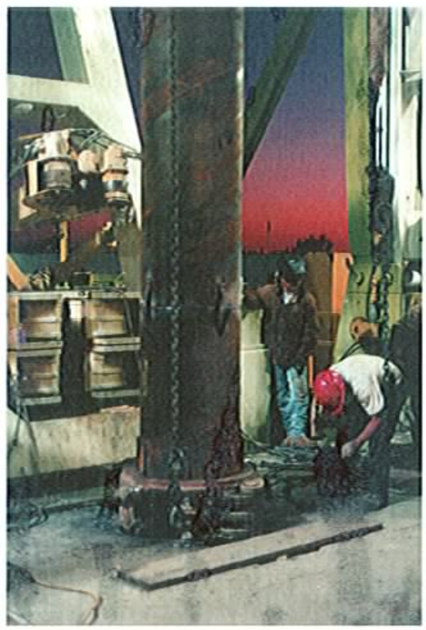
W-1798 + FMB-MW

Lee County Utilities Fort Myers Beach WWTP Deep Injection Well Engineering Report

Volume 1
Appendices A - K



Prepared by

JOHNSON ENGINEERING, INC.
CH2MHILL

December 1998
136794

Contents

List of Tables

List of Figures

List of Figures (continued)

List of Acronyms

bpl	Below pad level
CCL	Casing Color Locator
CBL	Cement bond log
FRP	Fiberglass-reinforced plastic
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
gpm	Gallons per minute
GRB	Gamma ray detector - bottom
GRM	Gamma ray detector - middle
GRT	Gamma ray detector - top
MIT	Mechanical integrity
mCi	MilliCurie
mg/L	Milligrams per liter
mgd	Million gallons per day
psi	Pounds per square inch
RTS	Radioactive tracer survey
SFWMD	South Florida Water Management District
TAC	Technical Advisory Committee
TDS	Total dissolved solids
EPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UIC	Underground Injection Control
USDW	Underground source of drinking water
WWTP	Wastewater treatment plant

Section 1
Introduction

SECTION 1

Introduction

Background Information

The Fort Myers Beach wastewater treatment plant (WWTP) injection well was constructed to serve as an alternative disposal mechanism for excess reclaimed water or secondary treated effluent. The WWTP and injection well system are owned by Lee County, and operated by ST Environmental Services. The WWTP is a conventional activated sludge treatment facility with filtration and high level disinfection. It is permitted for 6.0 million gallons per day (mgd). The facility is located at 17155 Pine Ridge Road, Fort Myers, Florida. Figure 1-1 presents a location map of the facility. A site plan of the WWTP is presented in Figure 1-2.

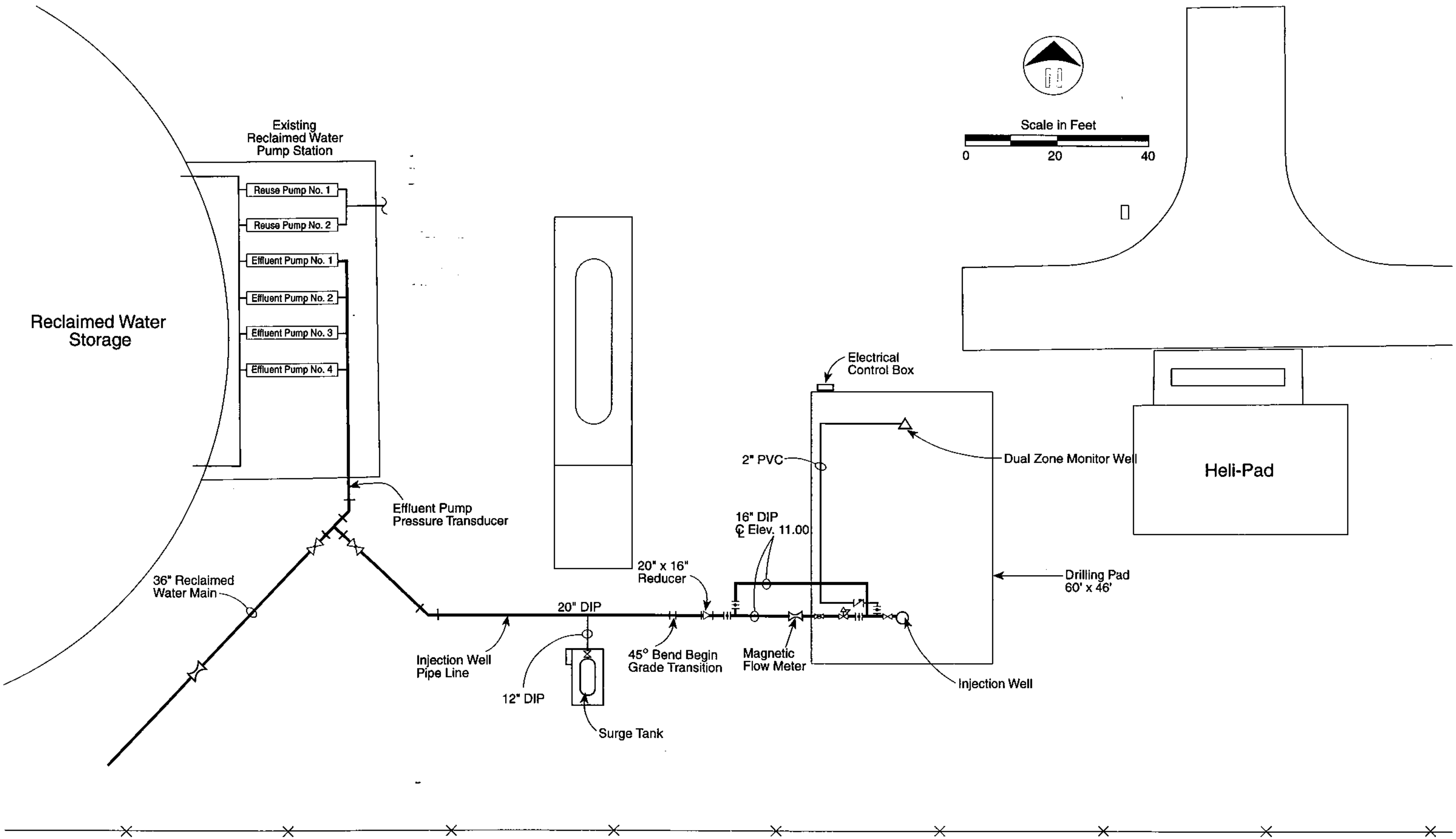
Before this project, effluent management was achieved solely through reuse to existing surrounding golf courses and to percolation ponds located northeast of the site. Because of unusually long periods of extremely wet weather, however, the percolation ponds exceeded their capacities on several occasions. As a result, the County entered into Consent Order No. 96-0919-36-DW, dated September 25, 1997, to provide for the construction and implementation of this injection well facility.

A permit application for the construction of injection well IW-1 and monitoring well MW-1 was submitted to the Florida Department of Environmental Protection (FDEP) on November 6, 1996. An FDEP Underground Injection Control (UIC) permit (Construction Permit 128633-001-UC) was issued on October 22, 1997. These permits allowed construction of IW-1 and MW-1. Appendix A contains a copy of the construction permit.

The design, permitting, and construction services for this injection well system were completed by Johnson Engineering and CH2M HILL. CH2M HILL was retained by Johnson Engineering to provide general hydrogeologic consulting services for this project.

Scope

This report summarizes the construction and testing of injection well IW-1 and dual-zone monitoring well MW-1 at the Fort Myers Beach WWTP. Construction and testing of the wells were performed in accordance with Chapter 62-528, Florida Administrative Code (F.A.C.), the recommendations of the FDEP Technical Advisory Committee (TAC), and the provisions of the FDEP construction permit. The wells and appurtenances were constructed following the contract documents for the "Construction of Deep Injection Well System at the Fort Myers Beach Wastewater Treatment Plant (Johnson Engineering and CH2M HILL, 1997)."



CH2MHILL

FIGURE 1-2
Project Site Plan

Project Description

Youngquist Brothers, Inc., of Fort Myers, Florida, was the selected prime contractor for construction of the injection well system, which included injection well IW-1, monitoring well MW-1, and associated appurtenances. Florida Geophysical was responsible for conducting the geophysical logging operations on five wells. Notice-to-Proceed was issued on December 8, 1997.

Construction activities at deep injection well system included installation of a permanent drilling pad, shallow pad monitoring wells, construction of the injection well, construction of the dual-zone monitoring well, installation of wellhead piping and hydropneumatic surge tank, and instrumentation.

The FDEP TAC coordinated the actions of local, state, and federal agencies, including FDEP's state and local representatives, the South Florida Water Management District (SFWMD), the U.S. Environmental Protection Agency (EPA), and the U.S. Geological Survey (USGS). A tabulated summary of construction activities and weekly summaries of the construction progress are presented in Appendix B and Appendix C, respectively.

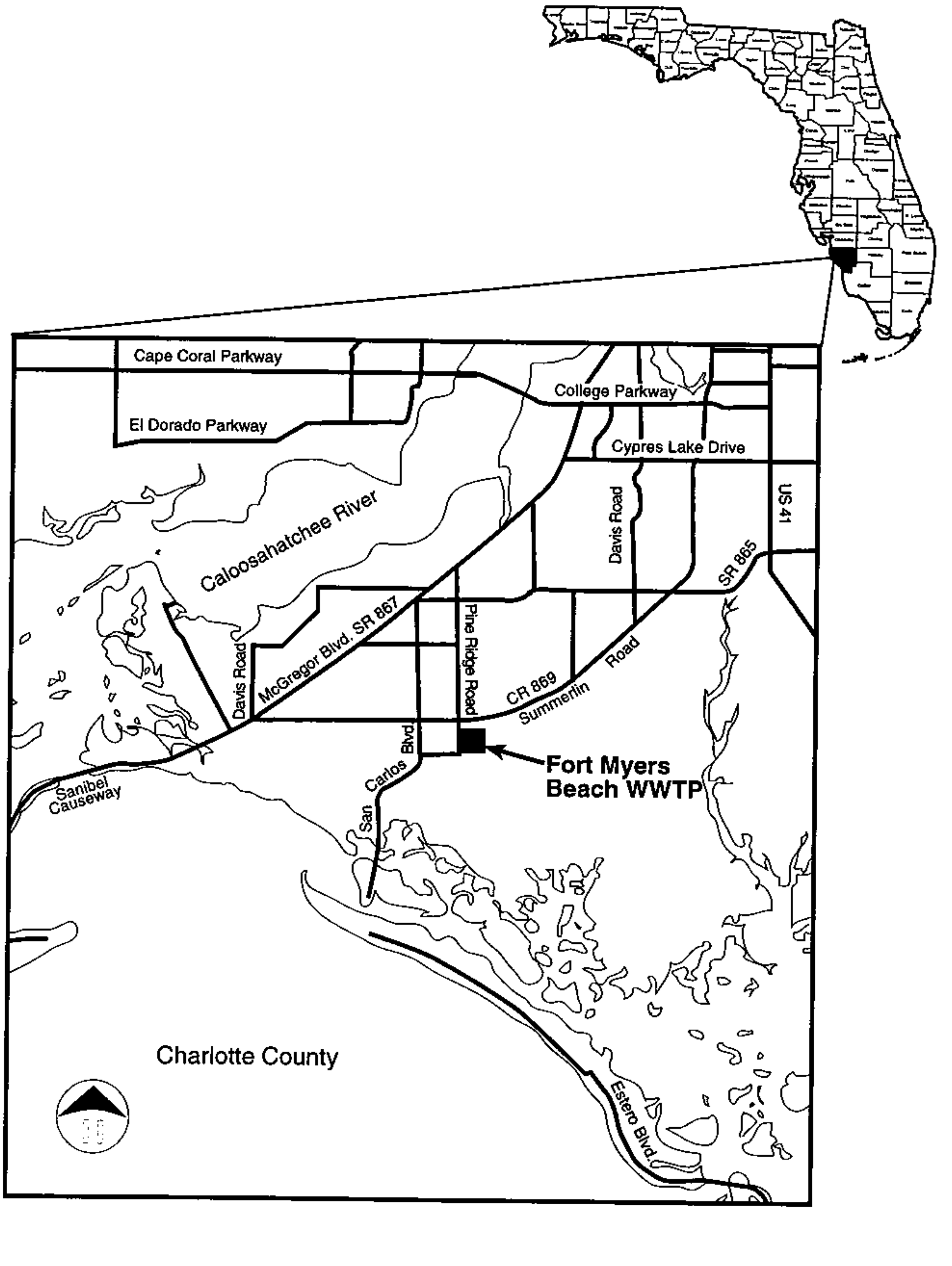


FIGURE 1-1
Project Location Map

CH2MHILL

Section 2
Construction

SECTION 2

Construction

This section describes the construction, drilling, and testing details associated with the construction of IW-1 and dual-zone monitoring well MW-1.

Before beginning drilling activities, a temporary drilling pad was installed, which contained both the drilling rig and cutting's tank. This pad was later modified to a permanent pad. Construction of the injection well system included construction of the pad, four surficial monitoring wells, a deep injection well, and a dual-zone monitoring well. Figures 2-1 and 2-2 provide diagrams of the temporary drilling pad and the permanent drilling pad, respectively.

Surficial Monitoring Wells

As required by the construction permit, four surficial monitoring wells were installed and sampled before the start of construction at IW-1. Surficial monitoring wells were installed at each corner of the drilling pad to monitor for groundwater contamination during construction. Following installation of the surficial monitoring wells, samples were collected from each well and analyzed to establish background water quality data. Figure 2-3 presents a typical surficial monitoring well diagram. Water quality data from the surficial monitoring wells is discussed in Section 4 of this report.

Injection Well IW-1

Drilling of injection well IW-1 began on January 12, 1998. Mud rotary drilling techniques were used to drill through the surficial aquifer and the clay intervals that make up the Hawthorn Group. Reverse air drilling techniques were used during subsequent drilling to a total depth of 3,036 feet below pad level (bpl) to remove drill cuttings from the borehole and to collect water samples at 30-foot intervals. A closed circulation system was used during reverse air drilling.

The drilling schedule and casing-setting depths were designed to conform to the hydrogeological features observed at the site, as well as to various regulatory agency requirements. Geologic formation samples were collected and described at 10-foot intervals during the drilling of the pilot hole. Data from the pilot hole interval (formation samples [cuttings], cores, water samples, air-lift specific capacity tests, packer tests, an injection test, and geophysical logs) were evaluated to assist in selection of the casing setting depths, and to interpret the site lithology and hydrogeology.

Three concentric steel casings were used to construct IW-1 (34-inch, 26-inch, and 16-inch outside diameters). Appendix D contains copies of casing mill certificates for each of the casings used during construction of IW-1. Immediately upon installation, the annular space around each casing string was cemented from the bottom of casing to land surface. The cementing program was specifically tailored for each casing installed. Table 2-1 provides a

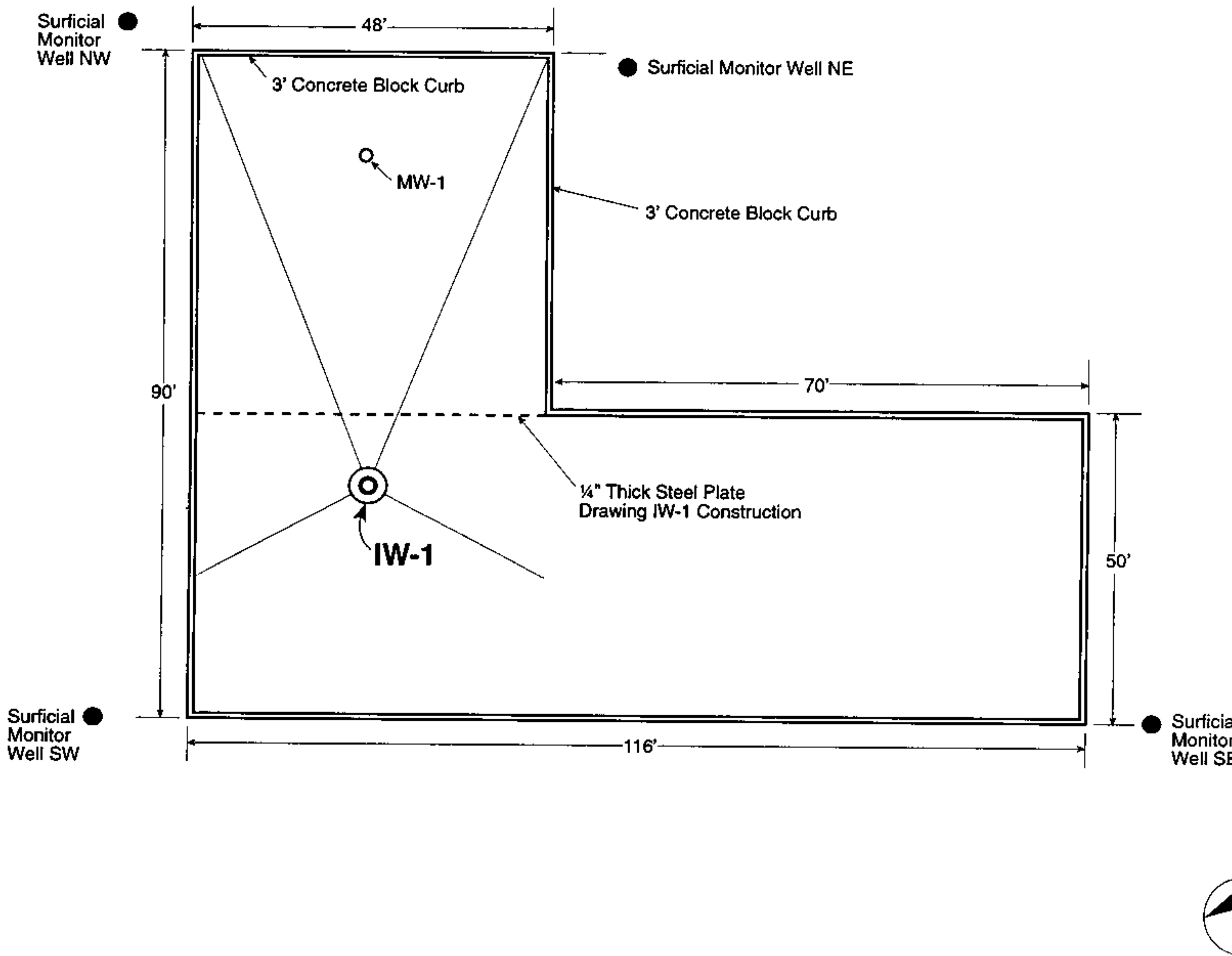


FIGURE 2-1
Temporary Drilling Pad

CH2MHILL

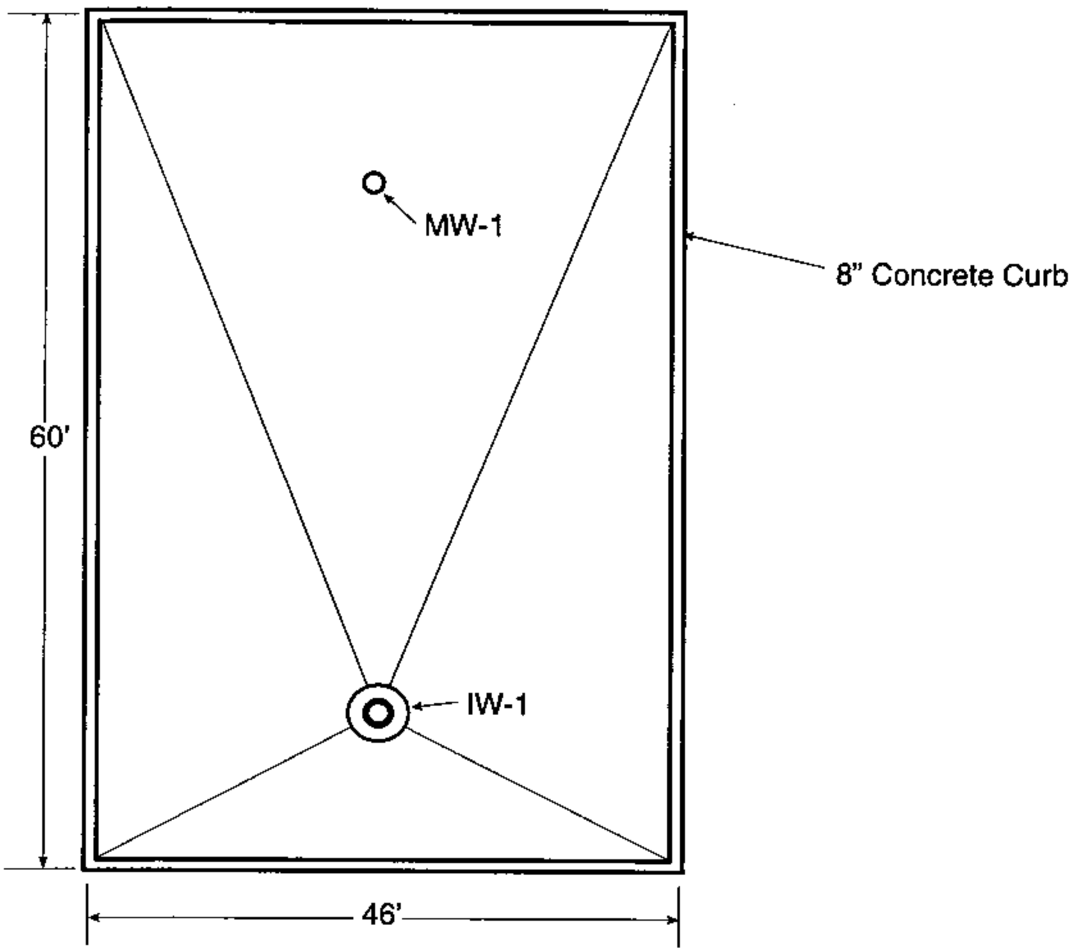


FIGURE 2-2
Permanent Drilling Pad

CH2MHILL

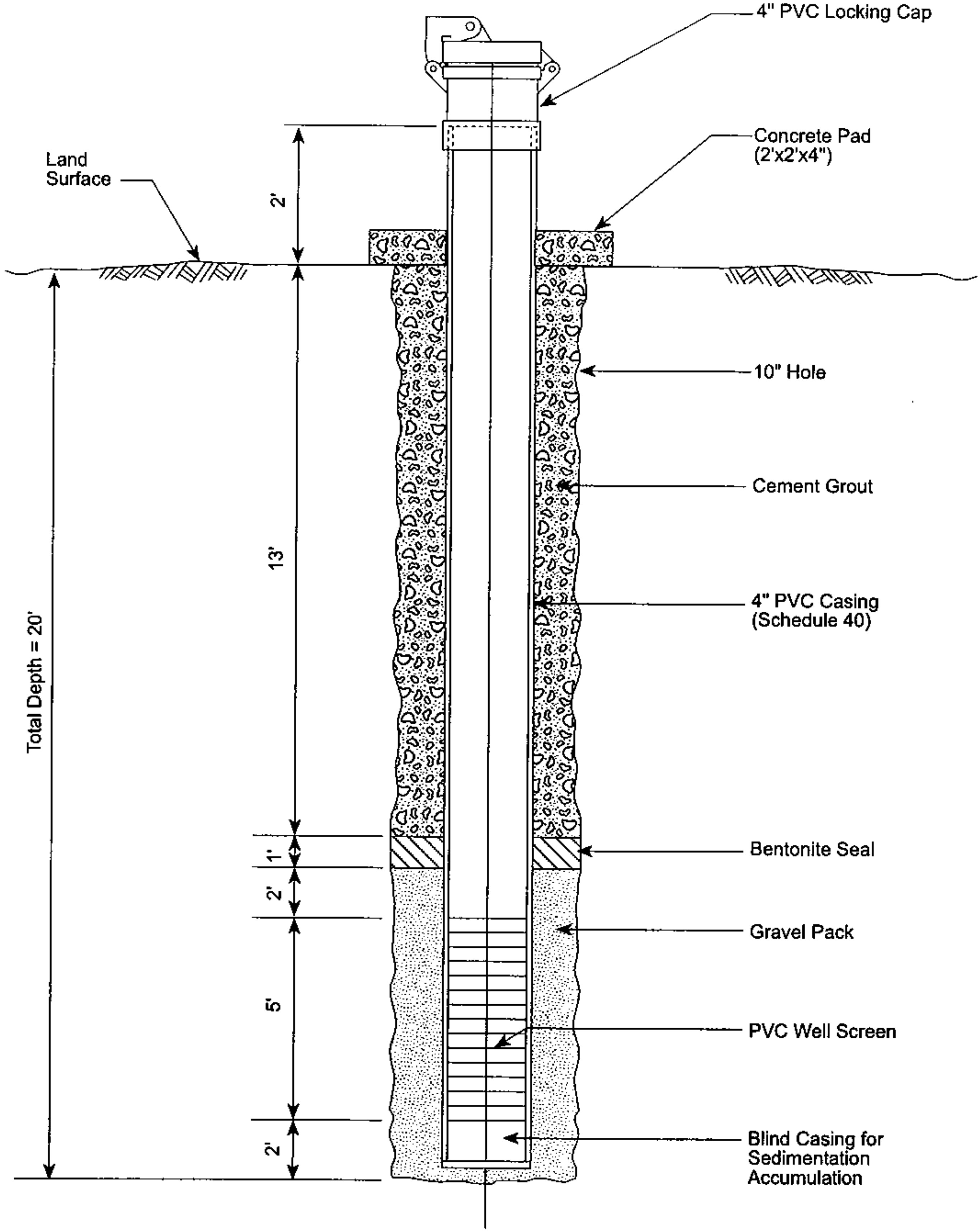


FIGURE 2-3
Typical Surficial Monitor Well Diagram

CH2MHILL

Table 2-1

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Summary of Casing Setting Depths and Cement Quantities

Casing	Casing Material	Outside Diameter (inches)	Inside Diameter (inches)	Casing Thickness (inches)	Casing Depth (feet bpl)	Date	Cement Stage	Type of Cement	Quantity of Cement (sacks)	Remarks
Shallow	Steel	34.00	33.00	0.500	398	1/16/98	#1	Neat	338	Pressure grout from bottom of casing
								4% bentonite	517	
Intermediate	Steel	26.00	25.00	0.500	1794	2/26/98	#1	Neat	789	Pressure grout from bottom of casing
								6% bentonite	478	
						2/26/98	#2	6% bentonite	1264	Tremied into annulus from 1,606 feet bpl
						2/27/98	#3	6% bentonite	1457	Tremied into annulus from 1,190 feet bpl
						2/27/98	#4	6% bentonite	1434	Tremied into annulus from 895 feet bpl
						2/28/98	#5	12% bentonite	928	Tremied into annulus from 625 feet bpl
Final	Steel	16.00	15.00	0.500	2370	4/28/98	#1	Neat	518	Pressure grout from bottom of casing
								6% bentonite	501	
						4/29/98	#2	Neat	195	Tremied into annulus from 2,132 feet bpl
						4/29/98		Gravel	15 yards	Tremied into annulus from 2,126 feet bpl
						4/29/98	#3	6% bentonite	498	Tremied into annulus from 2,110 feet bpl
						4/30/98		Gravel	10 yards	Tremied into annulus from 2,105 feet bpl
						4/30/98	#4	Neat	95	Tremied into annulus from 2,089 feet bpl
						5/1/98		Gravel	10 yards	Tremied into annulus from 2,080 feet bpl
						5/1/98	#5	Neat	106	Tremied into annulus from 2,050 feet bpl
						5/1/98	#6	6% bentonite	913	Tremied into annulus from 2,010 feet bpl
						5/2/98	#7	12% bentonite	1211	Tremied into annulus from 1,520 feet bpl
						5/25/98	#8	12% bentonite	189	Tremied into annulus from 230 feet bpl
								Total Sacks Neat:	**4354**	
								Total Sacks 4%:	**8992**	

bpl = below pad level

summary of casing depths and the types and quantities of cement used during the construction of IW-1. Figure 2-4 presents a cross-sectional view depicting the completion diagram of IW-1.

Construction of IW-1 began with the mud-rotary drilling of a nominal 12.25-inch-diameter pilot hole to a depth of 473 feet bpl. The pilot hole was then geophysically logged (caliper, gamma ray, spontaneous potential, and dual induction logs). Upon examination of the logs, the casing depth was targeted at 398 feet and the borehole was reamed to a nominal 40-inch-diameter to a depth of 405 feet bpl. A caliper log was then performed on the reamed hole and the 34-inch-diameter casing was installed and cemented through the surficial and intermediate aquifers to a depth of 398 feet bpl.

After allowing for a 24-hour cement cure time, the pilot hole was advanced with reverse air drilling techniques to a depth of 1,900 feet bpl. Three 4-inch-diameter cores were collected from the interval of 1,444 to 1,684 feet bpl during this phase of pilot hole drilling. Core analyses and descriptions are discussed in Section 4 of this report. Caliper, gamma ray, spontaneous potential, dual induction, borehole compensated sonic, temperature, fluid conductivity, and flowmeter logs were then conducted on the open hole interval. Five straddle packer tests were performed between the interval of 1,220 and 1,844 feet bpl in order to identify the base of the Underground Source of Drinking Water (USDW) and provide confining characteristics of the tested intervals. The results of the packer tests are presented and discussed in Section 4.

Based on the results of packer testing, coring, geophysical logging, and formation sample analyses, a 26-inch diameter casing setting depth of 1,800 feet bpl was recommended to and approved by the FDEP and TAC. The pilot hole was then back plugged with cement and reamed to a nominal 34-inch-diameter to a depth of 1,805 feet bpl. The reamed hole was then caliper-logged and the 26-inch-diameter intermediate casing was installed below the base of the USDW to a depth of 1,794 feet bpl, and its annular space cemented to land surface.

After the cement cure period, the pilot hole was advanced to a depth of 3,036 feet bpl. Five 4-inch-diameter cores were collected from the interval of 1,965 to 2,524 feet bpl during this phase of pilot hole drilling. Section 4 of this report presents core analyses, including detailed descriptions. Caliper, gamma ray, spontaneous potential, dual induction, borehole compensated sonic, temperature, fluid conductivity, video, and flowmeter logs were then conducted on the open hole interval. A drill stem packer test was performed on the interval from 1,450 to 1,990 feet bpl. Caliper, fluid resistivity, temperature, and flowmeter logs were performed on the test interval during drill stem packer testing. Section 4 of this report discusses the results of drill stem packer testing. Five packer tests were then conducted between the interval of 1,796 and 3,036 feet bpl in order to determine the confining characteristics of the tested intervals.

Based on flow results of packer testing, along with coring, geophysical logging, and formation sample analyses, a 16-inch diameter casing setting depth of 2,370 feet bpl was recommended to and approved by the FDEP and TAC. Before reaming the pilot hole, a bridge plug was installed at a depth of 2,405 feet bpl and the interval from the bridge plug to the 26-inch casing was back plugged with cement. The back plugged pilot hole was then reamed to a nominal (25-inch) diameter to a depth of 2,376 feet bpl and caliper-logged. The final casing (16-inch-diameter) was then installed to a depth of 2,370 feet bpl.

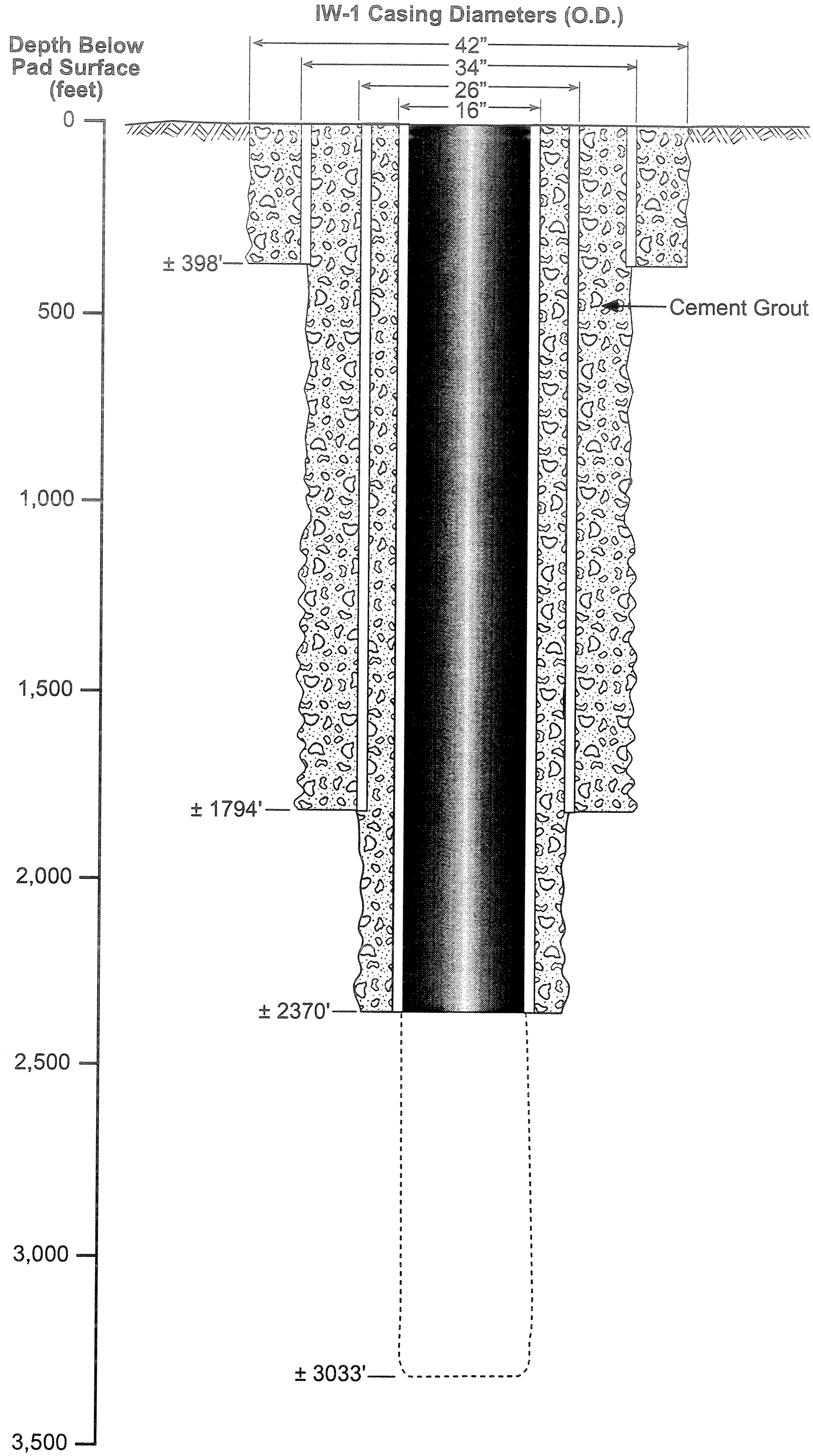


FIGURE 2-4
Injection Well Completion Diagram

CH2MHILL

A pressure test was conducted on the final casing string before conducting a cement bond log. The interval below the base of the final casing was then reamed to a nominal (15-inch) diameter to a depth of 3,033 feet bpl before developing the well and collecting a background water quality sample for laboratory analysis. The water quality sample analyses are presented in Section 4.

Caliper, gamma ray, temperature, video, and flowmeter logs were conducted on the well before performing a radioactive tracer survey (RTS) to assess the external mechanical integrity of IW-1. The IW-1 wellhead was then installed and wellhead piping was connected to the WWTP effluent disposal piping. Figure 2-5 presents the completion diagram for the IW-1 wellhead.

Monitoring Well MW-1

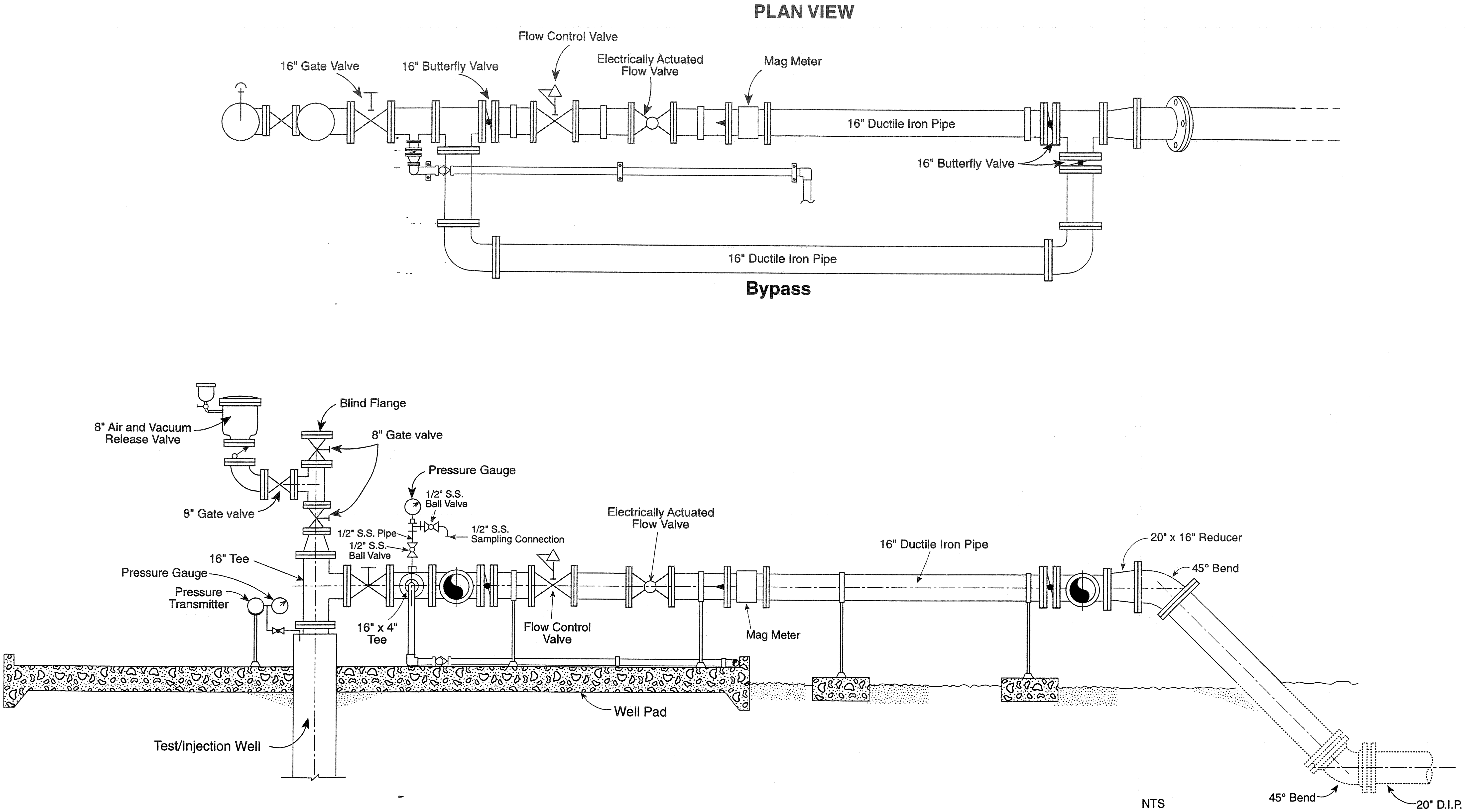
Drilling of monitoring well MW-1 began on May 15, 1998, utilizing the same drilling techniques used for the injection well. The upper monitoring zone is constructed in the first permeable zone above the base of the USDW, and is open over the intervals from 1,170 to 1,271 feet bpl. The lower monitoring zone is constructed below the base of the USDW within the first permeable zone above the uppermost portion of the injection zone, and is open over the interval between 1,563 and 1,649 feet bpl.

MW-1 was constructed using three (3) concentric casings (24-inch, 16-inch, and 6-5/8-inch outside diameters). Appendix E contains copies of casing mill certificates for each casing used during construction of MW-1. The cementing program was specifically tailored for each casing installed. Table 2-2 summarizes the casing depths and the types and quantities of cement used for the construction of MW-1. Figure 2-6 presents a cross-section representation of the completed well.

Construction of MW-1 began with the mud-rotary drilling of a nominal 12.25-inch-diameter pilot hole to a depth of 410 feet bpl. The pilot hole was then geophysically logged (caliper, gamma ray, spontaneous potential, and dual induction logs) and reamed to a nominal 28-inch-diameter to a depth of 405 feet bpl. A caliper log was then performed on the reamed hole and a 24-inch-diameter steel casing was installed and cemented to a depth of 400 feet bpl.

After completion of the surface casing, followed by a 24-hour waiting period, the pilot hole was then advanced to a depth of 1,193 feet bpl and geophysically logged. Logs conducted included caliper, gamma ray, spontaneous potential, dual induction, borehole compensated sonic, temperature, fluid conductivity, and flowmeter. After logging, the pilot hole was reamed to a nominal 22-inch diameter to a depth of 1,180 feet. After conducting a caliper log on the reamed hole, the 16-inch casing was installed and cemented to a depth of 1,170 feet bpl.

The pilot hole was then drilled to a depth of 1,720 feet bpl and geophysically logged. Logs included caliper, gamma ray, spontaneous potential, dual induction, borehole compensated sonic, temperature, fluid conductivity, and flowmeter. After logging, the pilot hole was reamed to a nominal 15-inch diameter to a depth of 1,710 feet bpl and geophysically logged with a caliper tool. Upon completion of the caliper log, the 6-5/8-inch fiberglass-reinforced plastic (FRP) casing was set to a depth of 1,572 feet bpl. The borehole below the base of the



CH2MHILL

FIGURE 2-5
Injection Wellhead Completion Diagram

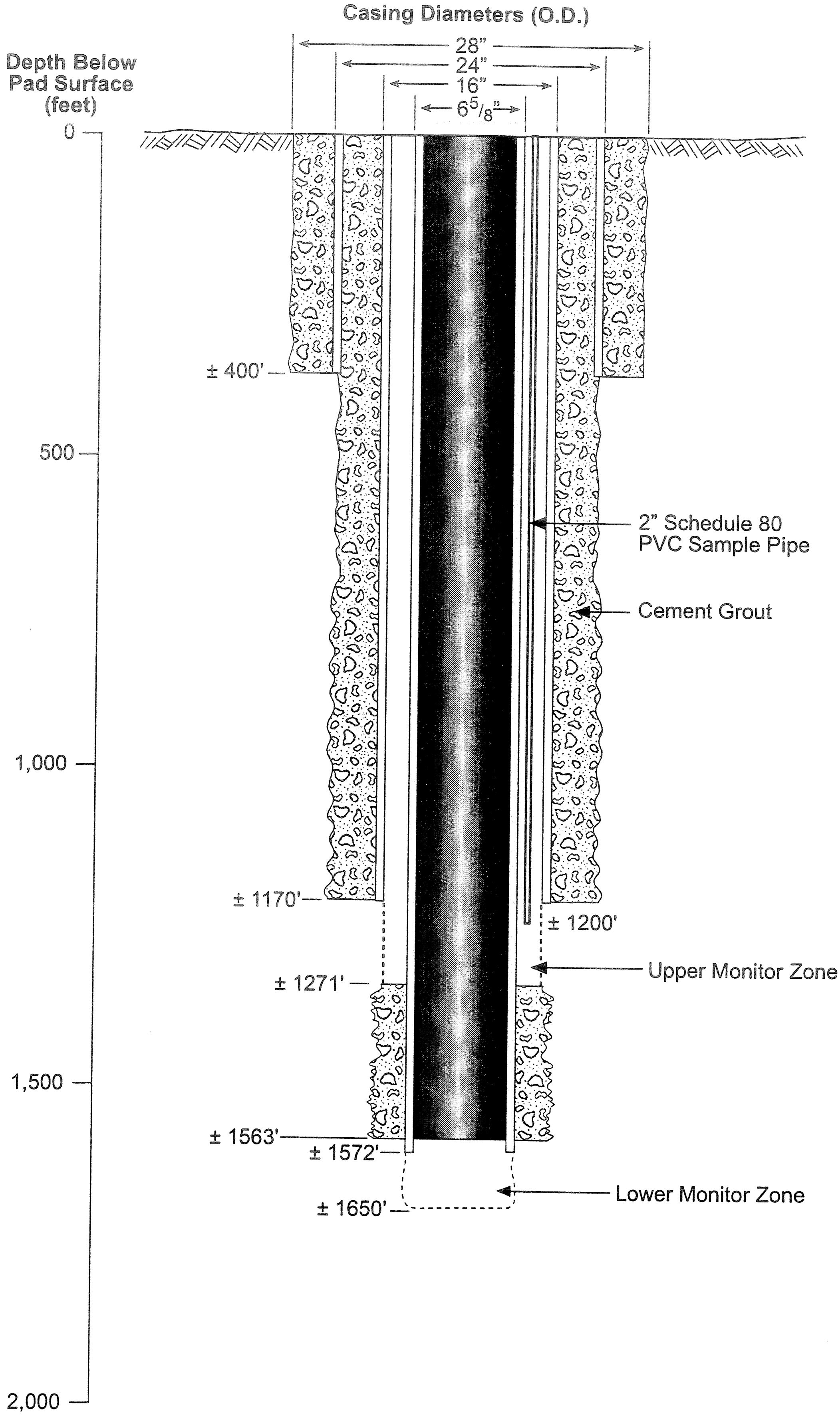


FIGURE 2-6
Dual-Zone Monitor Well Completion Diagram

CH2MHILL

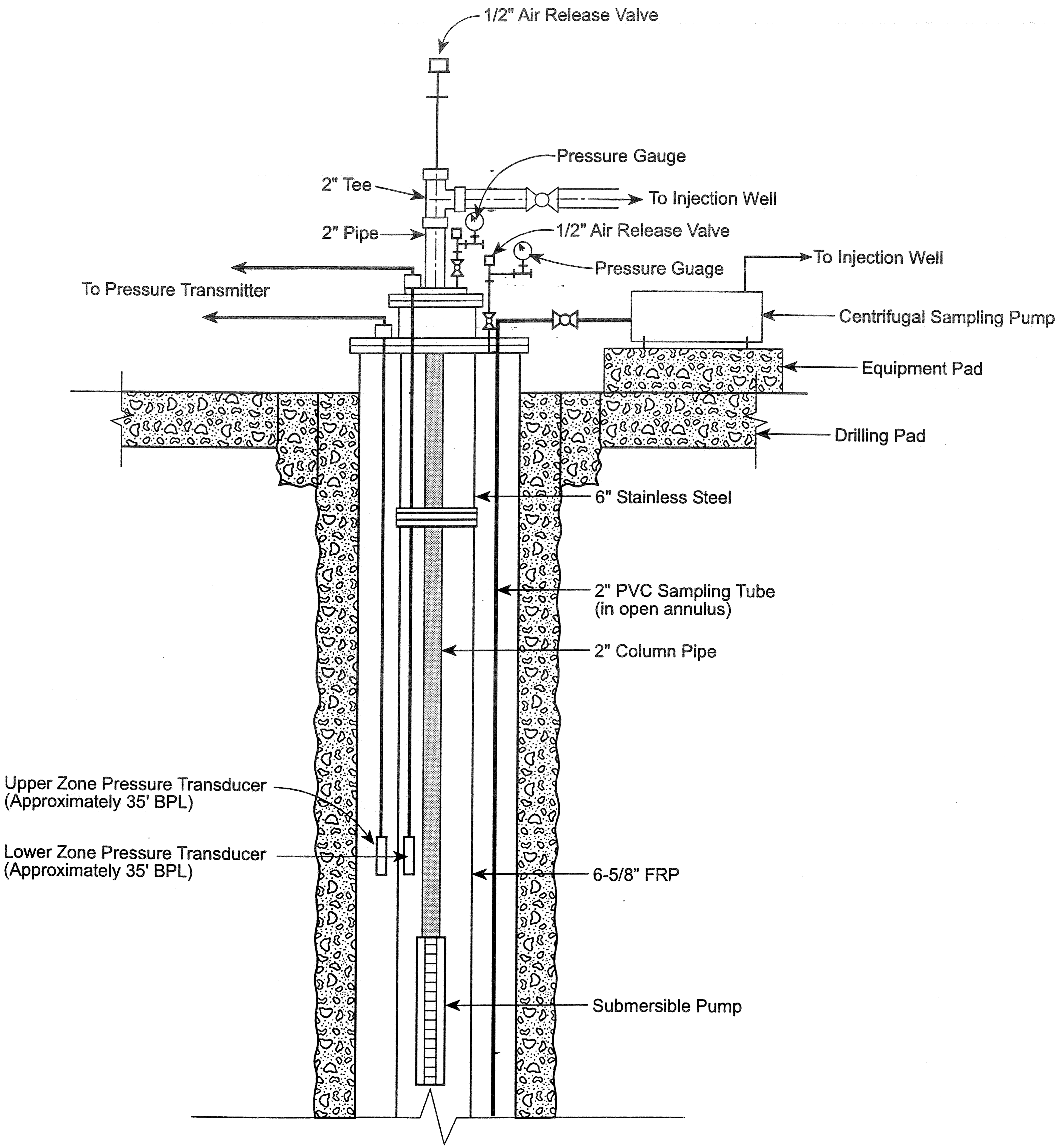
Table 2-2

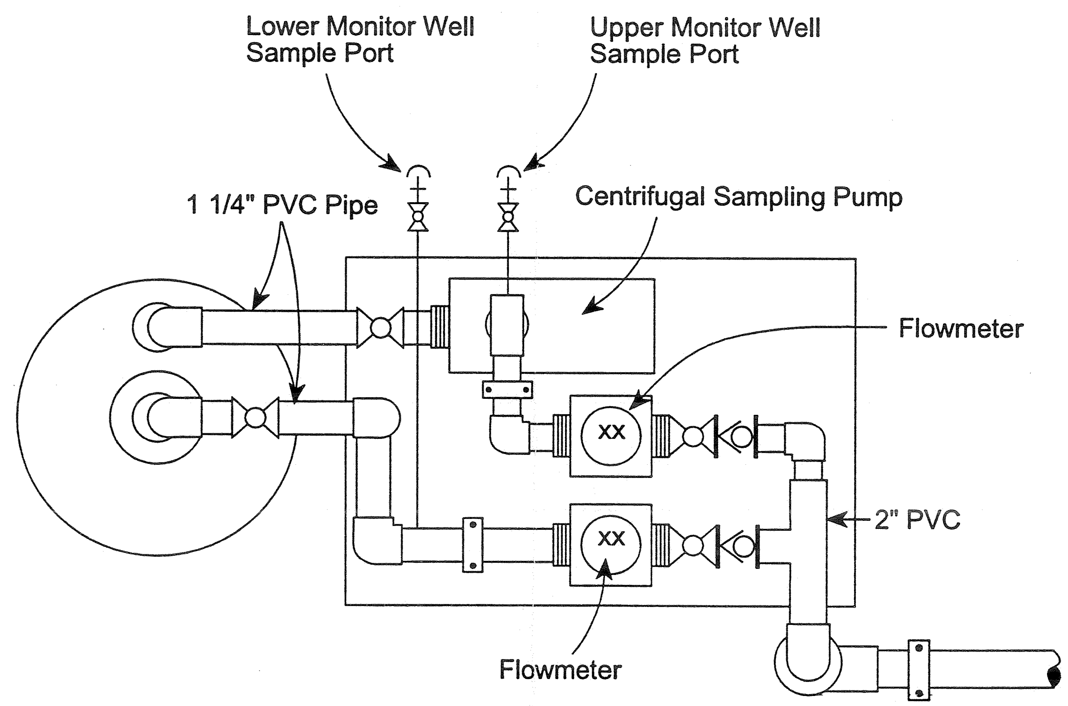
Fort Myers Beach Wastewater Treatment Plant
Monitoring Well MW-1
Summary of Casing Setting Depths and Cement Quantities

Casing	Casing Material	Outside Diameter (inches)	Inside Diameter (inches)	Casing Thickness (inches)	Casing Depth (feet bpl)	Date	Cement Stage	Type of Cement	Quantity of Cement (sacks)	Remarks
Shallow	Steel	24.00	23.00	0.500	400	5/17/98	#1	Neat	224	Pressure grout from bottom of casing
								6% bentonite	189	
Intermediate	Steel	16.00	15.00	0.500	1170	5/24/98	#1	Neat	390	Pressure grout from bottom of casing
								6% bentonite	847	
						5/25/98	#2	12% bentonite	462	Tremied into annulus from 610 feet bpl
Final	FRP	6.63	5.43	0.600	1572	6/5/98	#1	Neat	5	Gravel to 1,563 feet bpl. Tremied into annulus from 1,561 feet bpl
						6/5/98	#2	Neat	5	Tremied into annulus from 1,561 feet bpl
						6/5/98	#3	Neat	333	Tremied into annulus from 1,560 feet bpl
						6/5/98	#4	Neat	62	Tremied into annulus from 1,309 feet bpl
								Total Sacks Neat:	**1019**	
								Total Sacks 6%:	**1036**	
								Total Sacks 12%:	**462**	

bpl = below pad level

FRP casing was then back plugged with neat cement to a depth of 1,649 feet bpl, filling the borehole with gravel to a depth of 1,563 bpl. The FRP casing was then cemented over the interval from 1,271 to 1,563 feet bpl. Caliper, gamma ray, cement bond, and video logs were then performed on the well. A pressure test was then conducted on the FRP casing before developing the monitoring zones, collecting background water quality samples, and installing the wellhead. Figure 2-7 presents the completion diagram for the MW-1 wellhead.





Monitoring Well Piping Detail

FIGURE 2-7
Monitor Well Wellhead and Piping Completion Diagram

Section 3
Geologic and Hydrogeologic Framework

SECTION 3

Geologic and Hydrogeologic Framework

Geology and Hydrogeology

Lee County's aquifer systems are developed within a thick carbonate platform which overlies the Early Jurassic period (150 to 195 million years old) basement rocks. Sediments within the carbonate platform range in age from Lower Eocene to Holocene. The sediments consist primarily of carbonates and Miocene age siliciclastics. The aquifer systems in Lee County are developed in sediments ranging in age from late Paleocene (55 million years old) to Holocene (recent) and include the Floridan Aquifer System, the Intermediate Aquifer System, and the Surficial Aquifer System. In general, groundwater within Lee County becomes more mineralized with depth. Potable groundwater is found only in limited quantities within the surficial aquifer and very upper portions of the intermediate aquifer.

Lithostratigraphic Descriptions

Sediments encountered during the construction of the IW-1 and MW-1 ranged in age from Holocene to Lower Eocene. This section briefly discusses these sediments and their relationship to the hydrostratigraphy of the site. Figure 3-1 provides a stratigraphic and hydrostratigraphic column of the site. The hydrostratigraphic nomenclature utilized in Figure 3-1 and discussed below is based on SFWMD Technical Publication 84-10.

Undifferentiated Holocene to Pliocene

Unconsolidated shell fragments and fine-grained limestone make up the undifferentiated Holocene to Pliocene sediments at the site. The undifferentiated Holocene and Pleistocene age deposits at the site are present from land surface to approximately 40 feet bpl and consists of unconsolidated shells and shell fragments. The undifferentiated Holocene and Pliocene deposits comprise the water table portion of the Surficial Aquifer at the site.

Miocene Series

Hawthorn Group. In Lee County, the Hawthorn Group is divided into two members. The upper member is the Peace River Formation, which is made up primarily of greenish gray, phosphatic clay with occasional interbedded fine-grained limestone at the site. The lower member of the Hawthorn Group is the Arcadia Formation, a predominantly carbonate formation consisting of limestone and phosphatic limestone with interbedded phosphatic clay. Aquifers within the Hawthorn Group are collectively referred to as the Intermediate Aquifer System.

The top of the Peace River Formation was encountered at a depth of approximately 40 feet bpl, and is approximately 105 feet thick at the site. The top of the Peace River Formation is a low permeability unit that acts as a confining interval (Upper Hawthorn Confining Zone) separating the Surficial Aquifer from the Sandstone aquifer, and consists of moderately porous sandy limestone, and is found between approximately 115 and 125 feet bpl.

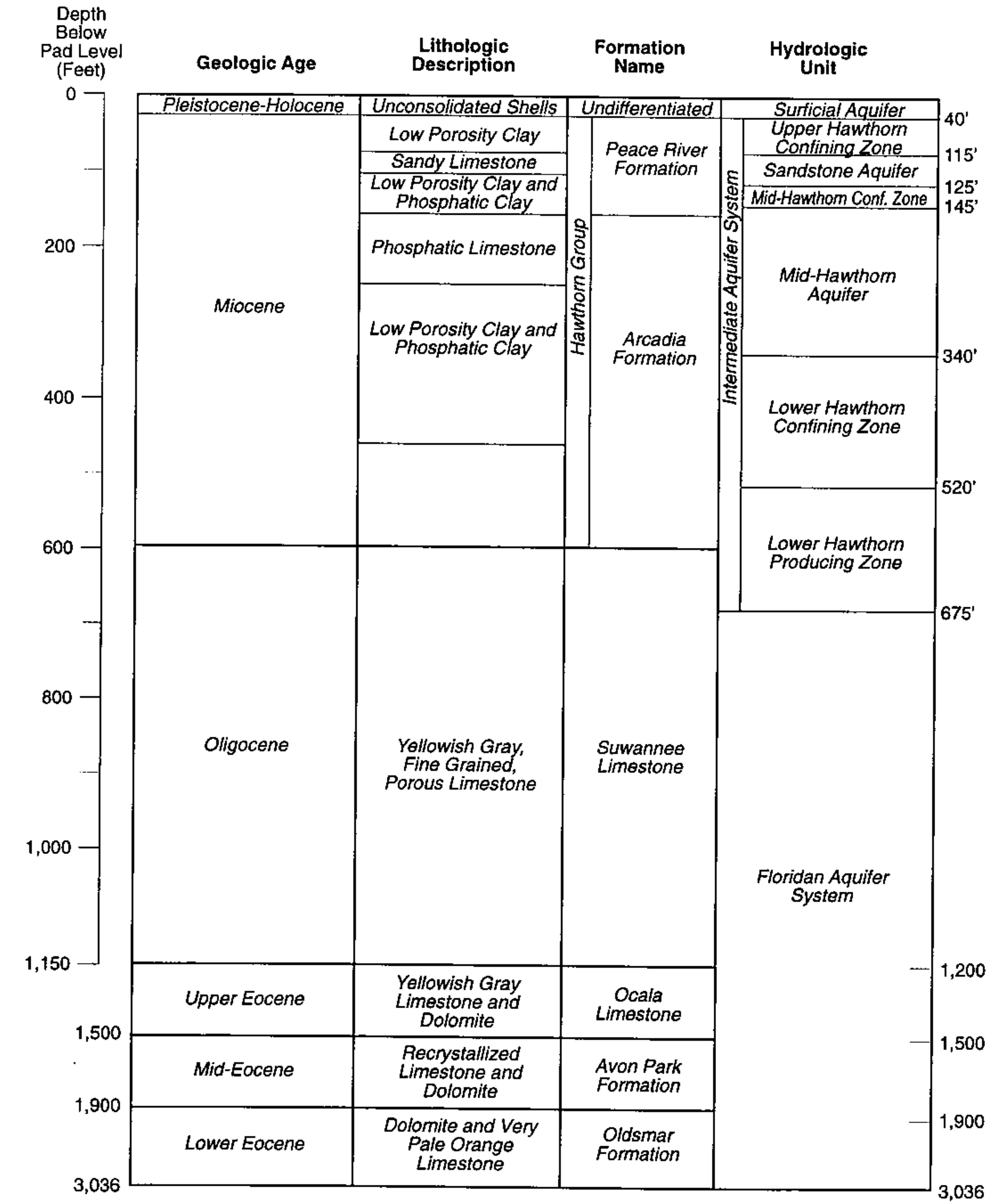


FIGURE 3-1
Stratigraphic and Hydrostratigraphic Column of the Fort Myers Beach WWTP Injection Well System Site

CH2MHILL

The Mid-Hawthorn Confining Zone is present below the Sandstone aquifer across the interval from approximately 125 to 145 feet bpl and consists of low permeability greenish-gray clay and phosphatic clay.

The lower stratigraphic unit of the Hawthorn Group, the Arcadia Formation, was encountered at a depth of approximately 145 feet bpl and consists primarily of interbedded phosphatic limestone, clay, and fossiliferous limestone at the site. The Arcadia Formation is estimated to be 530 feet thick at the site and is characterized by a moderate to high gamma ray signature (10 to 215 API units). The Mid-Hawthorn aquifer is present at the site from 145 to 340 feet bpl and consists primarily of interbedded fine-grained limestone and phosphatic limestone. The Lower Hawthorn Confining Zone separates the Mid-Hawthorn aquifer from the Lower Hawthorn aquifer and is present from 340 to 520 feet bpl. The Lower Hawthorn Confining Zone is made up primarily of clay and phosphatic clay with interbedded limestone. The Lower Hawthorn producing zone is present from 520 to 675 feet bpl and consists of light gray limestone thin interbeds of clay, fossiliferous limestone, and phosphatic limestone. The Lower Hawthorn producing zone is underlain by the Floridan Aquifer System.

Oligocene Series

Suwannee Limestone. The Suwannee Limestone of the Oligocene Age occurs from a depth of approximately 675 to 1,200 feet bpl and is characterized by a yellowish-gray and light gray limestone with occasional interbedded dolomite, clay, and phosphatic limestone. It is part of the upper Floridan Aquifer System, and characteristically exhibits moderate to high permeability and artesian pressure. The base of the formation is marked by a decrease in gamma ray activity.

Eocene Series

Ocala Formation. The Ocala Formation of the Upper Eocene Age occurs from a depth of approximately 1,200 to 1,500 feet bpl. The formation is characterized by fine-grained limestone with occasional interbedded dolomite. The limestone contains intervals with abundant foraminifera and high porosity and permeability. The Ocala Formation is part of the upper Floridan Aquifer System, and characteristically exhibits thin intervals of moderately high permeability. The Ocala Formation overall, however, has relatively low permeability. The contact between the Suwannee Limestone and the upper-most permeable section of the Ocala Formation were selected for the upper monitoring interval of the injection well system.

Avon Park Formation. The Avon Park Formation of the Mid-Eocene Age occurs from a depth of approximately 1,500to 1,900 feet bpl and is characterized by yellowish-gray, recrystallized limestone with a small amount of dolomitic limestone and dolomite. The upper portion of the Avon Park Formation typically exhibits permeability. The lower portion of the formation is often finer grained, has a lower porosity than the upper portion, and typically is confining in nature.

Oldsmar Formation. The Oldsmar Formation of the Eocene Age occurs from a depth of approximately 1,900 feet bpl to below the total depth of the well. The lithology of the Oldsmar Formation at this site is predominantly dolomite and interbedded recrystallized limestone. The Oldsmar Formation contains highly transmissive, fractured, and cavernous intervals often referred to as the "Boulder Zone." Injected effluent exits the borehole in the "Boulder Zone."

Section 4
Testing During Construction

SECTION 4

Testing During Construction

Testing during the construction of the injection well system included formation sampling, reverse-air pilot hole water sampling, geophysical logging, air-lift specific capacity testing, coring, packer testing, and injection testing. Results of the testing were used to determine the hydraulic characteristics of the strata intercepted by the borehole, which were then used to determine the optimal design of the wells. The surficial aquifer monitoring wells were sampled once a week to monitor water quality changes within the water table aquifer.

Surficial Monitoring Well Water Quality

Throughout construction, water samples were collected on a weekly basis from each of the four surficial monitoring wells to ensure that the surficial aquifer was not impacted by construction activities. Water samples were field-analyzed for chloride, conductivity, temperature, and pH. The water level at each well was also recorded. Figure 4-1 presents chloride concentrations for all four wells during construction of the injection and monitoring wells.

Both the water quality and water level at each surficial monitoring well remained relatively stable throughout the construction period, with chloride concentrations generally fluctuating between 150 milligrams per liter (mg/L) and 180 mg/L. Appendix F contains the complete sampling data for each of the surficial monitoring wells for the duration of the project. No construction-related impacts to the surficial aquifer were observed throughout the testing period.

Formation Sampling

Formation cutting samples from IW-1 and MW-1 were collected at 10-foot intervals from land surface to the total depth of the wells and were characterized for rock type, color, consolidation, porosity, and fossils. Table 4-1 provides a generalized summary of the geologic formations encountered during construction of the wells. Appendix G contains a detailed lithologic description of samples from IW-1 and MW-1.

Geophysical Logging

Geophysical logs were performed in the pilot hole intervals of IW-1 and MW-1 to correlate data obtained by different mechanisms and to provide additional geologic water quality information of the intercepted borehole. Specifically, the geophysical logs were compared to the formation samples taken during drilling and used to identify formation boundaries, as well as to obtain specific geologic and hydrogeologic data pertaining to the underground formations. These data were then utilized in the selection of optimum casing setting depths for each well, determination of coring and packer testing intervals, and identification of water producing intervals. Reamed hole caliper logs were also performed prior to casing

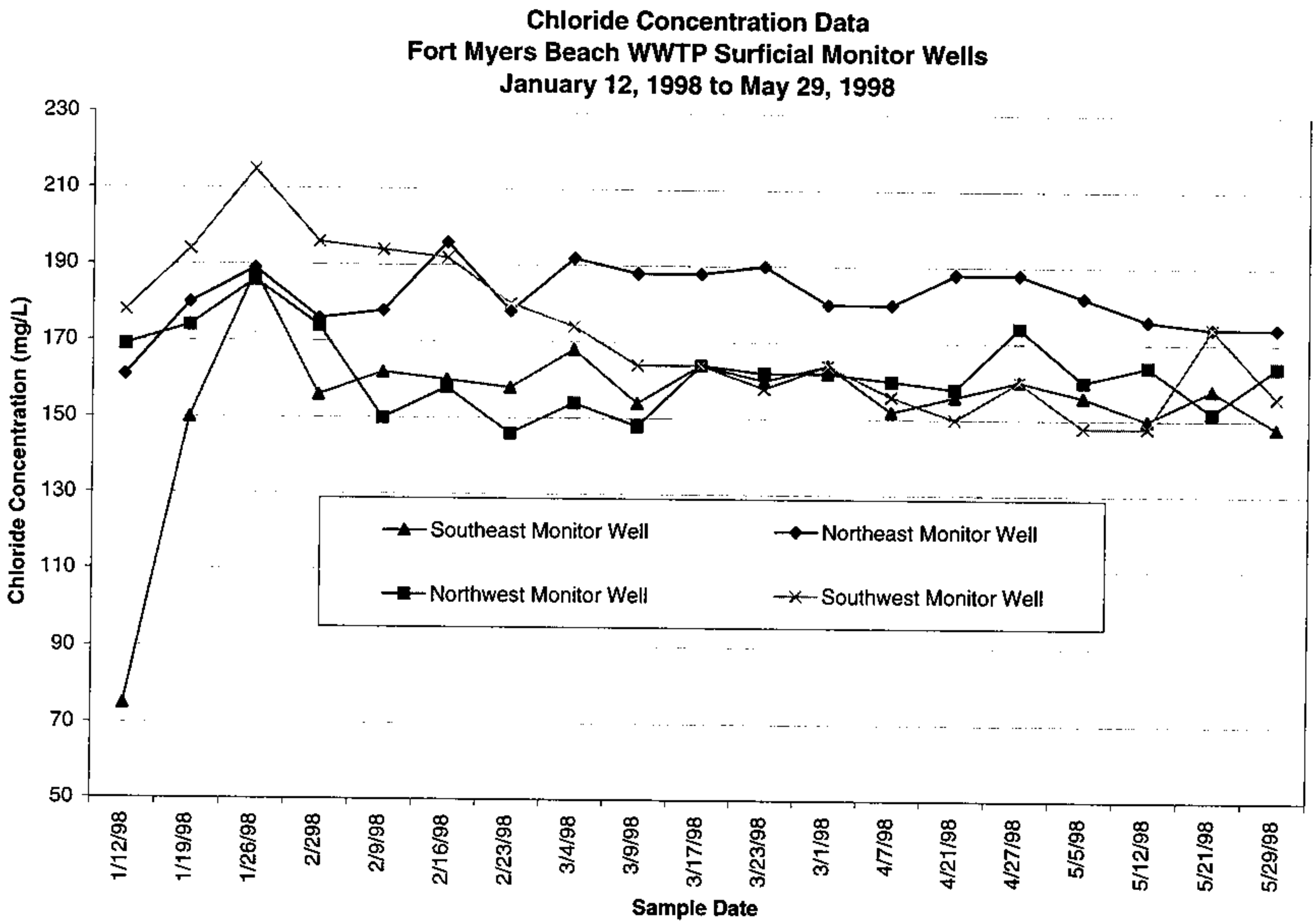


Figure 4-1
Surficial Monitor Wells Chloride Concentrations

P:water\136794\report\charts\fig4-1

TABLE 4-1
Geologic Formations Encountered

Depth Interval (feet bpl)	Description	Formation	Geologic Age
0 – 40	Limestone, Shell Fragments	Undifferentiated	Holocene to Pleistocene
40 – 145	Clay, Phosphatic Clay	Peace River (Hawthorn Group)	Miocene
145 – 675	Limestone, Phosphatic Limestone, and Interbedded Clay	Arcadia (Hawthorn Group)	Miocene
675 – 1,205	Limestone, some Clay, Phosphate	Suwannee	Oligocene
1,205 – 1,500	Limestone, Dolomite	Ocala	Eocene
1,500 – 1,900	Yellowish Gray Limestone, Dolomite	Avon Park	Eocene
1,900 – 3,036	Dolomite, Very Pale Orange Limestone	Oldsmar	Eocene

installation to confirm borehole size and appropriate casing setting depths. Table 4-2 summarizes geophysical logging conducted during the construction of both wells. Appendix L contains copies of each log performed during construction of IW-1 and MW-1.

In general, the geophysical logs correlate to each other, the drill cuttings, cores, and packer tests data very well. Evaluation of the geophysical logs suggests that the interval from land surface to 3,036 feet bpl can be divided into eight zones. Table 4-3 presents a geophysical log interpretation of these eight zones.

A stratigraphic profile of the site was derived from the correlation of formation samples with geophysical logs performed during pilot hole drilling. Strata encountered during construction of the well ranged in age from Holocene to Lower Eocene Age deposits. The Surficial, Intermediate, and Floridan Aquifer Systems were penetrated by both wells. Figure 4-2 presents a geologic and hydrogeologic section of the site and geophysical logs (gamma ray, caliper, and dual-induction) with a completion diagram of IW-1.

Pilot Hole Water Quality

Water samples were collected at approximately 30-foot intervals during reverse air drilling of IW-1 and MW-1 to provide a generalized profile of water quality changes with respect to depth. The samples were analyzed for TDS, chlorides, sulfate, sodium, and conductivity. Closed circulation reverse air drilling techniques were used during pilot hole drilling below a depth of approximately 400 feet bpl in both wells.

In all closed circulation systems, pilot hole water quality reflects a mixture of formation fluids for the entire open hole interval and any fresh water which may have been used to begin reverse air drilling. The mixing of pilot hole water from multiple zones results in muted changes in water quality with depth, and may not necessarily relate to the water quality near the bottom of the borehole.

TABLE 4-2
Fort Myers Beach WWTP Injection Well System
Summary of Geophysical Logging Activities

Logging Event	Date	Well Name	Well Progress and Casing Depth	Type of Log Run1	Purpose
1	January 13, 1998	IW-1	12-1/4 Inch Pilot Hole to 473 feet bpl	C, DI, SP, GR	Evaluate Surficial Aquifer and portion of the Hawthorn Group
2	January 16, 1998	IW-1	40-1/2 Inch Reamed Hole to 405 feet bpl	C, GR	Confirm Reamed Hole Characteristics
3	January 30, 1998	IW-1	12-1/4 Inch Pilot Hole to 1,900 feet bpl	C, GR, DI, S, SP, FC, FT, FM, PFC, PFT, PFM	Evaluate the Lower Portion of the Hawthorn Group, Suwannee, Ocala, and Avon Park Formations
4	February 25, 1998	IW-1	32-1/2 Inch Reamed Hole to 1,805 feet bpl	C, GR	Confirm Reamed Hole Characteristics
5	March 26, 1998	IW-1	12-1/4 Inch Pilot Hole to 3,036 feet bpl	C, GR, DI, S, SP, FC, FT, PFC, PFT	Evaluate the Avon Park and Oldsmar Formations
6	March 30, 1998	IW-1	12-1/4 Inch Pilot Hole to 3,036 feet bpl	TV, FM, PFM	Evaluate the Avon Park and Oldsmar Formations
7	April 28, 1998	IW-1	24-1/2 Inch Reamed Hole to 2,375 feet bpl	C, GR	Confirm Reamed Hole Characteristics
8	April 29-May 1, 1998	IW-1	16-Inch Casing to 2,370 feet bpl	T, GR	Confirm Cement Tops
9	May 6, 1998	IW-1	16-Inch Casing to 2,370 feet bpl	CBL	Evaluate Cement Behind 16-Inch Casing
10	May 12, 1998	IW-1	14-3/4 Inch Reamed Hole to 3,033 feet bpl	C, GR	Evaluate the Open Hole Interval of the Well
11	May 13, 1998	IW-1	14-3/4 Inch Reamed Hole to 3,033 feet bpl	VS, FM, PFM	Evaluate the Open Hole Interval of the Well
12	May 15, 1998	MW-1	12-1/4 Inch Pilot Hole to 410 feet bpl	C, DI, SP, GR	Evaluate Surficial Aquifer and portion of the Hawthorn Group
13	May 17, 1998	MW-1	29 Inch Reamed Hole to 405 feet bpl	C, GR	Confirm Reamed Hole Characteristics
14	May 21, 1998	MW-1	12-1/4 Inch Pilot Hole to 1,193 feet bpl	C, GR, DI, S, SP, FC, FT, FM, PFC, PFT, PFM	Evaluate the Lower Portion of the Hawthorn Group and Suwannee Formation
15	May 23, 1998	MW-1	22-1/2 Inch Reamed Hole to 1,175 feet bpl	C, GR	Confirm Reamed Hole Characteristics
16	May 25, 1998	MW-1	16-Inch Casing to 1,170 feet bpl	T, GR	Confirm Cement Tops

TABLE 4-2
Fort Myers Beach WWTP Injection Well System
Summary of Geophysical Logging Activities

Logging Event	Date	Well Name	Well Progress and Casing Depth	Type of Log Run1	Purpose
17	May 28, 1998	MW-1	12-1/4 Inch Pilot Hole to 1,720 feet bpl	C, GR, DI, S, SP, FC, FT, FM, PFC, PFT, PFM	Evaluate Suwannee, Ocala, and Avon Park Formations
18	June 2, 1998	MW-1	14-3/4 Inch Reamed Hole to 1,718 feet bpl	C, GR	Confirm Reamed Hole Characteristics
19	June 11, 1998	MW-1	6-5/8 Inch Casing to 1,574 feet bpl	C, GR, SB, VS	Evaluate Open Hole Interval and Cement Behind 6-5/8 Inch Casing
20	June 15, 1998	IW-1	Completed Well	T	Evaluate Integrity of the 16-Inch Casing
21	June 16, 1998	IW-1	Completed Well	RTS	Evaluate Cement at the Base of the 16-Inch Casing

1 Legend:
C - Caliper, GR - Natural Gamma Ray, DI - Dual Induction, SP - Spontaneous Potential, FC - Fluid Conductivity, FT - Fluid Temperature, FM - Flowmeter, PFC - Pumping Fluid Conductivity, PFT - Pumping Fluid Temperature, VS - Video Survey, S - Sonic, T - Temperature, CBL - Cement Bond Log, SB - Sector Bond, RTS - radioactive tracer survey
bpl - below pad level

TABLE 4-3
Geophysical Log Interpretation

Interval (feet bpl)	Comments
0 to 1,170	Alternating intervals of confining and transmissive intervals. Transmissive intervals occur in the Surficial, Intermediate, and upper Floridan Aquifer Systems. Confining intervals are located within the Hawthorn Group and portions of the lower Floridan Aquifer System. The dual induction log indicates that water within this interval contains less than 10,000 mg/L of total dissolved solids (TDS) and is, therefore, located within the interval classified as an Underground Source of Drinking Water (USDW).
1,170 to 1,270	Transmissive, containing zones of moderate fluid production. The dual induction log indicates that water within this interval is a USDW.
1,270 to 1,770	Confining, does not contain any major fluid producing zones, with minor fluid production from fractures at 1,530 and 1,575 feet bpl, and a minor producing zone at 1,645 feet bpl. Review of the dual induction log indicates that the transition zone from the USDW to water containing greater than 10,000 mg/L TDS is located between approximately 1,390 and 1,490 feet bpl.
1,770 to 1,840	Transmissive, contains a zone of high fluid production (1,770 to 1,780 feet bpl) and moderate fluid production at 1,840 feet bpl. The dual induction log demonstrates that water within this interval is below the USDW.
1,840 to 2,040	Confining, does not contain major fluid producing zones. The dual induction log demonstrates that water within this interval is below the USDW.
2,040 to 2,195	Highly transmissive, a highly cavernous and fractured zone. This zone is similar to the upper Boulder Zone present at various injection well sites in Southeast Florida. The dual induction log demonstrates that water within this interval is below the USDW.
2,195 to 2,440	Semi-confining, contains non-productive and moderately productive zones; most production is from fractures in the upper half of this interval. The dual induction log demonstrates that water within this interval is below the USDW.
2,440 to 3,036	Highly transmissive, a highly cavernous and fractured zone. This is similar to the Boulder Zone that is used for injection in Southeast Florida. The dual induction log demonstrates that water within this interval is below the USDW.

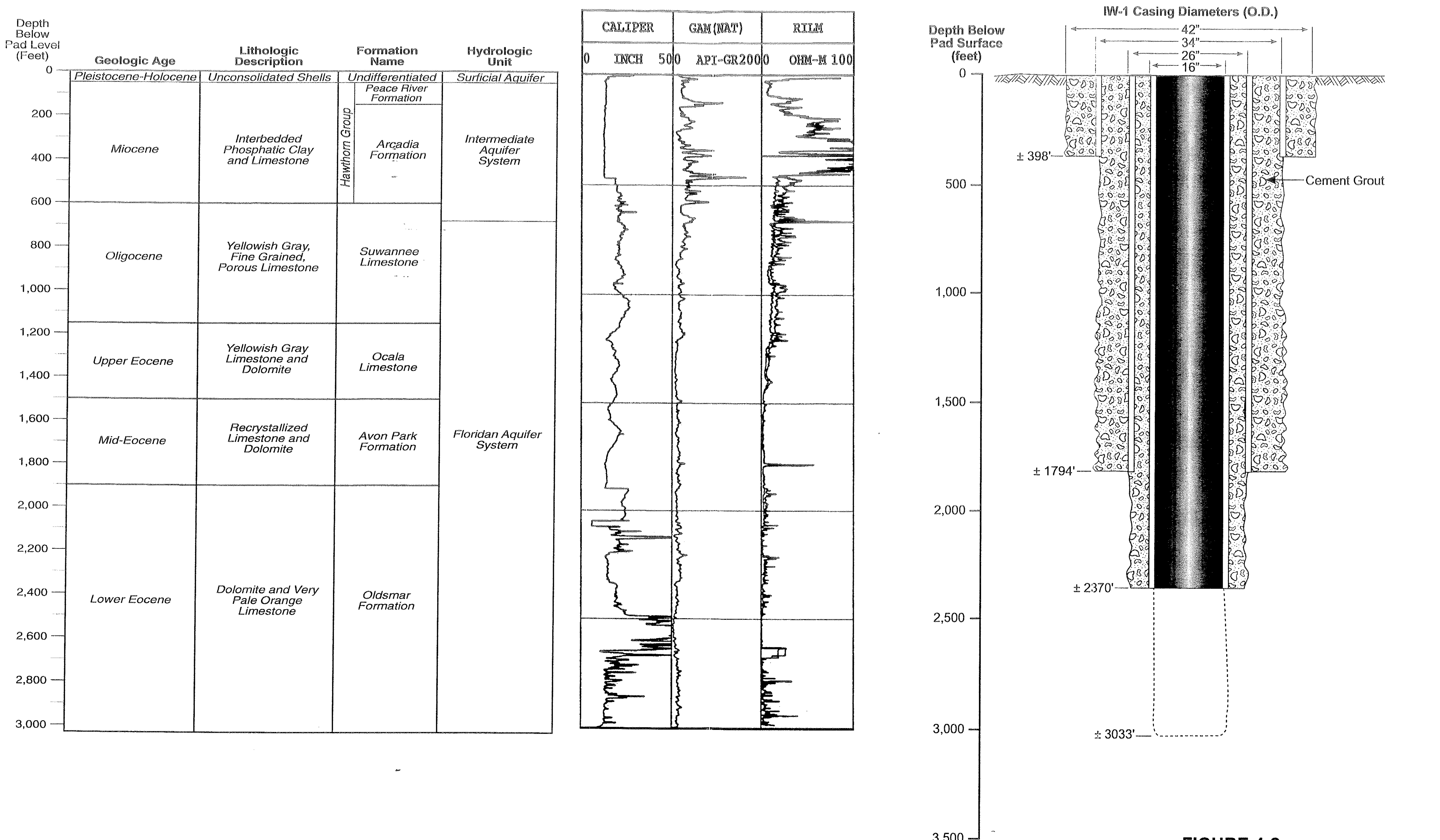


FIGURE 4-2
Generalized Subsurface Data
and Completion Diagram for IW-1

CH2MHILL

Generally, pilot hole water quality data for IW-1 and MW-1 are presented in Tables 4-4 and 4-5, respectively. Because of the mostly fresh make-up water used during the initiation of drilling from the bottom of the intermediate casing of IW-1, pilot hole water samples were not collected.

Once the well was again making water, the make-up water was discontinued, and water samples were collected again. The large increase in salinity noted upon re-collecting the samples can be attributed to the high transmissity of the borehole at depth, allowing large quantities of native water to displace the make-up water and provide a large change in water quality. In fact, the 10,000 mg/L TDS boundary (base of USDW) was noted much closer to land surface through packer testing. The muted water quality changes of the pilot hole samples, however, did not detect this interface. Analytical results from the testing of IW-1 and MW-1 showed an increase in concentration with depth for most parameters with depth.

Air-Lift Specific Capacity Tests

Air-lift specific capacity tests were conducted at approximately 100 to 120-foot intervals from 398 to 2,754 feet bpl and 400 to 1,676 feet bpl at IW-1 and MW-1, respectively, to provide information on the specific capacity of the open hole interval of each well. Each test was conducted for a duration of approximately 15 minutes, during which time water level and flow rate measurements were taken to provide data for specific capacity calculations.

Tables 4-6 and 4-7 summarize the air-lift specific capacity data for IW-1 and MW-1, respectively. Figures 4-3 and 4-4 present the air-lift specific capacity and normalized air-lift specific capacity data with respect to depth for each well. The normalized air-lift specific capacity data were derived by calculating the specific capacity of the given interval divided by length of the test interval. The graphed data (Figures 4-3 and 4-4) allow an evaluation of the productivity of the borehole which is unbiased by the amount of open borehole during testing.

As shown in Table 4-6 and Figure 4-3, an increase in specific capacity occurred between the intervals of 500 to 900 feet bpl, and 1,072 to 1,313 feet bpl in IW-1, suggesting that these intervals are relatively productive. A similar increase in specific capacity occurred in the interval from 1,170 to 1,433 feet bpl in MW-1, as shown in (Table 4-7 and Figure 4-4). Results of air-lift specific capacity testing are greatly influenced by the density and heterogeneity of the fluid in the borehole at the time of testing. Increases in fluid density below 1,313 feet bpl at IW-1 and 1,433 feet bpl at MW-1 alter the test data such that data obtained below these depths cannot directly be compared to the specific capacity data obtained in the less dense waters in the upper sections of the wells.

Coring

While drilling the injection well pilot hole, core samples were collected to correlate with drill cuttings and geophysical logs. Samples were obtained by a 4-inch diameter, 30-foot core barrel. A total of nine cores were collected between 1,444 and 2,524 feet bpl. The cores were first examined and described on site. Selected cores were then shipped to a testing laboratory for a detailed analysis.

TABLE 4-4
Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Pilot Hole Water Quality

Date	Depth (feet bpl)	TDS (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Sodium (mg/L)	Conductivity (µmhos/cm)
1/20/98	430	1,120	155	149	74	2,360
1/20/98	460	1,030	152	153	74	2,140
1/20/98	490	1,430	152	109	73	2,440
1/20/98	520	1,490	152	115	76	2,300
1/20/98	550	1,365	152	116	75	2,100
1/20/98	580	1,435	182	129	76	2,160
1/21/98	610	1,060	175	139	114	1,940
1/21/98	640	1,240	177	136	115	1,940
1/21/98	670	1,010	175	132	109	2,060
1/21/98	700	1,315	172	141	115	2,040
1/21/98	730	936	280	165	164	1,920
1/21/98	760	1,080	327	185	184	1,800
1/21/98	790	1,000	310	175	177	1,870
1/21/98	820	900	301	179	172	1,860
1/21/98	850	1,144	360	232	196	2,300
1/21/98	880	1,154	370	234	197	2,300
1/21/98	910	1,088	415	248	236	2,260
1/21/98	940	1,132	440	262	240	2,260
1/22/98	970	1,008	385	239	202	2,010
1/22/98	1,000	1,000	370	232	199	1,940
1/22/98	1,030	892	355	242	182	1,780
1/22/98	1,060	902	360	225	185	1,800
1/22/98	1,090	1,456	608	248	291	2,440
1/22/98	1,120	1,188	515	229	244	2,100
1/22/98	1,150	1,172	475	230	232	2,080
1/22/98	1,180	1,240	490	238	237	2,120
1/23/98	1,210	1,612	685	258	326	2,610
1/23/98	1,240	1,624	655	254	323	2,480
1/23/98	1,270	1,504	595	230	290	2,360
1/23/98	1,300	1,304	570	217	260	2,140
1/23/98	1,330	1,104	470	189	218	1,800
1/23/98	1,360	1,320	565	196	258	1,940
1/23/98	1,390	1,396	625	219	292	2,300
1/23/98	1,420	1,372	307	201	630	2,320
1/26/98	1,450	1,518	750	249	369	2,670
1/26/98	1,480	1,396	675	284	370	2,440
1/26/98	1,510	2,353	1,115	299	514	3,860
1/26/98	1,540	1,500	715	246	370	2,640
1/27/98	1,570	1,815	800	227	395	2,980
1/27/98	1,600	1,865	1,050	231	450	3,140
1/27/98	1,630	2,207	1,000	289	545	3,680
1/27/98	1,660	2,113	900	299	533	3,580
1/28/98	1,690	1,950	900	280	463	3,340
1/28/98	1,720	1,855	900	270	446	3,140
1/28/98	1,750	2,205	925	314	460	3,300
1/28/98	1,780	2,710	1,175	305	543	3,300
1/28/98	1,810	2,487	925	314	457	3,960
1/28/98	1,840	3,047	1,300	347	612	4,540
1/28/98	1,870	3,520	1,475	390	745	5,060
3/3/98	1,900	N/A	N/A	N/A	N/A	N/A
3/3/98	1,930	N/A	N/A	N/A	N/A	N/A
3/4/98	1,960	N/A	N/A	N/A	N/A	N/A
3/4/98	1,990	17,950	7,148	1,233	3,555	23,600

TABLE 4-4
Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Pilot Hole Water Quality

Date	Depth (feet bpl)	TDS (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Sodium (mg/L)	Conductivity (µmhos/cm)
3/4/98	2,020	19,300	7,898	1,251	3,847	25,200
3/5/98	2,050	21,600	9,797	1,665	5,138	29,900
3/5/98	2,080	23,400	10,697	1,784	5,293	30,700
3/5/98	2,110	26,900	14,396	2,256	7,151	35,900
3/5/98	2,140	31,400	20,994	2,812	10,012	42,500
3/5/98	2,170	31,100	20,544	3,011	9,991	42,300
3/5/98	2,200	32,500	20,494	3,024	10,183	42,500
3/5/98	2,230	32,600	19,844	2,863	9,964	42,300
3/5/98	2,360	32,700	19,744	2,947	9,798	42,500
3/6/98	2,290	31,400	19,194	2,892	9,475	41,500
3/6/98	2,320	33,400	19,444	2,832	9,465	41,900
3/6/98	2,350	34,200	19,484	2,861	9,546	42,100
3/6/98	2,380	32,350	18,394	2,877	9,493	42,100
3/10/98	2,410	32,900	18,794	2,583	9,431	41,700
3/10/98	2,440	34,000	20,194	2,824	10,161	43,100
3/10/98	2,470	34,400	20,344	2,851	10,499	43,600
3/10/98	2,500	34,900	22,293	2,902	10,311	44,300
3/11/98	2,540	35,100	20,794	3,001	10,549	44,500
3/11/98	2,570	35,155	21,343	2,799	10,506	44,500
3/11/98	2,600	35,760	22,843	3,071	10,484	44,700
3/11/98	2,630	35,550	21,793	3,024	10,272	45,000
3/11/98	2,660	34,500	20,244	2,807	9,932	41,400
3/11/98	2,690	33,800	20,494	2,791	9,985	41,700
3/11/98	2,720	36,000	20,494	2,785	9,889	42,200
3/12/98	2,750	N/A	N/A	N/A	N/A	N/A
3/12/98	2,780	N/A	N/A	N/A	N/A	N/A
3/12/98	2,810	N/A	N/A	N/A	N/A	N/A
3/13/98	2,840	N/A	N/A	N/A	N/A	N/A
3/13/98	2,870	36,100	20,744	2,922	10,662	44,000
3/16/98	2,900	35,200	21,493	2,850	10,746	42,800
3/17/98	2,930	35,700	21,743	2,825	11,093	42,500
3/17/98	2,960	36,000	20,993	2,880	10,616	43,400
3/17/98	2,990	35,900	20,744	2,872	10,673	43,600
3/18/98	3,020	37,200	21,943	2,916	11,708	43,500

feet bpl = feet below pad level
mg/L = milligrams per liter
µmhos/cm = micromhos per centimeter

TABLE 4-5
Fort Myers Beach Wastewater Treatment Plant
Monitoring Well MW-1
Pilot Hole Water Quality

Date	Depth (feet bpl)	TDS (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Sodium (mg/L)	Conductivity (µmhos/cm)
5/20/98	430	1,096	487	117	247	1,841
5/20/98	460	1,044	475	120	240	2,910
5/20/98	490	1,028	460	117	235	1,960
5/20/98	520	1,016	460	126	240	1,936
5/20/98	550	1,028	455	113	229	1,580
5/20/98	580	1,000	445	135	229	1,599
5/20/98	610	1,096	455	119	236	1,921
5/20/98	660	1,092	465	90	245	1,976
5/20/98	690	952	440	124	216	1,434
5/20/98	720	1,052	445	131	233	1,540
5/20/98	750	1,292	550	179	286	2,470
5/20/98	780	1,232	570	159	287	1,170
5/20/98	810	1,100	530	154	276	1,714
5/20/98	840	948	445	118	239	1,396
5/20/98	870	1,352	640	165	360	1,990
5/21/98	900	1,412	587	157	322	2,040
5/21/98	930	1,710	850	226	457	3,310
5/21/98	990	1,630	1,162	295	598	3,150
5/21/98	1,080	1,933	1,019	279	525	2,860
5/21/98	1,110	1,880	1,075	266	548	3,040
5/21/98	1,140	2,313	1,125	263	566	4,430
5/21/98	1,190	2,220	1,075	253	553	4,240
5/26/98	1,220	4,560	1,350	304	794	9,070
5/26/98	1,250	6,340	1,415	289	796	9,330
5/26/98	1,280	5,560	1,330	294	764	8,470
5/26/98	1,310	5,800	1,450	311	799	8,540
5/26/98	1,340	5,880	1,700	296	833	8,920
5/26/98	1,370	5,860	1,500	302	829	8,870
5/26/98	1,400	5,760	1,550	317	830	8,920
5/26/98	1,430	5,440	1,375	314	829	8,830

TABLE 4-5
Fort Myers Beach Wastewater Treatment Plant
Monitoring Well MW-1
Pilot Hole Water Quality

Date	Depth (feet bpl)	TDS (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Sodium (mg/L)	Conductivity (µmhos/cm)
5/26/98	1,460	4,620	1,475	287	816	8,760
5/26/98	1,490	5,220	1,475	328	809	8,790
5/26/98	1,520	4,620	1,450	291	812	8,650
5/26/98	1,550	4,680	1,425	297	818	8,680
5/27/98	1,580	4,180	1,824	329	896	7,560
5/27/98	1,610	4,000	2,024	375	987	7,470
5/27/98	1,640	4,800	2,124	381	994	8,250
5/27/98	1,670	5,260	2,299	373	1,070	8,180
5/27/98	1,700	5,240	2,374	475	1,214	8,270

feet bpl = feet below pad level
mg/L = milligrams per liter
µmhos/cm = micromhos per centimeter

TABLE 4-6
Fort Myers Beach WWTP
Injection Well IW-1
Air-Lift Specific Capacity Tests Results

Test #	Test Interval (ft. bpl)	Pumping Rate (gpm)	Drawdown (feet)	Specific Capacity (gpm/ft)
1/20/98	398-500	300	162	1.9
1/20/98	398-600	450	150	3.0
1/21/98	398-700	635	96.5	6.6
1/21/98	398-800	680	79	8.6
1/22/98	398-900	585	37.75	15.5
1/22/98	398-1072	585	37.75	15.5
1/22/98	398-1192	578	25	23.1
1/23/98	398-1313	680	22	30.9
1/23/98	398-1434	673	26.9	25.0
1/26/98	398-1554	689	25.5	27.0
1/27/98	398-1669	748	30.2	24.8
1/28/98	398-1793	623	23	27.1
1/28/98	398-1900	478	18.8	25.4
3/4/98	1794-2020	50	14.7	3.4
3/5/98	1794-2153	725	2.2	329.5
3/5/98	1794-2273	750	1.4	535.7
3/6/98	1794-2380	825	0	Very Large
3/11/98	1794-2633	825	0	Very Large
3/12/98	1794-2754	850	0	Very Large

ft. bpl = feet below pad level
gpm = gallons per minute
gpm/ft = gallons per minute per foot

TABLE 4-7
Fort Myers Beach WWTP
Monitoring Well MW-1
Air-Lift Specific Capacity Tests Results

Test #	Test Interval (ft. bpl)	Pumping Rate (gpm)	Drawdown (feet)	Specific Capacity (gpm/ft)
5/21/98	400-1060	500	18.8	26.60
5/21/98	400-1193	828	17.4	47.59
5/26/98	1170-1330	411	2.9	141.72
5/26/98	1170-1433	1100	2.3	478.26
5/26/98	1170-1533	650	89	7.30
5/26/98	1170-1676	470	104	4.52

ft. bpl = feet below pad level
ft. bpl = feet below pad level
gpm = gallons per minute
gpm/ft = gallons per minute per foot

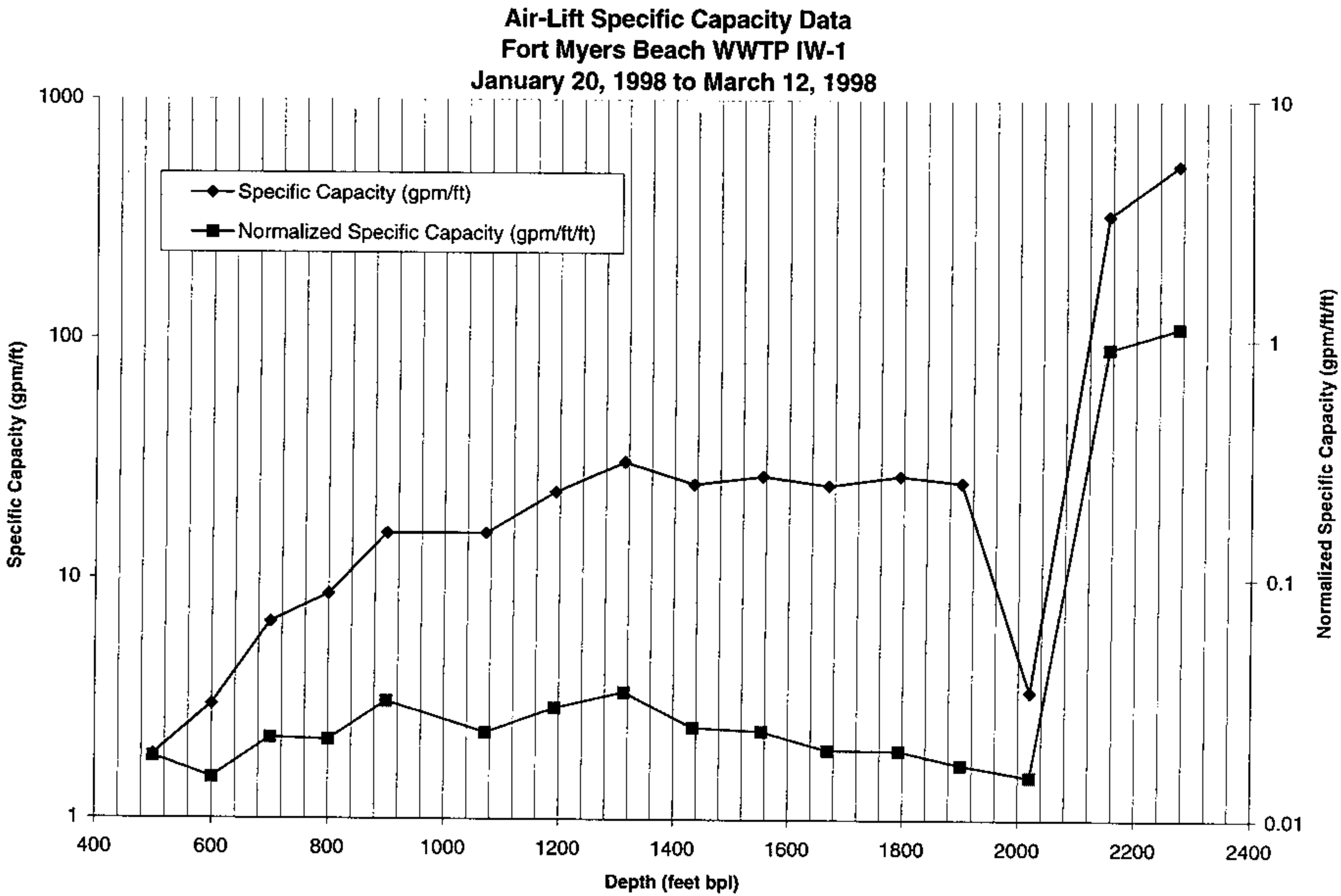


Figure 4-3
IW-1 Air-Lift Specific Capacity Data

P:water\136794\report\charts\air-lift

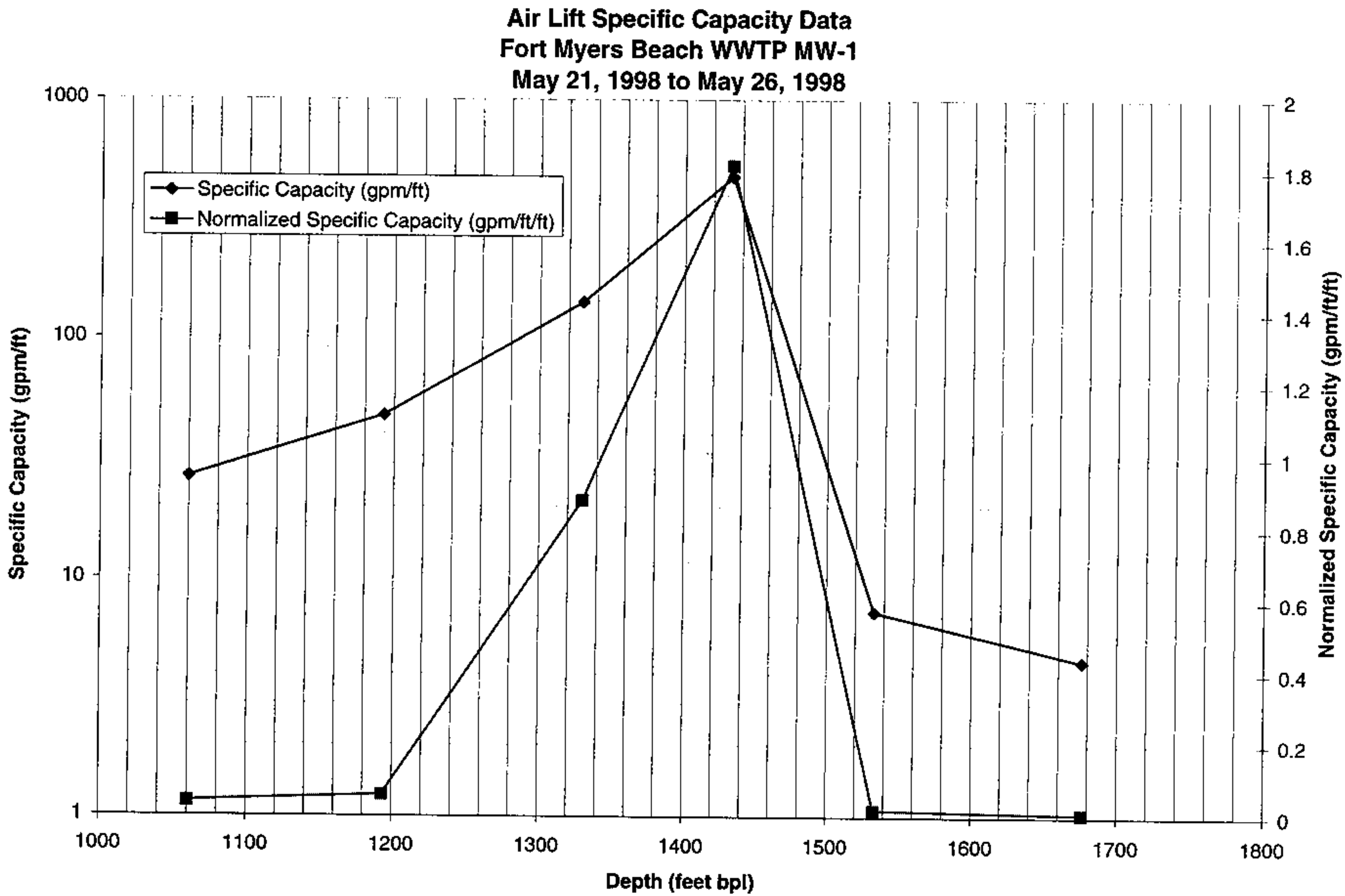


Figure 4-4
MW-1 Air-Lift Specific Capacity Data

P:\water\136794\report\charts\air-lift_MW1

The testing laboratory (Ardaman & Associates, Inc.) analyzed the selected cores for vertical and horizontal permeability and total and effective porosity. Table 4-8 presents results of laboratory analyses and a generalized description of each core. Appendix H contains detailed description of the cores and laboratory methods used for hydraulic conductivity and porosity determinations, along with the laboratory results. Results of hydraulic conductivity laboratory analyses demonstrate varying degrees of confining characteristics throughout the intervals tested, with vertical hydraulic conductivities as low as 1.0×10^{10} cm/sec.

Packer Tests

Eight straddle packer tests and two single packer tests were conducted in intervals between 1,220 and 3,000 feet bpl to determine water quality and hydraulic characteristics of the test intervals. Large diameter borehole conditions, due to washouts in many portions of the open hole, (see the caliper logs), were a limiting factor in the selection of intervals suitable for straddle packer testing.

Each packer test consisted of pumping the test interval at a predetermined rate and recording water level drawdown over time. Preliminary pumping tests were conducted to determine the optimal pumping rate for each interval.

Figures 4-7 through 4-16 present packer test recovery water level data and calculated transmissivity and hydraulic conductivity for each packer test.

Data from the pumping portion of each packer test were used to determine the specific capacity of the test interval. Water level recovery measurements were taken immediately following the pumping to provide data for transmissivity and hydraulic conductivity. Water levels during the packer tests and recovery periods were measured using a submersible pressure transducer and were recorded by an *Insitu* Hermit 2000 series data logger. Water samples were collected throughout the pumping portion of the tests and analyzed for conductivity and chlorides to demonstrate that water quality had stabilized before collecting a final water sample for laboratory analysis. Final water samples were collected at the end of pumping to evaluate water quality within the test interval to help identify the base of the USDW.

Table 4-9 summarizes water quality data for packer tests conducted between 1,220 and 3,036 feet bpl. Water quality data from the straddle packer tests demonstrate that the base of the USDW is located within the interval from 1,400 to 1,515 feet bpl. Below this interval, water quality degrades quickly to TDS concentrations of greater than 30,000 mg/L. The water quality data obtained from the packer test closely correlates to the geophysical log interpretations.

Table 4-10 summarizes packer tests flow rates, drawdown, calculated specific capacity, transmissivity, and hydraulic conductivity. Figures 4-5 and 4-6 present graphs showing specific capacity with depth for the intervals from 1,000 to 2,400 feet bpl and 1,000 to 2,200 feet bpl, respectively. Figure 4-5 is presented to demonstrate the relatively high specific capacity of the interval between the upper and lower Boulder Zones, suggesting that these two zones may be hydraulically connected. Figure 4-6 supports the relatively high specific capacity of intervals below 1,830 feet bpl, in contrast to the very low specific capacity (confining) of intervals above 1,830 feet bpl.

TABLE 4-8
Fort Myers Beach WWTP
Injection Well IW-1
Core Summary

Cored Interval (ft. bpl)	Generalized Description	Sample Depth (ft. bpl)	Vertical Hydraulic Conductivity (cm/sec)	Horizontal Hydraulic Conductivity (cm/sec)	Total Porosity (%)
1444 to 1458	Limestone, fine grained, low porosity, well consolidated	1449.7-1450.2 1453.5-1454.0	1.0×10^{-5} 1.2×10^{-5}	1.3×10^{-5} 1.2×10^{-5}	39 38
1554 to 1569	Limestone, very fine to gravel grained, very low to high porosity, moderately to well consolidated	1555.2-1555.6 1557.0-1557.4	1.0×10^{-7} 1.6×10^{-8}	5.3×10^{-6}	38
1669 to 1684	Limestone, fine to medium sand grained, low to moderate porosity, well consolidated	1674.1-1674.5	2.8×10^{-5}	1.6×10^{-5}	35
1930 to 1942	Limestone, fine to medium sand grained, low porosity, well consolidated	1930.1-1930.6	4.5×10^{-5}	1.3×10^{-5}	26
1965 to 1984	Interbedded limestone and dolomite, fine to medium sand grained, low to very high porosity, vuggy, well consolidated	1965.0-1965.8 1972.3-1972.8	3.6×10^{-4} 7.0×10^{-6}	4.9×10^{-4} 6.8×10^{-6}	30 29
2045 to 2062	Dolomite, very fine grained, high to low porosity, vuggy, well consolidated	2050.7 - 2051.0	1.0×10^{-10}		3
2280 to 2297	Interbedded dolomitic limestone and dolomite, very fine sand grained, low porosity, some small vugs, well consolidated	2280.0-2280.3 2287.0-2287.5	1.6×10^{-7} 2.8×10^{-8}	1.0×10^{-7} 1.4×10^{-9}	14 7
2380 to 2408	Interbedded limestone and dolomitic limestone, very fine to medium sand grained, low porosity, some small vugs, well consolidated	2381.0-2381.4 2385.2-2386.0	3.7×10^{-6} 9.4×10^{-7}	3.5×10^{-6} 9.5×10^{-7}	16 20
2514 to 2524	Limestone, fine to medium sand grained, low porosity, well consolidated	2514.3-2514.8 2517.8-2518.5	3.0×10^{-4} 4.4×10^{-4}	4.2×10^{-4} 5.2×10^{-4}	34 34

ft. bpl = feet below pad level

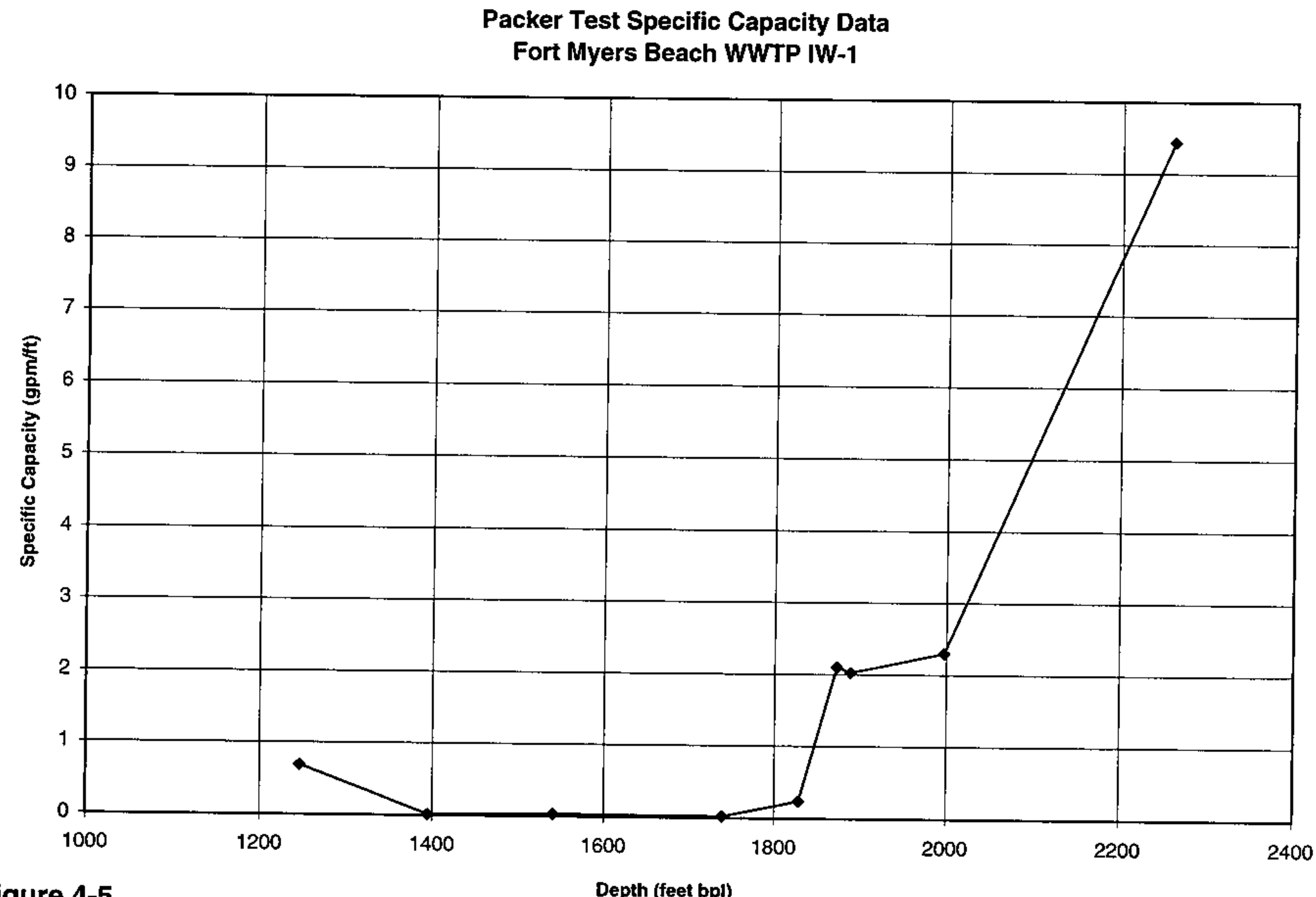


Figure 4-5

Packer Test Specific Capacity Data Between 1,000 and 2,400 feet bpl

Note: Indicated depth is the middle of the test interval.

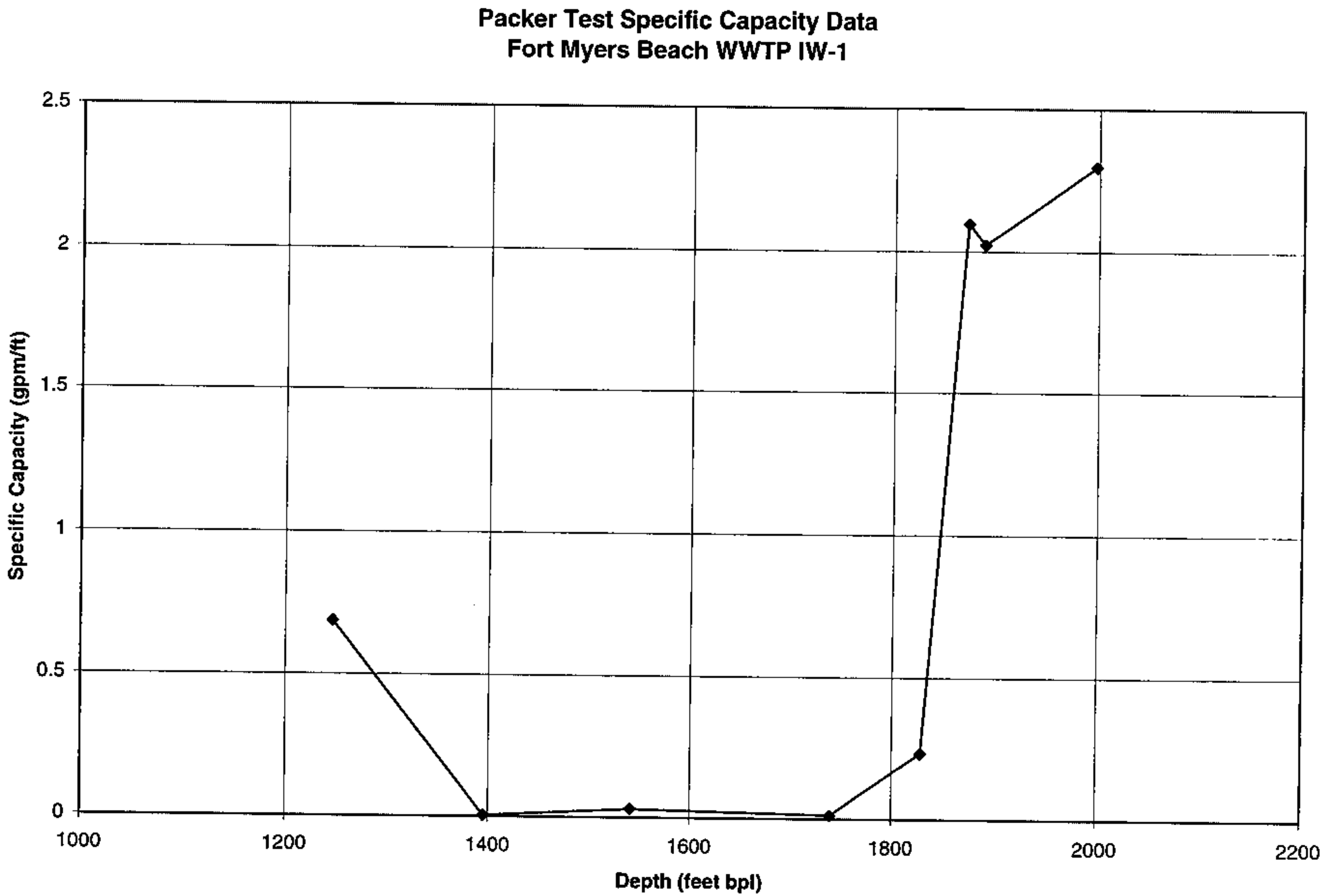


Figure 4-6

Packer Test Specific Capacity Data Between 1,000 and 2,200 feet bpl

Note: Indicated depth is the middle of the test interval.

P:water\136794\report\charts\fig4-6

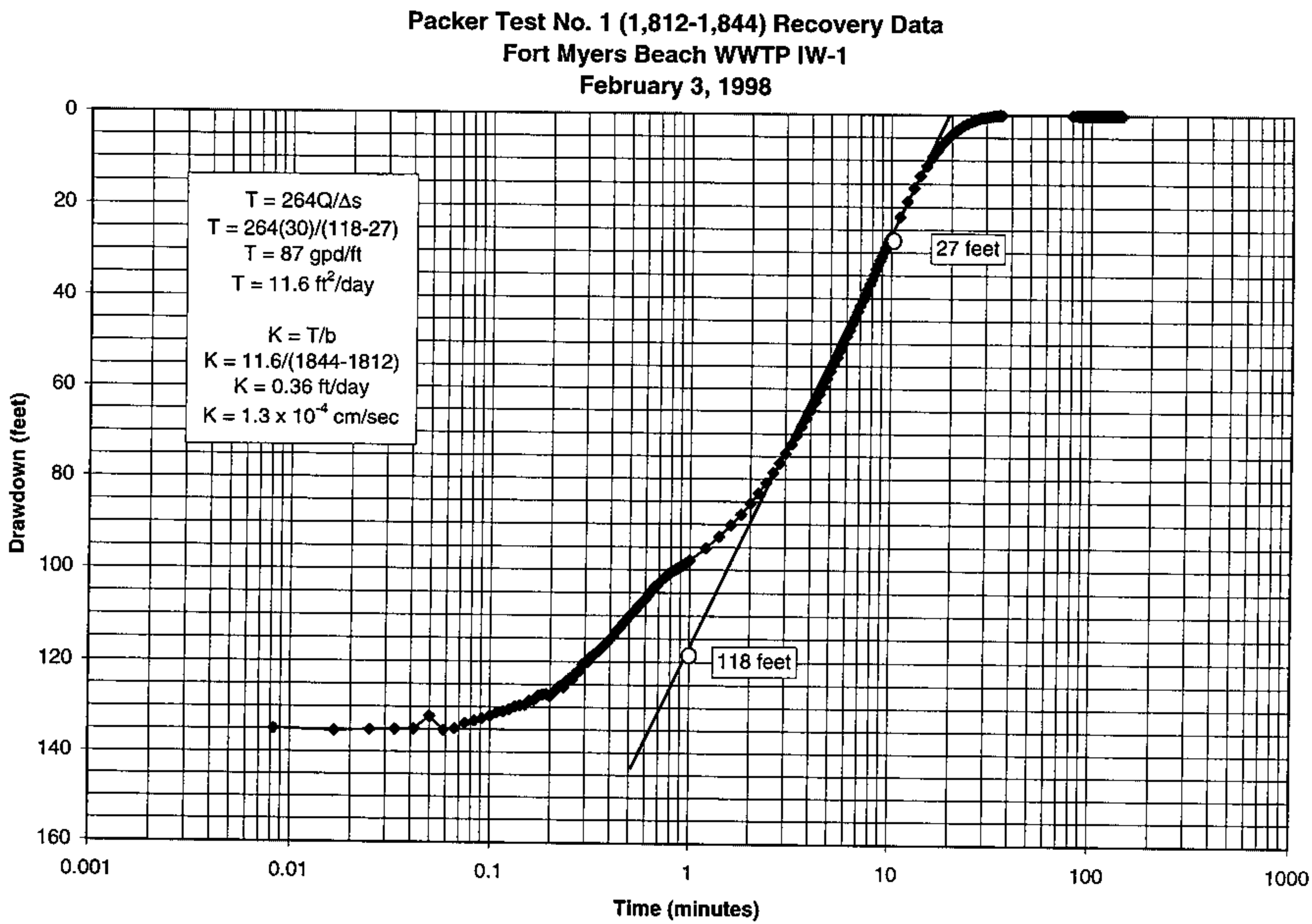


Figure 4-7
Packer Test No. 1 (1,812-1,844 feet bpl) Recovery Data

P:water\136794\report\charts\packer1_1812-1844

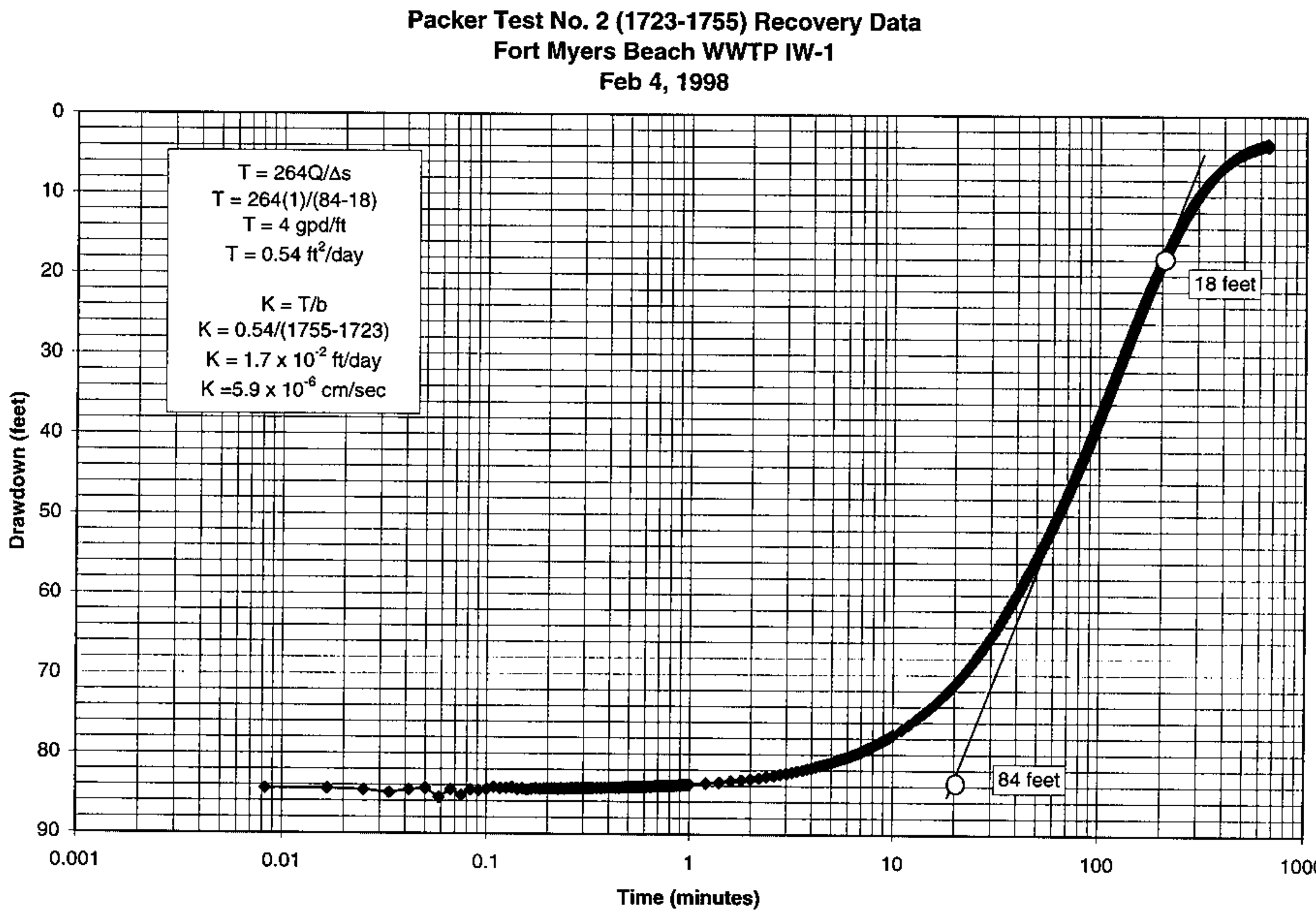


Figure 4-8
Packer Test No. 2 (1,723-1,755 feet bpl) Recovery Data

P:water\136794\report\charts\packer2_1723-1755

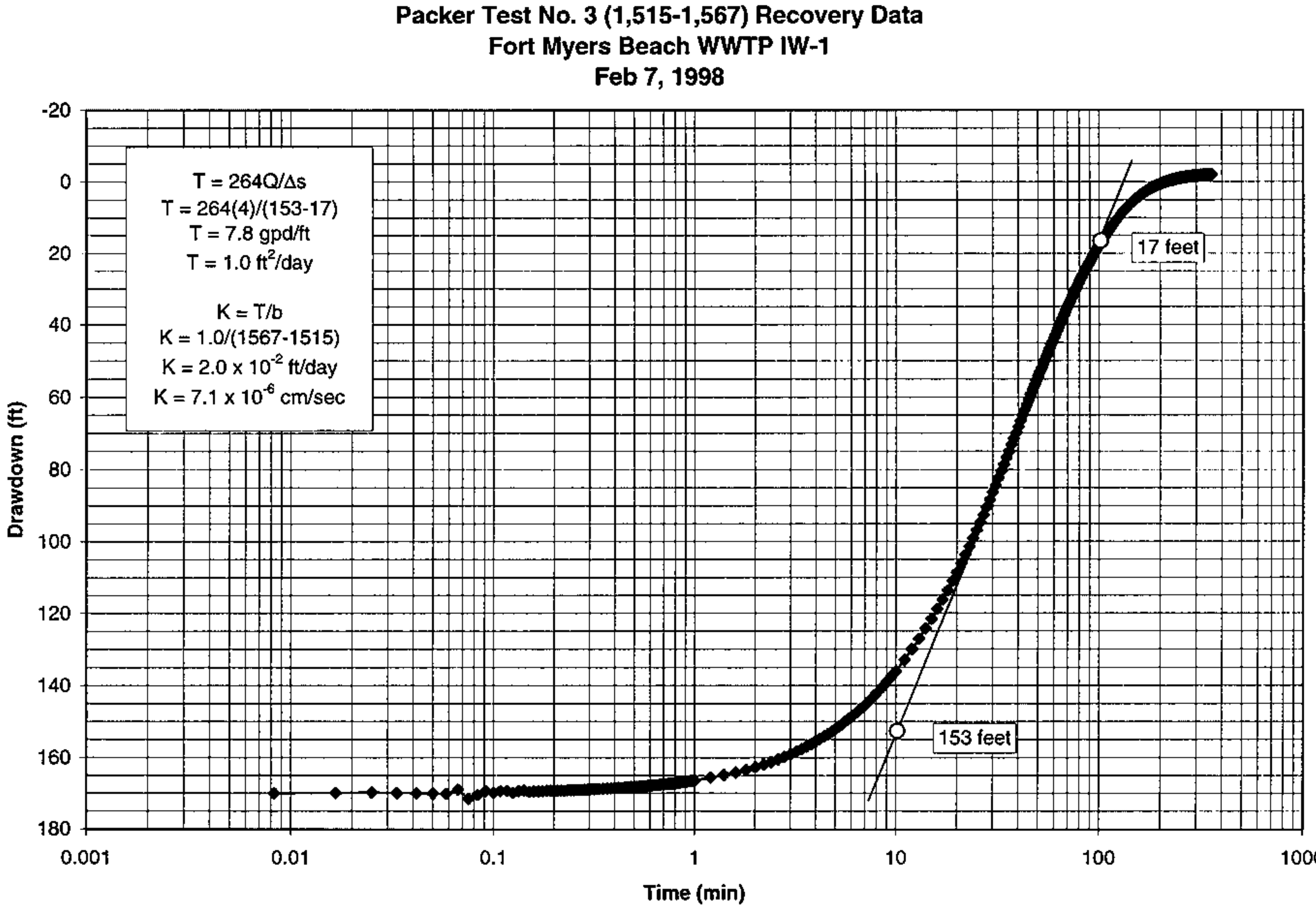


Figure 4-9
Packer Test No. 3 (1,515-1,567 feet bpl) Recovery Data

P:water\136794\report\charts\packer3_1515-1567

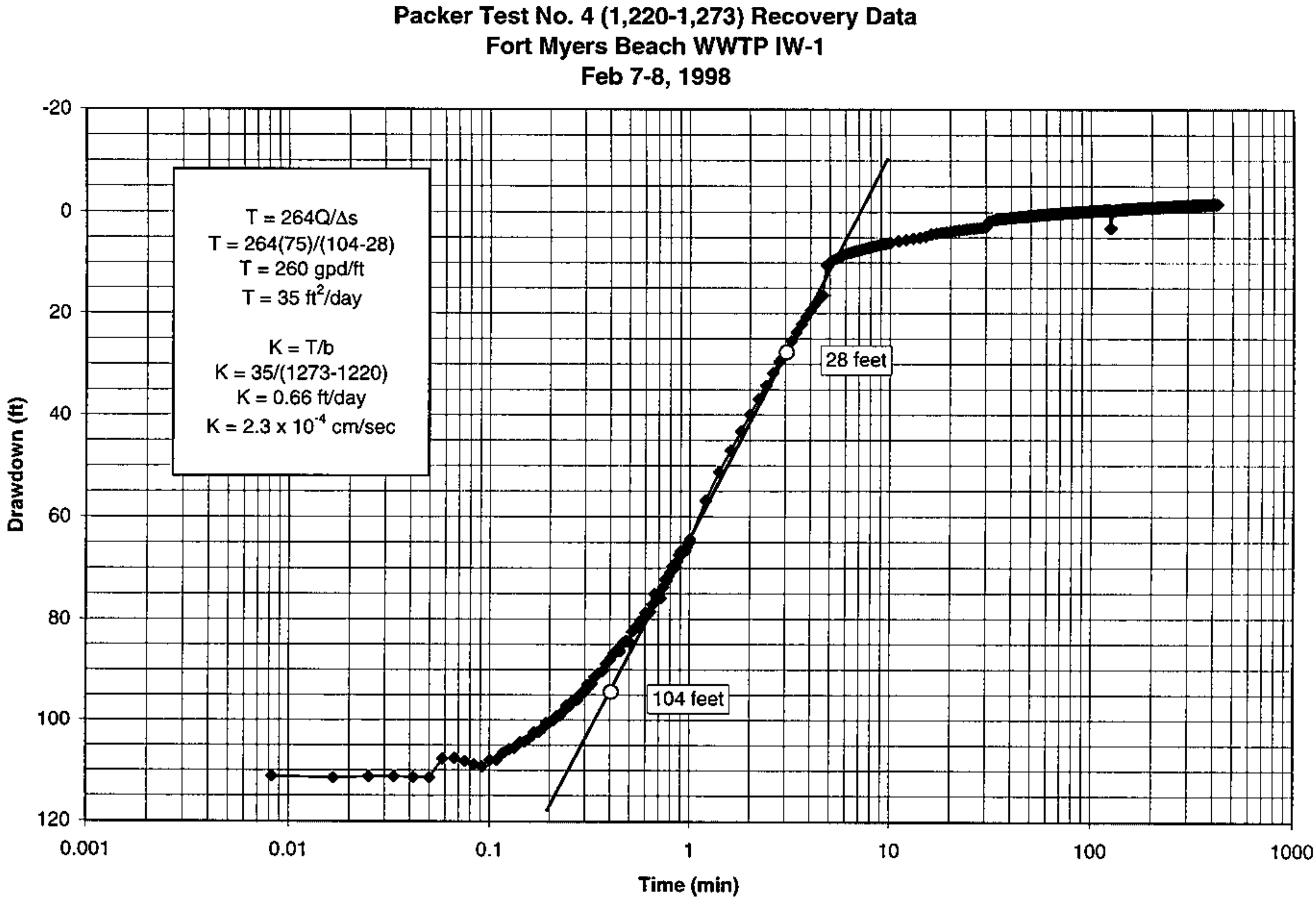


Figure 4-10
Packer Test No. 4 (1,220-1,273 feet bpl) Recovery Data

P:water\136794\report\charts\packer4_1220-1273

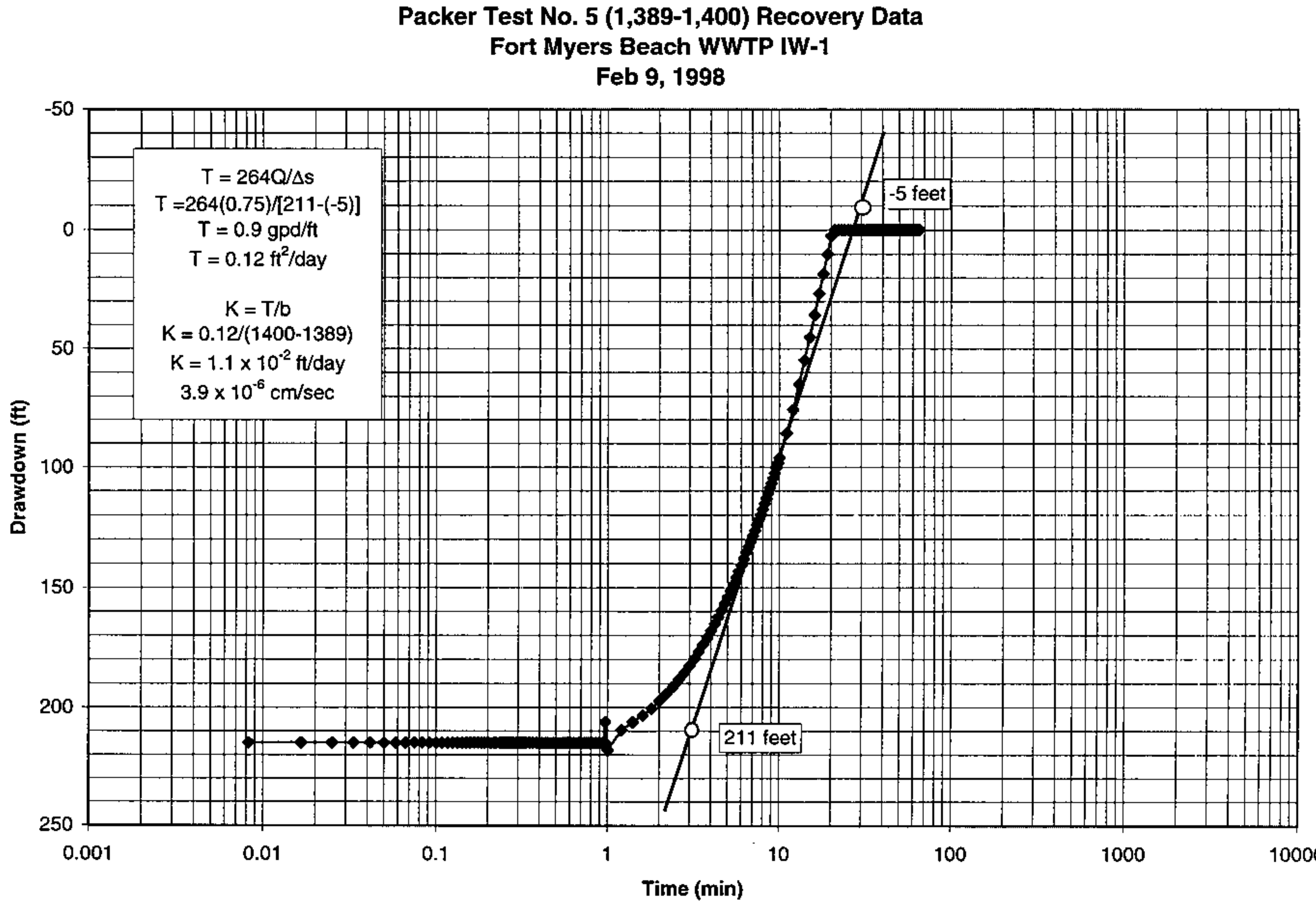


Figure 4-11
Packer Test No. 5 (1,389-1,400 feet bpl) Recovery Data

P:water\136794\report\charts\packer5_1389-1400

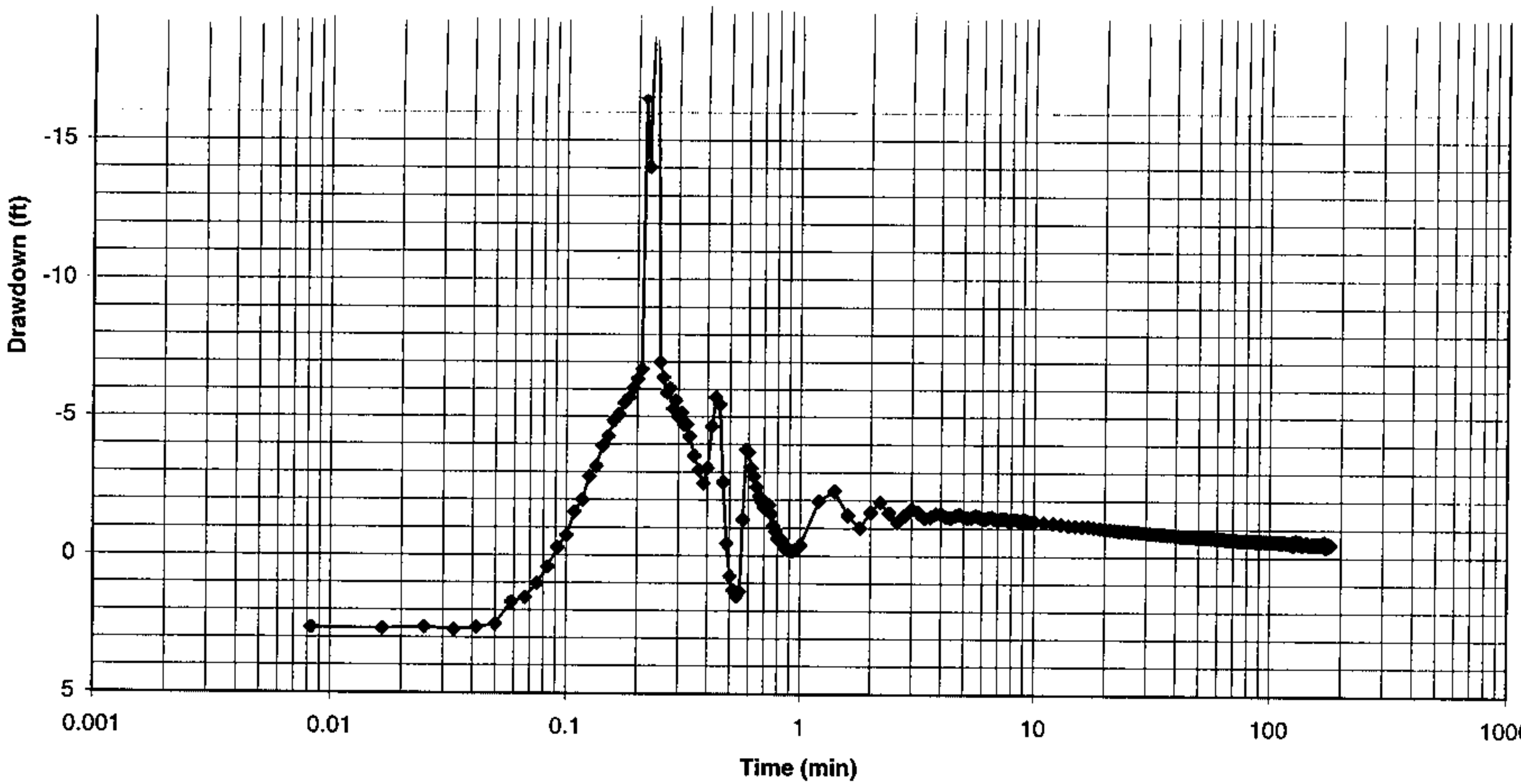


Figure 4-13
Packer Test No. 7 (2,319-3,000 feet bpl) Recovery Data

P:water\136794\report\charts\packer7_2319-3000

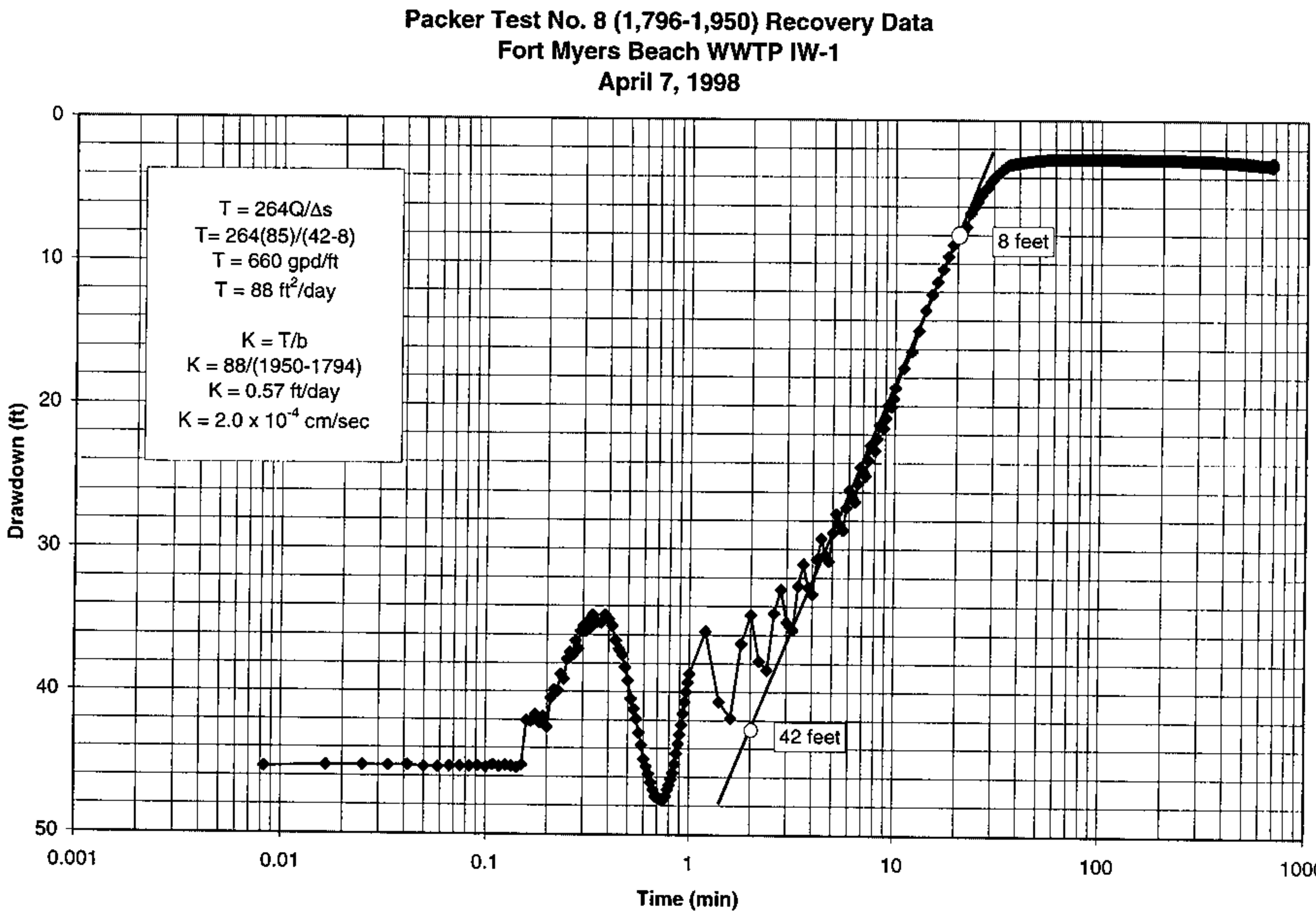


Figure 4-14
Packer Test No. 8 (1,796-1,950 feet bpl) Recovery Data

P:water\136794\report\charts\packer8_1796-1950

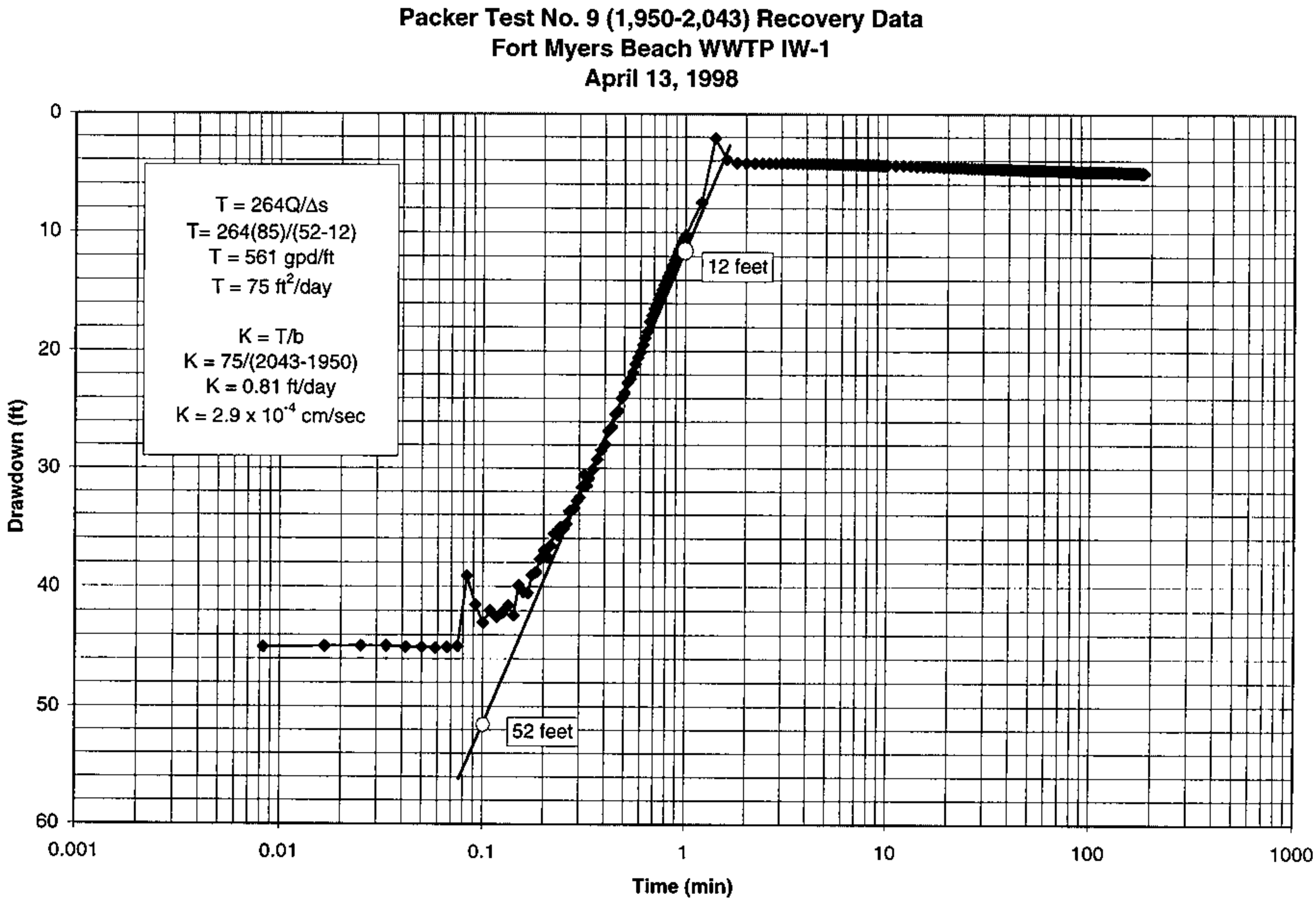


Figure 4-15
Packer Test No. 9 (1,950-2,043 feet bpl) Recovery Data

P:water\136794\report\charts\packer9_1950-2043

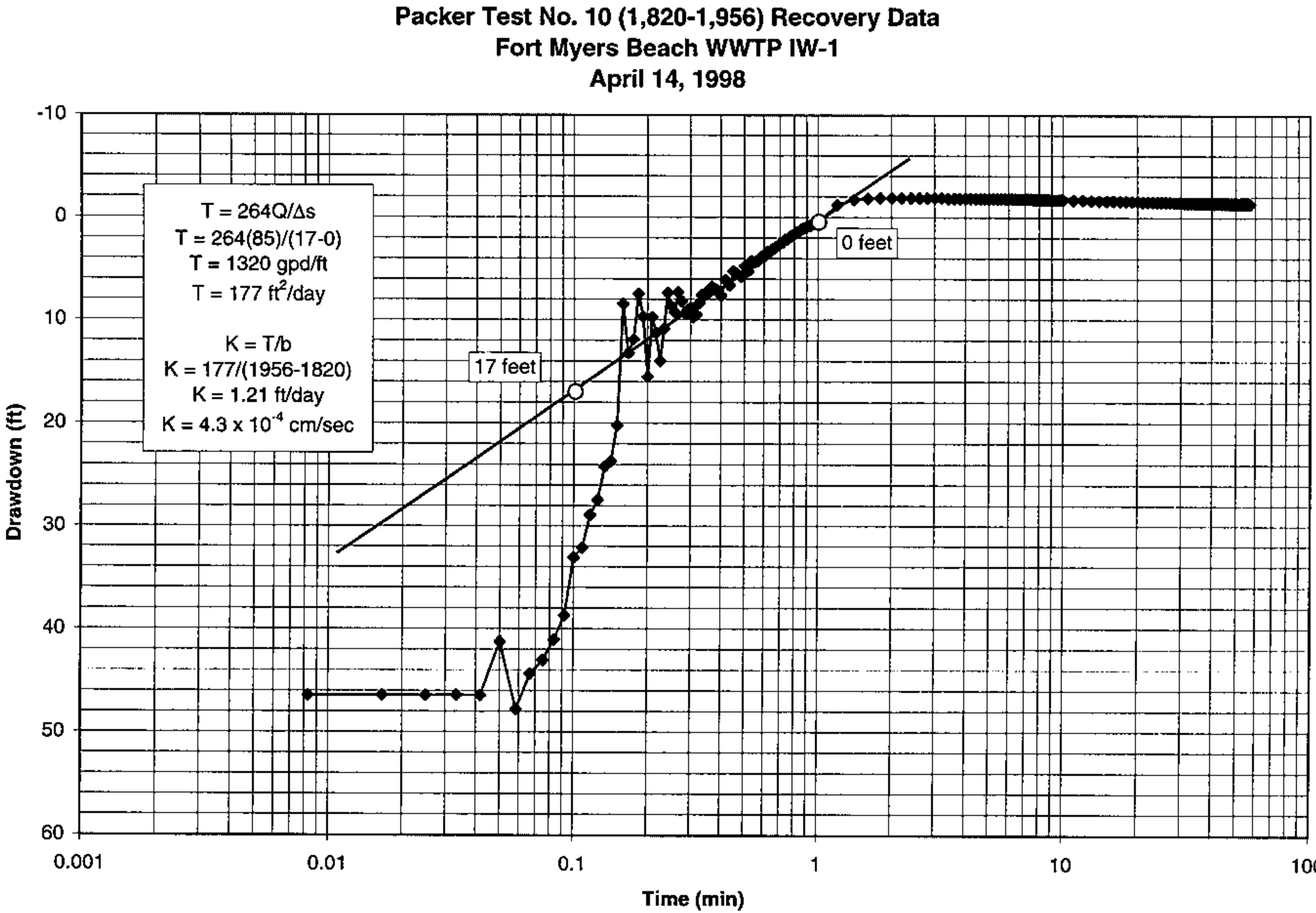


Figure 4-16
Packer Test No. 10 (1,820-1,956 feet bpl) Recovery Data

P:water\136794\report\charts\packer10_1820-1956

Table 4-9

Fort Myers Beach WWTP

Injection Well IW-1

Packer Tests Water Quality Summary

	Parameter							
Test Interval (ft. bpl)	Conductivity (µmhos/cm)	TDS (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Magnesium (mg/L)	pH (S.U.)
1,220 to 1,273	6,670	5,000	2,294	443	14.9	1,079	152	7.89
1,389 to 1,400	9,000	6,675	3,400	348	47.4	1,395	234	7.15
1,515 to 1,567	44,600	31,900	16,394	1,371	221	7,745	826	7.35
1,723 to 1,755*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,812 to 1,844	69,200	41,600	19,494	2,994	301	10,205	897	7.31
1,796 to 1,950	3,800	30,000	16,495	2,390	248	8,517	641	7.51
1,820 to 1,956	40,150	33,650	18,494	2,452	255	10,076	674	7.50
1,950 to 2,043	40,400	33,600	22,493	2,483	266	10,282	709	7.28
2,219 to 2,300	44,900	37,400	24,492	2,870	257	11,602	824	7.15
2,319 to 3,036	45,200	37,200	20,494	2,899	270	11,896	903	7.21

ft. bpl = feet below pad level

µmhos/cm = micromhos per centimeter

mg/L = milligrams per liter

µmhos/cm = micromhos per centimeter

N/A = not available

*The interval from 1,723 to 1,755 was not sampled due to the low pumping rate (1 gpm) and the long period of time necessary to purge the drill stem and collect a representative background sample.

TABLE 4-10
Fort Myers Beach WWTP
Injection Well IW-1
Packer Tests Data

Test #	Test Interval (ft. bpl)	Pumping Rate (gpm)	Drawdown (feet)	Specific Capacity (gpm/ft)	Transmissivity (gpd/ft)	Hydraulic Conductivity (ft/day)
1	1,812 - 1,844	30	129	0.23	87	0.36
2	1,723 - 1,755	1	84	0.01	4.0	0.017
3	1,515 - 1,567	5	170	0.03	7.8	0.02
4	1,220 - 1,273	75	109	0.69	260	0.66
5	1,389 - 1,400	0.75	200	0.004	0.9	0.01
6	2,219 - 2,300	100	10.6	9.43	ND	ND
7	2,319 - 3,000	100	0.3	333.33	ND	ND
8	1,794 - 1,950	85	40.5	2.10	660	0.57
9	1,950 - 2,043	85	37	2.30	561	0.81
10	1,820 - 1,956	85	42	2.02	1320	1.21

ft. bpl = feet below pad level
gpm = gallons per minute
gpm/ft = gallons per minute per foot
gpd/ft = gallons per day per foot
ft/day = feet per day

ND = Not Determined

Injection Test

An injection test was conducted at IW-1 on July 15, 1998 to evaluate the hydraulic characteristics of the injection well and verify the integrity of the confining units between the injection zone and the monitoring intervals of MW-1. Flow rate was measured using a 16-inch Water Specialties flowmeter throughout the 12-hour test. Injection pressure at IW-1 and water level in both of the monitoring zones of MW-1 were monitored and recorded for the 5-day background period, 12-hour test, and 12-hour recovery period using an *Insitu* Hermit 2000 data recorder. In addition to the injection and onsite monitoring well, the water level in USGS Well No. L-2529 (constructed to a total depth of 545 feet bpl and located approximately 0.5 miles from the site) was also monitored. An *Insitu* Hermit 1000 data logger was installed at the wellhead for approximately a day and a half before the start of the test, through the injection test, and for the 12-hour recovery period.

The injection test was conducted at a flow rate between 5,350 and 5,500 gallons per minute (gpm) using reclaimed water from the WWTP. Figures 4-17 through 4-19 present the injection well wellhead pressure, compared with water levels of both zones of MW-1, and ambient barometric pressure. Figures 4-20 through 4-22 present the wellhead pressure of IW-1, compared with both zones of the monitoring well MW-1, and tidal water elevations for Matanzas Pass, located approximately 2 miles to the south of the injection well site.

Wellhead pressure at IW-1 was approximately 26 pounds per square inch (psi) before the test, and ranged from approximately 43 to 46 psi (because of the minor fluctuations in flow rate) during the injection test. Wellhead pressure returned to approximately 26 psi almost immediately following injection. The approximate 20 psi increase in wellhead pressure is primarily a result of pipe friction losses within the well casing. Considering pipe friction losses for a 15-inch inside diameter new steel pipe at a flow rate of 5,500 gpm, the net adjusted wellhead pressure increase within the formation is approximately 3 psi. This 3 psi results in a calculated specific capacity of approximately 800 gpm/foot.

Water level changes in both monitoring zones of MW-1 related to barometric and tidal effects are evident throughout the monitoring period. There is no apparent correlation of pressure changes related to injection testing, however, in either zone of the monitoring well.

Figure 4-23 presents water levels for USGS Well No. L-2529 from approximately 39 hours before the start of the injection test through the 12-hour recovery period. No correlation of water level changes in the monitoring well related to injection testing at Well No. L-2529 was noted.

Background Water Quality Sampling

IW-1 was sampled for background water quality on May 12, 1998, after fully developing the well to establish true background conditions. Appendix I contains complete analytical results for the water quality background samples obtained from IW-1 and both monitoring zones of MW-1. The water sample was analyzed for primary and secondary drinking water standards and FDEP's minimum criteria. The background sample had a TDS concentration of 29,200 mg/L, further demonstrating that the injection zone is located below the base of the USDW.

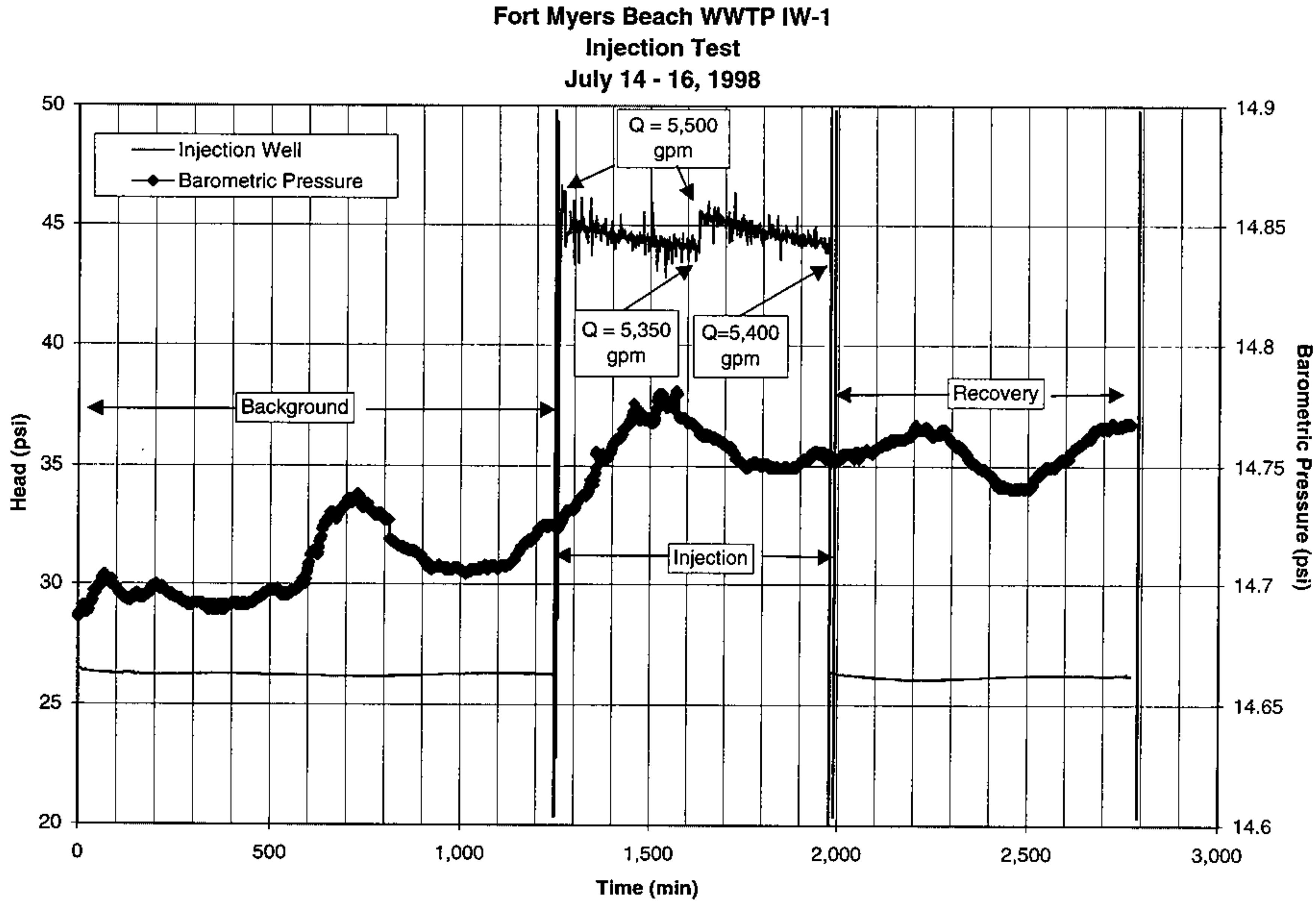


Figure 4-17
Injection Well IW-1 Wellhead Pressure and Barometric Pressure

P:water\136794\report\charts\injection_test1_up\fig1

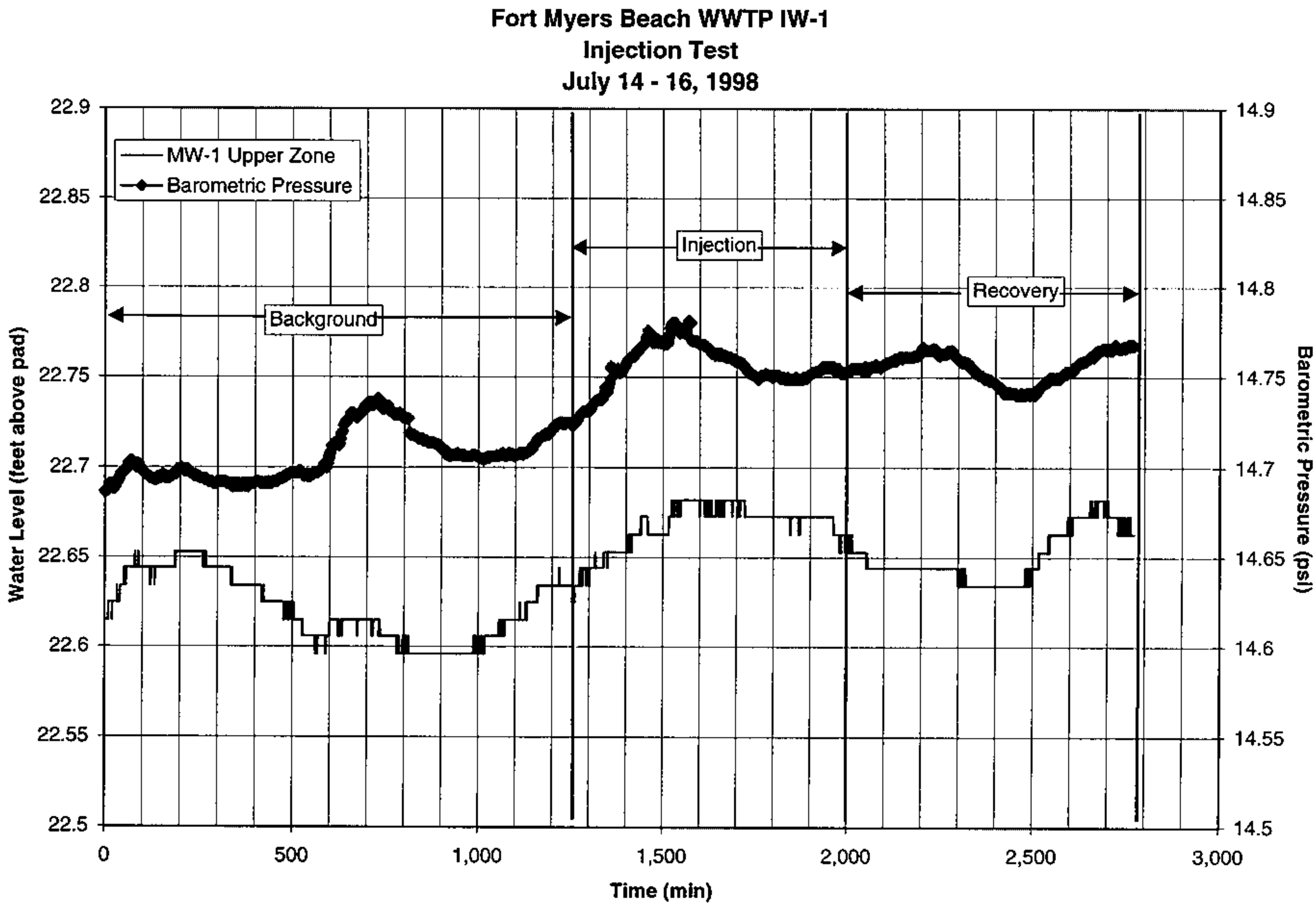


Figure 4-18
Monitor Well MW-1 Upper Monitor Zone Water Level and Barometric Pressure

P:water\136794\report\charts\injection_test1_up\fig2

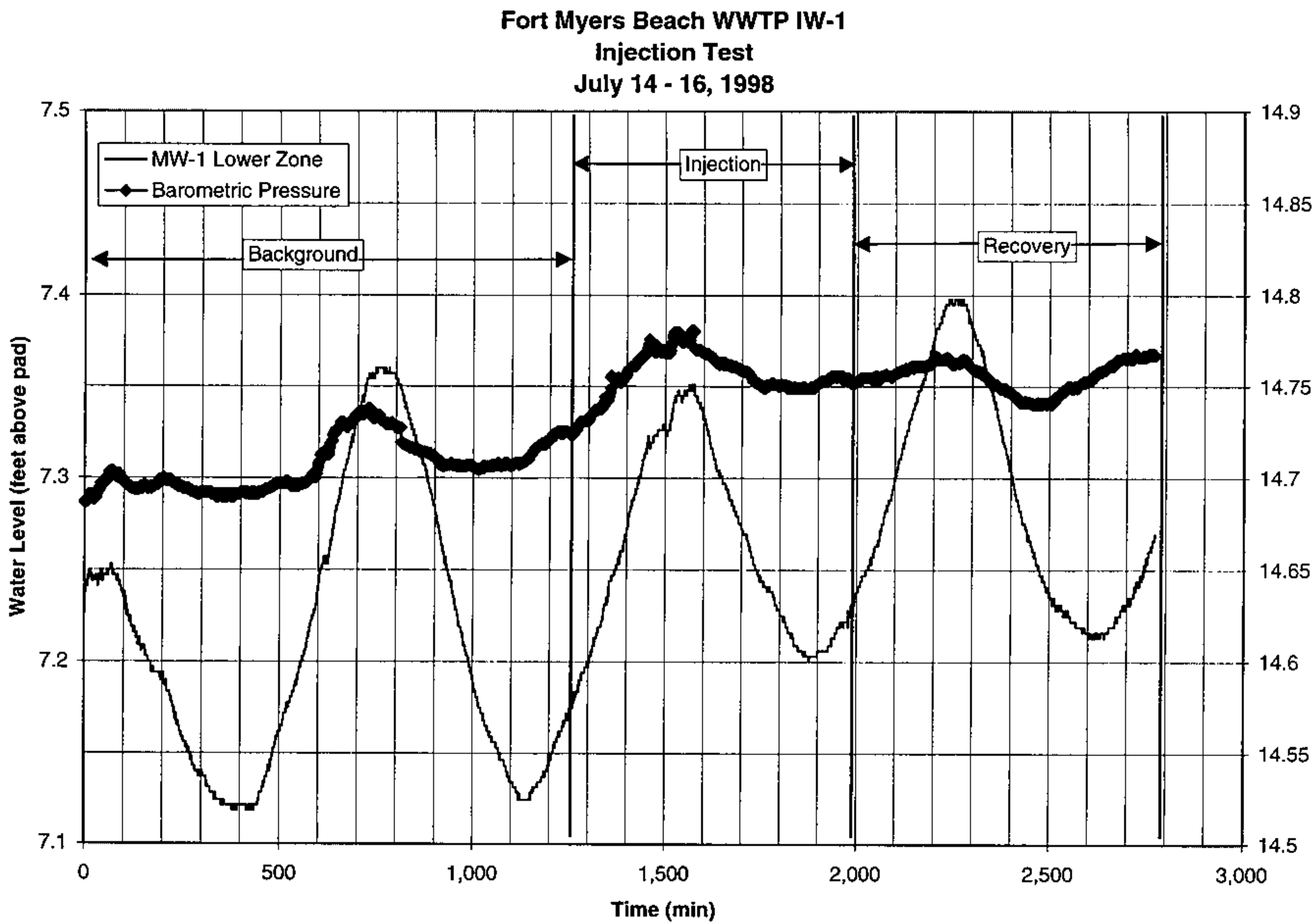


Figure 4-19
Monitor Well MW-1 Lower Monitor Zone Water Level and Barometric Pressure

P:water\136794\report\charts\injection_test1_up\fig3

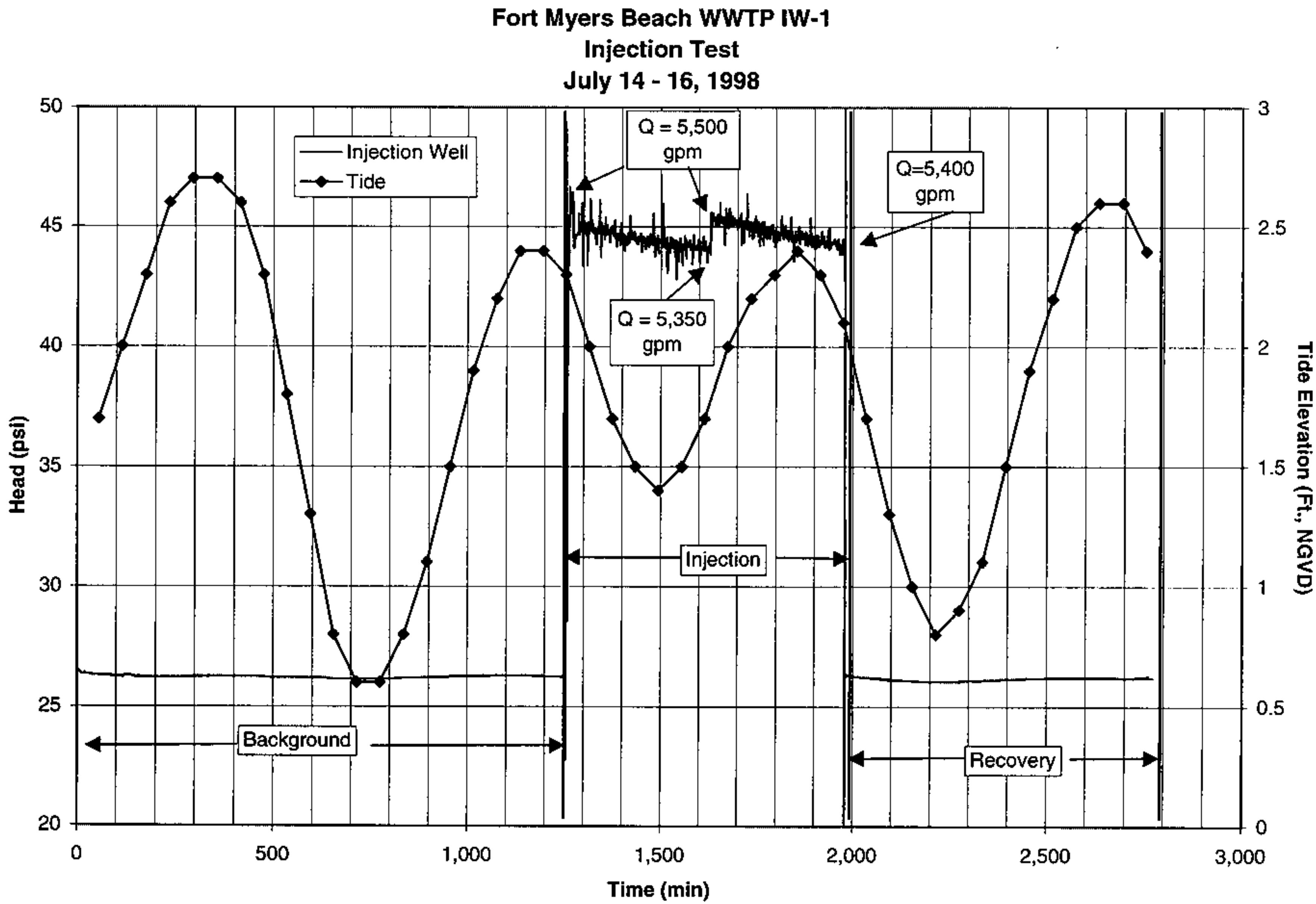


Figure 4-20
Injection Well IW-1 Wellhead Pressure and Tidal Elevations

P:water\136794\report\charts\injection_test1_up\fig4

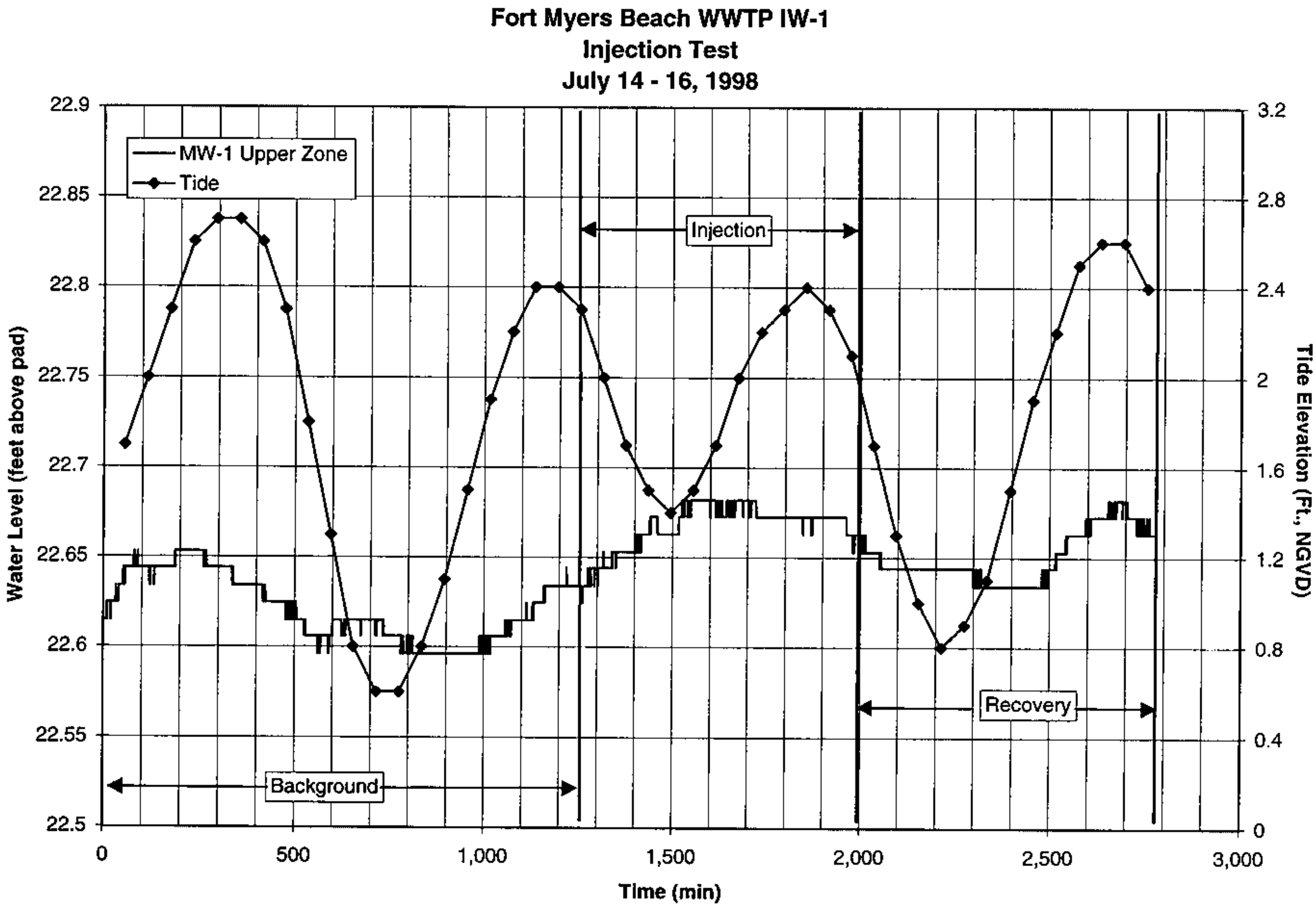


Figure 4-21
Monitor Well MW-1 Upper Monitor Zone Water Level and Tidal Elevations

P:water\136794\report\charts\injection_test1_up\fig5

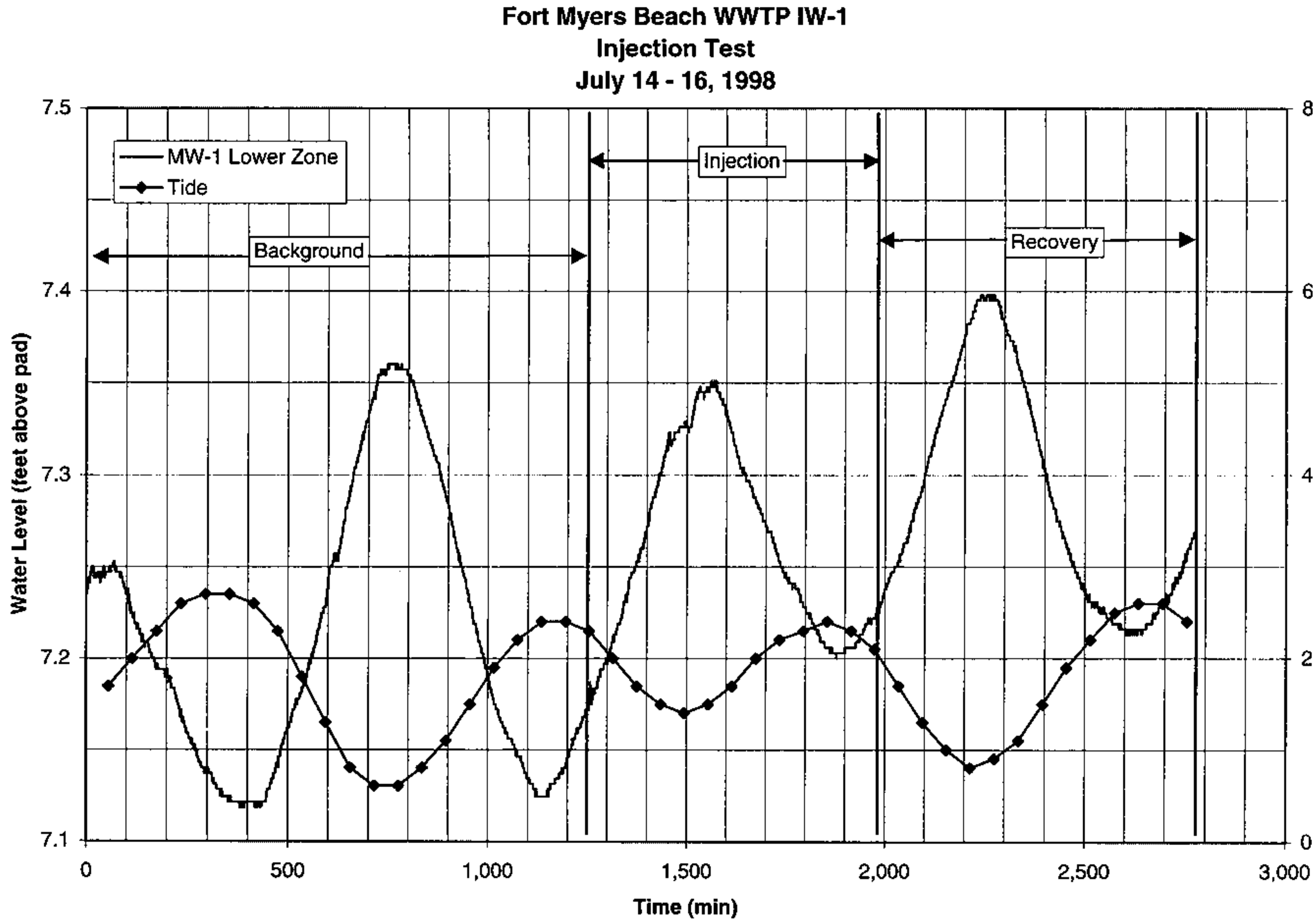


Figure 4-22
Monitor Well MW-1 Lower Monitor Zone Water Level and Tidal Elevations

P:water\136794\report\charts\injection_test1_up\fig6

Both monitoring zones of MW-1 were sampled for background water quality on July 6, 1998. Before sampling, both zones were fully developed. The samples were analyzed for primary and secondary drinking water standards and FDEP's minimum criteria. The background sample for the upper monitoring zone had a TDS concentration of 4,020 mg/L, further demonstrating that the monitoring zone is located above the base of the USDW. The TDS concentration of the lower monitoring zone sample was 30,000 mg/L, further demonstrating that the lower monitoring zone is located below the base of the USDW.

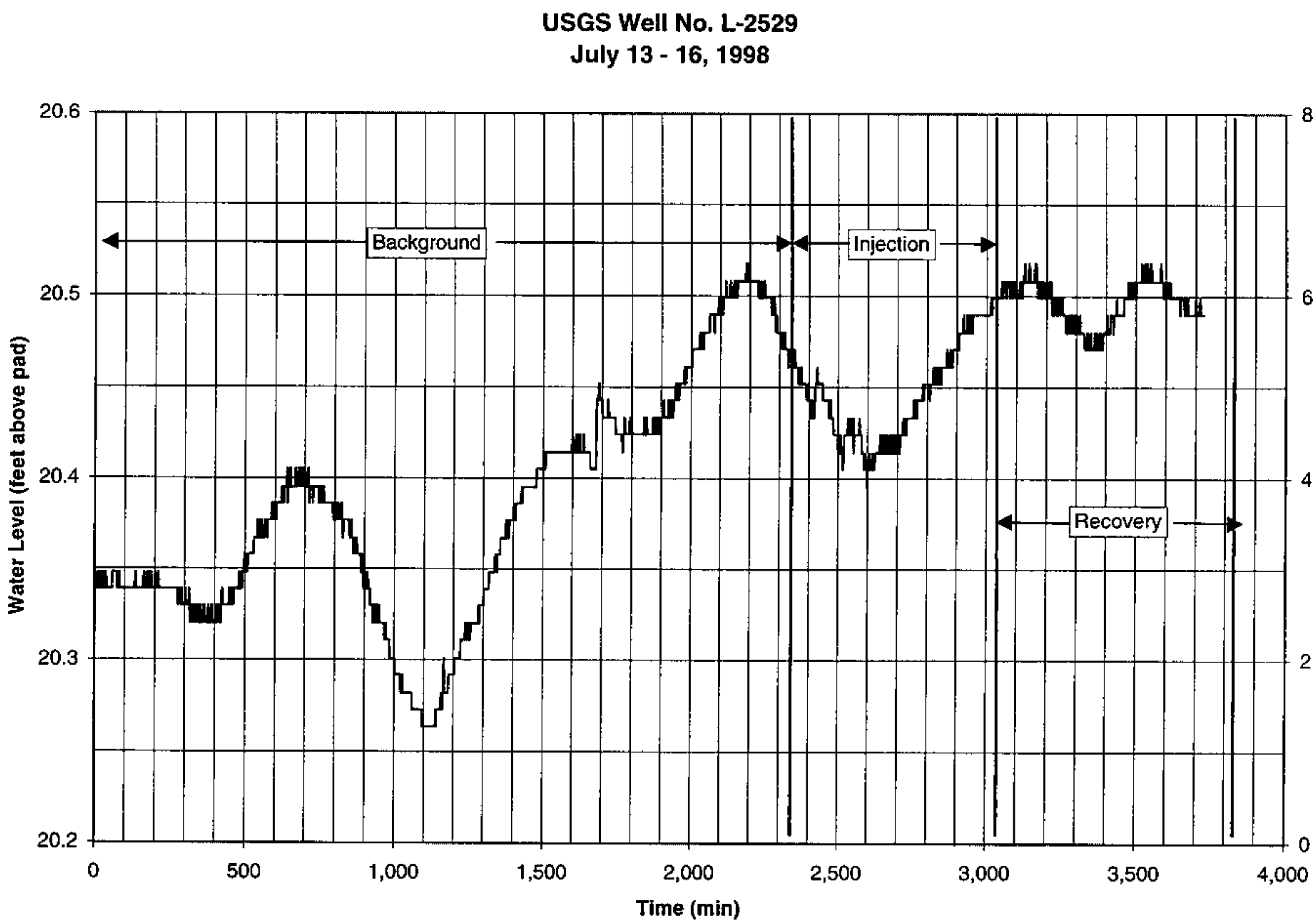


Figure 4-23
USGS Well No. 2529 Water Level Data

P:water\136794\report\charts\usgs

Section 5
Mechanical Integrity Testing

SECTION 5

Mechanical Integrity Testing

Mechanical Integrity Testing (MIT) of well IW-1 and MW-1 was performed to evaluate the integrity of the wells in accordance with standards set forth in Chapter 62-528, F.A.C. Testing of IW-1 included a video survey of the casing and wellbore, temperature and cement bond logs, a casing pressure test, and radioactive tracer testing. Testing of MW-1 included a video survey, sector bond log, and a casing pressure test. Results of testing demonstrated that both wells meet the requirements for both internal and external MIT as set forth in Chapter 62-528.300(6), F.A.C.

Injection Well IW-1

Casing Pressure Test

On May 4, 1998, a casing pressure test was successfully conducted on the final 16-inch diameter casing of IW-1. The pressure test was conducted after cementing the casing in place and before drilling out the cement plug at the base of casing. The casing was pressurized with water to 150 psi. The wellhead pressure was monitored for a 2-hour period with a calibrated 200-psi pressure gauge. Pressure readings were recorded manually every 5 minutes during the 2-hour test. During the course of the test, the pressure increased slightly from 150 psi to 155 psi. The 5 psi gain was within the 5 percent limit (7.5 psi) specified by FDEP for a 1-hour pressure test. The casing pressure test was observed by Jack Myers (FDEP), Mark Beaverson (Johnson Engineering), and Bill Beddow (CH2M HILL). A total of 12 gallons of water were drained from the casing as pressure was released. A summary of the casing pressure test data is provided in Appendix J.

Video Survey

A color camera video survey was conducted at IW-1 on May 13, 1998, by Florida Geophysical Logging, Inc., after completely flushing the well with greater than 50,000 gallons of potable water from an onsite fire hydrant. A backflow preventer was installed at the fire hydrant before beginning the potable water flush. The camera assembly was equipped with centralizers to keep it centered in the well, and its elevation was "zeroed" at pad level. The video survey was conducted to a depth of 3,036 feet bpl.

The survey showed no inconsistencies, and the casing appeared to be in good condition. The base of the 16-inch casing was identified at a depth of 2,375 feet bpl. The video survey was terminated when the top of sediment in the borehole was encountered at a depth of 3,036 feet bpl. Appendix K contains a copy of the video survey report.

Geophysical Logging

Cement bond and high resolution temperature logs were performed on injection well IW-1 by Florida Geophysical Logging, Inc., on May 5 and June 15, 1998, respectively. Appendix L contains copies of the logs.

The cement bond log (CBL) was conducted to assess the quality of the cement-to-casing bond of the final casing of IW-1. The log was performed before the cement plug at the base of the casing was drilled out. Additionally, the log was performed before cementing the upper 230 feet of the 16-inch casing to allow the tool to be calibrated to uncemented casing (above 230 feet bpl) and cemented casing (below 230 feet bpl). The CBL demonstrated an adequate cement bond exists around the final 16-inch casing from 230 feet bpl to the base of the logged interval, with the exception of the interval from approximately 2,045 to 2,100 feet bpl, where gravel was placed during well construction because of the presence of lost circulation zones. Above 230 feet bpl, the cement bond log confirms that the casing was uncemented at the time of the logging event. The interval from land surface to 230 feet bpl was cemented following completion of the cement bond log.

The temperature log (run from land surface to a total depth of 3,033 feet bpl) indicated a temperature between 86.8°F and 95.5°F from 100 to 2,440 feet bpl. Between 2,440 and 3,033 feet bpl, the temperature increased from 95.2°F to approximately 101.5°F. Results of temperature logging give no indication of leaks in the 16-inch diameter casing.

Radioactive Tracer Survey

Background

On June 16, 1998, an RTS was performed on IW-1 after pumping 45,000 gallons of potable water into the well. The survey was conducted by Florida Geophysical Logging, Inc., in the presence of Mr. Jack Myers (FDEP) and Mr. David McNabb (CH2M HILL).

In preparation for RTS logging, a gamma ray log was conducted on June 15, 1998, from the total depth of the well at 3,030 feet bpl to land surface to establish background conditions on the entire well. Using the Casing Colar Locator (CCL), the base of the 24-inch casing was delineated at 2,372 feet bpl. The base of casing was identified using by the CCL during each logging run throughout the RTS.

One static test and two dynamic tests were performed. The tracer fluid (Iodine 131) was placed in an RTS tool equipped with an ejector, upper, middle, and lower gamma ray detectors, and a CCL. The upper (top) gamma ray detector (GRT) is located 10 feet above the ejector on the tool. The middle (GRM) and lower (bottom) (GRB) gamma ray detectors are located 3.1 feet and 12.3 feet, respectively, below the ejector. Figure 5-1 presents a schematic diagram of the radioactive tracer tool used during the test.

During the static test, the ejector was located 1 foot below the base of the casing (2,373 feet bpl). For the dynamic tests, the ejector was positioned 5 feet above the base of the casing at a depth of 2,367 feet bpl. For each test, the RTS tool was placed in time drive for 2 minutes prior to ejecting tracer to ensure the detectors were functioning properly. Following the 2-minute detector test, 1 milliCurie (mCi) of Iodine 131 was ejected under both static and dynamic conditions. Gamma ray activity was monitored for 60 minutes after release of tracer during each test. Following each monitoring period, a log out of position was performed to 200 feet above the highest point at which elevated gamma counts were detected. This was followed by a flush of at least one casing volume of water. After the flush, the tool was lowered and logged out of position to 200 feet above the highest point at which elevated gamma counts were detected. The dynamic tests were performed at an injection rate of 40 gpm of potable water from an onsite fire hydrant. A backflow preventer was installed at the fire hydrant before performing the dynamic tests.

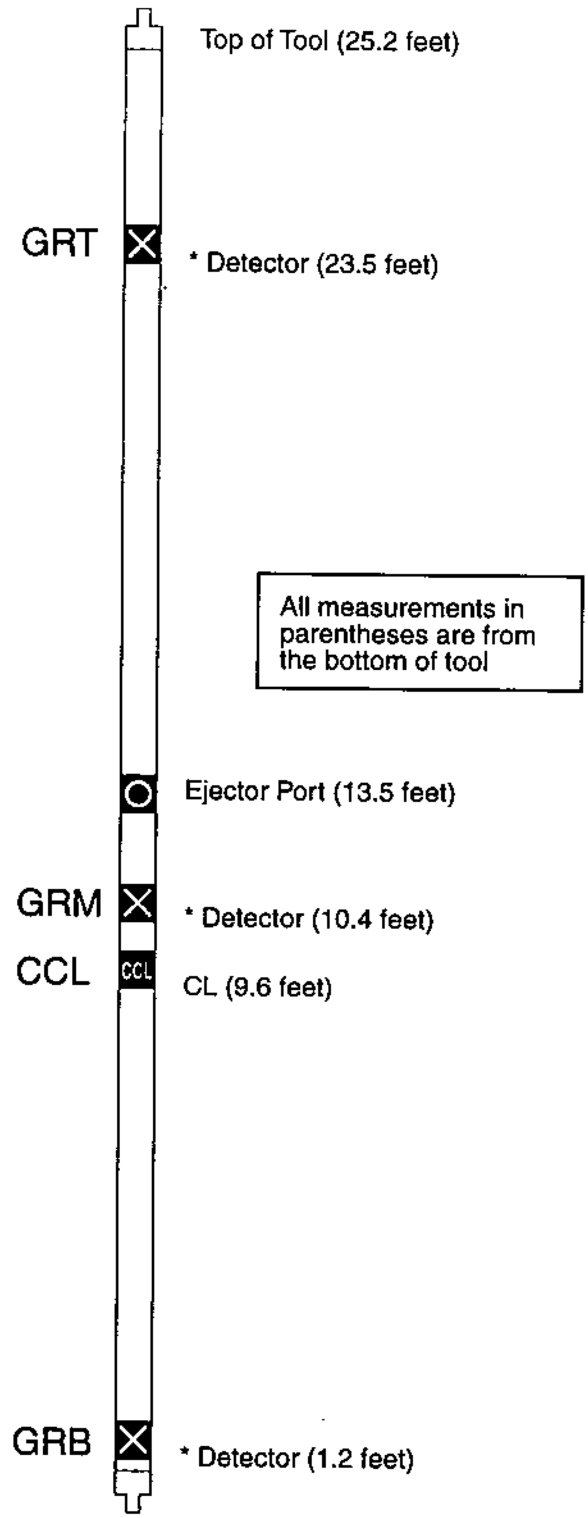


FIGURE 5-1
Florida Geophysical Radioactive Tracer (RTS) Tool

The background gamma log that ran from the pad level to a total depth of 3,030 feet bpl is identified at the top of the RTS log sheet as BACKGROUND GAMMA RAY. Following the background gamma log, a log was performed to verify the base of casing at 2,372 feet bpl. This log pass is identified at the top of the log sheet as CASING BOTTOM TIE-IN. The log verified the base of casing at 2,372 feet bpl. The log sheet presents four logs across the page from left to right, as follows:

- GRT (top detector, 10 feet above ejector)
- GRM (middle detector, 3.1 feet below ejector)
- GRB (bottom detector, 12.3 feet below ejector)

The CCL is displayed on the right side of the GRT track. Appendix L contains a copy of the RTS log.

Ejection No. 1 (First Static Test)

The first static test began by positioning the ejector 1 foot below the base of the 16-inch-casing at a depth of 2,371 feet bpl. After 2 minutes of time drive logging to ensure that the detectors were functioning properly, 1 mCi of tracer was ejected. The output of the three gamma detectors during the 2-minute test of the detectors and the hour following ejection of 1 mCi of tracer is displayed in log file STATIC TEST. For this log, the vertical scale represents time and the horizontal scale represents the gamma ray count. Reading the log upwards, approximately 3 inches of the vertical scale represents 5 minutes of time. Increased gamma ray activity was evident less than a minute following the release of tracer at the middle detector, 3.1 feet below the ejector port.

At 2.5 minutes after ejection, tracer was detected at the middle detector. Tracer was then detected at the bottom and top detectors at 3.5 and 7 minutes, respectively, after ejection. These time intervals represent relatively uniform diffusion of tracer away from the ejector. Dispersion of tracer appeared fairly uniform during the 60 minute monitoring period.

After the first static test, a log out of position was conducted. The output of the three gamma detectors and the CCL during the log out of position is displayed in the log file titled LOG OUT OF POSITION. Elevated gamma activity related to staining of the casing is evident on the log out of position. Residual staining is also evident on the middle and bottom detectors. Gamma ray activity at the top detector is similar to the background gamma ray log above a depth of 2,326 feet bpl. The casing was then flushed with more than 14,000 gallons of water before lowering the RTS tool to the base of the casing.

As shown on log file titled LOG AFTER FLUSH PASS, the log out of position following the casing flush indicates the residual tracer stain in the casing and on the middle detector was reduced by the casing flush. The residual stain on the bottom detector was removed by the casing flush. Gamma ray activity at the top and bottom detectors is similar to the background gamma ray log above a depth of 2,355 feet bpl.

The results of the static test indicate static diffusion of radioactive tracer during the 60-minute monitoring period.

Ejection No. 2 (First Dynamic Test)

The second ejection was conducted under dynamic conditions to verify the integrity of the grout seal around the base of the 16-inch casing. Potable water was pumped into the well at a rate of 40 gpm. The ejector of the tool was positioned 5 feet above the base of the casing (2,367 feet bpl) and 1 mCi of tracer was released following 2 minutes of time drive logging. The gamma ray response from each detector is shown on log file DYNAMIC TEST #1. An increased gamma ray response was evident at the middle detector approximately 1.5 minutes following the release of the tracer. The tracer was then detected at the lower detector after approximately 3 minutes. Elevated gamma response was not detected at the upper detector during the first dynamic test conducted for a duration of 60 minutes.

Following the first dynamic test, the tool was logged out of position while continuing to inject at 40 gpm. The output of the three gamma detectors and the CCL during the log out of position is displayed in the log file titled LOG OUT OF POSITION. The log out of position shows that the middle detector and base of casing had residual tracer staining. Increased gamma ray activity was not encountered above a depth of 2,355 feet bpl at the top and bottom detectors. The casing was then flushed with more than 15,000 gallons of water before lowering the RTS tool to the base of the casing.

As shown on log file titled LOG AFTER FLUSH PASS, the log out of position following the casing flush indicates that the residual stain was reduced on the middle detector. A residual stain was also reduced at the base of casing. Gamma ray activity at the upper detector and at the top and bottom detectors is similar to the background gamma ray log above a depth of 2,355 feet bpl.

The results of the first dynamic test indicate no upward migration of radioactive tracer.

Ejection No. 3 (Second Dynamic Test)

The third ejection was conducted under dynamic conditions to verify the results of the first dynamic test. Potable water was pumped into the well at a rate of 42 gpm. The ejector of the tool was positioned 5 feet above the base of the casing (2,367 feet bpl) and 1 mCi of tracer was released following 2 minutes of time drive logging. The gamma ray response from each detector is shown on log file DYNAMIC TEST #2. An increased gamma ray response was evident at the middle detector almost immediately following the release of the tracer. The tracer was then detected at the lower detector after approximately 1.5 minutes. Elevated gamma response was not detected at the upper detector during the second dynamic test conducted for a duration of 60 minutes.

Following the second dynamic test, the tool was logged out of position while continuing to inject at 42 gpm. The output of the three gamma detectors and the CCL during the log out of position is displayed in the log file titled LOG OUT OF POSITION. The log out of position shows that the base of casing had residual tracer staining. Increased gamma ray activity was not encountered above a depth of 2,355 feet bpl at either of the detectors during the log out of position. The casing was then flushed with in excess of 14,000 gallons of water while lowering the radioactive tracer tool to a depth of 2,560 feet bpl and ejecting the remaining tracer into the open borehole. The tool was then raised to 2,470 feet bpl and the final gamma ray log to surface was conducted.

As shown on log file titled FINAL GAMMA RAY PASS, the final gamma ray log indicates that elevated gamma ray activity was not encountered above a depth of 2,355 feet bpl. A residual stain was present in the open borehole and at the base of the casing up to a depth of 2,355 feet bpl.

The results of the second dynamic test and the entire RTS survey indicate no upward migration of radioactive tracer inside or outside of casing.

Monitoring Well MW-1

Casing Pressure Test

On June 12, 1998, a casing pressure test was successfully conducted on the 6-5/8-inch FRP casing of MW-1. The pressure test was conducted after cementing the casing in place and installing a packer in the well to a depth of 1,544 feet bpl. The casing was pressurized with water to 150 psi with a high-pressure pump. Precaution was taken to bleed air from the well after pressurizing the casing. The pressure was monitored for a 1-hour with a calibrated 200-psi pressure gauge.

During the hour-long test, the pressure fell from the initial reading of 150 psi to 144 psi. The 6 psi loss was within the 5 percent limit (7.5 psi) specified by FDEP. The casing pressure test was observed by Richard Orth (FDEP) and Mark Beaverson (Johnson Engineering). Appendix J contains a summary of the casing pressure test data.

Video Survey

A color camera video survey was conducted at MW-1 on May 13, 1998, by Florida Geophysical Logging, Inc., after flushing the well with more than 7,000 gallons of potable water from an on-site fire hydrant. A backflow preventer was installed at the fire hydrant before beginning the potable water flush. The camera assembly was equipped with centralizers to keep it centered in the well, and its elevation was "zeroed" at pad level. The video survey was conducted to a depth of 1,639 feet bpl.

The survey showed no inconsistencies, and the casing appeared in good condition. The base of the 6-5/8-inch FRP casing was identified at a depth of 1,574 feet bpl. The video survey was terminated when the top of sediment in the borehole was encountered at a depth of 1,639 feet bpl, indicating that the lower 11 feet of the borehole had filled with sediment. Appendix K contains a report of the video survey.

Geophysical Logging

A cement bond log (CBL) was performed on MW-1 by Florida Geophysical Logging, Inc., on June 11, 1998. Appendix L contains a copy of the CBL.

The CBL was conducted to assess the quality of the cement-to-casing bond of the final FRP casing of MW-1. The log was performed after cementing the final casing from 1,271 to 1,563 feet bpl. Because most geophysical logging tools are calibrated for use in steel casing, it is not possible to provide a typical quantitative wave train analysis for fiberglass materials. Therefore, the CBL log for the well provides a qualitative image of the cement behind the casing. The CBL log demonstrates an adequate cement bond around the 6-5/8-inch casing from 1,271 to 1,565 feet bpl. Above 1,271 feet bpl, the log shows the open hole interval and uncemented casing. Casing joints, at 30-foot intervals, are also evident in the uncemented portion of the log.

Section 6
Summary and Conclusions

SECTION 6

Summary and Conclusions

A deep injection well system was constructed at the Fort Myers Beach Wastewater Treatment Plant in Fort Myers, Florida, to provide an alternative means of effluent disposal. Construction of the injection well system began on January 12, 1998, and was substantially completed on June 5, 1998. Final completion of the project, including demobilization and site restoration, occurred on September 4, 1998.

Injection well IW-1 was constructed with a final 16-inch diameter casing string set to a depth of 2,370 feet bpl and a 663-foot open hole interval down to a total depth of 3,033 feet bpl. Dual-zone monitoring well MW-1 was constructed with open borehole intervals between 1,170 to 1,271 feet bpl and 1,563 to 1,650 feet bpl. Construction and testing were conducted in accordance with FDEP construction permit 128633-001-UC, the applicable sections of Chapter 62-528, F.A.C., and the construction contract documents prepared by Johnson Engineering and CH2M HILL.

The testing program was approved by the FDEP and TAC before issuance of the construction permit. A comprehensive testing program was conducted during construction of the injection well system to evaluate the site hydrogeology and assist in selection of the casing-setting depths. The testing program consisted of collecting formation samples, cores, pilot hole water samples, geophysical logging, air-lift specific capacity tests, packer tests, an injection test, and background water quality samples.

Packer tests identified the base of the USDW between 1,400 and 1,515 feet bpl. Interpretation of the geophysical logs correlate with the data obtained during packer testing and suggests that the base of the USDW is located at approximately 1,430 feet bpl. These data were used to ensure that MW-1 was constructed with one monitoring zone above and one monitoring zone below the base of the USDW.

The testing program identified the top of the injection zone at 1,770 feet bpl. The injection zone is characterized by extremely high transmissivity, highly fractured and cavernous dolomite with intervals of lower transmissivity limestone. Confining units were identified above the injection zone over the interval from 1,270 to 1,770 feet bpl. Several minor production intervals are present within the confining units. Additional confinement is present above 1,170 feet bpl.

Geophysical logging, pressure testing, a video survey, and an RTS survey were performed to demonstrate mechanical integrity of the final casing of IW-1. MI of the 6-5/8-inch diameter FRP casing of MW-1 was verified through geophysical logging, pressure testing, and a video survey. All testing confirmed that the final casing of both wells demonstrated MI and met the standards established in Chapter 62-528, F.A.C.

Appendix A
Construction Permit No. 128633-001-UC

Department of Environmental Protection

Lawton Chiles
Governor

South District
2295 Victoria Avenue, Suite 364
Fort Myers, Florida 33901-3881

Virginia B. Wetherell
Secretary

P E R M I T

PERMITTEE:

Lee County Utilities Dept.
2178 McGregor Blvd.
Fort Myers, Florida 33901

I.D. No: 5236C01544
Permit/Certification
Number: 128633-001-UC
Date of Issue: October 22, 1997
Expiration Date: October 22, 1997
County: Lee
Latitude: 26° 29' 30" N
Longitude: 81° 56' 00" W
Section/Town/Range:
Project: Lee County Utilities
IW-1 Injection Well

This permit is issued under the provisions of Chapter 403, Florida Statutes (F.S.), and Florida Administrative Code (F.A.C.) Rules 62-3, 62-4, 62-550, 62-600 and 62-528. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents, attached hereto or on file with the Department and made a part hereof and specifically described as follows:

Construct a nominal 16 inch diameter Class I injection well (IW-1) with cemented steel casing to approximately 2,400 feet below land surface (bls) and an approximate total depth of 3,000 feet bls utilized for the back-up means of disposal of 6.0 million gallons per day (MGD) of treated domestic effluent from the South County Wastewater Treatment Facility. The IW-1 dual zone monitor well will monitor the discharge from this well.

The application to construct a Class I injection well system, DER Form 17-1.209(9), was received November 6, 1996 with supporting documents and additional information last received December 26, 1996. The certificate of financial responsibility was issued February 21, 1997. Project is located at the Fort Myers Beach Wastewater Treatment Plant, 17155 Pine Ridge Road, Fort Myers, Florida.

Subject to General Conditions 1-16 and Specific Conditions 1-11.

PERMITTEE:

Lee County Utilities Dept.

I.D. No.: 5236C01544
Permit/Cert. No.: 128633-001-UC
Date of Issue: October 22,1997
Expiration Date: October 22, 1997

GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "permit conditions" and are binding and enforceable pursuant to Sections 403.141, 403.727, or 403.859 through 403.861, F.S. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5) F.S., the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

. This permit conveys no title to land or water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by any order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credential or other documents as may be required by law, and at reasonable times, access to the premises where the permitted activity is located or conducted to:

GENERAL CONDITIONS:

a. Have access to and copy any records that must be kept under the conditions of the permit;
b. Inspect the facility, equipment, practices, or operations regulated or required under this permit; and
c. Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

a. A description of and cause of non-compliance; and
b. The period of non-compliance, including dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance. The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source, which are submitted to the Department, may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Section 403.111 and 403.73, F.S. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided however, the permittee does not waive any other rights granted by Florida Statutes or Department rules. A reasonable time for compliance with a new or amended surface water quality standard, other than those standards addressed in Rule 62-3.051, shall include a reasonable time to obtain or be denied a mixing zone for the new or amended standard.

11. This permit is transferable only upon Department approval in accordance with F.A.C. Rules 62-4.120 and 62-30.300, F.A.C. as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

GENERAL CONDITIONS:

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. This permit also constitutes:

(a) Determination of Best Available Control Technology (BACT)
(b) Determination of Prevention of Significant Deterioration (PSD)
(c) Certification of compliance with State Water Quality Standards (Section 401, PL 92-500)
(d) Compliance with New Source Performance Standards

14. The permittee shall comply with the following:

(a) Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically, unless otherwise stipulated by the Department.

(b) The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation), required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report or application unless otherwise specified by Department rule.

(c) Records of monitoring information shall include:

1. the date, exact place, and time of sampling or measurements;
2. the person responsible for performing the sampling or measurements;
3. the dates analyses were performed;
4. the person responsible for performing the analyses;
5. the analytical techniques or methods used;
6. the results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware the relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

PERMITTEE:

Lee County Utilities Dept.

I.D. No.: 5236C01544
Permit/Cert. No.: 128633-001-UC
Date of Issue: October 22,1997
Expiration Date: October 22, 1997

GENERAL CONDITIONS:

16. In the case of an underground injection control permit, the following permit conditions also shall apply:

(a) All reports or information required by the Department shall be certified as being true, accurate and complete.

(b) Reports of compliance or noncompliance with, or any progress reports on, requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

(c) Notification of any noncompliance which may endanger health or the environment shall be reported verbally to the Department within 24 hours and again within 72 hours, and a final written report provided within two weeks.

1. The verbal reports shall contain any monitoring or other information which indicate that any contaminant may endanger an underground source of drinking water and any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between underground sources of drinking water.

2. The written submission shall contain a description of an a discussion of the cause of the noncompliance and, if it has not been corrected, the anticipated time the noncompliance is expected to continue, the steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance and all information required by Rule 62-528.415(4)(b), F.A.C.

(d) The Department shall be notified at least 180 days before conversion or abandonment of an injection well, unless abandonment within a lesser period of time is necessary to protect waters of the State.

SPECIFIC CONDITIONS:

1. Site Requirements

a. A drilling pad shall be provided to collect spillage of contaminants and to support the heaviest load that will be encountered during drilling.

b. The disposal of drilling fluids, cuttings, formation water or waste shall be in a sound environmental manner that avoids violation of surface and ground water quality standards. The disposal method shall be approved by the Department prior to start of construction.

SPECIFIC CONDITIONS:

c. Provide specific drilling pad dimensions and design details prior to commencing construction and shortly after selection of drilling contractor.

d. The four water table monitoring wells shall be sampled and analyzed prior to drilling this injection well and then weekly thereafter. Sampling shall include specific conductance, pH, chloride, temperature and water level.

e. A survey indicating the exact location in metes and bounds of all wells authorized by this permit shall be provided prior to issuance of an operating permit.

2. Construction and Testing Requirements

a. The permittee shall contact the TAC chairman so that he may schedule progress review meetings at appropriate times with the TAC and permittee for the purpose of reviewing the results of tests, geophysical logging, surveys, drilling records and construction problems. At a minimum, meetings shall be scheduled for the purpose of selecting final setting depth for the 16 inch casing for the injection well.

b. All drilling shall be inside a blow out preventer upon penetration of the Florida Aquifer.

c. Mechanical integrity testing is a two part demonstration which includes a pressure test to demonstrate that no leaks are present in the casing, tubing or packer and a temperature or noise log and radioactive tracer survey to demonstrate the absence of leaks behind the casing. Verification of pressure gauge calibration must be provided at the scheduled tests.

d. Department approval and Technical Advisory Committee (TAC) review pursuant to F.A.C. Rule 62-528 is required for the following stages of construction:

(1) Intermediate casing seat selection (injection and monitor wells).
(2) Final casing seat selection (injection and monitor wells).
(3) Operational (long term) testing with effluent.

e. The cementing program, as required in Section 62-528.410(5), Florida Administrative Code, shall be submitted to the Department and the Technical Advisory Committee for review. Cementing shall not commence prior to approval being granted.

SPECIFIC CONDITIONS:

f. All temperature surveys (except for mechanical integrity demonstration) shall be run within 48 hours after cementing.

g. TAC meetings are scheduled on the 1st Tuesday of each month subject to a 5 working day prior notice and timely receipt of critical data by all TAC members. Emergency meetings may be arranged when justified to avoid undue construction delay.

h. The Permittee shall insure that safe internal pressures are maintained during the cementing of all casings.

i. The background water quality of the injection zone shall be established prior to commencement of any injection testing. Parameters to be measured are contained on Pages 1-6, Section 02311 in the January, 1997 technical specifications.

j. The injection and monitor well(s) at the site shall be abandoned when no longer usable for their intended purpose, or when posing potential threat to the quality of the waters of the State. Within 180 days of well abandonment, the permittee shall submit to the Department and the TAC the proposed plugging method, pursuant to Rule 62-528.435, F.A.C.

k. All salt used in well drilling shall be stored in an environmentally sound manner. Accurate records shall be kept on the amount of salt used.

l. All dual induction, sonic and caliper geophysical logs run on the pilot holes of all injection and monitor wells shall be submitted with scales of both two inches equals one hundred feet (2"=100') and five inches equals one hundred feet (5"=100').

3. <u>Quality Assurance/Quality Control Requirements</u>

a. This permit approval is based upon evaluation of the data contained in the application dated November 6, 1996, and the plans and/or specifications submitted in support of the application. Any proposed modifications to this permit shall be submitted in writing to the Underground Injection Control program manager, the TAC, and USEPA for review and clearance prior to implementation. Changes of negligible impact to the environment and staff time will be reviewed by the program manager, cleared when appropriate and incorporated into this permit. Changes or modifications other than those described above will require submission of a completed application and appropriate processing fee as per Rule 62-4.050, F.A.C.

b. A professional engineer registered pursuant to Chapter 471, Florida Statutes shall be retained throughout the construction period to be responsible for the construction operation and to

SPECIFIC CONDITIONS:

certify the application, specifications, completion report and other related documents. The Department shall be notified immediately of any change of engineer.

c. Where required by Chapter 471 (P.E.) or Chapter 492 (P.G.) F.S., applicable portions of permit applications and supporting documents which are submitted to the Department for public record shall be signed and sealed by the professional(s) who approved or prepared them.

d. The Department shall be notified immediately of any problems that may seriously hinder compliance with this permit, construction progress, or good construction practice. The Department may require a detailed written report describing the problem, remedial measures taken to assure compliance and measures taken to prevent recurrence of the problem.

e. Issuance of a Class I Test/Injection well construction and testing permit does not obligate the Department to authorize operation of the injection well system, unless the wells qualify for an operation permit applied for by the permittee and issued by the Department.

4. Reporting Requirements

a. All reports and surveys required by this permit must be submitted concurrently to all the members of the TAC. The TAC consists of representatives from these agencies:

Florida Department of Environmental Protection
South District
2295 Victoria Avenue, Suite 364
Fort Myers, FL 33901

Florida Department of Environmental Protection
Bureau of Drinking Water and Ground Water Resources
UIC Section
2600 Blair Stone Rd.
Tallahassee, FL 32399-2400

South Florida Water Management District
Well Construction Permitting
P.O. Box 24860
West Palm Beach, FL 33416-4860

PERMITTEE:

Lee County Utilities Dept.

I.D. No.: 5236C01544
Permit/Cert. No.: 128633-001-UC
Date of Issue: October 22,1997
Expiration Date: October 22, 1997

SPECIFIC CONDITIONS:

United States Environmental Protection Agency, Region IV
UIC Section
100 Alabama Street SW
Atlanta, Georgia 30303

United States Geological Society
9100 NW 36th Street , Suite 107
Miami, FL 33178

b. Members of the TAC shall receive a weekly summary of the daily log kept by the contractor. The weekly reporting period shall run Friday through Thursday and reports shall be mailed each Friday. The report shall include but is not limited to the following:

(1) Description of daily footage drilled by diameter of bit or size of hole opener or reamer being used;
(2) Description of formation and depth encountered; and specific conductance of water samples collected during drilling. Description of work during installation and cementing of casings; include amounts of casing and actual cement used versus calculated volume required.
(3) Lithological description of drill cuttings collected every ten (10) feet or at every change in formation. Description of work and type of testing accomplished, geophysical logging, pumping tests, and coring results.
(4) Description of any construction problems that develop and their status to include a description of what is being done or has been done to correct the problem.
(5) Description of the amount of salt used.
(6) Results of any water quality analyses performed as required by this permit.
(7) Copies of the driller's log are to be submitted with the weekly summary.

c. The Department must be notified seventy-two (72) hours prior to all testing for mechanical integrity on the injection well and pressure testing on the monitor wells. Testing should begin during daylight hours Monday through Friday.

d. Annotated copies of geophysical logs, lithologic descriptions and logs and water quality data (from drilling and packer tests) must be submitted to TAC for intermediate and final casing seat selection approvals by the Department.

e. An evaluation of all test results must be submitted with all test data, and also the geophysical logs if requested by the Department.

SPECIFIC CONDITIONS:

f. After completion of construction and testing, a final report shall be submitted to the Department and the TAC. The report shall include, but not be limited to, all information and data collected under Rule 62-528.330(2) and Rule 62-528.330(3), F.A.C., with appropriate interpretations. Mill certificates for the casing(s) shall be included in this report. To the extent possible, the transmissivity of the injection zone and maximum injection rate within safe pressure limits shall be estimated.

5. Operational Testing Requirements

a. The Department shall require operational testing to demonstrate that the well can absorb the design and peak daily flows that are expected over the next five years, prior to granting approval for operation.

b. No effluent shall be injected into the well without written authorization from the Department. The letter authorizing operational testing with effluent shall list specific conditions for operation and monitoring during the operational testing phase of the project. These conditions shall include at a minimum:

(1) Injection pressure limitation;
(2) Injection flow rate limitation;
(3) Injection well monitoring requirements;
(4) Effluent monitoring requirements;
(5) Weekly ground water sampling of monitor wells;
(6) Monthly specific injectivity testing;
(7) A maximum of two (2) years for operational testing.

Treated effluent may be injected for the purpose of the 18 hour short term injection test, provided a complete wastestream analysis is submitted prior to the test. Parameters shall include primary and secondary drinking water standards as well as the following:

Sulfide (Field measurement)
Soluble Orthophosphate
Ammonium
Organic Nitrogen
Diethylphthallate
Dimethylphthallate
Butylbenzylphthallate
Naphthalene
Anthracene
Phenanthrene
Phenol
2,4,6-trichlorophenol
2-chlorophenol

SPECIFIC CONDITIONS:

c. If any monitoring data indicates the movement of injection fluids or formation fluid into underground sources of drinking water, the Department shall prescribe such additional requirements for construction, corrective action (including possible closure of the injection well), operation, monitoring, or reporting as are necessary to prevent such movement. These additional requirements shall be imposed by modifying the permit, or by enforcement action if the permit has been violated.

d. Prior to operational testing approval, at a minimum the following items must be submitted to and approved by the Department and TAC review:

(1) Borehole television survey of final casing;
(2) Geophysical logs with interpretations;
(3) Certification of mechanical integrity and interpreted test data;
(4) Injection test data and evaluation;
(5) Confining zone data (cores, etc.) and confirmation of confinement;
(6) Background water quality data (monitor zones);
(7) Waste stream analysis;
(8) Surface equipment completion certified pursuant to Rule 62-600.540(4), F.A.C.
(9) Draft operation and maintenance manual with emergency procedures.
(10) Notice of completion of construction and as-built well construction specifications;
(11) Documentation that any necessary corrective action has been completed for improperly plugged wells in the area of review;
(12) A description of the actual injection procedure;
(13) A discussion of the compatibility of the injection fluids with fluids in the injection zone and minerals in both the injection zone and the confining zone.

e. The permittee shall use continuous indicating and recording devices to monitor injection flow rate, injection pressure, annular pressure and monitor zone pressures. In the case of operational failure of any of these instruments for a period of more than 48 hours, the permittee shall report to the Department in writing the remedial action to be taken and the date when the failure will be corrected.

f. The Engineer of Record or designated qualified representative must be present for the start-up operations and the Department must be notified in writing of the date operational testing commenced for the well.

SPECIFIC CONDITIONS:

6. Abnormal Events

a. In the event the permittee is temporarily unable to comply with any conditions of this permit due to breakdown of equipment, power outages, destruction by hazard of fire, wind, or by other cause, the permittee shall notify the Department. Notification shall be made in person, by telephone or by telegraph within 24 hours of breakdown or malfunction to the UIC Program staff, South District office.

b. A written report of any noncompliance referenced in 1) above shall be submitted to the South District office within five days after its occurrence. The report shall describe the nature and cause of the breakdown or malfunction, the steps being taken or planned to be taken to correct the problem and prevent its reoccurrence, emergency procedures in use pending correction of the problem, and the time when the facility will again be operating in accordance with permit conditions.

7. Emergency Disposal

a. All applicable federal, state and local permits must be in place to allow for any alternate discharges due to emergency or planned outage conditions.

b. Any changes in emergency disposal methods must be submitted for Technical Advisory Committee (TAC) review and Department approval.

c. The permittee shall notify the Department within 24 hours whenever an emergency discharge has occurred (Rule 62-528.415(4)(c)1., F.A.C.). Written notification shall be provided to the Department within 5 days after each occurrence. The Permittee shall indicate the location and duration of the discharge and the volume of fluid discharged.

8. Financial Responsibility

a. The permittee shall maintain the resources necessary to close, plug and abandon the injection and associated monitor wells, at all times (Rule 62-528.435(9), F.A.C.).

b. The permittee shall review annually the plugging and abandonment cost estimates. An increase in any one year shall require the permittee to submit documentation to obtain an updated Certificate of Demonstration of Financial Responsibility.

SPECIFIC CONDITIONS:

b. The permittee shall review annually the plugging and abandonment cost estimates. An increase in any one year shall require the permittee to submit documentation to obtain an updated Certificate of Demonstration of Financial Responsibility.

c. In the event that the mechanism used to demonstrate financial responsibility should become invalid for any reason, the permittee shall notify the Department of Environmental Protection in writing within 14 days of such invalidation. The permittee shall, within 30 days of said notification, submit to the Department for approval, new financial documentation in order to comply with Rule 62-528.435(9), F.A.C., and the conditions of this permit.

9. Mechanical Integrity

a. Prior to operational testing the permittee shall establish, and thereafter maintain, mechanical integrity.

b. If the Department determines that the injection well lacks mechanical integrity, written notice shall be given to the permittee.

c. Within 48 hours of receiving written notice from the department that the well lacks mechanical integrity the permittee shall cease injection into the well unless the Department allows continued injection pursuant to (d) below.

d. The Department may allow the permittee to continue operation of a well that lacks mechanical integrity if the permittee demonstrates that fluid movement into or between underground sources of drinking water is not occurring.

10. Signatories

a. All reports and other submittal required to comply with this permit shall be signed by a person authorized under Rules 62-528.340(1) or (2), F.A.C.

b. In accordance with Rule 62-528.340(4), F.A.C., all reports shall contain the following certification:
"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my

PERMITTEE:

Lee County Utilities Dept.

I.D. No.: 5236C01544
Permit/Cert. No.: 128633-001-UC
Date of Issue: October 22,1997
Expiration Date: October 22, 1997

SPECIFIC CONDITIONS:

knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

11. The permittee is reminded of the necessity to comply with the pertinent regulations of any other regulatory agency, as well as any county, municipal, and federal regulations applicable to the project. These regulations may include, but not limited to, those of the Federal Emergency Management Agency in implementing flood control measures. This permit should not be construed to imply compliance with the rules and regulations of other regulatory agencies.

Note: In the event of an emergency the permittee shall contact the Department by calling (904)413-9911. During normal business hours, the permittee shall call (941)332-6975.

Issued this 22nd day of October, 1997.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Abdul B. Ahmadi, Ph.D., P.E.
Water Facilities Administrator

ABA/JBM/klm

Appendix B
Summary of Construction Activity

Fort Myers Beach Wastewater Treatment Plant Injection Well IW-1 Summary of Construction Activities	
Date	**Milestone**
1/12/98	Began drilling 12-1/4-inch diameter pilot hole.
1/13/98	Completed pilot hole drilling to a depth of 473 feet bpl. Conducted geophysical logging. Logs conducted include caliper, gamma ray, spontaneous potential, and dual induction.
1/14/98	Began reaming the pilot hole to a nominal 41-inch diameter.
1/15/98	Completed reaming the pilot hole to a depth of 405 feet bpl.
1/16/98	Installed and cemented the 34-inch diameter casing to a depth of 398 feet bpl.
1/20/98	Began drilling 12-1/4-inch diameter pilot hole.
1/23/98	Cored the interval from 1,444 to 1,458 feet bpl.
1/27/98	Cored the interval from 1,554 to 1,569 feet bpl.
1/28/98	Cored the interval fro, 1,669 to 1,684 feet bpl.
1/29/98	Completed drilling the 12-1/4-inch diameter pilot hole to a depth of 1,900 feet bpl.
1/30/98	Conducted geophysical logging. Logs performed include static caliper, gamma ray, spontaneous potential, dual induction, sonic, fluid resistivity, temperature, and flowmeter, and dynamic fluid resistivity, temperature, and flowmeter.
2/3/98	Conducted a straddle packer test on the interval from 1,812 to 1,844 feet bpl.
2/4/98	Conducted a straddle packer test on the interval from 1,723 to 1,755 feet bpl.
2/6/98	Began straddle packer test on the interval from 1,515 to 1,567 feet bpl.
2/7/98	Completed straddle packer test on the interval from 1,515 to 1,567 feet bpl. Conducted a straddle packer test on the interval from 1,220 to 1,273 feet bpl.
2/9/98	Began straddle packer test on the interval from 1,389 to 1,400 feet bpl.
2/10/98	Completed straddle packer test on the interval from 1,389 to 1,400 feet bpl.
2/11/98	Began backplugging the pilot hole with cement.
2/13/98	Completed backplugging the pilot hole with cement.
2/16/98	Began reaming the backplugged pilot hole to a nominal 33-inch diameter.
2/24/98	Completed reaming the backplugged pilot hole to a depth of 1,805 feet bpl.
2/25/98	Conducted a caliper log on the reamed hole and installed the 26-inch diameter casing to a depth of 1,794 feet bpl.
2/26/98	Began cementing the 26-inch diameter casing in place.
2/28/98	Completed cementing the 26-inch diameter casing in place to land surface.
3/3/98	Cored the interval from 1,965 to 1,984 feet bpl.
3/5/98	Cored the interval from 2,045 to 2,062 feet bpl.
3/6/98	Cored the interval from 2,280 to 2,297 feet bpl.
3/9/98	Cored the interval from 2,380 to 2,408 feet bpl.
3/10/98	Cored the interval from 2,514 to 2,524 feet bpl.
3/17/98	Completed pilot hole drilling to a depth of 3,036 feet bpl.
3/26/98	Conducted geophysical logging on the open hole interval. Logs performed include static caliper, gamma ray, spontaneous potential, dual induction, sonic, fluid resistivity, temperature, and dynamic fluid resistivity, and temperature.
3/30/98	Condcuted a video survey on the open hole interval.
4/1/98	Conducted a packer test on the interval from 2,216 to 2,300 feet bpl.
4/3/98	Conducted a packer test on the interval from 2,319 to 3,036 feet bpl.
4/7/98	Conducted a packer test on the interval from 1,796 to 1,950 feet bpl.
4/13/98	Conducted a packer test on the interval from 1,950 to 2,023 feet bpl.
4/14/98	Conducted a packer test on the interval from 1,820 to 1,956 feet bpl.
4/20/98	Installed a bridge plug to a depth of 2,404 feet bpl.
4/21/98	Backplugged the pilot hole with cement.
4/22/98	Began reaming the backplugged pilot hole to a nominal 25-inch diameter.
4/27/98	Completed reaming the backplugged pilot hole to a depth of 2,376 feet bpl.
4/28/98	Conducted a caliper log on the reamed hole and installed the 16-inch casing to a depth of 2,370 feet bpl. Began cementing the 16-inch casing in place.

Fort Myers Beach Wastewater Treatment Plant Injection Well IW-1 Summary of Construction Activities	
Date	**Milestone**
	Completed cementing the 16-inch casing from 2,370 to 230 feet bpl.
5/4/98	Successfully conducted a casing pressure test on the 16-inch casing.
5/5/98	Conducted a cement bond log on the 16-inch casing. Began reaming the interval below the 16-inch casing to a nominal 15-inch diameter.
5/11/98	Completed reaming the pilot hole to a depth of 3,033 feet bpl.
5/12/98	Conducted geophysical logging on the open hole interval. Logs performed include caliper and gamma ray. Collected background water quality sample.
5/13/98	Conducted geophysical logging. Logs performed include video survey and static and dynamic flowmeter.
6/15/98	Conducted temperature and background gamma ray log.
6/16/98	Conducted a radioactive tracer survey on the well.
6/18/98	Final completion of construction of the well.
7/15/98	Conducted an injection test on the well.

bpl = below pad level

Fort Myers Beach Wastewater Treatment Plant Monitor Well MW-1 Summary of Construction Activities	
Date	**Milestone**
5/15/98	Drilled 12-1/4-inch diameter pilot hole to a depth of 410 feet bpl. Conducted geophyscial logging. Logs conducted include caliper, gamma ray, and dual induction.
5/16/98	Began reaming the pilot hole to a nominal 28-inch diameter.
5/17/98	Completed reaming the pilot hole to a depth of 405 feet bpl. Conducted a caliper log on the reamed hole. Installed and cemented 24-inch diameter casing to a depth of 400 feet bpl.
5/20/98	Began drilling 12-1/4-inch diameter pilot hole.
5/21/98	Completed drilling the 12-1/4-inch diameter pilot hole to a depth of 1,193 feet bpl. Conducted geophysical logging. Logs performed include static caliper, gamma ray, spontaneous potential, dual induction, sonic, fluid resistivity, temperature, and flowmeter, and dynamic fluid resistivity, temperature, and flowmeter.
5/22/98	Began reaming the pilot hole to a nominal 22-inch diameter.
5/23/98	Completed reaming the pilot hole to a depth of 1,180 feet bpl. Conducted a caliper log on the reamed hole.
5/24/98	Installed 16-inch casing to a depth of 1,170 feet bpl. Began cementing the 16-inch casing in place.
5/25/98	Completed cementing the 16-inch casing in place.
5/26/98	Began drilling 12-1/4-inch diameter pilot hole.
5/27/98	Completed pilot hole drilling to a depth of 1,720 feet bpl.
5/28/98	Conducted geophysical logging. Logs performed include static caliper, gamma ray, spontaneous potential, dual induction, sonic, fluid resistivity, temperature, and flowmeter, and dynamic fluid resistivity, temperature, and flowmeter.
6/1/98	Reamed the pilot hole to a nominal 15-inch diameter to a depth of 1,710 feet bpl.
6/2/98	Conducted a caliper log on the reamed hole.
6/4/98	Installed the 6-5/8-inch casing to a depth of 1,572 feet bpl. Backplugged the reamed hole to a depth of 1,650 feet bpl. Installed gravel in the open hole portion to a depth of 1,563 feet bpl. Began cementing the 6-5/8-inch casing in place.
6/5/98	Completed cementing the 6-5/8-inch casing in place to a depth of 1,271 feet bpl.
6/10/98	Conducted video survey on the completed well.
6/11/98	Conducted geophysical logging. Logs performed include cement bond log and caliper log.
6/12/98	Conducted pressure test on the 6-5/8-inch casing.
6/18/98	Final completion of contruction of the well
7/6/98	Collected background water quality samples from both monitor zones.
bpl = below pad level	

Appendix C
Weekly Summaries

MEMORANDUM CH2M HILL

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng. Tom McCormick/CH2M HILL	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Mark Beaverson/Johnson Eng. Bill Beddow/CH2M HILL
FROM:	David McNabb/CH2M HILL	
DATE:	January 19, 1998	
SUBJECT:	Weekly Summary No. 1 January 12 through January 15, 1998	
PROJECT:	Fort Myers Beach WWTP IW-1	

Summary of Engineer's/Driller's Log

Construction of deep injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant began on January 12, 1998. As required by the construction permit, the surficial aquifer monitor wells were installed and sampled before construction began. Construction began with the drilling of the 12.25-inch diameter pilot hole from pad level to 473 feet below pad level (bpl) using rotary mud drilling techniques. Geophysical logging of the pilot hole was performed on January 13, 1998. Logs conducted include gamma ray, dual-induction, spontaneous potential, and caliper. Copies of the geophysical logs are attached for your records. Following geophysical logging, the pilot hole was reamed to a depth of 405 feet bpl and a caliper log was performed. Installation of the 34-inch diameter casing then began and had reached a depth of 100 feet bpl at the end of the reporting period. Salt was not used while drilling during the reporting period. There were no unusual construction related events during the reporting period.

It is anticipated that installation and cementing of the 34-inch diameter casing to a depth of 400 feet bpl will be completed next week. The Contractor will then rig up for reverse air drilling and begin pilot hole drilling to a depth of 1,800 feet bpl.

Attachments:
- Engineer's Daily Reports
- Driller's Daily Reports
- Shallow Monitor Wells Water Quality Reports
- Lithologic Description
- Geophysical Logs

a:

MEMORANDUM CH2M HILL

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng.	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Tom McCormick/CH2M HILL Bill Beddow/CH2M HILL
FROM:	David McNabb/CH2M HILL	
DATE:	January 23, 1998	
SUBJECT:	Weekly Summary No. 2 January 16 through January 22, 1998	
PROJECT:	Fort Myers Beach WWTP IW-1	

Summary of Engineer's/Driller's Log

The second week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on January 22, 1998. The week began with completion of the installation of the 36-inch casing to a depth of 400 feet bpl. The casing was then cementing in place using a total of 71 barrels of neat cement and 140 barrels of 4% bentonite cement. The rest of the week was spent rigging up for reverse air drilling and pilot hole drilling to a depth of 1,208 feet bpl. Salt was not used while drilling during the reporting period. Anomalous deviation surveys during pilot hole drilling were determined to be related to the Contractor switching sure-shot targets after removing the target from the tool and a bent deviation tool housing.

It is anticipated that coring will take place during pilot hole drilling nest week. The pilot hole will be drilled to approximately 1,800 feet bpl and geophysically logged. Straddle packer testing in selected intervals may also take place next week.

Attachments:
- Engineer's Daily Reports
- Driller's Daily Reports
- Shallow Monitor Wells Water Quality Reports
- Pilot Hole Conductivity Data
- Lithologic Description

a:

MEMORANDUM CH2M HILL

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng.	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Tom McCormick/CH2M HILL Bill Beddow/CH2M HILL
FROM:	David McNabb/CH2M HILL	
DATE:	January 30, 1998	
SUBJECT:	Weekly Summary No. 3 January 23 through January 29, 1998	
PROJECT:	Fort Myers Beach WWTP IW-1	

Summary of Engineer's/Driller's Log

The third week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on January 29, 1998. Pilot hole drilling reached a depth of 1,900 feet below pad level (bpl) on January 28, 1998. Pilot hole water samples were collected at 30 foot intervals during pilot hole drilling. Results of field conductivity measurements of the pilot hole water samples are attached. The intervals from 1,444 to 1,458, 1,554 to 1,569, and 1,669 to 1,684 feet bpl underwent coring. Core descriptions and a summary of coring results are attached. Well construction activities then ceased in order to allow the well to reach equilibrium in preparation for geophysical logging. Salt was not used while drilling during the reporting period.

It is anticipated that the pilot hole will undergo geophysical logging and straddle packer testing next week.

Attachments:
- Engineer's Daily Reports
- Driller's Daily Reports
- Shallow Monitor Wells Water Quality Reports
- Pilot Hole Conductivity Data
- Core Descriptions
- Lithologic Description

a:

MEMORANDUM

CH2M HILL

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng.	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Tom McCormick/CH2M HILL Bill Beddow/CH2M HILL
FROM:	David McNabb/CH2M HILL	
DATE:	February 6, 1998	
SUBJECT:	Weekly Summary No. 4 January 30 through February 5, 1998	
PROJECT:	Fort Myers Beach WWTP IW-1	

Summary of Engineer's/Driller's Log

The fourth week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on February 5, 1998. The week was spent conducting geophysical logging on the open hole interval from 398 to 1,900 feet bpl. Logs conducted include caliper, gamma ray, spontaneous potential, dual induction, borehole compensated sonic, flowmeter, temperature, and fluid resistivity conducted under static conditions and flowmeter, temperature, and fluid resistivity logs conducted under dynamic conditions. Copies of the logs are attached for your review. The intervals from 1,812 to 1,844 and 1,723 to 1,755 feet below pad level (bpl) underwent straddle packer testing. Conductivity of a water sample collected at the end of the test conducted on the interval from 1,812 to 1,844 feet bpl was 46,000 umhos/cm. The rest of the week was spent preparing to conduct a straddle packer test on the interval from 1,515 to 1,569 feet bpl. Salt was not used while drilling during the reporting period. There were no unusual construction events during the reporting period.

It is anticipated that additional straddle packer tests will be conducted on the pilot hole prior to reaming the pilot hole next week.

Attachments:
- Engineer's Daily Reports
- Driller's Daily Reports
- Shallow Monitor Wells Water Quality Reports
- Geophysical Logs

a:

MEMORANDUM

CH2M HILL

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng.	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Tom McCormick/CH2M HILL Bill Beddow/CH2M HILL

FROM: David McNabb/CH2M HILL

DATE: February 13, 1998

SUBJECT: Weekly Summary No. 5
February 6 through February 12, 1998

PROJECT: Fort Myers Beach WWTP IW-1

Summary of Engineer's/Driller's Log

The fifth week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on February 12, 1998. The week was spent conducting straddle packer tests on the intervals from 1,220 to 1,273, 1,389 to 1,400, and 1,515 to 1,567 feet bpl and backplugging the pilot from 1,900 to 396 feet bpl. Pilot hole backplugging was conducted in 3 stages using a total of 642 barrels of 12% bentonite cement. Conductivity of a water samples collected at the completion of each straddle packer test is presented in the table below. Salt was not used while testing during the reporting period. There were no unusual construction events during the reporting period.

Test Interval (feet bpl)	Conductivity (umhos/cm)
1,220 to 1,273	6,670
1,389 to 1,400	9,000
1,515 to 1,567	44,600

It is anticipated that the backplugged pilot hole will be reamed next week in preparation for installation of the intermediate casing.

Attachments: Engineer's Daily Reports
Driller's Daily Reports
Shallow Monitor Wells Water Quality Reports

a:

MEMORANDUM

CH2M HILL

TO: Lindsey Sampson/Lee County
Steve Anderson/SFWMD
Ron Reese/USGS
Steve Morrison/Johnson Eng..
Lonnie Howard/Johnson Eng.
Jack Myers/FDEP-FMY
Joe Haberfeld/FDEP-Tlh.
Nancy Marsh/USEPA
Tom McCormick/CH2M HILL
Bill Beddow/CH2M HILL

FROM: David McNabb/CH2M HILL

DATE: February 20, 1998

SUBJECT: Weekly Summary No. 6
February 13 through February 19, 1998

PROJECT: Fort Myers Beach WWTP IW-1

Summary of Engineer's/Driller's Log

The sixth week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on February 19, 1998. The week was spent reaming the backplugged pilot hole in preparation for installing the 26-inch diameter intermediate casing. Reaming had reached a depth of 1,412 feet below pad level (bpl) by the end of the reporting period. The recommendation for setting the intermediate casing to a depth of approximately 1,800 feet bpl was approved by FDEP on February 16, 1998. Salt was not used during the reporting period. There were no unusual construction events during the reporting period.

It is anticipated that reaming and installation of the intermediate casing will be completed next week.

Attachments: Engineer's Daily Reports
Driller's Daily Reports
Shallow Monitor Wells Water Quality Reports

a:

MEMORANDUM

CH2M HILL

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng.	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Tom McCormick/CH2M HILL Bill Beddow/CH2M HILL

FROM: David McNabb/CH2M HILL

DATE: February 27, 1998

SUBJECT: Weekly Summary No. 7
February 20 through February 26, 1998

PROJECT: Fort Myers Beach WWTP IW-1

Summary of Engineer's/Driller's Log

The seventh week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on February 26, 1998. The week was spent finishing reaming the backplugged pilot hole to a depth of 1,805 feet below pad level (bpl) and installing the 26-inch diameter intermediate casing to a depth of 1,794 feet bpl. Cementing of the 26-inch casing had been completed to a depth of 1,206 feet bpl in 2 stages by the end of the reporting period. Salt was not used during the reporting period. There were no unusual construction events during the reporting period.

It is anticipated that cementing of the intermediate casing to surface will be completed and pilot hole drilling of the interval from 1,800 to 3,000 feet will begin next week.

Attachments: Engineer's Daily Reports
Driller's Daily Reports
Shallow Monitor Wells Water Quality Reports

a:

MEMORANDUM

CH2M HILL

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng.	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Tom McCormick/CH2M HILL Bill Beddow/CH2M HILL
FROM:	David McNabb/CH2M HILL	
DATE:	March 6, 1998	
SUBJECT:	Weekly Summary No. 8 February 27 through March 6, 1998	
PROJECT:	Fort Myers Beach WWTP IW-1	

Summary of Engineer's/Driller's Log

The eighth week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on March 6, 1998. The week began with completing cementing the 26-inch diameter intermediate casing to land surface. Pilot hole drilling then began and had reached a depth of 2,160 feet below pad level (bpl) by the end of the reporting period. The intervals from 1,930 to 1,942, 1,965 to 1,984, and 2,045 to 2,062 feet bpl underwent coring during the week. Salt was not used during the reporting period. There were no unusual construction events during the reporting period.

It is anticipated that pilot hole drilling to a depth of 3,000 feet and geophysical logging of the pilot hole will be completed week. Additional cores may also be collected.

Attachments:
- Engineer's Daily Reports
- Driller's Daily Reports
- Lithologic Description
- Core Descriptions
- Pilot Hole Water Quality
- Shallow Monitor Wells Water Quality Reports

a:

MEMORANDUM

CH2M HILL

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng.	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Tom McCormick/CH2M HILL Bill Beddow/CH2M HILL

FROM: David McNabb/CH2M HILL

DATE: March 13, 1998

SUBJECT: Weekly Summary No. 9
March 6 through March 12, 1998

PROJECT: Fort Myers Beach WWTP IW-1

Summary of Engineer's/Driller's Log

The ninth week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on March 12, 1998. Pilot hole drilling continued this week and had reached a depth of 2,820 feet below pad level (bpl) by the end of the week. The intervals from 2,280 to 2,297, 2,380 to 2,408, and 2,514 to 2,524 feet bpl underwent coring during the week. Salt was not used during the reporting period. There were no unusual construction events during the reporting period.

It is anticipated that pilot hole drilling to a depth of 3,000 feet and geophysical logging of the pilot hole will be completed next week. Straddle packer testing may also take place next week.

Attachments:
- Engineer's Daily Reports
- Driller's Daily Reports
- Lithologic Description
- Core Descriptions
- Pilot Hole Water Quality
- Shallow Monitor Wells Water Quality Reports

a:

MEMORANDUM

CH2M HILL

TO:

Lindsey Sampson/Lee County
Steve Anderson/SFWMD
Ron Reese/USGS
Steve Morrison/Johnson Eng..
Lonnie Howard/Johnson Eng.
Jack Myers/FDEP-FMY
Joe Haberfeld/FDEP-Tlh.
Nancy Marsh/USEPA
Tom McCormick/CH2M HILL
Bill Beddow/CH2M HILL

FROM: David McNabb/CH2M HILL

DATE: March 20, 1998

SUBJECT: Weekly Summary No. 10
March 13 through March 19, 1998

PROJECT: Fort Myers Beach WWTP IW-1

Summary of Engineer's/Driller's Log

The tenth week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on March 19, 1998. Pilot hole drilling was completed to a depth of 3,036 feet below pad level (bpl) on March 17, 1998. The rest of the week was spent conditioning the hole in preparation for geophysical logging. Salt was not used during the reporting period. There were no unusual construction events during the reporting period.

It is anticipated that the pilot hole will undergo geophysical logging next week. Straddle packer testing may also take place next week.

Attachments:

Engineer's Daily Reports
Driller's Daily Reports
Lithologic Description
Pilot Hole Water Quality
Shallow Monitor Wells Water Quality Reports

a:

MEMORANDUM

CH2M HILL

TO: Lindsey Sampson/Lee County
Steve Anderson/SFWMD
Ron Reese/USGS
Steve Morrison/Johnson Eng..
Lonnie Howard/Johnson Eng.
Jack Myers/FDEP-FMY
Joe Haberfeld/FDEP-Tlh.
Nancy Marsh/USEPA
Tom McCormick/CH2M HILL
Bill Beddow/CH2M HILL

FROM: David McNabb/CH2M HILL

DATE: March 27, 1998

SUBJECT: Weekly Summary No. 11
March 20 through March 26, 1998

PROJECT: Fort Myers Beach WWTP IW-1

Summary of Engineer's/Driller's Log

The eleventh week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on March 26, 1998. The week was spent preparing the open borehole for geophysical logging. Geophysical logging began on March 26, 1998. Logs completed by the end of the reporting period include caliper, gamma ray, spontaneous potential, dual induction, borehole compensated sonic, temperature, and fluid resistivity conducted under static conditions. Copies of the logs were not yet available at the time this weekly summary was prepared, however, copies of the logs will be included with next weeks summary. Four thousand pounds of salt were used to kill the well to allow drill pipe to be tripped into the hole during the reporting period. There were no unusual construction events during the reporting period.

It is anticipated that geophysical logging will be completed next week. Packer testing of the open borehole may also take place next week.

Attachments:
Engineer's Daily Reports
Driller's Daily Reports
Shallow Monitor Wells Water Quality Reports

a:

MEMORANDUM CH2M HILL

TO: Lindsey Sampson/Lee County
Steve Anderson/SFWMD
Ron Reese/USGS
Steve Morrison/Johnson Eng..
Lonnie Howard/Johnson Eng.
Jack Myers/FDEP-FMY
Joe Haberfeld/FDEP-Tlh.
Nancy Marsh/USEPA
Tom McCormick/CH2M HILL
Bill Beddow/CH2M HILL

FROM: David McNabb/CH2M HILL

DATE: April 3, 1998

SUBJECT: Weekly Summary No. 12
March 27 through April 2, 1998

PROJECT: Fort Myers Beach WWTP IW-1

Summary of Engineer's/Driller's Log

The twelfth week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on April 2, 1998. The week was spent conducting geophysical logging, packer, and removing cement from the base of casing. Logs conducted include fluid conductivity, flowmeter, and dual induction. Copies of the logs were not yet available at the time this weekly summary was prepared, however, copies of the logs will be included with next weeks summary or our final casing string seat recommendation. Packer testing of the intervals from 2,319 to 3,000 and 2,216 to 2,300 feet bpl had been completed by the end of the reporting period. The cement at the base of the 26-inch diameter casing was removed using a 22.5-inch drill bit in order to allow packer testing with large diameter packers. Four thousand pounds of salt was used to kill the well to allow the 22.5-inch drill bit to be tripped into the well. There were no unusual construction events during the reporting period.

It is anticipated that packer testing will be completed next week. The pilot hole will be cemented following completion of the packer testing.

Attachments: Engineer's Daily Reports
Driller's Daily Reports
Shallow Monitor Wells Water Quality Reports

a:

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng.	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Tom McCormick/CH2M HILL Bill Beddow/CH2M HILL
FROM:	David McNabb/CH2M HILL	
DATE:	April 10, 1998	
SUBJECT:	Weekly Summary No. 13 April 3 through April 9, 1998	
PROJECT:	Fort Myers Beach WWTP IW-1	

Summary of Engineer's/Driller's Log

The thirteenth week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on April 9, 1998. The interval from 2,319 to 3,000 feet below pad level (bpl) underwent packer testing on April 3, 1998. This interval had been packer tested during the previous week, however, it was necessary to re-run the test due to a malfunctioning memory gauge during the previous week's test. A caliper log was conducted on the interval from 1,796 to 2,260 feet bpl on April 3, 1998. A copy of the caliper log will be included with next week's summary. A packer test was conducted on the interval from 1,796 to 1,950 feet bpl on April 7, 1998. The remainder of the week was spent waiting for the arrival of a packer sleeve to allow straddle packer testing of large diameter portions of the pilot hole. Copies of the geophysical logs conducted during the previous two weeks are attached for your review. Four thousand pounds of salt was used to kill the well to allow installation of the packer prior to both of the packer tests conducted this week. The salt was developed from the well prior to conducting the packer tests. There were no unusual construction events during the reporting period.

It is anticipated that packer testing will be completed next week. The pilot hole will be cemented following completion of the packer testing.

Attachments:
- Engineer's Daily Reports
- Driller's Daily Reports
- Shallow Monitor Wells Water Quality Reports

a:

MEMORANDUM

CH2MHILL

TO: Lindsey Sampson/Lee County
Steve Anderson/SFWMD
Ron Reese/USGS
Steve Morrison/Johnson Eng..
Lonnie Howard/Johnson Eng.
Jack Myers/FDEP-FMY
Joe Haberfeld/FDEP-Tlh.
Nancy Marsh/USEPA
Tom McCormick/CH2M HILL
Bill Beddow/CH2M HILL

FROM: David McNabb/CH2M HILL

DATE: April 17, 1998

SUBJECT: Weekly Summary No. 14
April 10 to April 16, 1998

PROJECT: Fort Myers Beach WWTP IW-1

Summary of Engineer's/Driller's Log

The fourteenth week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on April 16, 1998. Difficulty was encountered when attempting to trip into the hole with packers for packer testing due to an obstruction in the hole at a depth of 1,960 feet below pad level (bpl). The interval from 1,796 to 2,050 feet bpl was reamed with a 22.5-inch bit on April 11, 1998 to allow packers to be tripped into the hole below 1,960 feet bpl. A caliper log was then performed on the reamed interval in preparation for packer testing. Copies of the caliper log and the caliper log performed on April 3, 1998 are attached for your review. Packer testing of the intervals from 1,950 to 2,043 and 1,820 to 1,950 feet bpl took place on April 13 and April 14, 1998, respectively. After completion of packer testing, the borehole was cleaned with a 12.25-inch bit to a depth of 2,550 feet bpl and reamed to a depth of 2,030 feet bpl in preparation for installation of the final casing string. A total of 11,000 pounds of salt was used to kill the well for drilling and testing activities during the reporting period. There were no unusual construction events during the reporting period.

It is anticipated that the pilot hole will be cemented and reaming in preparation for installation of the final casing string will take place next week.

Attachments: Engineer's Daily Reports
Driller's Daily Reports
Shallow Monitor Wells Water Quality Reports
Geophysical Logs

a:

MEMORANDUM

CH2M HILL

TO: Lindsey Sampson/Lee County
Steve Anderson/SFWMD
Ron Reese/USGS
Steve Morrison/Johnson Eng..
Lonnie Howard/Johnson Eng.
Jack Myers/FDEP-FMY
Joe Haberfeld/FDEP-Tlh.
Nancy Marsh/USEPA
Tom McCormick/CH2M HILL
Bill Beddow/CH2M HILL

FROM: David McNabb/CH2M HILL

DATE: April 24, 1998

SUBJECT: Weekly Summary No. 15
April 17 through April 23, 1998

PROJECT: Fort Myers Beach WWTP IW-1

Summary of Engineer's/Driller's Log

The fifteenth week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on April 23, 1998. A video survey was performed on the interval from 1,974 to 2,050 feet below pad level (bpl) on April 17, 1998 to verify that reaming which had taken place during the previous reporting period had eliminated the pilot hole. A bridge plug was installed to a depth of 2,404 feet bpl on April 20, 1998. The pilot hole over the interval from 2,404 to 2,197 feet bpl was backplugged with 106 barrels of 12% bentonite cement prior to beginning to ream the borehole from a depth of 2,030 feet bpl. Reaming had reached a depth of 2,300 feet bpl at the end of the reporting period. Verbal approval for setting the final casing to a depth of approximately 2,370 feet bpl was received from Joe Haberfeld (FDEP) on April 23, 1998. Six thousand pounds of salt was used to kill the well in preparation for tripping the reaming bit out of hole on the evening of April 23, 1998. There were no unusual construction events during the reporting period.

It is anticipated that the final casing will be installed and cemented next week.

Attachments:
Engineer's Daily Reports
Driller's Daily Reports
Shallow Monitor Wells Water Quality Reports

a:

MEMORANDUM CH2M HILL

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng.	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Tom McCormick/CH2M HILL Bill Beddow/CH2M HILL
FROM:	David McNabb/CH2M HILL	
DATE:	May 1, 1998	
SUBJECT:	Weekly Summary No. 16 April 24 through April 30, 1998	
PROJECT:	Fort Myers Beach WWTP IW-1	

Summary of Engineer's/Driller's Log

The sixteenth week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on April 30, 1998. The backplugged pilot hole was reamed to a depth of 2,375 feet below pad level (bpl) in preparation for installation of the final casing string. Three of the roller cones on the reaming bit broke off while reaming at a depth of 2,300 feet bpl. The bit roller cones were ground up during subsequent reaming. A caliper log was conducted on the reamed hole prior to installing the final casing string to a depth of 2,370 feet bpl on April 28, 1998. A copy of the caliper log is attached for your records. Cementing of the casing had reached a depth of 2,089 feet bpl by the end of the reporting period. A total of 35 yards of gravel were used to assist cementing in the interval from 2,126 to 2,089 feet bpl. It is anticipated that gravel will not be used during the rest of the cementing process. Twenty thousand pounds of salt was used to kill the well during the reporting period. There were no unusual construction events during the reporting period.

It is anticipated that cementing of the final casing string will be completed next week. The casing will then be pressure tested and a cement bond log will be conducted.

Attachments: Engineer's Daily Reports
Driller's Daily Reports
Shallow Monitor Wells Water Quality Reports

a:

MEMORANDUM

CH2M HILL

TO:

Lindsey Sampson/Lee County
Steve Anderson/SFWMD
Ron Reese/USGS
Steve Morrison/Johnson Eng..
Lonnie Howard/Johnson Eng.
Jack Myers/FDEP-FMY
Joe Haberfeld/FDEP-Tlh.
Nancy Marsh/USEPA
Tom McCormick/CH2M HILL
Bill Beddow/CH2M HILL

FROM: David McNabb/CH2M HILL

DATE: May 8, 1998

SUBJECT: Weekly Summary No. 17
May 1 through May 7, 1998

PROJECT: Fort Myers Beach WWTP IW-1

Summary of Engineer's/Driller's Log

The seventeenth week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on May 8, 1998. During this week the final casing string was cemented to 230 feet below pad level (bpl). A pressure test was successfully conducted on the final casing on April 4, 1998. The test was witnessed by Jack Myers (FDEP-Fort Myers). The casing gained 5 psi during the 2 hour test. A cement bond log was conducted on the final casing string the same day. A copy of the cement bond log is enclosed for your records. Reaming of the open borehole below casing with a 14.75-inch bit had reached a depth of 2,870 feet bpl by the end of the reporting period. Six thousand pounds of salt was used to kill the well during the reporting period. There were no unusual construction events during the reporting period.

It is anticipated that the 14.75-inch hole will be completed to 3,000 feet bpl next week. The open borehole will then be geophysically logged.

Attachments:

Engineer's Daily Reports
Driller's Daily Reports
Shallow Monitor Wells Water Quality Reports
Geophysical Logs

a:

MEMORANDUM

CH2M HILL

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng.	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Tom McCormick/CH2M HILL Bill Beddow/CH2M HILL
FROM:	David McNabb/CH2M HILL	
DATE:	May 15, 1998	
SUBJECT:	Weekly Summary No. 18 May 8 through May 14, 1998	
PROJECT:	Fort Myers Beach WWTP IW-1	

Summary of Engineer's/Driller's Log

The eighteenth week of construction on injection well IW-1 at the Fort Myers Beach Wastewater Treatment Plant ended on May 14, 1998. During this week, reaming of the pilot hole to a depth of 3,033 feet bpl was completed. A caliper log was then conducted on the open borehole on May 12, 1998 and a flowmeter and video log was conducted on May 13, 1998. The rest of the week was spent moving the rig to the monitor well location and rigging up to begin drilling the monitor well. Ten thousand pounds of salt were used to kill the well during the reporting period. There were no unusual construction events during the reporting period. Copies of the caliper and flowmeter logs are attached for your records. A copy of the video log will be included in the final engineering report for the well.

It is anticipated that drilling of the monitor well will begin next week. The 24-inch casing may also be installed in the monitor well next week.

Attachments:	Engineer's Daily Reports Driller's Daily Reports Shallow Monitor Wells Water Quality Reports Geophysical Logs

a:

MEMORANDUM

CH2M HILL

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng.	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Tom McCormick/CH2M HILL Bill Beddow/CH2M HILL
FROM:	David McNabb/CH2M HILL	
DATE:	May 22, 1998	
SUBJECT:	Weekly Summary No. 19 May 15 through May 21, 1998	
PROJECT:	Fort Myers Beach WWTP IW-1	

Summary of Engineer's/Driller's Log

The nineteenth week of construction on the injection well system at the Fort Myers Beach Wastewater Treatment Plant ended on May 21, 1998. Drilling of injection well IW-1 is now complete. Testing and installation of surface equipment will be completed in the near future. Construction of dual-zone monitor well MW-1 began on May 15, 1998. During this week, the pilot hole was drilled to a depth of 410 feet below pad level (bpl) prior to conducting geophysical logging. Logs conducted include caliper, gamma ray, spontaneous potential and dual induction. The pilot hole was then reamed prior to conducting a caliper log and installing and cementing the 24-inch diameter casing to a depth of 400 feet bpl. The pilot was then drilled to a depth of 1,190 feet bpl prior to conducting geophysical logging. Logs conducted include caliper, gamma ray, spontaneous potential, dual induction, sonic, fluid conductivity, temperature, and flowmeter. Copies of the geophysical logs conducted during the reporting period are attached for your records. There were no unusual construction events during the reporting period.

It is anticipated that the pilot hole will be reamed to a depth of 1,175 feet bpl and caliper logged in preparation for installing the 16-inch casing next week. Following completion of cementing the 16-inch casing, the pilot hole will be drilled to 1,710 feet bpl. Air-lift specific capacity tests will be conducted at approximately 100-foot intervals during pilot hole drilling to 1,710 feet bpl to assist in evaluating the productivity of the drilled interval.

Attachments:
- Engineer's Daily Reports
- Driller's Daily Reports
- Shallow Monitor Wells Water Quality Reports
- Geophysical Logs

a:

MEMORANDUM **CH2M HILL**

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng.	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Tom McCormick/CH2M HILL Bill Beddow/CH2M HILL
FROM:	David McNabb/CH2M HILL	
DATE:	May 29, 1998	
SUBJECT:	Weekly Summary No. 20 May 22 through May 28, 1998	
PROJECT:	Fort Myers Beach WWTP IW-1	

Summary of Engineer's/Driller's Log

The twentieth week of construction on the injection well system at the Fort Myers Beach Wastewater Treatment Plant ended on May 28, 1998. Drilling of injection well IW-1 is now complete. Testing and installation of surface equipment will be completed in the near future. During this week, the pilot hole at MW-1 was reamed to a depth of 1,175 feet below pad level (bpl) prior to conducting a caliper log. The 16-inch casing was then installed and cemented to a depth of 1,170 feet bpl. The pilot hole was then advanced to a depth of 1,720 feet bpl and geophysically logged. Logs conducted include caliper, gamma ray, spontaneous potential, dual induction, sonic, fluid conductivity, temperature, and flowmeter. Copies of the geophysical logs conducted during the reporting period are attached for your records. Salt was not used during the reporting period. Air lift specific capacity testing was conducted at approximately 120-foot intervals during pilot hole drilling below a depth of 1,000 feet bpl. The specific capacity testing data are inconsistent and appear to have been influenced by high density borehole fluid due to a large amount of suspended silt from the drilling process. There were no unusual construction events during the reporting period.

Work at the monitor well has currently stopped pending FDEP approval of the monitoring zone recommendation. Upon FDEP approval, the pilot hole will be reamed to the appropriate casing setting depth and the 6-inch FRP casing will be installed.

Attachments:
- Engineer's Daily Reports
- Driller's Daily Reports
- Shallow Monitor Wells Water Quality Reports
- Geophysical Logs

a:

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng.	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Tom McCormick/CH2M HILL Bill Beddow/CH2M HILL
FROM:	David McNabb/CH2M HILL	
DATE:	June 5, 1998	
SUBJECT:	Weekly Summary No. 21 May 29 through June 4, 1998	
PROJECT:	Fort Myers Beach WWTP IW-1	

Summary of Engineer's/Driller's Log

The twenty-first week of construction on the injection well system at the Fort Myers Beach Wastewater Treatment Plant ended on June 4, 1998. Drilling of injection well IW-1 is now complete. Testing and installation of surface equipment will be completed in the near future. During this week, the pilot hole at MW-1 was reamed to a depth of 1,718 feet below pad level (bpl) prior to conducting a caliper log. The 6-5/8-inch FRP casing was then installed to a depth of 1,572 feet bpl. The reamed hole was then backplugged with neat cement to a depth of 1,650 feet bpl prior to installing gravel over the interval from 1,563 to 1,650 feet bpl. One barrel of neat cement was then pumped on top of the gravel to establish a bridge plug in order to allow the FRP casing to be cemented in place. A copy of the reamed hole caliper at a scale of 5 inches equal 100 feet is attached for your records. A copy of the caliper log at scales of 1, 2, and 5-inches equal 100 feet will be included with next week's summary. Salt was not used during construction of the monitor well during the reporting period. There were no unusual construction events during the reporting period.

It is anticipated that the FRP casing will be cemented over the interval from 1,270 to 1,563 feet bpl next week. A pressure test on the FRP casing is also anticipated to take place next week. The Contractor will also start rigging down next week.

Attachments:
- Engineer's Daily Reports
- Driller's Daily Reports
- Shallow Monitor Wells Water Quality Reports
- Geophysical Logs
- Lithologic Log

a:

MEMORANDOM

TO:	Lindsey Sampson/Lee County	Jack Myers/FDEP-FMY
	Steve Anderson/SFWMD	Joe Haberfeld/FDEP-Tlh.
	Ron Reese/USGS	Nancy Marsh/USEPA
	Steve Morrison/Johnson Eng..	Tom McCormick/CH2M HILL
	Lonnie Howard/Johnson Eng.	Bill Beddow/CH2M HILL

FROM: Mark K. Beaverson / Johnson Engineering, Inc.

DATE: June 11, 1998

SUBJECT: Weekly Summary No. 22
June 5 through June11, 1998

PROJECT: Fort Myers Beach WWTP IW-1

Summary of Engineer's Log

The twenty-second week of construction on the injection well system at the Fort Myers Beach Wastewater Treatment Plant ended on June 11, 1998. This week of construction included final cementing of the 6" RFP casing in the dual zone monitoring well, utilizing a total of 83 barrels of Neat Cement. Upon the completion of the cementing operation the Youngquist Brothers rig # 222 was released and moved from the permanent pad. The following Geophysical Logs were run on the monitoring well: The X–Y Caliper/Gamma ray Log, from bottom of well, 1639.5' *(Plug Back Total Depth)* from pad level to the surface. A video Survey was run from 1639.5' from pad level to surface through the 6" RFP casing and open hole. The Sector Cement Bond Log was run from the bottom of the 6" RFP casing at 1574 from pad level to 1000' from pad level. The top of cement was recorded at 1260' from pad level. There were no unusual construction events during the reporting period.

During the coming week, the contractor will start on the surface piping and permanent pad completion. Most all the material for this work has arrived on location.

Attachments: Engineer's Daily Reports
Geophysical Logs

a:

MEMORANDUM

CH2M HILL

TO:	Lindsey Sampson/Lee County Steve Anderson/SFWMD Ron Reese/USGS Steve Morrison/Johnson Eng.. Lonnie Howard/Johnson Eng.	Jack Myers/FDEP-FMY Joe Haberfeld/FDEP-Tlh. Nancy Marsh/USEPA Tom McCormick/CH2M HILL Bill Beddow/CH2M HILL
FROM:	David McNabb/CH2M HILL	
DATE:	June 19, 1998	
SUBJECT:	Weekly Summary No. 23 May 12 through June 18, 1998	
PROJECT:	Fort Myers Beach WWTP IW-1	

Summary of Engineer's/Driller's Log

The twenty-third week of construction on the injection well system at the Fort Myers Beach Wastewater Treatment Plant ended on June 18, 1998. Drilling of injection well IW-1 and monitor well MW-1 is now complete. Testing and installation of surface equipment will be completed in the near future. During this week, a casing pressure test was successfully conducted on monitor well MW-1. A temperature log and background gamma ray log was conducted on IW-1 on June 15, 1998. A radioactive tracer survey was conducted on IW-1 on June 16, 1998. A copy of the temperature log will be included with the next weekly summary. The background gamma ray log and the radioactive tracer survey will be included with the request for operational testing. Salt was not used during the reporting period. There were no unusual construction events during the reporting period.

It is anticipated that portions of the surface piping for both wells will be installed next week.

Attachments:
- Engineer's Daily Reports
- Driller's Daily Reports
- Shallow Monitor Wells Water Quality Reports

a:

Appendix D
IW-1 Casing Mill Certificates

01/05/98 09:20 ☎7703871235 CAPPCO USA @002

STANDARD CERTIFIED TEST REPORT
GEORGIA TUBULAR PRODUCTS, INC.

GTP

Customer Name: YOUNGQUIST BROTHERS
Customer Address: 15000 PINE RIDGE ROAD
City, State, Zip: FT MYERS, FL 33908

Date: 5/8/97
Customer Order No. 103199
G.T.P. Sales Order No. 1931

Specification SPIRALWELD STEEL PIPE ASTM A139 GR B "MADE IN USA"

Heat No.	Size O.D.	Wt./Ft. or Wall Thick	Min. Hydro Test Pres. P.S.I.	MECHANICAL PROPERTIES: Yield Strength P.S.I. Point	Tensile Strength P.S.I.	Elong In 2 %	CHEMICAL ANALYSIS (%): C	Mn	P	S	Si
274723	34"	.500	620	53664	73927	38.	.20	.83	.006	.004	.208
274713				58950	76465	37.	.20	.85	.007	.006	.216
175847				54035	74077	37.	.19	.82	.007	.009	.212
→ 175836				56532	74849	36.	.21	.89	.008	.004	.223
…5839				56483	74534	37.	.20	.86	.008	.003	.219
…709				57598	76075	36.	.20	.94	.008	.006	.226
…4712				56941	74365	36.	.20	.89	.007	.003	.220
274715				56047	75706	31.	.20	.86	.008	.003	.227

274723	274713	175847	175836	175839	274709	274712	274715
4	3	4	2	4	4	2	2
	3	4	4	4	4		
			3				
			3				

The undersigned hereby certifies that the above materials have been inspected and tested in accordance with the methods prescribed in the applicable specifications and the results of such inspection and tests shown above. In determining properties or characteristics for which no methods of inspecting or testing are prescribed by said specifications, the standard mill inspection and testing practices of Georgia Tubular Products, Inc. have been applied. Unless it appears otherwise in the results of such inspection and tests shown above, the undersigned believes that said materials conform to said specifications.

Subscribed and sworn to before me

8 day of May 1997

Deanna K. Whitley — Notary Public

MY COMMISSION EXPIRES AUG. 24, 1999

R. SCOTT PANTER MFG MGR — Name & Title

GTP

Georgia Tubular Products, Inc.
109 Dent Drive, Cartersville, GA 30121
(770) 386-2553

STANDARD CERTIFIED TEST REPORT
GEORGIA TUBULAR PRODUCTS, INC.

Customer Name: YOUNGQUIST BROTHERS
Customer Address: 15465 PINE RIDGE RD
City, State, Zip: FT MYERS, FL 33908

Date: 12/31/97
Customer Order No. 20234
G.T.P. Sales Order No. 2227

Specification SPIRALWELD STEEL PIPE ASTM A139 GR B "MADE IN USA"

Heat No.	Size O.D.	Wt./Ft. or Wall Thick	Min. Hydro Test Pres. P.S.I.	MECHANICAL PROPERTIES Yield Strength P.S.I. Point	Tensile Strength P.S.I.	Elong In 2" %	CHEMICAL ANALYSIS (%) C	Mn	P	S	Si
278781	34"	.500	618	50004	75354	31.	.22	.63	.007	.007	
170241				51129	71197	31.	.21	.61	.006	.007	

Heat # Per Piece
278781 - 5
170241 - 1

The undersigned hereby certifies that the above materials have been inspected and tested in accordance with the methods prescribed in the applicable specifications and the results of such inspection and tests shown above. In determining properties or characteristics for which no methods of inspecting or testing are prescribed by said specifications, the standard mill inspection and testing practices of Georgia Tubular Products, Inc. have been applied. Unless it appears otherwise in the results of such inspection and tests shown above, the undersigned believes that said materials conform to said specifications.

Subscribed and sworn to before me

1 day of Dec 1997

[signature] Notary Public

MY COMMISSION EXPIRES AUG. 24, 1999

[signature]
R. SCOTT PANTER MFG MGR — Name & Title

Georgia Tubular Products, Inc.
109 Dent Drive, Cartersville, GA 30121
(770) 386-2553

STANDARD CERTIFIED TEST REPORT
GEORGIA TUBULAR PRODUCTS, INC.

GTP

Customer Name: YOUNGQUIST BROTHERS
Customer Address: 15465 PINE RIDGE RD
City, State, Zip: FT MYERS, FL 33908

Date: 1/13/98
Customer Order No. 20228
G.T.P. Sales Order No. 2225

Specification: SPIRALWELD STEEL PIPE ASTM A139 GR B "MADE IN USA"

Heat No.	Size O.D.	Wt./Ft. or Wall Thick	Min. Hydro Test Pres. P.S.I.	MECHANICAL PROPERTIES: Yield Strength P.S.I. Point	Tensile Strength P.S.I.	Elong In 2 %	CHEMICAL ANALYSIS (%): C	Mn	P	S	Si
279263	26"	.500	807	51490	70771	32.	.20	.62	.004	.006	
279266				54403	72363	31.	.21	.69	.004	.005	
279267				52951	70686	27.	.20	.63	.004	.006	

HEAT # PER PIECE

279263	279266	279267
4	13	49

The undersigned hereby certifies that the above materials have been inspected and tested in accordance with the methods prescribed in the applicable specifications and the results of such inspection and tests shown above. In determining properties or characteristics for which no methods of inspecting or testing are prescribed by said specifications, the standard mill inspection and testing practices of Georgia Tubular Products, Inc. have been applied. Unless it appears otherwise in the results of such inspection and tests shown above, the undersigned believes that said materials conform to said specifications.

Subscribed and sworn to before me

this 13 day of Jan. 1998

[signature] Notary Public

MY COMMISSION EXPIRES AUG 24, 1998

MY COMMISSION EXPIRES AUG 24, 19__

[signature]

R. SCOTT PANTER MFG MGR — Name & Title

Georgia Tubular Products, Inc.
109 Dent Drive, Cartersville, GA 30121
(770) 386-2550

USS ... SION OF USX CORPORATION

TUBULAR PRODUCTS CERTIFIED TEST REPORT

(TYPE B - IN ACCORDANCE WITH ISO 10474/EN10204 ...)

TIME: 13:45:38 USX

USS, USX, and ... are trade marks of USX Corporation

MILL ORDER/ITEM NO.	SHIPPERS NO.	P.O. NUMBER	VEHICLE ID.
DR26770 01		18439	

SOLD TO ADDRESS	MAIL TO ADDRESS	VENDOR
BARTOW STEEL INC P O BOX 1789 BARTOW, FL 33830-1789	BARTOW STEEL INC P O BOX 1789 BARTOW, FL 33830-1789	USS TUBULAR PRODUCTS 1807 EAST 28TH ST. LORAIN, OH 44055

SPECIFICATION AND GRADE

PIPE CARBON SMLS STD PIPE API 5L-X41ST EDITION DTD 4/1/95 GRADE B AND GRADE X42 ASTM A53-X96 ASTM A106-X95 GRADE B QUAD STENCIL ASME SA53-X1995 EDITION 1996 ADDENDUM ASME SA106-X1995 EDITION 1996 ADDENDUM GRADE B CARBON EQUIVALENT ON HEAT ANALYSIS .40 MAX BASED ON C+MN OVER 6 + (CR+MO+V) OVER 5 + (CU+NI) OVER 15 BLK BARE PE BEV 30 DEG MEETING ALL THE APPLICABLE REQUIREMENTS OF NACE STANDARD MR-01-75

MATERIAL COND: AS ROLLED — OD: 16.000 (406.400) in (mm) — WALL: 0.500 (12.700) in (mm)

TENSILE

PRODUCT IDENTIFICATION	TEST TYPE/ ORIENTATION	TEST COND.	GAUGE WIDTH IN	YIELD PSI	EXT % .50	TENSILE PSI	Y/T	ELONG % IN 2"	HARDNESS SCALE: HRB	MIN HYDRO PSI	INDEX SEQ
				MIN: 42000		MIN: 60000	MAX:	MIN: 29.5	MIN: / MAX: 100.0	2230	5
A61079	STRIP/T/B	AR	1.500	48700	.50	73100	0.67	43.0	B 82.0	2230	5

** END OF DATA THIS SHEET **

LEGEND: L - LONGITUDINAL; U - UPSET; T - TRANSVERSE; N - NORMALIZED; QT - QUENCHED & TEMPERED; SR - STRESS RELIEVED; AR - AS ROLLED; B - BODY; W - WELD

PRODUCT IDENTIFICATION	TYPE	C	MN	P	S	SI	CU	NI	CR	MO	AL	N	V	B	TI	CB	CO	CE.*
																		MAX .40
A61079	HEAT	17	103	009	007	26	03	02	05	01	036		003					.36
A61079	PROD	17	104	011	006	25	02	02	05	01	035		000					.35
A61079	PROD	18	104	011	006	25	03	02	05	01	034		000					.37

** END OF DATA THIS SHEET **

*C.E. IS BASED ON THE FOLLOWING EQUATION(S): CE=C+(MN/6)+(CR+MO+V)/5+ (NI+CU)/15

DECIMAL POSITIONS FOR ELEMENTS ARE INDICATED BY THE LEFT MARGIN, VERTICAL DOTTED LINE OR DECIMAL POINT.

Ft. Myers Injection Well

USS A ... STEEL GROUP ... DIVISION OF USX CORPORATION

TUBULAR PRODUCTS
CERTIFIED TEST REPC...
(TYPE B - IN ACCORDANCE WITH ISO 10474/EN10204 ...(50049))

DATE: 04/01/98
TIME: 13:45:38 USX

USS, USS, USX are trademarks of USX Corporation.

MILL ORDER/ITEM NO.	SHIPPERS NO.	P.O. NUMBER	
DR26770 01		18499	

MATERIAL COND: AS ROLLED

O.D.: 10.000(406.400) in (mm) WALL: 0.500 (12.700) in (mm)

PRODUCT IDENTIFICATION	FLAT	BEND	GRAIN SIZE	MIN COLLAPSE	CHARPY V-NOTCH IMPACT TESTING: DIR	TEST LOC.	TEMP	SIZE	TEST COND.	FT-LBS 1	2	3	AVG	% SHEAR 1	2	3	AVG
A61079	OK																

** END OF DATA THIS SHEET **

LEGEND: L - LONGITUDINAL T - TRANSVERSE B - BODY W - WELD HAZ - HEAT AFFECTED ZONE

TESTING / INSPECTION INFORMATION

TEST / INSPECTION	YES	RESULTS / COMMENTS
FULL LENGTH VISUAL	X	
FULL LENGTH EMI	X	
FULL LENGTH MPI	X	OD X OD/ID ___ L ___ L/T X
FULL LENGTH UT		
END AREA INSPECTION (PLAIN END)		OD ___ OD/ID ___ L ___ L/T ___
SPECIAL END AREA (SEA) INSP.		MPI ___ UT ___
FULL LENGTH DRIFT		MPI ___ UT ___
		DRIFT MANDREL SIZE:

ADDITIONAL NOTES/COMMENTS

ALL MELTING AND MANUFACTURING TOOK PLACE IN THE USA. NO REPAIRS BY WELDING. NO MERCURY OR MERCURY COMPOUNDS ARE ADDED TO THE STEEL AND ALL MERCURY BEARING EQUIPMENT IS PROTECTED BY A DOUBLE BOUNDARY OF CONTAINMENT.

THIS IS TO CERTIFY THAT THE PRODUCT DESCRIBED HEREIN WAS MANUFACTURED, SAMPLED, TESTED AND/OR INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND FULFILLS THE REQUIREMENTS IN SUCH RESPECTS.

PREPARED BY THE OFFICE OF: F.J. MIKULSKI MGR. MET. & Q.A. USS TUBULAR PRODUCTS

DATE 04/01/98

Appendix E
MW-1 Casing Mill Certificates

STANDARD CERTIFIED TEST REPORT
GEORGIA TUBULAR PRODUCTS, INC.

Customer Name YOUNGQUIST BROTHERS
Customer Address 15465 PINE RIDGE RD
City, State, Zip FT MYERS, FL 33908

Date: 12/31/97
Customer Order No. 20228
G.T.P. Sales Order No. 2225

Specification SPIRALWELD STEEL PIPE ASTM A139 GR B "MADE IN USA"

Heat No.	Size O.D.	Wt./Ft. or Wall Thick	Min. Hydro Test Pres. P.S.I.	Mechanical Properties: Yield Strength P.S.I. Point	Tensile Strength P.S.I.	Elong in 2 %	Chemical Analysis (%): C	Mn	P	S	Si
B7V2298	24"	.500	875	48700	68500	45.	.16	.88	.009	.008	

Heat # per piece
B7V2298 - 4 pcs

The undersigned hereby certifies that the above materi[al] applicable specifications and the results of such inspect[ion] methods of inspecting or testing are prescribed by sai[d] Products, Inc. have been applied. Unless it appears othe[rwise] that said materials conform to said specifications.

Subscribed and sworn to before me

31 day of Dec 19 97

Deanna L Whitley
Notary Public
MY COMMISSION EXPIRES AUG. 24, 1999

USS A DIVISION OF USX CORPORATION

TUBULAR PRODUCTS
CERTIFIED TEST REPORT
(TYPE B - IN ACCORDANCE WITH ISO 10474/EN10204 ... 50049)

TIME: 13:45:38 USX™

USS, USS, USX are trademarks of USX Corporation

MILL ORDER/ITEM NO.	SHIPPERS NO.	P.O. NUMBER	
0026770 01		18439	

MATERIAL COND: AS ROLLED

O.D.: 16.000(406.400) in (mm) WALL: 0.500 (12.700) in (mm)

PRODUCT IDENTIFICATION	FLAT	BEND	GRAIN SIZE	MIN COLLAPSE	CHARPY V-NOTCH IMPACT TESTING: ORI	TEST LOC.	TEMP	SIZE	TEST COND.	FT-LBS 1	FT-LBS 2	FT-LBS 3	FT-LBS AVG	% SHEAR 1	% SHEAR 2	% SHEAR 3	% SHEAR AVG
A61079	OK																

** END OF DATA THIS SHEET **

LEGEND: L - LONGITUDINAL T - TRANSVERSE B - BODY W - WELD HAZ - HEAT AFFECTED ZONE

TESTING / INSPECTION INFORMATION

TEST / INSPECTION	YES	RESULTS / COMMENTS
FULL LENGTH VISUAL	X	
FULL LENGTH EMI	X	OD _X_ OD/ID ___ L ___ UT _X_
FULL LENGTH MPI		
FULL LENGTH UT		OD ___ OD/ID ___ L ___ UT ___
END AREA INSPECTION (PLAIN END)		MPI ___ UT ___
SPECIAL END AREA (SEA) INSP.		MPI ___ UT ___
FULL LENGTH DRIFT		DRIFT MANDREL SIZE:

ADDITIONAL NOTES/COMMENTS

ALL MELTING AND MANUFACTURING TOOK PLACE IN THE USA. NO REPAIRS BY WELDING. NO MERCURY OR MERCURY COMPOUNDS ARE ADDED TO THE STEEL AND ALL MERCURY BEARING EQUIPMENT IS PROTECTED BY A DOUBLE BOUNDARY OF CONTAINMENT.

THIS IS TO CERTIFY THAT THE PRODUCT DESCRIBED HEREIN WAS MANUFACTURED, SAMPLED, TESTED AND/OR INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND FULFILLS THE REQUIREMENTS IN SUCH RESPECTS.

PREPARED BY THE OFFICE OF: F.J. MIKULSKI MGR. MET. & Q.A. USS TUBULAR PRODUCTS

DATE 04/01/98

TUBULAR FIBERGLASS COMPANY
11811 Proctor Road, Houston, Texas 77038
TEL (713) 847-2987 FAX (713) 847-1931

March 1, 1994

RED BOX® 2500

FIBERGLASS TUBING, CASING, AND LINERS
AROMATIC AMINE CURED EPOXY RESIN

DIMENSIONAL SPECIFICATIONS

Nominal Size (inches)	Nominal O.D. (inches)	Nominal I.D. (inches)	Minimum Drift Dia. (inches)	Pin Upset Dia. (inches)	Max. Box O.D. (inches)	Nominal Wall (inches)	Nominal Weight		Connection Type (API 5B 2.6a* and 2.3**)
							(Lbs/Ft)	(Lbs/Jt)	
2-3/8	2.50	2.00	1.89	2.70	3.35	0.25	1.6	47	2-3/8" 8 Rd EUE Long*
2-7/8	3.10	2.50	2.38	3.19	3.88	0.31	2.3	69	2-7/8" 8 Rd EUE Long*
3-1/2	3.77	3.00	2.89	3.85	4.66	0.38	3.4	102	3-1/2" 8 Rd EUE Long*
4-1/2	5.01	4.00	3.87	5.01	5.80	0.51	5.9	177	4-1/2" 8 Rd EUE Long*
5-1/2	5.53	4.41	4.31	5.60	6.78	0.56	7.3	220	5-1/2" 8 Rd Csg Long**
6-5/8	6.85	5.44	5.31	6.85	8.08	0.71	11.2	335	6-5/8" 8 Rd Csg Long**
7-5/8	7.82	6.21	6.07	7.82	9.27	0.81	14.5	436	7-5/8" 8 Rd Csg Long**
9-5/8	9.82	7.84	7.73	9.82	11.73	0.99	23.8	715	9-5/8" 8 Rd Csg Long**

Standard Joint Length: 30 Feet

PERFORMANCE AND RATINGS (-60°F to +200°F)

Pipe Size (inches)	Pressure Rating (psi)	Mill Test Pressure (psi)	Collapse Rating (psi)	Axial Tension Rating (Lbs)	Stretch vs Tension Over Pipe Wt-(Ft)
2-3/8	2,500	2,500	3,300	18,300	0.197 x P x L
2-7/8	2,500	2,500	3,300	24,900	0.129 x P x L
3-1/2	2,500	2,500	3,300	33,200	0.087 x P x L
4-1/2	2,500	2,500	3,300	47,800	0.050 x P x L
5-1/2	2,500	2,500	3,300	54,500	0.041 x P x L
6-5/8	2,500	2,500	3,400	73,600	0.026 x P x L
7-5/8	2,500	2,500	3,400	90,700	0.020 x P x L
9-5/8	2,500	2,500	3,400	114,800	0.012 x P x L

P = Tensile Load (1000 lbs)
L = String Length (Feet)

MECHANICAL AND PHYSICAL PROPERTIES

PROPERTY	VALUE	UNIT	TEST METHOD
Tensile Strength, Hoop	31,300	psi	ASTM D1599
Tensile Strength, Axial	30,000	psi	ASTM D2105
Modulus of Elasticity, Axial	3.0	10E+6 psi	ASTM D2105
Long Term Hydrostatic Strength at 20 Years	19,193	psi	ASTM D2992 (B)
Specific Gravity	1.9	---	ASTM D792
Density	0.07	lb./cu./in.	ASTM D792
Thermal Conductivity	1.4	Btu/hr/ft2 in/°F	---
Thermal Expansion Coefficient (Linear)	1.1	10E-5 in/in/°F	ASTM D696
Flow Factor	150	---	Hazen Williams

Appendix F
Surficial Monitor Well Water Quality Data

Project: Fort Myers Beach Wastewater Treatment Plant Deep Injection Well

Surficial Monitor Well Water Quality Data
Southeast Monitor Well (SE)

Date	Time (hours)	Depth to Water (ft-btoc)	Conductivity (umhos/cm)	Chloride (mg/L)	Temperature (degrees C)	pH (S.U.)	Remarks	Sampled By
1/12/98	8:49	7.27	850	75	23	7.2	Initial sampling before drilling began.	LVH
1/19/98	9:15	6.67	1,120	150	23	7.0		LVH
1/26/98	11:10	7.09	1,060	188	22	6.8	sampled @ +/-12:00 by contractor	LVH
2/298	8:15	7.31	1,120	156	22	6.9		LVH
2/9/98	9:00	6.05	1,100	162	24	7.0		MKB
2/16/98	9:00	5.80	1,100	160	25	7.1		MKB
2/23/98	7:30	6.00	1,120	158	25	7.0		MKB
3/4/98	12:30	6.00	1,100	168	25	7.0		MKB
3/9/98	9:20	5.90	1,100	154	24	7.0		MKB
3/17/98	8:00	6.80	1,080	164	25	7.1		MKB
3/23/98	14:00	5.90	1,100	160	25	7.1		MKB
3/1/98	13:00	6.90	1,120	164	25	7.1		MKB
4/7/98	9:30	7.45	1,100	152	23	7.1		LVH
4/21/98	9:00	7.10	1,110	156	23	7.1		MKB
4/27/98	13:30	8.00	1,120	160	24	7.2		MKB
5/5/98	14:00	7.60	1,120	156	24	7.2		MKB
5/12/98	14:00	8.00	1,200	150	24	7.1		MKB
5/21/98	8:45	8.30	1,120	158	25	7.1		MKB
5/29/98	7:00	7.60	1,120	148	24	7.1	Construction completed, last sampling event.	MKB

ft-btoc: feet below top of casing
umhos/cm: micromhos per centimeter
mg/L: milligrams per liter
C: Celsius
S.U.: standard units
TOC: Top of Casing

Project: Fort Myers Beach Wastewater Treatment Plant Deep Injection Well

Surficial Monitor Well Water Quality Data
Northeast Monitor Well (NE)

Date	Time (hours)	Depth to Water (ft-btoc)	Conductivity (umhos/cm)	Chloride (mg/L)	Temperature (degrees C)	pH (S.U.)	Remarks	Sampled By
1/12/98	9:00	5.48	1,180	161	24	7.0	Initial sampling before drilling began.	LVH
1/19/98	9:45	4.92	1,300	180	23	6.9		LVH
1/26/98	11:12	5.35	1,370	189	23	7.1	sampled @ +/-12:00 by contractor	LVH
2/2/98	7:55	5.56	1,300	176	23	7.0		LVH
2/9/98	9:00	4.30	1,310	178	25	7.1		MKB
2/16/98	9:00	4.00	1,460	196	26	7.1		MKB
2/23/98	7:30	4.40	1,360	178	25	7.2		MKB
3/4/98	12:30	4.20	1,350	192	25	7.0		MKB
3/9/98	9:20	4.20	1,320	188	24	7.0		MKB
3/17/98	8:00	5.20	1,290	188	25	7.1		MKB
3/23/98	14:00	4.00	1,320	190	25	7.0		MKB
3/31/98	13:00	5.10	1,460	180	25	7.1		MKB
4/7/98	9:30	5.70	1,310	180	24	7.0		LVH
4/21/98	9:00	6.00	1,330	188	24	7.0		MKB
4/27/98	13:30	6.00	1,340	188	23	7.1		MKB
5/5/98	14:00	5.90	1,360	182	24	7.2		MKB
5/12/98	14:00	6.30	1,360	176	24	7.1		MKB
5/21/98	8:45	6.60	1,320	174	25	7.0		MKB
5/29/98	7:00	5.80	1,300	174	24	7.1	Construction completed, last sampling event.	MKB

ft-btoc: feet below top of casing
umhos/cm: micromhos per centimeter
mg/L: milligrams per liter
C: Celcius
S.U.: standard units
TOC: Top of Casing

Project: Fort Myers Beach Wastewater Treatment Plant Deep Injection Well

Surficial Monitor Well Water Quality Data
Northwest Monitor Well (NW)

Date	Time (hours)	Depth to Water (ft-btoc)	Conductivity (umhos/cm)	Chloride (mg/L)	Temperature (degrees C)	pH (S.U.)	Remarks	Sampled By
1/12/98	9:55	casing bent	1,200	169	25	7.0	Initial sampling before drilling began.	LVH
1/19/98	10:00	5.76	1,180	174	24	7.2		LVH
1/26/98	11:05	6.22	1,180	186	23	6.9	sampled @ +/-12:00 by contractor	LVH
2/2/98	7:38	6.40	1,190	174	23	7.1		LVH
2/9/98	9:00	5.14	1,200	150	24	7.1		MKB
2/16/98	9:00	4.90	1,240	158	24	7.1		MKB
2/23/98	7:30	5.30	1,240	146	24	7.0		MKB
3/4/98	12:30	5.30	1,260	154	25	7.0		MKB
3/9/98	9:20	4.90	1,240	148	25	6.9		MKB
3/17/98	8:00	6.10	1,160	164	25	7.0		MKB
3/23/98	14:00	4.90	1,240	162	25	7.1		MKB
3/31/98	13:00	5.90	1,300	162	25	7.0		MKB
4/7/98	9:30	7.55	1,220	160	24	6.9		LVH
4/21/98	9:00	7.90	1,250	158	24	6.9		MKB
4/27/98	13:30	7.90	1,240	174	23	7.0		MKB
5/5/98	14:00	7.70	1,290	160	24	6.9		MKB
5/12/98	14:00	8.20	1,280	164	24	7.0		MKB
5/21/98	8:45	7.70	1,260	152	25	6.9	Construction completed, last sampling event.	MKB
5/29/98	7:00	7.20	1,250	164	24	7.0		MKB

ft-btoc: feet below top of casing
umhos/cm: micromhos per centimeter
mg/L: milligrams per liter
C: Celcius
S.U.: standard units
TOC: Top of Casing

Project: Fort Myers Beach Wastewater Treatment Plant Deep Injection Well

Surficial Monitor Well Water Quality Data
Southwest Monitor Well (SW)

Date	Time (hours)	Depth to Water (ft-btoc)	Conductivity (umhos/cm)	Chloride (mg/L)	Temperature (degrees C)	pH (S.U.)	Remarks	Sampled By
1/12/98	8:21	5.26	1,060	178	23	7.1	Initial sampling before drilling began.	LVH
1/19/98	9:00	4.71	1,200	194	23	7.0		LVH
1/26/98	11:08	5.19	1,280	215	23	7.1	sampled @ +/-12:00 by contractor	LVH
2/2/98	8:05	5.38	1,260	196	23	7.2		LVH
2/9/98	9:00	4.10	1,260	194	25	7.2		LVH
2/16/98	9:00	3.90	1,260	192	25	7.2		MKB
2/23/98	7:30	4.20	1,240	180	24	7.2		MKB
3/4/98	12:30	4.10	1,220	174	25	7.0		MKB
3/9/98	9:20	3.90	1,200	164	24	7.0		MKB
3/17/98	8:00	5.00	1,150	164	25	7.2		MKB
3/23/98	14:00	4.00	1,180	158	25	7.1		MKB
3/31/98	13:00	5.00	1,200	164	25	7.2		MKB
4/7/98	9:30	5.50	1,270	156	23	7.0		LVH
4/21/98	9:00	5.90	1,160	150	23	7.1		MKB
4/27/98	13:30	6.00	1,180	160	24	7.2		MKB
5/5/98	14:00	5.70	1,200	148	24	7.2		MKB
5/12/98	14:00	6.10	1,140	148	24	7.2		MKB
5/21/98	8:45	6.60	1,320	174	25	7.0		MKB
5/29/98	7:00	5.60	1,200	156	25	7.1	Construction completed, last sampling event.	MKB

ft-btoc: feet below top of casing
umhos/cm: micromhos per centimeter
mg/L: milligrams per liter
C: Celcius
S.U.: standard units
TOC: Top of Casing

Appendix G
Lithologic Logs for IW-1 and MW-1

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Lithologic Description

Date	Depth (ft. bpl) From	To	Observer's Description
1/12/98	0	10	Limestone (60%), yellowish gray, fine sand grained, sparry cement, low porosity, well consolidated; shell fragments (40%), light gray, coarse sand to fine gravel grained, unconsolidated
1/12/98	10	20	Same as above
1/12/98	20	30	Shell fragments, light gray, unconsolidated
1/12/98	30	40	Same as above
1/12/98	40	50	Clay (80%), greenish gray, moderate plasticity, phosphatic; shell fragments (20%), light gray, unconsolidated
1/12/98	50	60	Clay, greenish gray, high plasticity, phosphatic
1/12/98	60	70	Same as above
1/12/98	70	80	Same as above
1/12/98	80	90	Same as above
1/12/98	90	100	Same as above
1/12/98	100	110	Same as above
1/12/98	110	120	Same as above, with limestone (20%), light gray, fine sand grained, low porosity, moderately consolidated
1/12/98	120	130	Same as above, reduce limestone to 10%
1/12/98	130	140	Phosphatic Clay, medium gray, high plasticity, trace of limestone
1/12/98	140	150	Limestone, light gray, fine sand grained, some quartz, sparry cement, low porosity, phosphatic, well consolidated
1/12/98	150	160	Same as above
1/12/98	160	170	Same as above
1/12/98	170	180	Fossiliferous Limestone, yellowish gray, primarily coral fragments, moderate porosity, phosphatic, moderately consolidated
1/12/98	180	190	No sample
1/12/98	190	200	No sample
1/12/98	200	210	Phosphatic Limestone, medium gray, fine sand grained, sparry cement, low to moderate porosity, poorly consolidated
1/12/98	210	220	Same as above
1/12/98	220	230	Limestone (60%), yellowish gray, fine sand grained, sparry cement, low porosity, well consolidated; phosphatic limestone (40%), medium gray, fine sand grained, sparry cement, low to moderate porosity, poorly consolidated
1/13/98	230	240	Limestone, light gray, fine sand grained, some quartz, sparry cement, low porosity, phosphatic, well consolidated
1/13/98	240	250	Same as above
1/13/98	250	260	Same as above
1/13/98	260	270	Same as above
1/13/98	270	280	Same as above
1/13/98	280	290	Same as above
1/13/98	290	300	Same as above
1/13/98	300	310	Same as above
1/13/98	310	320	Same as above
1/13/98	320	330	Limestone (70%), yellowish gray, fine sand grained, sparry cement, low porosity, phosphatic, moderately consolidated; clay (30%), light gray,
1/13/98	330	340	Limestone, yellowish gray, fine sand grained, micritic cement, moderate porosity, slightly phosphatic, poorly consolidated
1/13/98	340	350	Clay (80%), light gray, phosphatic; limestone (20%), yellowish gray, fine sand grained, micritic cement, poorly consolidated
1/13/98	350	360	Clay, greenish gray, high plasticity, phosphatic, trace of limestone
1/13/98	360	370	Limestone, light gray, fine sand grained, some quartz, sparry cement, low porosity, phosphatic, well consolidated

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Lithologic Description

Date	Depth (ft. bpl) From	To	Observer's Description
1/13/98	370	380	Clay (80%), light gray, phosphatic; limestone (20%), yellowish gray, fine sand grained, micritic cement, poorly consolidated
1/13/98	380	390	Limestone (60%), light gray, fine sand grained, sparry cement, moderate porosity, trace of phosphate, moderately consolidated; clay (40%), greenish gray to light gray, moderately plastic
1/13/98	390	400	Same as above, increase limestone to 90%, decrease clay to 10%
1/13/98	400	410	Phosphatic Clay (70%), light gray; limestone (30%), yellowish gray, fine sand grained, micritic cement, poorly consolidated
1/13/98	410	420	Limestone (60%), light gray, fine sand grained, sparry cement, moderate porosity, phosphatic, moderately consolidated; clay (40%), light gray,
1/13/98	420	430	Limestone (70%), yellowish gray, fine sand grained, sparry cement, moderate porosity, phosphatic, moderately consolidated; clay (30%), light gray, slightly phosphatic
1/13/98	430	440	Clay, light gray, moderately plastic, phosphatic
1/13/98	440	450	Same as above
1/13/98	450	460	Same as above
1/13/98	460	470	Same as above
1/20/98	470	480	Same as above
1/20/98	480	490	Clay (80%), light gray, phosphatic; limestone (20%), yellowish gray, fine sand grained, micritic cement, poorly consolidated
1/20/98	490	500	Same as above, increase limestone to 40%
1/20/98	500	510	Same as above, decrease limestone to 20%
1/20/98	510	520	Same as above, increase limestone to 40%
1/20/98	520	530	Limestone, light olive gray, fine sand grained, sparry cement, low porosity, poorly to moderately consolidated
1/20/98	530	540	Limestone (70%), light gray, fine sand grained, sparry cement, moderate porosity, phosphatic, moderately consolidated; clay (30%), light gray, slightly
1/20/98	540	550	Fossiliferous Limestone, light gray, fine sand to fine gravel sized, sparry cement, high porosity, slightly phosphatic, moderately consolidated
1/20/98	550	560	Same as above, with 20% light gray clay
1/20/98	560	570	Clay, medium gray, phosphatic
1/20/98	570	580	Phosphatic Limestone (70%), medium gray, fine to medium sand grained, sparry cement, moderate porosity, moderately consolidated; clay (30%), medium gray, phosphatic
1/20/98	580	590	Limestone, tan, fine to medium sand grained, sparry cement, low porosity, trace of phosphate, moderately consolidated
1/21/98	590	600	Same as above, with moderate porosity
1/21/98	600	610	Same as above
1/21/98	610	620	Same as above
1/21/98	620	630	Limestone, tan, fine to medium sand grained, sparry cement, moderate porosity, phosphatic, moderately consolidated
1/21/98	630	640	Same as above
1/21/98	640	650	Limestone, light gray, coarse sand sized recrystallized fossil fragments in a micritic matrix, low porosity (moldic), trace of phosphate, well consolidated
1/21/98	650	660	Limestone, tan, fine to medium sand grained, sparry cement, moderate porosity, phosphatic, moderately consolidated
1/21/98	660	670	Same as above
1/21/98	670	680	Limestone, tan, fine sand grained, sparry cement, high porosity, phosphatic, poorly to moderately consolidated
1/21/98	680	690	Same as above
1/21/98	690	700	Same as above

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Lithologic Description

Date	Depth (ft. bpl) From	To	Observer's Description
1/21/98	700	710	Phosphatic Limestone, medium gray, fine sand grained, sparry cement, low to moderate porosity, poorly consolidated
1/21/98	710	720	Limestone, yellowish gray, fine sand grained, sparry cement, low porosity, phosphatic, moderately consolidated
1/21/98	720	730	Same as above
1/21/98	730	740	Limestone, medium gray, fine sand grained, sparry cement, low porosity, phosphatic, moderately consolidated
1/21/98	740	750	Limestone, light gray, fine to medium sand grained, sparry cement, low to moderate porosity, moderate to well consolidated
1/21/98	750	760	Same as above
1/21/98	760	770	Same as above, with 20% dolomite, medium brown, microcrystalline, low porosity, well consolidated
1/21/98	770	780	Limestone, yellowish gray, fine sand to coarse sand grained, sparry cement, moderate porosity, well consolidated
1/21/98	780	790	Limestone, yellowish gray, fine to medium sand grained, sparry cement, moderate to high porosity, moderately consolidated
1/21/98	790	800	Same as above
1/21/98	800	810	Limestone (70%), light gray, fine sand grained, sparry cement, moderate porosity, phosphatic, poorly consolidated; clay (30%), light gray, trace of fine grained quartz sand
1/21/98	810	820	Limestone, yellowish gray, contains a small amount of fine quartz sand, fine to medium sand grained, sparry cement, moderate to high porosity, trace of phosphate, moderately consolidated
1/21/98	820	830	Same as above
1/21/98	830	840	Same as above
1/21/98	840	850	Same as above
1/22/98	850	860	Limestone, yellowish gray, medium sand grained, sparry cement, moderate porosity, moderately consolidated
1/22/98	860	870	Same as above with a trace of phosphate
1/22/98	870	880	Same as above, with no phosphate and low to moderate porosity
1/22/98	880	890	Limestone, yellowish gray, fine to medium sand grained, sparry cement, moderate porosity, trace of phosphate, poorly consolidated
1/22/98	890	900	Same as above
1/22/98	900	910	Limestone, light gray to yellowish gray, fine sane grained, sparry cement, moderate porosity, well consolidated
1/22/98	910	920	Limestone, light gray, fine sand grained, sparry cement, moderate porosity, moderately consolidated
1/22/98	920	930	Same as above
1/22/98	930	940	Same as above, with 10% light gray, well consolidated micrite
1/22/98	940	950	Limestone (70%), light gray, fine sand grained, sparry cement, moderate porosity, trace of phosphate, moderately consolidated; clay (30%), light gray
1/22/98	950	960	Clay (80%), light gray, trace of phosphate; limestone (20%), yellowish gray, fine sand grained, micritic cement, poorly consolidated
1/22/98	960	970	Limestone (90%), light gray, fine to medium sand grained, low porosity, well consolidated; clay (10%), light gray
1/22/98	970	980	Limestone, light gray, fine to medium sand grained, low porosity, well
1/22/98	980	990	Same as above
1/22/98	990	1000	Same as above
1/22/98	1000	1010	Same as above
1/22/98	1010	1020	Same as above
1/22/98	1020	1030	Same as above

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Lithologic Description

Date	Depth (ft. bpl) From	To	Observer's Description
1/22/98	1030	1040	Limestone, yellowish gray, fine sand grained, moderate to high porosity, poorly to moderately consolidated
1/22/98	1040	1050	Same as above
1/22/98	1050	1060	Same as above
1/22/98	1060	1070	Same as above
1/22/98	1070	1080	Same as above
1/22/98	1080	1090	Same as above
1/22/98	1090	1100	Same as above
1/22/98	1100	1110	Same as above
1/22/98	1110	1120	Same as above
1/22/98	1120	1130	Same as above
1/22/98	1130	1140	Same as above
1/22/98	1140	1150	Same as above
1/22/98	1150	1160	Same as above
1/22/98	1160	1170	Same as above
1/22/98	1170	1180	Same as above
1/22/98	1180	1190	Same as above
1/23/98	1190	1200	Same as above
1/23/98	1200	1210	Dolomite (80%), pale yellowish brown, microcrystalline, low porosity, well consolidated; limestone (20%), yellowish gray, fine to medium sand grained, low porosity, moderately consolidated
1/23/98	1210	1220	Limestone, yellowish gray, fine sand grained, moderate to high porosity, poorly to moderately consolidated
1/23/98	1220	1230	Same as above
1/23/98	1230	1240	Same as above
1/23/98	1240	1250	Same as above
1/23/98	1250	1260	Same as above, with 20% dolomite, medium brown, microcrystalline, low porosity, well consolidated
1/23/98	1260	1270	Same as above, no dolomite
1/23/98	1270	1280	Same as above
1/23/98	1280	1290	Same as above
1/23/98	1290	1300	Same as above
1/23/98	1300	1310	Same as above
1/23/98	1310	1320	Same as above
1/23/98	1320	1330	No sample
1/23/98	1330	1340	No sample
1/23/98	1340	1350	Limestone, yellowish gray, very fine sand grained, micritic cement, low porosity, poorly consolidated
1/23/98	1350	1360	Same as above
1/23/98	1360	1370	Same as above
1/23/98	1370	1380	Limestone, yellowish gray, fine to medium sand grained, sparry cement, low porosity, poorly consolidated
1/23/98	1380	1390	Same as above
1/23/98	1390	1400	Limestone, yellowish gray, medium to coarse sand grained, sparry cement, moderate to high porosity, abundant forams, poorly consolidated
1/23/98	1400	1410	Same as above
1/23/98	1410	1420	Limestone, yellowish gray, fine sand grained, some fine quartz sand, sparry cement, low porosity, some forams (~1%), poorly consolidated
1/23/98	1420	1430	Same as above
1/26/98	1430	1440	Same as above
1/26/98	1440	1450	Limestone, yellowish gray, fine sand grained, some medium quartz sand, micritic cement, phosphatic (~5%), low porosity, moderately consolidated

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Lithologic Description

Date	Depth (ft. bpl) From	To	Observer's Description
1/26/98	1450	1460	Same as above, less phosphatic (~2%)
1/26/98	1460	1470	Limestone, yellowish gray, fine sand grained, some very fine quartz sand, sparry cement, low porosity, poor to moderately consolidated
1/26/98	1470	1480	Same as above
1/26/98	1480	1490	Same as above
1/26/98	1490	1500	Micrite, yellowish gray, trace of phosphate, moderate to well consolidated
1/26/98	1500	1510	Limestone, yellowish gray, recrystallized, small amount of fine quartz sand, sparry cement, low porosity, well consolidated
1/26/98	1510	1520	Same as above, with a trace of light gray clay
1/26/98	1520	1530	Limestone, yellowish gray, recrystallized, small amount of fine quartz sand, sparry cement, trace of phosphate, low porosity, well consolidated
1/26/98	1530	1540	Same as above, with no phosphate
1/26/98	1540	1550	Same as above, with a trace of light gray clay
1/26/98	1550	1560	Same as above
1/26/98	1560	1570	Limestone, yellowish gray, recrystallized, small amount of fine quartz sand, sparry cement, trace of phosphate, low porosity, well consolidated
1/27/98	1570	1580	Same as above, with no phosphate
1/27/98	1580	1590	Same as above, trace of phosphate
1/27/98	1590	1600	Same as above
1/27/98	1600	1610	Same as above
1/27/98	1610	1620	Same as above
1/27/98	1620	1630	Same as above
1/27/98	1630	1640	Same as above
1/27/98	1640	1650	Same as above
1/27/98	1650	1660	Same as above
1/27/98	1660	1670	Same as above
1/27/98	1670	1680	Same as above
1/27/98	1680	1690	Same as above
1/27/98	1690	1700	Same as above, with ~2% forams
1/27/98	1700	1710	Same as above, no forams, no phosphate
1/27/98	1710	1720	Same as above
1/28/98	1720	1730	Same as above
1/28/98	1730	1740	Same as above
1/28/98	1740	1750	Same as above
1/28/98	1750	1760	Same as above
1/28/98	1760	1770	Same as above
1/28/98	1770	1780	Limestone (90%), yellowish gray, recrystallized, sparry cement, trace of phosphate, low porosity, well consolidated; dolomite (10%), dusky yellowish brown, low porosity, well consolidated
1/28/98	1780	1790	Same as above
1/28/98	1790	1800	Limestone, yellowish gray, recrystallized, sparry cement, trace of phosphate, low porosity, well consolidated
1/28/98	1800	1810	Same as above, with 5% dolomite, dusky yellowish brown, low porosity, well consolidated
1/28/98	1810	1820	Same as above, no dolomite
1/28/98	1820	1830	Same as above
1/28/98	1830	1840	Same as above
1/28/98	1840	1850	Same as above
1/28/98	1850	1860	Limestone (70%), yellowish gray, recrystallized, sparry cement, moderate porosity, well consolidated; dolomitic limestone (30%), dark yellowish brown, fine sand grained, sparry cement, moderate to high porosity, well consolidated

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Lithologic Description

Date	Depth (ft. bpl) From	To	Observer's Description
1/28/98	1860	1870	Limestone, yellowish gray, recrystallized, sparry cement, trace of phosphate, low porosity, well consolidated
1/28/98	1870	1880	Same as above
1/28/98	1880	1890	Same as above with a trace of phosphate and dolomite
1/28/98	1890	1900	Same as above
3/3/98	1900	1910	Limestone, very pale orange, fine to medium sand grained, micritic cement, low to moderate porosity, moderately consolidated
3/3/98	1910	1920	Same as above
3/3/98	1920	1930	Same as above
3/3/98	1930	1940	No sample, cored interval
3/3/98	1940	1950	Limestone, very pale orange, fine to medium sand grained, micritic cement, low to moderate porosity, moderately consolidated
3/3/98	1950	1960	Same as above
3/4/98	1960	1970	No sample, cored interval
3/4/98	1970	1980	No sample, cored interval
3/4/98	1980	1990	Same as above
3/4/98	1990	2000	Limestone (80%), very pale orange, fine to medium sand grained, micritic cement, low to moderate porosity, moderately consolidated; dolomite (20%), dusky yellowish brown to dark yellowish brown, very fine grained, abundant
3/4/98			small vugs, low porosity, well consolidated
3/4/98	2000	2010	Limestone, very pale orange, fine to medium sand grained, micritic cement, low to moderate porosity, moderately consolidated
3/4/98	2010	2020	Same as above
3/4/98	2020	2030	No sample
3/4/98	2030	2040	No sample
3/5/98	2040	2050	No sample, cored interval
3/5/98	2050	2060	No sample, cored interval
3/5/98	2060	2070	Dolomite, moderate yellowish brown to dusky yellowish brown, very fine grained, sucrosic, low porosity, well consolidated
3/5/98	2070	2080	No sample
3/5/98	2080	2090	No sample
3/5/98	2090	2100	No sample
3/5/98	2100	2110	No sample
3/5/98	2110	2120	Dolomite, moderate yellowish brown to dusky yellowish brown, microcrystalline, low porosity, well consolidated
3/5/98	2120	2130	Same as above
3/5/98	2130	2140	Same as above
3/5/98	2140	2150	Same as above
3/5/98	2150	2160	Same as above
3/6/98	2160	2170	Same as above
3/6/98	2170	2180	Same as above
3/6/98	2180	2190	Same as above
3/6/98	2190	2200	Same as above
3/6/98	2200	2210	Same as above
3/6/98	2210	2220	Dolomite, moderate yellowish brown to light brown, microcrystalline, low porosity, well consolidated
3/6/98	2220	2230	Same as above
3/6/98	2230	2240	Same as above
3/6/98	2240	2250	Same as above
3/6/98	2250	2260	Dolomite (90%), moderate yellowish brown to light brown, microcrystalline, low porosity, well consolidated; dolomitic limestone (10%), very pale orange, very fine sand grained, low porosity, well consolidated

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Lithologic Description

Date	Depth (ft. bpl) From	To	Observer's Description
3/6/98	2260	2270	Same as above
3/6/98	2270	2280	Dolomite, moderate yellowish brown to light brown, microcrystalline, low porosity, well consolidated
3/6/98	2280	2290	Dolomitic Limestone (70%), pale yellowish gray to light brownish gray, very fine grained, low porosity, well consolidated; dolomite (30%), moderate yellowish brown, microcrystalline, moderate porosity, well consolidated
3/6/98	2290	2300	Dolomite, moderate yellowish brown to light brown, microcrystalline, low porosity, well consolidated
3/6/98	2300	2310	Dolomitic Limestone (50%), pale yellowish gray to light brownish gray, very fine grained, low porosity, well consolidated; dolomite (50%), moderate yellowish brown, microcrystalline, moderate porosity, well consolidated
3/6/98	2310	2320	Dolomite, moderate yellowish brown to light brown, microcrystalline, low porosity, well consolidated
3/6/98	2320	2330	Same as above
3/6/98	2330	2340	Dolomite (50%), moderate yellowish brown, microcrystalline, low porosity, well consolidate; limestone (50%), very pale orange, fine sand grained, sparry cement, moderate porosity, moderately consolidated
3/6/98	2340	2350	Same as above
3/6/98	2350	2360	Same as above
3/6/98	2360	2370	Same as above
3/6/98	2370	2380	Same as above
3/6/98	2380	2390	No sample, cored interval
3/6/98	2390	2400	No sample, cored interval
3/10/98	2400	2410	No sample, cored interval
3/10/98	2410	2420	Limestone, very pale orange, fine sand grained, sparry cement, low porosity, well consolidated
3/10/98	2420	2430	Same as above
3/10/98	2430	2440	Same as above
3/10/98	2440	2450	Same as above
3/10/98	2450	2460	Dolomite, pale yellowish brown, microcrystalline, low porosity, well consolidated
3/10/98	2460	2470	Limestone, very pale orange, fine sand grained, sparry cement, low porosity, well consolidated
3/10/98	2470	2480	Same as above
3/10/98	2480	2490	Same as above
3/10/98	2490	2500	Same as above
3/10/98	2500	2510	Same as above
3/10/98	2510	2520	Same as above
3/10/98	2520	2530	Same as above
3/10/98	2530	2540	Same as above
3/10/98	2540	2550	Same as above
3/10/98	2550	2560	Same as above
3/11/98	2560	2570	No sample
3/11/98	2570	2580	Limestone, light brown, fine sand grained, sparry cement, low porosity, moderately consolidated
3/11/98	2580	2590	Dolomitic Limestone, medium brown, fine sand grained, low porosity, well consolidated
3/11/98	2590	2600	Dolomite, moderate yellowish brown to dusky yellowish brown, microcrystalline, low porosity, well consolidated
3/11/98	2600	2610	Same as above
3/11/98	2610	2620	Dolomitic Limestone, pale brown, fine sand grained, low porosity, well consolidated

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Lithologic Description

Date	Depth (ft. bpl) From	To	Observer's Description
3/11/98	2620	2630	Dolomite (60%), moderate yellowish brown to dusky yellowish brown, microcrystalline, low porosity, well consolidated; dolomitic limestone, medium brown, fine sand grained, low porosity, well consolidated
3/11/98	2630	2640	Dolomite, dusky yellowish brown, microcrystalline, low porosity, well
3/11/98	2640	2650	Same as above
3/11/98	2650	2660	Same as above
3/11/98	2660	2670	Same as above
3/11/98	2670	2680	Same as above
3/11/98	2680	2690	Same as above
3/11/98	2690	2700	Dolomitic Limestone, pale brown, fine sand grained, low porosity, well consolidated
3/11/98	2700	2710	Dolomite, dusky yellowish brown, microcrystalline, low porosity, well
3/11/98	2710	2720	Dolomite (60%), dusky yellowish brown, microcrystalline, low porosity, well consolidated; dolomitic limestone (40%), pale brown, fine sand grained, low porosity, well consolidated
3/11/98	2720	2730	Dolomite, dusky yellowish brown, microcrystalline, low porosity, well
3/11/98	2730	2740	Same as above
3/11/98	2740	2750	Same as above
3/12/98	2750	2760	Same as above
3/12/98	2760	2770	Same as above
3/12/98	2770	2780	Same as above
3/12/98	2780	2790	Same as above
3/12/98	2790	2800	Same as above
3/12/98	2800	2810	Same as above
3/12/98	2810	2820	Dolomite, dark yellowish brown, microcrystalline, low porosity, well
3/13/98	2820	2830	Same as above
3/13/98	2830	2840	Same as above
3/13/98	2840	2850	Same as above
3/13/98	2850	2860	Same as above
3/13/98	2860	2870	Same as above
3/16/98	2870	2880	Same as above
3/16/98	2880	2890	Same as above
3/16/98	2890	2900	Same as above
3/16/98	2900	2910	Same as above
3/16/98	2910	2920	Same as above
3/16/98	2920	2930	Same as above
3/17/98	2930	2940	Same as above
3/17/98	2940	2950	Dolomite, moderate yellowish brown to dark yellowish brown, fine to medium sand grained, moderate to high porosity, well consolidated
3/17/98	2950	2960	Dolomite, moderate yellowish brown to black, microcrystalline, low porosity, well consolidated
3/17/98	2960	2970	Dolomite, moderate yellowish brown to black, microcrystalline, low primary porosity, numerous small vugs, vugs are not interconnected, well consolidated
3/17/98	2970	2980	Same as above
3/17/98	2980	2990	Dolomite, dusky yellowish brown to black, microcrystalline, low porosity, well consolidated
3/17/98	2990	3000	Dolomite, dark yellowish brown, microcrystalline, low primary porosity, numerous small vugs, vugs are not interconnected, well consolidated
3/17/98	3000	3010	Dolomite, moderate yellowish brown to dusky yellowish brown, microcrystalline, low porosity, well consolidated
3/17/98	3010	3020	Dolomite, dark yellowish brown, microcrystalline, low primary porosity, numerous small vugs, vugs are not interconnected, well consolidated

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Lithologic Description

Date	Depth (ft. bpl) From	To	Observer's Description
3/17/98	3020	3030	Same as above

ft. bpl = feet below pad level

Fort Myers Beach Wastewater Treatment Plant
Monitor Well MW-1
Lithologic Description

Date	Depth (ft. bpl) From	To	Observer's Description
5/15/98	0	10	Limestone (60%), yellowish gray, fine sand grained, sparry cement, low porosity, well consolidated; shell fragments (40%), light gray, coarse sand to fine gravel grained, unconsolidated
5/15/98	10	20	Same as above
5/15/98	20	30	Shell fragments, light gray, unconsolidated
5/15/98	30	40	Sand, light brown, very fine grained, unconsolidated
5/15/98	40	50	Clay (80%), greenish gray, moderate plasticity, phosphatic; shell fragments (20%), light gray, unconsolidated
5/15/98	50	60	Clay, greenish gray, high plasticity, phosphatic
5/15/98	60	70	Same as above
5/15/98	70	80	Same as above
5/15/98	80	90	Same as above
5/15/98	90	100	Same as above
5/15/98	100	110	Same as above, with limestone (20%), light gray, fine sand grained, some quartz sand, moderate porosity, moderately consolidated
5/15/98	110	120	Same as above, reduce limestone to 10%
5/15/98	120	130	Same as above
5/15/98	130	140	Phosphatic Clay, medium gray, high plasticity, trace of limestone
5/15/98	140	150	Limestone, light gray, fine sand grained, some quartz, sparry cement, low porosity, phosphatic, well consolidated
5/15/98	150	160	Same as above
5/15/98	160	170	Same as above
5/15/98	170	180	Fossiliferous Limestone, yellowish gray, primarily coral fragments, moderate porosity, phosphatic, moderately consolidated
5/15/98	180	190	Limestone, yellowish gray, medium sand grained, sparry cement, high porosity, abundant shell fragments, moderately to poorly consolidated
5/15/98	190	200	Same as above
5/15/98	200	210	Phosphatic Limestone, medium gray, fine sand grained, sparry cement, low to moderate porosity, poorly consolidated
5/15/98	210	220	Same as above
5/15/98	220	230	Limestone (60%), yellowish gray, fine sand grained, sparry cement, low porosity, well consolidated; phosphatic limestone (40%), medium gray, fine sand grained, sparry cement, low to moderate porosity, poorly consolidated
5/15/98	230	240	Limestone, light gray, fine sand grained, some quartz, sparry cement, low porosity, phosphatic, well consolidated
5/15/98	240	250	Same as above
5/15/98	250	260	Same as above
5/15/98	260	270	Same as above
5/15/98	270	280	Same as above
5/15/98	280	290	Same as above
5/15/98	290	300	Same as above
5/15/98	300	310	Same as above
5/15/98	310	320	Same as above
5/15/98	320	330	Limestone (70%), yellowish gray, fine sand grained, sparry cement, low porosity, phosphatic, moderately consolidated; clay (30%), light gray,
5/15/98	330	340	Limestone, yellowish gray, fine sand grained, micritic cement, moderate porosity, slightly phosphatic, poorly consolidated
5/15/98	340	350	Clay (80%), light gray, phosphatic; limestone (20%), yellowish gray, fine sand grained, micritic cement, poorly consolidated
5/15/98	350	360	Clay, greenish gray, high plasticity, phosphatic, trace of limestone
5/15/98	360	370	Limestone, light gray, fine sand grained, some quartz, sparry cement, low porosity, phosphatic, well consolidated

Fort Myers Beach Wastewater Treatment Plant
Monitor Well MW-1
Lithologic Description

Date	Depth (ft. bpl) From	To	Observer's Description
5/15/98	370	380	Clay (80%), light gray, phosphatic; limestone (20%), yellowish gray, fine sand grained, micritic cement, poorly consolidated
5/15/98	380	390	Limestone (60%), light gray, fine sand grained, sparry cement, moderate porosity, trace of phosphate, moderately consolidated; clay (40%), greenish gray to light gray, moderately plastic
5/15/98	390	400	Same as above, increase limestone to 90%, decrease clay to 10%
5/15/98	400	410	Limestone (60%), light gray, fine sand grained, sparry cement, moderate porosity, phosphatic, moderately consolidated; clay (40%), light gray,
5/20/98	410	420	Limestone (70%), yellowish gray, fine sand grained, sparry cement, moderate porosity, phosphatic, moderately consolidated; clay (30%), light gray, slightly phosphatic
5/20/98	420	430	Clay, light gray, moderately plastic, phosphatic
5/20/98	430	440	Same as above
5/20/98	440	450	Same as above
5/20/98	450	460	Phosphatic Clay, light gray, moderately plastic
5/20/98	460	470	Clay, light gray, moderately plastic, phosphatic
5/20/98	470	480	Same as above
5/20/98	480	490	Same as above
5/20/98	490	500	Same as above
5/20/98	500	510	Clay (80%), light gray, moderately plastic, phosphatic; Limestone (20%), light gray, fine sand grained
5/20/98	510	520	Same as above, decrease limestone to 10%
5/20/98	520	530	Limestone (70%), light olive gray, fine sand grained, sparry cement, low porosity, poorly to moderately consolidated; Clay, light olive gray, moderate plasticity, low porosity
5/20/98	530	540	Limestone, light gray, fine sand grained, sparry cement, moderate porosity, phosphatic, moderately consolidated
5/20/98	540	550	Same as above
5/20/98	550	560	Clay, light gray, moderately plastic, phosphatic
5/20/98	560	570	Limestone, light gray, fine sand grained, sparry cement, moderate porosity, phosphatic, moderately consolidated
5/20/98	570	580	Clay (80%), light gray, moderately plastic, phosphatic; Limestone (20%), light gray, fine sand grained
5/20/98	580	590	Same as above
5/20/98	590	600	Limestone, light gray, fine to medium sand grained, sparry cement, low to moderate porosity, trace of phosphate, well consolidated
5/20/98	600	610	Same as above
5/20/98	610	620	Same as above
5/20/98	620	630	Same as above
5/20/98	630	640	Same as above
5/20/98	640	650	Limestone, light gray, coarse sand sized recrystallized fossil fragments in a micritic matrix, low porosity, trace of phosphate, well consolidated
5/20/98	650	660	Same as above
5/20/98	660	670	Limestone, light gray, fine to medium sand grained, low porosity, poorly consolidated
5/20/98	670	680	Same as above
5/20/98	680	690	Same as above
5/20/98	690	700	Limestone, light gray, fine sand grained, micritic cement, low to moderate porosity, trace of phosphate, well consolidated
5/20/98	700	710	Same as above, moderately consolidated
5/20/98	710	720	Same as above, poorly consolidated
5/20/98	720	730	Same as above

Fort Myers Beach Wastewater Treatment Plant
Monitor Well MW-1
Lithologic Description

Date	Depth (ft. bpl) From	To	Observer's Description
5/20/98	730	740	Same as above
5/20/98	740	750	Same as above
5/20/98	750	760	Same as above
5/20/98	760	770	Same as above, trace of dolomite
5/20/98	770	780	Same as above, no dolomite
5/20/98	780	790	Same as above
5/20/98	790	800	Limestone (70%), light gray, fine sand grained, sparry cement, moderate porosity, phosphatic, poorly consolidated; clay (30%), light gray, trace of fine grained quartz sand
5/20/98	800	810	Limestone, light gray, fine sand grained, sparry cement, moderate porosity, moderately consolidated
5/20/98	810	820	Same as above
5/20/98	820	830	Same as above
5/20/98	830	840	Same as above
5/20/98	840	850	Same as above
5/20/98	850	860	Limestone, light gray, very fine sand grained, sparry cement, moderate porosity, well consolidate, trace of dolomite
5/20/98	860	870	Limestone, yellowish gray, fine sand grained, low porosity, poorly consolidated
5/20/98	870	880	Limestone, yellowish gray, fine to medium sand grained fossil fragments, sparry cement, high porosity, poorly consolidated
5/20/98	880	890	Limestone, yellowish gray, fine sand grained, low porosity, poorly consolidated
5/20/98	890	900	Same as above
5/20/98	900	910	Same as above
5/20/98	910	920	Same as above
5/20/98	920	930	Same as above, moderately consolidated
5/20/98	930	940	Limestone (70%), light gray, fine sand grained, sparry cement, moderate porosity, trace of phosphate, moderately consolidated; clay (30%), light gray
5/20/98	940	950	Clay (80%), light gray, trace of phosphate; limestone (20%), yellowish gray, fine sand grained, micritic cement, poorly consolidated
5/20/98	950	960	Limestone (80%), light gray, fine to medium sand grained, low porosity, well consolidated; clay (20%), light gray
5/20/98	960	970	Limestone, light gray, fine to medium sand grained, low porosity, poorly to moderately consolidated
5/20/98	970	980	Same as above, poorly consolidated
5/20/98	980	990	Same as above
5/20/98	990	1000	Same as above
5/20/98	1000	1010	Same as above
5/20/98	1010	1020	Same as above
5/20/98	1020	1030	Same as above
5/20/98	1030	1040	Limestone, yellowish gray, fine to medium sand grained, moderate to high porosity, poorly to moderately consolidated
5/20/98	1040	1050	Same as above
5/20/98	1050	1060	Same as above
5/21/98	1060	1070	Same as above
5/21/98	1070	1080	Same as above
5/21/98	1080	1090	Same as above
5/21/98	1090	1100	Same as above
5/21/98	1100	1110	Same as above
5/21/98	1110	1120	Same as above
5/21/98	1120	1130	Same as above
5/21/98	1130	1140	Same as above
5/21/98	1140	1150	Same as above

Fort Myers Beach Wastewater Treatment Plant
Monitor Well MW-1
Lithologic Description

Date	Depth (ft. bpl) From	To	Observer's Description
5/21/98	1150	1160	Same as above
5/21/98	1160	1170	Same as above
5/21/98	1170	1180	Same as above
5/21/98	1180	1190	Same as above
5/26/98	1190	1200	Dolomite, pale yellowish brown, microcrystalline, low porosity, well consolidated
5/26/98	1200	1210	Same as above
5/26/98	1210	1220	Limestone, yellowish gray, fine sand grained, low to moderate porosity, poorly to moderately consolidated
5/26/98	1220	1230	Same as above
5/26/98	1230	1240	Same as above, moderately consolidated, with a trace of dolomite, medium brown, microcrystalline, low porosity, well consolidated
5/26/98	1240	1250	Limestone, yellowish gray, fine sand grained, low porosity, poorly consolidated
5/26/98	1250	1260	Micrite, yellowish gray, low porosity, poorly consolidated
5/26/98	1260	1270	Limestone, yellowish gray, fine sand grained, low porosity, moderately consolidated, abundant forams
5/26/98	1270	1280	Same as above
5/26/98	1280	1290	Limestone, yellowish gray, fine sand grained, moderate to high porosity, moderately consolidated
5/26/98	1290	1300	Same as above
5/26/98	1300	1310	Same as above
5/26/98	1310	1320	Same as above, poorly to moderately consolidated
5/26/98	1320	1330	Same as above, poorly consolidated
5/26/98	1330	1340	Same as above
5/26/98	1340	1350	Limestone, yellowish gray, very fine sand grained, micritic cement, low porosity, poorly consolidated
5/26/98	1350	1360	Same as above
5/26/98	1360	1370	Same as above
5/26/98	1370	1380	Limestone, yellowish gray, fine to medium sand grained, sparry cement, low porosity, poorly consolidated
5/26/98	1380	1390	Same as above
5/26/98	1390	1400	Limestone, yellowish gray, medium to coarse sand grained, sparry cement, moderate to high porosity, abundant forams, poorly consolidated
5/26/98	1400	1410	Same as above
5/26/98	1410	1420	Same as above, fewer forams
5/26/98	1420	1430	Same as above
5/26/98	1430	1440	Same as above
5/26/98	1440	1450	Same as above
5/26/98	1450	1460	Same as above, abundant forams, moderately consolidated
5/26/98	1460	1470	Same as above
5/26/98	1470	1480	Limestone, yellowish gray, fine sand grained, some very fine quartz sand, sparry cement, low porosity, poor to moderately consolidated
5/26/98	1480	1490	Same as above
5/26/98	1490	1500	Same as above
5/26/98	1500	1510	Same as above
5/26/98	1510	1520	Same as above
5/26/98	1520	1530	Same as above
5/26/98	1530	1540	Same as above
5/26/98	1540	1550	Same as above
5/26/98	1550	1560	Same as above
5/26/98	1560	1570	Limestone, yellowish gray, recrystallized, small amount of fine quartz sand, sparry cement, low porosity, well consolidated
5/26/98	1570	1580	Same as above

Fort Myers Beach Wastewater Treatment Plant
Monitor Well MW-1
Lithologic Description

Date	Depth (ft. bpl) From	To	Observer's Description
5/26/98	1580	1590	Same as above
5/26/98	1590	1600	Same as above
5/26/98	1600	1610	Same as above
5/26/98	1610	1620	Same as above
5/26/98	1620	1630	Same as above
5/26/98	1630	1640	Same as above
5/26/98	1640	1650	Same as above
5/26/98	1650	1660	Same as above
5/26/98	1660	1670	Same as above
5/26/98	1670	1680	Same as above
5/26/98	1680	1690	Same as above
5/26/98	1690	1700	Same as above
5/26/98	1700	1710	Same as above
5/26/98	1710	1720	Same as above

Appendix H
Core Descriptions and Laboratory Results

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Core Description

Core #: 1

Date Recovered: 1/23/98

Interval Cored: 1,444 to 1,458 feet bpl

Amount Recovered: 12.5 feet

Recovery Percentage: 89%

Depth Interval (feet bpl) From	To	Observer's Description
1,444.0	1,456.5	Limestone, yellowish gray (5 Y 8/1), silt to fine sand grained, some fine to medium quartz sand, micritic cement, low porosity, well consolidated

feet bpl = feet below pad level

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Core Description

Core #: 2

Date Recovered: 1/27/98

Interval Cored: 1,554 to 1,569 feet bpl

Amount Recovered: 6 feet

Recovery Percentage: 40%

Depth Interval (feet bpl) From	To	Observer's Description
1,554.0	1,555.6	Limestone, very pale orange (10 YR 8/2), coarse sand to fine gravel, recrystallized fossil fragments, primarily gastropods, micritic cement, low porosity, well consolidated
1,555.6	1,556.3	Limestone, yellowish gray (5 Y 7/2), micritic, with some clay, very low porosity, moderately consolidated
1,556.3	1,557.3	Limestone, very pale orange (10 YR 8/2), fine to medium sand grained, sparry cement, moderate porosity, well consolidated
1,557.3	1,558.0	Limestone, yellowish gray (5 Y 7/2), silt to fine sand grained, micritic cement, low porosity, well consolidated
1,558.0	1,560.0	Limestone, very pale orange (10 YR 8/2), fine to medium sand grained, sparry cement, moderate to high porosity, well consolidated
1,560.0	1,562.0	Limestone, very pale orange (10 YR 8/2), fine to medium sand grained matrix with medium gravel sized fossils

feet bpl = feet below pad level

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Core Description

Core #: 3

Date Recovered: 1/28/98

Interval Cored: 1,669 to 1,684 feet bpl

Amount Recovered: 6 feet

Recovery Percentage: 40%

Depth Interval (feet bpl) From	To	Observer's Description
1,669.0	1,673.0	Limestone, very pale orange (10 YR 8/2), fine to medium sand grained, sparry cement, moderate porosity, well consolidated
1,673.0	1,673.5	Limestone, light olive gray (5 Y 5/2), fine sand grained, recrystallized, sparry cement, low porosity, well consolidated
1,673.5	1,674.2	Limestone, yellowish gray (5 Y 7/2), fine sand grained, recrystallized, spary cement, low porosity, well consolidated,
1,674.2	1,675.0	Limestone, very pale orange (10 YR 8/2), fine to medium sand grained, sparry cement, moderate porosity, well consolidated

feet bpl = feet below pad level

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Core Description

Core #: 4

Date Recovered: 3/3/98

Interval Cored: 1,930 to 1,942 feet bpl

Amount Recovered: 1.2 feet

Recovery Percentage: 10%

Depth Interval (feet bpl) From	To	Observer's Description
1,930.0	1,931.2	Limestone, very pale orange (10 YR 8/2), fine to medium sand grained, micritic cement, low porosity, well consolidated

feet bpl = feet below pad level

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Core Description

Core #: 5

Date Recovered: 3/4/98

Interval Cored: 1,965 to 1,984 feet bpl

Amount Recovered: 10.1 feet

Recovery Percentage: 53%

Depth Interval (feet bpl) From	To	Observer's Description
1,965.0	1,972.0	Limestone, pale yellowish brown (10 YR 6/2), fine to medium sand grained, sparry cement, moderate porosity, well consolidated, abundant foraminifera
1,972.0	1,972.3	Limestone, pale yellowish brown (10 YR 6/2), medium sand grained, sparry cement, low porosity, well consolidated, very thin dark dolomite stringers
1,972.3	1,972.8	Limestone, pale yellowish brown (10 YR 6/2), fine to medium sand grained, sparry cement, moderate porosity, well consolidated, abundant foraminifera
1,972.8	1,974.1	Dolomite, dark yellowish brown, sucrosic, abundant small vugs, very high porosity, well consolidated
1,974.1	1,975.1	Limestone, pale yellowish brown (10 YR 6/2), fine to medium sand grained, sparry cement, moderate porosity, well consolidated, abundant foraminifera

feet bpl = feet below pad level

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Core Description

Core #: 6

Date Recovered: 3/5/98

Interval Cored: 2,045 to 2,062 feet bpl

Amount Recovered: 6 feet

Recovery Percentage: 35%

Depth Interval (feet bpl) From	To	Observer's Description
2,045.0	2,051.0	Dolomite, dusky yellowish brown (10 YR 2/2) to dark yellowish brown (10 YR 4/2), very fine grained, sucrosic, abundant small to large vugs, high porosity, well consolidated

feet bpl = feet below pad level

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Core Description

Core #: 7

Date Recovered: 3/6/98

Interval Cored: 2,280 to 2,297 feet bpl

Amount Recovered: 10 feet

Recovery Percentage: 59%

Depth Interval (feet bpl) From	To	Observer's Description
2,280.0	2,280.3	Dolomitic Limestone, grayish orange (10 YR 7/4), very fine sand grained, low porosity, well consolidated
2,280.3	2,281.3	Dolomitic Limestone, grayish orange (10 YR 7/4), very fine sand grained, low porosity, some small vugs, well consolidated
2,281.3	2,282.3	Dolomitic Limestone, grayish orange (10 YR 7/4), very fine sand grained, low porosity, well consolidated
2,282.3	2,283.5	Dolomitic Limestone, grayish orange (10 YR 7/4), very fine sand grained, low porosity, some 1 to 2 inch diameter vugs, well consolidated
2,283.5	2,284.7	Dolomitic Limestone, grayish orange (10 YR 7/4), very fine sand grained, low porosity, well consolidated
2,284.7	2,285.4	Dolomite, pale yellowish brown (10 YR 6/2), microcrystalline, very low porosity, well consolidated
2,285.4	2,288.4	Dolomitic Limestone, grayish orange (10 YR 7/4), very fine sand grained, low porosity, some small vugs, well consolidated
2,288.4	2,289.3	Dolomitic Limestone, grayish orange (10 YR 7/4), very fine sand grained, low porosity, well consolidated
2,289.3	2,290.0	Dolomitic Limestone, grayish orange (10 YR 7/4), very fine sand grained, low porosity, some small vugs, well consolidated

feet bpl = feet below pad level

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Core Description

Core #: 8

Date Recovered: 3/9/98

Interval Cored: 2,380 to 2,408 feet bpl

Amount Recovered: 14 feet

Recovery Percentage: 50%

Depth Interval (feet bpl) From	To	Observer's Description
2,380.0	2,385.0	Recrystallized Limestone, yellowish gray (5 Y 7/2), very fine sand grained, sparry cement, low porosity, well consolidated
2,385.0	2,386.5	Limestone, very pale orange (10 YR 8/2), fine to medium sand grained, low porosity, well consolidated
2,386.5	2,388.5	Dolomitic Limestone, moderate yellowish brown (10 YR 5/4), microcrystalline, low porosity, some small vugs, well consolidated
2,388.5	2,389.4	Limestone, very pale orange (10 YR 8/2), fine to medium sand grained, low porosity, well consolidated
2,389.4	2,390.2	Limestone, yellowish gray (5 Y 7/2), fine to medium sand grained, low porosity, well consolidated
2,390.2	2,394.0	Limestone, very pale orange (10 YR 8/2), fine to medium sand grained, low porosity, well consolidated

feet bpl = feet below pad level

Fort Myers Beach Wastewater Treatment Plant
Injection Well IW-1
Core Description

Core #: 9

Date Recovered: 3/10/98

Interval Cored: 2,514 to 2,524 feet bpl

Amount Recovered: 6 feet

Recovery Percentage: 60%

Depth Interval (feet bpl) From	To	Observer's Description
2,514.0	2,520.0	Limestone, very pale orange (10 YR 8/2), fine to medium sand grained, low porosity, well consolidated

feet bpl = feet below pad level

Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

April 10, 1998
File Number 98-041

Youngquist Brothers, Inc.
15465 Pine Ridge Road
Fort Myers, Florida 33908

RECEIVED APR 1 3 1998

Attention: Mr. Troy Moore

Subject: Laboratory Test Results on Rock Core Specimens, Fort Myers Injection Well IW-1

Gentlemen:

Permeability and effective porosity tests have been completed on 5 rock core samples provided for testing by your firm from Fort Myers Injection Well IW-1. Unconfined compression tests were also requested, but could not be performed. As specified, priority was given to obtaining specimens from the samples for vertical and horizontal permeability tests. Insufficient lengths of rock core were provided to perform both the permeability tests and unconfined compression tests.

Permeability Tests

The permeability tests were performed in general accordance with ASTM Standard D 5084 "Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible-Wall Permeameter" using the constant-head (Method A) test method. The permeability test results are presented in Table 1. The core samples provided for testing were too short to obtain separate vertically and horizontally oriented specimens. Accordingly, the vertical permeability tests were performed first on specimens maintained at the as-received diameter and cut to lengths of 6.0 to 12.2 cm. After completing the vertical permeability tests, horizontal permeability specimens were obtained by coring 5.1 cm diameter cylinders from the vertical specimens. The horizontal specimens were then trimmed to lengths of 6.5 to 7.6 cm to provide flat, parallel ends. A horizontal permeability test was not performed on the sample from 1,555.25 feet. This sample fractured when attempting to core the horizontal test specimen. Since the vertical permeability test specimens were cored upon completion of testing to obtain horizontal permeability test specimens, the final moisture contents of the vertical specimens were not measured. The dry densities and degrees of saturation of the vertical permeability specimens, therefore, were estimated using the final moisture contents from the corresponding horizontal permeability test specimens.

Each permeability test specimen was air-dried, deaired under vacuum, and then saturated with deaired distilled water from the bottom upward while still under vacuum. Each specimen was then mounted in a triaxial-type permeameter and encased within a latex membrane. The specimens were confined using an average isotropic effective confining stress of 20 lb/in^2 and permeated with deaired tap water under back-pressure. Satisfactory saturation was verified by a B-factor equal to or greater than 95%, or a B-factor that remained relatively constant for two consecutive increments of applied cell pressure. The inflow to and outflow from each specimen were monitored with time, and the hydraulic conductivity was calculated for each recorded flow increment. The tests were continued until steady-state flow conditions were obtained, as evidenced by an outflow/inflow ratio between 0.75 and 1.25, and until stable values of hydraulic conductivity were measured. The final degree of saturation was calculated upon completion of testing using the final dry mass, moisture content and volume, and an assumed specific gravity of 2.70. Although some of the calculated final degrees of saturation are low, the B-factors indicate satisfactory saturation. The calculated final degrees of saturation are potentially affected by occluded voids within the specimens, surface irregularities, and the use of final moisture contents for the vertical permeability test specimens from the corresponding horizontal permeability test specimens.

Total Porosity

The total porosity, n, of each permeability test specimen was calculated from the measured dry density, γ_d, and assumed specific gravity, G_s, of 2.70 using the equation: $n = 1 - (\gamma_d/(G_s)(\gamma_w))$ where γ_w = unit weight of water. The calculated total porosities are presented in Table 1.

Effective Porosity

The pore fluid within the specimens, after saturation, displayed relatively high conductivity on the order of 20,000 µmhos/cm. The chloride concentration measured on one specimen equalled 12,000 mg/l. The high conductivities, therefore, were reflective of the presence of salts that dissolved when the air-dried specimens were saturated during performance of the permeability tests. The existence of an initially high pore fluid conductivity allows estimating the effective porosity (i.e., the portion of the pore space effective in transmitting flow) by flowing distilled water through a specimen and monitoring the decrease in conductivity of the outflow as the salt water in the specimen is displaced by the low conductivity distilled water (i.e., conductivity of about 180 µmhos/cm). Assuming no reactions between the distilled water permeant and specimen, the arrival time and corresponding volume of flow when the outflow conductivity equals 50% of the initial conductivity can be used to estimate effective porosity using advective transport theory. The effective porosities of the vertical permeability test specimens estimated by this technique are tabulated below.

Depth (feet)	Porosity	
	Total	Effective
1,449.75 - 1,450.25	0.39	0.27
1,453.5 - 1,454.0	0.38	0.30
1,557.0 - 1,557.4	0.38	0.38
1,674.1 - 1,674.5	0.35	0.34

If you have any questions or require additional testing services, please contact us.

Very truly yours,
ARDAMAN & ASSOCIATES, INC.

Shawkat Ali

Shawkat Ali, Ph.D., P.E.
Geotechnical Engineer

Thomas S. Ingra

Thomas S. Ingra, P.E.
Senior Project Engineer
Florida Registration No. 31987

SA/TSI/jo

D:\AL\98-041 YOUNGQ.001.wpd

Youngquist Brothers, Inc.
File Number 98-041
April 10, 1998

Table 1

PERMEABILITY TEST RESULTS
FORT MYERS INJECTION WELL IW-1

Depth (feet)	Test Specimen Orientation	D-5084 Test Method*	Initial Conditions					$\bar{\sigma}_c$ (lb/in^2)	u_b (lb/in^2)	B Factor (%)	Average Hydraulic Gradient	Final Conditions			Hydraulic Conductivity, k_{20} (cm/sec)
			Length (cm)	Diameter (cm)	w_c (%)	γ_d (lb/ft^3)	n					w_c (%)	γ_d (lb/ft^3)	S (%)	
1449.75- 1450.25	Vertical Horizontal	A A	10.66 6.53	9.88 5.05	22.4 22.3	103.2 104.7	0.39 0.38	20 20	79 89	96 89**	15 21	22.4 22.4†	103.2 104.7	98 99	$1.0x10^{-5}$ $1.3x10^{-5}$
1453.5- 1454.0	Vertical Horizontal	A A	12.22 7.50	9.85 5.09	22.2 22.2	103.9 105.2	0.38 0.38	20 20	79 89	97 95	16 19	22.2 22.2†	103.9 105.2	96 100	$1.2x10^{-5}$ $1.2x10^{-5}$
1555.25- 1555.6	Vertical	A	6.00	9.96	10.4	115.5	0.31	20	174	97	4[illegible]	[illegible]6.7	115.5	98	$1.0x10^{-7}$
1557.0- 1557.4	Vertical Horizontal	A A	7.04 7.53	9.88 5.10	20.9 20.9	103.7 106.1	0.38 0.37	20 20	79 89	100 96	30 19	20.9 20.9†	103.7 106.1	9[illegible] 96	$1.6x10^{-6}$ $5.3x10^{-6}$
1674.1- 1674.5	Vertical Horizontal	A A	8.70 7.57	9.53 5.05	20.1 20.4	108.7 106.7	0.35 0.37	20 20	79 89	94** 95	18 18	20.4 20.4†	108.7 106.7	100 95	$2.8x10^{-5}$ $1.6x10^{-5}$

Where: w_c = Moisture content; γ_d = Dry density; n = Total porosity; $\bar{\sigma}_c$ = Average isotropic effective confining stress; u_b = Back-pressure; and S = Calculated degree of saturation using an assumed specific gravity of 2.70.

* Method A = Constant-head test.

** B-Factor remained relatively constant for two consecutive increments of applied cell pressure.

† Vertical permeability test specimen was cored upon completion of testing to obtain horizontal permeability test specimen. The final moisture content of the vertical test specimen was not measured, and was assumed to be the same as the horizontal test specimen.

Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

July 28, 1998
File Number 98-041

Youngquist Brothers, Inc.
15465 Pine Ridge Road
Fort Myers, Florida 33908

Attention: Mr. Edward McCullers

Subject: Laboratory Test Results on Rock Core Specimens, Fort Myers Injection Well IW-1

Gentlemen:

Permeability, unconfined compression and effective porosity tests have been completed on 10 rock core samples provided for testing by your firm from Fort Myers Injection Well IW-1. Due to the irregular shape and short length of the samples, each of the requested tests could not be performed on each sample. As specified, priority was given to obtaining specimens from the samples for vertical and horizontal permeability tests.

Permeability Tests

Permeability tests were performed in general accordance with ASTM Standard D 5084 "Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible-Wall Permeameter" using the constant-head (Method A) and falling-head with rising tailwater level (Method C) test methods. The permeability test results are presented in Table 1. The core samples provided for testing were too short to obtain separate vertically and horizontally oriented specimens. Accordingly, the vertical permeability tests were performed first on specimens maintained at the as-received diameter and cut to lengths of 6.9 to 14.9 cm (except for the sample from 2050.7-2051.0 feet that was cored to a 5.1 inch diameter cylindrical specimen). After completing the vertical permeability tests, horizontal permeability specimens were obtained by coring 5.1 cm diameter cylinders from the vertical specimens. The horizontal specimens were then trimmed to lengths of 6.9 to 8.3 cm to provide flat, parallel ends. A horizontal permeability test could not be performed on the sample from 2050.7 to 2051.0 feet because the sample was cored to obtain the vertical permeability test specimen. Since the vertical permeability test specimens were cored upon completion of testing to obtain horizontal permeability test specimens, the final moisture contents of the vertical specimens were not measured. The dry densities and degrees of saturation of the vertical permeability specimens were estimated using the final moisture contents from the corresponding horizontal permeability test specimens.

Each permeability test specimen was air-dried, deaired under vacuum, and then saturated with deaired tap water from the bottom upward while still under vacuum. Each specimen was then mounted in a triaxial-type permeameter and encased within a latex membrane. The specimens were confined using an average isotropic effective confining stress of 20 lb/in^2 and permeated with deaired tap water under back-pressure. Satisfactory saturation was verified by a B-factor equal to or greater than 95%, or a B-factor that remained relatively constant for two consecutive increments of applied cell pressure. The inflow to and outflow from each specimen were monitored

8008 S. Orange Avenue 32809 · P.O. Box 593003 Orlando, Florida 32859-3003 · Phone (407) 855-3860 · FAX (407) 859-8121
Offices in Bartow ... Orlando ... Sarasota, Tallahassee, Tampa ...

with time, and the hydraulic conductivity was calculated for each recorded flow increment. The tests were continued until steady-state flow conditions were obtained, as evidenced by an outflow/inflow ratio between 0.75 and 1.25, and until stable values of hydraulic conductivity were measured. The final degree of saturation was calculated upon completion of testing using the final dry mass, moisture content and volume, and assumed specific gravities of 2.70 to 2.85. Although some of the calculated final degrees of saturation are low, the B-factors indicate satisfactory saturation. The calculated final degrees of saturation are potentially affected by occluded voids within the specimens, surface irregularities, and the use of final moisture contents for the vertical permeability test specimens from the corresponding horizontal permeability test specimens.

Total Porosity

The total porosity, n, of each permeability test specimen was calculated from the dry density, γ_d, and assumed specific gravity, G_s, of 2.70 to 2.85 using the equation: $n = 1 - (\gamma_d/(G_s)(\gamma_w))$ where γ_w = unit weight of water. The calculated total porosities are presented in Table 1.

Effective Porosity

The pore fluid within some specimens, after saturation, displayed relatively high conductivity on the order of 20,000 to 40,000 μmhos/cm. The high conductivities were reflective of the presence of salts that dissolved when the air-dried specimens were saturated during performance of the permeability tests. The existence of an initially high pore fluid conductivity allows estimating the effective porosity (i.e., the portion of the pore space effective in transmitting flow) by flowing distilled water through a specimen and monitoring the decrease in conductivity of the outflow as the salt water in the specimen is displaced by the low conductivity distilled water. Assuming no reactions between the distilled water permeant and specimen, the arrival time and corresponding volume of flow when the outflow conductivity equals 50% of the initial conductivity can be used to estimate effective porosity using advective transport theory. The effective porosities of vertical permeability test specimens estimated by this technique are tabulated below.

Depth (feet)	Porosity	
	Total	Effective
1972.3 - 1972.8	0.29	0.20
2280.0 - 2280.3	0.14	0.12
2381.0 - 2381.4	0.16	0.16
2517.8 - 2518.5	0.34	0.34

Unconfined Compression Tests

Unconfined compression tests were performed in general accordance with ASTM Standard D 2938 "Standard Test Method for Unconfined Compressive Strength of Intact Rock Core Specimens". The tests were performed on specimens cored to diameters of 3.2 to 5.1 cm and trimmed to lengths of 7.5 to 10.5 cm to provide a length to diameter ratio of approximately 2, and then capped with a sulfur capping compound. The specimens were loaded at a constant rate of deformation of 0.0076 cm/minute to attempt to maintain a target time to failure between 2 and 15 minutes. The unconfined compressive strengths and Young's modulus determined from the unconfined compression tests are summarized in Table 2. The stress-strain curves are presented in Figures 1 and 2.

If you have any questions or require additional testing services, please contact us.

Very truly yours,
ARDAMAN & ASSOCIATES, INC.

Shawkat Ali, Ph.D., P.E.
Geotechnical Engineer

Thomas S. Ingra, P.E.
Senior Project Engineer
Florida Registration No. 31987

SA/TSI/jo

A:\98-041 YOUNG w tbls.002.wpd

Youngquist Brothers, Inc.
File Number 98-041
July 28, 1998

Table 1

PERMEABILITY TEST RESULTS
FORT MYERS INJECTION WELL IW-1

Depth (feet)	Test Specimen Orientation	D-5084 Test Method*	Initial Conditions					$\bar{\sigma}_c$ (lb/in^2)	u_b (lb/in^2)	B Factor (%)	Average Hydraulic Gradient	Final Conditions			Hydraulic Conductivity, k_{20} (cm/sec)
			Length (cm)	Diameter (cm)	w_c (%)	γ_d (lb/ft^3)	n					w_c (%)	γ_d (lb/ft^3)	S (%)	
1930.1-1930.6	Vertical	C	6.90	9.71	11.7	124.5	0.26	20	80	--	2.8	12.6†	124.5	[illegible]	4.5×10^{-5}
	Horizontal	A	7.74	5.09	12.6	125.6	0.25	20	170	90**	14	12.6	125.6	100	1.3×10^{-6}
1965.0-1965.8	Vertical	C	14.94	9.79	14.8	117.2	0.30	20	80	92**	1.2	15.9†	117.2	98	3.6×10^{-4}
	Horizontal	C	7.63	5.08	15.9	117.7	0.30	20	90	96	2.1	15.9	117.7	99	4.9×10^{-4}
1972.3-1972.8	Vertical	A	8.79	9.45	14.6	120.2	0.29	20	80	97	15	14.5†	120.2	[illegible]	7.0×10^{-6}
	Horizontal	A	7.66	5.05	14.5	119.7	0.29	20	170	97	14	14.5	119.7	97	6.8×10^{-6}
2050.7-2051.0	Vertical	A	6.34	5.12	0.7	170.6	0.03	20	160	96	218	1.1	170.6	99	1.0×10^{-10}
2280.0-2280.3	Vertical	A	7.46	10.04	5.1	152.2	0.14	20	170	92**	30	5.5†	152.2	93	1.6×10^{-7}
	Horizontal	A	8.27	5.09	5.5	153.3	0.14	20	170	97	26	5.5	153.3	97	1.0×10^{-7}
2287.0-2287.5	Vertical	A	12.20	10.05	2.8	159.1	0.07	20	170	99	13	2.8†	159.1	98	2.8×10^{-8}
	Horizontal	A	7.91	5.10	2.8	159.4	0.07	20	165	95	88	2.8	159.4	100	1.4×10^{-9}
2381.0-2381.4	Vertical	A	9.73	9.95	5.3	149.1	0.16	20	80	87**	30	6.4†	149.1	94	3.7×10^{-6}
	Horizontal	A	8.29	5.09	6.4	149.4	0.16	20	170	98	16	6.4	149.4	96	3.5×10^{-6}
2385.2-2386.0	Vertical	A	8.69	9.83	8.4	141.4	0.20	20	170	95	30	8.4†	141.4	93	9.4×10^{-7}
	Horizontal	A	7.52	5.09	8.4	140.8	0.21	20	170	98	30	8.4	140.8	91	9.5×10^{-7}
2514.3-2514.8	Vertical	C	13.00	9.45	17.8	111.6	0.34	20	80	90**	1.5	17.8†	111.6	94	3.0×10^{-4}
	Horizontal	C	6.91	5.09	17.6	113.3	0.33	20	90	95	2.1	17.8	113.3	99	4.2×10^{-4}
2517.8-2518.5	Vertical	C	9.09	9.53	17.4	110.6	0.34	20	80	95	2.1	18.4†	110.6	95	4.4×10^{-4}
	Horizontal	C	7.56	5.08	18.4	111.3	0.34	20	90	92**	2.1	18.4	111.3	97	5.2×10^{-4}

Where: w_c = Moisture content; γ_d = Dry density; n = Total porosity; $\bar{\sigma}_c$ = Average isotropic effective confining stress; u_b = Back-pressure; and S = Calculated degree of saturation using assumed specific gravities of 2.70 to 2.85.

* Method A = Constant-head test; Method C = Falling-head with increasing tailwater level.

** B-Factor remained relatively constant for two consecutive increments of applied cell pressure.

† Vertical permeability test specimen was cored upon completion of testing to obtain horizontal permeability test specimen. The final moisture content of the vertical test specimen was not measured, and was assumed to be the same as the horizontal test specimen.

Youngquist Brothers, Inc.
File Number 98-041
July 28, 1998

Table 2

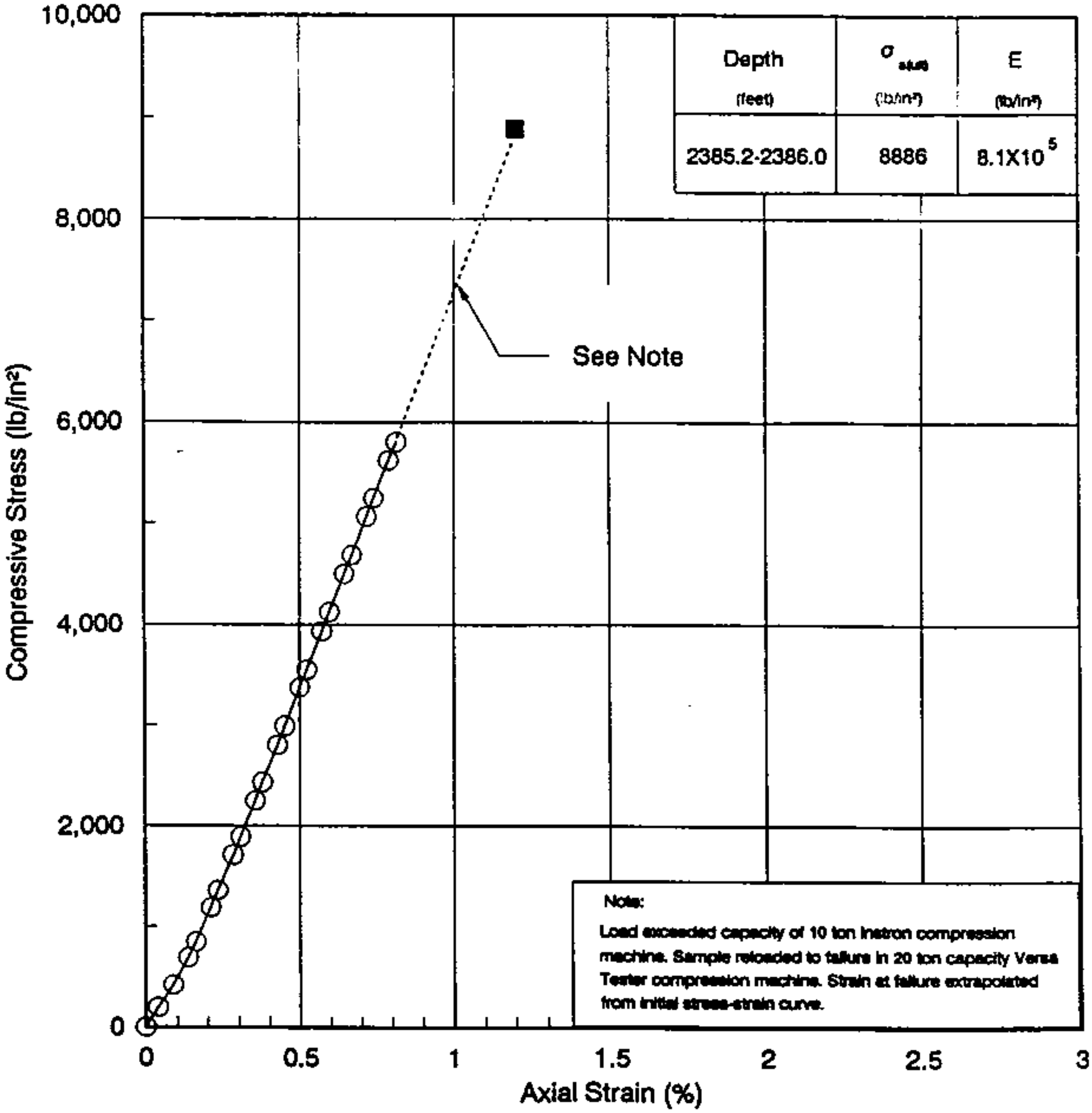
UNCONFINED COMPRESSION TEST RESULTS
FORT MEYERS INJECTION WELL IW-1

Depth (feet)	Specimen Dimensions			w_c (%)	γ_d (lb/ft^3)	Loading Rate (cm/min)	t_f (min)	Unconfined Compressive Strength σ_a(ult) (lb/in^2)		Young's Modulus E(lb/in^2)**
	Length L (cm)	Diameter D (cm)	L/D					Measured	Corrected*	
2385.2 - 2386.0	10.49	5.09	2.06	0.2	151.5	0.0076	16.6	8866	8918	8.1×10^5
2517.8 - 2518.5	7.46	3.27	2.28	6.7	109.5	0.0076	3.9	1750	1776	5.5×10^5

Where: w_c = Moisture content; γ_d = Dry density; and t_f = Time to failure.

* Unconfined compressive strength corrected to L/D ratio of 2 in accordance with ASTM Standard D 2938-86.
** Young's modulus calculated from the slope of the straight-line portion of the stress-strain curve.

D:\AL\98-041 YOUNG w tbls.002.wpd



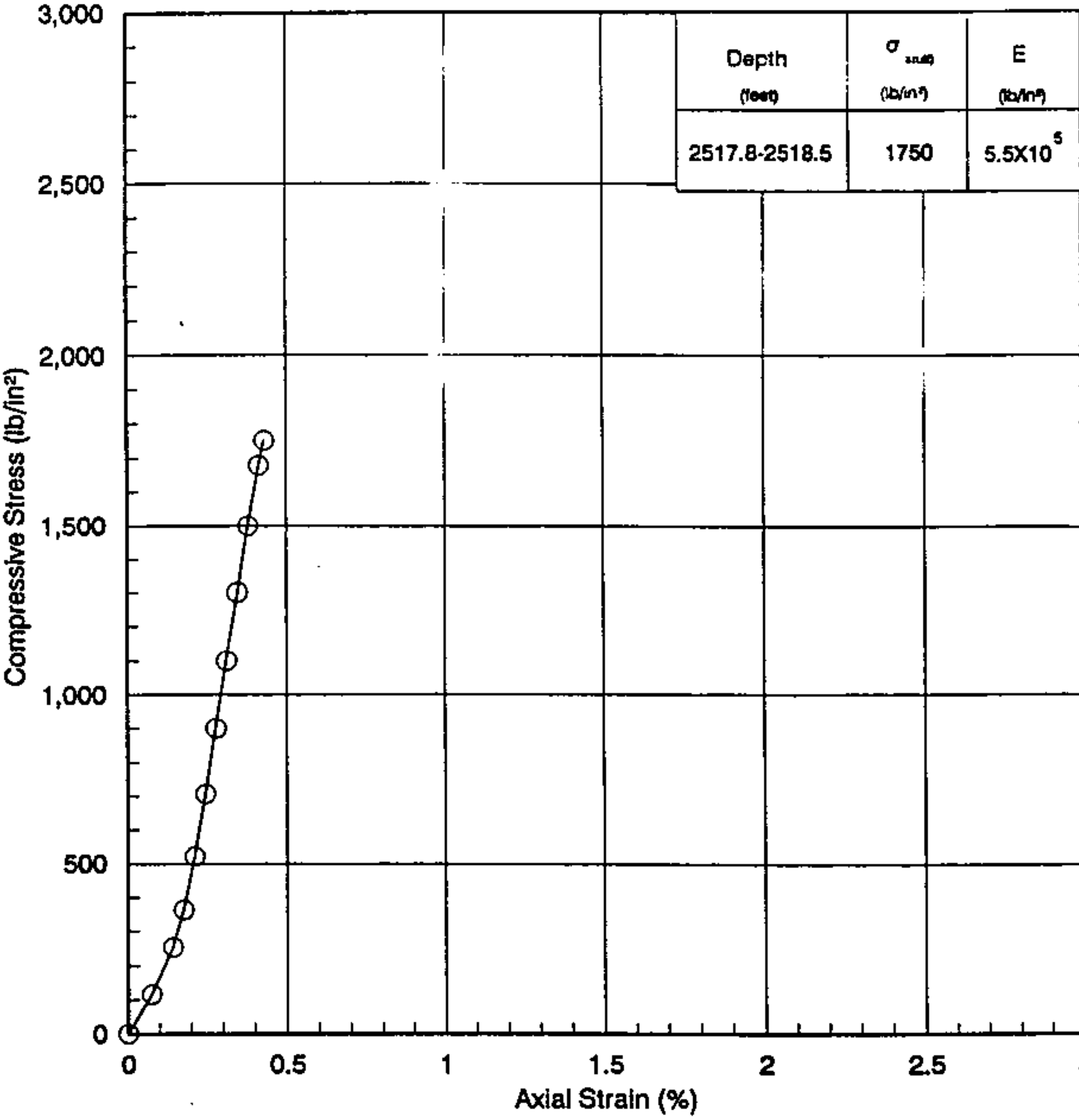
UNCONFINED COMPRESSION TEST

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

FORT MYERS INJECTION WELL IW-1

YOUNGQUIST BROTHERS, INC.

DRAWN BY: SA	CHECKED BY: SA	DATE: 07-23-98
FILE NO.: 98-041	APPROVED BY: [signature]	FIGURE: 1



Depth (feet)	σ_{ult} (lb/in²)	E (lb/in²)
2517.8-2518.5	1750	$5.5X10^5$

UNCONFINED COMPRESSION TEST

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

FORT MYERS INJECTION WELL IW-1

YOUNGQUIST BROTHERS, INC.

DRAWN BY: SA	CHECKED BY: SA	DATE: 07-23-98
FILE NO.: 98-041	APPROVED BY:	FIGURE: 2

Appendix I
Background Water Quality Data

INTAKE #: 514279

Sanders Laboratories
Environmental Testing Services

Date *10-Jun-98*

Project Name: Deep Injection Well
Project Location: Ft. Myers Beach
Sample Supply: Ground Water
Collector: Ray Burroughs
Sample Received Date/Time: 5/12/98 9:00

Youngquist Brothers, Inc.
15465 Pine Ridge Road

Fort Myers, FL 33908-

RECEIVED [illegible]

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	Inorganic Analysis 62-550.310(1) PWS030								
1005	Arsenic (0.05)	N983309	0.005	mg/L	EPA 206.2	5/12/98	0.0022	84352	ua
1010	Barium (2)	N983309	3.33	mg/L	EPA 208.2	5/15/98	0.200	84352	ua
1015	Cadmium (0.005)	N983309	<0.003	mg/L	EPA 213.1	5/13/98	0.003	84352	ua
1020	Chromium (0.1)	N983309	0.081	mg/L	EPA 218.1	5/13/98	0.020	84352	ua
	Cyanide (0.2)	N983309	<0.006	mg/L	SM 4500-CN	5/15/98	0.006	83331	ua
[illegible]	Fluoride (4)	N983309	0.70	mg/L	EPA 340.2	5/13/98	0.2	84352	ua
1030	Lead (0.015)	N983309	0.039	mg/L	EPA 239.2	5/13/98	0.001	84352	ua
1035	Mercury (0.002)	N983309	<0.001	mg/L	EPA 245.1	5/15/98	0.001	84352	ua
1036	Nickel (0.1)	N983309	<0.010	mg/L	EPA 249.1	5/20/98	0.010	84352	ua
1040	Nitrate (10)	N983309	0.08	mg/L	EPA 353.2	5/14/98	0.01	84352	ua
1041	Nitrite (1)	N983309	<0.01	mg/L	EPA 354.1	5/12/98	0.01	84352	ua
1045	Selenium (0.05)	N983309	<0.004	mg/L	EPA 270.2	5/15/98	0.004	84352	ua
1052	Sodium (160)	N983309	10,454	mg/L	EPA 273.1	5/21/98	0.003	84352	ua
1074	Antimony (0.006)	N983309	0.047	mg/L	EPA 200.9	5/18/98	0.0017	83331	ua
1075	Beryllium (0.004)	N983309	0.0009	mg/L	EPA 200.7	5/18/98	0.0003	83331	ua
1085	Thallium (0.002)	N983309	0.030	mg/L	EPA 200.9	5/18/98	0.0006	83331	ua
	Secondary Chemical Analysis 62-550.320 PWS031								
1002	Aluminum (0.2)	N983309	<0.2	mg/L	EPA 202.1	5/15/98	0.2	84352	ua
1017	Chloride (250)	N983309	19,744	mg/L	SM4500Cl-B	5/20/98	5	84352	ua
1022	Copper (1.0)	N983309	0.084	mg/L	EPA 220.2	5/18/98	0.001	84352	ua
1025	Fluoride (2.0)	N983309	0.70	mg/L	EPA 340.2	5/13/98	0.2	84352	ua
1028	Iron (0.3)	N983309	1.29	mg/L	EPA 236.1	5/19/98	0.015	84352	ua
[illegible]	Manganese (0.05)	N983309	<0.005	mg/L	EPA 243.1	5/19/98	0.005	84352	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Rpt form #5; Rev 1/1/96

1050 Endeavor Ct. • Nokomis, FL 34275 • Phone: (941) 488-8103 • (800) 255-3108 • Fax: (941) 484-6774

Parameter ID	Analysis		Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
1050	Silver	(0.1)	N983309	0.074	mg/L	EPA 272.1	5/13/98	0.010	84352	ua
[illegible]	Sulfate	(250)	N983309	3,188	mg/L	EPA 375.4	5/18/98	5	84352	ua
[illegible]	Zinc	(5.0)	N983309	0.065	mg/L	EPA 289.1	5/18/98	0.005	84352	ua
1905	Color	(15.0)	N983309	70	PtCo units	EPA 110.3	5/12/98	1	84352	ua
1920	Odor	(3.0)	N983309	1.0	TON	EPA 140.1	5/12/98	1.0	84352	ua
1925	pH	(6.5-8.5)	N983309	7.64	std units	EPA 150.1	5/12/98	n/a	84352	ua
1930	Total Dissolved Solids (500)		N983309	29,200	mg/L	EPA 160.1	5/12/98	7	84352	ua
2905	Foaming Agents (1.5)		N983309	<0.02	mg/L	SM 5540C	5/14/98	0.02	83331	ua

Pesticide/PCB Chemical Analysis

62-550.310(2)(c)

PWS029

2005	Endrin (2)	N983309	<0.002	ug/L	EPA 508	5/14/98	0.002	83331	ua
2010	Lindane (0.2)	N983309	<0.002	ug/L	EPA 508	5/14/98	0.002	83331	ua
2015	Methoxychlor (40)	N983309	<0.052	ug/L	EPA 508	5/14/98	0.052	83331	ua
2020	Toxaphene (3)	N983309	<0.309	ug/L	EPA 508	5/14/98	0.309	83331	ua
2031	Dalapon (200)	N983309	<0.036	ug/L	EPA 515.1	5/28/98	0.036	83331	ua
2032	Diquat (20)	N983309	<0.26	ug/L	EPA 549.1	5/20/98	0.26	83331	ua
2033	Endothall (100)	N983309	<15.4	ug/L	EPA 548	5/14/98	15.4	83331	ua
2034	Glyphosate (700)	N983309	<9.44	ug/L	EPA 547	5/21/98	9.44	83331	ua
2035	Di(2-ethylhexyl) adipate (400)	N983309	<0.71	ug/L	EPA 525.2	5/21/98	0.71	83331	ua
2036	Oxamyl (Vydate) (200)	N983309	<2.57	ug/L	EPA 531.1	5/26/98	2.57	83331	ua
[illegible]	Simazine (4)	N983309	<0.078	ug/L	EPA 507	5/14/98	0.078	83331	ua
2039	Di(2-ethylhexyl) phthalate (6)	N983309	3.12	ug/L	EPA 525.2	5/21/98	1.15	83331	ua
2040	Picloram (500)	N983309	<0.029	ug/L	EPA 515.1	5/28/98	0.029	83331	ua
2041	Dinoseb (7)	N983309	<0.055	ug/L	EPA 515.1	5/28/98	0.055	83331	ua
2042	Hexachlorocyclopentadiene(50)	N983309	<0.01	ug/L	EPA 508	5/14/98	0.01	83331	ua
2046	Carbofuran (40)	N983309	<7.04	ug/L	EPA 531.1	5/26/98	7.04	83331	ua
2050	Atrazine (3)	N983309	<0.035	ug/L	EPA 507	5/14/98	0.035	83331	ua
2051	Alachlor (2)	N983309	<0.012	ug/L	EPA 507	5/14/98	0.012	83331	ua
2065	Heptachlor (0.4)	N983309	<0.004	ug/L	EPA 508	5/14/98	0.004	83331	ua
2067	Heptachlor Epoxide (0.2)	N983309	<0.002	ug/L	EPA 508	5/14/98	0.002	83331	ua
2105	2,4-D (70)	N983309	<0.026	ug/L	EPA 515.1	5/28/98	0.026	83331	ua
2110	2,4,5-TP (Silvex) (50)	N983309	<0.017	ug/L	EPA 515.1	5/28/98	0.017	83331	ua
2274	Hexachlorobenzene (1)	N983309	<0.008	ug/L	EPA 508	5/14/98	0.008	83331	ua
2306	Benzo(a)pyrene (.2)	N983309	<0.013	ug/L	EPA 550	5/20/98	0.013	83331	ua
2326	Pentachlorophenol (1)	N983309	<0.007	ug/L	EPA 515.1	5/28/98	0.007	83331	ua
2383	PCB (0.5)	N983309	<0.1	ug/L	EPA 508	5/14/98	0.1	83331	ua
2931	Dibromochloropropane (.2)	N983309	<0.004	ug/L	EPA 504	5/23/98	0.004	83331	ua
2946	Ethylene Dibromide (0.02)	N983309	<0.006	ug/L	EPA 504	5/23/98	0.006	83331	ua
2959	Chlordane (2)	N983309	<0.446	ug/L	EPA 508	5/14/98	0.446	83331	ua

Volatile Organic Analysis

62-550.310(2)(b)

PWS028

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2378	1,2,4-Trichlorobenzene (70)	N983309	<0.22	ug/L	EPA 524.2	5/14/98	0.22	83331	ua
2380	Cis-1,2-Dichloroethylene (70)	N983309	<0.03	ug/L	EPA 524.2	5/14/98	0.03	83331	ua
2955	Xylenes (Total) (10,000)	N983309	<0.24	ug/L	EPA 524.2	5/14/98	0.24	83331	ua
2964	Dichloromethane (5)	N983309	<0.31	ug/L	EPA 524.2	5/14/98	0.31	83331	ua
2968	O-Dichlorobenzene (600)	N983309	<0.05	ug/L	EPA 524.2	5/14/98	0.05	83331	ua
2969	Para-Dichlorobenzene (75)	N983309	<0.02	ug/L	EPA 524.2	5/14/98	0.02	83331	ua
2976	Vinyl Chloride (1)	N983309	<0.29	ug/L	EPA 524.2	5/14/98	0.29	83331	ua
2977	1,1-Dichloroethylene (7)	N983309	<0.02	ug/L	EPA 524.2	5/14/98	0.02	83331	ua
2979	Trans-1,2-Dichloroethylene(100)	N983309	<0.12	ug/L	EPA 524.2	5/14/98	0.12	83331	ua
2980	1,2-Dichloroethane (3)	N983309	<0.02	ug/L	EPA 524.2	5/14/98	0.02	83331	ua
2981	1,1,1-Trichloroethane (200)	N983309	<0.21	ug/L	EPA 524.2	5/14/98	0.21	83331	ua
2982	Carbon Tetrachloride (3)	N983309	<0.29	ug/L	EPA 524.2	5/14/98	0.29	83331	ua
2983	1,2-Dichloropropane (5)	N983309	<0.33	ug/L	EPA 524.2	5/14/98	0.33	83331	ua
2984	Trichloroethylene (3)	N983309	<0.02	ug/L	EPA 524.2	5/14/98	0.02	83331	ua
2985	1,1,2-Trichloroethane (5)	N983309	<0.23	ug/L	EPA 524.2	5/14/98	0.23	83331	ua
2987	Tetrachloroethylene (3)	N983309	<0.21	ug/L	EPA 524.2	5/14/98	0.21	83331	ua
2989	Monochlorobenzene (100)	N983309	<0.23	ug/L	EPA 524.2	5/14/98	0.23	83331	ua
2990	Benzene (1)	N983309	<0.05	ug/L	EPA 524.2	5/14/98	0.05	83331	ua
[illegible]	Toluene (1000)	N983309	<0.41	ug/L	EPA 524.2	5/14/98	0.41	83331	ua
	Ethylbenzene (700)	N983309	<0.47	ug/L	EPA 524.2	5/14/98	0.47	83331	ua
2996	Styrene (100)	N983309	<0.2	ug/L	EPA 524.2	5/14/98	0.2	83331	ua

Radiochemical Analysis

62-550.310(5)

PWS033

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
4000	Gross Alpha	N983309	91.9	pCi/L	EPA 900.0	5/19/98	+/-15.5	83141	ua
4020	Radium 226	N983309	28.4	pCi/L	EPA 903.1	5/20/98	+/-0.9	83141	ua
4030	Radium 228	N983309	2.0	pCi/L	Brks/Blnchrd	5/20/98	+/-0.6	83141	ua

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	Hydrogen Sulfide, Field	N983309	<0.2	mg/L	HACH	5/12/98	0.2	84352	ua

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	Ammonium	N983309	<0.05	mg/L	epa350.3/calc	5/15/98	0.05	84352	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D.L.	LabID	Analyst
	Orthophosphate	N983309	<0.02	mg/L	EPA 365.2	5/13/98	0.02	84352	ua
	Potassium	N983309	302	mg/L	EPA 258.1	5/21/98	0.003	84352	ua
	Magnesium	N983309	1,196	mg/L	EPA 242.1	5/27/98	0.0008	84352	ua
	Calcium	N983309	610	mg/L	EPA 215.1	5/27/98	0.022	84352	ua
	Phosphorus, Total	N983309	0.02	mg/L	EPA 365.2	5/18/98	0.02	84352	ua
	Fecal Coliform	N983309	<1	col/100ml	SM9222D	5/12/98 11:55	1	84352	ua
	Fecal Strep	N983309	<1	col/100ml	SM9230C	5/12/98 11:55	1	84352	ua
	Total Coliform	N983309	<1	col/100ml	SM9222B	5/12/98 11:55	1	84352	ua

Unregulated Group III Analysis

62-550.415

PWS036 & 037

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D.L.	LabID	Analyst
2262	Isophorone	N983309	<7.26	ug/L	EPA 625	6/2/98	7.26	83331	ua
[illegible]	2,4-Dinitrotoluene	N983309	<4.78	ug/L	EPA 625	6/2/98	4.78	83331	ua
	Dimethylphthalate	N983309	<9.47	ug/L	EPA 625	6/2/98	9.47	83331	ua
2284	Diethylphthalate	N983309	<4.3	ug/L	EPA 625	6/2/98	4.3	83331	ua
2290	Di-n-Butylphthalate	N983309	14.6	ug/L	EPA 625	6/2/98	4.01	83331	ua
2294	Butyl benzyl phthalate	N983309	<2.55	ug/L	EPA 625	6/2/98	2.55	83331	ua
9089	Di-n-octylphthalate	N983309	<2.43	ug/L	EPA 625	6/2/98	2.43	83331	ua
9108	2-Chlorophenol	N983309	<4.1	ug/L	EPA 625	6/2/98	4.1	83331	ua
9112	2-Methyl-4,6-dinitophenol	N983309	<4.0	ug/L	EPA 625	6/2/98	4.0	83331	ua
9115	Phenol	N983309	<2.6	ug/L	EPA 625	6/2/98	2.6	83331	ua
9116	2,4,6-Trichlorophenol	N983309	<4.66	ug/L	EPA 625	6/2/98	4.66	83331	ua

Priority Pollutants/Extractables

	Anthracene	N983309	<10.0	ug/L	EPA 525.2	5/21/98	10.0	83331	ua
	Naphthalene	N983309	<10.0	ug/L	EPA 525.2	5/21/98	10.0	83331	ua
	Phenanthrene	N983309	<10.0	ug/L	EPA 525.2	5/21/98	10.0	83331	ua
	Phenol	N983309	<2.6	ug/L	EPA 525.2	6/2/98	2.6	83331	ua

Trihalomethane Analysis

62-550.310(2)(a)

PWS027

[illegible]	Total THM's (0.10)	N983309	<0.00036	mg/L	EPA 524.2	5/14/98	0.00036	83331	ua

Unregulated Group I Analysis

62-550.405

PWS035

2021	Carbaryl	N983309	<3.89	ug/L	EPA 531.1	5/26/98	3.89	83331	ua
2022	Methomyl	N983309	<3.2	ug/L	EPA 531.1	5/26/98	3.2	83331	ua
2043	Aldicarb Sulfoxide	N983309	<1.88	ug/L	EPA 531.1	5/26/98	1.88	83331	ua
2044	Aldicarb Sulfone	N983309	<5.57	ug/L	EPA 531.1	5/26/98	5.57	83331	ua
2045	Metolachlor	N983309	<0.108	ug/L	EPA 507	5/14/98	0.108	83331	ua
2047	Aldicarb	N983309	<5.95	ug/L	EPA 531.1	5/26/98	5.95	83331	ua
2066	3-Hydroxycarbofuran	N983309	<3.35	ug/L	EPA 531.1	5/26/98	3.35	83331	ua
2077	Propachlor	N983309	<5	ug/L	EPA 508	5/14/98	5	83331	ua
2356	Aldrin	N983309	<0.005	ug/L	EPA 508	5/14/98	0.005	83331	ua
2364	Dieldrin	N983309	<0.02	ug/L	EPA 508	5/14/98	0.02	83331	ua
2440	Dicamba	N983309	<0.005	ug/L	EPA 515.1	5/14/98	0.005	83331	ua
2595	Metribuzin	N983309	<0.024	ug/L	EPA 507	5/28/98	0.024	83331	ua
2076	Butachlor	N983309	<0.021	ug/L	EPA 508	5/14/98	0.021	83331	ua

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst

Unregulated Group II Analysis

62-550.410

PWS034

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2210	Chloromethane	N983309	<0.35	ug/L	EPA 524.2	5/14/98	0.35	83331	ua
2212	Dichlorodiflouromethane	N983309	<0.26	ug/L	EPA 524.2	5/14/98	0.26	83331	ua
2214	Bromomethane	N983309	<0.29	ug/L	EPA 524.2	5/14/98	0.29	83331	ua
2216	Chloroethane	N983309	<0.29	ug/L	EPA 524.2	5/14/98	0.29	83331	ua
2218	Trichlorofluoromethane	N983309	<0.28	ug/L	EPA 524.2	5/14/98	0.28	83331	ua
2251	Methyl-Tert-Butyl-Ether	N983309	<0.27	ug/L	EPA 524.2	5/14/98	0.27	83331	ua
2408	Dibromomethane	N983309	<0.03	ug/L	EPA 524.2	5/14/98	0.03	83331	ua
2410	1,1-Dichloropropylene	N983309	<0.06	ug/L	EPA 524.2	5/14/98	0.06	83331	ua
2412	1,3-Dichloropropane	N983309	<0.05	ug/L	EPA 524.2	5/14/98	0.05	83331	ua
2413	1,3-Dichloropropene	N983309	<0.21	ug/L	EPA 524.2	5/14/98	0.21	83331	ua
2414	1,2,3-Trichloropropane	N983309	<0.39	ug/L	EPA 524.2	5/14/98	0.39	83331	ua
2416	2,2-Dichloropropane	N983309	<0.38	ug/L	EPA 524.2	5/14/98	0.38	83331	ua
2941	Chloroform	N983309	<0.16	ug/L	EPA 524.2	5/14/98	0.16	83331	ua
2942	Bromoform	N983309	<0.31	ug/L	EPA 524.2	5/14/98	0.31	83331	ua
2943	Bromodichloromethane	N983309	<0.36	ug/L	EPA 524.2	5/14/98	0.36	83331	ua
2944	Dibromochloromethane	N983309	<0.27	ug/L	EPA 524.2	5/14/98	0.27	83331	ua
2965	O-Chlorotoluene	N983309	<0.33	ug/L	EPA 524.2	5/14/98	0.33	83331	ua
2966	P-Chlorotoluene	N983309	<0.29	ug/L	EPA 524.2	5/14/98	0.29	83331	ua
2967	M-Dichlorobenzene	N983309	<0.2	ug/L	EPA 524.2	5/14/98	0.2	83331	ua
[illegible]	1,1-Dichloroethane	N983309	<0.1	ug/L	EPA 524.2	5/14/98	0.1	83331	ua
2986	1,1,1,2-Tetrachloroethane	N983309	<0.13	ug/L	EPA 524.2	5/14/98	0.13	83331	ua
2988	1,1,2,2-Tetrachloroethane	N983309	<0.33	ug/L	EPA 524.2	5/14/98	0.33	83331	ua
2993	Bromobenzene	N983309	<0.05	ug/L	EPA 524.2	5/14/98	0.05	83331	ua

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	Bicarbonate Alkalinity	N983309	110	mg/L	4500-CO2-D	5/15/98		84352	ua
	Carbonate Alkalinity	N983309	0.37	mg/L	4500-CO2-D	5/15/98		84352	ua
	Hydroxide Alkalinity	N983309	0.14	mg/L	4500-CO2-D	5/15/98		84352	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	Free Carbon Dioxide	N983309	6.20	mg/L	4500-CO2-D	5/15/98		84352	ua
	Total Carbon Dioxide	N983309	103	mg/L	4500-CO2-D	5/15/98		84352	ua
	Nitrogen, Total Kjeldahl	N983309	0.45	mg/L	EPA 351.2	5/22/98	0.2	84352	ua
	Nitrogen, Organic	N983309	0.40	mg/L	Calc.	5/22/98		84352	ua
	Turbidity	N983309	3.5	NTU	EPA 180.1	5/12/98	0.1	84352	ua

Approved by:

Debra A. Sanders
Laboratory Director

Approved by:

Patrick N. Sterling
Laboratory Manager

Comments:

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Sanders Laboratories
Environmental Testing Services

INTAKE #: 515423

Project Name:	Dual Zone Monitoring Well
Project Location:	Zone 1 (Upper)/Ft. Myers Beach
Sample Supply:	Ground Water
Collector:	Ray Burroughs
Sample Received Date/Time:	7/6/98 10:30

Date *04-Aug-98*

Youngquist Brothers, Inc.
15465 Pine Ridge Road

Fort Myers, FL 33908-

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
			Inorganic Analysis 62-550.310(1) PWS030						
1005	Arsenic (0.05)	N984695	<0.0022	mg/L	EPA 206.2	7/15/98	0.0022	84352	ua
1010	Barium (2)	N984695	0.682	mg/L	EPA 208.2	7/13/98	0.200	84352	ua
1015	Cadmium (0.005)	N984695	<0.003	mg/L	EPA 213.1	7/8/98	0.003	84352	ua
1020	Chromium (0.1)	N984695	<0.020	mg/L	EPA 218.1	7/8/98	0.020	84352	ua
1024	Cyanide (0.2)	N984695	<0.006	mg/L	SM4500CNE	7/15/98	0.006	83331	ua
1025	Fluoride (4)	N984695	1.90	mg/L	EPA 340.2	7/7/98	0.2	84352	ua
1030	Lead (0.015)	N984695	<0.001	mg/L	EPA 239.2	7/9/98	0.001	84352	ua
1035	Mercury (0.002)	N984695	<0.001	mg/L	EPA 245.1	7/15/98	0.001	84352	ua
1036	Nickel (0.1)	N984695	<0.010	mg/L	EPA 249.1	7/20/98	0.010	84352	ua
1040	Nitrate (10)	N984695	<0.01	mg/L	EPA 353.2	7/6/98	0.01	84352	ua
1041	Nitrite (1)	N984695	<0.01	mg/L	EPA 354.1	7/6/98	0.01	84352	ua
1045	Selenium (0.05)	N984695	<0.004	mg/L	EPA 270.2	7/7/98	0.004	84352	ua
1052	Sodium (160)	N984695	1,071	mg/L	EPA 273.1	7/9/98	0.003	84352	ua
1074	Antimony (0.006)	N984695	<0.002	mg/L	EPA 204.2	7/15/98	0.002	83331	ua
1075	Beryllium (0.004)	N984695	<0.004	mg/L	EPA 200.7	7/15/98	0.004	83331	ua
1085	Thallium (0.002)	N984695	<0.002	mg/L	EPA 279.2	7/15/98	0.002	83331	ua
			Secondary Chemical Analysis 62-550.320 PWS031						
1002	Aluminum (0.2)	N984695	<0.2	mg/L	EPA 202.1	7/13/98	0.2	84352	ua
1017	Chloride (250)	N984695	2,049	mg/L	SM4500Cl-B	7/12/98	5	84352	ua
1022	Copper (1.0)	N984695	<0.010	mg/L	EPA 220.1	7/8/98	0.010	84352	ua
1025	Fluoride (2.0)	N984695	1.90	mg/L	EPA 340.2	7/7/98	0.2	84352	ua
1028	Iron (0.3)	N984695	0.197	mg/L	EPA 236.1	7/7/98	0.015	84352	ua
1032	Manganese (0.05)	N984695	0.016	mg/L	EPA 243.1	7/20/98	0.005	84352	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

1050 Endeavor Ct. • Nokomis, FL 34275 • Phone: (941) 488-8103 • (800) 255-3108 • Fax: (941) 484-6774

Parameter ID	Analysis		Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
1050	Silver	(0.1)	N984695	<0.010	mg/L	EPA 272.1	7/8/98	0.010	84352	ua
1055	Sulfate	(250)	N984695	398	mg/L	EPA 375.4	7/7/98	5	84352	ua
5	Zinc	(5.0)	N984695	0.039	mg/L	EPA 289.1	7/8/98	0.005	84352	ua
1905	Color	(15.0)	N984695	23	PtCo units	EPA 110.3	7/7/98	1	84352	ua
1920	Odor	(3.0)	N984695	1	TON	EPA 140.1	7/7/98	1	84352	ua
1925	pH	(6.5-8.5)	N984695	8.07	std units	EPA 150.1	7/7/98	n/a	84352	ua
1930	Total Dissolved Solids (500)		N984695	4,020	mg/L	EPA 160.1	7/7/98	7	84352	ua
2905	Foaming Agents (1.5)		N984695	<0.02	mg/L	SM5540C	7/8/98	0.02	83331	ua

Radiochemical Analysis

62-550.310(5)

PWS033

4000	Gross Alpha	N984695	6.0	pCi/L	EPA 900.0	7/15/98	+/-3.3	83141	ua
4020	Radium 226	N984695	3.2	pCi/L	EPA 903.1	7/17/98	+/-0.3	83141	ua
4030	Radium 228	N984695	1.1	pCi/L	Brks/Blnchrd	7/17/98	+/-0.7	83141	ua

Trihalomethane Analysis

62-550.310(2)(a)

PWS027

2950	Total THM's (0.10)	N984695	<0.00036	mg/L	EPA 524.2	7/8/98	0.00036	83331	ua

Volatile Organic Analysis

62-550.310(2)(b)

PWS028

2378	1,2,4-Trichlorobenzene (70)	N984695	<0.22	ug/L	EPA 524.2	7/8/98	0.22	83331	ua
2380	Cis-1,2-Dichloroethylene (70)	N984695	<0.03	ug/L	EPA 524.2	7/8/98	0.03	83331	ua
2955	Xylenes (Total) (10,000)	N984695	<0.24	ug/L	EPA 524.2	7/8/98	0.24	83331	ua
2964	Dichloromethane (5)	N984695	<0.31	ug/L	EPA 524.2	7/8/98	0.31	83331	ua
2968	O-Dichlorobenzene (600)	N984695	<0.05	ug/L	EPA 524.2	7/8/98	0.05	83331	ua
2969	Para-Dichlorobenzene (75)	N984695	<0.02	ug/L	EPA 524.2	7/8/98	0.02	83331	ua
2976	Vinyl Chloride (1)	N984695	<0.29	ug/L	EPA 524.2	7/8/98	0.29	83331	ua
2977	1,1-Dichloroethylene (7)	N984695	<0.02	ug/L	EPA 524.2	7/8/98	0.02	83331	ua
2979	Trans-1,2-Dichloroethylene(100)	N984695	<0.12	ug/L	EPA 524.2	7/8/98	0.12	83331	ua
2980	1,2-Dichloroethane (3)	N984695	<0.02	ug/L	EPA 524.2	7/8/98	0.02	83331	ua
2981	1,1,1-Trichloroethane (200)	N984695	<0.21	ug/L	EPA 524.2	7/8/98	0.21	83331	ua
2982	Carbon Tetrachloride (3)	N984695	<0.29	ug/L	EPA 524.2	7/8/98	0.29	83331	ua
2983	1,2-Dichloropropane (5)	N984695	<0.33	ug/L	EPA 524.2	7/8/98	0.33	83331	ua
2984	Trichloroethylene (3)	N984695	<0.02	ug/L	EPA 524.2	7/8/98	0.02	83331	ua
2985	1,1,2-Trichloroethane (5)	N984695	<0.23	ug/L	EPA 524.2	7/8/98	0.23	83331	ua
2987	Tetrachloroethylene (3)	N984695	<0.21	ug/L	EPA 524.2	7/8/98	0.21	83331	ua
2989	Monochlorobenzene (100)	N984695	<0.23	ug/L	EPA 524.2	7/8/98	0.23	83331	ua
2990	Benzene (1)	N984695	<0.05	ug/L	EPA 524.2	7/8/98	0.05	83331	ua
2991	Toluene (1000)	N984695	<0.41	ug/L	EPA 524.2	7/8/98	0.41	83331	ua
92	Ethylbenzene (700)	N984695	<0.47	ug/L	EPA 524.2	7/8/98	0.47	83331	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2996	Styrene (100)	N984695	<0.2	ug/L	EPA 524.2	7/8/98	0.2	83331	ua

Pesticide/PCB Chemical Analysis

62-550.310(2)(c)

PWS029

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2005	Endrin (2)	N984695	<0.002	ug/L	EPA 508	7/16/98	0.002	83331	ua
2010	Lindane (0.2)	N984695	<0.002	ug/L	EPA 508	7/16/98	0.002	83331	ua
2015	Methoxychlor (40)	N984695	<0.052	ug/L	EPA 508	7/16/98	0.052	83331	ua
2020	Toxaphene (3)	N984695	<0.309	ug/L	EPA 508	7/16/98	0.309	83331	ua
2031	Dalapon (200)	N984695	<0.036	ug/L	EPA 515.1	7/30/98	0.036	83331	ua
2032	Diquat (20)	N984695	<0.26	ug/L	EPA 549.1	7/16/98	0.26	83331	ua
2033	Endothall (100)	N984695	<15.4	ug/L	EPA 548	7/20/98	15.4	83331	ua
2034	Glyphosate (700)	N984695	<9.44	ug/L	EPA 547	7/8/98	9.44	83331	ua
2035	Di(2-ethylhexyl) adipate (400)	N984695	<0.71	ug/L	EPA 525.2	7/16/98	0.71	83331	ua
2036	Oxamyl (Vydate) (200)	N984695	<2.57	ug/L	EPA 531.1	7/10/98	2.57	83331	ua
2037	Simazine (4)	N984695	<0.078	ug/L	EPA 507	7/16/98	0.078	83331	ua
2039	Di(2-ethylhexyl) phthalate (6)	N984695	<1.15	ug/L	EPA 525.2	7/16/98	1.15	83331	ua
2040	Picloram (500)	N984695	<0.029	ug/L	EPA 515.1	7/30/98	0.029	83331	ua
2041	Dinoseb (7)	N984695	<0.055	ug/L	EPA 515.1	7/30/98	0.055	83331	ua
2042	Hexachlorocyclopentadiene(50)	N984695	<0.01	ug/L	EPA 505	7/16/98	0.01	83331	ua
2046	Carbofuran (40)	N984695	<7.04	ug/L	EPA 531.1	7/10/98	7.04	83331	ua
2050	Atrazine (3)	N984695	<0.035	ug/L	EPA 507	7/16/98	0.035	83331	ua
1	Alachlor (2)	N984695	<0.012	ug/L	EPA 507	7/16/98	0.012	83331	ua
5	Heptachlor (0.4)	N984695	<0.004	ug/L	EPA 508	7/16/98	0.004	83331	ua
2067	Heptachlor Epoxide (0.2)	N984695	<0.002	ug/L	EPA 508	7/16/98	0.002	83331	ua
2105	2,4-D (70)	N984695	<0.026	ug/L	EPA 515.1	7/30/98	0.026	83331	ua
2110	2,4,5-TP (Silvex) (50)	N984695	<0.017	ug/L	EPA 515.1	7/30/98	0.017	83331	ua
2274	Hexachlorobenzene (1)	N984695	<0.008	ug/L	EPA 508	7/16/98	0.008	83331	ua
2306	Benzo(a)pyrene (.2)	N984695	<0.013	ug/L	EPA 550	7/17/98	0.013	83331	ua
2326	Pentachlorophenol (1)	N984695	<0.007	ug/L	EPA 515.1	7/30/98	0.007	83331	ua
2383	PCB (0.5)	N984695	<0.1	ug/L	EPA 508	7/16/98	0.1	83331	ua
2931	Dibromochloropropane (.2)	N984695	<0.004	ug/L	EPA 504	7/14/98	0.004	83331	ua
2946	Ethylene Dibromide (0.02)	N984695	<0.006	ug/L	EPA 504	7/14/98	0.006	83331	ua
2959	Chlordane (2)	N984695	<0.446	ug/L	EPA 508	7/16/98	0.446	83331	ua

Unregulated Group I Analysis

62-550.405

PWS035

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2021	Carbaryl	N984695	<3.89	ug/L	EPA 531.1	7/10/98	3.89	83331	ua
2022	Methomyl	N984695	<3.2	ug/L	EPA 531.1	7/10/98	3.2	83331	ua
2043	Aldicarb Sulfoxide	N984695	<1.88	ug/L	EPA 531.1	7/10/98	1.88	83331	ua
2044	Aldicarb Sulfone	N984695	<5.57	ug/L	EPA 531.1	7/10/98	5.57	83331	ua
2045	Metolachlor	N984695	<0.108	ug/L	EPA 507	7/16/98	0.108	83331	ua
7	Aldicarb	N984695	<5.95	ug/L	EPA 531.1	7/10/98	5.95	83331	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2066	3-Hydroxycarbofuran	N984695	<3.35	ug/L	EPA 531.1	7/10/98	3.35	83331	ua
77	Propachlor	N984695	<5	ug/L	EPA 508	7/16/98	5	83331	ua
.	Aldrin	N984695	<0.005	ug/L	EPA 508	7/16/98	0.005	83331	ua
2364	Dieldrin	N984695	<0.02	ug/L	EPA 508	7/16/98	0.02	83331	ua
2440	Dicamba	N984695	<0.005	ug/L	EPA 515.1	7/30/98	0.005	83331	ua
2595	Metribuzin	N984695	<0.024	ug/L	EPA 507	7/16/98	0.024	83331	ua
2076	Butachlor	N984695	<0.21	ug/L	EPA 507	7/16/98	0.21	83331	ua

Unregulated Group II Analysis

62-550.410

PWS034

2210	Chloromethane	N984695	<0.29	ug/L	EPA 524.2	7/8/98	0.29	83331	ua
2212	Dichlorodiflouromethane	N984695	<0.26	ug/L	EPA 524.2	7/8/98	0.26	83331	ua
2214	Bromomethane	N984695	<0.29	ug/L	EPA 524.2	7/8/98	0.29	83331	ua
2216	Chloroethane	N984695	<0.35	ug/L	EPA 524.2	7/8/98	0.35	83331	ua
2218	Trichlorofluoromethane	N984695	<0.28	ug/L	EPA 524.2	7/8/98	0.28	83331	ua
2251	Methyl-Tert-Butyl-Ether	N984695	<0.27	ug/L	EPA 524.2	7/8/98	0.27	83331	ua
2408	Dibromomethane	N984695	<0.03	ug/L	EPA 524.2	7/8/98	0.03	83331	ua
2410	1,1-Dichloropropylene	N984695	<0.06	ug/L	EPA 524.2	7/8/98	0.06	83331	ua
2412	1,3-Dichloropropane	N984695	<0.21	ug/L	EPA 524.2	7/8/98	0.21	83331	ua
2413	1,3-Dichloropropene	N984695	<0.05	ug/L	EPA 524.2	7/8/98	0.05	83331	ua
2414	1,2,3-Trichloropropane	N984695	<0.39	ug/L	EPA 524.2	7/8/98	0.39	83331	ua
5	2,2-Dichloropropane	N984695	<0.38	ug/L	EPA 524.2	7/8/98	0.38	83331	ua
.41	Chloroform	N984695	<0.16	ug/L	EPA 524.2	7/8/98	0.16	83331	ua
2942	Bromoform	N984695	<0.31	ug/L	EPA 524.2	7/8/98	0.31	83331	ua
2943	Bromodichloromethane	N984695	<0.36	ug/L	EPA 524.2	7/8/98	0.36	83331	ua
2944	Dibromochloromethane	N984695	<0.27	ug/L	EPA 524.2	7/8/98	0.27	83331	ua
2965	O-Chlorotoluene	N984695	<0.29	ug/L	EPA 524.2	7/8/98	0.29	83331	ua
2966	P-Chlorotoluene	N984695	<0.2	ug/L	EPA 524.2	7/8/98	0.2	83331	ua
2967	M-Dichlorobenzene	N984695	<0.2	ug/L	EPA 524.2	7/8/98	0.2	83331	ua
2978	1,1-Dichloroethane	N984695	<0.1	ug/L	EPA 524.2	7/8/98	0.1	83331	ua
2986	1,1,1,2-Tetrachloroethane	N984695	<0.13	ug/L	EPA 524.2	7/8/98	0.13	83331	ua
2988	1,1,2,2-Tetrachloroethane	N984695	<0.33	ug/L	EPA 524.2	7/8/98	0.33	83331	ua
2993	Bromobenzene	N984695	<0.05	ug/L	EPA 524.2	7/8/98	0.05	83331	ua

Unregulated Group III Analysis

62-550.415

PWS036 & 037

2262	Isophorone	N984695	<7.26	ug/L	EPA 625	7/14/98	7.26	83331	ua
2270	2,4-Dinitrotoluene	N984695	<4.78	ug/L	EPA 625	7/14/98	4.78	83331	ua
2282	Dimethylphthalate	N984695	<9.47	ug/L	EPA 625	7/14/98	9.47	83331	ua
2284	Diethylphthalate	N984695	<4.3	ug/L	EPA 625	7/14/98	4.3	83331	ua
2290	Di-n-Butylphthalate	N984695	<4.01	ug/L	EPA 625	7/14/98	4.01	83331	ua
4	Butyl benzyl phthalate	N984695	<2.55	ug/L	EPA 625	7/14/98	2.55	83331	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
9089	Di-n-octylphthalate	N984695	<2.43	ug/L	EPA 625	7/14/98	2.43	83331	ua
'08	2-Chlorophenol	N984695	<4.1	ug/L	EPA 625	7/14/98	4.1	83331	ua
.2	2-Methyl-4,6-dinitophenol	N984695	<4.0	ug/L	EPA 625	7/14/98	4.0	83331	ua
9115	Phenol	N984695	32.2	ug/L	EPA 625	7/14/98	2.6	83331	ua
9116	2,4,6-Trichlorophenol	N984695	<4.66	ug/L	EPA 625	7/14/98	4.66	83331	ua
	BOD	N984695	1.7	mg/L	EPA 405.1	7/6/98 12:00	1	84352	ua
	Ammonia-N	N984695	0.67	mg/L	EPA 350.3	7/8/98	0.05	84352	ua
	Nitrogen, Organic	N984695	<0.20	mg/L	EPA 351.2	7/8/98	0.2	84352	ua
	Nitrogen, Total Kjeldahl	N984695	0.73	mg/L	EPA 351.2	7/7/98	0.2	84352	ua
	Orthophosphate	N984695	<0.02	mg/L	EPA 365.2	7/7/98	0.02	84352	ua
	Turbidity	N984695	7.8	NTU	EPA 180.1	7/7/98	0.1	84352	ua
	Potassium	N984695	43.9	mg/L	EPA 258.1	7/15/98	0.003	84352	ua

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time		D. L.	LabID	Analyst
	Magnesium	N984695	172	mg/L	EPA 242.1	7/20/98		0.0008	84352	ua
	Phosphorus, Total	N984695	0.04	mg/L	EPA 365.2	7/10/98		0.02	84352	ua
	Calcium	N984695	134	mg/L	EPA 215.1	7/20/98		0.022	84352	ua
	Carbonate, CO3	N984695	0.44	mg/L	SM 4500	7/14/98			84352	ua
	Bicarbonate, HCO3	N984695	136	mg/L	4500-CO2-D	7/14/98			84352	ua

EPA 610

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time		D. L.	LabID	Analyst
	Naphthalene	N984695	<5	ug/L	EPA 8100	7/16/98		5	83331	ua
	Phenanthrene	N984695	<5	ug/L	EPA 8100	7/16/98		5	83331	ua
	Anthracene	N984695	<5	ug/L	EPA 8100	7/16/98		5	83331	ua
	Total Coliform	N984695	<1	col/100ml	SM9222B	7/6/98	11:55	1	84352	ua
	Fecal Coliform	N984695	<1	col/100mL	SM9222D	7/6/98	11:55	1	84352	ua
	Fecal Strep	N984695	<1	col/100ml	SM9230C	7/6/98	11:55	1	84352	ua

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst

Field Data

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	pH, Field	N984695	8.07	std unit	EPA 150.1	7/6/98	n/a	84352	ua
	Conductivity	N984695	6,550	umhos/cm	EPA 120.1	7/6/98	1.0	84352	ua
	Water Temperature	N984695	24.6	°C	EPA 170.1	7/6/98	0.1	84352	ua
	Air Temperature	N984695	[illegible]	°C	EPA170.1	7/6/98	0.1	84352	ua
	Weather, Condition	N984695	Cloudy			7/6/98		84352	ua
	Dissolved Oxygen, Field	N984695	1.1	mg/L	EPA 360.1	7/6/98	0.1	84352	ua
	Salinity	N984695	3.5	%	SM210C	7/6/98	1	84352	ua
	Sulfide	N984695	<0.2	mg/L	HACH	7/6/98	0.2	84352	ua

Approved by:

Debra A. Sanders

Debra Sanders
Laboratory Director

Approved by:

Patrick N. Sterling
Laboratory Manager

Comments:

INTAKE #: 515424

Sanders Laboratories
Environmental Testing Services

Date *04-Aug-98*

Project Name:	Dual Zone Monitoring Well
Project Location:	Zone 2 (Lower)/Ft. Myers Beach
Sample Supply:	Ground Water
Collector:	Ray Burroughs
Sample Received Date/Time:	7/6/98 10:30

Youngquist Brothers, Inc.
15465 Pine Ridge Road

Fort Myers, FL 33908-

Inorganic Analysis

62-550.310(1)

PWS030

Parameter ID	Analysis		Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
1005	Arsenic	(0.05)	N984696	<0.0022	mg/L	EPA 206.2	7/15/98	0.0022	84352	ua
1010	Barium	(2)	N984696	4.83	mg/L	EPA 208.2	7/13/98	0.200	84352	ua
1015	Cadmium	(0.005)	N984696	<0.003	mg/L	EPA 213.1	7/8/98	0.003	84352	ua
1020	Chromium	(0.1)	N984696	0.093	mg/L	EPA 218.1	7/8/98	0.020	84352	ua
'4	Cyanide	(0.2)	N984696	<0.006	mg/L	SM4500CNE	7/15/98	0.006	83331	ua
.025	Fluoride	(4)	N984696	1.43	mg/L	EPA 340.2	7/7/98	0.2	84352	ua
1030	Lead	(0.015)	N984696	<0.001	mg/L	EPA 239.2	7/14/98	0.001	84352	ua
1035	Mercury	(0.002)	N984696	<0.001	mg/L	EPA 245.1	7/15/98	0.001	84352	ua
1036	Nickel	(0.1)	N984696	<0.010	mg/L	EPA 249.1	7/20/98	0.010	84352	ua
1040	Nitrate	(10)	N984696	<0.01	mg/L	EPA 353.2	7/6/98	0.01	84352	ua
1041	Nitrite	(1)	N984696	<0.01	mg/L	EPA 354.1	7/6/98	0.01	84352	ua
1045	Selenium	(0.05)	N984696	<0.004	mg/L	EPA 270.2	7/17/98	0.004	84352	ua
1052	Sodium	(160)	N984696	10,032	mg/L	EPA 273.1	7/9/98	0.003	84352	ua
1074	Antimony	(0.006)	N984696	<0.002	mg/L	EPA 204.2	7/15/98	0.002	83331	ua
1075	Beryllium	(0.004)	N984696	<0.004	mg/L	EPA 200.7	7/15/98	0.004	83331	ua
1085	Thallium	(0.002)	N984696	<0.002	mg/L	EPA 279.2	7/15/98	0.002	83331	ua

Secondary Chemical Analysis

62-550.320

PWS031

Parameter ID	Analysis		Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
1002	Aluminum	(0.2)	N984696	<0.2	mg/L	EPA 202.1	7/13/98	0.2	84352	ua
1017	Chloride	(250)	N984696	18,167	mg/L	SM4500Cl-B	7/12/98	5	84352	ua
1022	Copper	(1.0)	N984696	0.076	mg/L	EPA 220.1	7/8/98	0.010	84352	ua
1025	Fluoride	(2.0)	N984696	1.43	mg/L	EPA 340.2	7/7/98	0.2	84352	ua
'028	Iron	(0.3)	N984696	0.370	mg/L	EPA 236.1	7/7/98	0.015	84352	ua
32	Manganese	(0.05)	N984696	<0.005	mg/L	EPA 243.1	7/20/98	0.005	84352	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Rpt form #5; Rev 1/1/96

1050 Endeavor Ct. • Nokomis, FL 34275 • Phone: (941) 488-8103 • (800) 255-3108 • Fax: (941) 484-6774

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
1050	Silver (0.1)	N984696	<0.010	mg/L	EPA 272.1	7/8/98	0.010	84352	ua
55	Sulfate (250)	N984696	2,659	mg/L	EPA 375.4	7/7/98	5	84352	ua
5	Zinc (5.0)	N984696	<0.005	mg/L	EPA 289.1	7/8/98	0.005	84352	ua
1905	Color (15.0)	N984696	14	PtCo units	EPA 110.3	7/7/98	1	84352	ua
1920	Odor (3.0)	N984696	2	TON	EPA 140.1	7/7/98	1	84352	ua
1925	pH (6.5-8.5)	N984696	7.64	std units	EPA 150.1	7/7/98	n/a	84352	ua
1930	Total Dissolved Solids (500)	N984696	30,000	mg/L	EPA 160.1	7/7/98	7	84352	ua
2905	Foaming Agents (1.5)	N984696	0.03	mg/L	SM 5540C	7/8/98	0.02	83331	ua

Radiochemical Analysis

62-550.310(5)

PWS033

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
4000	Gross Alpha	N984696	16.3	pCi/L	EPA 900.0	7/15/98	+/-4.7	83141	ua
4020	Radium 226	N984696	9.3	pCi/L	EPA 903.1	7/17/98	+/-0.5	83141	ua
4030	Radium 228	N984696	1.4	pCi/L	Brks/Blnchrd	7/17/98	+/-0.7	83141	ua

Trihalomethane Analysis

62-550.310(2)(a)

PWS027

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2950	Total THM's (0.10)	N984696	<0.00036	mg/L	EPA 524.2	7/8/98	0.00036	83331	ua

Volatile Organic Analysis

62-550.310(2)(b)

PWS028

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2378	1,2,4-Trichlorobenzene (70)	N984696	<0.22	ug/L	EPA 524.2	7/8/98	0.22	83331	ua
2380	Cis-1,2-Dichloroethylene (70)	N984696	<0.03	ug/L	EPA 524.2	7/8/98	0.03	83331	ua
2955	Xylenes (Total) (10,000)	N984696	<0.24	ug/L	EPA 524.2	7/8/98	0.24	83331	ua
2964	Dichloromethane (5)	N984696	<0.31	ug/L	EPA 524.2	7/8/98	0.31	83331	ua
2968	O-Dichlorobenzene (600)	N984696	<0.05	ug/L	EPA 524.2	7/8/98	0.05	83331	ua
2969	Para-Dichlorobenzene (75)	N984696	<0.02	ug/L	EPA 524.2	7/8/98	0.02	83331	ua
2976	Vinyl Chloride (1)	N984696	<0.29	ug/L	EPA 524.2	7/8/98	0.29	83331	ua
2977	1,1-Dichloroethylene (7)	N984696	<0.02	ug/L	EPA 524.2	7/8/98	0.02	83331	ua
2979	Trans-1,2-Dichloroethylene(100)	N984696	<0.12	ug/L	EPA 524.2	7/8/98	0.12	83331	ua
2980	1,2-Dichloroethane (3)	N984696	<0.02	ug/L	EPA 524.2	7/8/98	0.02	83331	ua
2981	1,1,1-Trichloroethane (200)	N984696	<0.21	ug/L	EPA 524.2	7/8/98	0.21	83331	ua
2982	Carbon Tetrachloride (3)	N984696	<0.29	ug/L	EPA 524.2	7/8/98	0.29	83331	ua
2983	1,2-Dichloropropane (5)	N984696	<0.33	ug/L	EPA 524.2	7/8/98	0.33	83331	ua
2984	Trichloroethylene (3)	N984696	<0.02	ug/L	EPA 524.2	7/8/98	0.02	83331	ua
2985	1,1,2-Trichloroethane (5)	N984696	<0.23	ug/L	EPA 524.2	7/8/98	0.23	83331	ua
2987	Tetrachloroethylene (3)	N984696	<0.21	ug/L	EPA 524.2	7/8/98	0.21	83331	ua
2989	Monochlorobenzene (100)	N984696	<0.23	ug/L	EPA 524.2	7/8/98	0.23	83331	ua
2990	Benzene (1)	N984696	<0.05	ug/L	EPA 524.2	7/8/98	0.05	83331	ua
91	Toluene (1000)	N984696	<0.41	ug/L	EPA 524.2	7/8/98	0.41	83331	ua
92	Ethylbenzene (700)	N984696	<0.47	ug/L	EPA 524.2	7/8/98	0.47	83331	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2996	Styrene (100)	N984696	<0.2	ug/L	EPA 524.2	7/8/98	0.2	83331	ua

Pesticide/PCB Chemical Analysis

62-550.310(2)(c)

PWS029

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2005	Endrin (2)	N984696	<0.002	ug/L	EPA 508	7/16/98	0.002	83331	ua
2010	Lindane (0.2)	N984696	<0.002	ug/L	EPA 508	7/16/98	0.002	83331	ua
2015	Methoxychlor (40)	N984696	<0.052	ug/L	EPA 508	7/16/98	0.052	83331	ua
2020	Toxaphene (3)	N984696	<0.309	ug/L	EPA 508	7/16/98	0.309	83331	ua
2031	Dalapon (200)	N984696	<0.036	ug/L	EPA 515.1	7/30/98	0.036	83331	ua
2032	Diquat (20)	N984696	<0.26	ug/L	EPA 549.1	7/16/98	0.26	83331	ua
2033	Endothall (100)	N984696	<15.4	ug/L	EPA 548	7/20/98	15.4	83331	ua
2034	Glyphosate (700)	N984696	<9.44	ug/L	EPA 547	7/8/98	9.44	83331	ua
2035	Di(2-ethylhexyl) adipate (400)	N984696	<0.71	ug/L	EPA 525.2	7/16/98	0.71	83331	ua
2036	Oxamyl (Vydate) (200)	N984696	<2.57	ug/L	EPA 531.1	7/10/98	2.57	83331	ua
2037	Simazine (4)	N984696	<0.078	ug/L	EPA 507	7/16/98	0.078	83331	ua
2039	Di(2-ethylhexyl) phthalate (6)	N984696	<1.15	ug/L	EPA 525.2	7/16/98	1.15	83331	ua
2040	Picloram (500)	N984696	<0.029	ug/L	EPA 515.1	7/30/98	0.029	83331	ua
2041	Dinoseb (7)	N984696	<0.055	ug/L	EPA 515.1	7/30/98	0.055	83331	ua
2042	Hexachlorocyclopentadiene(50)	N984696	<0.01	ug/L	EPA 508	7/16/98	0.01	83331	ua
2046	Carbofuran (40)	N984696	<7.04	ug/L	EPA 531.1	7/10/98	7.04	83331	ua
2050	Atrazine (3)	N984696	<0.035	ug/L	EPA 507	7/16/98	0.035	83331	ua
1	Alachlor (2)	N984696	<0.012	ug/L	EPA 507	7/16/98	0.012	83331	ua
065	Heptachlor (0.4)	N984696	<0.004	ug/L	EPA 508	7/16/98	0.004	83331	ua
2067	Heptachlor Epoxide (0.2)	N984696	<0.002	ug/L	EPA 508	7/16/98	0.002	83331	ua
2105	2,4-D (70)	N984696	<0.026	ug/L	EPA 515.1	7/30/98	0.026	83331	ua
2110	2,4,5-TP (Silvex) (50)	N984696	<0.017	ug/L	EPA 515.1	7/30/98	0.017	83331	ua
2274	Hexachlorobenzene (1)	N984696	<0.008	ug/L	EPA 508	7/16/98	0.008	83331	ua
2306	Benzo(a)pyrene (.2)	N984696	<0.013	ug/L	EPA 550	7/17/98	0.013	83331	ua
2326	Pentachlorophenol (1)	N984696	<0.007	ug/L	EPA 515.1	7/30/98	0.007	83331	ua
2383	PCB (0.5)	N984696	<0.1	ug/L	EPA 508	7/16/98	0.1	83331	ua
2931	Dibromochloropropane (.2)	N984696	<0.004	ug/L	EPA 504	7/14/98	0.004	83331	ua
2946	Ethylene Dibromide (0.02)	N984696	<0.006	ug/L	EPA 504	7/14/98	0.006	83331	ua
2959	Chlordane (2)	N984696	<0.446	ug/L	EPA 508	7/16/98	0.446	83331	ua

Unregulated Group I Analysis

62-550.405

PWS035

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2021	Carbaryl	N984696	<3.89	ug/L	EPA 531.1	7/10/98	3.89	83331	ua
2022	Methomyl	N984696	<3.2	ug/L	EPA 531.1	7/10/98	3.2	83331	ua
2043	Aldicarb Sulfoxide	N984696	<1.88	ug/L	EPA 531.1	7/10/98	1.88	83331	ua
2044	Aldicarb Sulfone	N984696	<5.57	ug/L	EPA 531.1	7/10/98	5.57	83331	ua
045	Metolachlor	N984696	<0.108	ug/L	EPA 507	7/16/98	0.108	83331	ua
7	Aldicarb	N984696	<5.95	ug/L	EPA 531.1	7/10/98	5.95	83331	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2066	3-Hydroxycarbofuran	N984696	<3.35	ug/L	EPA 531.1	7/10/98	3.35	83331	ua
~77	Propachlor	N984696	<5	ug/L	EPA 508	7/16/98	5	83331	ua
͵	Aldrin	N984696	<0.005	ug/L	EPA 508	7/16/98	0.005	83331	ua
2364	Dieldrin	N984696	<0.02	ug/L	EPA 508	7/16/98	0.02	83331	ua
2440	Dicamba	N984696	<0.005	ug/L	EPA 515.1	7/30/98	0.005	83331	ua
2595	Metribuzin	N984696	<0.024	ug/L	EPA 507	7/16/98	0.024	83331	ua
2076	Butachlor	N984696	<0.021	ug/L	EPA 507	7/16/98	0.021	83331	ua

Unregulated Group II Analysis

62-550.410

PWS034

2210	Chloromethane	N984696	<0.35	ug/L	EPA 524.2	7/8/98	0.35	83331	ua
2212	Dichlorodiflouromethane	N984696	<0.26	ug/L	EPA 524.2	7/8/98	0.26	83331	ua
2214	Bromomethane	N984696	<0.29	ug/L	EPA 524.2	7/8/98	0.29	83331	ua
2216	Chloroethane	N984696	<0.29	ug/L	EPA 524.2	7/8/98	0.29	83331	ua
2218	Trichlorofluoromethane	N984696	<0.28	ug/L	EPA 524.2	7/8/98	0.28	83331	ua
2251	Methyl-Tert-Butyl-Ether	N984696	<0.27	ug/L	EPA 524.2	7/8/98	0.27	83331	ua
2408	Dibromomethane	N984696	<0.03	ug/L	EPA 524.2	7/8/98	0.03	83331	ua
2410	1,1-Dichloropropylene	N984696	<0.06	ug/L	EPA 524.2	7/8/98	0.06	83331	ua
2412	1,3-Dichloropropane	N984696	<0.21	ug/L	EPA 524.2	7/8/98	0.21	83331	ua
2413	1,3-Dichloropropene	N984696	<0.05	ug/L	EPA 524.2	7/8/98	0.05	83331	ua
2414	1,2,3-Trichloropropane	N984696	<0.39	ug/L	EPA 524.2	7/8/98	0.39	83331	ua
6	2,2-Dichloropropane	N984696	<0.38	ug/L	EPA 524.2	7/8/98	0.38	83331	ua
~41	Chloroform	N984696	<0.16	ug/L	EPA 524.2	7/8/98	0.16	83331	ua
2942	Bromoform	N984696	<0.31	ug/L	EPA 524.2	7/8/98	0.31	83331	ua
2943	Bromodichloromethane	N984696	<0.36	ug/L	EPA 524.2	7/8/98	0.36	83331	ua
2944	Dibromochloromethane	N984696	<0.27	ug/L	EPA 524.2	7/8/98	0.27	83331	ua
2965	O-Chlorotoluene	N984696	<0.33	ug/L	EPA 524.2	7/8/98	0.33	83331	ua
2966	P-Chlorotoluene	N984696	<0.29	ug/L	EPA 524.2	7/8/98	0.29	83331	ua
2967	M-Dichlorobenzene	N984696	<0.2	ug/L	EPA 524.2	7/8/98	0.2	83331	ua
2978	1,1-Dichloroethane	N984696	<0.1	ug/L	EPA 524.2	7/8/98	0.1	83331	ua
2986	1,1,1,2-Tetrachloroethane	N984696	<0.13	ug/L	EPA 524.2	7/8/98	0.13	83331	ua
2988	1,1,2,2-Tetrachloroethane	N984696	<0.33	ug/L	EPA 524.2	7/8/98	0.33	83331	ua
2993	Bromobenzene	N984696	<0.05	ug/L	EPA 524.2	7/8/98	0.05	83331	ua

Unregulated Group III Analysis

62-550.415

PWS036 & 037

2262	Isophorone	N984696	<7.26	ug/L	EPA 625	7/14/98	7.26	83331	ua
2270	2,4-Dinitrotoluene	N984696	<4.78	ug/L	EPA 625	7/14/98	4.78	83331	ua
2282	Dimethylphthalate	N984696	<9.47	ug/L	EPA 625	7/14/98	9.47	83331	ua
2284	Diethylphthalate	N984696	<4.3	ug/L	EPA 625	7/14/98	4.3	83331	ua
~290	Di-n-Butylphthalate	N984696	<4.01	ug/L	EPA 625	7/14/98	4.01	83331	ua
~4	Butyl benzyl phthalate	N984696	<2.55	ug/L	EPA 625	7/14/98	2.55	83331	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
9089	Di-n-octylphthalate	N984696	<2.43	ug/L	EPA 625	7/14/98	2.43	83331	ua
[illegible]	2-Chlorophenol	N984696	<4.1	ug/L	EPA 625	7/14/98	4.1	83331	ua
	2-Methyl-4,6-dinitophenol	N984696	<4.0	ug/L	EPA 625	7/14/98	4.0	83331	ua
9115	Phenol	N984696	<2.6	ug/L	EPA 625	7/14/98	2.6	83331	ua
9116	2,4,6-Trichlorophenol	N984696	<4.66	ug/L	EPA 625	7/14/98	4.66	83331	ua
	BOD	N984696	<1	mg/L	EPA 405.1	7/6/98 12:00	1	84352	ua
	Ammonia-N	N984696	0.23	mg/L	EPA 350.3	7/8/98	0.05	84352	ua
	Nitrogen, Organic	N984696	0.42	mg/L	EPA 351.2	7/8/98	0.2	84352	ua
	Nitrogen, Total Kjeldahl	N984696	0.65	mg/L	EPA 351.2	7/7/98	0.2	84352	ua
	Orthophosphate	N984696	0.04	mg/L	EPA 365.2	7/7/98	0.02	84352	ua
	Turbidity	N984696	0.8	NTU	EPA 180.1	7/7/98	0.1	84352	ua
	Potassium	N984696	451	mg/L	EPA 258.1	7/20/98	0.003	84352	ua

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	Magnesium	N984696	932	mg/L	EPA 242.1	7/20/98	0.0008	84352	ua
	Phosphorus, Total	N984696	0.04	mg/L	EPA 365.2	7/10/98	0.02	84352	ua
	Calcium	N984696	588	mg/L	EPA 215.1	7/20/98	0.022	84352	ua
	Carbonate, CO3	N984696	0.09	mg/L	SM 4500	7/14/98		84352	ua
	Bicarbonate, HCO3	N984696	120	mg/L	4500-CO2-D	7/14/98		84352	ua

EPA 610

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	Naphthalene	N984696	<5	ug/L	EPA 8100	7/16/98	5	83331	ua
	Phenanthrene	N984696	<5	ug/L	EPA 8100	7/16/98	5	83331	ua
	Anthracene	N984696	<5	ug/L	EPA 8100	7/16/98	5	83331	ua
	Total Coliform	N984696	<1	col/100ml	SM9222B	7/6/98 12:00	1	84352	ua
	Fecal Coliform	N984696	<1	col/100mL	SM9222D	7/6/98 12:00	1	84352	ua
	Fecal Strep	N984696	<1	col/100ml	SM9230C	7/6/98 12:00	1	84352	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst

Field Data

pH, Field	N984696	7.64	std unit	EPA 150.1	7/6/98	n/a	84352	ua
Conductivity	N984696	37,400	umhos/cm	EPA 120.1	7/6/98	1.0	84352	ua
Water Temperature	N984696	24.8	°C	EPA 170.1	7/6/98	0.1	84352	ua
Air Temperature	N984696	31.5	°C	EPA170.1	7/6/98	0.1	84352	ua
Weather, Condition	N984696	Cloudy			7/6/98		84352	ua
Dissolved Oxygen, Field	N984696	1.4	mg/L	EPA 360.1	7/6/98	0.1	84352	ua
Salinity	N984696	19.3	%	SM2520B	7/6/98	1	84352	ua
Sulfide	N984696	<0.2	mg/L	HACH	7/6/98	0.2	E84380	ua

Approved by:

Debra Sanders
aboratory Director

Approved by:

Patrick N. Sterling
Laboratory Manager

Comments:

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Rpt form #5; Rev 1/1/96

Sanders Laboratories
Environmental Testing Services

CHAIN-OF-CUSTODY RECORD

INTAKE FORM # 515423-515424

Page 1 of 1

Client: Youngquist Brothers Well Drilling
Address:
Phone: Fax:

Report To:
Bill To:
P.O. #:
Project Name: 2nd Zone MW
Project Location: Ft. Myers Beach

Sample Supply: Ground Water
Customer Type:
Field Report #:
Kit #:
REQUESTED DUE DATE: 7-20-98

Sampled By (PRINT): Ray Burroughs
Sampler Signature: [signature]

Analyses Request: Pri & Sec Inorg; GA Rad 226&228; Prim VOCs; Pest & PCBS; Unreg Sec Vol Inorg; Bol NH3 Org N; TKN, OP, Turb; K, Mg, TP, Ca; CO3, Bicarbonate; 610, TOC, Cl; Fecal Ct, Fecal S; (Field) pH, Cond, Temp, Sil, Alk

ITEM #	SAMPLE DESCRIPTION / LOCATION	JOB #	DATE	TIME	TYPE	NO. OF CONTAINERS	UNPRESERVED	H_2SO_4	HNO_3	HCL		Pri & Sec Inorg	GA Rad 226&228	Prim VOCs	Pest & PCBS	Unreg Sec Vol Inorg	Bol NH3 Org N	TKN, OP, Turb	K, Mg, TP, Ca	CO3, Bicarbonate	610, TOC, Cl	Fecal Ct, Fecal S	LAB NUMBER
1	Zone 1 UPPER		7/6/98	0805								X	X	X	X	X	X	X	X	X	X	X	N984695
2	Zone 2 LOWER		7/6/98	0900								X	X	X	X	X	X	X	X	X	X	X	N984696

SHIPMENT METHOD OUT / DATE	RETURNED / DATE	VIA	ITEM #	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
				[signature]	7/6/98	1030	[signature]	7-6-98	1050

COOLER #

COMMENTS:
* Napthalene
Anthracene
Phenanthrene

Sub-Lets Shipped Greyhound & UPS Ground

Appendix J
Pressure Test Data Sheets

Fort Myers Beach WWTP
Injection Well IW-1
Casing Pressure Test

Client: Lee County

Well Name: IW-1

Date: 4-May-98

Observers: Jack Myers/FDEP
Mark Beaverson/Johnson Engineering
Bill Beddow/CH2M HILL

Notes: Cement plug at base of casing

Time	Lapse Time (minutes)	Casing Pressure (psi)	Comments
1350	0	150.0	Start Test
1355	5	150.0	
1400	10	150.0	
1405	15	150.5	
1410	20	151.0	
1415	25	151.0	
1420	30	151.5	
1425	35	151.5	
1430	40	152.00	
1435	45	152.0	
1440	50	152.0	
1445	55	152.2	
1450	60	152.2	
1455	65	152.5	
1500	70	153.0	
1505	75	153.0	
1510	80	153.0	
1515	85	153.5	
1520	90	153.8	
1525	95	153.8	
1530	100	154.0	
1535	105	154.5	
1540	110	154.8	
1545	115	154.8	
1550	120	155.0	Test Complete

Note: 12 gallons of water were released during pressure bleed-off.

Fort Myers Beach WWTP
Monitor Well MW-1
Casing Pressure Test

Client:	Lee County
Well Name:	MW-1
Date:	12-Jun-98
Observers:	Richard Orth/FDEP Mark Beaverson/Johnson Engineering
Packer Depth:	1,544 feet bpl

Time	Lapse Time (minutes)	Casing Pressure (psi)	Comments
1620	0	150.0	Start Test
1625	5	149.0	
1630	10	148.5	
1635	15	148.0	
1640	20	147.0	
1650	30	146.0	
1705	45	144.0	
1715	55	144.0	
1720	60	144.0	Test Complete

Note: Pressure released by FDEP representative 60 minutes into the test.

Appendix K
Video Survey Reports

Fort Myers Beach WWTP
Injection Well IW-1
Video Survey Summary

Date: 13-May-98
Observer: Mark Beaverson
Reviewer: David McNabb

Depth in feet below pad level		Observations
From	To	
0	100	Water is clear. Logging through drill pipe, start the video at 35 feet bpl.
100	200	Logging stopped at 125 and 183 feet bpl to allow flushing, then resumed logging.
200	300	Logging stopped at 206, 246 and 266 feet bpl to allow flushing, then resumed logging. Casing joints at 204, 246, and 290 feet bpl.
300	400	Casing joint at 384 feet bpl.
400	500	Casing joints at 415, 458, and 498 feet bpl.
500	600	Casing joints at 580 feet bpl.
600	700	Casing joints at 620 and 660 feet bpl.
700	800	Water clarity is variable.
800	900	logging.
900	1000	Casing joints at 916, 958, and 1,000 feet bpl.
1000	1100	Casing joints at 1,043 and 1,087 feet bpl.
1100	1200	Casing joint at 1,169 feet bpl.
1200	1300	Casing joints at 1,212, 1,253, and 1,297 feet bpl.
1300	1400	Casing joints and 1,339 and 1,381 feet bpl.
1400	1500	Casing joints at 1,425 and 1,466 feet bpl.
1500	1600	Casing joints at 1,508, 1,550, and 1,590 feet bpl.
1600	1700	Moderate visibility.
1700	1800	Casing joints at 1,754 and 1,795 feet bpl.
1800	1900	Casing joints at 1,836 and 1,877 feet bpl.
1900	2000	Casing joints at 1,918 and 1,960 feet bpl;.
2000	2100	Casing joints at 2,001, 2,043, and 2,085 feet bpl.
2100	2200	Casing joints at 2,126 and 2,168 feet bpl.
2200	2300	Casing joints at 2,211, 2,252, and 2,294 feet bpl.
2300	2375	Casing joints at 2,336 feet bpl. Base of casing at 2,375 feet bpl.
2375	2483	Generally gauge borehole with frequent fractures and cavernous enlargements.
2483	2885	Highly fractured and cavernous interval.
2885	3036	Slightly less fractured and cavernous than the interval above. Top of sediment at 3,036 feet bpl.

bpl = below pad level

Fort Myers Beach WWTP
Injection Well IW-1
Video Survey Summary

Date: 13-May-98
Observer: David McNabb

Depth in feet below pad level		Observations
From	To	
1795	1798	Water is clear inside of casing. Base of casing at 1,798 feet bpl.
1798	1950	Egg-shaped, smooth borehole.
1950	2089	Accasional borehole irregularities, decreasing water clarity with depth.
2089	2097	Water clarity increased significantly. Interval of gauge borehole with frequent fractures.
2097	2138	Extremely fractured and cavernous interval.
2138	2158	Nearly gauge borehole with minor cavities.
2158	2199	Highly fractured and cavernous interval.
2199	2303	Gauge borehole with occasional small cavities.
2303	2320	Gauge borehole with occasional medium sized cavities.
2320	2427	Gauge borehole with infrequent cavities.
2427	2443	Fractured and cavernous interval.
2443	2466	Gauge borehole with accasional small fracture and cavities
2466	2490	Gauge borehole with large fractures intersecting the borehole walls.
2490	2597	Extremely fractured and cavernous interval. Ledge will not allow the camera below 2,597 feet bpl.

bpl = below pad level

Fort Myers Beach WWTP
Monitor Well MW-1
Video Survey Summary

Date: June 11, 198
Observer: Mark Beaverson
Reviewer: David McNabb

Depth in feet below pad level		Observations
From	To	
0	100	Water is very clear, casing joints at 33, 64, and 94 feet bpl.
100	200	Casing joints at 123, 152, and 182 feet bpl.
200	300	Casing joints at 211, 241, and 270 feet bpl.
300	400	Casing joints at 300, 330, 359, and 389 feet bpl.
400	500	Casing joints at 418, 448, and 478 feet bpl.
500	600	Casing joints at 507, 537, 567, and 596 feet bpl.
600	700	Casing joints at 626, 656, and 685 feet bpl.
700	800	Casing joints at 715, 744, and 774 feet bpl.
800	900	Casing joints at 804, 833, 863, and 893 feet bpl.
900	1000	Casing joints at 922, 952, and 982 feet bpl.
1000	1100	Casing joints at 1,011, 1,041, and 1,070 feet bpl.
1100	1200	Casing joint at 1,100, 1,130, 1,159, and 1,189 feet bpl.
1200	1300	Casing joints at 1,219, 1,248, and 1,278 feet bpl.
1300	1400	Casing joints at 1,308, 1,337, 1,367, and 1,397 feet bpl.
1400	1500	Casing joints at 1,426, 1,456, and 1,485 feet bpl.
1500	1574	Casing joints at 1,515 and 1,545 feet bpl. Base of casing at 1,574 feet bpl.
1574	1624	Gauge borehole.
1624	1625	Fracture intersects the borehole.
1625	1639	Gauge borehole, top of sediment encountered at 1,639 feet bpl.

bpl = below pad level