	100		SS				222	DOM	LCWR	
4619			NE SE 17-43-25	432517	85		SS				205	DOM	LCWR	
4620			SW SE 17-43-25	432517	110		SS				324	DOM	LCWR	
4621			SW SE 17-43-25	432517	100		SS				584	DOM	LCWR	
6111			SW NW 17-43-25	432517	115	74	SS				253	IRR	LCWR	
6112			SW NW 17-43-25	432517	115	75	SS				410	DOM	LCWR	
6113			NE SE 17-43-25	432517	94	66	SS				290	DOM	LCWR	
6114			SE SW 17-43-25	432517	100	80	SS				148	RP	LCWR	
6115			NW NW 17-43-25	432517	100	75	SS				315	DOM	LCWR	
6116			SE SE 17-43-25	432517	94	75	SS				280	DOM	LCWR	
6117			SE NE 17-43-25	432517	94	74	SS					IRR	LCWR	
6118			SE NE 17-43-25	432517	120	78	SS				286	DOM	LCWR	
6119			SE NE 17-43-25	432517	100	72	SS				255	DOM	LCWR	
6120			NE SE 17-43-25	432517	100	80	SS				292	DOM	LCWR	
6121			NW SW 17-43-25	432517	114	80	SS				350	DOM	LCWR	
6122			SW SE 17-43-25	432517	115	78	SS				358	DOM	LCWR	
6123			SW SE 17-43-25	432517	95	80	SS				330	DOM	LCWR	
808	L-277		NE NW 18-43-25	432518	1000		SU			1800	1020	IND	USGS	
809	L-278		NE NW 18-43-25	432518	900		SU	X				IND	USGS	
810	L-279		NE NW 18-43-25	432518	1300		OC					IND	USGS	
811	L-280		NE NW 18-43-25	432518	103		SS					OBS	USGS	
812	L-281		NE NW 18-43-25	432518	904		SU					IND	USGS	
823	L-725		SE NE 18-43-25	432518	121	81	SS	X	X	650	215	OBS	USGS	
844	L-1211		SW NW 18-43-25	432518			LH				920	STOCK	USGS	TDS=4500
845			NE SW 18-43-25	432518			SS					OBS	USGS	
849			NW NW 18-43-25	432518			SS					OBS	USGS	
4622			SE SE 18-43-25	432518	100		SS				118	RP	LCWR	
4623			SW NE 18-43-25	432518	100		SS			1200	240	DOM	LCWR	

TABLE 2 - 2 SUMMARY OF PERTINENT CHARACTERISTICS OF WELLS WITHIN THE AREA OF REVIEW

VGI #	USGS #	SFWMD #	LOCATION	SORT	T.D. (ft.)	C.D. (ft.)	AQUIFER	LITH LOG	GEOPHY LOG	COND	CHLOR	USE	SOURCE	COMMENTS
4624			SE SE 18-43-25	432518	120		SS			1500	215	DOM	LCWR	
4625			SE NW 18-43-25	432518	120		SS			1900	755	IRR	LCWR	
4626			SE NW 18-43-25	432518	105		SS			1050	158	DOM	LCWR	
4627			SE SE 18-43-25	432518	60		SS				186	DOM	LCWR	
4628			SE SW 18-43-25	432518	102		SS			1100	154	DOM	LCWR	
4629			NW SW 18-43-25	432518	94		SS			1400	310	DOM	LCWR	
4630			SW SW 18-43-25	432518	41		WT			900	74	DOM	LCWR	
4631			NW NW 18-43-25	432518	105		SS			1100	180	DOM	LCWR	
4632			SE SE 18-43-25	432518	210		MH			1300	266	DOM	LCWR	
4633			SW SE 18-43-25	432518	85		SS				231	IRR	LCWR	
4634			NW NW 18-43-25	432518	145		SS				710	DOM	LCWR	
4635			SE SE 18-43-25	432518	81		SS				264	DOM	LCWR	
4636			SE SE 18-43-25	432518	100		SS				218	DOM	LCWR	
4637			SE SE 18-43-25	432518	85		SS				320	DOM	LCWR	
5269			NE NW 18-43-25	432518	898		SU	X				IRR	BOG	FGS # W-618
5857		WA-414	NW NW 18-43-25	432518	980	170	MH/LH/SU		X			IRR	SFWMD	
5858		WA-689	NE NE 18-43-25	432518	894	210	MH/LH/SU		X			IRR	SFWMD	
6124			NW NW 18-43-25	432518	100	80	SS				800	DOM	LCWR	
6125			NW NW 18-43-25	432518	112	95	SS				150	DOM	LCWR	
6126			SW SW 18-43-25	432518	100	75	SS				183	DOM	LCWR	
6127			SW SW 18-43-25	432518	100	77	SS				175	IRR	LCWR	
6128			SE SE 18-43-25	432518	96	76	SS				328	DOM	LCWR	
6129			SE SE 18-43-25	432518	90	70	SS				360	DOM	LCWR	
6130			SW SE 18-43-25	432518	80	62	SS				62	DOM	LCWR	
6131			SW SE 18-43-25	432518	75	63	SS				310	DOM	LCWR	
6132			NW SE 18-43-25	432518	90	70	SS					TEST	LCWR	
6133			SW NE 18-43-25	432518	120	75	SS				240	DOM	LCWR	
6134			SW SW 18-43-25	432518	96	78	SS					DOM	LCWR	
5086		WA-297	SE SE 19-43-25	432519	730	140	SS/H/SU		X	3000	831	IRR	SFWMD	PLGD 4/25/83, F 10 gpm
1467			SE SE 19-43-25	432519			SS				170	DOM	OWNER	
1468			SE SE 19-43-25	432519	600		LH				860	STOCK	OWNER	
1473			SE SE 19-43-25	432519	90		SS				250	STOCK	OWNER	
4497			SE NW 19-43-25	432519	145		SS				276	DOM	LCWR	
4498			NW SW 19-43-25	432519	90		SS			1000	122	PWS	LCWR	
4499			NW SE 19-43-25	432519	90		SS			1400	178	DOM	LCWR	
4500			NW NE 19-43-25	432519	215		MH			600	144	DOM	LCWR	
5859		WA-929	19-43-25	432519	626	125	MH/LH		X			IRR	SFWMD	PLUGGED 2/19/88
6135			NW SW 19-43-25	432519	100	70	SS				80	DOM	LCWR	

TABLE 2 - 2 SUMMARY OF PERTINENT CHARACTERISTICS OF WELL WITHIN THE AREA OF REVIEW

6136			SW NW 19-43-25	432519	97	77	SS				145		LCWR	
6137			NW NW 19-43-25	432519	95	74	SS				80	DOM	LCWR	
6138			NW SW 19-43-25	432519	115	73	SS					DOM	LCWR	
6139			NW NE 19-43-25	432519	80	68	SS				204	DOM	LCWR	
6140			NW NE 19-43-25	432519	80	68	SS				214	DOM	LCWR	
6141			SW NE 19-43-25	432519	113	73	SS				196	DOM	LCWR	
6142			SE SE 19-43-25	432519	85	65	SS				136	IRR	LCWR	
6143			NE SW 19-43-25	432519	91	71	SS				132	DOM	LCWR	
6144			NE SW 19-43-25	432519	100	60	SS				127	DOM	LCWR	
6145			SE NW 19-43-25	432519	97	57	SS				116	DOM	LCWR	
1463			SE SW 20-43-25	432520	200	140	SS/MH			900	80	TEST	TEST DRILLING	WUP # 00178-W
1464			SE SW 20-43-25	432520	95	65	SS			710	160	OBS	DRILLING	WUP # 00178-W
1466			SE SW 20-43-25	432520							190	DOM	OWNER	
1488			SE SW 20-43-25	432520	198		SS/MH			900	80	OBS	DRILLING	WUP # 00178-W
1489			SE SW 20-43-25	432520	105	64	SS				164	PWS	DRILLING	WUP # 00178-W
1491			SW NE 20-43-25	432520	120	85	SS	X			480	OBS	FIELD RECON	
1493			SW NE 20-43-25	432520							250	IRR	FIELD RECON	
4495			NE NE 20-43-25	432520	95		SS			1200	156	DOM	LCWR	
4496			SW SW 20-43-25	432520	600		LH			2600	520	IRR	LCWR	BAYSHORE ELEM.; F15gpm
6146			NE NE 20-43-25	432520	118	100	SS				430	IRR	LCWR	
6147			NE NE 20-43-25	432520	118	100	SS				244	IRR	LCWR	
6148			NE SE 20-43-25	432520	180		SS					IRR	LCWR	
6149			NE NE 20-43-25	432520	120	80	SS				184	IRR	LCWR	
6150			NE NE 20-43-25	432520	105	65	SS				160	DOM	LCWR	
1490			NW SW 21-43-25	432521	100	67	SS				240	OBS	FIELD RECON	
815	L-284		SW SW 21-43-25	432521	100		SS					STOCK	USGS	
816	L-285		SE SW 21-43-25	432521	500		LH					DOM	USGS	
846	L-1213		SW SE 21-43-25	432521			LH				720	STOCK	USGS	TDS=2200
1486			SW SW 21-43-25	432521							340	PWS	FIELD RECON	
1487			NW SW 21-43-25	432521	105		SS				510	DOM	OWNER	
4638			SE NW 21-43-25	432521	95		SS				149	DOM	LCWR	
4639			NE NW 21-43-25	432521	100		SS			1000	166	DOM	LCWR	
4640			NW NW 21-43-25	432521	120		SS			1200	180	DOM	LCWR	
4641			NW NW 21-43-25	432521	100		SS			1000	182	DOM	LCWR	
4642			NW NW 21-43-25	432521	95		SS			2300		DOM	LCWR	
4643			SE NW 21-43-25	432521	95		SS			1300	202	DOM	LCWR	
4644			NW NW 21-43-25	432521	100		SS			2500	302	DOM	LCWR	
4645			SE NW 21-43-25	432521	91		SS			900	100	DOM	LCWR	

TABLE 2 - 2 SUMMARY OF PERTINENT CHARACTERISTICS OF WELLS WITHIN THE AREA OF REVIEW

VGI #	USGS #	SFWMD #	LOCATION	SORT	T.D. (ft.)	C.D. (ft.)	AQUIFER	LITH LOG	GEOPHY LOG	COND	CHLOR	USE	SOURCE	COMMENTS
4646			NW NW 21-43-25	432521	76		SS			1200	180	DOM	LCWR	
4647			NW NW 21-43-25	432521	90		SS			1000	155	DOM	LCWR	
4648			NW NW 21-43-25	432521	102		SS			2700	670	DOM	LCWR	
4649			NW NW 21-43-25	432521	135		SS				302	DOM	LCWR	
4650			NW NW 21-43-25	432521	115		SS				186	DOM	LCWR	
4651			NE NW 21-43-25	432521	125		SS				180	DOM	LCWR	
6151			NW NW 21-43-25	432521	120	90	SS				700	DOM	LCWR	
6152			NW NW 21-43-25	432521	120	80	SS				282	DOM	LCWR	
6153			NE NW 21-43-25	432521	92	70	SS				92	RP	LCWR	
6154			NE NW 21-43-25	432521	115	80	SS				160	DOM	LCWR	
6155			NE NW 21-43-25	432521	120	80	SS				52	DOM	LCWR	
6156			NE NW 21-43-25	432521	125	80	SS					DOM	LCWR	
6157			NE NW 21-43-25	432521	100	90	SS				130	DOM	LCWR	
6158			SE NW 21-43-25	432521	100	82	SS				142	DOM	LCWR	
6159			NW NW 21-43-25	432521	100	80	SS				168	DOM	LCWR	
6160			NW NW 21-43-25	432521	120	85	SS				200	DOM	LCWR	
6161			NW NW 21-43-25	432521	100	80	SS				171	DOM	LCWR	
6162			NW NW 21-43-25	432521	104	84	SS				168	DOM	LCWR	
6163			NW NW 21-43-25	432521	110	60	SS				184	DOM	LCWR	
6164			NW NW 21-43-25	432521	100	65	SS				565	DOM	LCWR	
571	L-1986		SE SW 22-43-25	432522	185		MH	X	X			TEST	USGS	
817	L-296		NE SE 22-43-25	432522	83		SS					DOM	USGS	
818	L-287		NE SE 22-43-25	432522	652		LH					STOCK	USGS	
826	L-903		NW SE 22-43-25	432522	665	107	SS/MH/LH			2000	685	IRR	USGS	
847	L-1214		SW SE 22-43-25	432522			LH				800	OBS	USGS	TDS=2200
859	L-2107		SW SE 22-43-25	432522	500		LH				1000	OBS	USGS	
4652			NW NE 22-43-25	432522	120		SS				224	IRR	LCWR	WUP # 36-00838-W
4653			SW NW 22-43-25	432522	100		SS			900	165	DOM	LCWR	
4654			NE NE 22-43-25	432522	110		SS			1300	235	DOM	LCWR	
4655			NE NE 22-43-26	432522	85		SS			3100	690	DOM	LCWR	
4656			NE NE 22-43-27	432522	100		SS			1200	204	DOM	LCWR	
4657			SW SE 22-43-25	432522	90		SS			3200	770	DOM	LCWR	
4658			NE NW 22-43-25	432522	135		SS			1000	190	DOM	LCWR	
4659			SW NW 22-43-25	432522	120		SS			900		DOM	LCWR	
4660			NE NW 22-43-25	432522	115		SS			1150	182	DOM	LCWR	
4661			NE NW 22-43-25	432522	115		SS				87	DOM	LCWR	
4662			SW SE 22-43-25	432522	105		SS				276	DOM	LCWR	
4663			NW NE 22-43-25	432522	100		SS				182	TEST	LCWR	

TABLE 2 - 2 SUMMARY OF PERTINENT CHARACTERISTICS OF WELLS WITHIN THE AREA OF REVIEW

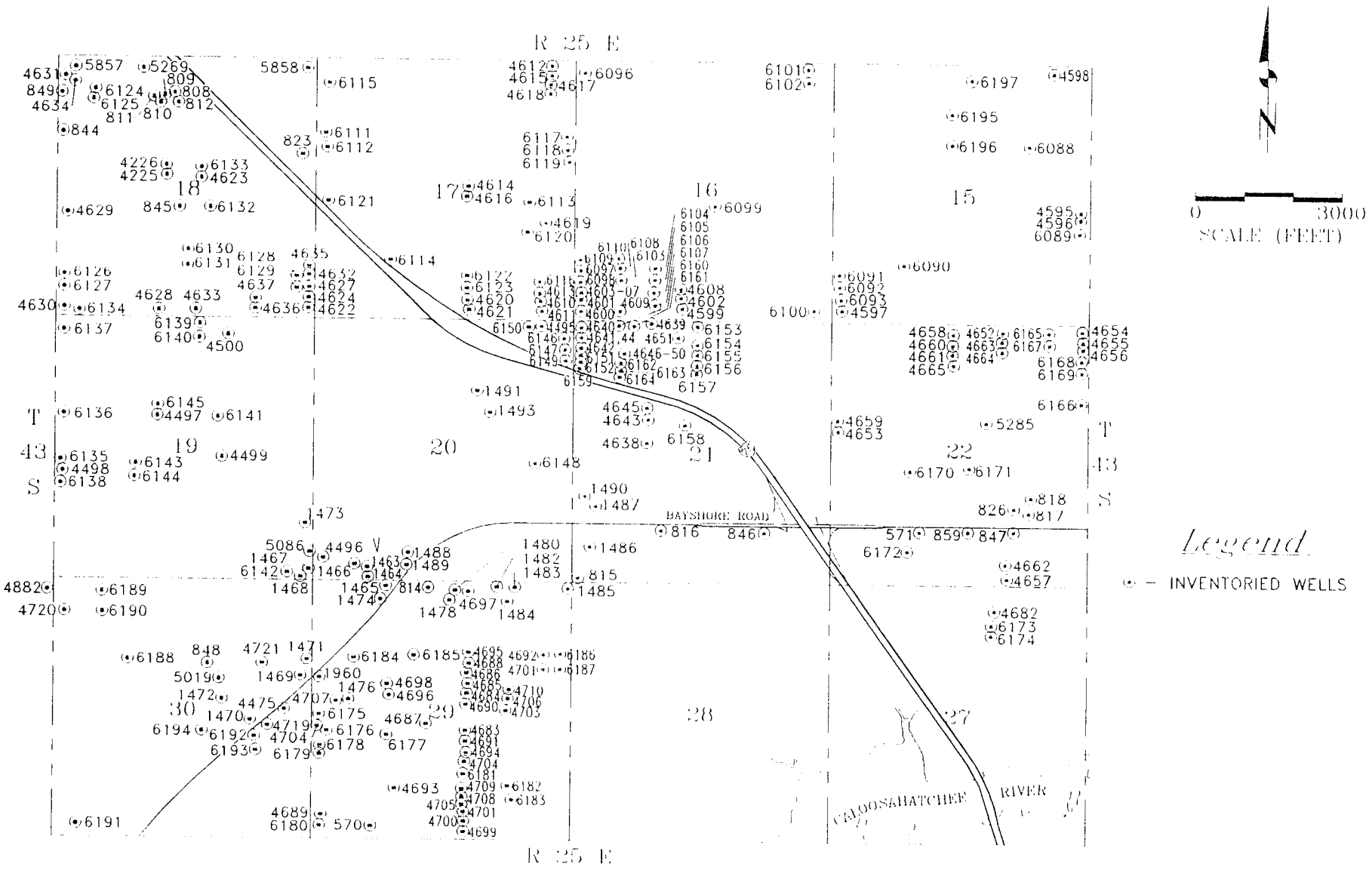
VGI #	USGS #	SFWMD #	LOCATION	SORT	T.D. (ft.)	C.D. (ft.)	AQUIFER	LITH LOG	GEOPHY LOG	COND	CHLOR	USE	SOURCE	COMMENTS
4664			NW NE 22-43-25	432522	105		SS				196	TEST	LCWR	
4665			NE NW 22-43-25	432522	100		SS				182	DOM	LCWR	
5285			SW NE 22-43-25	432522			SS					IRR	SFWMD	WUP # 36-00652-W
6165			NE NE 22-43-25	432522	90	70	SS				380	DOM	LCWR	
6166			SE NE 22-43-25	432522	100	80	SS				260	DOM	LCWR	
6167			NE NE 22-43-25	432522	100	60	SS				176	DOM	LCWR	
6168			NE NE 22-43-25	432522	110	70	SS				355	DOM	LCWR	
6169			NE NE 22-43-25	432522	110	75	SS				690	DOM	LCWR	
6170			NE SW 22-43-25	432522	108	68	SS					DOM	LCWR	
6171			NW SE 22-43-25	432522	84	75	SS				180	DOM	LCWR	
6172			SE SW 22-43-25	432522	120	80	SS				310	DOM	LCWR	
4682			NW NE 27-43-25	432527	70		SS			1000	182	DOM	LCWR	
6173			NW NE 27-43-25	432527	80	61	SS				149	DOM	LCWR	
6174			NW NE 27-43-25	432527	80	61	SS				47	DOM	LCWR	
1478			NE NW 29-43-25	432529			SS				160	DOM	FIELD RECON	
1479			NW NE 29-43-25	432529	220		MH				140	DOM	OWNER	
1480			NW NE 29-43-25	432529			SS				80	IRR	OWNER	
570	L-637		SW SW 29-43-25	432529	300		MH	X	X			TEST	USGS	
814	L-283		NE NW 29-43-25	432529	500		MH					STOCK	USGS	
1465			NE NW 29-43-25	432529	50		SS				40	DOM	OWNER	
1474			NE NW 29-43-25	432529			SS				150	DOM	TENANT	
1476			SW NW 29-43-25	432529	92		SS				100	IRR	FIELD RECON	
1477			NW SW 29-43-25	432529	66	34	SS				110	DOM	FIELD RECON	
1481			NW NE 29-43-25	432529			SS				140	DOM	OWNER	
1482			NW NE 29-43-25	432529			SS				270	DOM	FIELD RECON	
1483			NE NE 29-43-25	432529			SS				280	DOM	OWNER	
1484			NW NE 29-43-25	432529	87		SS				260	DOM	OWNER	
1485			NE NE 29-43-25	432529			SS				90	DOM	FIELD RECON	
1960			SW NW 29-43-25	432529								DOM	FIELD RECON	
4683			NW SE 29-43-25	432529	185		SS			1000		IRR	LCWR	
4684			SW NE 29-43-25	432529	180		SS			1300	176	IRR	LCWR	
4685			SW NE 29-43-25	432529	190		SS/MH			3700	550	IRR	LCWR	
4686			SW NE 29-43-25	432529	90		SS			900	96	IRR	LCWR	
4687			NE SW 29-43-25	432529	180		SS			1100	155	IRR	LCWR	
4688			SW NE 29-43-25	432529	85		SS			900	100	IRR	LCWR	
4689			SW SW 29-43-25	432529	80		SS			950	80	DOM	LCWR	
4690			SW NE 29-43-25	432529	160		SS			2300	522	IRR	LCWR	
4691			NW SE 29-43-25	432529	160		SS			1100	195	IRR	LCWR	

TABLE 2 - 2 SUMMARY OF PERTINENT CHARACTERISTICS OF WELLS WITHIN THE AREA OF REVIEW

VGI #	USGS #	SFWMD #	LOCATION	SORT	T.D. (ft.)	C.D. (ft.)	AQUIFER	LITH LOG	GEOPHY LOG	COND	CHLOR	USE	SOURCE	COMMENTS
4692			SE NE 29-43-25	432529	180		SS			900	82	IRR	LCWR	
4693			SE SW 29-43-25	432529	200		SS/MH			1000	148	IRR	LCWR	
4694			NW SE 29-43-25	432529	180		SS			700	60	IRR	LCWR	
4695			SW NE 29-43-25	432529	180		SS			1300	254	IRR	LCWR	
4696			SE NW 29-43-25	432529	180		SS			1050	121	IRR	LCWR	
4697			NW NE 29-43-25	432529	60		SS			1100	168	DOM	LCWR	
4698			SE NW 29-43-25	432529	200		SS/MH			1200	170	DOM	LCWR	
4699			SW SE 29-43-25	432529	72		SS			1400	252	IRR	LCWR	
4700			SW SE 29-43-25	432529	176		SS				145	IRR	LCWR	
4701			SW SE 29-43-25	432529	167		SS				172	IRR	LCWR	
4702			SE NE 29-43-25	432529	180		SS				157	IRR	LCWR	
4703			SW NE 29-43-25	432529	78		SS				144	IRR	LCWR	
4704			NW SW 29-43-25	432529	100		SS				84	DOM	LCWR	
4705			SW SE 29-43-25	432529	180		SS				525	DOM	LCWR	
4706			SW NE 29-43-25	432529	180		SS				173	IRR	LCWR	
4707			SW NW 29-43-25	432529	58		SS				142	IRR	LCWR	
4708			SW SE 29-43-25	432529	90		SS				234	DOM	LCWR	
4709			SW SE 29-43-25	432529	180		SS				240	IRR	LCWR	
4710			SW NE 29-43-25	432529	260		MH				72	IRR	LCWR	
6175			NW SW 29-43-25	432529	78	62	SS				118	IRR	LCWR	
6176			NW SW 29-43-25	432529	75	66	SS				160	DOM	LCWR	
6177			NE SW 29-43-25	432529	240	140	SS/MH				188	DOM	LCWR	
6178			NW SW 29-43-25	432529	200	140	SS/MH				128	DOM	LCWR	
6179			NW SW 29-43-25	432529	80	58	SS				87	DOM	LCWR	
6180			SW SW 29-43-25	432529	247	160	SS/MH				115	DOM	LCWR	
6181			NW SE 29-43-25	432529	195	140	SS/MH				171	IRR	LCWR	
6182			SW SE 29-43-25	432529	140	134	SS				400	DOM	LCWR	
6183			SW SE 29-43-25	432529	180	135	SS				372	DOM	LCWR	
6184			SW NW 29-43-25	432529	220	145	SS/MH				146	IRR	LCWR	
6185			SE NW 29-43-25	432529	120	80	SS				110	IRR	LCWR	
6186			SE NE 29-43-25	432529	85	60	SS				222	DOM	LCWR	
6187			SE NE 29-43-25	432529	90	65	SS				230	IRR	LCWR	
1469			SE NE 30-43-25	432530	190		MH				120	DOM	OWNER	
1470			NW SE 30-43-25	432530	50	15	WT				360	IRR	OWNER	
1471			SE NE 30-43-25	432530			SS				460	IRR	OWNER	
1472			SW NE 30-43-25	432530			SS				840	STOCK	OWNER	
4719			NE SE 30-43-25	432530	190		MH				1192	IRR	LCWR	
4720			NW NW 30-43-25	432530	110		SS				206	DOM	LCWR	

TABLE 2 - 2 SUMMARY OF PERTINENT CHARACTERISTICS OF WELLS WITHIN THE AREA OF REVIEW

VGI #	USGS #	SFWMD #	LOCATION	SORT	T.D. (ft.)	C.D. (ft.)	AQUIFER	LITH LOG	GEOPHY LOG	COND	CHLOR	USE	SOURCE	COMMENTS
4721			SE NE 30-43-25	432530	35		WT			1600	328	IRR	LCWR	
5019	L-1216	WA-170	SW NE 30-43-25	432530	476	170	SS/MH		X	2900	719	IRR	SFWMD	PLGD 2/25/82, F 260gpm
6188			SE NW 30-43-25	432530	100	70	SS				150	DOM	LCWR	
6189			NW NW 30-43-25	432530	97	80	SS				85	TEST	LCWR	
6190			NW NW 30-43-25	432530	100	60	SS				112	DOM	LCWR	
6191			SW SW 30-43-25	432530	120	95	SS				472	DOM	LCWR	
6192			NE SE 30-43-25	432530	220	180	SS/MH				310	IRR	LCWR	
6193			NE SE 30-43-25	432530	110	70	SS				730	IRR	LCWR	
6194			NW SE 30-43-25	432530	125	80	SS				500	IRR	LCWR	



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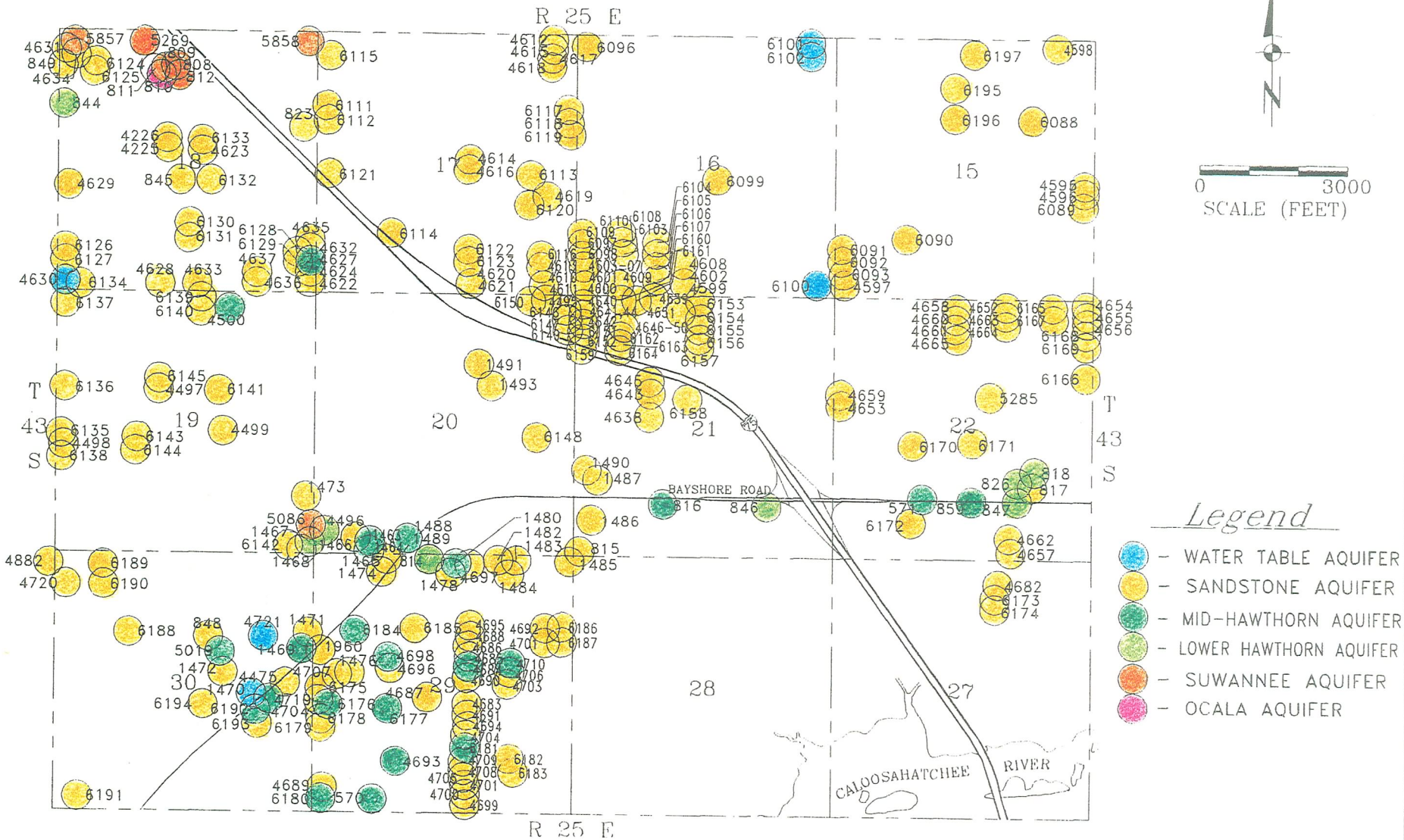
AIR • WATER • SOIL TECHNOLOGY

DRN. BY: G.C.S. CHK. BY: A. PROBST/S.B.T. DATE: 05/05/08

PROJECT NAME: LEE COUNTY NORTH RESERVOIR PILOT ASR PROJECT NUMBER: PR 10815.01

FIGURE 2-5. MAP SHOWING LOCATION OF INVENTORIED WELLS IN AREA OF REVIEW.



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AIR • WATER • SOIL TECHNOLOGY

DRN. BY: G.C.S. DWG. NO. A-P10813KB-1 DATE: 05/05/98

PROJECT NAME: LEE COUNTY - NORTH RESERVOIR PILOT ASR PROJECT NUMBER: P8-10813.01

FIGURE 2-6. DEPTH OF PENETRATION MAP.

F - MAPPED OR KNOWN FAULTS

Based upon a review of available published data, no known or mapped faults have been identified within the Area of Review.

G - PROPOSED ASR ZONE

The precise ASR zone will be determined by testing in the exploratory well. Intervals of porous limestones within the Lower Hawthorn and Suwannee aquifers are the most prospective. The proposed total depth of 980 feet for the Lee County North Reservoir pilot ASR well should provide for evaluation of enough zones to identify an interval with adequate transmissivity to store anticipated available excess treated water from a water treatment plant during the off-peak season.

H - INJECTION AND PETROLEUM TEST WELLS

There are no injection wells within the Area of Review. There are no producing petroleum wells located within the Area of Review. Petroleum test wells are located in the general vicinity of the ASR site, but outside of the Area of Review.

APPENDIX B

WELL PROGNOSIS

WELL PROGNOSIS

PROJECT NAME: Lee County North Reservoir ASR Program
PROJECT NUMBER:
WELL NAME: ASR Test Well LM-6198
LOCATION: SW SW Sec. 20, T43S, R25E
ELEVATION: Est. 12' (GL)

ANTICIPATED STRATIGRAPHIC TOPS:

	Surface
Pamlico/Ft. Thompson Fm. (Holocene-Pleistocene)	NP
Pinecrest/Ochopee Mbrs. of Tamiami Fm. (Pliocene)	30'
Cape Coral Clay Mbr. of Peace River Fm. (Miocene)	75'
Lehigh Acres Sandstone Mbr. of Peace River Fm.	215'
Fort Myers Clay Mbr. of Peace River Fm.	245'
Mid-Hawthorn Zone I Mbr. of Arcadia Fm.	390'
Unnamed Marl/Clay Zone of Arcadia Fm.	410'
Mid-Hawthorn Zone II Limestone of Arcadia Fm.	425'
Unnamed Marl/Clay Mbr. of Arcadia Fm.	440'
Unnamed Limestone Zone of Arcadia Fm.	480'
Unnamed Marl/Clay Zone of Arcadia Fm.	505'
Lower Hawthorn Zone I of Arcadia Fm.	555'
Unnamed Marl/Clay Zone of Arcadia Fm.	570'
Lower Hawthorn Ls. Zone II of Arcadia Fm.	610'
Unnamed Marl/Clay Zone of Arcadia Fm.	620'
Lower Hawthorn Zone III Ls. of Arcadia Fm.	690'
Unnamed Marl/Clay Zone of Arcadia Fm.	715'
Suwannee Zone I Ls. (Oligocene)	755'
Unnamed Marl/Clay Zone	775'
Suwannee Zone II Ls.	900'
Unnamed Marl/Clay Zone	905'
Suwannee Zone III Ls.	970'
Unnamed Marl/Clay Zone	

CONTROL WELLS: LM-809, LM-5086

POTENTIAL PACKER TEST ZONES:

Lower Hawthorn Zone I Ls.
Lower Hawthorn Zone II Ls.
Lower Hawthorn Zone III Ls.
Suwannee Zone I Ls.
Suwannee Zone II Ls.
Suwannee Zone III Ls.

A total of three zones are to be tested.

ANTICIPATED TOTAL DEPTH: 980'

10813WGG.D22

ANTICIPATED GEOPHYSICAL LOGGING PROGRAMS:

Prior to setting upper casing - Resistivity, Gamma Ray, Caliper
Prior to running tests - Gamma Ray, Caliper
Prior to setting production casing - Resistivity, Gamma Ray, Caliper, Flowmeter
After each stage of casing cementing - Temperature

ANTICIPATED CASING PROGRAM:

16" @ 35'	Surface
12" @ 510'	Upper
6" @ 630'	Production

SAMPLE COLLECTION PROGRAM:

Lithologic Samples - Every 5'
Water - Every 10' from 510' to Total Depth

CORING PROGRAM:

Up to four 10-foot long 4-inch diameter cores. See potential packer test zones for potential core intervals.

DRILLING METHOD:

Mud rotary to upper casing setting depth
Reverse air rotary below upper casing

ADDITIONAL INSTRUCTIONS:

Call in morning report every day
All casing setting depths, test zones, packer seats, and core intervals must be reviewed and approved by the Project Manager

N.B. This is an exploratory well to test several potential aquifer storage and recovery zones. Accurate depth and lithologic control is critical. All anticipated stratigraphic tops listed above were obtained from analyses of regional well control, actual depths and unit thickness may be significantly different at the site.

PROGNOSIS PREPARED BY:

Daniel J. Acquaviva, P.G. 4/22/98

APPENDIX C

DAILY DRILLING REPORTS

DAILY DRILLING REPORT

LCU - North Reservoir ASR
Observation Well # 1
SW SW Sec 20-T43S-R25E
Lee County, Florida

Well Water Systems Rig #1

11/16/98 Pres Ops @ 9:00 AM: MIRT.
Ops Last 48 hrs: MI equip.

11/17/98 Pres Ops @ 9:00 AM: Drlg @ 7' BLS.
Ops last 24 hrs: MI RT & equip. Had site OKed by LCU personnel.
SD for day @ 11:00 AM.

11/18/98 Pres Ops @ 9:00 AM: Prep to drill out of surf csg.
Ops Last 24 hrs: Drld 24" dia hole to 42'. BHA = 24" dia bit + sub, total length = 3.2'. POH. WIH w/ 18" dia steel csg. Landed csg @ 42' BLS. Grtd w/ 44 sks cmt by tremie.
Lithology: Sd, vy fn to fn grnd, minor clay, 0-6'; clay, sandy, some organics, 6-9.5'; marl, soft, stcky, 9.5-11'; marl w' interbdded ls, 11-20'; clay, 20-23'; ls, biomicritic, phos, poor to fair por, 23-30'; clay, 30-38'; ls, biomicritic, good por, 38-40'; clay, 40-42'.
Formation Tops: Pamlico/Ft. Thompson @ surf; Tamiami @ 23'; Cape Coral Clay @ 40'. Running 10' high to prognosis.

11/19/98 Pres Ops @ 9:00 AM: GBIH w/ 8" bit.
Ops Last 24 hrs: Drld 8" hole to 348'. BHA = bit + x-over sub, total length = 1.3'. POH. SD for night @ 5:00 PM.
Lithology: Clay, 42-64'; ls, sndy, 64-78'; clay, w/ some intrbd sndy ls, 78-95; ls, sndy, some intrbd clay, 95-118'; clay, phos, 118-135'; ls, sndy, some marl, 135-154'; clay, minor sndy ls, 154-161'; ls, biomicritic, intrbd clay, 161-170'; clay, w/intrbd ls, 170-193'; clay, phos, 193-230'; ls, biomicritic, some intrbd clay, 230-254'; ls, biomicritic, 254-260'; clay, phos, minor intrbd ls, 260-342'; clay, minor shell & interbd ls, 342-348'.
Formation Tops: Peace River fm, Lehigh Acres mbr @ 64', Ft. Myers Clay mbr @ 170'; Arcadia fm, Mid Hawthorn Zone I mbr @ 230'.
Running 15' high to prognosis.

11/20/98 Pres Ops @ 9:00 AM: Prep to GIH w/ reamer.
Ops Last 24 hrs: WIH w/ 8" bit. Drld to 485'. LC @ 482'. Strated f as TOH. Est F 1225 gpm. POH. WBIH to 300'. Spttd 8 sks Baroid mud. POH. Geophy logger on-site @ 12:45 PM. WIH w/ wireline logging tools. Ran GR, SP, Res. WBIH to 300' open-ended. Spptd 2000 gals mud w/ 4 sks Baroid. MW 9.5. POH. Welded temp steel plate to cap. SD for night @ 7:30 PM.
Lithology: Clay, minor inrbd ls, 348-356'; ls, biomic, fair to good por, 356-360; clay, minor intrbd ls, 360-380'; clay, 380-385'; ls, biomic, minor clay, 385-395'; clay, 395-400'; clay, phos, minor ls, 400-416'; ls, mic, phos, minor intrbd clay, 416-432'; clay, minor intrbd ls, 432-446'; clay, 446-448'; ls, biomic, phos, gd moldic por, hard, 448-465'; clay, minor ls, 465-480'; ls, biomic, gd to excl moldic & vugular por, minor dol, sic, gd intrcrystl por, 480-482'; no samples, 482-485'.
Formation Tops: Mid Hawthorn Zone II @ 385'; Unnamed Limestone Zone of Mid Hawthorn @ 416'; Lower Hawthorn Zone I @ 480'.
Running 25' high to prognosis.

Distribution: FAX#:

E. Wong, LCU	479-8176
D. Giles, HMA	481-1015
A. Muniz, HS	(561) 997-8159

DAILY DRILLING REPORT

LCU - North Reservoir ASR
Observation Well # 1
SW SW Sec 20-T43S-R25E
Lee County, Florida

Well Water Systems Rig #1

11/23/98 Pres Ops @ 9:00 AM: Reaming 18" hole @ 110'.
Ops Last 72 hrs: Spttd 12 sks Baroid & one yd sd. Welded on bushings for BOP's. SD for weekend @ 4:00 PM 11/20/98.

11/24/98 Pres Ops @ 9:00 AM: Repairing drive shaft.
Ops Last 24 hrs: WIH w/ 18" bit. Reamed 8" dia pilot hole to 18" dia from 42 to 315'. BHA = 8" dia lead bit + 17.5" dia step bit + sub + stabilizer/collar + x-over sub, total length = 19.2'. MW 9.0. SD for night @ 6:30 PM.

11/25/98 Pres Ops @ 9:00 AM: Repairing drive shaft.
Ops Last 24 hrs: Repaired drive shaft.

11/30/98 Pres Ops @ 9:00 AM: Reaming 18" hole @ 457'.
Ops Last 5 days: Repaired drive shaft. Reamed 8" dia pilot hole to 18" dia from 315' to 425'. Made short trip to 395'. MW 9.3. SD for holiday @ 5:30 PM 11/25/98.

12/1/98 Pres Ops @ 9:00 AM: Prep to GIH w/ logging tools.
Ops Last 24 hrs: Reamed 8" dia pilot hole to 18" dia from 395' to 485'. LC 482-485'. Drld 18" hole from 485 to 498'. C&c. POH. WBIH to c&c swelling clays between 200-300'. MW 9.3. POH. WBIH. SD for night @ 6:00 PM.
Lithology: Ls, biomic, gd moldic and vug por, 485-498'.

12/2/98 Pres Ops @ 9:00 AM: WOC.
Ops Last 24 hrs: POH. Ran Caliper/GR-SP-Res log from 498' to 42'. Dev sur @ 450' 0 deg dev, @ 360' 0.5 deg dev, @ 270' 0.5 deg dev, @ 180' 0.5 deg dev, @ 90' 0.5 deg dev. Spptd 4 sks Baroid. WIH w/ 12" ID (.375" wt) steel casing. Landed @ 495'. Centralizers @ 5', 20', 40', 130', 230', 330', 430', 485'. Pressure grtd w/ 126 sks neat cmt. Chased w/300 gals wtr. SD for night @ 8:15 PM.
Picked TO Lower Hawthorn Zone I @ 452' based on GR log. Running 53' high to prognosis.

Distribution:

	FAX#:
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DAILY DRILLING REPORT

LCU - North Reservoir ASR
Observation Well # 1
SW SW Sec 20-T43S-R25E
Lee County, Florida

Well Water Systems Rig #1

12/2/98 Pres Ops @ 9:00 AM: WOC.
Ops Last 24 hrs: POH. Ran Caliper/GR-SP-Res log from 498' to 42'. Dev sur @ 450' 0 deg dev, @ 360' 0.5 deg dev, @ 270' 0.5 deg dev, @ 180' 0.5 deg dev, @ 90' 0.5 deg dev. Spptd 4 sks Baroid. WIH w/ 12" ID (.375" wt) steel casing. Landed @ 495'. Centralizers @ 5', 20', 40', 130', 230', 330', 430', 485'. Pressure grtd w/ 126 sks neat cmt. Chased w/300 gals wtr. SD for night @ 8:15 PM.
Picked TO Lower Hawthorn Zone I @ 452' based on GR log. Running 53' high to prognosis.

12/3/98 Pres Ops @ 9:00 AM: Prep to spt last stage cmt.
Ops Last 24 hrs: Tagged TOC @ 295'. Sptd 111 sks neat cmt by tremie. SD for night @ 4:00 PM.

12/4/98 Pres Ops @ 9:00 AM: GIH w/ RT.
Ops Last 24 hrs: Tagged TOC @ 180'. Sptd 72 sks neat cmt by tremie. Had returns @ surf. Cleaned site. RU reverse air. SD for night @ 5:30 PM.

12/7/98 Pres Ops @ 9:00 AM: RU for test.
Ops Last 72 hrs: WIH w/ 8" bit. Tagged TOC inside csg @ 478'. Set air line @ 200'. BHA = bit + sub; total length = 2.6'. Drld 8" dia hole by reverse air to 522'. SD for weekend @ 5:00 PM 12/4/98.
Lithology: Ls, biomic, xlnt moldic & vug por, minor dol, xstlln, phos, 498-502'; ls, xlnt moldic & vug por, phos, 502-518'; dol, xstlln, hard, poor por, & marl, clayey, sticky, 518-522'.
Reverse Air WQ: @ 502' est TDS = 1380 mg/l; @ 522' est TDS = 1345 mg/l.

12/8/98 Pres Ops @ 9:00 AM: Dlrg @ 583'.
Ops last 24 hrs: Ran aquifer test. Flowed well at rates of 92 gpm, 222 gpm, 327 gpm, and 430 gpm for 30 min each, flowed well at 428 gpm for 2 hrs. Est Transmissivity = 90,000 gpd/ft. Dissolved Chlorides = 880 mg/l.
SD for night at 7:15 PM.

12/9/98 Pres Ops @ 9:00 AM: RU for packer test.
Ops Last 24 hrs: Drld 8" dia pilot hole to 625'. POH. SD for night @ 5:00 PM.
Lithology: Dol, xstln, poor por, hard, 522-525'; clay, soft, 525-529'; ls, biomic, phos, gd to xlnt por, 529-534'; dol, poor to fair por, 534-541'; ls, biomic, v phos, gd to xlnt por, tr clay, 541-570'; ls, biomic to calcar, xlnt por, 570-592'; ls, cal, gd to xlnt moldic por, 592-619'; Clay, cohesive, 619-625'.
Reverse Air WQ: @ 563' Dis Cl = 770 mg/l ; @ 595' Dis Cl = 830 mg/l; @ 625' Dis Cl = 840 mg/l.

Distribution:

	FAX#:
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D. Giles, HMA	481-1015
A. Muniz, HS	(561) 997-8159

DAILY DRILLING REPORT

LCU - North Reservoir ASR
Observation Well # 1
SW SW Sec 20-T43S-R25E
Lee County, Florida

Well Water Systems Rig #1

12/8/98 Pres Ops @ 9:00 AM: Dlrg @ 583'.
Ops last 24 hrs: Ran aquifer test. Test interval 480-518'. Flowed well at rates of 92 gpm, 222 gpm, 327 gpm, and 430 gpm for 30 min each, flowed well at 428 gpm for 2 hrs. Est Transmissivity = 90,000 gpd/ft. Dissolved Chlorides = 880 mg/l.
SD for night at 7:15 PM.

12/9/98 Pres Ops @ 9:00 AM: RU for packer test.
Ops Last 24 hrs: Drld 8" dia pilot hole to 625'. POH. SD for night @ 5:00 PM.
Lithology: Dol, xstln, poor por, hard, 522-525'; clay, soft, 525-529'; ls, biomic, phos, gd to xlnt por, 529-534'; dol, poor to fair por, 534-541'; ls, biomic, v phos, gd to xlnt por, tr clay, 541-570'; ls, biomic to calcar, xlnt por, 570-592'; ls, cal, gd to xlnt moldic por, 592-619'; clay, cohesive, 619-625'.
Reverse Air WQ: @ 563' Dis Cl = 770 mg/l ; @ 595' Dis Cl = 830 mg/l; @ 625' Dis Cl = 840 mg/l.
Formation Tops: Lower Hawthorn Zone III @ 529'. Running 91' high to prognosis.

12/10/98 Pres Ops @ 9:00 AM: RD from packer test.
Ops Last 24 hrs: RU for packer test. WIH w/ packer. Seated packer @ 527-531'. Had good seal. Sealed wellhead. Set 6' submersible pump @ 89'. SWL in annulus= 24.42'above TO flange. SWL in test zone = 30.91' above TO flange. Test interval 529-619'. Preflow @ 330 gpm. SI. Performed 4 step specific capacity test at rates of 73, 149, 230, 295 gpm for 30 min each. Est Transmissivity = 39,000 gpd/ft. No drawdown in annulus. Dissolved Chlorides = 700 mg/l. SD for night @ 6:30 PM.

12/11/98 Pres Ops @ 9:00 AM: GIH w/ packer.
Ops Last 24 hrs: POH w/ packer. Found packer damaged. WIH w/ 8" bit. Dlrd 8" dia pilot hole to 705'. Made short trip to 505'. SD for night @ 5:00 PM.
Lithology: Clay, cohesive (minor ls @ 632 & 634'), 625-640'; ls, calcar, fair to gd intergran & remnant moldic por (minor clay @ 654'), 640-656'; ls, calcar, fair to gd por (tr clay, stiff @ 690'), 656-703'; clay, firm, 703-705'.
Reverse Air Water Quality: @ 656' Dis Cl = 840 mg/l; @ 687' Dis Cl = 840 mg/l; @ 703' Dis Cl = 890 mg/l.
Formation Tops: Suwannee Zone I @ 640', Unnamed Marl/Clay Zone @ 703'. Running 52' high to prognosis.

12/14/98 Pres Ops @ 9:00 AM: POH w/ packer.
Ops Last 72 hrs: WIH w/ packer. Set packer @ 638-642'. Had gd seal. Set submer pump @ 106'. SWL = 31.9' above flange. Performed preflow @ 310 gpm. SI. Performed specific capacity test at rates of 79, 150, 221, 281 gpm for 30 min per step. Est Transmissivity = 16,000 gpd/ft. No drawdown in annulus. Dissolved Chlorides = 740 mg/l. SD for weekend @ 4:30 PM.

Distribution:

	FAX#:
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DAILY DRILLING REPORT

LCU - North Reservoir ASR
Observation Well # 1
SW SW Sec 20-T43S-R25E
Lee County, Florida

Well Water Systems Rig #1

12/14/98 Pres Ops @ 9:00 AM: POH w/ packer.
Ops Last 72 hrs: WIH w/ packer. Set packer @ 638-642'. Had gd seal. Set submer pump @ 106'. SWL = 31.9' above flange. Performed preflow @ 310 gpm. SI. Performed specific capacity test at rates of 79, 150, 221, 281 gpm for 30 min per step. Est Transmissivity = 16,000 gpd/ft. No drawdown in annulus. Dissolved Chlorides = 740 mg/l. SD for weekend @ 4:30 PM.

12/15/98 Pres Ops @ 9:00 AM: Cir @ 890'.
Ops Last 24 hrs: POH w/ packer. WBIH w/ 8" bit. Drld 8" hole to 873'. SD for night @ 5:00 PM.
Lithology: Clay, w/ interbd ls, 705-710'; ls, mic, poor por, minor clay, 710-723'; ls, calcar, fair to gd por, minor clay (746-746.5'), 723-750'; ls, calcar, gd intergrn por, 750-766'; clay, 766-767.5'; ls, calcar, fair to gd por, 767.5-778'; clay, firm, 778-778.5'; ls, calcar, fair por, 778.5-803'; clay, stiff, 803-807.5'; ls, calcar, fair to gd por, some interbd clay, 807.5-828'; ls, calcar, fair to gd por, 828-836'; ls, calcar, gd intergrn & remnant moldic por, 836-842'; clay, 842-843'; ls, calcar, fair to gd por, 843-873'.
Reverse Air Water Quality: @ 717' Dis Cl = 840 mg/l; @ 748' Dis Cl = 830 mg/l; @ 778' Dis Cl = 810 mg/l; @ 808' Dis Cl = 830 mg/l; @ 843' Dis Cl = 820 mg/l; @ 873' Dis Cl = 800 mg/l.
Formation Tops: Suwannee Zone II @ 723'; Suwannee Zone III @ 828'. Running 77' high to prognosis.

12/16/98 Pres Ops @ 9:00 AM: Performing packer test.
Ops last 24 hrs: Drld 8" hole to 890'. POH. WBIH w/ packer. Set packer @ 805-809'. Had gd seal. Set submer pump @ 80'. SWL in annulus = 24.42' above TO flange. SWL in test zone = 32.58' above TO flange. Performed preflow @ 180 gpm. SI. SD for night @ 5:00 PM.
Lithology: Ls, calcar, fair to gd por, 873-890'; clay, stiff, minor dol, 887-890'.

12/17/98 Pres Ops @ 9:00 AM: Drlg @ 935'.
Ops Last 24 hrs: Performed specific capacity test @ rates of 55, 70, 115, 158, 190 gpm for 30 min each. Est Transmissivity = 5500 gpd/ft. Dis Cl = 720 mg/l. POH w/ packer. WBIH w/ 8" bit. Drld 8" hole to 903'. SD for night @ 4:45 PM.
Lithology: Clay, w/ interbd dol, 890-894'; ls, calcar, poor to fair por, 894-896'; ls, mic, poor to fair por, 896-898'; ls, calcar, poor to fair por, 898-900'; ls, mic, poor por, 900-901'; clay, firm, 901-902.5'; ls, mic, poor por, 902.5-903'.

Distribution:

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A. Muniz, HS	(561) 997-8159

DAILY DRILLING REPORT

LCU - North Reservoir ASR
Observation Well # 1
SW SW Sec 20-T43S-R25E
Lee County, Florida

Well Water Systems Rig #1

12/17/98 Pres Ops @ 9:00 AM: Drlg @ 935'.
Ops Last 24 hrs: Performed specific capacity test @ rates of 55, 70, 115, 158, 190 gpm for 30 min each. Est Transmissivity = 5500 gpd/ft. Dis Cl = 720 mg/l. POH w/ packer. WBIH w/ 8" bit. Drld 8" hole to 903'. SD for night @ 4:45 PM.
Lithology: Clay, w/ interbd dol, 890-894'; ls, calcar, poor to fair por, 894-896'; ls, mic, poor to fair por, 896-898'; ls, calcar, poor to fair por, 898-900'; ls, mic, poor por, 900-901'; clay, firm, 901-902.5'; ls, mic, poor por, 902.5-903'.

12/18/98 Pres Ops @ 9:00 AM: Performing final packer test.
Ops Last 24 hrs: Drld 8" hole to 980'. Reached TD for well @ 12:00 Noon. POH. WBIH w/ packer. Set packer @ 900-904'. Set submer pump @ 100'. Est F 1745 gpm. SI. SD for night @ 7:00 PM.
Lithology: Ls, mic, poor por, 903-904'; dol, very hard, xstln, poor por, 904-907'; dol, very hard, gd moldic por (cavernous 911-914'), 907-914'; dol, suc, gd vuggy por, 914-922'; ls, calcar, fair to gd por, 922-957'; clay, 957-957.5'; ls, calcar, fair to gd por, 957.5-977'; ls, mic poor por, 977-978'; clay, firm, 978-980'.
Formation Tops: Ocala @ 904'.
Reverse Air Water Quality: @ 905' Dis Cl = 830 mg/l; @ 935 Dis Cl = 640 mg/l; @ 965' Dis Cl = 840 mg/l; @ 980' Dis Cl = 820 mg/l.

12/21/98 Pres Ops @ 9:00 AM: WO geophysical logger.
Ops Last 72 hrs: Conducted packer test of Ocala Zone I (904-977'). Performed preflow @ 350 gpm. SI. SWL in test zone = 32.91' ALS. SWL in annulus = 24.84' ALS. Performed specific capacity test @ rates of 85, 160, 240, 320 gpm for 30 min each. Est Transmissivity = 72000 gpd/ft. Dis Cl = 1000 mg/l. POH w/ packer. SD for weekend @ 5:00 PM.

12/22/98 Pres Ops @ 9:00 AM: WOO.
Ops Last 24 hrs: Ran geophysical logs - GR, LSN, Caliper, Sonic, Temp, Fluid Res, Flowmeter. SI. SD for night @ 5:45 PM.

12/23/98 Pres Ops @ 9:00 AM: SD for holidays. Will resume ops 1/4/99.
Ops Last 24 hrs: WOO.

1/4/99 Pres Ops @ 9:00 AM: Prep to plug back.
Ops Last 12 days: SD for holidays.

1/5/99 Pres Ops @ 9:00 AM: GIH w/ tremie to tag TO sand.
Ops Last 24 hrs: Killed well w/ 4 sks Baroid. WIH open ended to 966'. Spttd .75 bag 6/20 sd (approx 30 cu ft). PU to 495'. MW 13.5. SD for night @ 6:30 PM.

1/6/99 Pres Ops @ 9:00 AM: WO supplies.
Ops Last 24 hrs: WBIH open ended. Tagged TO sd @ 925'. Spttd 40 sks cmt. PU to 495'. SD for night @ 1:00 PM.

Distribution:

	FAX#:
E. Wong, LCU	479-8176
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A. Muniz, HS	(561) 997-8159

DAILY DRILLING REPORT

LCU - North Reservoir ASR
Observation Well # 1
SW SW Sec 20-T43S-R25E
Lee County, Florida

Drilling Contractor: Well Water Systems

1/6/99 Pres Ops @ 9:00 AM: WO supplies.
Ops Last 24 hrs: WBIH open ended. Tagged TO sd @ 925'. Spttd 40 sks cmt. PU to 495'. SD for night @ 1:00 PM.

1/7/99 Pres Ops @ 9:00 AM: Pumping cmt.
Ops Last 24 hrs: WBIH open ended. Tagged TOC @ 911'. Pumped 60 sks neat cmt. PU to 495'. WOC for 5 hrs. Tagged TOC @ 745'. Pumped 36 sks neat cmt. PU to 495'. SD for night @ 5:30 PM.

1/8/99 Pres Ops @ 9:00 AM: Prep to PB w/ sd.
Ops Last 24 hrs: Tagged TOC @ 643'. Pmpd 7 sks neat cmt. PU to 495'. MW 13.5. SD for night @ 3:30 PM.

1/11/99 Pres Ops @ 9:00 AM: POH w/ 12" bit.
Ops Last 72 hrs: Tagged TOC @ 615'. Spttd 40 cu ft sd. Tagged TO sd @ 560'. Spttd 16 cu ft sd. Tagged To sd @ 545'. Added 10 cu ft sd. Tagged TO sd @ 520'. POH. WBIH w/ 12' bit to ream. BHA= bit + sub + x-over sub, total length = 4.3'. Reamed 12" dia hole to 537'. PU to 495'. SD for weekend @ 7:00 PM 1/8/99.

1/12/99 Pres Ops @ 9:00 AM: Prep to tag TOC.
Ops Last 24 hrs: WBIH. Reamed 12" hole to 539'. POH. WIH w/ 6" dia Sched 80 PVC csg. Landed csg @ 537'. Pressure grtd w/ 60 sks neat cmt. SD for day @ 2:30 PM.

1/13/99 Pres Ops @ 9:00 AM: Prep to MORT.
Ops Last 24 hrs: Tagged TOC @ 425'. Filled csg w/ wtr. Pres to 10 psi. Pmpd Pmpd 80 sks neat cmt by tremie. SD for night @ 3:30 PM.

1/14/99 Pres Ops @ 9:00 AM: SI.
Ops Last 24 hrs: Tagged TOC @ 180'. Pmpd 42 sks neat cmt. RD & MORT. SD for day @ 10:30 AM.

1/22/99 Pres Ops @ 9:00 AM: Prep to RURT.
Ops Last 8 days: MIRT - West Coast Drilling Rig #1 on 1/21/99.

1/23/99 Pres Ops @ 9:00 AM: GIH w/ 5" bit.
Ops Last 24 hrs: WIH w/ 5" bit. BHA = bit + sub, total length + 1.1'. Found TOC @ 534'. Set air line @ 240'. Drld 5" hole by reverse air rotary to 579'. POH. SI well. SD for night @ 6:30 PM.

1/25/99 Pres Ops @ 9:00 AM: GIH w/ 5" bit.
Ops Last 48 hrs: WIH w/ 5" bit. Drld 5" hole to 600'. Broke air line. POH. SI well. SD for weekend @ 4:00 PM 1/23/99.

1/26/99 Pres Ops @ 9:00 AM: WO drill crew.
Ops Last 24 hrs: WIH w/ 5" bit, Drilled out sand back plug to 615'. Air developed well w/ rig air for 2 hrs. POH. Set up air compressor. Air developed well for 2 hrs. MORT. SD for night @ 2:30 PM

Distribution:

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DAILY DRILLING REPORT

LCU - North Reservoir ASR
Observation Well # 1
SW SW Sec 20-T43S-R25E
Lee County, Florida

Drilling Contractor: Well Water Systems

1/22/99 Pres Ops @ 9:00 AM: Prep to RURT.
Ops Last 8 days: MIRT - West Coast Drilling Rig #1 on 1/21/99.

1/23/99 Pres Ops @ 9:00 AM: GIH w/ 5" bit.
Ops Last 24 hrs: WIH w/ 5" bit. BHA = bit + sub, total length + 1.1'. Found TOC @ 534'. Set air line @ 240'. Drld 5" hole by reverse air rotary to 579'. POH. SI well. SD for night @ 6:30 PM.

1/25/99 Pres Ops @ 9:00 AM: GIH w/ 5" bit.
Ops Last 48 hrs: WIH w/ 5" bit. Drld 5" hole to 600'. Broke air line. POH. SI well. SD for weekend @ 4:00 PM 1/23/99.

1/26/99 Pres Ops @ 9:00 AM: WO drill crew.
Ops Last 24 hrs: WIH w/ 5" bit, Drilled out sand back plug to 615'. Air developed well w/ rig air for 2 hrs. POH. Set up air compressor. Air developed well for 2 hrs. MORT. SD for night @ 2:30 PM

1/27/99 Pres Ops @ 9:00 AM: SI.
Ops Last 24 hrs: Air developed well w/ air compressor for 6 hrs. SI. SD for night @ 3:15 PM.

N.B. This is the last report for this well.

Distribution:

	FAX#:
E. Wong, LCU	479-8176
D. Giles, HMA	481-1015
A. Muniz, HS	(561) 997-8159

APPENDIX D

CASING MILL SLIPS

검 사 증 명 서 (A)

MILL INSPECTION CERTIFICATE

현 대 강 관 주 식 회 사
HYUNDAI PIPE CO., LTD.
• 본사 공장 울산광역시 동구 염포동 265번지 (우)682-070
ULSAN PLANT : 265, YUMPO-DONG, DONG-KU, ULSAN METROPOLITAN, KOREA
TEL (052)287-2101~9 FAX (052)287-8916
TLX HDPIPE K 55776
• 서울사무소 서울특별시 중구 무교동 77번지 (우)100-070
SEOUL OFFICE : # 77, MUKYO-DONG, JUNG-KU, SEOUL, KOREA
TEL : 773-0522 FAX : 775-7095
TLX : HDPIPE K 24656, K 22956

증명서번호 CERTIFICATE NO E-8-04-305 페이지 PAGE 1

발행일자 DATE OF ISSUE APR. 28. 1998. E4808400

계약번호 CONTRACT P/O NO

품명 COMMODITY E.R.W. STEEL PIPE

규격 SPECIFICATION API 5L X42/API 5LB/ASTM A53B

수요가 CUSTOMER

BARTOW STEEL, INC.
MILL TEST REPORT
FOR SUBMITTAL INFORMATION ONLY
PENDING APPROVAL FOR PURCHASE

G : GOOD

치수 DIMENSION 외경 × 두께 × 길이 OUTSIDE DIA × THICK × LENGTH	수량 QUANTITY PCS	중량 WEIGHT KGS	수압시험 HYDRO STATIC TEST Mpa kg/cm² PSI	육안검사 VISUAL EXAMINATION	편평시험 FLATTENING TEST	굽힘시험 BENDING TEST	인장시험 TENSILE TEST	충격시험 IMPACT	화학성분 CHEMICAL COMPOSITION	비고 REMARK
*2 *3 *4				6 7 8 9 10 11 12 13	아연도금 COATING TEST 아연부착량 WEIGHT of ZINC COAT / 연속시험 CONT. TEST	제조번호 HEAT NO	항복점 YIELD STRENGTH / 인장강도 TENSILE STRENGTH / 연신율 ELONGATION	충격에너지 IMPACT ENERGY / 충격치 IMPACT VALUE	C Si Mn P S Cu Ni Cr Mo V	
							PSI / kg/mm² / N/mm²	FT-LBS / kg-m	× 100 × 1000 × 100	
B OD 12-3/4" x .375" x21.000'	424	200,340	148	G G G G G		A20904	29.7 47.2 50.2	40	17 1 78 15 9 6 1 2 Tr 1	
(323.9mm x 9.53mm x 6.401M)			2110				42200 67100 71400			
						Y27630	36.0 52.6 55.4	36	18 2 79 18 8 6 1 2 1 Tr	
							51200 74800 78800			
						Y28911	32.9 50.3 53.2	32	18 1 75 16 7 6 1 2 1 Tr	
							46800 71500 75700			
B OD 12-3/4" x .375" x42.000'	265	250,425	148	G G G G G		Y27743	36.2 52.8 55.4	31	17 2 76 15 9 6 1 2 1 Tr	
(323.9mm x 9.53mm x 12.802M)			2110				51500 75100 78800			
B OD 12-3/4" x .500" x42.000'	58	72,349	197	G G G G G		Y27627	31.6 49.4 52.2	39	18 1 74 12 8 6 1 2 1 Tr	
(323.9mm x12.70mm x 12.802M)			2800				44900 70300 74200			
B OD 16" x .250" x42.000'	81	64,944	79	G G G G G		A31120	30.4 46.9 49.5	38	15 1 69 17 8 6 1 2 1 Tr	
(406.4mm x 6.35mm x 12.802M)			1120				43200 66700 70400			
						A31614	33.1 50.2 53.2	39	14 1 68 19 0 5 2 1 Tr 1	
							47100 71400 75700			
						A34573	29.9 45.1 48.2	41	14 1 68 17 8 6 2 1 Tr 1	
							42500 64100 68600			
TOTAL ->	828	588,058								

BARTOW STEEL, INC.
MILL TEST REPORT
FOR SUBMITTAL INFORMATION ONLY
PENDING APPROVAL FOR PURCHASE

NOTES *1 Type of pipe End 관종

B Black Plain End Square-cut	GPE Galvanized Plain End Square-cut
BE Black Plain End Beveled	GPEB Galvanized Plain End Beveled
BT Black Threaded & Coupled	GTC Galvanized Threaded & Coupled
BVJ Black Victaulic Joint	GVJ Galvanized Victaulic Joint
SCT Sherardized Threaded & Coupled	

*2 NB Nominal Bore 호칭, OD Outside Diameter
*3 Unit 단위 M Metric, F Feet, I Inch
*4 Flattening or Bending Test 편평 또는 굽힘시험
*5 Nondestructive Test 비파괴검사
*6 Crush Test 순압시험
*7 W Weld Part 용접부
*8 G Good
*9 Drift Test 관확시험
*10 Reverse Flattening Test 리버스시험
*11 H Heat (Ladle) Analysis 용탕분석, P Product Analysis 제품분석
*12 Unit 단위 M Metric, I Inch
*13 Visual & Dimension Test 육안 및 치수검사
*14 Weld Ductility Test 용접부 연성시험
*15 Flaring Test 압편시험
*16 B Base Metal 모재부

본 제품은 귀사의 구매에 합격되었음을 보증합니다.

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN ACCEPTED IN ACCORDANCE WITH THE PRESCRIBED SPECIFICATION AND ORDER.

SURVEYOR

B. H. Kim
INSPECTION MANAGER

BARNES IND PLAS PIPE, TAMPA
7920 U.S.301 N.
TAMPA, FL 33637

Phone #: (813) 985-3995

N/A

Invoice #: 192034 Pg. 1

Customer ID: 123806

****
* *
* INVOICE *
* *
****

Bill to:

WELL WATER SYSTEMS
17174 JEAN ST.
FORT MYERS, FL 33912

Ship to:

WELL WATER SYSTEMS
17174 JEAN ST.
FORT MYERS, FL 33912

Date	Ship Via	F.O.B.	Terms
01/18/99	BARNES TRUCK	Destination	Net 30

Order	P.O. Number	Salesperson	FROM SALESORDER#
01/12/99	BOBBY	MIKE HALE	192807

Req	Ship	B.O.	Item No.	Description
960	960		PIPE-80-060	6 SCH 80 PIPE BE

Invoice subtotal
Sales tax @ 6.000%

Invoice total

ORDER TAKEN BY BOB S. PULLED BY:_____DEL BY:_____

APPENDIX E

LITHOLOGIC LOG

GEOLOGIST'S LOG OF LCU- NORTH RESERVOIR ASR OBSERVATION WELL #1
LM-6208
SEC 20 - T43S - R25E

Depth (feet)	Lithology
0 - 6	Sand, pale yellowish brown (10YR 6/2), very fine to fine grained, sub-angular to subrounded quartz, good to excellent porosity, shelly, minor Clay, moderate yellowish brown (10YR 5/4), soft, cohesive.
6 - 9.5	Clay, pale yellowish brown (10 YR 6/2), sandy, cohesive, stiff, poor porosity, common organics, occasional Marl.
9.5 - 20	Marl, yellowish grey (5Y 8/1), soft, sticky, phosphatic, interbedded with Limestone, yellowish grey (5y 8/1), micritic, moderately soft to moderately hard, poor to fair porosity, minor shell.
20 - 23	Clay, pale olive (10 Y 6/2), soft, and sticky.
23 - 40	Limestone, yellowish grey (5Y 6/2), biomicritic, phosphatic, common casts and molds, poor to fair porosity, some quartz grains interbedded with Clay, yellowish grey (5Y 8/1), soft, cohesive, poor porosity and apparent permeability.
40 - 64	Clay, yellowish grey (5Y 7/2) to light olive grey (5Y 5/2), soft, sticky.
64 - 78	Limestone, yellowish grey (5Y 7/2) to pale olive (10Y 6/2), sandy, biomicritic, abundant shell, phosphatic,good porosity, good apparent permeability.
78 - 95	Clay, light olive grey (5Y 5/2) to light olive grey (5Y 6/1), sticky.
95 - 118	Sandy Limestone, pale olive (10 YR 6/2), phosphatic, abundant shell, good porosity, fair to good apparent permeability, moderately hard, interbedded with Clay pale olive, soft sticky, cohesive.
118 -124	Clay, dark greenish grey (5GY 4/1), soft, firm, cohesive, phosphatic.
124 - 135	Clay, as above, with minor shell and sandy Limestone, minor phosphate from 126 - 128 feet.
135 - 154	Limestone, sandy, yellowish grey (5Y 7/2) to pale olive (10Y 6/2), biomicrite, phosphatic, common shell, with occasional Marl, yellowish grey (5 Y 7/2), soft.
155 - 161	Clay, pale olive (10 Y 6/2), soft, sticky, very phosphatic, minor amounts of sandy Limestone (as above).
161 - 170	Limestone, yellowish grey (5Y 7/2), to pale greenish yellow (10 Y 8/2), biomicrite, moderate hardness, phosphatic, good to excellent porosity and apparent permeabilityinterbedded with Clay, greenish yellow (10 Y 8/2), very soft, sticky.
170 - 190	Clay, soft to firm, with Limestone as above.
190 - 193	Clay, dusky yellow green (5GY 5/2), soft to firm, phosphatic, good porosity and fair to good apparent permeability.

GEOLOGIST'S LOG OF LCU - NORTH RESERVOIR ASR OBSERVATION WELL #1
CONTINUED
LM-6208
SEC 20 - T43S - R25E

Depth (feet)	Lithology
193 - 203	Clay, yellowish grey (5Y 7/2), soft to firm, phosphatic.
203 - 214	Clay, as above, with occasional Limestone, yellowish grey (5Y 7/2), micritic, moderately hard, phosphatic, fair to poor porosity and apparent permeability.
214 - 230	Clay, dark greenish gray (5GY 4/1), soft to firm, phosphatic, minor to trace amounts of Dolomite, moderate olive brown (5Y 4/4), very hard.
230 - 235	Limestone, yellowish grey (5Y 8/1), biomicritic, moderately hard, phosphatic, fair to good porosity, with Clay, yellowish grey (5Y 8/1), soft, sticky, phosphatic.
235 - 254	Limestone, and Clay, as above.
254 - 256	Limestone, very pale orange (10YR 8/2), biomicritic, phosphatic, moderately soft to moderately hard, fair to good porosity, apparent permeability, interbedded with Clay, yellowish grey (5Y 8/1), soft, sticky, phosphatic.
256 - 260	Limestone, with Clay, as above.
260 - 286	Clay, yellowish grey (5Y 8/1), soft, sticky, phosphatic, minor Limestone, very pale orange (10 YR 8/2) to yellowish grey (5Y 8/1), biomicritic.
286 - 334	Clay, as above, phosphatic.
334- 342	Clay, yellowish grey (5Y 8/1), soft, sticky, phosphatic, interbedded with Limestone, yellowish grey, biomicrite, moderately hard, fair to good porosity and apparent permeability.
342 - 355	Clay, pale olive (10 Y 6/2), to dusky yellow green, (5GY 5/2), firm, phosphatic, interbedded with Limestone, light olive grey(5Y 5/2), to yellowish grey (5Y 8/1), biomicritic, moderate to hard, phosphatic, good moldic porosity, fair to good apparent permeability, minor large (1/2") bivalves noted.
356 - 360	Limestone, yellowish grey (5Y 8/1), biomicritic, moderately hard to hard, phosphatic, fair to good porosity and apparent permeability, with Clay, as above.
360 - 370	Clay, pale olive (10Y 6/2), soft, phosphatic, poor apparent intergrannular porosity and permeability, interbedded with Limestone, as above.
370 - 380	Clay, yellowish grey (5Y 7/2), soft, sticky, cohesive, phosphatic, minor Limestone noted.

GEOLOGIST'S LOG OF LCU - NORTH RESERVOIR ASR OBSERVATION WELL #1
CONTINUED
LM-6208
SEC 20 - T43S - R25E

Depth (feet)	Lithology
380 - 385	Clay, yellowish grey to pale olive (10Y 6/2), soft, sticky, cohesive, phosphatic, with Limestone, pale olive (10Y 6/2), micritic, soft, phosphatic, poor to fair porosity and apparent permeability.
385 - 390	Limestone with occasional Clay, as above.
390 - 400	Clay, yellowish grey (5Y 7/2), with Limestone, yellowish grey (5Y 7/2).
400 - 411	Clay, pale olive (10Y 6/2), soft, sticky, cohesive, phosphatic, poor intergrannular porosity and apparent permeability, with Limestone, yellowish grey (5Y 7/2), micritic, soft, phosphatic, poor to fair porosity and apparent permeability.
411 - 416	Clay, pale olive (10 Y 6/2), soft to firm, phosphatic, interbedded with Limestone, very pale orange (10YR 8/2), biomicritic, moderately hard, phosphatic, fair to good porosity and apparent permeability.
416 - 432	Limestone, very pale orange (10YR 8/2), micritic, phosphatic, fair to good moldic porosity and apparent permeability, with Clay, as above.
432 - 446	Clay, pale olive (10Y 6/2), soft, sticky with Limestone, as above.
446 - 448	Clay, pale olive (10Y 6/2), to dark greenish grey (5GY 4/1), soft, sticky, phosphatic, with Limestone, yellowish grey (5Y 7/2), micritic, phosphatic, fair to good porosity and apparent permeability.
448 - 455	Limestone, yellowish grey (5y 7/2), biomicritic, phosphatic, moderate to hard, fair to good moldic porosity and apparent permeability, with Clay, yellowish grey, soft, phosphatic.
455 - 465	Limestone, as above, with Clay, as above.
465 - 468	Limestone, yellowish grey (5Y 7/2), with interbeds of marl, with Clay, yellowish grey, soft.
468 - 472	Clay, pale olive (10Y 6/2), soft to firm, phosphatic with Limestone, yellowish grey (5Y 8/1), biomicritic, moderately hard to hard, phosphatic, poor to fair moldic porosity and apparent permeability.
472 - 480	Limestone, with Clay, as above.
480 - 485	Limestone, yellowish grey (5Y 7/2), biomicritic, phosphatic, moderately hard, good to excellent intergrannular, moldic, and vuggular porosity. Lost circulation at 482', excellent apparent permeability, abundant molds and casts, with common Dolomite fragments, moderate yellowish brown (10YR 5/4), hard, crystalline (sugary) texture, vuggy porosity and high apparent permeability.

GEOLOGIST'S LOG OF LCU - NORTH RESERVOIR ASR OBSERVATION WELL #1
CONTINUED
LM-6208
SEC 20 - T43S - R25E

Depth (feet)	Lithology
485 - 498	Limestone, yellowish grey (5Y 8/1) to light grey (N7), biomicritic, moderately hard to hard, phosphatic, abundant molds and casts, good moldic porosity and apparent good to excellent permeability, dolomite fragments common.
498 - 502	Limestone, yellowish grey (5Y 8/1), biomicritic, phosphatic, moderately hard, excellent moldic and vugular porosity, excellent apparent permeability, abundant molds and casts, minor dolomite fragments noted. Dolomite, light olive grey (5Y 6/1), crystalline, phosphatic, with some good to excellent vuggy porosity, fair to good apparent permeability.
502 - 518	Limestone, yellowish grey (5Y 8/1), biomicrite, phosphatic, moderately hard, excellent moldic porosity and permeability, abundant molds and casts.
518 - 522	Dolomite, light olive grey (5Y 6/1), crystalline, poor to fair apparent permeability, minor Marl, yellowish grey (5Y 8/1), soft, sticky, poor porosity and apparent permeability, phosphatic, minor Limestone, yellowish grey, as above.
522 - 525	Dolomite, light olive grey (5Y 6/1), crystalline texture, phosphatic, hard, poor porosity and apparent permeability. interbedded with minor Limestone, yellowish grey, biomicritic, moderately hard, dolomitic phosphatic, poor porosity and apparent permeability.
525 - 529	Clay, yellowish grey (5Y 8/1) to white (N9), soft, cohesive, phosphatic.
529 - 534	Limestone, yellowish grey (5Y 8/1) to light olive grey (5Y 6/1),biomicritic, moderately soft to moderately hard, phosphatic, good to excellent porosity, and good apparent permeability.
534 - 541	Dolomite, pale olive (10Y 6/2), crystalline (remnant biomicritic) texture, hard, phosphatic, poor to fair porosity and apparent permeability.
541 - 570	Limestone, yellowish grey (5Y 8/1), biomicritic, moderately hard, very phosphatic, abundant molds and casts, good to excellent porosity and apparent permeability, with rare Clay, yellowish grey, soft, sticky.
570 - 592	Limestone, very pale orange(10 YR 8/2) to pale yellowish brown (10 YR 6/2), biomicritic, moderately soft to moderately hard, good to excellent porosity and apparent permeability, calcarenitic.
592 - 619	Limestone, as above, networked biomicritic, moderately soft, good intergrannular and moldic porosity and apparent permeability.
619 - 640	Clay, very light grey (N8), sandy, firm, cohesive, interbedded with minor Limestone at 632' and 634'.

GEOLOGIST'S LOG OF LCU - NORTH RESERVOIR ASR OBSERVATION WELL #1
CONTINUED
LM-6208
SEC 20 - T43S - R25E

Depth (feet)	Lithology
640 - 656	Limestone, yellowish grey (5Y 8/1), to pale yellowish brown (10YR 6/2), calcarenitic texture with remnant biomicrite, moderately soft to moderately hard, fair to good moldic and intergrannular porosity noted, fair to good apparent permeability, minor to trace amounts of Clay, pale yellowish brown (10YR 6/2) noted.
656 - 705	Limestone, very pale orange (10YR 8/2), to pale yellowish brown (10YR 6/2), calcarenitic texture with remnants of biomicritic texture, moderately soft, fair to good intergrannular and moldic porosity and apparent permeability, rare Clay, light olive grey (5Y 6/1), stiff.
705 - 710	Clay, yellowish grey (5Y 8/1), soft to firm, cohesive, interbedded with Limestone, yellowish grey, micritic (limey mud), soft, poor intergrannular porosity and apparent permeability.
710 - 723	Limestone, yellowish grey (5Y 8/1), micritic (limey mudstone), soft, poor porosity and apparent permeability, minor interbeds of Clay noted.
723 - 748	Limestone, very pale orange (10YR 8/2) to pale yellowish brown (10YR 6/2), calcarenitic with remnant biomicrite, soft to moderately soft, fair to good intergrannular and porosity and apparent permeability.
748 - 750	Limestone, pale yellowish brown (10YR 6/2), biomicritic, moderately soft, fair to good porosity and apparent permeability.
750 - 766	Limestone, pale yellowish brown (10YR 6/2), calcarenitic with remnant biomicrite texture, hard, excellent intergrannular and moldic porosity and apparent permeability.
766 - 767.5	Clay, yellowish grey (5Y 8/1), firm, cohesive.
767.5 - 778	Limestone, yellowish grey (5Y 8/1) to pale yellowish brown (10YR 6/2), calcarenitic, moderately soft to moderately hard, minor phosphate, good intergrannular porosity and apparent permeability.
778 - 778.5	Clay, pale yellowish brown (10YR 6/2), to dusty yellowish brown(10YR 2/2), firm, stiff, poor porosity and apparent permeability.
778.5 - 803	Limestone, pale yellowish brown (10YR 6/2), calcarenitic, moderately soft to moderately hard, good intergrannular porosity and fair to good apparent permeability.
803 - 807.5	Clay, yellowish grey (5Y 8/1), stiff, firm, cohesive, poor apparent porosity and permeability.
807.5 - 828	Limestone, yellowish grey (5Y 8/1), calcarenitic, moderately soft, fair to good intergrannular and minor moldic porosity and apparent permeability.
828 - 836	Limestone, yellowish grey (5Y 8/1), calcarenitic, moderately soft, good intergrannular porosity and apparent permeability.

GEOLOGIST'S LOG OF LCU - NORTH RESERVOIR ASR OBSERVATION WELL #1
CONTINUED
LM-6208
SEC 20 - T43S - R25E

Depth (feet)	Lithology
836 - 842	Limestone, very pale orange (10YR 8/2), calcarenitic with remnant biomicritic texture causing good to excellent moldic and intergrannular porosity, moderately soft, fair to good apparent permeability.
842 - 843	Clay, pale yellowish brown (10YR 6/2), soft, firm, poor porosity and apparent permeability.
843 - 866	Limestone, pale yellowish brown (10YR 6/2), calcarenitic with remnant biomicritic texture, moderately soft to moderately hard, fair to good intergrannular porosity and apparent permeability. Increased moldic porosity at 866' .
866 - 873	Limestone, pale yellowish brown (10YR 6/2), calcarenitic with remnant biomicritic texture, fair to good intergrannular and moldic porosity and apparent permeability.
873 - 887	Limestone, yellowish grey (5Y 7/2), calcarenitic, moderately soft, fair to good intergrannular porosity and poor to fair apparent permeability.
887 - 889	Clay, yellowish grey(5Y 8/1) to very light grey (N8), stiff, cohesive.
889 - 894	Clay, pale yellowish brown(10YR 6/2), stiff, cohesive, low apparent porosity and permeability, with Limestone, pale yellowish brown, dolomitic crystalline with faint remnant biomicrite texture, hard, poor porosity and apparent permeability.
894 - 896	Limestone, yellowish grey (5Y 7/2), calcarenitic, moderately soft to moderately hard, fair to good intergrannular porosity and apparent permeability.
896 - 898	Limestone, pale yellowish brown (10YR 6/2) to light olive grey (5Y 5/2), micritic, moderately soft to moderately hard, poor to fair intergrannular porosity and apparent permeability.
898 - 900	Limestone, yellowish grey (5Y 8/1), calcarenitic, moderately soft to moderately hard, poor to fair intergrannular (minor moldic) porosity and apparent permeability.
900 - 901	Limestone, yellowish grey (5Y 8/1), to pale yellowish brown, micritic, moderately soft to moderately hard, poor intergrannular porosity and apparent permeability.
901 - 902.5	Clay, yellowish grey (5Y 8/1), firm.
902.5 - 904	Limestone, yellowish grey (5Y 8/1), micritic, moderately soft to moderately hard, poor intergrannular porosity and apparent permeability.

GEOLOGIST'S LOG OF LCU - NORTH RESERVOIR ASR OBSERVATION WELL #1
CONTINUED
LM-6208
SEC 20 - T43S - R25E

Depth (feet)	Lithology
904 - 907	Dolomite, pale yellowish brown (10YR 6/2) to to dark yellowish brown (10YR 4/2), crystalline texture, very hard, poor intergrannular porosity and apparent permeability, minor vuggy porosity.
907 - 914	Dolomite, light olive grey(5Y 5/2) ,crystalline texture, very hard, poor porosity and apparent permeability. vuggy/ cavernous porosity from 911' to 914' (excellent permeability expected in this interval), remnant moldic porosity noted.
914 - 922	Dolomite, yellowish grey (5Y 8/1) to pale yellowish brown (10YR 6/2), sucrosic texture, moderately hard to hard, good to excellent vuggy porosity and good to excellent permeability. Minor interbedded Limestone, yellowish grey, calcareous texture, moderately soft to moderately hard, poor intergrannular porosity.
922 - 957	Limestone, yellowish grey (5Y 8/1), to light grey (N7), calcarenite, moderately soft to moderately hard, fair to good intergrannular and moldic porosity (10 - 12mm) and apparent permeability, minor micritic limestone noted at 950' .
957 - 957.5	Clay, yellowish gray (5Y 8/1), soft to firm.
957.5 - 977	Limestone, yellowish grey (5Y 8/1), calcarenitic, moderately soft to moderately hard, fair to good intergrannular and minor moldic porosity and apparent permeability.
977 - 978	Limestone, yellowish grey (5Y 8/1), micritic, moderately soft, poor intergrannular porosity and apparent permeability.
978 - 980	Clay, yellowish grey (5Y 8/1), firm.

APPENDIX F

STRIP LOG

PLATE I

WELL NAME: NORTH RESERVOIR OBSERVATION WELL #1(LM-6208)
LOCATION: SEC. 20 - T43S - R25E, LEE COUNTY, FLORIDA

DEPTH (FEET)	DRILL TIME (MIN./FT.) 0 2 4 6 8 10 12 14 16 18 20 22 24	LITHOLOGY	LITHOLOGIC DESCRIPTIONS	REVERSE AIR WATER QUALITY (EST. TDS - mg/l)	PACKER TEST INFORMATION	CORE INFORMATION
0	TAMIAMI FORMATION		SAND, PALE YELLOWISH BROWN (10 YR 6/2). FINE GRAINED SUB-ANGULAR, HIGH POROSITY, INTERBEDDED WITH CLAY, MODERATE YELLOWISH BROWN (10 YR 5/4), SOFT, COHESIVE, ORGANICS			
			MARL, YELLOWISH GRAY (5 Y 8/1), SOFT, PHOSPHATIC, INTERBEDDED W/LIMESTONE, YELLOWISH GRAY (5Y8/1), MICRITIC, SHELL			
			LIMESTONE, YELLOWISH GRAY (5Y8/1), BIOMICRITIC, PHOSPHATIC, POOR TO FAIR POROSITY, SOME QUARTZ GRAINS INTERBEDDED W/CLAY, YELLOWISH GRAY(5Y8/1) SOFT, COHESIVE			
50	CAPE CORAL CLAY MEMBER (PEACE RIVER FM.)		CLAY, LIGHT OLIVE GRAY (5Y5/2), SOFT, STICKY, LOW APPARENT PERMEABILITY, COHESIVE			
			LIMESTONE, YELLOWISH GRAY (5Y7/2) TO PALE OLIVE (10Y6/2), BIO-MICRITIC, ABUNDANT SHELL, SANDY, GOOD APPARENT POROSITY, MOD-GOOD PERMEABILITY, PHOSPHATIC			
	LEHIGH ACRES MEMBER (PEACE RIVER FM.)		CLAY, PALE OLIVE (10Y6/2) TO LIGHT OLIVE GRAY (5Y5/2), SOFT, STICKY			
100			LIMESTONE, PALE OLIVE, (10Y6/2), SANDY, PHOSPHATIC, SHELL, FAIR GOOD POROSITY			
	←GAMMA RAY		CLAY, DARK GREENISH GRAY (5GY4/1), SOFT, COHESIVE, LOW APPARENT POROSITY AND PERMEABILITY, PHOSPHATIC, MINOR SHELL AND SANDY LIMESTONE			
150			LIMESTONE, YELLOWISH GRAY (5Y7/2) TO PALE OLIVE(10Y6/2), SANDY, BIOMICRITIC, PHOPHATIC, SHELL FRAGMENTS COMMON, INTERBEDDED WITH CLAY, PALE OLIVE (10Y6/2), STICKY, PHOSPHATIC, POOR POROSITY			
			LIMESTONE, YELLOWISH GRAY (5Y7/2) TO PALE GREENISH YELLOW (10Y8/2), BIOMICRITIC, PHOSPHATIC, INTERBEDDED W/ CLAY, GREENISH YELLOW (10Y8/2), FIRM, PHOSPHATIC			
200	FT. MYERS CLAY MEMBER (PEACE RIVER FM.)		CLAY, DUSKY YELLOW GREEN (5GY5/2) TO YELLOWISH GRAY (5Y7/2), SOFT TO FIRM, PHOSPHATIC. WITH MINOR LIMESTONE, YELLOWISH GRAY (5Y7/2), MICRITIC, PHOSPHATIC, FAIR POROSITY, MINOR TO TRACE AMOUNTS OF DOLOMITE, YELLOWISH BROWN (10YR6/2) NOTICED TOWARD BOTTOM			
	MID-HAWTHORN ZONE I MEMBER (ARCADIA FM.)		LIMESTONE, YELLOWISH GRAY (5Y8/1), BIOMICRITIC, PHOSPHATIC, INTERBEDDED WITH CLAY, YELLOWISH GRAY (5Y8/1), SOFT, STICKY, PHOSPHATIC, POOR PERMEABILITY			
250			LIMESTONE, VERY PALE ORANGE (10YR8/2), BIOMICRITIC, PHOSPHATIC, INTERBEDDED WITH CLAY (5Y8/1), SOFT, STICKY			
			CLAY, YELLOWISH GRAY (5Y8/1), SOFT, STICKY, PHOSPHATIC, MINOR LIMESTONE, VERY PALE ORANGE (10YR8/2) TO YELLOWISH GRAY (5Y8/1) BIOMICRITIC			
300						
			CLAY, PALE OLIVE (10Y6/2) TO DUSKY YELLOW GREEN (5GY5/2), FIRM, PHOSPHATIC, INTERBEDDED WITH LIMESTONE, PALE OLIVE (10Y6/2) TO YELLOWISH GRAY (5Y8/1), BIOMICRITIC, GOOD MOLDIC POROSITY			
350	MID-HAWTHORN ZONE II MEMBER (ARCADIA FM.)		CLAY, YELLOWISH GRAY (5Y7/2), SOFT, STICKY, COHESIVE, MINOR LIMESTONE, PALE OLIVE (10Y6/2), PHOSPHATIC, MICRITE			
			LIMESTONE, PALE OLIVE (10Y6/2), MICRITIC, PHOSPHATIC, INTERBEDDED WITH CLAY, YELLOWISH GRAY (5Y7/2)			
400	UNNAMED LIMESTONE ZONE OF MID-HAWTHORN		CLAY, PALE OLIVE (10Y6/2), SOFT, STICKY, COHESIVE, PHOSPHATIC, INTERBEDDED WITH LIMESTONE (5Y7/2) TO VERY PALE ORANGE (10YR8/2) PHOSPHATE/MICRITIC			
			LIMESTONE, VERY PALE ORANGE (10YR8/2), MICRITIC, SOFT, PHOSPHATIC			
	CONFINING BEDS		CLAY, PALE OLIVE (10Y6/2) SOFT, COHESIVE			
450	LOWER HAWTHORN (ARCADIA FM.) ZONE I					
	ZONE II		LIMESTONE, YELLOWISH GRAY (5Y7/2), BIOMICRITE, PHOSPHATIC, FOSSILIFEROUS, MOD. HARD--HARD, GOOD MOLDIC POROSITY, DOLOMITIC FRAGMENTS NOTED BETWEEN 485'--502' LOST CIRCULATION 482--485'			
500						
	CONFINING BEDS		DOLOMITE, PALE OLIVE, CRYSTALLING			
			CLAY, YELLOWISH GRAY, PHOSPHATIC			
	ZONE III		LIMESTONE, YELLOWISH GRAY, BIOMICRITIC			
550			DOLOMITE, PALE OLIVE, CRYSTALLIZE			
	←DRILL TIME		LIMESTONE, BIOMICRITE, ABUNDANT MOLDS & CASTS, GOOD TO EXCELLENT MOLDIC POROSITY			
			LIMESTONE, PALE YELLOWISH BROWN, CALCARENITIC GOOD TO EXCELLENT INTERGRANULAR POROSITY AND REMNANT MOLDIC POROSITY			
600						
	CONFINING BEDS		CLAY, LIGHT GRAY, FIRM, COHESIVE, POOR POROSITY			
			LIMESTONE, CALCARENITIC, GOOD MOLDIC AND INTERGRANULAR POROSITY			
650	SUWANNEE ZONE I					
			LIMESTONE, VERY PALE ORANGE TO PALE YELLOWISH BROWN, CALCARENITIC TEXTURE, REMNANT BIOCRIMITIC MOLDIC POROSITY AND GOOD INTERGRANULAR POROSITY			
700	CONFINING BEDS		CLAY, YELLOWISH GRAY, FIRM, LIMESTONE, MICRITIC, POOR APPARENT POROSITY AND PERMEABILITY			
	ZONE II		LIMESTONE, VERY PALE ORANGE, CALCARENITIC, GOOD INTERGRANULAR AND MOLDIC POROSITY			
			CLAY, YELLOWISH GRAY, FIRM			
750			LIMESTONE, PALE YELLOWISH BROWN, CALCARENITE, VERY GOOD INTERGRANULAR AND MOLDIC POROSITY, REMNANT BIOMICRITIC POROSITY			
			CLAY, YELLOWISH GRAY, FIRM			
			LIMESTONE, PALE YELLOWISH BROWN, CALCARENITE, GOOD INTERGRANULAR POROSITY, MOD. PERMEABILITY			
800	CONFINING BEDS		CLAY, YELLOWISH GRAY, STIFF			
	ZONE III		LIMESTONE, VERY PALE ORANGE CALCARENITE, GOOD INTERGRANULAR AND MOLDIC POROSITY			
850						
	CONFINING BEDS		CLAY, YELLOWISH GRAY, FIRM AND DOLOMITE			
900			LIMESTONE, YELLOWISH GRAY, MICRITIC			
	OCALA		DOLOMITE, PALE YELLOWISH BROWN TO LIGHT OLIVE GRAY. CAVERN FROM 911'-914'			
			LIMESTONE, YELLOWISH GRAY, CALCARENITIC, MOD. SOFT - MOD. HARD, GOOD INTERGRANULAR POROSITY AND MOLDIC POROSITY			
950			CLAY, YELLOWISH GRAY, SOFT-FIRM			
			LIMESTONE, YELLOWISH GRAY, CALCARENITE, POOR - FAIR INTERGRANULAR POROSITY, MICRITIC AT 977'			
			CLAY, YELLOWISH GRAY, FIRM			
1000						

(EST. TDS - mg/l)
0 500 1000 1500 2000

TEST #1 (OH)
480'-518'
EST. TRANSMIS.
90,000 GPD./FT
DIS. CL=880mg/l
SWL=24.84' ALS

TEST #2
(SINGLE PACKER)
529'-619'
EST. TRANSMIS.
39,000 GPD./FT
DIS. CL=700mg/l
SWL=31.33' ALS

TEST #3
(SINGLE PACKER)
640'-703'
EST. TRANSMIS.
15,000 GPD./FT
DIS. CL=740mg/l
SWL=32.36' ALS

TEST #4
(SINGLE PACKER)
808'-890'
EST. TRANSMIS.
5,500 GPD./FT
DIS. CL=720mg/l
SWL=33.00' ALS

TEST #5
(SINGLE PACKER)
904'-977'
EST. TRANSMIS.
72,000 GPD./FT
DIS. CL=1000mg/l
SWL=32.91' ALS

D-013892DC-1
1/25/99

Water Resource Solutions

APPENDIX G

GEOPHYSICAL LOGS

Southern Resource Exploration Inc.

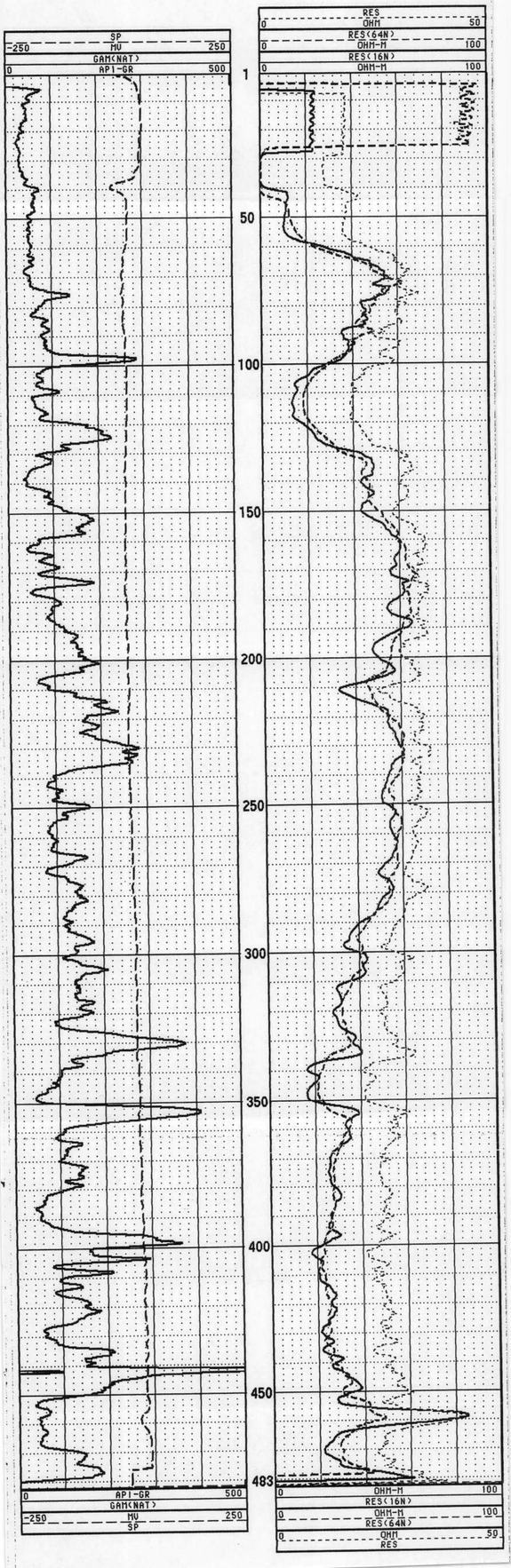
P.O. Box 14311
Gainesville, Florida 32604
Phone 352-372-5950

GAM, RES (16-64), SP

COMPANY	: WELL WATER SYSTEMS			OTHER SERVICES:	
WELL	: TEST WELL #1				
LOCATION/FIELD	: NORTH RESERVOIR B98-43				
COUNTY	: LEE				
STATE	: FL				
SECTION	: 20	TOWNSHIP	: 43S	RANGE	: 25E
DATE	: 11/19/98	PERMANENT DATUM	:	ELEVATIONS	
DEPTH DRILLER	: 485'	ELEV. PERM. DATUM:		KB	:
LOG BOTTOM	: 482.60	LOG MEASURED FROM:	GL	DF	:
LOG TOP	: 1.60	DRL MEASURED FROM:	GL	GL	:
CASING DRILLER	: 42	LOGGING UNIT	: BWT		
CASING TYPE	: STEEL	FIELD OFFICE	: GVL		
CASING THICKNESS	: -	RECORDED BY	: MAF		
BIT SIZE	: 7.875	BOREHOLE FLUID	: WATER	FILE	: ORIGINAL
MAGNETIC DECL.	:	RM	:	TYPE	: 9041A
MATRIX DENSITY	:	RM TEMPERATURE	:	LOG	: 4
FLUID DENSITY	:	MATRIX DELTA T	:	PLOT	: 9040B 2
NEUTRON MATRIX	:	FLUID DELTA T	: 189	THRESH	: 5000
REMARKS	:				

OBSERVED BY PAM BEDEN WATER RESOURCE SOLUTIONS

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



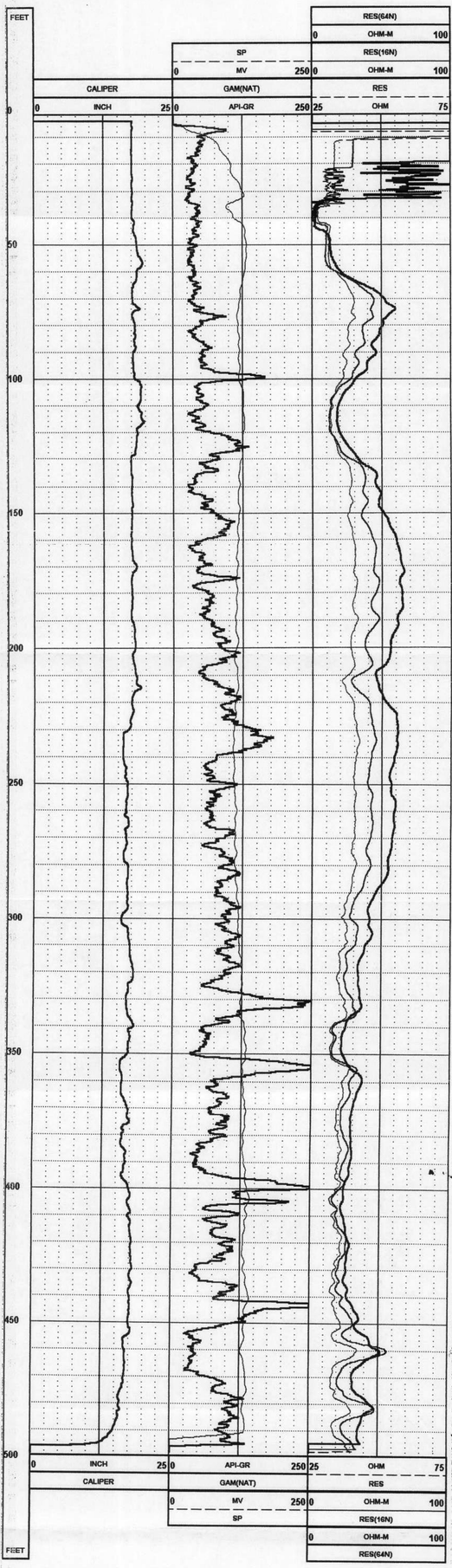
Southern Resource Exploration

P.O. Box 14311
Gainesville, Florida 32604
Phone 352-372-5950

ASR TEST WELL

COMPANY	: WELL WATER SYSTEMS			OTHER SERVICES:	
WELL	: ASR TEST WELL				
LOCATION/FIELD	: NORTH RESERVOIR				
COUNTY	: LEE				
STATE	: FL				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 12/01/98	PERMANENT DATUM	:	ELEVATIONS:	
DEPTH DRILLER	: 498'	ELEV. PERM. DATUM	:	KB	:
LOG BOTTOM	: 498.60	LOG MEASURED FROM:	TOC	DF	:
LOG TOP	: 1.40	DRL MEASURED FROM:	TOC	GL	:
CASING DRILLER	: 42	LOGGING UNIT	: BWT		
CASING TYPE	: STEEL	FIELD OFFICE	: GVL		
CASING THICKNESS:	-	RECORDED BY	: MAF		
BIT SIZE	: 17.5	BOREHOLE FLUID	: WATER	FILE	: ORIGINAL
MAGNETIC DECL.	:	RM	:	TYPE	: 9041A
MATRIX DENSITY	:	RM TEMPERATURE	:	LOG	: 0.
FLUID DENSITY	:	MATRIX DELTA T	:	PLOT	:
NEUTRON MATRIX	:	FLUID DELTA T	: 189	THRESH:	5000
REMARKS:					

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



Southern Resource Exploration

P.O. Box 14311
Gainesville, Florida 32604
Phone 352-372-5950

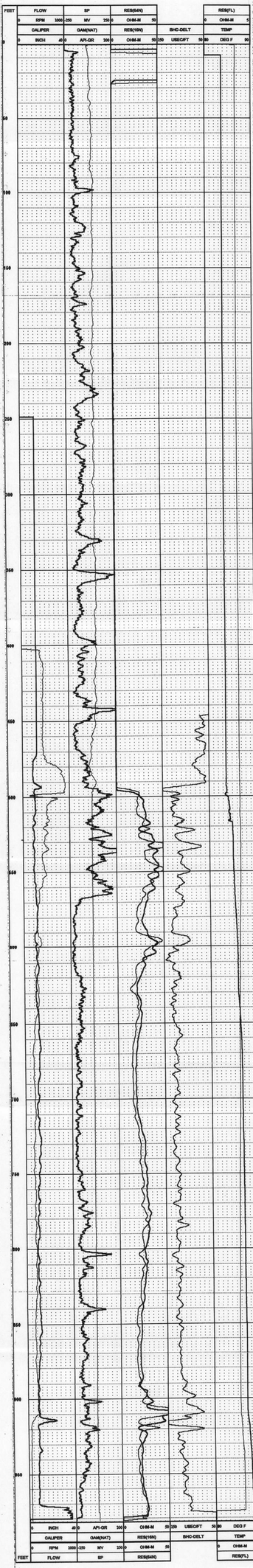
ASR TEST WELL

COMPANY	: WELL WATER SYSTEMS			OTHER SERVICES:	
WELL	: ASR TEST WELL				
LOCATION/FIELD	: NORTH RESERVOIR				
COUNTY	: LEE				
STATE	: FL				
SECTION	: 20	TOWNSHIP	: 43S	RANGE	: 25E
DATE	: 12/21/90	PERMANENT DATUM	:	ELEVATIONS:	
DEPTH DRILLER	: 880'	ELEV. PERM. DATUM	:	KB	:
LOG BOTTOM	: 862.00	LOG MEASURED FROM:	GL	DF	:
LOG TOP	: 1.00	DRL MEASURED FROM:	GL	GL	:
CASING DRILLER	: 400	LOGGING UNIT	: BWT		
CASING TYPE	: STEEL	FIELD OFFICE	: GWL		
CASING THICKNESS:	-	RECORDED BY	: MAF		
BIT SIZE	: 7.875	BOREHOLE FLUID	: MUD @ 68°F/20°C	FILE	: ORIGINAL
MAGNETIC DECL.	:	RM	:	TYPE	: 9041A
MATRIX DENSITY	:	RM TEMPERATURE	:	LOG	: 1
FLUID DENSITY	:	MATRIX DELTA T	:	PLOT	:
NEUTRON MATRIX	:	FLUID DELTA T	: 189	THRESH:	5000

REMARKS:

LOGGING OBSERVED BY PAMELA BEDAN
FLOW LOG RUN @40'/MIN. DOWN.

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



APPENDIX H

SPECIFIC CAPACITY PUMPING TEST DATA

1. Lower Hawthorn Zone II - Open Hole Test
2. Lower Hawthorn Zone III - Single Packer Test
3. Suwannee Zone I - Single Packer Test
4. Suwannee Zone III - Single Packer Test
5. Ocala Zone I - Single Packer Test

LEE COUNTY UTILITIES - NORTH RESERVOIR ASR PROJECT
SPECIFIC CAPACITY PUMPING TEST
WELL LM-6208 (OBSERVATION WELL #1)

TEST DATE: 12-07-98
STATIC WATER LEVEL: 18.48 FT. ABOVE MEASURING PT.
MEASURING PT. = 5.60 FT. ABOVE T.O.C (6.36 FT. ABOVE LAND SURFACE)
TEST INTERVAL: 480 - 518 FT. (LOWER HAWTHORN ZONE II)

FLOW RATE (GPM)	ELAPSED TIME (MINUTES)	WATER LEVEL (FT. AMP)	DRAWDOWN (FEET)	SPECIFIC CAPACITY (GPM/FT)
103	5	16.63	1.85	
	10	16.63	1.85	
	15	16.63	1.85	
	20	16.63	1.85	
	25	16.63	1.85	
	30	16.63	1.85	55.67
222	5	13.86	4.62	
	10	12.70	5.78	
	15	13.86	4.62	
	20	13.86	4.62	
	25	13.86	4.62	
	30	13.86	4.62	48.05
327	5	9.24	9.24	
	10	9.24	9.24	
	15	11.55	6.93	
	20	11.55	6.93	
	25	11.55	6.93	
	30	11.55	6.93	46.19
430	5	11.08	7.40	
	10	10.39	8.09	
	15	10.39	8.09	
	20	8.08	10.40	
	25	8.08	10.40	
	30	8.08	10.40	41.35

AMP= Above Measuring Point
GPM= Gallons Per Minute
T.O.C.= Top Of Casing

LEE COUNTY UTILITIES - NORTH RESERVOIR ASR PROJECT
SPECIFIC CAPACITY PUMPING TEST
WELL LM-6208 (OBSERVATION WELL #1)

TEST DATE: 12-09-98
STATIC WATER LEVEL: 25.98 FT. ABOVE MEASURING PT.
MEASURING PT. = 4.92 FT. ABOVE T.O.C (5.68 FT. ABOVE LAND SURFACE)
TEST INTERVAL: 529 - 619 FT. (LOWER HAWTHORN ZONE III)

FLOW RATE (GPM)	ELAPSED TIME (MINUTES)	WATER LEVEL (FT. AMP)	DRAWDOWN (FEET)	SPECIFIC CAPACITY (GPM/FT)
73	5	18.48	7.50	
	10	18.48	7.50	
	15	18.48	7.50	
	20	18.48	7.50	
	25	18.48	7.50	
	30	18.48	7.50	9.73
149	5	3.45	22.52	
	10	3.45	22.52	
	15	3.45	22.52	
	20	3.45	22.52	
	25	3.45	22.52	
	30	3.45	22.52	6.62
230	5	-28.60	55.83	
	10	-28.97	55.95	
	15	-30.05	56.03	
	20	-28.82	54.80	
	25	-30.07	56.05	
	30	-28.82	54.80	4.10
295	5	-56.98	82.96	
	10	-57.06	83.04	
	15	-57.17	83.15	
	20	-57.21	83.19	
	25	-57.21	83.19	
	30	-57.18	83.16	3.55

AMP= Above Measuring Point
GPM= Gallons Per Minute
T.O.C.= Top Of Casing

LEE COUNTY UTILITIES - NORTH RESERVOIR ASR PROJECT
SPECIFIC CAPACITY PUMPING TEST
WELL LM-6208 (OBSERVATION WELL #1)

TEST DATE: 12-11-98
STATIC WATER LEVEL: 24.02 FT. ABOVE MEASURING PT.
MEASURING PT. = 5.54 FT. ABOVE T.O.C (6.3O FT. ABOVE LAND SURFACE)
TEST INTERVAL: 640 - 703 FT. (SUWANNEE ZONE I)

FLOW RATE (GPM)	ELAPSED TIME (MINUTES)	WATER LEVEL (FT. BMP)	DRAWDOWN (FEET)	SPECIFIC CAPACITY (GPM/FT)
79	5	-12.47	11.55	
	10	-12.47	11.55	
	15	-12.01	12.01	
	20	-12.01	12.01	
	25	-12.01	12.01	
	30	-12.01	12.01	6.58
150	5	13.09	37.11	
	10	13.79	37.81	
	15	14.18	38.20	
	20	14.18	38.20	
	25	14.18	38.20	
	30	14.18	38.20	3.93
221	5	43.78	67.80	
	10	44.28	68.30	
	15	44.28	68.30	
	20	44.28	68.30	
	25	44.28	68.30	
	30	44.28	68.30	3.24
282	5	74.38	98.40	
	10	74.88	98.90	
	15	74.68	98.70	
	20	74.68	98.70	
	25	74.69	98.71	
	30	74.69	98.71	2.86

BMP= Below Measuring Pt.
GPM= Gallons Per Minute
T.O.C.= Top Of Casing

LEE COUNTY UTILITIES - NORTH RESERVOIR ASR PROJECT
SPECIFIC CAPACITY PUMPING TEST
WELL LM-6208 (OBSERVATION WELL #1)

TEST DATE: 12-16-98
STATIC WATER LEVEL: 30.03 FT. ABOVE MEASURING PT.
MEASURING PT. = 8.20 FT. ABOVE T.O.C (8.96 FT. ABOVE LAND SURFACE)
TEST INTERVAL: 808 - 890 FT. (SUWANNEE ZONE III)

FLOW RATE (GPM)	ELAPSED TIME (MINUTES)	WATER LEVEL (FT. BMP)	DRAWDOWN (FEET)	SPECIFIC CAPACITY (GPM/FT)
55	5	-10.40	19.63	
	10	-10.40	19.63	
	15	-10.40	19.63	
	20	-10.40	19.63	
	25	-10.40	19.63	
	30	-10.40	19.63	2.80
70	5	-5.78	24.25	
	10	-4.04	25.99	
	15	-5.78	24.25	
	20	-5.78	24.25	
	25	-5.78	24.25	
	30	-5.78	24.25	2.89
115	5	23.00	55.58	
	10	23.80	56.38	
	15	24.00	56.58	
	20	24.50	57.08	
	25	24.50	57.08	
	30	24.50	57.08	2.01
158	5	53.00	85.58	
	10	51.40	83.98	
	15	51.80	84.39	
	20	52.00	84.58	
	25	52.00	84.58	
	30	52.10	84.68	1.87
190	5	73.00	105.58	
	10	74.00	106.58	
	15	75.00	107.58	
	20	74.40	106.98	
	25	74.30	106.88	
	30	74.30	106.88	1.77

BMP= Below Measuring Pt.
GPM= Gallons Per Minute
T.O.C.= Top Of Casing

LEE COUNTY UTILITIES - NORTH RESERVOIR ASR PROJECT
SPECIFIC CAPACITY PUMPING TEST
WELL LM-6208 (OBSERVATION WELL #1)

TEST DATE: 12-18-98
STATIC WATER LEVEL: 25.41 FT. ABOVE MEASURING PT.
MEASURING PT. = 7.50 FT. ABOVE LAND SURFACE
TEST INTERVAL: 904 - 977 FT. (OCALA ZONE I)

FLOW RATE (GPM)	ELAPSED TIME (MINUTES0	WATER LEVEL (FT. BMP)	DRAWDOWN (FEET)	SPECIFIC CAPACITY (GPM/FT)
85	5	-17.33	8.08	
	10	-17.33	8.08	
	15	-17.33	8.08	
	20	-17.33	8.08	
	25	-17.33	8.08	
	30	-17.33	8.08	10.52
160	5	-3.47	21.97	
	10	-4.62	20.79	
	15	-4.62	20.79	
	20	-4.62	20.79	
	25	-4.62	20.79	
	30	-4.62	20.79	7.69
240	5	29.20	56.86	
	10	30.90	58.56	
	15	30.90	58.56	
	20	31.10	58.76	
	25	31.10	58.76	
	30	31.10	58.76	4.08
322	5	75.00	102.69	
	10	75.60	103.29	
	15	75.70	103.39	
	20	75.70	103.39	
	25	75.70	103.39	
	30	75.70	103.39	3.11

BMP= Below Measuring Pt.
GPM= Gallons Per Minute
T.O.C.= Top Of Casing

APPENDIX I

WATER QUALITY DATA

1. Reverse Air Water Quality
2. Aquifer Test Water Quality

TABLE - 1
LCU - NORTH RESERVOIR ASR PROJECT
ASR OBSERVATION WELL #1 - LM-6208
CHLORIDE AND CONDUCTIVITY vs. DEPTH

DEPTH (ft. below Land Surface)	SAMPLING DATE	DISSOLVED CHLORIDES (mg/l)	CONDUCTIVITY at 25° C (umhoc/cm)
502	12/4/98	860	3080
522	12/5/98	880	3250
533	12/8/98	880	3210
563	12/8/98	770	3150
595	12/8/98	830	3090
625	12/8/98	840	3020
656	12/10/98	840	3051
687	12/10/98	840	3042
703	12/10/98	890	3006
748	12/14/98	840	2575
717	12/14/98	830	2590
778	12/14/98	810	2580
808	12/14/98	830	2590
843	12/14/98	820	2520
873	12/14/98	800	2600
903	12/17/98	830	2790
935	12/17/98	640	2927
965	12/17/98	840	2905
980	12/17/98	820	2916

TABLE - 2
LCU - NORTH RESERVOIR ASR PROJECT
ASR OBSERVATION WELL #1 - LM-6208
CHLORIDE AND CONDUCTIVITY RESULTS FROM PACKER TESTS

ZONE TESTED	STEP NO.	FLOW RATE (gpm)	SAMPLING DATE	DISSOLVED CHLORIDES (mg/l)	CONDUCTIVITY at 25^0 C (umhoc/cm)
Lower Hawthorn	1	103	12/7/98	880	3290
Zone II	2	222	12/7/98	880	3250
(480 - 518')	3	327	12/7/98	860	3280
	4	430	12/7/98	890	3230
Lower Hawthorn	1	73	12/9/98	740	2590
Zone III	2	149	12/9/98	680	2580
(529 - 619')	3	230	12/9/98	720	2650
	4	295	12/9/98	700	2640
Suwannee	1	79	12/11/98	780	2710
Zone I	2	150	12/11/98	720	2700
(640 - 703')	3	221	12/11/98	740	2710
	4	282	12/11/98	740	2710
Suwannee	1	55	12/16/98	660	2280
Zone III	2	70	12/16/98	740	2485
(808 - 890')	3	115	12/16/98	700	2485
	4	158	12/16/98	700	2470
	5	190	12/16/98	720	2450
Ocala	1	85	12/18/98	970	3203
Zone I	2	160	12/18/98	970	3253
(904 - 977')	3	240	12/18/98	990	3284
	4	322	12/18/98	1000	3244