INITIAL RESULTS OF WATER SUPPLY EVALUATION AT SQUIRREL ISLAND GLADES COUNTY, FLORIDA

Prepared For

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Project No. 57052104

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1.0 INTRODUCTION

A water supply evaluation is being conducted by Lykes Bros., Inc., for a potential irrigation system at "Squirrel Island" in Glades County, Florida. As part of this study, Law Environmental, Inc., has collected recorded information on wells in the vicinity of the site, and conducted testing on wells in and around the property. The initial focus of the water supply evaluation has been the Floridan aquifer system. The planned development site and the surrounding area are shown on Figure 1.

In June of 1990 Law tested 3 wells near the Squirrel Island property in order to estimate the potential for using the Floridan aquifer as a water supply source before drilling test wells in the planned development area. The results of this testing were submitted to Lykes Bros. in August of 1990 and indicated that although the yield and water quality were not as good as desired, the Floridan aquifer in the Squirrel Island area might potentially be utilized as a source of irrigation water supply.

In order to collect more detailed site specific data Lykes Bros. drilled two Floridan aquifer test wells at Squirrel Island beginning in March of 1991. Hydrogeologic testing was performed on both wells by Law Environmental. The following sections present the data collected at the two test wells, and a comparison of the site specific data with information collected on other wells within the general area.

2.0 SITE SPECIFIC DATA

The two test wells drilled at Squirrel Island were designated as Test Well #1 and Test Well #2. Their locations are shown on Figure 1. Testing and sampling conducted on each well consisted of geologic sampling, water quality testing, and hydraulic testing.

2.1 Well Construction and Geology

The well construction, and geologic cross-sections for Test Wells #1 and #2 are shown on Figures 2 and 3 respectively. Test Well #1 was drilled to a depth of 1,698 feet below land surface (bls) with casing set to 771 feet and then cemented back to 1,535 feet bls. The land surface elevation at site #1 is approximately 52 feet NGVD. Test Well #2 was drilled to a depth of 1,396 feet bls and cased to 750 feet, and the land surface elevation at this site is approximately 70 feet NGVD.

During the drilling of each test well, cuttings were collected at intervals of ten feet and described and recorded in Geologist's Logs which are presented in Appendix A. In general, as can be seen from the cross-sections, there is sand with some clay and shell from land surface down to about 120 to 150 feet which makes up the undifferentiated surficial deposits. Underlying the surficial deposits are a sequence of clays, limestones, and dolomites, with phosphate deposits

throughout, that extend to a depth of about 720 to 770 feet bls. These units make up what are known as the Peace River Formation and the Arcadia Formation, which together make up the Hawthorn Group. Underlying these formations are thick limestone and dolomite units that make up the Floridan aquifer. In descending order they are the "Suwannee" Limestone, Ocala Group Limestone, Avon Park Limestone, and Lake City Limestone. The geologic cross-sections also indicate that the "Suwannee" and the Ocala Group Limestones become thinner going from Test Well #2 towards Test Well #1, or in the East-Southeast direction. Test Well #1 extends down into the Lake City Limestone, whereas Test Well #2 terminates in the Avon Park Limestone.

2.2 Water Quality Testing

Water quality testing was conducted on both wells during the well construction and after each well was completed. Selected chloride and conductivity data for each well are also shown on Figures 2 and 3. Tables 1 and 2 and Appendices B and C present all of the water quality data collected at Test Well #1 and Test Well #2 respectively. The chloride and conductivity levels in Test Well #1 increased significantly below about 1,630 feet, and a highly mineralized (saline) zone was encountered at the bottom of the well. The well was cemented back to 1,535 feet in three separate stages in order to conduct a series of four packer tests. These tests enabled the water from specific depth intervals to be sampled and tested without the effects of mixing with water higher

up in the borehole. The results of the packer tests verify the presence of a high chloride zone (over 3,000 mg/l; milligrams per liter) below approximately 1,635 feet, but also indicate that the chloride level is only about 400 to 500 mg/l from above 1,635 feet to approximately 1,480 feet. The final composite chloride level in the well appears to be about 350 mg/l based on analysis of water samples collected during a pumping test after the well was completed. The final composite chloride level in Test Well #2 is about 450 to 500 mg/l.

2.3 Specific Capacity Testing

Specific capacity testing was also conducted at each well during the reverse-air drilling process. The specific capacity of a well is an estimate of how much water the well will yield per unit of drawdown of the water level. An increase in specific capacity indicates that more water is being produced in the well. Tables 3 and 4 present the specific capacity data for Test Wells #1 and #2 respectively. As can be seen from these tables, the specific capacity for Test Well #1 increased significantly at approximately 1,494 feet, while at #2 a significant increase occurred at about 1,370 feet. Therefore, it appears that most of the water in Test Well #1 is being produced from below about 1,490 feet bls, and in Test Well #2 most of the water appears to be coming from below about 1,350 feet bls.

2.4 Pumping Tests

The final task of the testing program for each test well, was the performance of a step-drawdown pumping test and constant-rate pumping test. The data for each of these tests are presented in Appendices D and E. Figure 4 shows the relationships between discharge and drawdown for Test Wells #1 and #2 which were derived from the results of the step-drawdown tests. As can be seen from these graphs, Test Well #1 is estimated to have approximately 2 to 3 times more drawdown in the well than Test Well #2 at an equivalent discharge rate. Results of the constant-rate pumping tests indicate that the transmissivity at the site of Test Well #1 is on the order of 47,500 gpd/ft (gallons per day per foot), while that at the site of Test Well #2 is estimated to be on the order of 85,000 gpd/ft.

6350 ft²/day

→ 11,364 ft²/day.

3.0 REGIONAL DATA COMPARISON

Information on wells in the vicinity of Squirrel Island was obtained from the South Florida Water Management District (SFWMD) and the United States Geological Survey (USGS) in order to compare existing data with the results from the two test wells. However, the data is limited because much of the information avaliable on wells in the area describes the surficial aquifer and not for the Floridan aquifer. Data obtained include water level, water quality, and well construction information.

Table 5 presents data obtained from wells drilled into the Floridan aquifer near Squirrel Island as well as from Test Well #1 and Test Well #2. The locations of these wells are shown on Figure 5 which also shows the cased and total depths of the wells as well as chloride data (depth and chloride data are shown on the transparent overlay sheet). In general, Test Wells #1 and #2 appear to have chloride levels similar to those of wells north of the Squirrel Island site. However, one well to the north of Squirrel Island, HIF-21, appears to have a much higher chloride level than othres in that same area. This may be due to its greater depth, nearly 1,600 feet, but wells HIF-22 and HIF-23 are almost as deep and have much lower chloride levels. It is possible that the chloride levels in wells HIF-22, HIF-23, and GLF-3 are diluted if the wells are open to the intermediate aquifer system by way of shallow casing depths. In the case of GLF-

3 this may be true because it is known to be cased only down to 200 feet. Information about the cased depths of HIF-22 and HIF-23 are not available. Therefore, it appears that there is significant variability in the water quality of the Floridan aquifer in that region, or that there may be a zone of higher chloride water at a depth of almost to 1,600 feet in that area. If the latter is the case, that zone may correspond to the zone encountered at Test Well #1 at a depth of nearly 1,700 feet bls which would indicate that it is consistent across the site.

Wells GLF-5 and GS-123, to the southeast of Squirrel Island, is reported to have higher chloride levels than the test wells and the other wells. Well GS-123 is reported to have a chloride level of 2,350 mg/l, but it is reported to be drilled to a depth of only 1,200 feet. Even GS-116 which is drilled to a much shallower depth (750 feet) is reported to have a somewhat higher chloride level than the test wells and the wells to the north of the site. This indicates that the chloride levels in the Floridan aquifer may tend to increase to the southeast in this region even at shallower depths.

Information about aquifer characteristics and/or possible production zones from any of the Floridan aquifer wells around Squirrel Island (other than the test wells) is extremely limited. However, based on completion depths of the wells presented in Table 5, and on completion depths of existing and proposed wells taken from various water use permit documents obtained from SFWMD, there

appears to be a wide range of depths to which wells have been or are planned to be drilled within the region. There does not appear to be any consistency as to the occurrence of production zones in the area of Squirrel Island.

4.0 CONCLUSIONS AND RECCOMENDATIONS

Based on the results of our testing of Test Wells #1 and #2 and on the data obtained from other wells in the area the following conclusions were made:

1. There is an apparent zone of high chloride water (above 1,000 mg/l) across the Squirrel Island region that occurs below about 1,600 to 1,700 feet below land surface.

2. The upper 500 to 600 feet of the Floridan aquifer in the area has good quality water (below 200 mg/l chloride), but the yield of water is quite low. In order to keep the chloride level to 200 mg/l or less and maintain a pumpage of approximately 500 gallons per minute (gpm), a well should be no deeper than about 1,350 feet and a drawdown of approximately 200 feet would be expected.

3. A higher yield of water (approximately 700 to 1,000 gpm) could be obtained from deeper wells, about 1,400 to 1,500 feet deep, with drawdowns of about 50 to 125 feet, but the chloride level would be expected to range from about 350 to 500 mg/l. Water of such quality would require mixing with fresher water to keep the chloride level to 200 mg/l or less for purposes of irrigation.

There are several potential constraints on using the Floridan aquifer as a single source of water supply for irrigation purposes. These constraints involve balancing the desired yield of water with the desired quality of water which might affect the economic viability of this source. Therefore, the following reccomendations are made:

1. It is reccomended that the intermediate aquifer system from about 300 feet to 700 feet be investigated for its potential yield of water and to better evaluate water quality. One or more exploratory wells should be drilled to approximately 700 feet bls and cased to about 300 feet. After completion of the well(s), hydraulic and water quality testing should be conducted.

2. It is suggested that the surficial aquifer should be investigated by digging one or more small seepage/recharge pits in order to explore and evaluate the possibility of obtaining water from the water table aquifer and for using such pits as a means of mixing Floridan and intermediate groundwater.

TABLES

Table 1. Water Quality Data For Squirrel Island Test Well #1.

Date (1991)	Depth (feet bls)	Chloride (mg/l)	Conductivity (umhos/cm)	TDS * (mg/l)	pH (units)
3/19	812	54	525	366	9.72
	843	40	510	348	10.30
	874	61	505	310	9.55
3/20	905	74	500	394	10.30
	936	64	510	324	10.73
	967	54	840	394	11.30
	998	78	545	327	9.21
3/21	1029	58	1450	510	11.65
	1060	54	550	314	10.01
	1091	80	1880	614	11.80
	1122	67	2085	643	11.81
3/22	1153	78	555	338	9.97
	1184	64	505	352	9.10
3/25	1215	68	555	372	8.73
	1246	54	510	350	9.44
	1277	68	500	356	9.19
3/26	1308	64	480	384	9.39
	1339	78	515	420	9.46
	1370	138	650	510	8.88
	1401	190	880	646	8.62
3/27	1432	208	995	682	8.38
	1463	268	1105	792	8.30
4/1	1494	408	1500	1010	8.23
	1525	454	1805	1090	7.83
	1556	458	1740	1050	7.93
	1587	434	1785	1060	7.93
4/2	1618	514	1900	1220	7.99
	1649	536	2050	1270	7.94
	1680	844	2970	1730	7.91
4/3	1698	1770	5610	3330	7.91
4/11	1664-1698 **	3370	10700	6050	7.84
4/17	1574-1635 **	531	2440	1510	11.20
4/23	1536-1585 **	449	1960	1220	10.90
4/29	1482-1535 **	427	2495	1290	11.50
5/6	1535 ***	335	1500	828	9.06
5/7	1535 ***	344	1580	870	8.54
5/8	1535 ***	366	1660	922	8.64
5/9	1535 ***	359	1590	888	8.48

Samples analysed by Lykes Bros. except as noted below.

* - Total dissolved solids analysed by Short Environmental Lab.

** - Sample obtained during packer test (all parameters analysed by Short Environmental Lab).

*** - Sample obtained during pump test (all parameters analysed by Short Environmental Lab).

Table 2. Water Quality Data For Squirrel Island Test Well #2.

Date (1991)	Depth (feet bls)	Chloride (mg/l)	Conductivity (umhos/cm)	TDS (mg/l)	pH (units)
6/4	1215	115	1190	550	11.30
	1246	180	1310	590	11.70
	1277	NC	3200	1320	12.20
6/5	1308	262	1300	590	9.70
	1339	265	1650	750	11.00
	1370	410	1835	820	9.70
	1396	450	2040	910	8.20
6/17	1396 *	416	1860	1080	7.94
6/18	1396 *	406	1910	1090	7.92
6/19	1396 *	439	1925	1090	8.02
6/20	1396 *	444	1730	1110	8.08
6/21	1396 *	485	1950	1120	8.11

Samples analysed in the field by Law Environmental except as noted below.

* - Sample obtained during pump test (all parameters analysed by Short Environmental Lab).

NC - Not collected.

Table 3. Specific Capacity Data - Squirrel Island Test Well #1.

Date (1991)	Depth (feet bls)	Discharge (gpm)	Drawdown (feet)	Specific Capacity (gpm/ft)
3/19	843	48	(192)	0.25
	874	78	(194)	0.36
3/20	905	70	(194)	0.36
	936	70	(189)	0.37
	967	94	(189)	0.50
	998	108	(193)	0.56
3/21	1029	108	(189)	0.57
	1060	108	(189)	0.57
	1091	98	(159)	0.59
	1122	123	137	0.90
3/22	1153	94	122	0.77
	1184	94	119	0.79
3/25	1215	94	112	0.84
	1246	123	102.5	1.20
	1277	123	105	1.20
3/26	1308	123	84	1.50
	1339	125	75	1.70
	1370	123	64	1.90
	1401	125	49	2.60
3/27	1432	139	41	3.40
	1463	123	33	3.70
	1494	156	14.6	10.70
4/1	1525	123	10.4	11.80
	1556	139	12.5	11.10
	1587	139	11.7	11.90
4/2	1618	193	14.8	13.00
	1649	174	10.4	16.70
	1680	174	8.1	21.50
	1698	174	5.4	32.20

Note: Numbers in parentheses are approximate, and not from direct measurements.

Table 4. Specific Capacity Data - Squirrel Island Test Well #2.

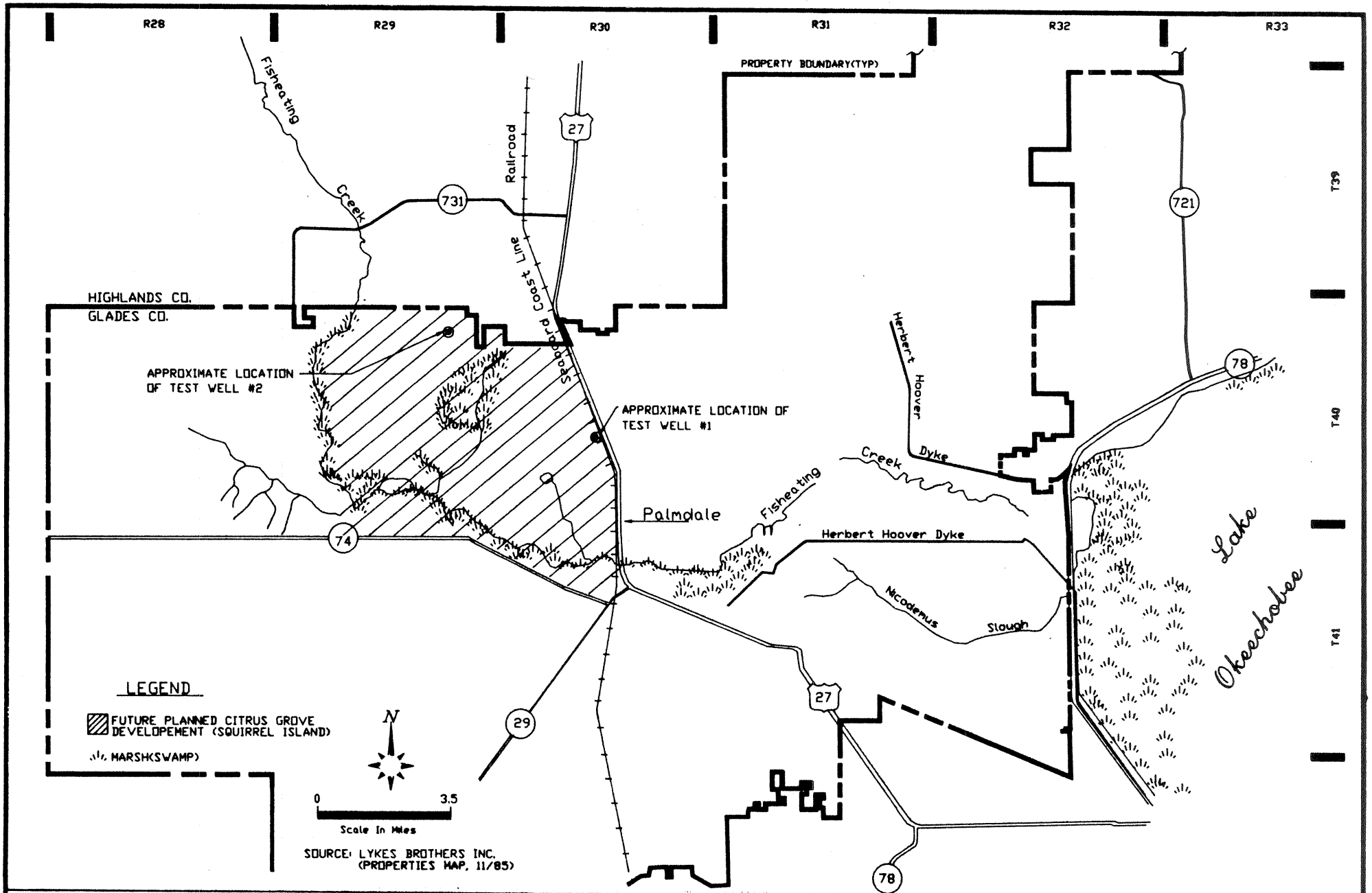
Date (1991)	Depth (feet bls)	Discharge (gpm)	Drawdown (feet)	Specific Capacity (gpm/ft)
6/4	1308	123	49.5	2.5
6/5	1339	156	35.9	4.3
	1370	174	14.9	11.7
6/6	1396	139	10.0	13.9

Table 5. Summary of Data For Wells In and Around Squirrel Island.

WELL NO.	LOCATION SEC.	TWN.	RNG.	OWNER	AQUIFER	TOTAL DEPTH (feet)	CASING DEPTH (feet)	CASING DIAMETER (inches)	WATER LEVEL (feet NGVD)	TRANS-MISSIVITY (gpd/ft)	CHLORIDE (mg/l)	CONDUC-TIVITY (umhos/cm)	SOURCE OF INFORMATION
TW #1	21	40S	30E	LYKES	FLORIDAN	1535	771	16.0	49.7(MAY 91)	47,500	360	1600	LAW ENV., INC.
TW #2	2	40S	29E	LYKES	FLORIDAN	1396	750	16.0	50.2(JUNE 91)	85,000	450	1925	LAW ENV., INC.
GLF-3	6	40S	30E	LYKES	FLA/INT	1500	200	10.0	51.09(MAY 82) 52.27(SEPT 82)	N/A	350 *	1800 *	SFWMD TECHNICAL PUBLICATION 84-1
GLF-5	8	41S	31E	LYKES	FLA/INT	1620	290	12.0	45.50(MAY 82) 46.03(SEPT 82)	N/A	1837.1	5945	SFWMD TECHNICAL PUBLICATION 84-1
GS-116	18	42S	31E	STATE ROAD DEPARTMENT	FLORIDAN	750	N/A	4.0	N/A	N/A	510	N/A	USGS R.I. #37
GS-123	14	42S	31E	J. H. PEEPLES	FLORIDAN	1200	400	8.0	N/A	N/A	2350	N/A	USGS R.I. #37
HIF-21	31	39S	28E	FISHEATING CREEK DAIRY	FLORIDAN	1594	695	16.0	48.47(MAY 82) 51.31(SEPT 81)	N/A	1660.6	5365	SFWMD TECHNICAL PUBLICATION 84-1
HIF-22	2	39S	28E	GRAHAM CO.	FLORIDAN	1560	N/A	16.0	48.86(MAY 82) 51.56(SEPT 82)	N/A	309.9	N/A	SFWMD TECHNICAL PUBLICATION 84-1
HIF-23	4	39S	28E	GRAHAM CO.	FLORIDAN	1560	N/A	16.0	49.99(SEPT 82)	N/A	328.2	N/A	SFWMD TECHNICAL PUBLICATION 84-1
HIF-38	36	39S	28E	GARDNIER	FLORIDAN	1430	750	12.0	45.30(MAY 82) 52.24(SEPT 82)	N/A	323.34	1446	SFWMD TECHNICAL PUBLICATION 84-1
X-55	15	39S	29E	USGS	FLORIDAN	1600	N/A	10.0	44 (MAY 81) 50.73(SEPT 81)	N/A	N/A	N/A	SFWMD TECHNICAL PUBLICATION 84-1

N/A - not available * - Field analysed by Law Environmental

FIGURES



LYKES CITRUS MANAGEMENT DIVISION
SQUIRREL ISLAND
GLADES COUNTY, FLORIDA

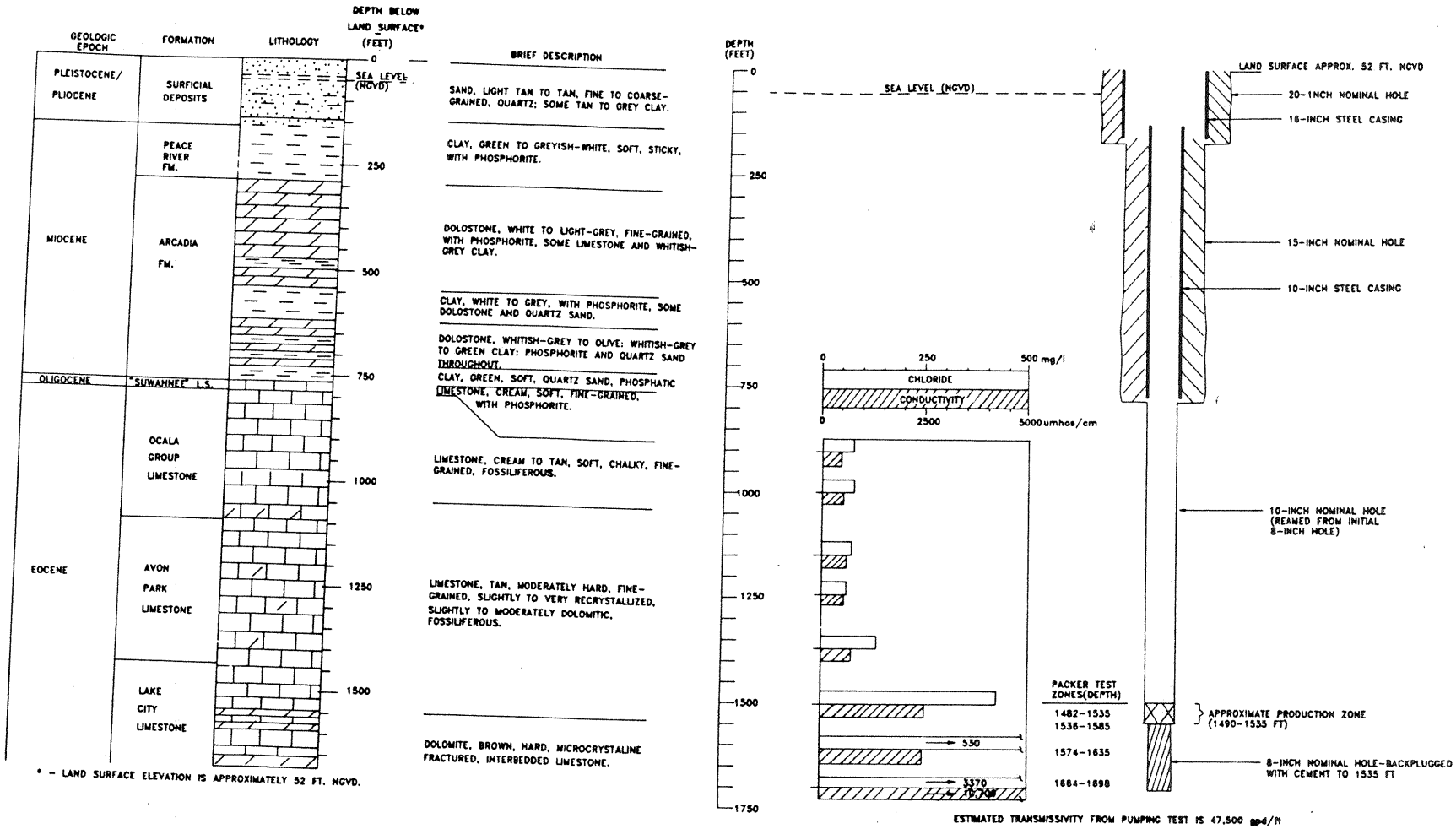
LAW ENVIRONMENTAL, INC.

SQUIRREL ISLAND

PROJECT LOCATION

JOB NO. 57052104

FIGURE 1



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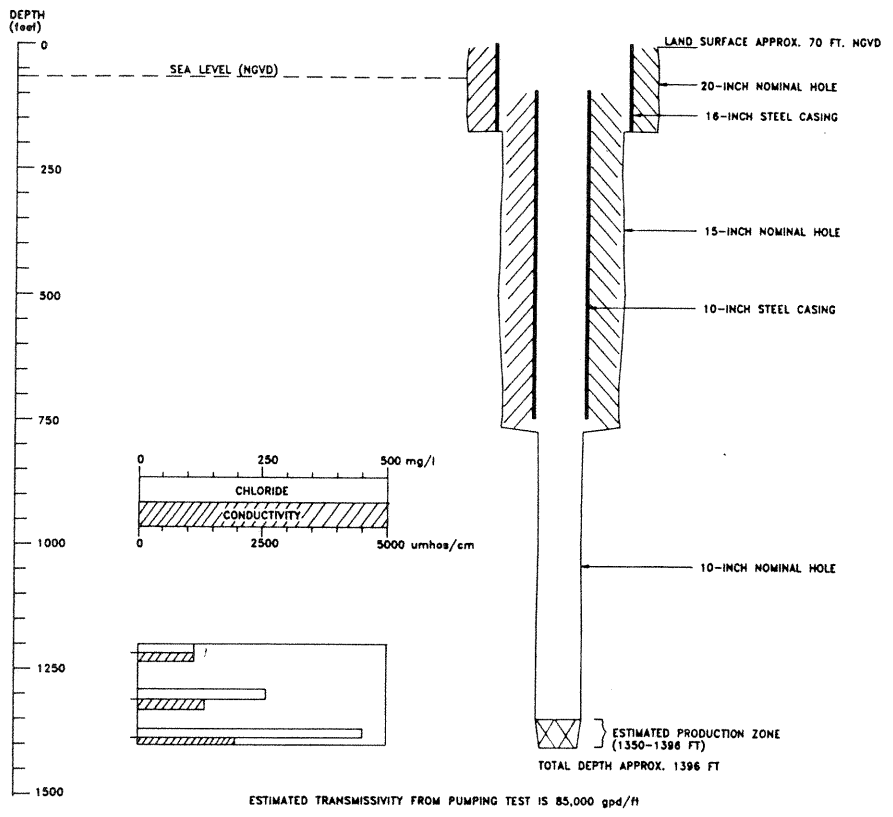
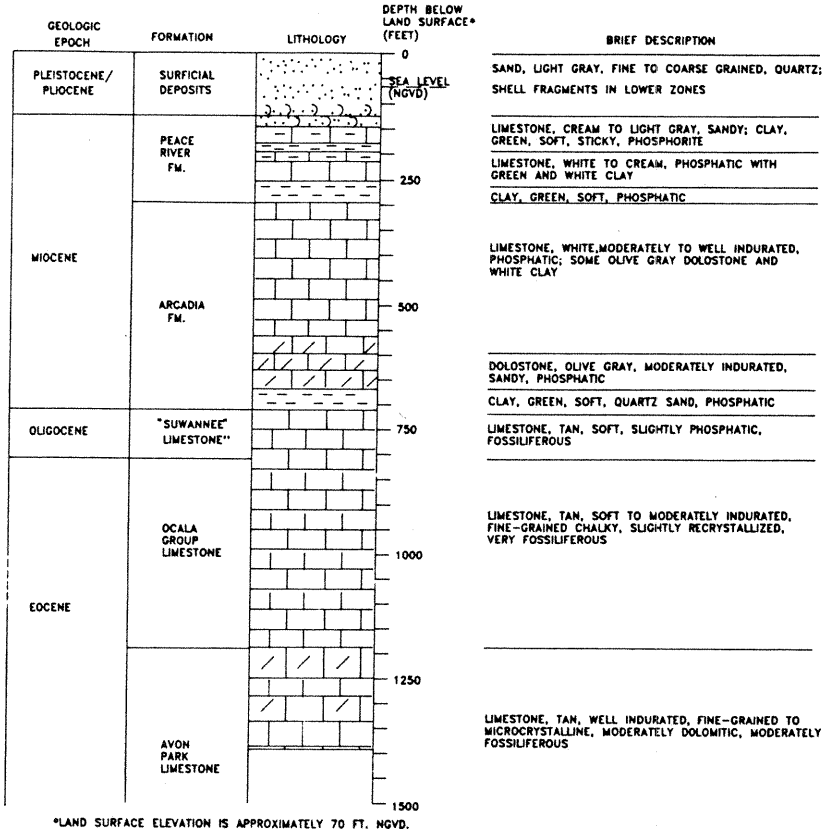
SQUIRREL ISLAND

TEST WELL #1
WATER QUALITY, PRODUCTION, CONSTRUCTION AND GEOLOGIC DATA

JOB NO. 57052104 FIGURE 2



ESTIMATED TRANSMISSIVITY FROM PUMPING TEST IS 85,000 gpd/ft



*LAND SURFACE ELEVATION IS APPROXIMATELY 70 FT. NGVD.

LYKES CITRUS
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GLADES COUNTY, FLORIDA

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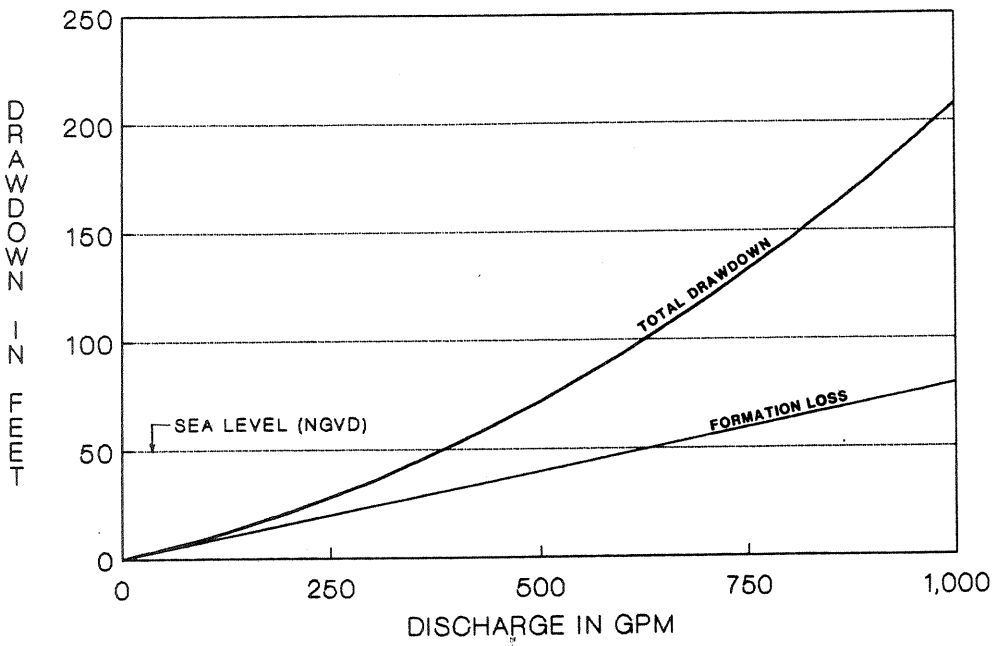
SQUIRREL ISLAND

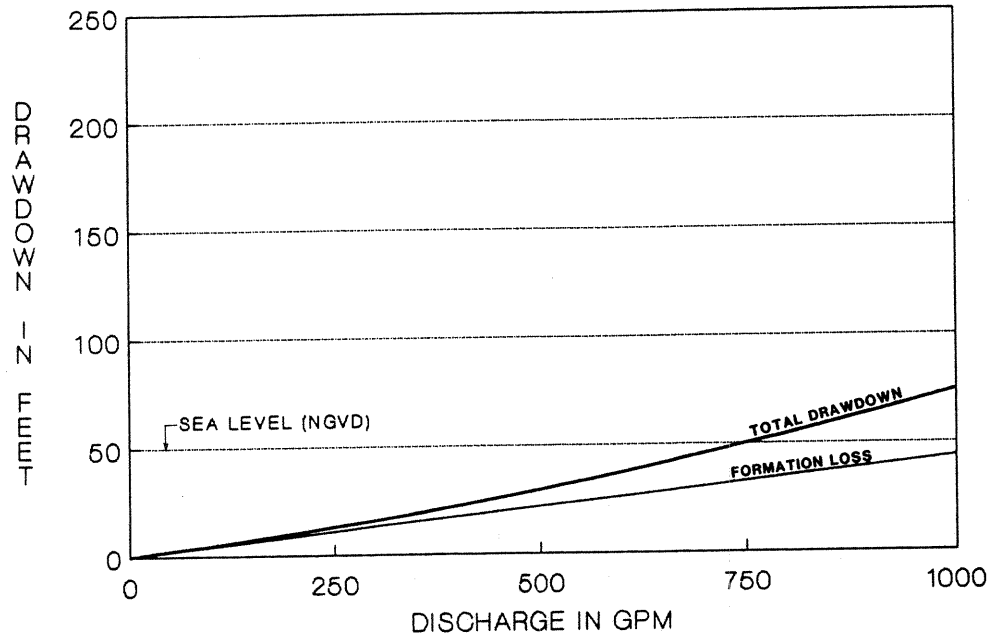
TEST WELL #2
WATER QUALITY, PRODUCTION, CONSTRUCTION AND GEOLOGIC DATA

JOB NO. 57052104 FIGURE 3

DISCHARGE VS DRAWDOWN FOR TEST WELL #1 FROM STEP-DRAWDOWN PUMPING TEST



DISCHARGE VS DRAWDOWN FOR TEST WELL #2 FROM STEP-DRAWDOWN PUMPING TEST



LYKES CITRUS MANAGEMENT DIVISION SQUIRREL ISLAND GLADES COUNTY, FLORIDA	LAW ENVIRONMENTAL, INC.	SQUIRREL ISLAND TEST WELL #1 & #2 DISCHARGE VS DRAWDOWN JOB NO. 57052104 FIGURE 4

NA
1540
(310)

NA
1560
(320)

NA
1600
(NA)

730
1430
(323)

625
1540
(1660)

800
1500
(350)

750
1595
(450)

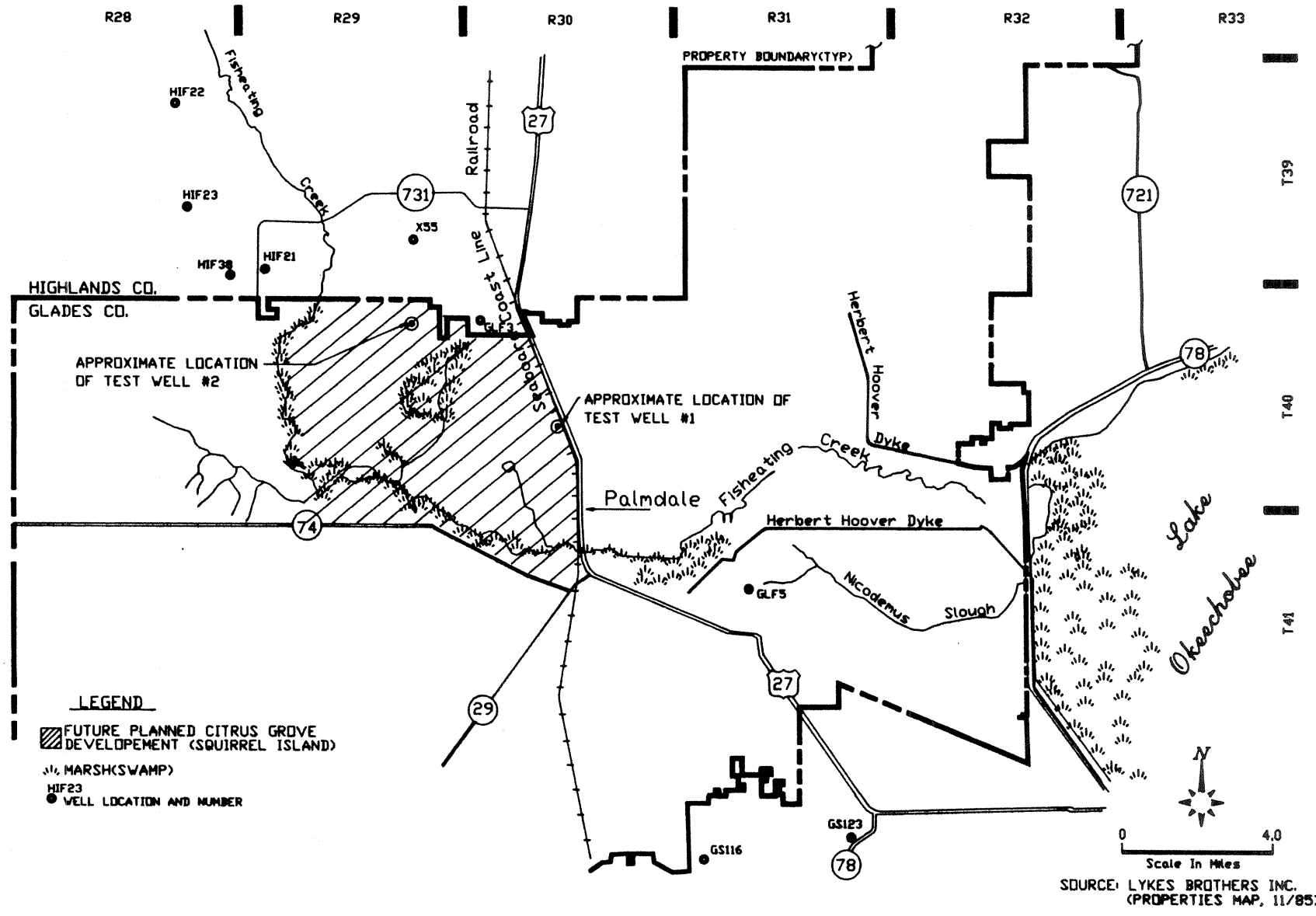
771
1595
(360)

230
1620
(1837)

400
1200
(2350)

NA
750
(510)

750 - CASED DEPTH
(430- TOTAL DEPTH
(350)- CHLORIDE LEVEL IN mg/l
NA -NOT AVAILABLE



LYKES CITRUS MANAGEMENT DIVISION
SQUIRREL ISLAND
GLADES COUNTY, FLORIDA

LAW ENVIRONMENTAL, INC.

SQUIRREL ISLAND

SELECTED REGIONAL WELL LOCATIONS
WITH DEPTH & CHLORIDE DATA (OVERLAY)

JOB NO. 57052104

FIGURE 5

APPENDIX A

GEOLOGIST'S LOGS FOR TEST WELLS #1 AND #2

GEOLOGIST'S LOG

SQUIRREL ISLAND TEST WELL #1

DEPTH INTERVAL		DESCRIPTION
0-20	Clayey Sand	Light tan, unconsolidated, Fine to coarse-grained, poorly sorted, sub-rounded quartz grains with tan sticky clay matrix and some organic material.
20-40	Sand	Light tan, unconsolidated, fine to medium-grained, moderately sorted, sub-rounded quartz, some organic material.
40-50	Clayey Sand	Tan, unconsolidated, fine to medium-grained, moderately sorted, sub-rounded, quartz, tan clay matrix.
50-60	Sandy Clay	Tan to dark tan, moderately sticky clay, with fine-grained quartz sand.
60-100	Clayey Sand	Tan, unconsolidated, fine to medium-grained, moderately well sorted, rounded, quartz, with tan moderately sticky clay.
100-150	Clayey Sand	Tan to light grey, unconsolidated, fine to coarse-grained, moderately sorted, rounded, quartz, with moderately sticky tan to grey clay.
150-160	Sandy Clay	Light grey, moderately sticky clay, with fine to medium-grained quartz sand.
160-240	Clay	Green to dark green, moderately to very sticky clay, some calcareous cemented sandstone (160-170 feet), fine-grained quartz sand, fine to coarse-grained phosphorite, some shell fragments and white limestone (220-240 feet).
240-260	Clay	Green to grayish-white, soft, very sticky clay, abundant fine-grained phosphorite, some thin hard claystone layers, some shell fragments and white limestone.
260-270	Clay	Dark green, soft, very sticky, some phosphorite and shell fragments.
270-352	Clay	Whitish-grey to dark green, soft, very sticky clay, abundant fine to coarse- grained phosphorite, some white limestone fragments, some hard thin clay-stone layers (325-240 feet).

SQUIRREL ISLAND TEST WELL #1

352-373	Dolostone	White to light grey, soft to moderately hard, fine-grained dolostone with dolosilt, 10-30% fine to coarse-grained, well rounded, well sorted quartz sand, some phosphorite, light green clay, and shell and limestone fragments.
373-405	Dolostone	Tan to whitish-grey, soft to moderately hard, fine-grained dolostone with dolosilt, 5-10% phosphorite, some quartz sand and limestone.
405-426	Dolostone	White to light grey, soft to moderately hard, fine-grained dolostone with dolosilt, abundant fine-grained phosphorite, 10-30% white clay, some limestone.
426-488	Dolostone	Whitish-grey to tan, soft to moderately hard, fine-grained dolostone with dolosilt, 10-30% fine-grained phosphorite, some light tan limestone.
488-509	Clay	White to grey, soft, sticky clay, 20-40% dolostone, abundant fine-grained phosphorite, minor amount of green clay.
509-550	Dolostone	White to light grey, soft to moderately hard, fine-grained dolostone with dolosilt, 10-20% fine-grained phosphorite, 5-20% white and some green, soft clay, some coarse-grained quartz sand, minor limestone fragments.
550-633	Clay	White to grey, soft, sticky clay, 20-50% grey to olive dolostone and dolosilt, abundant fine-grained phosphorite, minor amount green clay, some very fine-grained quartz sand stringers.
633-654	Dolostone	White to light grey, moderately soft to hard, fine-grained dolostone with dolosilt, 5-10% white soft clay, 5-10% fine to coarse-grained phosphorite, some fossil shell molds and casts, some limestone fragments.
654-680	Dolostone	Whitish-grey to olive, moderately soft to hard, fine-grained dolostone with dolosilt, 5-10% fine to coarse grained phosphorite, some fossil shell molds and casts, some limestone fragments, and some fine-grained quartz sand.
680-691	Clay	Green, very soft and sticky, 20-40% white to olive-gray dolostone and limestone, up to 5% phosphorite, some fine-grained quartz sand.
691-707	Dolostone	Whitish-grey to olive, moderately soft to hard, fine-grained dolostone with dolosilt, some fine to coarse-grained phosphorite, some limestone and fine-grained quartz sand.

SQUIRREL ISLAND TEST WELL #1

707-718	Clay	Green, soft, sticky, 10% light grey dolostone fragments, some phosphorite, some fine-grained quartz sand.
718-729	Dolostone	Whitish-grey to olive, moderately soft to hard, fine-grained dolostone with dolosilt, some phosphorite, some fine-grained quartz sand and traces of limestone.
729-776	Clay	Green, very soft and sticky, 5% fine to coarse-grained phosphorite, stringers of coarse-grained, well rounded, quartz sand, 10-30% whitish-grey to olive dolostone, traces of limestone.
776-791	Limestone	Cream, soft, fine-grained, some grey to olive dolostone and dolosilt, slightly phosphatic, some forams.
791-853	Limestone	Cream to tan, soft, moderately chalky, fine-grained, forams including Lepidocyclina sp. (1st appearance of Lepidocyclina sp. occurred between 791-801 feet).
893-1060	Limestone	Cream to tan, moderately soft, chalky, fine-grained, 20-30% forams (Lepidocyclina sp., Nummulites, etc.), byrozoans.
1060-1153	Dolomitic Limestone	Tan to dark tan, hard, fine-grained to microcrystalline, very recrystallized, 5-10% forams including Dictyoconus cookei (first appearance of Dictyoconus cookei occurred between 1,111-1,222 feet) and Operculinoides, some echinoids.
1153-1297	Limestone	Cream to tan, moderately hard, fine-grained, slightly recrystallized, some Forams including Dictyoconus cookei and Operculinoides, some echinoids; grayish, firm clay lenses occurred between 1,163-1,184 feet.
1297-1411	Limestone	Tan to dark tan, moderately hard, fine-grained, slightly to moderately recrystallized, moderately dolomitic, some forams including Dictyoconus cookei.
1411-1570	Limestone	Tan, moderately hard, fine-grained, slightly recrystall-ized, slightly dolomitic, 5-10% forams including Dictyoconus cookei and Dictyoconus americanus (1st appearance of Dictyoconus americanus occurred between 1,452-1,463 feet).
1570-1576	Dolomite	Brown, very hard, dense, microcrystalline, fractured, some gypsum appeared between 1,575-1,576 feet.
1576-1587	Limestone	Tan, moderately soft to hard, fine to medium-grained, slightly recrystallized, moderately dolomitic, abundant Dictyoconus sp. forams, moderate intergranular porosity.

SQUIRREL ISLAND TEST WELL #1

1587-1596	Dolomite	Brown, very hard, dense, microcrystalline, fractured, some vuggy porosity.
1596-1601	Limestone	Tan, moderately hard, fine-grained, slightly recrystallized, moderately dolomitic, some forams including Dictyoconus sp., poor porosity.
1601-1628	Dolomite	Brown to dark brown, very hard, moderately dense to dense, microcrystalline to finely crystalline, moderate vuggy porosity, fractured.
1628-1675	Limestone	Tan, moderately hard to hard, fine-grained, slightly to very dolomitic, some forams including Dictyoconus sp., some intergranular porosity.
1675-	Dolomite	Brown to dark brown, very hard, moderately dense to dense, microcrystalline to finely crystalline, some vuggy porosity, fractured, interbedded limestone.

Note: Samples described when wet

GEOLOGIST'S LOG

SQUIRREL ISLAND TEST WELL #2

DEPTH INTERVAL		DESCRIPTION
0-100	Sand	Light brownish gray to light gray, unconsolidated, fine to medium grained, sub-rounded to sub-angular, moderately to poorly sorted quartz sand.
100-120	Sand and Shell	Light gray, unconsolidated, fine to coarse-grained, sub-rounded, poorly sorted quartz, and white to cream, weathered shell fragments.
120-140	Sandstone and Shell	Olive gray, moderately to well indurated, fine to coarse-grained, calcareous clay cemented quartz sandstone with weathered shell fragments, and some limestone.
140-160	Limestone and Clay	Cream to light olive gray, moderately indurated, sandy limestone (quartz sand inclusions); green, soft, sticky clay interbedded with limestone.
160-180	Clay	Green, soft clay, with abundant fine to coarse quartz sand and some phosphorite.
180-190	Clay	Tan, soft clay, with abundant fine to very coarse phosphorite, and fine to coarse quartz sand common.
190-220	Limestone and Clay	Cream to tan, moderately indurated, fine-grained, abundant fine to very coarse phosphorite and shell fragments; green, soft, sticky clay interbedded.
220-260	Limestone	White to cream, moderately indurated, fine-grained, abundant fine-grained phosphorite, some shell fragments and white calcareous clay.
260-300	Clay	Green to dark green, soft to moderately firm, sticky clay, fine to coarse phosphorite, and cream to tan limestone and shell fragments present.
300-340	Limestone	White to tan, moderately to well indurated, fine-grained, limestone, fine to very coarse phosphorite, shell fragments, olive gray dolostone, some white calcareous clay.
340-614	Limestone	White, soft to moderately indurated, fine-grained to crystalline, some fine to very coarse phosphorite, some light olive gray dolostone.
614-645	Limestone Dolostone	White, moderately indurated, fine-grained limestone with fine-grained phosphorite; light olive gray to dark gray, moderately to well indurated, sandy textured dolostone with fine-grained phosphorite.

SQUIRREL ISLAND TEST WELL #2

614-645	Limestone Dolostone	White, moderately indurated, fine-grained limestone with fine-grained phosphorite; light olive gray to dark gray, moderately to well indurated, sandy textured dolostone with fine-grained phosphorite.
645-676	Dolostone	Light olive gray to dark gray, moderately indurated, sandy textured, with some fine-grained phosphorite.
676-717	Clay	Dark green, soft, sticky clay with fine quartz sand common, phosphorite present and some dolostone.
717-790	Limestone	Tan, moderately soft, fine-grained, slightly phosphatic.
790-812	Limestone	Tan, moderately soft, fine-grained, forams common (Nummulites sp.).
812-843	Limestone	Light tan, moderately soft, fine-grained, chalky, forams common (Lepidocyclina sp. first appeared between 812-823 feet).
843-884	Limestone	Light tan, moderately soft, fine-grained, chalky abundant forams including Lepidocyclina sp., Nummulites and Operculinoides sp.
884-956	Limestone	Dark tan, moderately soft, fine-grained, abundant Nummulites and Opreculinoides sp. forams embedded in limestone matrix, some Lepidocyclina present.
956-1008	Limestone	Tan, moderately soft, fine-grained, abundant Lepidocyclina and Nummulites.
1008-1070	Limestone	Tan moderately to well indurated, fine-grained, slightly recrystallized echinoids common.
1070-1194	Limestone	Tan, moderately to well indurated, granular texture to recrystallized, moderately fossilferous.
1194-1215	Dolomitic Limestone	Tan to dark tan, well indurated, fine-grained to micro-crystalline, some forams present including Dictyoconus sp.
1215-1396	Limestone	Tan, well indurated, fine-grained to microcrystalline, slightly dolomitic, moderately fossilferous including Dictyoconus sp. and Operculinoides sp. forams, small cavaties occurred between approximately 1,355 feet to 1,395 feet.

Note: Samples described when wet

APPENDIX B

TEST WELL #1
WATER QUALITY RESULTS

ETRES BROS. INC.
Agricultural Operations
LAKE PLACID, FLORIDA 33852

TO: Dale Hardin

FROM: Bill Bartnick BB DATE: March 27, 1991

SUBJECT: Squirrel Island Well[1] Lab Analyses Well # 403016.800

ITEM #	Depth (feet)	pH	CND	Cl	TDS *
1	812	9.72	525	54	366
3	843	10.30	510	40	348
5	874	9.55	505	61	310
7	905	10.30	500	74	394
9	936	10.73	510	64	324
11	967	11.30	840	54	394
13	998	9.21	545	78	327
15	1029	11.65	1450	58	510
17	1060	10.01	550	54	314
19	1091	11.80	1880	80	614
21	1122	11.81	2085	67	643
23	1153	9.97	555	78	358
25	1184	9.10	505	64	352
27	1215	8.73	555	68	372
29	1246	9.44u	510u	54u	350
30	Same (lab duplicate)	9.20f	505f	44f	~~356~~
31	1277	9.19	500	68	356
33	1308	9.39	480	64	384
35	1339	9.46	515	78	420
37	1370	8.88	650	138	510
39	1401	8.62	880	190	646
41	1432	8.38	995	208	682
43	1463	8.30	1105	268	792
45	1494	8.25	1405	382	956
47	1494	8.23	1500	408	1010

1 - Well location approximately 6 miles north of Palmdale, west of 27.
* - Samples taken to Short Environmental for sample analysis
u - Unfiltered
f - Filtered through .177 mm paper filter

BB/pc

cc: Pat Hamilton
Ken Kuhl
John Tallent

Agricultural Operations
LAKE PLACID, FLORIDA 33852

TO: Dale Hardin

FROM: Bill Bartnick BB pc DATE: April 9, 1991

SUBJECT: Squirrel Island Well[1] Lab Analyses Well #403016.80

ITEM #	DEPTH (FEET)	pH	CND	Cl	TDS*
47	1525	7.83	1805	454	1040
49	1556	7.93	1740	458	1050
51	1587	7.93	1785	434	1060
53	1618	7.99	1900	514	1120
55	1649	7.94	2050	536	1270
57	1680	7.91	2970	844	1790
59	1700	7.99	4900	1468	2830
61	1700	7.91	5610	1770	3530

This report addendum completes the depth series analyses for the first Squirrel Island Test Well. The packer testing tentatively scheduled for the week of April 8th will further analyze for more specific constituents. Furthermore, these results will be produced under separate cover.

1 - Well location approximately 6 miles north of Palmdale, West of 27

* - Samples taken to Short Environmental for sample analysis

BB/pc

cc: Pat Hamilton
Ken Kuhl
John Tallent

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

4-29-91

For: Lykes Brothers
Agricultural Operating Division
7 Lykes Road
Lake Placid, Florida 33852
Attn: Bill Bartnick

Laboratory Number: 3242-3257

Sample type: Groundwater
Project: Squirrel Island Test Well
Location: Glades County
Sampled by: B. Bartnick
Received: 3-26-91 @ 1015

REPORT OF ANALYSIS

LAB #	Sample ID	Memo Item #	Date Sampled	Total Dissolved Solids	Units	Method
3242	2	1	3/19/91	366.	mg/L	EPA 160.1
3243	4	3	3/19/91	348.	mg/L	EPA 160.1
3244	6	5	3/19/91	310.	mg/L	EPA 160.1
3245	8	7	3/20/91	394.	mg/L	EPA 160.1
3246	10	9	3/20/91	324.	mg/L	EPA 160.1
3247	12	11	3/20/91	394.	mg/L	EPA 160.1
3248	14	13	3/20/91	327.	mg/L	EPA 160.1
3249	16	15	3/21/91	510.	mg/L	EPA 160.1
3250	18	17	3/21/91	314.	mg/L	EPA 160.1
3251	20	19	3/21/91	614.	mg/L	EPA 160.1
3252	22	21	3/21/91	643.	mg/L	EPA 160.1
3253	24	23	3/22/91	338.	mg/L	EPA 160.1
3254	26	25	3/22/91	352.	mg/L	EPA 160.1
3255	28	27	3/25/91	372.	mg/L	EPA 160.1
3256	30	29	3/25/91	350.	mg/L	EPA 160.1
3257	32	31	3/25/91	356.	mg/L	EPA 160.1

Respectfully Submitted,

Bruce Cummings
Laboratory Manager

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

4-29-91

For: Lykes Brothers
Agricultural Operating Division
7 Lykes Road
Lake Placid, Florida 33852
Attn: Bill Bartnick

Laboratory Number: 3268-3275

Sample type: Groundwater
Project: Squirrel Island Test Well
Location: Glades County
Sampled by: B. Bartnick
Received: 3-28-91 @ 1108

REPORT OF ANALYSIS

LAB #	Sample ID	Memo Item #	Date Sampled	Total Dissolved Solids	Units	Method
3268	34	33	3/26/91	384.	mg/L	EPA 160.1
3269	36	35	3/26/91	420.	mg/L	EPA 160.1
3270	38	37	3/26/91	510.	mg/L	EPA 160.1
3271	40	39	3/26/91	646.	mg/L	EPA 160.1
3272	42	41	3/27/91	682.	mg/L	EPA 160.1
3273	44	43	3/27/91	792.	mg/L	EPA 160.1
3274	46	45	3/27/91	956.	mg/L	EPA 160.1
3275	48	47	3/27/91	1010.	mg/L	EPA 160.1

Respectfully Submitted,

Bruce Cummings

Bruce Cummings
Laboratory Manager

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

4-29-91

For: Lykes Brothers
Agricultural Operating Division
7 Lykes Road
Lake Placid, Florida 33852
Attn: Bill Bartnick

Laboratory Number: 3387-3394

Sample type: Groundwater
Project: Squirrel Island Test Well
Location: Glades County
Sampled by: B. Bartnick
Received: 4-5-91 @ 1100

REPORT OF ANALYSIS

LAB #	Sample ID	Memo Item 4	Date Sampled	Total Dissolved Solids	Units	Method
3387	48	47	4/1/91	1090.	mg/L	EPA 160.1
3388	50	49	4/1/91	1050.	mg/L	EPA 160.1
3389	52	51	4/1/91	1060.	mg/L	EPA 160.1
3390	54	53	4/2/91	1220.	mg/L	EPA 160.1
3391	56	55	4/2/91	1270.	mg/L	EPA 160.1
3392	58	57	4/2/91	1730.	mg/L	EPA 160.1
3393	60	59	4/3/91	2830.	mg/L	EPA 160.1
3394	62	61	4/3/91	3330.	mg/L	EPA 160.1

Respectfully Submitted,

Bruce Cummings

Bruce Cummings
Laboratory Manager

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

5-2-91

For: Lykes Brothers, Inc.
Agricultural Operating Division
7 Lykes Road
Lake Placid, FL 33852
Attn: Bill Bartnick

Laboratory Number: 3451

Sample type: Groundwater
Project: Squirrel Island Test Well
Location: 6 miles N of Palmdale, W of US 27
Sample ID: PT-1
Sampled by: D. Glicksberg on 4-11-91 @ 1145
Received: 4-12-91 @ 0730

REPORT OF ANALYSIS

Parameter	Result	Units	Method
Conductivity	10700.	umhos/cm	EPA 120.1
Total Hardness as CaCO3	1570.	mg/L	EPA 130.2
Magnesium (Mg)	232.	mg/L	EPA 130.2
Magnesium Hardness as CaCO3	956.	mg/L	Calc.
pH	7.84	S.U.	EPA 150.1
Total Dissolved Solids	6050.	mg/L	EPA 160.1
Calcium (Ca)	246.	mg/L	EPA 215.2
Calcium Hardness as CaCO3	614.	mg/L	EPA 215.2
Iron (Fe)	0.38	mg/L	EPA 236.1
Manganese (Mn)	0.041	mg/L	EPA 243.1
Potassium (K)	41.	mg/L	EPA 258.1
Sodium (Na)	1630.	mg/L	EPA 273.1
Bicarbonate as CaCO3	86.	mg/L	EPA 310.1
Chloride (Cl)	3370.	mg/L	EPA 325.3
Sulfate (SO4)	514.	mg/L	EPA 375.4
Sulfide (S)	4.8	mg/L	EPA 376.1
Specific Gravity	1.005		APHA 210B

Respectfully Submitted,

Bruce Cummings

Bruce Cummings
Laboratory Manager

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

5-2-91

For: Lykes Brothers, Inc.
Agricultural Operating Division
7 Lykes Road
Lake Placid, FL 33852
Attn: Bill Bartnick

Laboratory Number: 3507

Sample type: Groundwater
Project: Squirrel Island Test Well
Location: 6 miles N of Palmdale, W of US 27
Sample ID: PT-2
Sampled by: D. Glicksberg on 4-17-91 @ 1150
Received: 4-18-91 @ 0930

REPORT OF ANALYSIS

Parameter		Result	Units	Method
Conductivity		2440.	umhos/cm	EPA 120.1
Total Hardness as CaCO3		581.	mg/L	EPA 130.2
Magnesium (Mg)		32.	mg/L	EPA 130.2
Magnesium Hardness as CaCO3		132.	mg/L	Calc.
pH		11.2	S.U.	EPA 150.1
Total Dissolved Solids		1510.	mg/L	EPA 160.1
Calcium (Ca)		180.	mg/L	EPA 215.2
Calcium Hardness as CaCO3		449.	mg/L	EPA 215.2
Iron (Fe)		0.10	mg/L	EPA 236.1
Manganese (Mn)	<	0.005	mg/L	EPA 243.1
Potassium (K)		17.	mg/L	EPA 258.1
Sodium (Na)		265.	mg/L	EPA 273.1
Bicarbonate as CaCO3		209.	mg/L	EPA 310.1
Chloride (Cl)		531.	mg/L	EPA 325.3
Sulfate (SO4)		195.	mg/L	EPA 375.4
Sulfide (S)		1.4	mg/L	EPA 376.1
Specific Gravity		1.004		APHA 210B

Respectfully Submitted,

Bruce Cummings

Bruce Cummings
Laboratory Manager

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

5-3-91

For: Lykes Brothers, Inc.
Agricultural Operating Division
7 Lykes Road
Lake Placid, FL 33852
Attn: Bill Bartnick

Laboratory Number: 3593

Sample type: Groundwater
Project: Squirrel Island Test Well
Location: 6 miles N of Palmdale, W of US 27
Sample ID: PT-3
Sampled by: D. Glicksberg on 4-23-91
Received: 4-24-91 @ 1300

REPORT OF ANALYSIS

Parameter		Result	Units	Method
Conductivity		1960.	umhos/cm	EPA 120.1
Total Hardness as CaCO3		464.	mg/L	EPA 130.2
Magnesium (Mg)		25.	mg/L	EPA 130.2
Magnesium Hardness as CaCO3		107.	mg/L	Calc.
pH		10.9	S.U.	EPA 150.1
Total Dissolved Solids		1220.	mg/L	EPA 160.1
Calcium (Ca)		143.	mg/L	EPA 215.2
Calcium Hardness as CaCO3		357.	mg/L	EPA 215.2
Iron (Fe)		0.22	mg/L	EPA 236.1
Manganese (Mn)	<	0.005	mg/L	EPA 243.1
Potassium (K)		22.	mg/L	EPA 258.1
Sodium (Na)		227.	mg/L	EPA 273.1
Bicarbonate as CaCO3		248.	mg/L	EPA 310.1
Chloride (Cl)		449.	mg/L	EPA 325.3
Sulfate (SO4)		172.	mg/L	EPA 375.4
Sulfide (S)		1.5	mg/L	EPA 376.1
Specific Gravity		1.002		APHA 210B

Respectfully Submitted,

Bruce Cummings
Laboratory Manager

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

5-14-91

For: Lykes Brothers, Inc.
Agricultural Operating Division
7 Lykes Road
Lake Placid, FL 33852
Attn: Bill Bartnick

Laboratory Number: 3625

Sample type: Groundwater
Project: Squirrel Island Test Well
Location: 6 miles N of Palmdale, W of US 27
Sample ID: PT-4
Sampled by: D. Glicksberg on 4-29-91 @ 1810
Received: 4-30-91 @ 0930

REPORT OF ANALYSIS

Parameter	Result	Units	Method
Conductivity	2495.	umhos/cm	EPA 120.1
Total Hardness as CaCO3	528.	mg/L	EPA 130.2
Magnesium (Mg)	15.	mg/L	EPA 130.2
Magnesium Hardness as CaCO3	63.	mg/L	Calc.
pH	11.5	S.U.	EPA 150.1
Total Dissolved Solids	1290.	mg/L	EPA 160.1
Calcium (Ca)	186.	mg/L	EPA 215.2
Calcium Hardness as CaCO3	465.	mg/L	EPA 215.2
Iron (Fe)	0.52	mg/L	EPA 236.1
Manganese (Mn)	0.008	mg/L	EPA 243.1
Potassium (K)	31.	mg/L	EPA 258.1
Sodium (Na)	219.	mg/L	EPA 273.1
Bicarbonate as CaCO3	352.	mg/L	EPA 310.1
Chloride (Cl)	427.	mg/L	EPA 325.3
Sulfate (SO4)	190.	mg/L	EPA 375.4
Sulfide (S)	1.4	mg/L	EPA 376.1
Specific Gravity	1.002		APHA 210B

Respectfully Submitted,

Bruce Cummings

Bruce Cummings
Laboratory Manager

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

6-6-91

For: Lykes Brothers, Inc.
Agricultural Operating Division
7 Lykes Road
Lake Placid, FL 33852
Attn: Bill Bartnick

Laboratory Number: 3692

Sample type: Groundwater
Project: Pump Test Series
Location: Squirrel Island Well # 1
Sample ID: TPT-1
Sampled by: L. Price on 5-6-91 @ 1755
Received: 5-6-91 @ 1900

REPORT OF ANALYSIS

Parameter		Result	Units	Method
Conductivity		1500.	umhos/cm	EPA 120.1
Total Hardness as CaCO3		340.	mg/L	EPA 130.2
Magnesium (Mg)		34.	mg/L	EPA 130.2
Magnesium Hardness as CaCO3		140.	mg/L	Calc.
pH		9.06	S.U.	EPA 150.1
Total Dissolved Solids		828.	mg/L	EPA 160.1
Calcium (Ca)		80.	mg/L	EPA 215.2
Calcium Hardness as CaCO3		200.	mg/L	EPA 215.2
Iron (Fe)		0.083	mg/L	EPA 236.1
Manganese (Mn)	<	0.005	mg/L	EPA 243.1
Potassium (K)		6.4	mg/L	EPA 258.1
Sodium (Na)		180.	mg/L	EPA 273.1
Bicarbonate as CaCO3		102.	mg/L	EPA 310.1
Chloride (Cl)		335.	mg/L	EPA 325.3
Sulfate (SO4)		164.	mg/L	EPA 375.4
Sulfide (S)		3.5	mg/L	EPA 376.1
Specific Gravity		1.003		APHA 210B

Respectfully Submitted,

Bruce Cummings
Laboratory Manager

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

6-6-91

For: Lykes Brothers, Inc.
Agricultural Operating Division
7 Lykes Road
Lake Placid, FL 33852
Attn: Bill Bartnick

Laboratory Number: 3698

Sample type: Groundwater
Project: Pump Test Series
Location: Squirrel Island Well # 1
Sample ID: TPT-2
Sampled by: L. Price on 5-7-91 @ 1612
Received: 5-7-91 @ 1730

REPORT OF ANALYSIS

Parameter		Result	Units	Method
Conductivity		1580.	umhos/cm	EPA 120.1
Total Hardness as CaCO3		347.	mg/L	EPA 130.2
Magnesium (Mg)		36.	mg/L	EPA 130.2
Magnesium Hardness as CaCO3		147.	mg/L	Calc.
pH		8.54	S.U.	EPA 150.1
Total Dissolved Solids		870.	mg/L	EPA 160.1
Calcium (Ca)		80.	mg/L	EPA 215.2
Calcium Hardness as CaCO3		200.	mg/L	EPA 215.2
Iron (Fe)		0.028	mg/L	EPA 236.1
Manganese (Mn)	<	0.005	mg/L	EPA 243.1
Potassium (K)		5.1	mg/L	EPA 258.1
Sodium (Na)		186.	mg/L	EPA 273.1
Bicarbonate as CaCO3		74.	mg/L	EPA 310.1
Chloride (Cl)		344.	mg/L	EPA 325.3
Sulfate (SO4)		170.	mg/L	EPA 375.4
Sulfide (S)		3.5	mg/L	EPA 376.1
Specific Gravity		1.002		APHA 210B

Respectfully Submitted,

Bruce Cummings

Bruce Cummings
Laboratory Manager

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

6-6-91

For: Lykes Brothers, Inc.
Agricultural Operating Division
7 Lykes Road
Lake Placid, FL 33852
Attn: Bill Bartnick

Laboratory Number: 3706

Sample type: Groundwater
Project: Pump Test Series
Location: Squirrel Island Well # 1
Sample ID: TPT-3
Sampled by: L. Price on 5-8-91 @ 1600
Received: 5-8-91 @ 1730

REPORT OF ANALYSIS

Parameter		Result	Units	Method
Conductivity		1660.	umhos/cm	EPA 120.1
Total Hardness as CaCO3		369.	mg/L	EPA 130.2
Magnesium (Mg)		39.	mg/L	EPA 130.2
Magnesium Hardness as CaCO3		159.	mg/L	Calc.
pH		8.64	S.U.	EPA 150.1
Total Dissolved Solids		922.	mg/L	EPA 160.1
Calcium (Ca)		84.	mg/L	EPA 215.2
Calcium Hardness as CaCO3		210.	mg/L	EPA 215.2
Iron (Fe)		0.12	mg/L	EPA 236.1
Manganese (Mn)	<	0.005	mg/L	EPA 243.1
Potassium (K)		5.1	mg/L	EPA 258.1
Sodium (Na)		186.	mg/L	EPA 273.1
Bicarbonate as CaCO3		74.	mg/L	EPA 310.1
Chloride (Cl)		366.	mg/L	EPA 325.3
Sulfate (SO4)		171.	mg/L	EPA 375.4
Sulfide (S)		3.3	mg/L	EPA 376.1
Specific Gravity		1.004		APHA 210B

Respectfully Submitted,

Bruce Cummings

Bruce Cummings
Laboratory Manager

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

6-6-91

For: Lykes Brothers, Inc.
Agricultural Operating Division
7 Lykes Road
Lake Placid, FL 33852
Attn: Bill Bartnick

Laboratory Number: 3707

Sample type: Groundwater
Project: Pump Test Series
Location: Squirrel Island Well # 1
Sample ID: TPT-4
Sampled by: L. Price on 5-9-91
Received: 5-8-91 @ 1735

REPORT OF ANALYSIS

Parameter		Result	Units	Method
Conductivity		1590.	umhos/cm	EPA 120.1
Total Hardness as CaCO3		374.	mg/L	EPA 130.2
Magnesium (Mg)		41.	mg/L	EPA 130.2
Magnesium Hardness as CaCO3		169.	mg/L	Calc.
pH		8.48	S.U.	EPA 150.1
Total Dissolved Solids		888.	mg/L	EPA 160.1
Calcium (Ca)		82.	mg/L	EPA 215.2
Calcium Hardness as CaCO3		205.	mg/L	EPA 215.2
Iron (Fe)		0.034	mg/L	EPA 236.1
Manganese (Mn)	<	0.005	mg/L	EPA 243.1
Potassium (K)		4.9	mg/L	EPA 258.1
Sodium (Na)		186.	mg/L	EPA 273.1
Bicarbonate as CaCO3		75.	mg/L	EPA 310.1
Chloride (Cl)		359.	mg/L	EPA 325.3
Sulfate (SO4)		165.	mg/L	EPA 375.4
Sulfide (S)		2.9	mg/L	EPA 376.1
Specific Gravity		1.002		APHA 210B

Respectfully Submitted,

Bruce Cummings

Bruce Cummings
Laboratory Manager

APPENDIX C

TEST WELL #2
WATER QUALITY RESULTS

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

7-2-91

For: Lykes Brothers, Inc.
Agricultural Operating Division
7 Lykes Road
Lake Placid, FL 33852
Attn: Dianne Cummings

Laboratory Number: 4060

Sample type: Groundwater
Project: Pump Test Series
Location: Squirrel Island Well # 2
Sample ID: TPT-1
Sampled by: L. Price on 6-17-91 @ 1700
Received: 6-18-91 @ 1800

REPORT OF ANALYSIS

Parameter		Result	Units	Method
Conductivity		1860.	umhos/cm	EPA 120.1
Total Hardness as CaCO3		434.	mg/L	EPA 130.2
Magnesium (Mg)		59.	mg/L	EPA 130.2
Magnesium Hardness as CaCO3		243.	mg/L	Calc.
pH		7.94	S.U.	EPA 150.1
Total Dissolved Solids		1080.	mg/L	EPA 160.1
Calcium (Ca)		76.	mg/L	EPA 215.2
Calcium Hardness as CaCO3		190.	mg/L	EPA 215.2
Iron (Fe)		0.083	mg/L	EPA 236.1
Manganese (Mn)	<	0.005	mg/L	EPA 243.1
Potassium (K)		5.0	mg/L	EPA 258.1
Sodium (Na)		214.	mg/L	EPA 273.1
Bicarbonate as CaCO3		76.	mg/L	EPA 310.1
Chloride (Cl)		416.	mg/L	EPA 325.3
Sulfate (SO4)		214.	mg/L	EPA 375.4
Sulfide (S)		2.3	mg/L	EPA 376.1
Specific Gravity		1.002		APHA 210B

Respectfully Submitted,

David W. Murto

David W. Murto
Chief Chemist

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

7-2-91

For: Lykes Brothers, Inc.
Agricultural Operating Division
7 Lykes Road
Lake Placid, FL 33852
Attn: Dianne Cummings

Laboratory Number: 4061

Sample type: Groundwater
Project: Pump Test Series
Location: Squirrel Island Well # 2
Sample ID: TPT-2
Sampled by: L. Price on 6-18-91 @ 1630
Received: 6-18-91 @ 1800

REPORT OF ANALYSIS

Parameter		Result	Units	Method
Conductivity		1910.	umhos/cm	EPA 120.1
Total Hardness as CaCO3		439.	mg/L	EPA 130.2
Magnesium (Mg)		58.	mg/L	EPA 130.2
Magnesium Hardness as CaCO3		239.	mg/L	Calc.
pH		7.92	S.U.	EPA 150.1
Total Dissolved Solids		1090.	mg/L	EPA 160.1
Calcium (Ca)		80.	mg/L	EPA 215.2
Calcium Hardness as CaCO3		200.	mg/L	EPA 215.2
Iron (Fe)		0.049	mg/L	EPA 236.1
Manganese (Mn)	<	0.005	mg/L	EPA 243.1
Potassium (K)		5.0	mg/L	EPA 258.1
Sodium (Na)		201.	mg/L	EPA 273.1
Bicarbonate as CaCO3		76.	mg/L	EPA 310.1
Chloride (Cl)		406.	mg/L	EPA 325.3
Sulfate (SO4)		201.	mg/L	EPA 375.4
Sulfide (S)		2.5	mg/L	EPA 376.1
Specific Gravity		1.003		APHA 210B

Respectfully Submitted,

David W. Murto

David W. Murto
Chief Chemist

SHORT ENVIRONMENTAL LABORATORIES. INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

7-2-91

For: Lykes Brothers, Inc.
Agricultural Operating Division
7 Lykes Road
Lake Placid, FL 33852
Attn: Dianne Cummings

Laboratory Number: 4066

Sample type: Groundwater
Project: Pump Test Series
Location: Squirrel Island Well # 2
Sample ID: TPT-3
Sampled by: L. Price on 6-19-91 @ 1600
Received: 6-19-91 @ 1710

REPORT OF ANALYSIS

Parameter		Result	Units	Method
Conductivity		1925.	umhos/cm	EPA 120.1
Total Hardness as CaCO3		434.	mg/L	EPA 130.2
Magnesium (Mg)		58.	mg/L	EPA 130.2
Magnesium Hardness as CaCO3		239.	mg/L	Calc.
pH		8.02	S.U.	EPA 150.1
Total Dissolved Solids		1090.	mg/L	EPA 160.1
Calcium (Ca)		79.	mg/L	EPA 215.2
Calcium Hardness as CaCO3		198.	mg/L	EPA 215.2
Iron (Fe)		0.034	mg/L	EPA 236.1
Manganese (Mn)	<	0.005	mg/L	EPA 243.1
Potassium (K)		4.9	mg/L	EPA 258.1
Sodium (Na)		216.	mg/L	EPA 273.1
Bicarbonate as CaCO3		83.	mg/L	EPA 310.1
Chloride (Cl)		439.	mg/L	EPA 325.3
Sulfate (SO4)		202.	mg/L	EPA 375.4
Sulfide (S)		2.5	mg/L	EPA 376.1
Specific Gravity		1.004		APHA 210B

Respectfully Submitted,

David W. Murto

David W. Murto
Chief Chemist

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

7-6-91

For: Lykes Brothers, Inc.
Agricultural Operating Division
7 Lykes Road
Lake Placid, FL 33852
Attn: Dianne Cummings

Laboratory Number: 4103

Sample type: Groundwater
Project: Pump Test Series
Location: Squirrel Island Well # 2
Sample ID: TPT-4
Sampled by: L. Price on 6-20-91 @ 1430
Received: 6-20-91 @ 1630

REPORT OF ANALYSIS

Parameter		Result	Units	Method
Conductivity		1730.	umhos/cm	EPA 120.1
Total Hardness as CaCO3		444.	mg/L	EPA 130.2
Magnesium (Mg)		64.	mg/L	EPA 130.2
Magnesium Hardness as CaCO3		263.	mg/L	Calc.
pH		8.08	S.U.	EPA 150.1
Total Dissolved Solids		1110.	mg/L	EPA 160.1
Calcium (Ca)		72.	mg/L	EPA 215.2
Calcium Hardness as CaCO3		180.	mg/L	EPA 215.2
Iron (Fe)		0.026	mg/L	EPA 236.1
Manganese (Mn)	<	0.005	mg/L	EPA 243.1
Potassium (K)		5.0	mg/L	EPA 258.1
Sodium (Na)		216.	mg/L	EPA 273.1
Bicarbonate as CaCO3		75.	mg/L	EPA 310.1
Chloride (Cl)		444.	mg/L	EPA 325.3
Sulfate (SO4)		203.	mg/L	EPA 375.4
Sulfide (S)		3.0	mg/L	EPA 376.1
Specific Gravity		1.003		APHA 210B

Respectfully Submitted,

Bruce Cummings

Bruce Cummings
Laboratory Manager

SHORT ENVIRONMENTAL LABORATORIES, INC.
10405 US 27 South
Sebring, Florida 33870
1-800-833-4022 HRS # 85344 (813) 655-4022

7-6-91

For: Lykes Brothers, Inc.
Agricultural Operating Division
7 Lykes Road
Lake Placid, FL 33852
Attn: Dianne Cummings

Laboratory Number: 4108

Sample type: Groundwater
Project: Pump Test Series
Location: Squirrel Island Well # 2
Sample ID: TPT-5
Sampled by: L. Price on 6-21-91 @ 0940
Received: 6-20-91 @ 1410

REPORT OF ANALYSIS

Parameter		Result	Units	Method
Conductivity		1950.	umhos/cm	EPA 120.1
Total Hardness as CaCO3		490.	mg/L	EPA 130.2
Magnesium (Mg)		67.	mg/L	EPA 130.2
Magnesium Hardness as CaCO3		276.	mg/L	Calc.
pH		8.11	S.U.	EPA 150.1
Total Dissolved Solids		1120.	mg/L	EPA 160.1
Calcium (Ca)		86.	mg/L	EPA 215.2
Calcium Hardness as CaCO3		215.	mg/L	EPA 215.2
Iron (Fe)		0.034	mg/L	EPA 236.1
Manganese (Mn)	<	0.005	mg/L	EPA 243.1
Potassium (K)		4.9	mg/L	EPA 258.1
Sodium (Na)		218.	mg/L	EPA 273.1
Bicarbonate as CaCO3		86.	mg/L	EPA 310.1
Chloride (Cl)		485.	mg/L	EPA 325.3
Sulfate (SO4)		194.	mg/L	EPA 375.4
Sulfide (S)		2.3	mg/L	EPA 376.1
Specific Gravity		1.003		APHA 210B

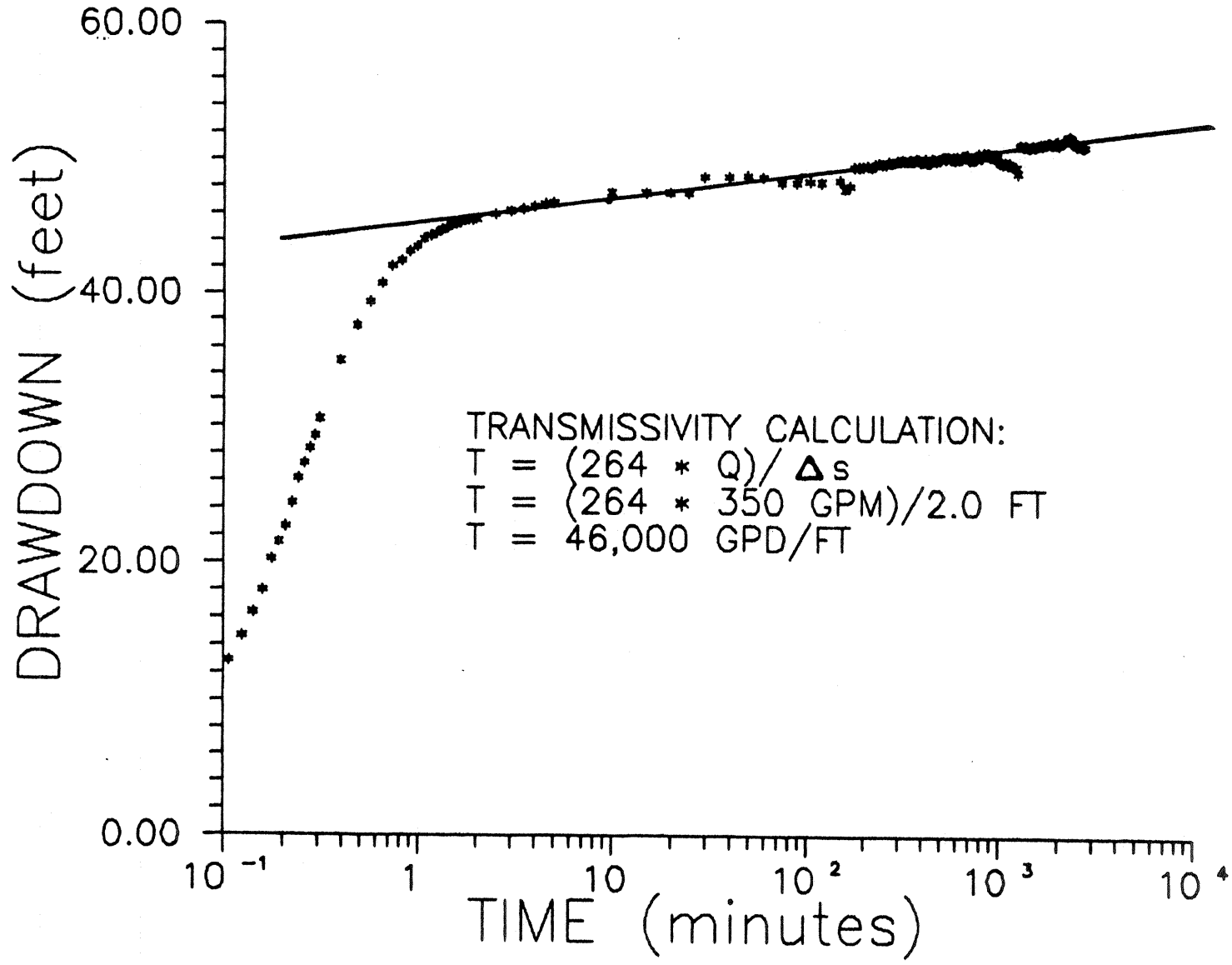
Respectfully Submitted,

Bruce Cummings

Bruce Cummings
Laboratory Manager

APPENDIX D

TEST WELL #1
PUMPING TEST DATA AND ANALYSES



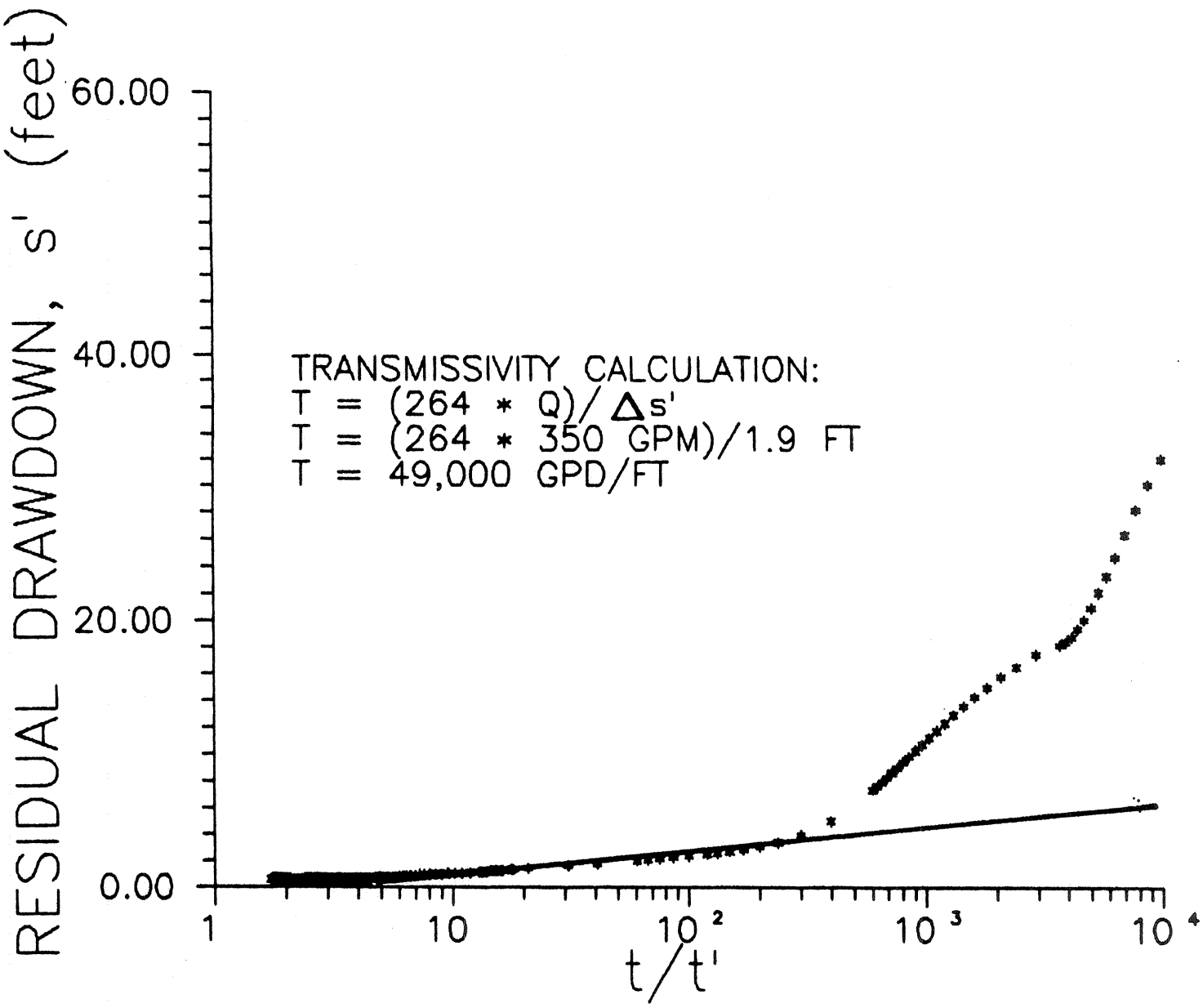
LYKES CITRUS
MANAGEMENT DIVISION
SQUIRREL ISLAND
GLADES COUNTY, FLORIDA

LAW ENVIRONMENTAL, INC.

SQUIRREL ISLAND

TEST WELL #1
TIME-DRAWDOWN PLOT

JOB NO. 57052102



LYKES CITRUS
MANAGEMENT DIVISION
SQUIRREL ISLAND
GLADES COUNTY, FLORIDA

LAW ENVIRONMENTAL, INC.

SQUIRREL ISLAND

TEST WELL #1
RECOVERY ANALYSIS PLOT

JOB NO. 57052102

TEST WELL #1 CONSTANT RATE PUMPING TEST DATA

Elapsed Time (minutes)	Drawdown (feet)	Elapsed Time (minutes)	Drawdown (feet)	Elapsed Time (minutes)	Drawdown (feet)	Elapsed Time (minutes)	Drawdown (feet)
0.000	0.000	75.000	48.300	660.000	50.420	1630.000	51.200
0.003	0.140	90.000	48.340	670.000	50.400	1660.000	51.280
0.007	5.400	105.000	48.420	680.000	50.440	1690.000	51.240
0.023	2.610	120.000	48.350	690.000	50.400	1720.000	51.280
0.040	4.190	150.000	48.490	700.000	50.510	1750.000	51.290
0.057	6.660	160.000	47.860	710.000	50.140	1780.000	51.340
0.073	8.590	170.000	48.110	720.000	50.270	1810.000	51.430
0.090	10.780	180.000	49.490	730.000	50.170	1840.000	51.420
0.107	12.870	190.000	49.490	740.000	50.170	1870.000	51.350
0.123	14.670	200.000	49.550	750.000	50.200	1900.000	51.350
0.140	16.400	210.000	49.570	760.000	50.250	1930.000	51.310
0.157	17.960	220.000	49.470	770.000	50.260	1960.000	51.380
0.173	20.310	230.000	49.690	780.000	50.400	1990.000	51.280
0.190	21.530	240.000	49.790	790.000	50.400	2020.000	51.480
0.207	22.700	250.000	49.740	800.000	50.580	2050.000	51.200
0.223	24.400	260.000	49.740	810.000	50.420	2080.000	51.360
0.240	26.210	270.000	49.910	820.000	50.350	2110.000	51.360
0.257	27.290	280.000	49.830	830.000	50.320	2140.000	51.410
0.273	28.390	290.000	49.860	840.000	50.460	2170.000	51.540
0.290	29.290	300.000	50.000	850.000	50.620	2200.000	51.560
0.307	30.570	310.000	49.970	860.000	50.520	2230.000	51.590
0.390	34.950	320.000	50.080	870.000	50.530	2260.000	51.670
0.473	37.570	330.000	50.040	880.000	50.530	2290.000	51.870
0.557	39.320	340.000	49.970	890.000	50.670	2320.000	51.850
0.640	40.710	350.000	50.140	900.000	50.590	2350.000	51.900
0.723	42.030	360.000	50.050	910.000	50.370	2380.000	51.790
0.807	42.430	370.000	49.990	920.000	50.490	2410.000	51.550
0.890	43.120	380.000	50.210	930.000	50.360	2440.000	51.560
0.973	43.530	390.000	50.100	940.000	50.390	2470.000	51.460
1.057	44.080	400.000	49.940	950.000	50.480	2500.000	51.300
1.140	44.280	410.000	50.070	960.000	50.520	2530.000	51.220
1.223	44.490	420.000	50.180	970.000	50.510	2560.000	51.190
1.307	44.770	430.000	49.880	980.000	50.290	2590.000	51.270
1.390	44.900	440.000	49.940	990.000	50.440	2620.000	51.250
1.473	45.080	450.000	49.920	1000.000	50.110	2650.000	51.290
1.557	45.170	460.000	50.190	1030.000	49.950	2680.000	51.320
1.640	45.330	470.000	50.170	1060.000	49.790	2710.000	51.070
1.723	45.460	480.000	49.970	1090.000	49.950	2740.000	51.130
1.807	45.490	490.000	50.170	1120.000	49.800	2770.000	51.140
1.890	45.540	500.000	50.170	1150.000	49.920	2800.000	51.100
1.973	45.570	510.000	50.180	1180.000	49.670		
2.473	45.920	520.000	50.280	1210.000	49.620		
2.973	46.150	530.000	50.300	1240.000	49.570		
3.473	46.330	540.000	50.220	1270.000	49.150		
3.973	46.490	550.000	50.300	1300.000	51.200		
4.473	46.720	560.000	50.370	1330.000	51.250		
5.000	46.810	570.000	50.210	1360.000	51.140		
10.000	47.550	580.000	50.260	1390.000	51.220		
15.000	47.550	590.000	50.360	1420.000	51.090		
20.000	47.570	600.000	50.080	1450.000	51.020		
25.000	47.500	610.000	50.310	1480.000	51.140		
30.000	48.720	620.000	50.370	1510.000	51.200		
40.000	48.700	630.000	50.240	1540.000	51.130		
50.000	48.800	640.000	50.250	1570.000	51.120		
60.000	48.700	650.000	50.210	1600.000	51.200		

TEST WELL #1 CONSTANT RATE PUMPING TEST RECOVERY DATA

Elapsed Time (minutes)	Residual Drawdown (feet)	Elapsed Time (minutes)	Residual Drawdown (feet)	Elapsed Time (minutes)	Residual Drawdown (feet)	Elapsed Time (minutes)	Residual Drawdown (feet)
0.000	49.200	5.500	2.600	94.000	0.700	580.000	0.610
0.003	48.970	6.000	2.510	96.000	0.690	590.000	0.610
0.007	48.650	6.500	2.400	98.000	0.690	600.000	0.610
0.010	48.380	7.000	2.260	100.000	0.680	610.000	0.600
0.013	48.030	7.500	2.170	110.000	0.670	620.000	0.580
0.017	47.520	8.000	2.100	120.000	0.660	630.000	0.590
0.020	47.050	8.500	2.030	130.000	0.660	640.000	0.580
0.037	44.340	9.000	1.800	140.000	0.660	650.000	0.580
0.070	41.720	9.500	1.650	150.000	0.660	660.000	0.580
0.053	39.160	10.000	1.460	160.000	0.660	670.000	0.580
0.087	36.780	12.000	1.350	170.000	0.660	680.000	0.580
0.103	34.220	14.000	1.330	180.000	0.660	690.000	0.570
0.120	32.060	16.000	1.310	190.000	0.650	700.000	0.580
0.137	30.090	18.000	8.000	200.000	0.660	710.000	0.580
0.153	28.200	20.000	1.290	210.000	0.660	720.000	0.600
0.170	26.340	22.000	1.280	220.000	0.650	730.000	0.600
0.187	24.680	24.000	1.260	230.000	0.660	740.000	0.610
0.203	23.320	26.000	1.240	240.000	0.660	750.000	0.630
0.220	22.120	28.000	1.240	250.000	0.650	760.000	0.630
0.237	21.000	30.000	1.230	260.000	0.660	770.000	0.650
0.253	20.100	32.000	1.210	270.000	0.660	780.000	0.660
0.270	19.360	34.000	1.200	280.000	0.650	790.000	0.660
0.287	18.780	36.000	1.210	290.000	0.660	800.000	0.680
0.303	18.420	38.000	1.190	300.000	0.660	810.000	0.680
0.320	18.160	40.000	1.180	310.000	0.660	820.000	0.680
0.403	17.490	42.000	1.170	320.000	0.660	830.000	0.680
0.487	16.530	44.000	1.100	330.000	0.670	840.000	0.680
0.570	15.770	46.000	1.060	340.000	0.660	850.000	0.700
0.653	14.970	48.000	1.070	350.000	0.660	860.000	0.700
0.737	14.260	50.000	1.050	360.000	0.660	870.000	0.700
0.820	13.560	52.000	1.000	370.000	0.660	880.000	0.660
0.903	12.920	54.000	0.990	380.000	0.660	890.000	0.650
0.987	12.310	56.000	0.960	390.000	0.680	900.000	0.640
1.070	11.740	58.000	0.930	400.000	0.670	910.000	0.620
1.153	11.210	60.000	0.920	410.000	0.670	920.000	0.610
1.237	10.700	62.000	0.890	420.000	0.670		
1.320	10.240	64.000	0.880	430.000	0.660		
1.403	9.790	66.000	0.860	440.000	0.660		
1.487	9.380	68.000	0.850	450.000	0.660		
1.570	8.980	70.000	0.830	460.000	0.660		
1.653	8.620	72.000	0.800	470.000	0.660		
1.737	8.270	74.000	0.800	480.000	0.660		
1.820	7.920	76.000	0.780	490.000	0.650		
1.903	7.610	78.000	0.760	500.000	0.660		
1.987	7.330	80.000	0.750	510.000	0.650		
2.487	5.000	82.000	0.750	520.000	0.650		
2.987	3.950	84.000	0.740	530.000	0.630		
3.487	3.400	86.000	0.730	540.000	0.630		
3.987	3.070	88.000	0.710	550.000	0.630		
4.487	2.870	90.000	0.700	560.000	0.630		
5.000	2.720	92.000	0.700	570.000	0.620		

NOTE: Engine shut off during pumping phase after 2800 minutes and water level recovered back to within one foot of the static level. At this time the engine was turned back on and the well was pumped for 1190 minutes, after which the actual recovery phase was begun.

STEP-DRAWDOWN TEST DATA ANALYSIS
Author: J. D. Hardin, PG

After: Bierschenk, W. H., 1964. Determining Well Efficiency by Multiple Step-Drawdown Tests. Publication 64, Internat. Assoc. Sci. Hydrology

Location:	Squirrel Island
Well No.:	Test Well #1
Well Dia.:	16 inches
Csg Depth:	771 feet
Well Depth:	1535 feet
Date :	May 16, 1991
Description:	Step-drawdown test conducted by Brian McMahon/Ben Rushing

Table 1.-- Step-drawdown test data.

STEP NO	STATIC LEVEL	PUMPING LEVEL	DRAWDOWN	DELTA DRAWDOWN	DISCHARGE (GPM)	SW/Q
1	3.98	46.51	42.53		345	0.123275
2	3.98	65.23	61.25	18.72	445	0.137640
3	3.98	81.89	77.91	16.66	530	0.147

Table 2.-- Step-Drawdown Test Results

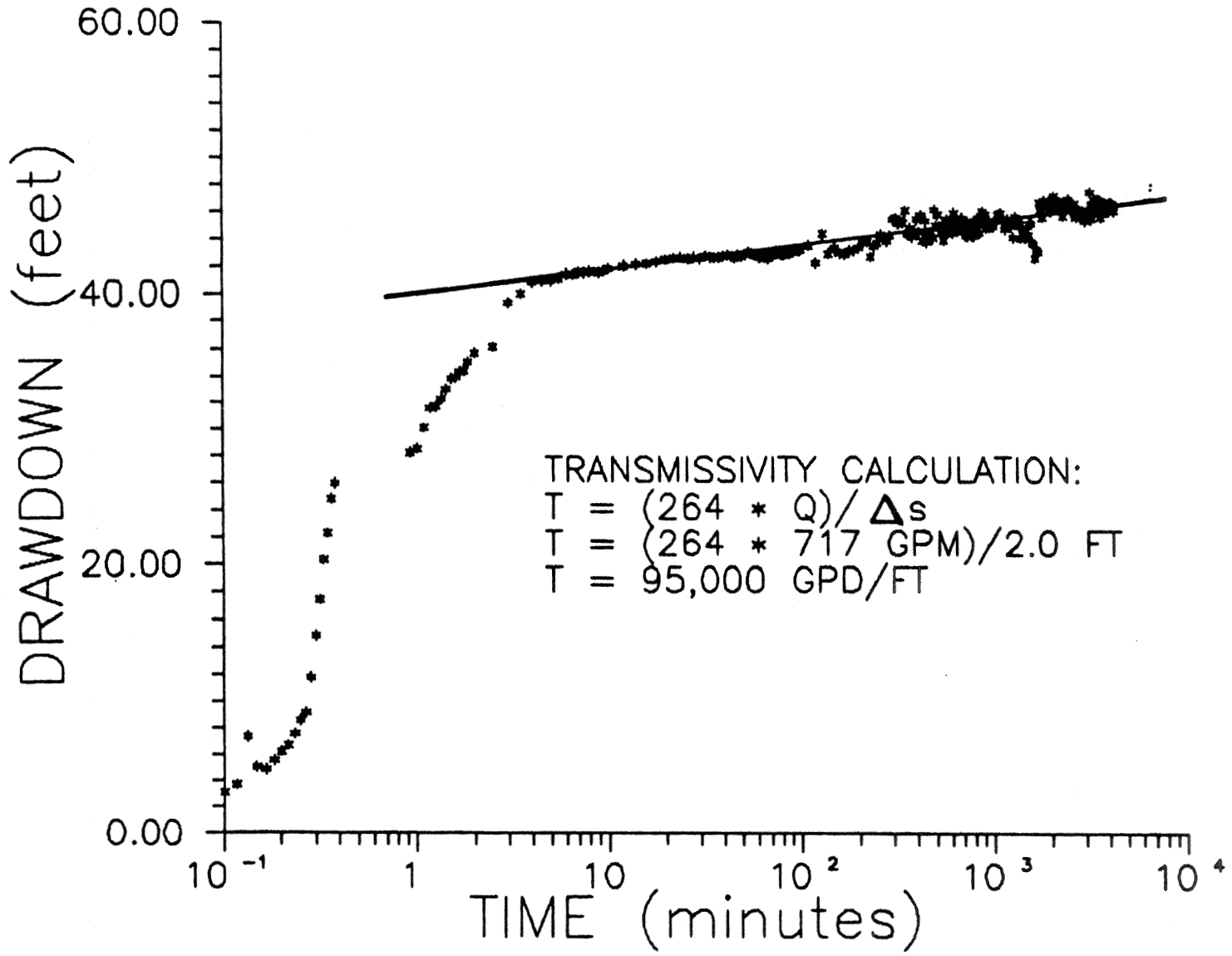
Design Discharge Rate (gpm)	750
Formation Constant (B) =	0.0793480
Well Loss Constant (C) =	0.0001286
Formation Loss (BQ) =	59.51
Well Loss (CQ^2) =	72.39
Total Drawdown (ft) =	131.90
Calculated Transmissivity (gpd/ft) =	46,000
Well Efficiency (Bierschenk) (%) =	45.1
Well Efficiency (Johnson) (%) =	24.7

Table 3.-- Relationship between formation loss and well loss for various pumping rates.

DISCHARGE RATE (GPM)	FORMATION LOSS	WELL LOSS	TOTAL DRAWDOWN
0	0	0	0
100	7.93	1.29	9.22
200	15.87	5.15	21.02
300	23.80	11.58	35.39
400	31.74	20.59	52.33
500	39.67	32.17	71.85
600	47.61	46.33	93.94
700	55.54	63.06	118.60
800	63.48	82.36	145.84
900	71.41	104.24	175.65
1,000	79.35	128.69	208.04
1,100	87.28	155.72	243.00
1,200	95.22	185.31	280.53
1,300	103.15	217.49	320.64
1,400	111.09	252.23	363.32
1,500	119.02	289.55	408.58
1,600	126.96	329.45	456.40
1,700	134.89	371.92	506.81
1,800	142.83	416.96	559.78
1,900	150.76	464.57	615.33
2,000	158.70	514.76	673.46

APPENDIX E

TEST WELL #2
PUMPING TEST DATA AND ANALYSES



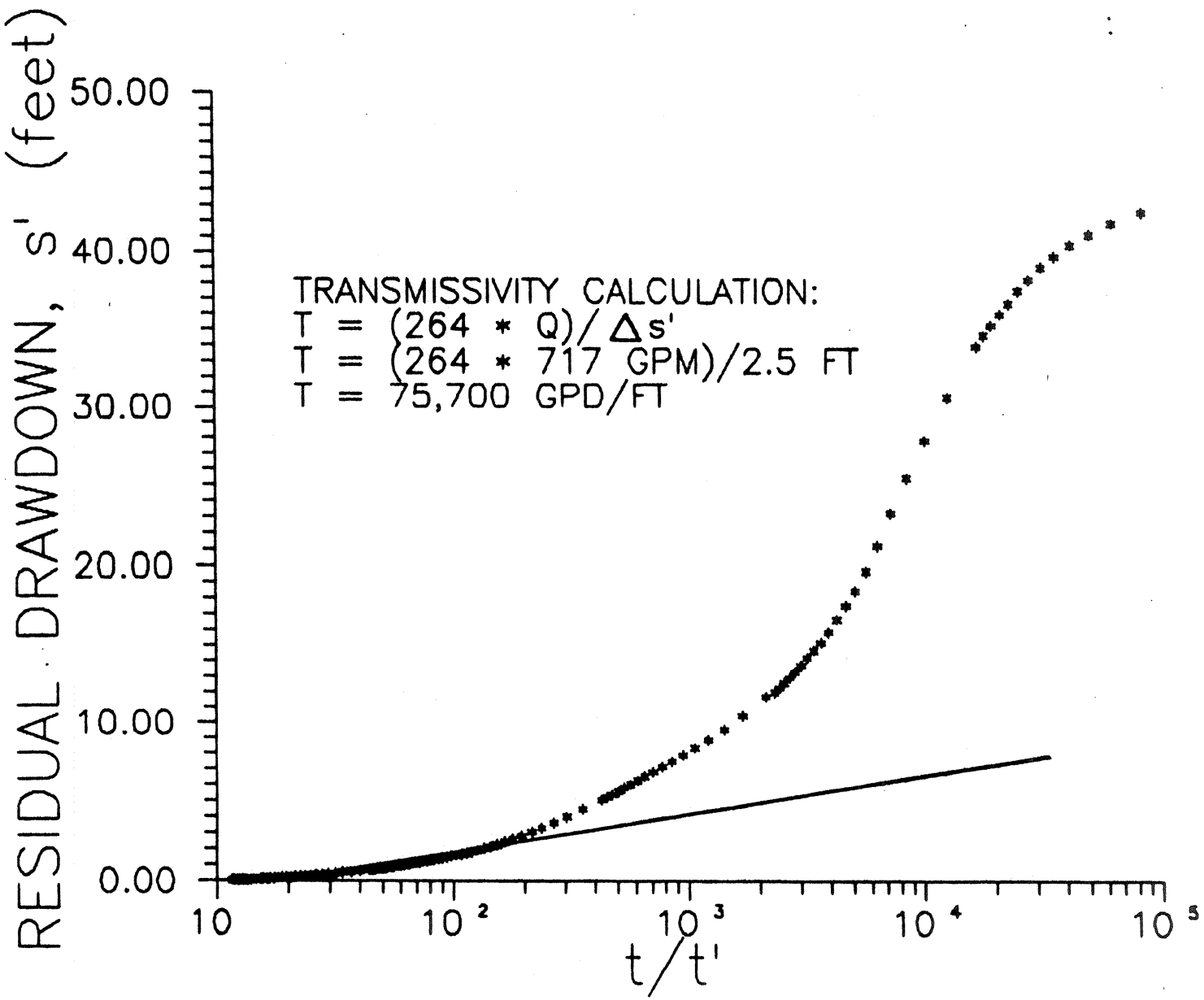
LYKES CITRUS
MANAGEMENT DIVISION
SQUIRREL ISLAND
GLADES COUNTY, FLORIDA

LAW ENVIRONMENTAL, INC.

SQUIRREL ISLAND

TEST WELL # 2
TIME-DRAWDOWN PLOT

JOB NO. 57052103



LYKES CITRUS
MANAGEMENT DIVISION
SQUIRREL ISLAND
GLADES COUNTY, FLORIDA

LAW ENVIRONMENTAL, INC.

SQUIRREL ISLAND

TEST WELL # 2
RECOVERY ANALYSIS PLOT

JOB NO. 57052103

TEST WELL #2 CONSTANT RATE PUMPING TEST DATA

Elapsed Time (minutes)	Drawdown (feet)	Elapsed Time (minutes)	Drawdown (feet)	Elapsed Time (minutes)	Drawdown (feet)	Elapsed Time (minutes)	Drawdown (feet)
0.000	0.000	12.000	41.980	190.000	43.110	720.000	44.220
0.017	2.010	14.000	42.130	200.000	43.310	730.000	45.330
0.033	2.710	16.000	42.160	210.000	43.730	740.000	44.230
0.050	3.270	18.000	42.290	220.000	43.760	750.000	44.500
0.067	3.340	20.000	42.450	230.000	42.660	760.000	45.160
0.084	3.050	22.000	42.550	240.000	43.440	770.000	44.220
0.100	3.120	24.000	42.610	250.000	43.670	780.000	45.040
0.117	3.720	26.000	42.470	260.000	44.280	790.000	44.180
0.134	7.370	28.000	42.580	270.000	44.110	800.000	44.380
0.150	5.050	30.000	42.500	280.000	43.790	810.000	44.760
0.167	4.900	32.000	42.710	290.000	44.230	820.000	45.310
0.184	5.570	34.000	42.620	300.000	45.430	830.000	45.490
0.200	6.230	36.000	42.650	310.000	45.510	840.000	45.430
0.217	6.720	38.000	42.580	320.000	45.110	850.000	44.430
0.234	7.590	40.000	42.710	330.000	45.260	860.000	45.390
0.250	8.570	42.000	42.800	340.000	45.170	870.000	45.630
0.267	9.140	44.000	42.700	350.000	46.050	880.000	45.990
0.284	11.750	46.000	42.580	360.000	44.360	890.000	45.530
0.301	14.860	48.000	42.800	370.000	44.780	900.000	45.090
0.317	17.440	50.000	42.750	380.000	44.140	910.000	45.820
0.334	20.330	52.000	42.800	390.000	44.530	920.000	44.770
0.351	22.330	54.000	42.980	400.000	45.400	930.000	45.040
0.367	24.850	56.000	42.950	410.000	44.480	940.000	44.960
0.384	26.020	58.000	42.830	420.000	45.720	950.000	45.310
0.933	28.260	60.000	42.770	430.000	43.860	960.000	44.960
1.017	28.560	62.000	42.620	440.000	45.310	970.000	45.060
1.100	30.140	64.000	42.830	450.000	43.680	980.000	45.010
1.183	31.610	66.000	42.550	460.000	44.310	990.000	45.130
1.267	31.730	68.000	42.500	470.000	44.460	1000.000	44.910
1.350	32.300	70.000	42.740	480.000	44.020	1030.000	45.330
1.433	32.990	72.000	42.680	490.000	46.100	1060.000	45.760
1.517	33.780	74.000	42.970	500.000	44.960	1090.000	45.880
1.600	33.900	76.000	42.970	510.000	45.760	1120.000	45.410
1.683	34.320	78.000	42.920	520.000	44.880	1150.000	44.720
1.767	34.370	80.000	42.840	530.000	44.460	1180.000	45.430
1.850	35.020	82.000	42.820	540.000	45.010	1210.000	45.150
2.000	35.670	84.000	42.930	550.000	43.870	1240.000	44.900
2.500	36.150	86.000	42.930	560.000	44.690	1270.000	44.110
3.000	39.280	88.000	42.900	570.000	45.420	1300.000	45.630
3.500	39.950	90.000	42.990	580.000	44.610	1330.000	45.140
4.000	40.810	92.000	43.010	590.000	44.480	1360.000	45.080
4.500	40.920	94.000	43.220	600.000	44.970	1390.000	44.080
5.000	40.910	96.000	43.120	610.000	44.430	1420.000	44.720
5.500	41.070	98.000	43.080	620.000	45.880	1450.000	44.110
6.000	41.360	100.000	43.110	630.000	45.140	1480.000	44.150
6.500	41.350	110.000	43.480	640.000	45.290	1510.000	44.310
7.000	41.550	120.000	42.210	650.000	44.570	1540.000	45.130
7.500	41.480	130.000	44.340	660.000	45.210	1570.000	45.100
8.000	41.590	140.000	42.880	670.000	45.240	1600.000	43.680
8.500	41.560	150.000	43.310	680.000	45.500	1630.000	43.610
9.000	41.500	160.000	42.930	690.000	45.080	1660.000	42.560
9.500	41.600	170.000	42.810	700.000	44.910	1690.000	43.190
10.000	41.830	180.000	43.120	710.000	45.070	1720.000	42.980

TEST WELL #2 CONSTANT RATE PUMPING TEST DATA (CONT'D.)

Elapsed Time (minutes)	Drawdown (feet)	Elapsed Time (minutes)	Drawdown (feet)
1750.000	46.660	3340.000	45.970
1780.000	46.100	3370.000	46.210
1810.000	45.570	3400.000	46.790
1840.000	46.800	3430.000	46.440
1870.000	46.580	3460.000	46.320
1900.000	46.550	3490.000	46.900
1930.000	46.510	3520.000	46.410
1960.000	46.780	3550.000	46.310
1990.000	46.000	3580.000	46.770
2020.000	46.430	3610.000	45.560
2050.000	46.570	3640.000	46.260
2080.000	47.150	3670.000	46.370
2110.000	46.600	3700.000	46.560
2140.000	46.710	3730.000	46.430
2170.000	46.480	3760.000	46.290
2200.000	46.750	3790.000	46.450
2230.000	46.750	3820.000	46.670
2260.000	46.360	3850.000	46.030
2290.000	46.010	3880.000	46.010
2320.000	45.670	3910.000	46.460
2350.000	46.100	3940.000	46.340
2380.000	46.580	3970.000	46.410
2410.000	46.180	4000.000	46.030
2440.000	46.480	4030.000	46.310
2470.000	46.900	4060.000	46.630
2500.000	46.710	4090.000	46.480
2530.000	46.200	4120.000	46.200
2560.000	46.370	4150.000	46.250
2590.000	46.200	4180.000	46.610
2620.000	46.280	4210.000	46.480
2650.000	46.560	4240.000	46.000
2680.000	45.880		
2710.000	45.560		
2740.000	45.780		
2770.000	45.970		
2800.000	46.150		
2830.000	45.700		
2860.000	45.930		
2890.000	45.710		
2920.000	45.700		
2950.000	45.900		
2980.000	45.700		
3010.000	45.320		
3040.000	45.490		
3070.000	45.730		
3100.000	45.700		
3130.000	45.510		
3160.000	46.000		
3190.000	47.400		
3220.000	45.430		
3250.000	46.500		
3280.000	46.570		
3310.000	46.000		

TEST WELL #2 CONSTANT RATE PUMPING TEST RECOVERY DATA

Elapsed Time (minutes)	Residual Drawdown (feet)	Elapsed Time (minutes)	Residual Drawdown (feet)	Elapsed Time (minutes)	Residual Drawdown (feet)	Elapsed Time (minutes)	Residual Drawdown (feet)
0.000	44.2400	1.750	12.3000	40.000	1.6600	130.000	0.5300
0.017	44.0700	1.833	12.0100	42.000	1.6000	140.000	0.4800
0.033	43.2600	2.000	11.7400	44.000	1.5300	150.000	0.4500
0.050	42.5300	2.500	10.4700	46.000	1.4600	160.000	0.4100
0.067	41.8100	3.000	9.5800	48.000	1.4200	170.000	0.3700
0.083	41.0600	3.500	8.8900	50.000	1.3600	180.000	0.3500
0.100	40.4000	4.000	8.3500	52.000	1.3200	190.000	0.3300
0.117	39.6800	4.500	7.8900	54.000	1.2700	200.000	0.3000
0.133	38.9800	5.000	7.4900	56.000	1.2300	210.000	0.2700
0.150	38.1800	5.500	7.1300	58.000	1.1800	220.000	0.2500
0.167	37.4500	6.000	6.8100	60.000	1.1500	230.000	0.2200
0.183	36.6200	6.500	6.5300	62.000	1.1200	240.000	0.2100
0.200	35.9200	7.000	6.2700	64.000	1.0900	250.000	0.1800
0.217	35.1900	7.500	6.0200	66.000	1.0600	260.000	0.1600
0.233	34.5400	8.000	5.8000	68.000	1.0200	270.000	0.1600
0.250	33.8400	8.500	5.5900	70.000	1.0000	280.000	0.1400
0.333	30.6100	9.000	5.4000	72.000	0.9600	290.000	0.1300
0.417	27.8100	9.500	5.2200	74.000	0.9500	300.000	0.1200
0.500	25.4400	10.000	5.0500	76.000	0.9300	310.000	0.1000
0.583	23.2600	12.000	4.4500	78.000	0.9000	320.000	0.1000
0.667	21.2600	14.000	4.0000	80.000	0.8700	330.000	0.0800
0.750	19.6800	16.000	3.6200	82.000	0.8500	340.000	0.0800
0.833	18.4900	18.000	3.3200	84.000	0.8300	350.000	0.0600
0.917	17.5800	20.000	3.0500	86.000	0.8200	360.000	0.0600
1.000	16.7000	22.000	2.8200	88.000	0.8000	370.000	0.0500
1.083	15.9000	24.000	2.6100	90.000	0.7800	380.000	0.0300
1.167	15.2400	26.000	2.4400	92.000	0.7600	390.000	0.0300
1.250	14.7000	28.000	2.2800	94.000	0.7500	400.000	0.0200
1.333	14.2100	30.000	2.1500	96.000	0.7300		
1.417	13.7500	32.000	2.0500	98.000	0.7100		
1.500	13.3300	34.000	1.9300	100.000	0.7000		
1.583	12.9600	36.000	1.8300	110.000	0.6300		
1.667	12.6200	38.000	1.7500	120.000	0.5800		

STEP-DRAWDOWN TEST DATA ANALYSIS
Author: J. D. Hardin, PG

After: Bierschenk, W. H., 1964. Determining Well Efficiency by Multiple Step-Drawdown Tests. Publication 64, Internat. Assoc. Sci. Hydrology

Location:	Squirrel Island
Well No.:	Test Well #2
Well Dia.:	16 inches
Csg Depth:	750 feet
Well Depth:	1396 feet
Date :	June 17, 1991
Description:	Step-drawdown test conducted by David H. Glicksberg

Table 1.-- Step-drawdown test data.

STEP NO	STATIC LEVEL	PUMPING LEVEL	DRAWDOWN	DELTA DRAWDOWN	DISCHARGE (GPM)	SW/Q
1	21.42	44.12	22.70		410	0.055365
2	21.42	58.78	37.36	14.66	590	0.063322
3	21.42	74.42	53.00	15.64	790	0.067088

Table 2.-- Step-Drawdown Test Results

Design Discharge Rate (gpm)	750
Formation Constant (B) =	0.0436510
Well Loss Constant (C) =	0.0000306
Formation Loss (BQ) =	32.74
Well Loss (CQ^2) =	17.23
Total Drawdown (ft) =	49.97
Calculated Transmissivity (gpd/ft) =	85,000
Well Efficiency (Bierschenk) (%) =	65.5
Well Efficiency (Johnson) (%) =	35.3

Table 3.-- Relationship between formation loss and well loss for various pumping rates.

DISCHARGE RATE (GPM)	FORMATION LOSS	WELL LOSS	TOTAL DRAWDOWN
0	0	0	0
100	4.37	0.31	4.67
200	8.73	1.23	9.96
300	13.10	2.76	15.85
400	17.46	4.90	22.36
500	21.83	7.66	29.48
600	26.19	11.03	37.22
700	30.56	15.01	45.56
800	34.92	19.60	54.52
900	39.29	24.81	64.09
1,000	43.65	30.63	74.28
1,100	48.02	37.06	85.08
1,200	52.38	44.10	96.49
1,300	56.75	51.76	108.51
1,400	61.11	60.03	121.14
1,500	65.48	68.91	134.39
1,600	69.84	78.41	148.25
1,700	74.21	88.51	162.72
1,800	78.57	99.23	177.81
1,900	82.94	110.57	193.50
2,000	87.30	122.51	209.81