CCUEP-IW-2

EAST PORT WATER RECLAMATION FACILITY
COMPLETION REPORT FOR IW-2

VOLUME 1

PREPARED FOR

CHARLOTTE COUNTY UTILITIES
PORT CHARLOTTE, FLORIDA

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TABLE OF CONTENTS

TABLE OF CONTENTS - CONTINUED

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF APPENDICES - CONTINUED

EXECUTIVE SUMMARY

This final construction report for Charlotte County's East Port Water Reclamation Facility's (EPWRF) second well (IW-2, State I.D. # 5208P00117) is being submitted in accordance with Chapter 62-528.430 of the Florida Administrative Code (FAC) and with the Specific Conditions (Item 4.f.) listed in the Construction Permit (Permit Number UC08-254545). The technical information provided in Sections 2,3 and 4 of this report is summarized by section in the following discussion.

- Section 2 - Geological and Hydrogeological Description

The geological and hydrogeological data provided in this report identify the various members of the stratigraphic column encountered while drilling this well. The base of the lowermost underground source of drinking water (USDW) was conservatively estimated to lie at a depth of 1580 feet below land surface (bls) in the injection well. The selection of this depth as the base of the USDW was founded on water quality information, geophysical logs, and the interpretation of these logs.

The location of the first major confining interval above the injection interval at 2965 feet was determined to be at an approximate depth of 2800 feet bls. The location of this unit was first determined by locating the approximate position of the injected/native water interface based on the water quality obtained during packer test number 5 and the permeability of core samples taken from this interval. Core permeabilities in the interval between 2802 ft and 2815 feet bls were found to be on the order of $1x10^{-10}$ cm/sec ($1x10^{-7}$ darcies). Permeability values of this low magnitude are sufficient to provide substantial confinement.

Effluent injection at a rate of approximately 5,300 gpm resulted in an aquifer bottom hole pressure buildup of less than 2 psi. Such a low pressure buildup for this rate of injection clearly indicates that the injection interval is highly transmissive and will accommodate a sustained high rate of injection based on the injection history of IW-1.

- Section 3 - Well Construction

Initial drilling of the IW-2 started on November 13, 1996. Drilling and testing operations were completed April 23, 1996. Initially, a 48-inch diameter hole was drilled to a depth of 410 feet bls. Thirty-eight inch diameter, 0.375-inch wall steel casing was run into the hole to a depth of 393 ft bls and cemented in place. The cement was pressure grouted from the bottom to the surface in one continuous stage.

The 38-inch intermediate borehole was drilled to a depth of approximately 1640 feet bls. The hole was extended approximately 65 feet deeper than originally specified so that the lowermost USDW and a highly fractured interval between approximately 1370 and 1600 feet bls could be completely isolated behind the intermediate casing string. The intermediate casing string (30-inch diameter, 0.375 wall thickness) was cemented from the base of the casing at approximately 1638 feet bls to 1528 ft bls using approximately 8730 cubic feet of cement. No additional fill occurred above4 1528 ft bls while pumping cement. Therefore, with the permission of the Florida Department of Environmental Protection (FDEP), gravel was pumped into the annulus between the borehole wall and the casing. Over 182,400 cubic feet of gravel were pumped down the well annulus before the cementing operations could begin again. Cementing was successfully restarted at a depth of 1296 feet and continued in stages until the complete annular region between 1296 feet bls and the surface was completely filled with cement.

The thirty-inch diameter hole for the long string casing was drilled to a depth of 2970 feet. The 20-inch diameter, 0.500 inch wall casing was set at a depth of 2965 feet and cemented in place. The initial cement was placed using the pressure method. Additional stages were placed in the annulus from the top of cement at approximately 2550 feet to 540 feet below the surface in 5 stages using the tremmie method. After completion of the cement bond log, the remaining annulus was cemented from 540 feet to the surface.

The final 20-inch diameter openhole was drilled from 2965 feet bls to a final depth of 3246 feet bls (TD).

o Section 4 - Data Collection and Analyses

Water quality data collected during packer tests placed the base of the USDW near 1580 feet bls. The top of the effluent plume occurred near 2800 feet bls. Packer test hydraulic data indicated horizontal transmissivity ranging from 4200 to 16,000 gpd/ft in the zones tested. Core testing indicated confining interval permeability values that were as low as 1×10^{-10} cm/sec. The water quality data place the top of the effluent plume within or below this low permeability boundary.

o Section 5 - Well Testing Program

The mechanical integrity test for this well included a video survey, a radioactive tracer test, and a pressure test of the longstring casing. The pressure test demonstrated that the longstring casing did not leak. The radioactive tracer survey showed that the cement behind the casing prevented fluid migration behind the casing.

A 5252 gpm injection test was performed on this well. The resulting pressure build-up during injection was 2 psi. The transmissivity is estimated to be greater than 1×10^{6} gpd/ft based on the recorded flow rate and pressure increase.

The information provided in this section clearly demonstrates that the well meets all mechanical integrity requirements. The injection test analysis clearly demonstrates that the injection interval is highly transmissive and will receive the injected effluent at the anticipated rate. As indicated in the the analysis of the injection test, little pressure buildup is anticipated.

Document Structure

This document is divided into six sections and multiple subsections. Figures, tables, and appendices are numbered with respect to the subsection in which they are primarily discussed. This numbering system allows the reader to determine exactly where a particular topic is discussed in the report and then to review the information provided in the figures, tables, and appendices where the support information is provided.

1.0 INTRODUCTION

This report documents the drilling, construction and testing of the East Port Injection Well No. 2 (IW-2). The well is located at the East Port Water Reclamation Facility (WRF) in Port Charlotte, Florida (Figure 1.0-1) and is owned by Charlotte County Utilities. The specific location of IW-2 is Latitude 26°58'26"N, Longitude 82°02'12"W and is in the SW¼, Section 20, Township 40 South, Range 23 East. This well is located approximately 0.5 miles north of Harborview Road and 0.5 miles east of Drance Street (Figure 1.0-2). The permit to construct the well (No. UC08-254545) was issued by the Florida Department of Environmental Protection (FDEP) on March 1, 1995. A copy of the permit is included in Appendix 1.0-1 of this report. The well is permitted for disposal of up to 10 MGD of back-up capacity from the existing reuse/disposal system. Capacity of the new East Port Wastewater Treatment Facility is 5.0 MGD. The authorization for the operational testing in this well is provided in Appendix 1.0-2.

The contractor for the project was Youngquist Bros. Inc. of Fort Myers, Florida. Well site construction supervision, data collection, and data analyses were provided by ViroGroup, Inc. of Cape Coral, Florida. Actual construction of IW-2 began on November 13, 1995 and the total depth of 3246 feet bls was reached on April 1, 1996. Additional well testing was complete by April 23. Construction of surface facilities, including retrofitting of the IW-1 pad, continued until June 12, 1996 at which time the project was deemed substantially complete.

The injection well is constructed using three concentric steel casings (38-, 30-, and 20-inch diameter), with the final injection casing set at 2965 feet below pad level (bls). The well is a tubingless type completion with the open hole extending from 2965 feet to 3246 feet bls. The East Port IW-2 well is located 160 feet west of the existing IW-1. The injection casing for IW-1 is 8⅝-inch outside diameter steel pipe set to a depth of 2977 feet bls. The open hole injection interval in IW-1 extends from 2977 to 3246 feet bls. IW-1 is currently permitted to receive 2.0 MGD of treated wastewater.

The monitoring well system, which serves both injection wells, consists of a dual zone monitor well located approximately 60 feet west of IW-1. This well monitors an upper zone from 1422 to 1494 feet bls, and a lower zone from 2249 to 2330 feet bls. At this site the base of the Underground Source of Drinking Water (USDW), which by definition contain less than 10,000 mg/l total dissolved solids (TDS), was identified at depths of 1,550 (CH2M Hill, 1988a) and 1580 feet bls (ViroGroup, 1996). The upper monitor zone is therefore located within the USDW, and the lower monitor zone is located approximately 700 feet below the base of the USDW.

In conformance with the Limiting Conditions of the FDEP construction permit, weekly progress reports were submitted to the Technical Advisory Committee (TAC). The TAC committee was composed of staff from the FDEP, the Southwest Florida Water Management District (SWFWMD), the United States Environmental Protection Agency

(USEPA), and the United States Geological Survey (USGS). FDEP personnel were notified of significant construction decisions and testing events during well construction, and were present during the performance of tests to demonstrate mechanical integrity. Copies of all geophysical logs, lithologic logs, video logs, and other pertinent information were supplied to the TAC during the course of construction in weekly progress reports.

This document supplements information previously provided in the report entitled "Preliminary Completion Report for Construction of the East Port Injection Well No. 2, Charlotte County Utilities, Charlotte County, Florida". The preliminary report was submitted to the FDEP in July, 1996 to satisfy reporting requirements for Construction Permit No. UC08-254545, and addressed items required by Specific Condition 5d of the permit. Additional information was provided to the Department in response to a request for additional information dated August 1, 1996. Operational testing of the East Port Injection Well No. 2 was approved by the FDEP in correspondence dated August 21 (Appendix 1.0-2). Operational testing began on August 30, 1996.

As a final note, the terms below land surface (bls) and below pad level (bpl) were used to reference subsurface depths during the initial development of this document. The term below land surface has been used as the basis reference in this document. In both cases, the zero (0) reference point is the top surface of the drilling pad.

2.0 SITE GEOLOGY AND HYDROLOGY

Information on the local and regional hydrogeology has been compiled from data collected during construction of the East Port IW-1 well (CH2M Hill, 1988b and CH2M Hill, 1990), the East Port IW-2 well, and from information obtained during construction of other deep injection wells in Southwest Florida (CH2M HILL, 1988a, ViroGroup, Inc., 1993, ViroGroup, Inc., 1995a). The area of review and assessment of regional and local hydrogeologic conditions was detailed in application materials prepared for the FDEP permit for construction and testing of the East Port IW-2 well (ViroGroup, 1994). Descriptions of the regional structure and hydrogeology of the Southwest Florida subsurface are available in reports by Gilboy (1985), Haberfeld (1991), and Hutchinson (1993). The stratigraphic nomenclature used in this report follows that used by Miller (1986) and Scott (1988 and 1992). Hydrostratigraphic nomenclature utilized in this report follows that proposed by the Southeastern Geological Society (SEGS, 1986) and used by Miller (1986).

2.1 Stratigraphy

The geologic formations encountered while drilling IW-2 consist of a series of interbedded sands, marls, and limestones of recent to Miocene age, and limestones and dolostones of Oligocene and Eocene age. The injection zone lies within the Eocene age Oldsmar Formation. In South Florida, the lower Oldsmar Formation consists of a highly fractured dolomite containing cavernous zones commonly referred to as the "Boulder Zone". This portion of the formation exhibits a high porosity and transmissivity which makes it suitable for the injection of treated effluent at high rates. At the East Port site, the Boulder Zone is located between 3050 and 3200 feet below land surface. A hydrostratigraphic column depicting the positions of the subsurface formations at the East Port site is presented in Figure 2.1-1. The lithologic log of East Port well IW-2 is included as Appendix 2.1-1. The following is a description of the various stratigraphic units encountered during the drilling of IW-2.

Undifferentiated deposits including Fort Thompson Formation/Caloosahatchee/Tamiami Formations

The undifferentiated sediments of the Fort Thompson, Caloosahatchee, and Tamiami formations lie approximately 0 to 90 feet below land surface. Lithologies in the interval consists predominantly of medium to fine quartz sand with common to abundant shells and minor to common interbedded marl and limestone. Detailed descriptions of the shallow stratigraphy in the Charlotte Harbor area were described by DuBar (1962). The age of the undifferentiated sediments range from Holocene to Pliocene at the base. In Charlotte County the base of the lowermost Tamiami Formation occurs at the top of the first green dolosilt/sand unit, which marks the top of the Peace River Formation of the Hawthorn Group (Scott, 1988).

Hawthorn Group

The Hawthorn Group underlies the Tamiami Formation unconformably, and is a complex sequence of phosphate bearing Miocene age sediments. The Hawthorn Group is comprised of an upper, primarily siliciclastic unit (Peace River Formation), and a lower, primarily carbonate unit (Arcadia Formation).

Encountered from 90 to approximately 210 feet below land surface, the Peace River Formation of the Hawthorn Group consists of an olive gray to medium gray dolomitic clay or dolosilt with variable amounts of accessory quartz and phosphatic sand, and fossil shell material. A sandy limestone unit occurs near the middle of the formation at the site. The Peace River Formation serves as a confining unit which separates the surficial aquifer hydrological unit from the Intermediate Aquifer System as discussed in Section 2.2. The total thickness of the Peace River formation at the East Port site is approximately 120 feet.

The Arcadia Formation of the Hawthorn Group is composed of limestones with interbedded marls, dolosilts, and calcareous sandstones. The top of the formation was encountered at a depth of 210 feet. The limestones are light to yellowish gray micrites and biomicrites with low to good porosity. Water bearing zones occur in the limestones having moderate to good porosity and comprise the Intermediate Aquifer System as defined in Section 2.2 at the site. Phosphate is the most common accessory mineral in the various lithology types occurring in the Arcadia Formation. The base of the Arcadia Formation at East Port was picked based on the presence of Sorites sp. foraminifera, phosphate content, and an attenuation of gamma ray activity on geophysical logs. The overall thickness of the Arcadia Formation at the site is about 530 feet.

Suwannee Limestone

The Oligocene age Suwannee Limestone is present from approximately 740 feet to 1115 feet below land surface. The contact between the Suwannee Limestone and overlying Hawthorn Group is marked by an abrupt attenuation of activity on gamma ray logs. The characteristic lithology of the Suwannee Limestone is a very pale orange or light tan biomicrite to biosparite (packstone to grainstone) having a medium grained calcarenitic texture. The limestones are typically moderately indurated, and are composed of moderately to well sorted foraminifera, pellets, and abraded fossil fragments. Porosity is primarily interparticle porosity, with good porosity in the upper part of the formation and low to moderate porosity in the lower portion of the formation. At the East Port site, the middle part of the formation contains significant amounts of low porosity lime muds. The total thickness of the Suwannee Limestone is approximately 375 feet at this site.

Ocala Limestone

The Ocala Limestone was encountered at 1115 feet bls at the East Port site. The Ocala Limestone is an Upper Eocene age formation primarily composed of light gray micrites and biomicrites. The formation exhibits a wide range of textural fabrics ranging from very fine grained, chalky mudstones to coquina-like grainstones. The formation can be subdivided into upper and lower units based on lithological differences (Scott, 1992). Typically, the upper portion of the formation is a soft, friable, variably muddy limestone (packstone to wackestone) with abundant foraminifera, and the lower portion is a more granular limestone consisting of grainstones to packstones and may be dolomitized in some regions. The Ocala Limestone is characterized by an abundance of foraminifera such as Operculinoides sp., Nummulites sp and Lepidocyclina sp. The formation was formerly called the Ocala Group and was subdivided into three formations based on fossil fauna assemblages (Puri, 1957).

In well IW-2, the Ocala Limestone is at least 285 feet thick, and consists of yellowish gray to grayish orange micritic to sparry limestones with poor to good porosity, abundant foraminifera, minor light gray clay or carbonate mud, and dolostone with interbedded limestone in the lower 50 feet of the formation. Because of the extensive dolomitization present in the lower portion of the Ocala and the underlying Avon Park Formation, the base of the Ocala Limestone is picked at the lowermost occurrence of light colored (white to very pale orange) limestones which overly the thick dolostone section comprising the Avon Park Formation at the site.

Avon Park Formation

The Middle Eocene age Avon Park Formation is composed of hard to moderately hard, yellowish brown crystalline to sucrosic (sugary) dolostone at the East Port site. The top of the formation was encountered at 1380 feet below land surface in IW-2. Numerous fractures and cavernous zones are common in the upper half of the formation from 1,380 to 1760 feet. This zone has been referred to as the Avon Park highly permeable zone by some authors (Haberfeld, 1991; Hutchinson, 1993), and is utilized for underground injection at some coastal locations in Southwest Florida, including Sarasota and El Jobean. The lower portion of the Avon Park Formation at East Port is comprised of hard, low permeability dolostones and serves as a confining interval.

Oldsmar Formation

The Lower Eocene age Oldsmar Formation underlies the Avon Park Formation. The Oldsmar Formation was encountered at 2100 feet below land surface at the East Port site. The Oldsmar Formation consist of hard to moderately hard limestones and dolomitic limestones. Although porosity is generally high, the lack of interconnection between pore spaces results in permeability which is typically low. However, some highly transmissive zones do exist within the Oldsmar Formation.

The uppermost permeable zone extends from 2265 to 2310 feet. The lower monitor zone of the East Port dual-zone monitor well system is completed in this moderately permeable interval. A second permeable zone extends from 2422 to 2443 feet. The third, and most highly developed permeable zone extends from 3065 to 3180 feet. This highly permeable, cavernous zone, known as the "Boulder Zone", has a very high transmissivity, and is an ideal zone for the injection of treated wastewater. The Boulder Zone is utilized extensively throughout South Florida as an injection zone. The East Port site marks the northern-most reported occurrence of the Boulder Zone on the west coast of Florida.

Although sonic porosities throughout much of the Oldsmar Formation typically range between 10 and 25 percent, analyses of cored samples indicate generally low permeabilities. With the exception of the highly permeable intervals listed above, the Oldsmar Formation is considered a confining interval. Information on the measured hydraulic properties of these confining units is provided in Section 2.4. Drilling of IW-2 was terminated at 3246 feet which lies above the bottom of the Oldsmar Formation.

Cedar Keys Limestone

The Cedar Keys Limestone is comprised of dolomite, limestone, and anhydrite. Although not reached in IW-2, this formation was encountered at approximately 3270 feet below land surface while drilling well IW-1. The formation consisted of white to medium gray anhydrite and olive gray dolostone, and was found to be a zone of low permeability. The Cedar Keys Limestone represents the base of the Floridan Aquifer System.

2.2 Hydrology

The water producing formations of Southwest Florida consist of Quaternary Age marine and nonmarine clastics and Tertiary Age limestones and dolomite. Three principal hydrogeologic units are recognized in the classification of aquifer systems in the state of Florida. They are the Surficial Aquifer System, the Intermediate Aquifer System, and the Floridan Aquifer System (SEGS, 1986). Each of these aquifer systems typically contain one or more permeable water bearing zones separated by relatively impermeable confining beds. The upper units are used for supplying freshwater for municipal, domestic, and irrigation purposes. The deeper saline water bearing aquifers are used for disposal of injected wastewater and reverse osmosis treatment plant concentrate.

Surficial Aquifer System

The Surficial Aquifer System is contiguous with land surface and comprised principally of unconsolidated to poorly consolidated clastic sediments and subordinate carbonates. At East Port the surficial aquifer consists of sand and shell with interbedded limestone and marl. The permeable lenses of sand, marl, and limestone contain water under unconfined conditions. The thickness of this aquifer system at the East Port site is approximately 90 feet.

Intermediate Aquifer System

The Intermediate Aquifer System lies between the Surficial and Floridian aquifers and is comprised of Miocene age sediments consisting of fine grained clastic deposits interlayered with carbonate rocks. The limestones of this system form low to moderate water producing aquifers, while the fine grained sediments form confining beds which restrict the flow of water. The confining units consist of sandy clay, clay, and marl and are located at the top, middle, and at the bottom of the aquifer system. The upper confining unit is comprised of low permeability clays of the Peace River Formation. This unit serves to effectively restrict flow between the Surficial and Intermediate Aquifer Systems. In the Charlotte County area, two aquifers have been identified within the intermediate system and are used extensively for domestic use. The Intermediate Aquifer System has a combined thickness of approximately 450 feet at the East Port site.

Floridan Aquifer System

A series of carbonate rocks of late Tertiary age which exhibit moderate to high permeabilities comprise the Floridan Aquifer System. Throughout most of Florida this aquifer system is composed of two permeable units: the Upper and the Lower Floridan aquifers. Less permeable dolostones and limestones act as the middle confining unit separating the Upper and Lower Floridan aquifers.

In Southwest Florida, the Upper Floridan Aquifer contains brackish water which can be converted for use as a potable water supply using reverse osmosis treatment. The lower Floridan Aquifer contains highly saline water and is used in some areas for disposal of injected wastewater and concentrate from reverse osmosis treatment plants. Drilling data in Southwest Florida show that the Lower Floridan Aquifer is not extensively developed and that the middle confining beds demonstrate low permeabilities down to the Cedar Keys Formation except in relatively infrequent permeable intervals which include the Boulder Zone intervals in South Charlotte County (Hutchinson, 1993).

In western Charlotte County the Upper Floridan Aquifer has been further subdivided by Hutchinson (1993) into the Suwannee permeable zone, the lower Suwannee-Ocala semiconfining unit, the Ocala-Avon Park moderately permeable zone and the Avon Park highly permeable zone. The highly permeable unit within the Avon Park was the source of construction delays associated with cementing the pilot hole and casing within this zone.

The Avon Park highly permeable zone consists of approximately 400 feet of massive, hard, dark brown dolostone containing large solution channels which have developed along fractures. The Avon Park highly permeable zone is used as the main zone of injection for wells north and west of the East Port site, where the zone occurs below the base of the Underground Source of Drinking Water (Section 2.3). This zone was encountered between 1380 to 1760 feet bls while drilling the IW-2 well. The base of the

USDW (1580 feet) is located within the Avon Park permeable zone at this Charlotte County location. To the south of the East Port site, the Avon Park highly permeable zone pinches out. The regional relationships of the injection zones utilized in Southwest Florida are shown on Figures 2.2-2 and 2.2-3.

Beneath the Avon Park Formation lies the Oldsmar Formation. For the most part, the formation consists of low permeability limestones which comprise a portion of the middle confining unit of the Floridan Aquifer System. Quantitative information on the confining zone is provided in Section 2.4. Permeable water bearing intervals which occur in the Oldsmar Formation would be considered the Lower Floridan Aquifer at the East Port site. Saline water producing zones were encountered in the top portion of the Oldsmar Formation and near the base of the formation at East Port. A high porosity interval occurs at the top of the Oldsmar Formation from 2088 to 2106 feet below land surface. Another water bearing zone occurs from 2290 feet to 2310 feet, which corresponds to the permeable interval monitored in the lower zone of the dual monitor well (2249 to 2330 feet below land surface).

One or more highly permeable cavernous zones are found within the dolostone of the Oldsmar Formation in many regions of South Florida. This highly permeable interval, commonly referred to as the Boulder Zone, was encountered between 3065 to 3180 feet below land surface in well IW-2. As shown in Figure 2.2-3, the Boulder Zone appears to pinch out north of Port Charlotte.

2.3 Underground Source of Drinking Water

Federal and state regulations controlling underground injection require that Class I injection wells be completed below depths that currently or could potentially serve as a source of drinking water. An Underground Source of Drinking Water, or USDW, is defined as an aquifer which contains fewer than 10,000 mg/l total dissolved solids. One of the primary objectives during construction of a Class I injection well was to establish the depth at which the base of the USDW occurs.

During construction of the East Port IW-2, the depth of the USDW was identified using water quality data obtained during reverse air drilling, packer tests, and interpretation of geophysical logs run on the pilot hole. Water quality data collection methods and results are discussed in Section 4. The specific depth of the USDW was determined from geophysical log analyses as follows:

The resistance of the connate water in a carbonate formation can be estimated using the following equation:

$$R_w = \phi^2 * R_t$$

where,

R_w = the resistivity of the connate water under downhole conditions
ϕ = the local formation porosity
R_t = the measured local, deep resistivity (R_{ID})

The water saturation in the pores is assumed to be 1.0 in the above equation (Dewan, 1983). At a temperature of 95°F, R_w for a 10,000 ppm brackish water is approximately equal to 0.45 ohm-meters. Given a porosity of 0.25 (25%), a formation resistance (R_t) equal to or less than 7.2 ohm-meters indicates that the TDS concentration exceeds 10,000 mg/l. In well IW-2, the required porosity and resistivity values were measured at a point between 1560 and 1570 feet bls. Log analysis of the Dual Induction Resistivity log therefore indicates that the base of the USDW could be located in the interval between 1560 and 1570 feet bls. However, additional calculations using this method could place the base of the USDW as low as 1598 feet bls.

Additional analysis of the geophysical data to determine the base of the USDW was provided by Florida Geophysical Logging, Inc. Florida Geophysical developed a continuous plot of TDS with depth based on sonic porosity and resistivity corrected for invasion using published empirical relationships between water quality parameters in the Floridian aquifer (Reese, 1994). This method places the base of the USDW slightly above 1580 feet bls as shown in Figure 2.3-1. Therefore, for this site, the base of the USDW is conservatively placed at a depth of 1580 ft bls.

2.4 Confining Zone Properties

Confinement beneath the USDW at East Port is provided by the Avon Park and Oldsmar Formations. Hydraulic analyses of core samples collected while drilling the IW-2 well indicate that dolomites and limestones within the subsurface region between 2048 feet and 2811 feet have low permeabilities and will provide good confinement for wastewater injected below these beds. Evaluation of the confining zone properties is provided by core analyses, lithologic and geophysical logs, formation water quality and by operational data available for the existing IW-1 well.

A description of the coring program conducted during construction of the East Port IW-2 well is detailed in Section 4.4 of this report. The core analyses results are summarized in Table 4.4-2, and lab results are included in Appendix 2.4-1. Vertical hydraulic conductivities ranged from 2.3×10^{-6} to 1.3×10^{-10} cm/sec (0.0065 to 3.6×10^{-7} ft/day) in samples analyzed from the depths of 2806 to 2811 feet. These low vertical permeabilities are sufficient to impede vertical migration and basically limit relevant vertical migration to this depth which lies over 1200 feet below the base of the USDW. Additional hydraulic data collected from the IW-2 core samples are also summarized in Table 2.4-1.

Results of core analyses conducted on samples collected from the IW-1 well show permeabilities between $4.9x10^{-6}$ and 0.137 ft/day in the region between 2,000 and 2,800 feet. Formation porosity ranged between 1% and 37% over this depth interval (CH2M Hill, 1988a). In both wells, the dolomite samples typically show a lower permeability than the limestone cores.

Evidence that the low permeability interval near 2800 feet is able to retard vertical migration of injected effluent was provided during packer test 5. The water quality of the produced water during this test (Section 4.7) showed an abrupt freshening. This freshening is a clear indication that the vertical movement of the injected effluent has not progressed above the tight confining layers located near 2800 feet bls.

In addition to the physical and lithologic data obtained from the cored intervals, information on the nature and degree of confinement above the injection zone can be inferred from the lithology log of IW-2 and from select geophysical logs run on the pilot hole. The lithologic log (Appendix 2.1-1) provides a qualitative determination of the porosity and permeability of samples collected from the confining intervals and can be consulted for more detailed information.

The BHC Sonic log run on the pilot hole below the USDW and above the injection zone provides a semi-quantitative evaluation of the degree of confinement occurring within the interval. Short travel times and low (<5%) porosity values recorded on the log provide additional indications that satisfactory confinement is present (Appendix 4.5.2-4).

Operational records of the existing IW-1 and dual zone monitor well have not shown any indications that effluent injected over the past five years is migrating upward toward underground sources of drinking water.

2.5 Injection Zone Properties

As indicated in Section 2.1, the injection zone is located in the subsurface region between 3065 and 3180 feet in IW-2 based on hole stability and a temperature log and is comprised of dolomitic limestone. The temperature log run in this section indicate cooler fluid is moving in the subsurface region between 3065 and 3180 feet bls. Aquifer performance data indicate that the formation transmissivity exceeds $1x10^{8}$ gpd/ft (Section 5.4).

3.0 WELL DESIGN AND CONSTRUCTION

3.1 Well Design and Final Construction

Preliminary designs for the East Port Injection Well No. 2 (IW-2) were completed in compliance with Chapter 62-528 of the Florida Administrative Code and submitted to the FDEP on April 21, 1994 (ViroGroup, 1994). The application materials to construct a Class I injection well were submitted to the Charlotte County Utilities Department for review and were received by the FDEP on July 15, 1994. The final materials and responses to requests for additional information were received by the FDEP on November 28, 1994. The certificate of financial responsibility was issued November 18, 1994. The FDEP released its "Intent to Issue Permit" in early January 1995 and the actual construction permit was issued on March 1, 1995.

The injection well is an open hole completion with 20-inch diameter steel injection casing extending from the surface to a depth of 2965 feet below land surface (Figure 3.1-1). The interval open to injection extends from the base of the 20-inch diameter casing down to a depth of 3246 feet bls. The maximum permitable capacity of the well is approximately 12.7 MGD of treated wastewater based on the inside casing diameter of 19-inches and the maximum allowed flow velocity of 10 feet per second.

3.2 Site Preparation

The land in the vicinity of the well construction site was cleared and rough graded by the contractor prior to mobilizing the drilling equipment. The drilling contractor for the project was Youngquist Brothers, Inc. (YBI) of Fort Myers, Florida. Notice to proceed with construction was given on October 4, 1995 and site preparation began soon afterwards.

Construction of the IW-2 well pad commenced on October 26, 1995. The pad framework of steel reinforcing consisted of #5 bar placed a minimum of 3-inches from the edge of the slab and on twelve-inch center spacing. The drilling pad concrete was poured on October 31, 1995. The pad utilized for drilling was designed to drain to a shallow sump located at the wellhead. Initial pad thickness ranged between 3 and 12 inches depending on distance from the sump and how much support was required. The drilling pad was finished with a 2 feet high retaining wall of concrete block construction to contain potential spills of water and/or drilling fluids.

The FDEP construction permit required that four water table aquifer wells be installed to monitor the quality of the shallow groundwater immediately adjacent to the well pad for the duration of construction. The purpose of the pad monitoring wells was to provide a means of assessing any potential impacts to the surficial aquifer at the site due to well construction activities. With the approval of the FDEP, two existing 4-inch diameter shallow pad wells, previously installed during the construction of IW-1, were used to monitor the northeast and southeast corners of the IW-2 pad. Two new 2-inch diameter shallow pad wells were installed to monitor the northwest and southwest corners of the IW-2 pad. The four shallow pad wells were numbered 1 through 4 in a clockwise direction from the northwest corner of the pad. The two new wells were installed prior to the start of drilling operations on October 30, 1995 and were constructed approximately 20 feet deep with the lower 10 feet being 2-inch diameter, Schedule 40 PVC slotted pipe (Figure 3.2-1). The 4 wells were sampled on a weekly or bi-weekly basis for chloride concentration and specific conductance analysis by ViroGroup hydrogeologists on site. Shallow pad well water quality is discussed in Section 4.8.

A 4-inch diameter water supply well was drilled immediately south of the Injection Well No. 1 (IW-1) pad for use during drilling operations. This well was drilled to a total depth of about 255 feet and cased to about 130 feet. A General Water Use Permit, No. 11-1000W, was issued by the Southwest Florida Water Management District (SWFWMD) which allowed 2000 gallons per day on the average or 5000 gallons maximum per day to be withdrawn from the well. A map showing the locations of the two well pads, the water supply well, and the shallow monitor wells is presented in Figure 3.2-2. The SWFWMD permits to drill these wells and the IW-2 are provided in Appendix 3.3.2-5.

3.3 Well Construction

Youngquist Brothers, Inc. began construction of the East Port IW-2 well on November 13, 1995 following completion of pad construction and drilling set-up. The well construction sequence involved hole drilling and installation of three strings of casing, referred to herein as the surface, intermediate and injection casing. The installation of the injection casing was followed by drilling of the open hole injection interval. A well construction chronology is presented in Table 3.3-1 and a schematic diagram of well IW-2 is shown in Figure 3.3-1. The cement used on this project was ASTM C-150, type II (Appendix 3.3-1). The following sections detail well construction activities.

3.3.1 Surface Casing Interval

Drilling of the 48-inch diameter wellbore for installation of the surface casing commenced on November 13, 1995. The drilling method used for the surface casing interval was rotary type drilling with a bentonite based drilling mud. A total depth of 408 feet below land surface was reached on November 16, 1995. On November 17, 1995 Florida Geophysical Logging Inc. provided gamma ray, xy caliper, and dual induction logging services on the 48-inch diameter hole (Section 4.5).

The caliper log, performed over this 408 foot interval, indicated that the actual diameter of the drilled hole, with a few exceptions, was approximately 50 inches (Appendix 4.5.1-1). Based on the results of the caliper log and the lithologic information gained from the construction of IW-1, it was decided that the base of the casing should be set at 393 feet bls. This depth was chosen since the diameter of the hole was closest to the actual diameter of the drill bit at that depth range. The gage size of the hole was interpreted to indicate the existence of a competent, less stressed region of the wellbore. In addition, a review of the information available from the construction records for IW-1 did not indicate that a more competent zone would be encountered within the next several hundred feet.

Surface Casing Installation

Thirty-eight (38) inch diameter, 0.375 wall steel casing was run into the nominal 48-inch diameter borehole to a depth of 393 feet. Mill certificates for this casing string are provided as Appendix 3.3.1-1. Each connection between the casing joints was made by welding the casing joints together. Appendix 3.3.1-2 provides the data on individual casing joint lengths.

The casing was cemented in place using the pressure grouting method as specified in the cementing program identified in the original permit application (ViroGroup, 1994). One thousand, one hundred and seventy nine (1179) cubic feet of 12% gel cement were pumped down the well followed by one thousand, one hundred and twelve (1112) cubic feet of neat cement. All cement was mixed and pumped in one continuous operation. Cementing operations were discontinued when cement returns were observed at the surface. After allowing time for the cement to set, the top of cement was tagged at a depth of 15 feet bls. Placement of cement in this manner left approximately 190 feet of neat cement behind the casing near the base. Approximately 200 feet of 12% gel cement lies above the neat cement behind the casing. The remaining 15 feet of the hole was cemented to the surface using 12% gel cement.

A cased hole temperature log was run to verify the location of the cement (Appendix 3.3.1-3) at approximately 15 feet bls. The base of the cement within the 38-inch diameter casing was tagged at approximately 390 feet bls during logging.

3.3.2 Intermediate Casing Interval

Drilling of the wellbore for the intermediate casing and all additional drilling was performed using the reverse air method. The initial pilot hole for the intermediate casing was drilled using a 12¼-inch bit. Reverse air water samples were collected at 30 foot intervals. The results of the reverse air water sampling are discussed in Section 4.3.

Packer tests were performed on the intervals between 1526 and 1575 feet and 1610 and 1654 feet (Section 4.7) during the drilling of the pilot hole in this interval. Geophysical logging performed over this interval included an Open Hole Temperature Log, a Caliper log, a Borehole Compensated Sonic Log, and a Dual Induction Laterlog-3 (Section 4.5).

Determining the Casing Setting Depth

Initially, the construction design indicated that the intermediate casing would be set at a depth of 1575 ft bls. However, hole stability problems encountered during drilling and geophysical logging (Section 4.5.2) indicated that cementing the lower portion of the hole above 1575 feet would be difficult based on concerns for the existence of conductive fractures within this interval. In addition, water quality analyses from the packer test performed on the subsurface interval from 1526 to 1575 feet (Section 4.7) indicated that the base of the USDW might not be isolated behind the intermediate casing string at the proposed setting depth of 1575 feet. The decision was made by ViroGroup personnel, in consultation with representatives from Youngquist Brothers Inc., to drill to a point below the USDW where more competent rock would be encountered and the success of the initial cementing stage was likely to be enhanced.

Therefore, the pilot hole was extended to 1654 feet bls. The second packer test (Section 4.7) was performed over the interval from 1610 to 1654 feet bls. The results of this test showed the water quality at this depth exceeded the 10,000 ppm level associated with a USDW. Thus, setting the casing at a depth below 1610 feet would isolate the USDW behind the intermediate casing. The actual setting depth of the casing was 1638 feet bls.

Cementing of the Pilot Hole

Once the final logging was completed on the pilot hole, YGI requested that they be allowed to fill the 12¼-inch pilot hole with cement. Permission was given to proceed with the requested cementing activity providing no additional costs would be incurred by Charlotte County. The purpose of this cementing operation was to prevent the development of a second subsurface hole while reaming through the unstable portion of the formation and to mechanically stabilize the formation for the reaming operation.

The placement of cement progressed from the base of the hole at 1654 feet bls to a depth of 1525 feet in the pilot hole. After successfully cementing to 1525 feet, no additional headway was made by continued cementing. Therefore, the drillers elected to pump approximately 50 cubic feet of gravel into the borehole. After pumping the gravel, the top of the gravel was tagged at 1505 feet bls. An additional 75 barrels (421 ft^3) of 25% gel cement was pumped. The top of cement was tagged at 1515 feet bls. Based on the lack of significant progress, the contractor elected to set a cement basket at 1319 feet and cement back from this point.

Approximately 15 sacks of cement were pumped in three stages before cementing operations above the cement basket could begin. The pilot hole cementing operations were completed after 550 feet of additional cement fill was obtained. The final top of cement in the pilot hole was tagged at 650 feet bls.

38-Inch Diameter Reamed Hole

A 38-inch diameter hole was reamed from 393 feet bls to a depth of 1640 feet bls. Reaming operations were slow due to hole instability problems. The caliper survey performed over this 38-inch diameter reamed hole segment (Appendix 4.5.2-2) showed that the reamed hole diameter from 400 feet to 1350 feet bls typically ranged between 37 and 40-inches. The two exceptions to this generalization occurred at approximately 410 feet and 875 feet bls where the hole diameter appeared to extend out to 50-inches.

Between 1350 feet and 1640 feet, the borehole diameter fluctuated widely. The borehole diameter was measured to vary between 38-inches and greater than 60-inches throughout the interval. The increased hole diameter and the occasional channels that were encountered while drilling were considered potential intervals for the loss of cement.

Installation of the 30-Inch Diameter Casing

Thirty (30) inch diameter, steel casing with a 0.375-inch wall thickness was welded together as it was lowered into the borehole. A total of 1650 feet of 30-inch casing was welded together (Appendix 3.3.2-2). The mill specification for this casing string appears in Appendix 3.3.2-1. The casing string was hung at a point 12 feet above pad level. The base of the casing was set at 1638 feet bls.

A summary of the cementing operations data shows that 2667 cubic feet of cement were required to bring the top of cement up to a depth of 1578 feet (Table 3.3.2-1). Another 2246 cubic feet of cement brought the top of cement up to 1524 feet bls. Various combinations of cement and pea gravel were used to cement this region. The actual volume of cement and other material used in the cementing operations was approximately five times the volume of cement theoretically required to cement the 30-inch casing into 114 feet of a 60-inch diameter hole.

The addition of approximately 3800 ft^3 of cement and 891 ft^3 of pea gravel brought the top of fill to a depth of approximately 1500 feet bls. At this point, the FDEP was contacted for permission to fill the void space behind the casing with gravel until a point was reached where cementing operations could be resumed. After an additional 20,000 cubic feet of cement and gravel were pumped, the top of fill was located at 1426 feet bls. From this point approximately, 143,000 cubic feet of gravel were required to be pumped into the annulus between the borehole and the casing to reach a tag depth of 1380 feet bls. An additional 500 ft^3 of gravel brought the top of fill to 1290 feet bls (Appendix 3.3.2-2). After filling the borehole annulus to the 1290 foot mark, cementing operations were resumed and the remaining interval was successfully cemented back to the surface using ASTM C-150, type II cement with 12% gel.

Temperature logs were run to locate the top of cement behind the casing after each cementing stage (Appendix 3.3.2-3). These logs show that slow progress was made during the cementing of the bottom of the borehole annulus to 1575 feet. The logs also show that good progress was made when cementing procedures were conducted above 1290 feet bls. Cementing operations for this segment of the hole required 42 days. Work commenced on January 8, 1996 and was completed on February 20, 1996.

3.3.3 Injection Casing Interval and Injection Zone

The drilling of the 12¼-inch pilot hole below the 30-inch diameter casing included three packer tests, the collection of three, 4-inch diameter cores, and the collection of specified geophysical logs. No significant problems were encountered during the drilling of this hole. Reverse air water samples were recovered every 30 feet (Section 4.3).

Packer tests 3, 4, and 5 were performed on the subsurface intervals between 2013 and 2055 feet bls, 2280 and 2317 feet bls, and 2743 and 2815 feet bls respectively. The results of these packer tests are discussed in Section 4.7. In addition, the following logs were performed over this segment of the hole:

- o Background Gamma Ray Survey
- o Temperature log
- o Dual Induction Log
- o Caliper Log
- o Borehole Compensated Sonic Log
- o Video Survey

Drilling of the 12¼-Inch Pilot Hole

The actual drilling of the 12¼-inch diameter pilot hole began on February 23, 1996 and was completed on March 7, 1996. Although the original specifications indicated that the pilot hole would be drilled to a depth of 3000 feet, the actual pilot hole was drilled to a total depth of 2970 feet. The depth of the pilot hole was reduced due to concerns about intercepting a void at a depth of 2980 to 2990 feet which appears on the video for the first well, IW-1. Since good pressure grouting is important at the base of the casing, there was no valid reason to risk the hole by extending the drilling depth for the injection casing below 2970 feet bls.

A request was made to the FDEP to allow the base of the injection casing to be raised from 2980 feet bls to 2965 feet bls. After review, the FDEP granted the request. Therefore, the target setting depth for the 20 inch casing was changed to 2965 feet.

Drilling of the 30-Inch Diameter Borehole

Rather than ream the pilot hole to 30-inches, the contractor chose to fill the borehole with cement and then drill a 30-inch borehole. Thus, the 30-inch diameter borehole was drilled from 1638 feet to 2970 feet. This operation was performed without difficulty.

Installation of the 20-Inch Casing

Installation of the 20-inch diameter, 0.500-inch wall steel casing began on March 21, 1996. The casing was welded together at each joint. The 20-inch diameter casing was run to a total depth of 2965 feet. A summary pipe tally for the 20-inch casing as it was measured going into the hole is provided in Appendix 3.3.3-2. Mill specifications for the 20-inch pipe appear in Appendix 3.3.3-1.

As indicated in Table 3.3.3-1, the 20-inch diameter casing string was grouted in place using eight (8) stages. The first cement stage was pressure grouted in place. A total of 425 feet of cement was pumped behind the casing in the first stage. All additional cement was placed using the tremmie method. The bottom approximate 130 feet of cement is neat cement. The remaining portion of the cemented hole was filled with cement containing 12% gel. Cement was brought to the surface during Stage 7.

Temperature logs (Appendix 3.3.3-3) were performed after cement stages 1 through 5 were pumped. These logs coupled with hard tags on the cement confirm the amount of fill that was obtained during each cementing stage (Table 3.3.3-1).

Cement Bond Log

Regulatory requirements specify that a cement bond log must be run on the cemented casing (Appendix 3.3.3-4). The cement bond log for this well was performed on March 27, 1996.

Analyses of the Cement Bond Long (CBL) indicates good bonding throughout the cemented portion of the well. The top of cement was estimated from the log at a depth of 540 feet. The top of cement as determined from the variable density log (VDL) compares to a Stage 7 cement tag depth of 557 feet bls determined by the driller. Review of the travel time indicates the logging tool was essentially centered to a depth of 2430 feet and just slightly off-center (but within acceptable tolerances) below that depth. The amplitude curve showed low readings (<20 mv) throughout most of the cemented portion of the well. The VDL shows strong casing arrivals in the uncemented interval above 540 feet.

The cement bond log shows that cement has been satisfactorily placed behind the 20-inch casing and that the cement sheath extends continuously from the base of the casing to 540 feet bls. The final cementing stage brought the cement to the surface. As a second bond log indicates (Appendix 3.3.3-5), there is a pronounced increase in the intensity of the formation signal and a decrease in the intensity of the surface pipe signal indicating the presence of cement behind the pipe.

Drilling of the Openhole

The open hole section of IW-2 was drilled between March 29, 1996 and April 1, 1996. A 12¼-inch diameter pilot hole was initially drilled to a depth of 3246 feet bls. This hole was reamed to a nominal diameter of 20-inches from 2965 feet to 3246 feet bls.

The reaming and cleaning of the open hole to 3246 feet bls completed the drilling activities at this site. All work performed after this point is associated with the testing of the well and construction and placement of surface equipment and piping.

3.4 Wellhead Construction and Instrumentation

The wellhead (Figure 3.4-1) at this site consists of a 20-inch ball valve connected to the 20-inch casing using a standard flange connection. A 20-inch tee sits on top of the ball valve. The tee is connected to a 20-inch x 16-inch flanged reducer coupling. This coupling, in turn, is connected to the 16-inch aboveground pipe that transfers the water from the 20-inch pipeline to the well. The tap for the pressure sensor has been placed in the coupling. A sixteen (16) inch Sparling Magnetic flowmeter is positioned approximately 30 feet upstream from the wellhead.

Flow into the well is controlled by a Pratt Model 2F11 butterfly valve and an EIM Model Q4 G2-1 electronic actuator for eventual remote control. Both the 20-inch ball valve and the 16-inch butterfly valve can be adjusted by manual actuators at the wellhead or electronically from the fiberglass control room (Figure 3.2-2). The signal from the Sparling Magnetic flowmeter and the Rosemount 1151 pressure transmitter are hard wired to Chessell 392 single pen circular chart recorders located in the fiberglass control room. Information on this instrumentation is provided in the Operation and Maintenance Manual for this well.

An eight inch gate valve is attached to the top of the 20-inch tee. A six inch air release valve is connected to the eight inch gate valve use an 8-inch x 6-inch flanged reducer coupling.

3.5 Surge Control Equipment

A surge control system has been integrated into the design of the injection wells. This system is intended to prevent potential water hammer damage to the pumps, piping system, and injection wells during pump startups and shutdowns. Water hammer effects are typically caused when a pump stops instantaneously, such as during a power failure. Additional manually set electronic time delays are employed to stop immediate energizing of the pumps when the electrical power is restored. The water in the piping system downstream of the pump will continue to flow due to momentum; an air void then forms at the pump. Eventually, the water flow will reverse direction and the air void will collapse creating potentially damaging pressures.

The surge protection equipment consists of two six-inch diameter slow-closing combination air-release valves attached to the piping distribution manifold located adjacent to the pumping station and an air release valve located on the top of the wellhead of each of the injection wells.

4.0 DATA COLLECTION AND ANALYSES

During the construction of the injection well, specific information was collected to determine characteristics of the borehole, provide a lithologic log, and to establish formation water quality and hydraulic characteristics. The data were utilized to verify the plumbness of the borehole, establish casing depths, and locate the confining and the injection intervals. Specific logging and sampling requirements are specified in Table 4.0-1.

4.1 Inclination Surveys

Inclination refers to the degree of deviation of the borehole from a true vertical alignment. Inclination surveys as required by FAC Chapter 62-528, and as specified in the FDEP construction permit, were conducted at 90 foot intervals throughout the construction process of the well in order to monitor the amount of deviation of the hole while drilling. The maximum allowable inclination is one degree (60 minutes), and the maximum allowable difference between any two successive surveys is one-half of a degree (30 minutes).

The inclination surveys were conducted by lowering a Totco Sure-Shot deviation survey tool on a wire line inside the drill pipe to a specified depth above the drill bit. The surveys were recorded on a paper disk which indicates the degree of deviation from the vertical. The results of the inclination surveys conducted are listed in Table 4.1-1.

The inclination survey results indicated that all portions of the wellbore were plumb and had proper vertical alignment. With the exception of one survey at 484 feet, no deviations greater than 0.375 degrees were recorded in any portion of the injection well.

4.2 Formation Sampling

Formation samples were retrieved from the drill cuttings at a minimum of 10-foot intervals, and at any formation changes as determined by the wellsite geologist. Three sets of cuttings samples were collected and catalogued according to depth interval. One sample set was distributed to the Florida Geological Survey and two sample sets were retained by ViroGroup, Inc. One set of cuttings will be retained for company archives and the other set will be available for public inspection. Splits from the samples were washed and described on site as they were collected. Detailed descriptions of the subsurface formation samples encountered while drilling IW-2 are included in the Lithologic Log (Appendix 2.2-1).

4.3 Reverse Air Sampling

Reverse air water samples were collected from the discharge line every 30 feet during reverse-air drilling of the pilot hole between 423 and 3213 feet bls in the injection well. These water samples were analyzed in the field for chloride concentration and specific conductivity as required by the FDEP Construction Permit. The results of the field analyses are presented in Table 4.3-1.

Because of the closed circulation system used during reverse air drilling, fresh water from the construction site water supply well was often added to the "mud pit" to replace fluid lost during the drilling process. The addition of water resulted in a dilution of the drill water circulation stream. Therefore reverse air water samples were not considered to be representative of the formation water. Because of the sampling limitations associated with a reverse air closed circulation system, packer tests were performed to obtain representative formation water samples from specific depth intervals (see Section 4.7).

4.4 Coring Program

The coring program conducted during construction of the East Port IW-2 well was designed to obtain samples of selected formation intervals overlying the planned injection interval. The cores were collected to provide additional information concerning the lithologic, physical, and hydraulic characteristics of the formation at the specified depth intervals. Laboratory analyses were performed on selected cores to establish the hydraulic and physical properties of the strata overlying the injection interval.

The planned coring program specified that 10 foot long cores would be collected from the subsurface intervals between 2000 and 2200 feet, 2260 and 2300 feet, and an additional two cores were to be recovered between 2350 and 2800 feet. A summary of the cores collected from the IW-2 well is listed in Table 4.4-1. Detailed lithologic descriptions of the cores are included in Appendix 4.4-1.

Core number 1 was collected from the interval between 2045 and 2055 feet below land surface level. Core samples 2 and 3 were collected over the interval between 2300 and 2317 feet. A single, 17 feet long core was taken in accordance with the ultimate desire of the FDEP to core a portion of the lower monitor zone interval (2249 to 2330 feet bls). Core number 4 was recovered from the interval between 2802 and 2815 feet. All coring was performed using a 4-inch diameter diamond coring bit and 20-foot long core barrel.

Core analyses were conducted by Ardaman and Associates of Orlando, Florida. A total of 18 core samples from IW-2 were sent for analysis. The samples were analyzed for vertical and horizontal permeability, bulk density, elastic modulus, and compressive strength. The core analyses results are summarized in Table 4.4-2 and detailed laboratory results (permeability, unconfined compressive strength, and Young's modulus) are included in Appendix 4.4-1.

As indicated in Table 4.4-2, core permeabilities ranged from a low of 0.14 microdarcy ($1.3*10^{-10}$ cm/sec) for a sample collected from near 2800 feet bls to 300 millidarcies ($3*10^{-4}$ cm/sec) for a sample collected near 2050 feet. The median permeability for the measured confining unit rock material is approximately 0.6 millidarcy ($6.1*10^{-7}$ cm/sec) for both horizontal and vertical direction. These permeability values indicate that vertical movement of underground fluids would be impeded in these zones and in other zones of similar lithologic and physical characteristics. However, it is important to understand that for vertical movement across bedding planes and not along bedding planes the permeability would be calculated as:

$$(1/k_{avg}) = (1/L)*(\Sigma l_i/k_i)$$

where,

k_{avg} = Average permeability of layered system
k_i = Permeability of the layer
l_i = Thickness of layer
L = Total thickness

For illustration purposes, consider the following values for a two layer system.

k_1 = 10 ft^2/day
k_2 = $1x10^{-10}$ ft^2/day
l_1 = 99 ft
l_2 = 1 ft
L = 100 ft

Based on the above values,

$$1/k_{avg} = (1/100)(99/10 + 1/10^{-10})$$

Solving for k_{avg} yields:

k_{avg} $1x10^{-8}$ ft^2/day

This result means that the 1 foot thick interval with a permeability of $1x10^{-10}$ ft^2/day will make a 100 foot interval of 10 ft^2/day permeability appear to have an average permeability of $1x10^{-8}$ ft^2/day. Thus, while flow along bedding planes reflects the higher permeability streaks, flow across bedding planes is controlled by the lower permeability units. Thus, as demonstrated at this site, vertical plume movement is controlled by thin layers of extremely low permeability material. It is the existence of a low permeability streak near 2800 feet bls that is responsible for the containment of the injected plume below this depth.

The minimum unconfined compressive strength was determined to be 3155 psi for a core obtained from 2308 ft bls. The highest unconfined compressive strength was 17,683 psi a core for sample collected at 2811 ft bls. The unconfined compressive strength of all tested cores demonstrated good mechanical strength under compressive loads. Young's modulus measured for these rocks was on the order of $5*10^5$ psi which is in the normal range of values anticipated for carbonate rocks (Hall, 1953).

4.5 Geophysical Logs

A suite of open-hole geophysical logs was run in the pilot hole at each casing setting depth prior to reaming the hole for casing installation. Geophysical logs run in each pilot hole included dual induction laterolog (DIL), spontaneous potential (SP), gamma ray (GR), and caliper. Additionally, a borehole-compensated (BHC) sonic log was run in every pilot hole below the upper casing, and a temperature/fluid resistivity log was run on the pilot hole upon reaching injection casing setting depth. Caliper and gamma ray logs were run on all reamed holes prior to installing casing strings.

DIL logs provide information on formation resistivity (the inverse of conductivity). GR logs are useful in stratigraphic correlations with off-set wells. BHC sonic logs provide information on porosity and also can provide some information regarding the presence of fractured zones.

Cased hole logs run in the East Port IW-2 included temperature and cement bond logs (CBL). Temperature logs were run following emplacement of each cement stage, and were useful in determining the status of cement curing behind casing. The cement bond logs were useful in determining bonding of the cement to the casing and the borehole wall. The cased hole logs were discussed in Section 3.3 of this report in conjunction with well construction.

A summary of the geophysical logs run during construction of East Port IW-2 is provided in Table 4.0-1. All open hole geophysical logs were submitted to the Technical Advisory Committee (TAC) with the weekly reports when applicable. A discussion of open hole geophysical log interpretations is provided in the following sections.

4.5.1 Depth Interval From 0 to 410 Feet

Gamma Ray Survey

The gamma ray survey performed over the interval between the surface and 410 ft bls indicated fluctuating background gamma activities ranging between 10 and 30 API units (Appendix 4.5.1-1). The gamma ray survey indicated normal regional gamma ray activity in this segment of the hole.

Caliper Survey

The caliper log, run to a depth of 411 feet shows that the hole diameter is most nearby gage at 393 feet. Hole diameter ranged from _____ to _____ over this interval.

Dual Induction Log

The resistivity values recorded by the Dual Induction Log (Appendix 4.5.1-2) are representative of formation waters with TDS levels of 2000 to 4000 ppm based on an assumed porosity of 0.25 (25%).

4.5.2 Depth Interval From 410 to 1654 Feet

Gamma Ray Survey

Normal regional background gamma ray activity was noted over this segment of the hole. The gamma ray survey performed along the 38-inch hole was similar in appearance to the survey run over the pilot hole as expected (Appendix 4.5.2-2). This gamma ray survey was also used to distinguish the transition between the Hawthorn Group and the Suwannee Limestone (Section 2.1).

XY Caliper Log

The xy caliper log (Appendix 4.5.2-1) run in the 12¼-inch pilot hole shows that there are several sections between 500 feet bls to 1300 feet bls where the borehole diameter reaches 20 to 25 inches. More importantly, between the depths of 1364 feet and 1630 feet, the caliper log indicates a region in which the borehole diameter ranges between 13 and 39-inches. This behavior is indicative of a fractured and/or highly vugular or cavernous subsurface region. It was noted during drilling that the drill bit fell several inches to reportedly a few feet during the drilling of this section. The drop of the drill bit indicates the presence of small caverns or dissolution channels. The data provided by this caliper log was indicative of the future problems encountered during the completion of this portion of the hole (Section 3.5).

The xy caliper log run in the nominal 38-inch hole was qualitatively similar to the caliper results obtained in the pilot hole. However, in the region between 1380 feet and 1600 feet, the diameter of the borehole was observed to exceed 60-inches in numerous places. Thus, the borehole consisted of interspersed ledges and water filled void areas (Appendix 4.5.2-2).

Open Hole Temperature Log

An open hole temperature log was run between the depths of 370 feet to 1654 feet bls (Appendix 4.5.2-4). From approximately 380 feet to 500 feet bls, the temperature decreased from 87°F to 85°F. From approximately 500 feet bls to 1370 feet bls, the temperature gradually increased from 85°F to 87.8°F. Between 1370 feet bls to 1382 feet bls, the temperature increased from 87.8°F to 90.5 °F. Between 1382 feet and 1500 feet, the temperature remained relatively constant near 90.5°F. At 1506 feet bls the temperature again began to rise from 90.7°F to 95.4°F at 1650 feet bls. Assuming a surface temperature of 75°F, the geothermal gradient to 1650 feet bls is estimated to be 1.2 °F/100 ft.

Dual Induction Laterlog-3

The Dual Induction Log (DIL) (Appendix 4.5.2-4) is utilized to obtain formation resistivity values. It is common practice to use the ILD of this log response since the signal for this measurement is obtained from the deepest penetrating signal into the formation. This log can be used to infer bulk formation water salinity based on a given set of assumptions. In this interval, the dual induction log was useful in defining the subsurface region where formation water containing less than 10,000 ppm total dissolved solids exists and where water with higher than 10,000 ppm TDS exists. In the region between 1500 and 1600 feet bls, the resistivity values varied between 2 and 10 ohm-meters.

Based on the application of the Archie equation (Section 2.3), a formation with 25% porosity should have a resistance equal to 7.2 ohm-meters or less if the formation water has a TDS concentration equal to or greater than 10,000 ppm. The Dual Induction log performed over the intermediate casing interval indicates that the USDW lies somewhere between 1560 feet and 1598. The base of the USDW was set at 1580 feet (Section 2.3) based on formation porosity and resistivity.

Borehole Compensated Sonic Log

A borehole compensated (BHC) sonic log (Appendix 4.5.2-5) was run between the subsurface depths of 385 and 1610 feet bls to provide additional information concerning porosity and the lithology of the intervals penetrated in this section of the borehole. Florida Geophysical's borehole compensated sonic log provides an estimate of the formation porosity as a function of depth based on observed sonic travel times. Formation porosity was commonly found to range between 25% and 50% in the region between 500 and 1100 feet bls. Between 1300 feet and 1610 feet, porosity was estimated to range between 5% and 100% at different points along the wellbore. The large variation in porosity readings is due to the large diameter of the borehole associated with the voids created by the collapse of the unstable borehole walls. One hundred per cent porosity simply means that the borehole walls were too large to obtain formation properties at the specified depths. These voids would be filled with water accumulated during the reverse air process and would not reflect actual formation water at depth.

4.5.3 Depth Interval From 1654 to 2965 Feet

Gamma Ray Survey

The gamma ray activity over this interval, with some exceptions, commonly ranges between 5 and 30 API units. The Most notable gamma ray spike (>50 API units) occurs in a 17 foot thick lignite bed located at a depth of approximately 2304 feet bls (Appendix 4.5.3-1). Similar responses are observed in the 30-inch hole (Appendix 4.5.3-2).

Caliper Survey

The XY caliper survey performed over this interval (Appendix 4.5.3-1) in the pilot hole indicated that the formation continued to slough into the wellbore from a depth of 1670 to 1700 feet. Below this depth, the 12¼-inch borehole varied in diameter between 12¼-inches and 20-inches with two exceptions. These exception occur at approximately 2100 and 2300 feet. In these short intervals (<5 feet), the wellbore diameter appears to be in excess of 30-inches. Similar deviations in excess of 60 inches appear in the 30-inch diameter hole (Appendix 4.5.3-2).

Dual Induction Laterlog-3

The measured resistivity over this borehole segment ranged between 3 and 0.8 ohm-meters for the ILD probe (Appendix 4.5.3-3). These formation resistivity values reflect formation waters with TDS levels in excess of 10,000 ppm. Both the Dual Induction Log and the fluid resistivity log (Appendix 4.5.3-4) indicate a freshening of the water at approximately 2900 feet bls.

It is of some interest to note that the low salinity water recovered during packer test 5 (Section 4.3) was not identified by this log. It is likely that the additional drilling prior to running the resistivity log allowed circulated water to enter into the formation and therefore all resistivity values are likely more representative of the reverse air water being recirculated than the native formation water.

Open Hole Temperature Log

The open hole temperature log (Appendix 4.5.3-4) shows regions where the temperature has been reduced further than the normal cooling that has occurred throughout the borehole. Specifically, additional cooling beyond background occurred within the regions between 2240 and 2300 feet bls, 2520 and 2620 feet bls, and 2750 to 2820 feet bls. It is likely that this cooling is due to loss of recirculated reverse air water to the formation. The minimal amount of time this hole was open and the minimal, and localized reduction in formation temperature indicates that the amount of water lost to these zones is relatively small.

Borehole Compensated Sonic Log

The borehole compensated sonic log (Appendix 4.5.3-5) indicates that there are a number of intervals between 1770 feet and 2050 feet which have a formation porosity of less than 0.05 (5%). These layers are likely excellent confining units. In addition, two short intervals between 2750 and 2820 feet bls indicate similarly low porosity. As indicated in Section 2.4, these low porosity intervals likely act as major barriers to vertical fluid movement.

4.5.4 Depth Interval From 2965 to 3244 Feet

Gamma Ray Survey

The gamma ray surveys performed in the pilot hole and the nominal 20-inch diameter borehole indicate normal, low level formation gamma ray activity in this segment of the hole (Appendices 4.5.4-1 and 4.5.4-2).

Caliper Logs

The caliper logs performed in this segment of the hole indicate that two fractured regions, similar to the one that was previously intersected between 1380 and 1600 feet bls, were encountered between the approximate depths of 2980 and 3180 feet bls. This subsurface interval likely spans the region into which most of the treated water will enter the subsurface (Appendices 4.5.4-1 and 4.5.4-2).

Open Hole Temperature Survey

The open hole temperature log indicates drilling activities and probably offset injection have lowered the observed bottomhole temperature (Appendix 4.5.4-3) in this subsurface interval. The temperature log also indicates that the reservoir temperature has been lowered the most in two subsurface intervals that lie between 3050 and 3200 feet bls. The cooling effect indicates that the major flow region will likely be in the two flow zones that occur between 3050 and 3200 feet bls.

Dual Induction Log

The resistivity signal is observed to increase from the base of the casing to near the bottom of the openhole section (Appendix 4.5.4-4). It is likely that a portion of this increase is related to the freshening of the water due to offset injection. It is interesting to note that the formation water existing in the interval between 2950 and 3050 feet bls has a salinity of 44,000 ppm based on NaCl. This is very close to the salinity of the original brine found at this depth. Thus, it is likely that much of the injected fluid will move through the highly permeable fracture system and not through the basic matrix porosity of the formation.

Borehole Compensated Sonic Log

The region in which severe formation sloughing has occurred in the wellbore (3070 to 3180 feet bls) is easily recognized using the borehole sonic logs (Appendix 4.5.4-5). The region of severe sloughing corresponds closely with the interval receiving most of the fluid lost to the formation (3050 to 3200 feet bls) as indicated by the temperature log (Appendix 4.5.4-3).

4.6 Video Surveys

The pilot hole and the injection well casing were surveyed with a downhole TV camera on two occasions. Video surveys were conducted to provide general qualitative observation of the strata penetrated and to provide a visual inspection of the completed sections of casing. The video surveys were run on two occasions. The first video (Appendix 4.6-1) was conducted on March 8, 1996 and covered the pilot hole interval from 1638 to 2974 feet bls. The second video was run on April 7, 1996 and covered the entire interval of the completed well from near land surface to 3100 feet bls. Both video surveys were conducted by Florida Geophysical Logging, Inc.

The first video was run primarily to perform a visual inspection of the subsurface sediments comprising the confining interval above the proposed injection zone. This subsurface interval was subsequently cased off by the final injection string casing.

The second video was run to provide a visual record of the final injection casing and of the reamed hole through the injection zone. On April 7, 1996, the video survey was conducted on the 20-inch casing and open hole from 66 feet to 3100 feet bls (Appendix 4.6-2). This survey was completed after two previous attempts to video the well were unsatisfactory. A total of 235,400 gallons (5 well volumes) of clear water from the supply well and upper monitor well was pumped into the injection well prior to running the video.

The clarity of the water was generally good throughout the logging of the cased hole. Water clarity began to decline in the open hole below the casing seat located at 2965 feet, and rapidly deteriorated once the video tool was lowered below 3070 feet. The video survey was terminated at 3100 feet. Since the clarity of the water was poor within the injection zone, and since there was some risk that proceeding further into the open hole could result in a stuck tool, it was concluded that the survey had been performed to an adequate depth for the purposes of this survey.

The video showed that from 66 feet to 2965 feet the casing was intact and free from visible defects. The cased interval from land surface to 66 feet was inspected in a video conducted the previous day as witnessed by Gordon Kennedy (ViroGroup, Inc.). The first video also showed that the open hole interval from 2965 feet to 3070 feet bls was completed in moderately porous, uniformly bedded limestone. Additional information on the structural and lithologic characteristics of the injection zone could not be interpreted from the video, because of the rapid deterioration of water clarity within the zone. The video provides an acceptable record of the entire cased interval, and provides a visual demonstration of mechanical integrity for the 20-inch diameter injection casing.

A brief description of the observations made while reviewing the two videos are provided in Appendices 4.6-1 and 4.6-2.

4.7 Packer Tests

Five packer tests were conducted during drilling of the 12¼-inch pilot hole below 393 feet to determine water quality and formation hydraulic parameters within selected depth intervals. All packer tests were conducted on a single interval using a single inflatable packer tool. Two packer tests were conducted prior to setting the intermediate casing string. These packer tests were designed to locate the base of the Underground Source of Drinking Water (USDW), defined as the depth at which total dissolved solids (TDS) exceed 10,000 mg/l. Three packer tests were conducted between the depths of approximately 2000 and 2900 feet below pad level in order to characterize the hydraulic and water quality properties at selected depth intervals within the middle confining beds between the Upper Floridan Aquifer and the Boulder Zone.

A summary of the packer test program, including test date, depth interval, tested, and calculated hydraulic coefficients, is provided in Table 4.7-1. Since the purpose of the first two packer tests was to determine water quality within the tested interval, no extensive hydraulic information was collected and analyzed.

The procedures used for conducting the packer tests were as follows:

1. Intervals to be tested were selected based upon lithologic logs, geophysical logs, and caliper logs.
2. A single inflatable packer was connected to the drill pipe.
3. The packer assembly was lowered to a depth, based on the caliper log, that would provide the best seat for the inflatable packer.
4. The packer was inflated, isolating the portion of the formation below the packer from the overlying strata. The seal, or seating, of the packer against the pilot hole wall was then verified.
5. A five horsepower submersible pump was set inside the drill pipe at approximately 150 feet below the drilling floor level.
6. The submersible pump was run to purge recirculated water from the interval being tested. This purging continued until water clarity, temperature, and conductivity

stabilized. The pump was then shut off to allow formation pressures (water levels) to return to static conditions prior to starting the packer test.

7. The open zone was pumped at a constant rate while recording water levels, water temperature, and conductivity. Flow rates were measured by means of a calibrated flowmeter. Drawdown and recovery data were measured and recorded using InSitu pressure transducers and electronic data logger. Pumping typically was continued at a constant rate for 4 hours.
8. Water samples were collected for laboratory analysis during each test.
9. The submersible pump was shut off and water level recovery data was gathered.

Specific water quality and hydraulic information obtained during each packer test are summarized as follows:

Packer Test Number 1

Packer test No. 1 was conducted over the interval from 1526 to 1575 feet below pad level on November 27, 1995. The test was conducted at a flow rate of 94 gpm. Pumpage continued for 4 hours. The results of water quality analyses for samples collected from this interval are provided in Table 4.7-2.

The main purpose for running this packer test was to locate the base of the USDW. The base of the USDW had previously been assigned to a depth of 1550 feet during the construction of IW-1. As indicated in Table 4.7-2, the measured total dissolved solids (TDS) value obtained during this packer test was 8,886 ppm after 16,900 gal of water had been produced from the interval. Chloride and conductivity readings indicated that a stable formation water composition was likely reached after the first 5000 gallons of water was produced.

Since the measured TDS value was less than 10,000 ppm, it could not be stated with certainty that the base of the USDW occurred above 1575 feet. This information contributed to the decision to install the intermediate casing at deeper depth than was originally planned.

Packer Test Number 2

The second packer test was performed on November 29, 1995 over the interval from 1610 to 1654 feet bls. The test was conducted at a flow rate of 83 gpm for a duration of 3 hours. Water samples were collected and analyzed on site for conductivity. Samples, were analyzed by the EPWRF laboratory for TDS, chlorides, and conductivity. The results of this test (Table 4.7-2) showed the TDS concentration over this depth interval was approximately 31,000 ppm. This TDS level exceeded the 10,000 ppm regulatory level used to identify a USDW and therefore indicated that the base of the USDW was likely to lie above 1610 feet (Section 4.3). This information, along with concerns about the integrity of the subsurface formation above 1600 feet, was used to chose a casing setting depth of 1638 feet for the intermediate casing string.

Packer Test Number 3

Packer Test 3 was conducted over the interval from 2013 to 2055 feet on February 28, 1996. After some initial short term pump and recovery testing, the test was conducted at a constant rate of 65 gpm for a total of 4 hours before shutting in the well and collecting recovery data for 1 hour. As indicated in Table 4.7-1, formation water samples collected from this interval were characterized by a chloride concentration in excess of 18,700 ppm and a conductivity in excess of 50,000 umhos/cm.

The recovery data was plotted semi-logarithmically as the difference in head from static conditions versus the total time since beginning of the flow test divided by the time since recovery was initiated (Figure 4.7-1). A regression line for the plotted data was chosen. The slope of the line was approximately 1.08 ft/cycle. Based on a slope of 1.17 ft/cycle (Δs), and a production rate (Q) of 65 gpm, the transmissivity (T) is calculated to be 14,700 gpd/ft based on the following relationship developed by Cooper and Jacob (1946), (Driscoll, p. 221):

$$
\begin{aligned}
T &= 264\ Q/\Delta s \\
&= 264*65/1.17 \\
&= 14{,}700 \text{ gpd/ft}
\end{aligned}
$$

Packer Test Number 4

The fourth packer test, which was performed over the depth interval between 2280 to 2317 feet, was conducted on March 1, 1996. After clearing the well and allowing the well to recover, the test was conducted for 4 hours at an average rate of 90 gpm. Data was collected during the pumping phase of the test and for 3 hours during the recovery of the well.

The chloride content of the water obtained from this interval measured 13,446 mg/l. The TDS values reached 27,910 mg/l (Table 4.7-2).

The water level data from the recovery test was plotted semi-logarithmically as the difference in head from static conditions versus the total time since the beginning of the flow test divided by the time since recovery was initiated. A regression line for analysis of transmissivity was not selected for this test since the data shows formation pressures were decreasing rather than increasing with time as required by theory.

To obtain an estimate of the formation transmissivity for this test, the data from the pumping portion of the test was utilized. Based on a measured flow rate of 88 gpm and

TABLE 4.7-1

PACKER TEST SUMMARY
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)

Test Number	Date	Interval Tested (feet bpl)	Pumping Rate (gpm)	Transmissivity (gpd/ft)
1	11/27/95	1,526 - 1,575	94	
2	11/29/95	1,610 - 1,654	83	
3	2/28/96	2,013 - 2,055	65	16,000
4	3/1/96	2,280 - 2,317	90	600
5	3/5/96	2,743 - 2,815	95	27,300

a drawdown of 31 feet at the end of the packer test, the horizontal transmissivity of the unit was estimated to be 4250 gpd/ft based on the following equation (Driscoll p.754):

$$T = (1500)*(Q/\Delta s)$$
$$= 4250 \text{ gpd/ft}$$

<u>Packer Test Number 5</u>

Packer test five, performed over depth interval from 2743 to 2815 feet, was conducted on March 5, 1996. After purging the well to remove solids and water that may have invaded the formation during drilling, the test was conducted for 4 hours at 95 gpm and then recovery data was collected for an additional 4 hours.

The chloride content measured in this interval was 980 mg/l and the conductance was measured to be 3480 (umhos/cm). These measurements suggest that the injected water has risen to approximately 2800 feet, but has not advanced above this depth. Thus, the confinement provided by the low permeability formation materials contained within this zone (Section 4.4) have essentially limited vertical movement of the freshwater plume to intervals below this point.

Water level data from the recovery test were plotted semi-logarithmically as the difference in head from static conditions versus the total time since beginning of the flow test divided by the time since recovery was initiated (Figure 4.7-3). A regression line from the plot of the data was chosen. The slope of the line was estimated to be 0.92 ft/cycle. Based on a slope of 0.92 ft/cycle (Δs), and a production rate (Q), of 95 gpm, the transmissivity (T), is calculated to be 27,300 gpd/ft using the following relationship developed by Cooper and Jacob (1946), (Driscoll, p. 221):

$$T = 264\ Q/\Delta s$$
$$= 264*95/0.92$$
$$= 27{,}300 \text{ gpd/ft}$$

It is important to recognize that the reported transmissivity values are for horizontal flow along bedding planes and into the well. Vertical permeability cannot be estimated using these test procedures (see Section 4.4).

4.8 Pad Monitor Well Water Quality

The pad monitor well water quality data are summarized in Table 4.8-1. The complete set of data are provided in Appendix 4.8-1. As the data in Table 4.8-1 show, chloride concentrations doubled in monitor wells 1 and 4 during the time when gravel operations were initiated on the intermediate borehole. From the middle of January through April 1996 the chloride concentration in wells MW-1 and MW-4 remained high while the chloride concentrations in MW-2 and MW-3 returned to near normal levels., By August 1996, chloride levels in MW-1 and MW-4 had dropped to 178 mg/l and 136 mg/l. Although these levels are less than the minimum associated with drinking water standards (250 mg/l) and are continuing to decline. No additional measurements have been made since August of 1996.

5.0 WELL TESTING PROGRAM

Chapter 62-528.300 (6) FAC requires the mechanical integrity of injection wells be demonstrated by providing proof that there is no leak in the casing, and there is no fluid movement adjacent to the well bore. Mechanical integrity of the East Port IW-2 was evaluated during construction using the following procedures:

1. Temperature logs,
2. Cement bond log,
3. Pressure test,
4. Video survey,
5. Radioactive Tracer Survey, and
6. Injection Test

All the tests were evaluated by ViroGroup Inc. personnel and judged to have been completed satisfactorily. The test results clearly demonstrate the mechanical integrity of IW-2. A summary of procedures and results is provided below. The cement bond log was discussed in Section 3.3.3, and the video survey was discussed in Section 4.6 of this report.

5.1 Temperature Logs

Beginning on March 24, 1996, temperature logs were run in the 20-inch diameter casing following emplacement of each stage of cement, with the exception of the final stage (Stage 8), which was pumped to land surface. The temperature logs were run to verify the presence and location of cement behind the casing. Physical tagging of each cement stage was used to compliment information obtained from the temperature logs.

The temperature log was run from land surface to 2942 feet following pressure grouting of the first stage. Logging of subsequent cement stages was conducted over an appropriate depth interval to overlap the previous cement stage. A composite cement top log, containing all temperature logs run on the 20-inch casing cement stages, is included in Appendix 3.3.3-3.

All of the temperature logs confirmed the presence of a continuous column of cement behind the longstring casing. A second cement bond log was run on the final stage of cement brought to the surface to evaluate the integrity of the annular grout in the interval from 50 feet to 540 feet. The second CBL shows that the upper 540 feet of the injection casing was successfully cemented (Appendix 3.3.3-5).

On April 8, 1996, a temperature survey was conducted from land surface to total well depth following flushing the well with cooler, brackish water. This test was performed prior to performing the Radioactive Tracer Survey. The temperature log indicates that significant cooling occurred in the interval below 3,000 feet (Appendix 5.1-1). No significant cooling was indicated at any other points within the well.

5.2 Pressure Test

Pressure testing of the 20-inch diameter casing was conducted on March 29, 1996 to evaluate the internal mechanical integrity of the injection casing and joint welds. The test was conducted following cementing of the casing annulus and prior to drilling through the cement at the bottom of the casing. The pressure test was observed by Mr. Jack Myers (FDEP) and Mr. Gordon Kennedy (ViroGroup).

The pressure test was conducted with an initial pressure of 225 psi. Water was used to pressure up the casing. The test was conducted for 60 minutes starting at 0830 hours. Casing pressure was monitored using a 0 to 300 psi pressure gage manufactured and calibrated by McDaniels Controls, Inc. Documentation of gage calibration is provided in Appendix 5.2-1. The pressure readings recorded during the test period are provided in Table 5.2-1.

As shown in Table 5.2-1, casing pressure ranged from the initial 225 psi to 215 psi after 60 minutes (-10 psi pressure change). This represents a loss of 4.4% of the initial test pressure, and thus complies with the requirements of Chapter 62-528.300(6)(e) FAC to demonstrate there are no leaks in the casing. Based on the pressure test results, the East Port IW-2 can be operated at a maximum injection pressure of 150 psi.

Even though the initial casing pressure test was approved, ViroGroup requested that a second pressure test be performed at no cost using a packer to verify mechanical integrity under conditions similar to those that will be encountered during normal operation. Pressure response data provided in Table 5.2-2 shows that the casing also met the mechanical integrity requirement during the second pressure test. During this test, a 1.1% pressure rise was observed over the 60 minute time period. The slight pressure increase indicates that thermal equilibrium and not yet been reached.

5.3 Radioactive Tracer Survey

A Radioactive Tracer Survey (RTS) was conducted on the East Port IW-2 well on April 8, 1996 by Florida Geophysical Logging, Inc. The procedure was conducted to evaluate the integrity of the annular cement seal at the bottom of the 20-inch diameter injection casing. Because gamma ray receivers can detect radioactive materials through steel casing, upward movement of fluids behind the casing can be detected using the radioactive tracer material ejected during this testing procedure.

In brief, the RTS procedure consisted of background temperature and gamma logs from land surface to total well depth, a static (no flow) radioactive tracer survey, two dynamic (flowing) radioactive tracer surveys, and a final background gamma ray log from total depth to land surface. The survey was witnessed by Joseph Haberfeld (FDEP) and Gordon Kennedy (ViroGroup, Inc.). A log documenting the results of the RTS is included in Appendix 5.3-1.

The RTS was performed the day after conducting the video survey. Prior to running the video, approximately 235,000 gallons of slightly brackish water was pumped into IW-2, using the supply well and upper monitor zone well for IW-1 as water sources. This water served to create a "fresh" water bubble for performing the video and RTS.

Equipment used by Florida Geophysical Logging during the procedure consisted of an RTS tool configuration with temperature probe, casing collar locator, tracer ejector and three gamma ray detectors. A schematic diagram of the RTS tool is included in Appendix 5.3-1. The radiation detectors were located 2.5 feet below the ejector, (GRM); 10 feet above the ejector (GRT), and 12.5 feet below the ejector (GRB). The tracer ejector tool was filled with 10 millicuries of iodine 131. The procedure used for the RTS is detailed as follows:

1. Ran temperature log from 25 feet below pad level (bls) to 3245 feet.

2. Ran background gamma log from 3245 feet to 21 feet below pad level. Pulled out of hole to fill tracer ejector tool.

3. Tripped ejector/detector tool to 3000 feet and re-logged to compare to background log run earlier, and verify casing tie-in. The bottom of casing reference depth was verified at 2968 feet by the casing collar locator.

4. Conducted static RTS with the ejector port positioned 1 foot below the bottom of the casing (2969 feet). Monitored gamma detectors with tool in stationary position, and recorder chart on time drive mode for one hour after ejecting 1 millicurie of Iodine 131. The tracer was detected at GRM in 32 seconds, and the tool saturated at 1500 API units. The tracer was detected at GRT & GRB in approximately 6 minutes. The maximum reading at GRT was 285 units, and was 385 units at GRB.

5. Logged up-hole from 2983 to 2692 feet. All three detectors returned to near background levels above the 2900 foot level. Flushed casing at approximately 1,000 gpm for 60 minutes (casing volume = 43,670 gallons; total flush approximately 60,000 gallons). Logged up-hole from 2983 to 2692 feet after flushing casing. All detectors indicated approximate background gamma levels.

6. Performed pumping RTS (Dynamic Test A) with the ejector port positioned 5 feet above the bottom of the casing (2963 feet) while injecting water into well at 50 gpm. Monitored gamma detectors with tool in stationary position, and recorder chart on time drive mode for 30 minutes after ejecting 1 millicurie of Iodine 131. Tracer detected at GRM in 20 seconds, and at GRB after 140 seconds. Both tools

saturated at approximately 1500 API units, and gamma ray activity declined in both detectors after the downward passage of the tracer slug. No tracer was detected moving upwards at the GRT.

7. Logged out of position from 2977 to 2692 feet. Minor staining was detected by GRM & GRB (30 API units) at 2963 feet while logging up-hole, and the GRT detector maintained approximate background readings throughout.

8. Performed second pumping RTS (Dynamic Test B) with the ejector port positioned 5 feet above the bottom of the casing (2963 feet) while injecting water into well at 73 gpm. Monitored gamma detectors with tool in stationary position and recorder chart set on time drive mode for 30 minutes after ejecting 1 millicurie of Iodine 131. Tracer was detected at GRM in 12 seconds, and at GRB after 100 seconds. Both tools saturated at approximately 1500 API units, and gamma ray activity declined in both detectors after passage of the tracer slug in the downward direction. No tracer was detected moving upwards at the GRT.

9. Logged out of position from 2977 to 2692 feet. Minor staining was detected by GRM & GRB (40 API units) at 2963 feet while logging up-hole, and the GRT detector maintained approximate background readings throughout. Flushed casing at approximately 1,000 gpm for 32 minutes (total flush = 32,000 gallons). Continued injecting water into well at 73 gpm after high pumping rate flush.

10. Lowered logging tool to injection zone and ejected remaining iodine (7 millicuries) and cycled chamber at 3070 feet bls. Lowered tool to bottom of hole.

11. Conducted final background gamma ray log, logging up-hole from 3245 to 11 feet bls. Tracer was detected at 3155 feet by GRT (70 api units), GRM (80 api units), and GRB (60 api units), indicating that the tracer had migrated downward to this injection zone depth following final ejection. Dragging of tracer material on the logging tool was apparent, and decreased to background levels at 3000 feet. Staining at the 2963 foot ejection depth was noted on all three detectors (35 api units on GRT). No other deviations from background gamma ray levels were noted during the final background logging run.

The results of the radioactive tracer survey indicate that upward movement of the tracer material behind the 20-inch diameter injection casing did not occur. During the three tests conducted, tracer material was recorded by the top detector during the static test only. This is attributed to a small convection current moving the tracer material inside the casing, as indicated by similar dispersion rates and radioactivity levels recorded at the bottom detector. The much higher radioactivity levels recorded at the middle detector, located nearer to the ejector port, also indicates a slight dispersion of the tracer material due to convection currents. The final background log detected tracer only in the injection zone, and minor staining at 2963 feet, the depth that tracer was ejected during the two dynamic tests. The RTS results thus indicate the integrity of the annular seal at the bottom of the casing. No fluid migration was indicated behind the 20-inch injection casing.

5.4 Injection Test

A 24-hour injection test was conducted at the East Port IW-2 beginning at 0930 hours on April 22, and ending at 0930 hours on April 23, 1996. Prior to conducting the test, approximately 60 hours of background pressure and temperature data were collected. Recovery data were collected for 12 hours following injection. A water quality analysis of the injected water is provided in Appendix 5.4-1.

The purpose of the injection test was to evaluate the impact of injecting at a high rate into IW-2 and to establish the current maximum injection rate that can be sustained using the current facility pumping capacity. Additional injection tests will be performed to permit higher injection rates after pumping facilities are upgraded. Treated wastewater from the facility storage reservoir was used for the injection test. Prior to the test, mechanical integrity of the injection casing was demonstrated by means of the Radioactive Tracer Survey and casing pressure test (Section s 5.2 and 5.3). The casing passed the required pressure test which was performed at a surface pressure of 225 psi.

Bottom hole pressure (BHP) and bottom hole temperature (BHT) data were collected in IW-2 by Florida Geophysical, Inc. using Geophysical Research Corporation (GRC) pressure transducers hung on a wireline tool set at 2,950 feet bls. Pressure data was also collected at the wellhead in IW-2, IW-1, and both deep monitor wells. In-Situ, Inc. pressure transducers and an automated data logger were used to record pressure data collected at the surface. Liquid filled pressure gauges and the IW-1 recording gauges were used to supplement and verify data recorded by the pressure transducers. Atmospheric pressure data at the site was also recorded throughout the background, injection, and recovery period using a GRC pressure transducer.

The average injection rate for the test was 5,252 gpm, which corresponds to a flow velocity of 5.9 feet /sec. The maximum BHP increase recorded during injection was 1.65 psi (approximately 3.80 feet). The maximum IW-2 wellhead pressure increase recorded was approximately 4 psi, and the IW-1 wellhead pressure increase was approximately 0.7 psi. No changes in pressure attributable to injection were noted in either the upper or lower monitor zones during the injection test.

Figure 5.4-1 provides an overview of the IW-2 bottomhole pressure response recorded over both the injection and recovery portions of the injection test. Figure 5.4-2 provides a semilog plot of pressure (feet) versus the log of reduced time. Analysis of this plot indicates that the average transmissivity of the injection zone is approximately 1,000,000 gpd/ft.

Figure 5.4-3 provides a plot of the surface pressure observed in the upper and lower monitor wells at this site during the background, injection, and recovery periods. As can be seen in Figure 5.4-3, the pressure in the monitor wells actually decreased during the injection period. A comparison of tidal data presented in Figure 5.4-4 with Figure 5.4-3 suggest that the observed fluctuation in both the upper and lower monitor intervals is best associated with the forces controlling tidal movement rather than injection activities. There is no indication that injection into IW-2 is impacting either of the two monitored aquifers. The tidal data was generated using TideMaster® software developed by Coastal Computer Company.

Barometric pressure data for the Fort Myers station were obtained from the Southeast Regional Climate Center, and appear in Appendix 5.4-2. No major storms or pressure disturbances occurred in this area during the time period of the injection test. There is no indication that changes in the barometric pressure influenced any of the observed pressure responses recorded during this testing.

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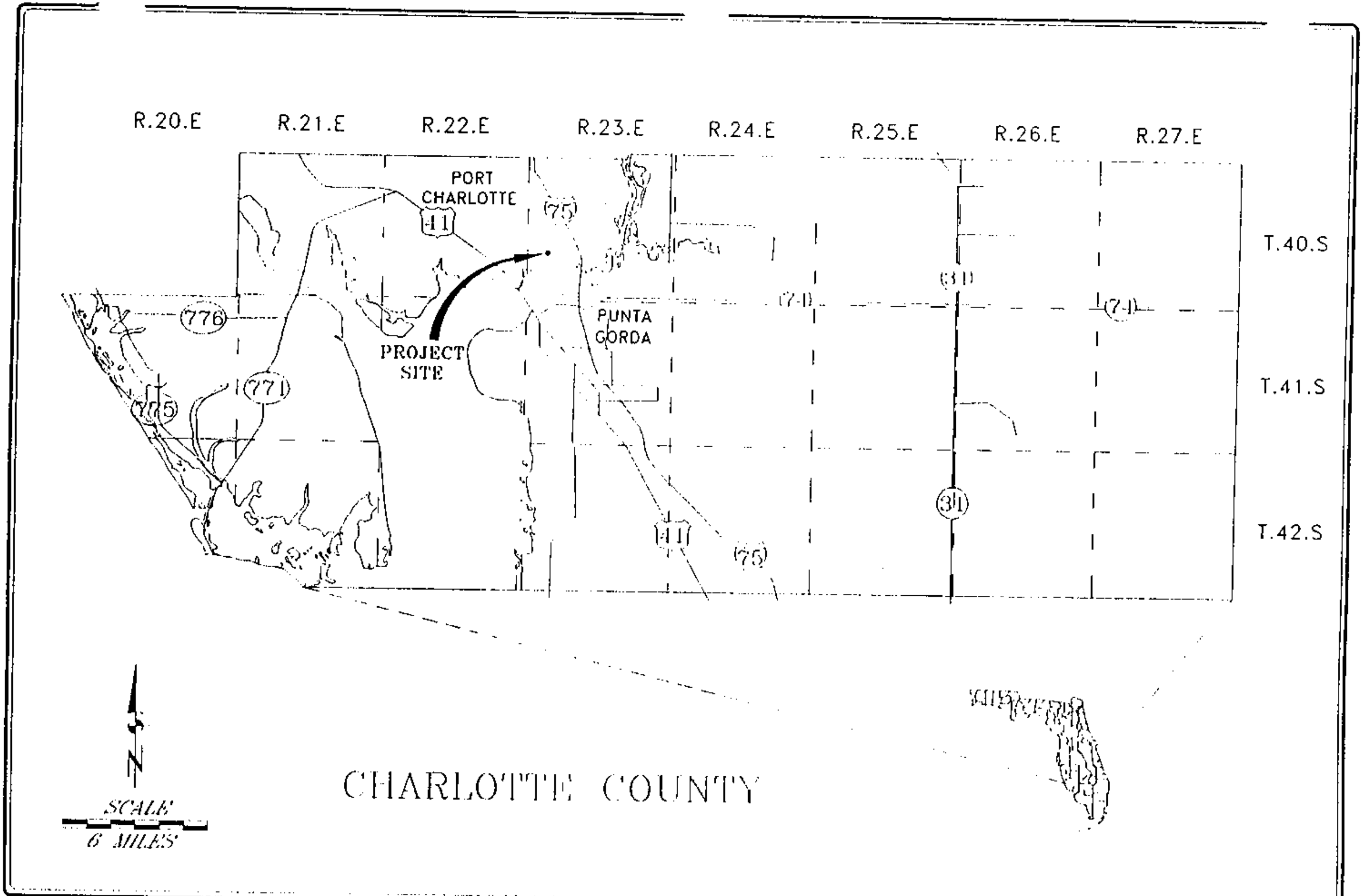
ViroGroup, Inc., 1995b, Historical Injection Data for IW-1 and Water Quality Data for MW-1 and MW-2, 1990 to 1994, prepared for Charlotte County Utilities, 12 pp.

ViroGroup, Inc., 1996, Preliminary Completion Report for Construction of the East Port Injection Well No. 2, Charlotte County Utilities, Charlotte County, Florida, prepared for Charlotte County Utilities, 23 pp.

FIGURES



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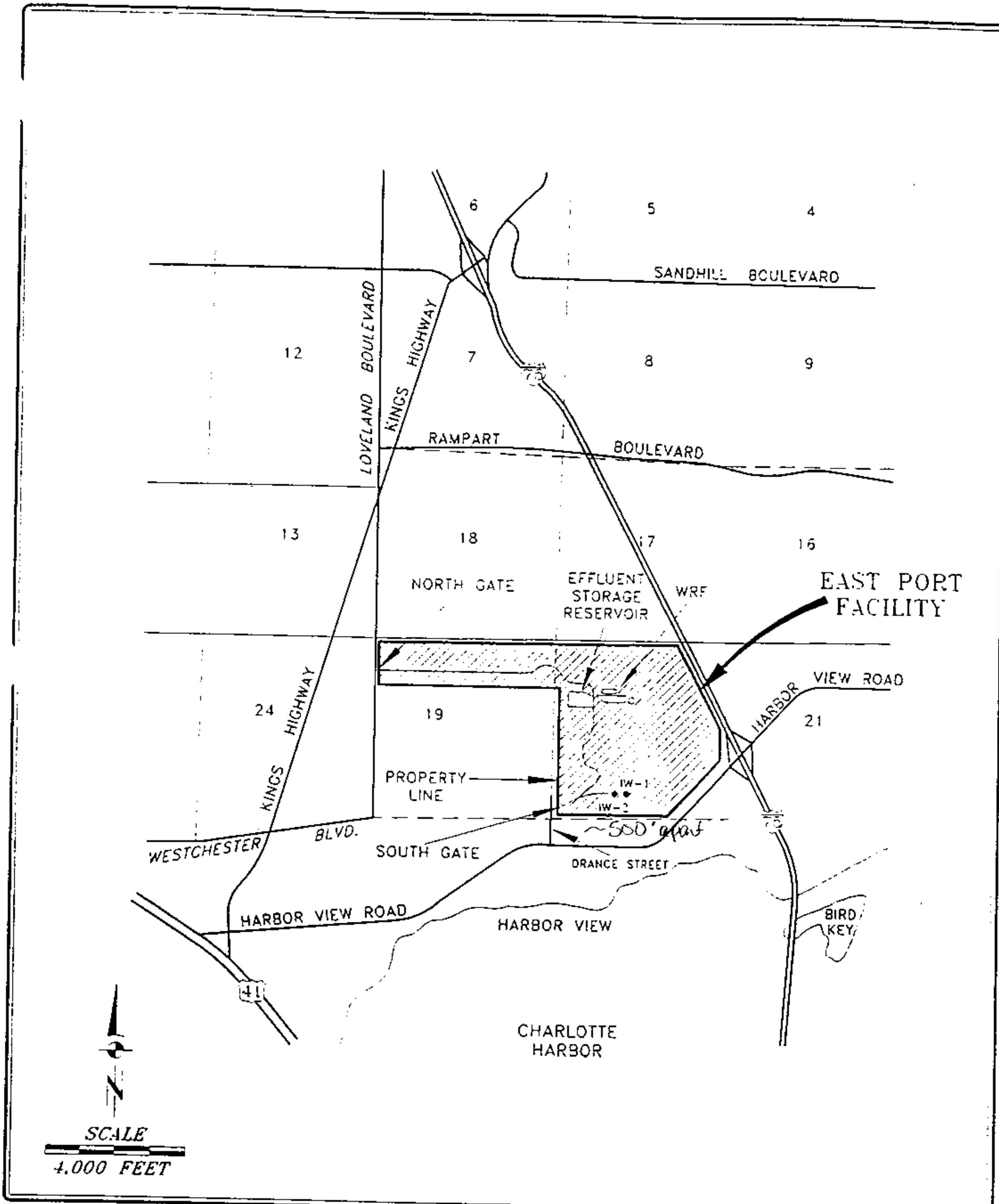
AIR • WATER • SOIL TECHNOLOGY

DRN. BY: CAM DWG NO. A-012574FA-1 DATE: 1/24/97

PROJECT NAME: CHARLOTTE CO. EAST PORT IW-2 PROJECT NUMBER: 01-02574.00

FIGURE 1.0-1. MAP SHOWING PROJECT LOCATION.



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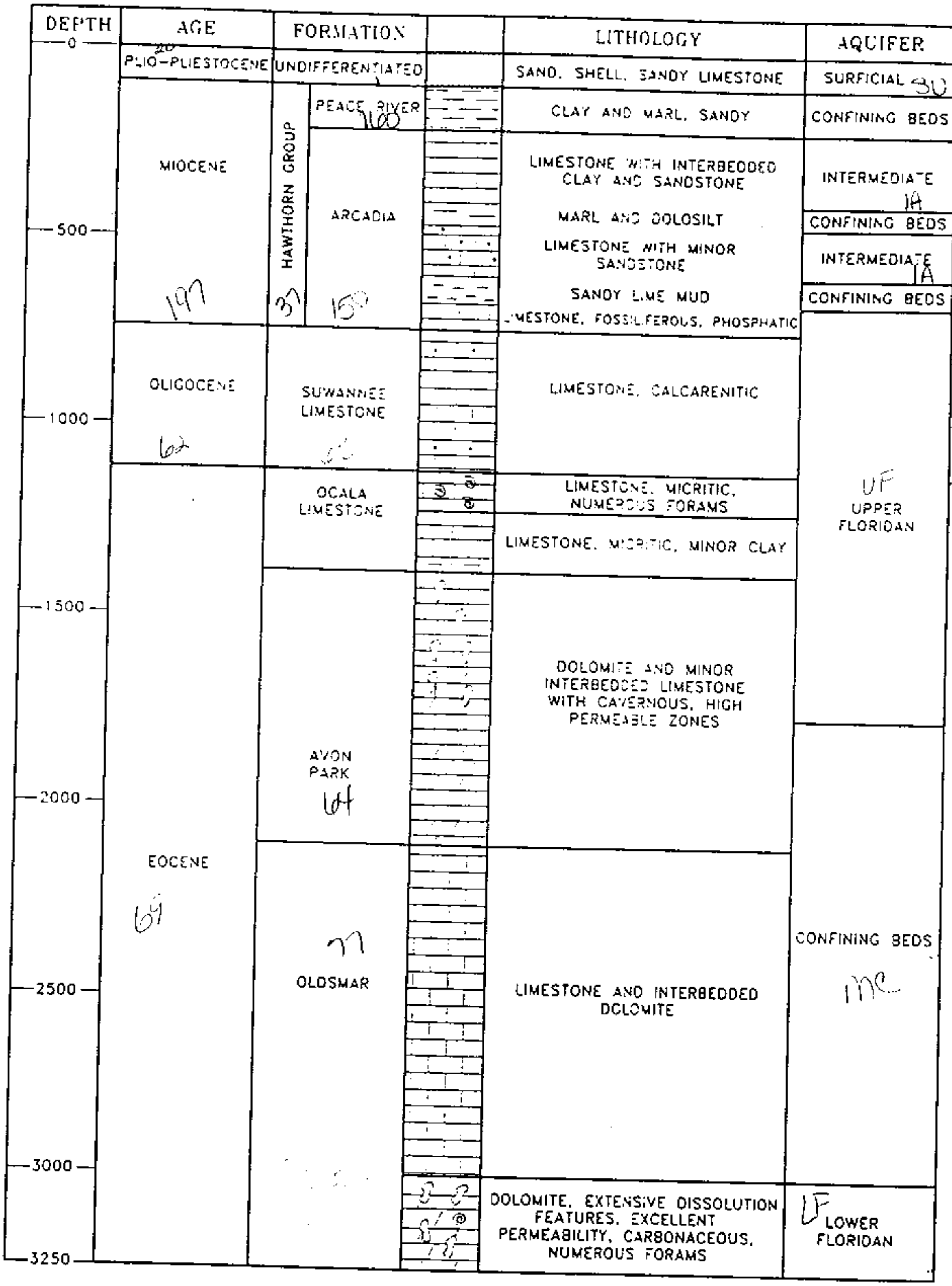
DRN. BY: CAM DWG NO. A-012574MA-7 DATE: 1/24/97

PROJECT NAME: CHARLOTTE CO. EAST PORT IW-2 NUMBER: 01-02574.00

FIGURE 1.0-2. GENERAL VICINITY MAP OF THE CHARLOTTE CO. EAST PORT WATER RECLAIMATION FACILITY.



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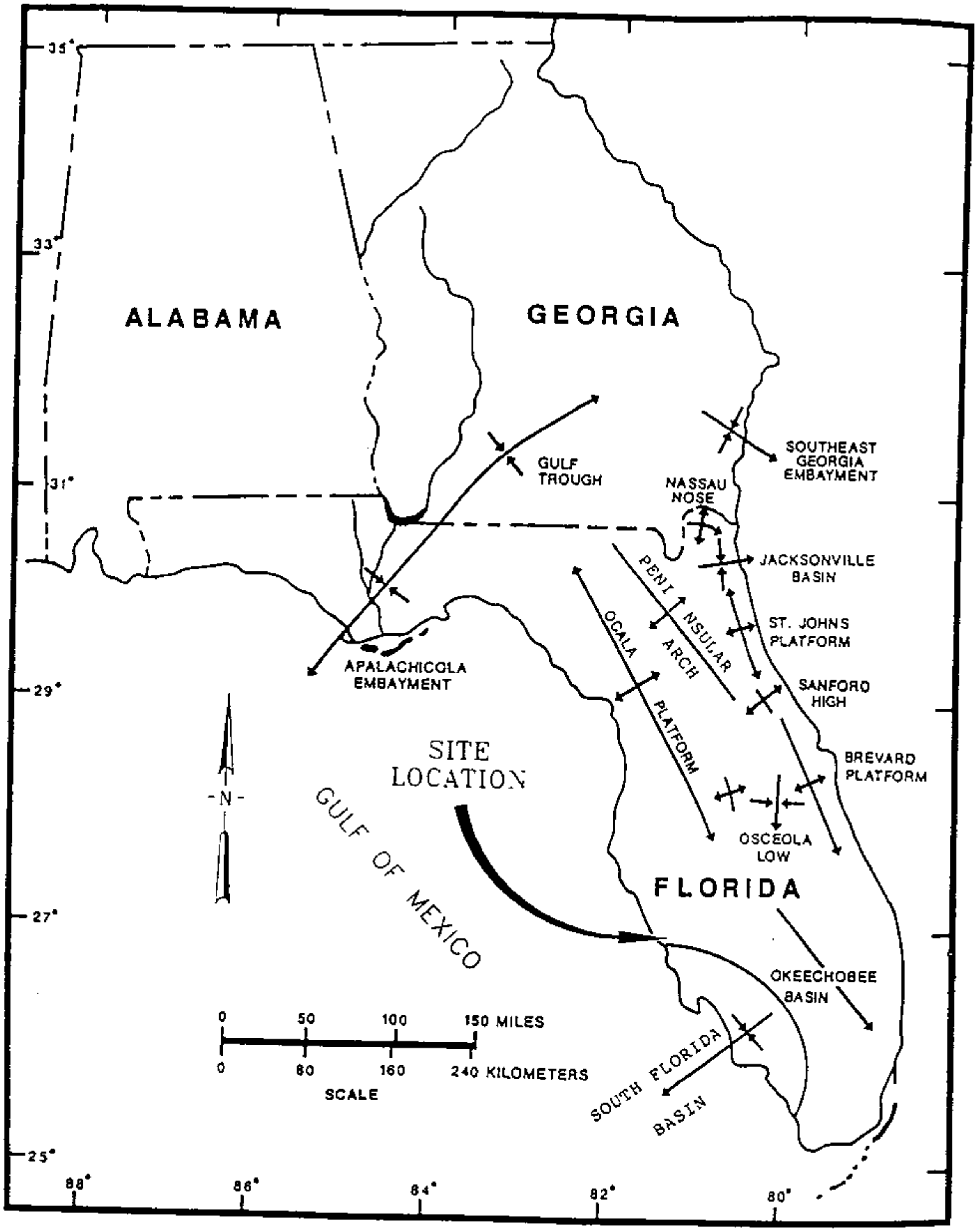
DRN. BY: CAM DWG NO. A-0125740A-2 DATE: 1/23/97

PROJECT NAME: CHARLOTTE COUNTY IW-2 NUMBER: 01-02574.00

FIGURE 2.1-1. GENERALIZED HYDROSTRATIGRAPHIC COLUMN FOR THE EAST PORT WRF STORE UTILITY SITE, CHARLOTTE CO., FL.



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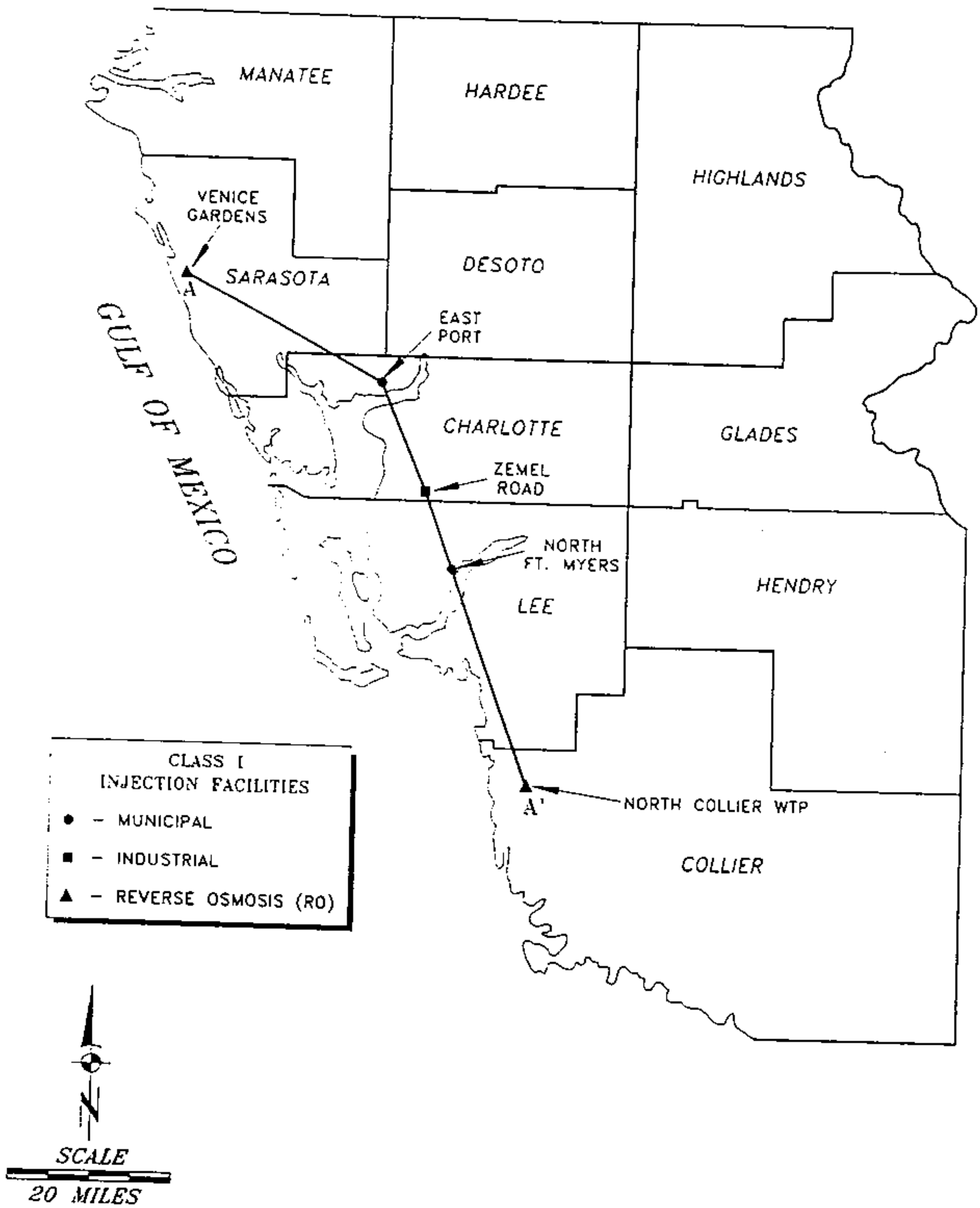
DRN BY: CAM	DWG. NO. A-012574AA-2	DATE: 1/23/97
PROJECT NAME: CHARLOTTE CO. EAST PORT IW-2		NUMBER: 01-02574.00

FIGURE 2.2-1. REGIONAL GEOLOGIC SETTING. (MODIFIED FROM SCOTT, 1988)



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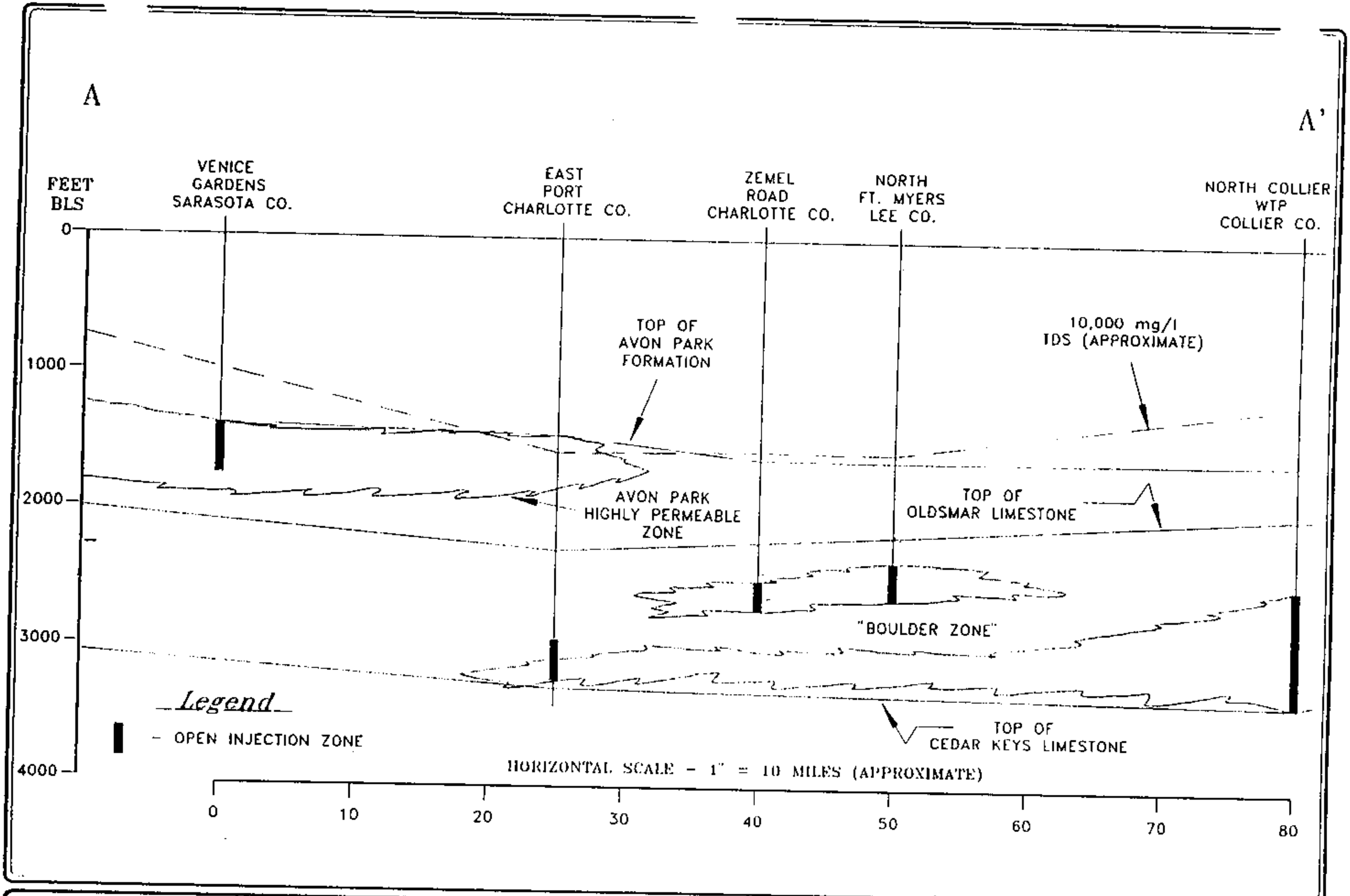
DRN BY: CAM	DWG. NO. A-012574KB-2	DATE: 1/23/97
PROJECT NAME: CHARLOTTE COUNTY IW-2		NUMBER: 01-02574.00

FIGURE 2.2-2. MAP SHOWING LINE OF CROSS-SECTION FOR FIGURE 2-3.



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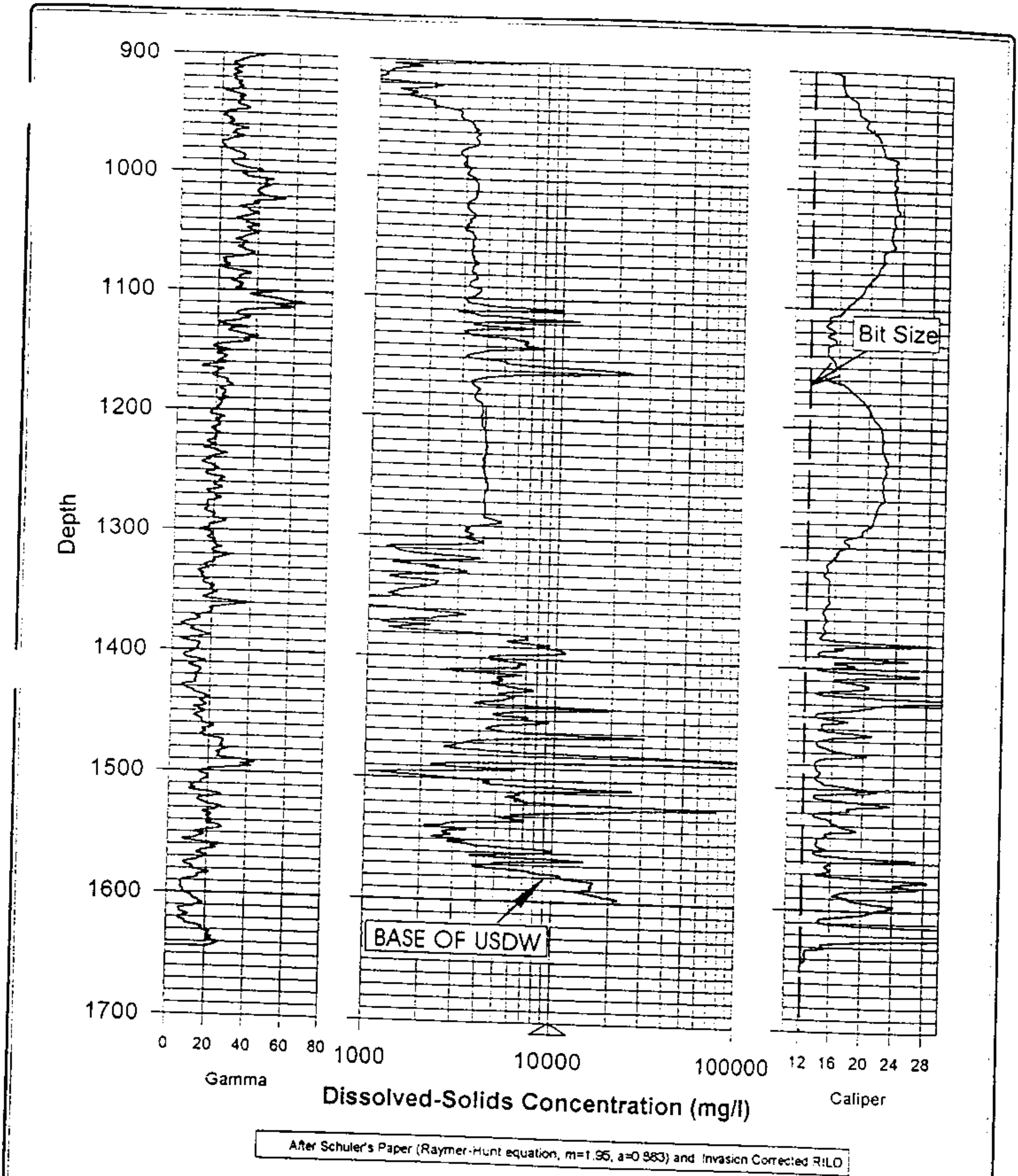
AIR • WATER • SOIL *T E C H N O L O G Y*

DRN. BY: CAM DWG. NO. A-012574DA-2 DATE: 1/23/97

PROJECT NAME: CHARLOTTE COUNTY IW-2 PROJECT NUMBER: 01-02574.00

FIGURE 2.2-3. GENERALIZED CROSS SECTION SHOWING PERMEABLE INJECTION ZONES IN SOUTHWEST FLORIDA. (MODIFIED FROM HABERFELD, 1991)



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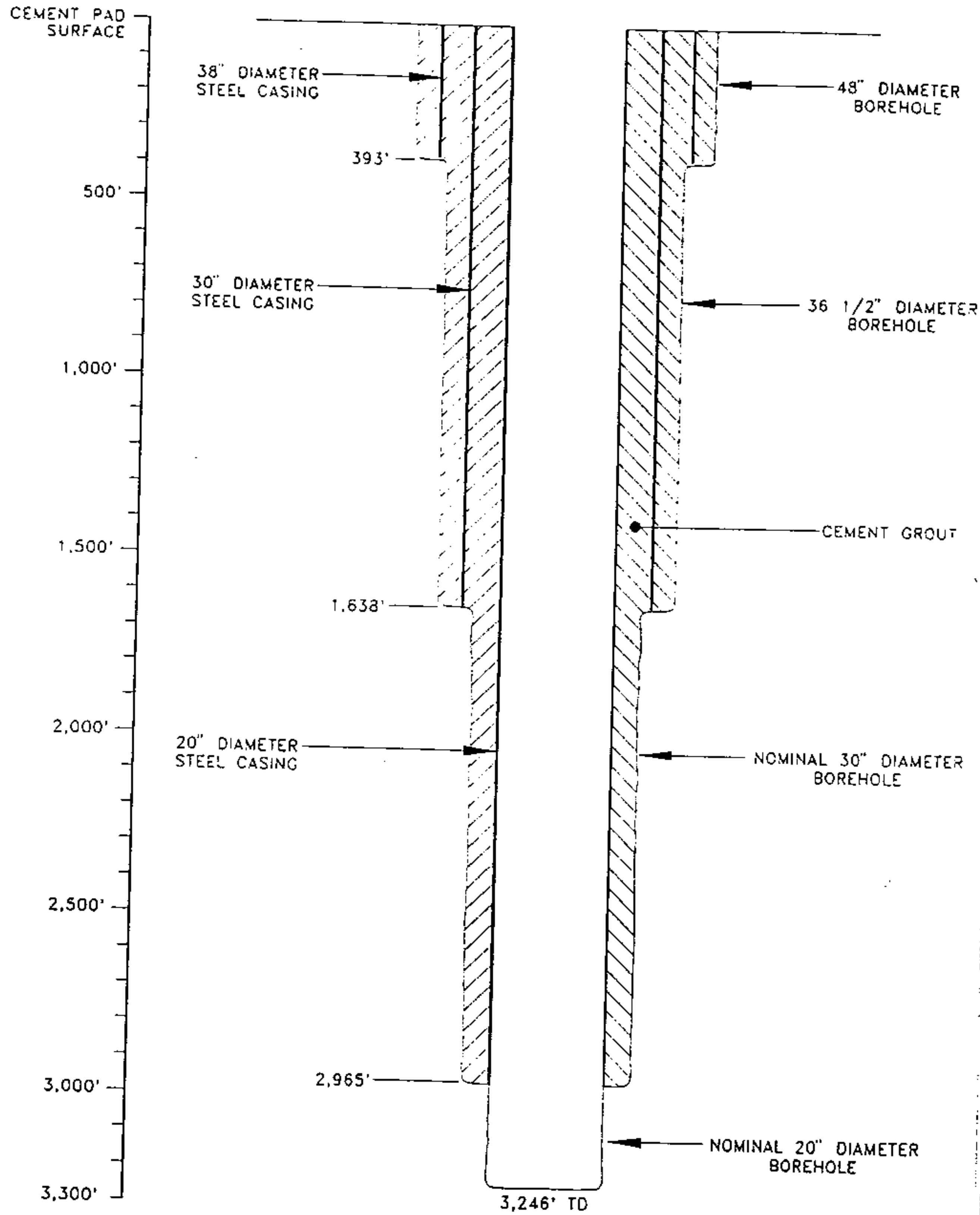
AIR • WATER • SOIL TECHNOLOGY

DRN BY: CAM	DWG. NO. A-012574AB-1	DATE: 1/23/97
PROJECT NAME: CHARLOTTE CO. IW-2		NUMBER: 01-02574.00

FIGURE 2.3-1. LOCATION OF USDW.



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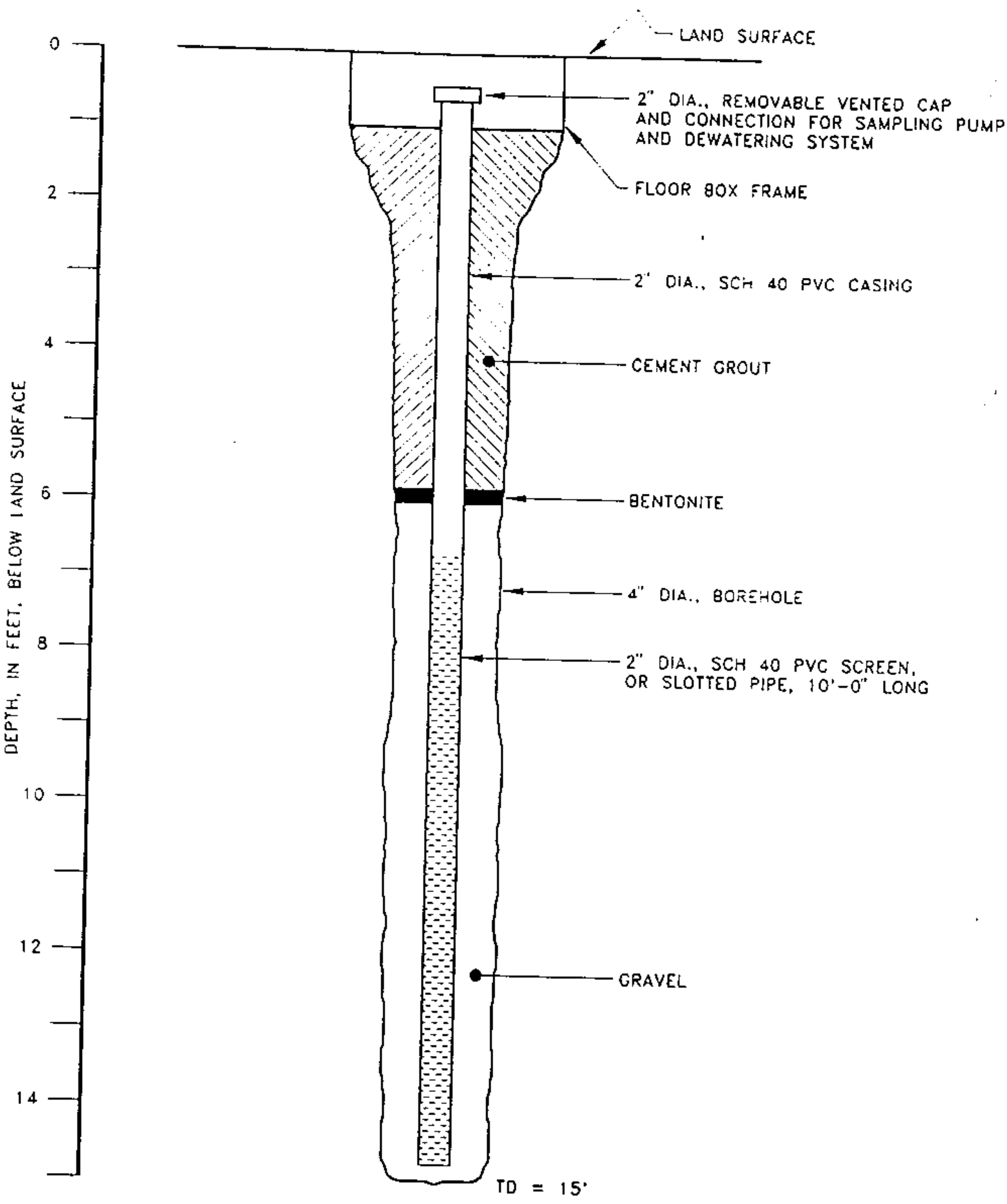
DRN BY: CAM	DWG. NO. A-012574NE-2	DATE: 1/23/97
PROJECT NAME: CHARLOTTE CO. EAST PORT IW-2		NUMBER: 01-02574.00

FIGURE 3.1-1. SCHEMATIC DIAGRAM OF EAST PORT INJECTION WELL No. 2 (CH-325).



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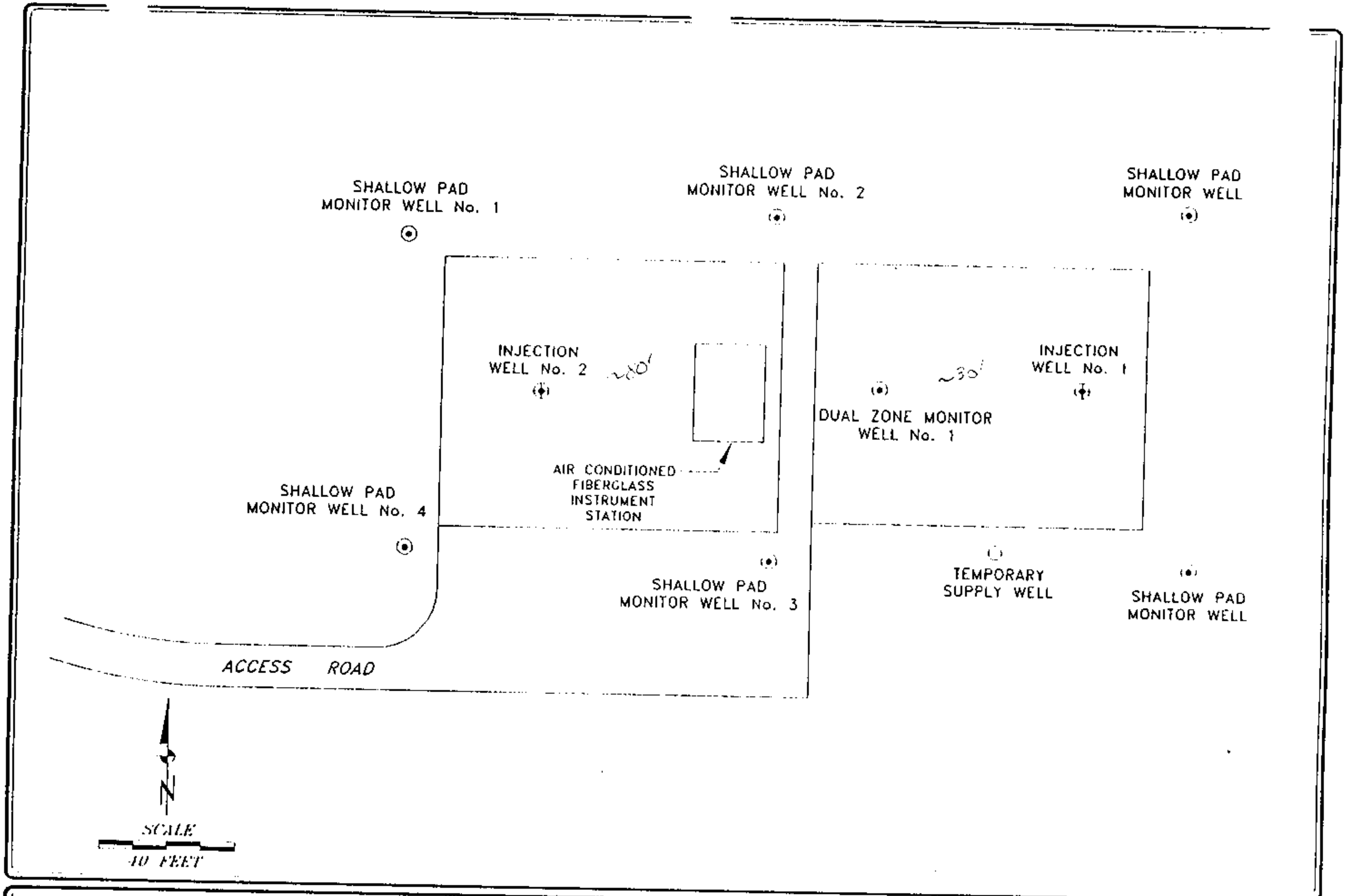
	DRN. BY: CAM DWG NO. A-012574NB-4 DATE: 1/23/97
	PROJECT NAME: CHARLOTTE E. PORT IW-2 NUMBER: 01-02574.00

FIGURE 3.2-1. INJECTION WELL DRILLING PAD WATER-TABLE MONITORING WELL CONSTRUCTION DETAILS.



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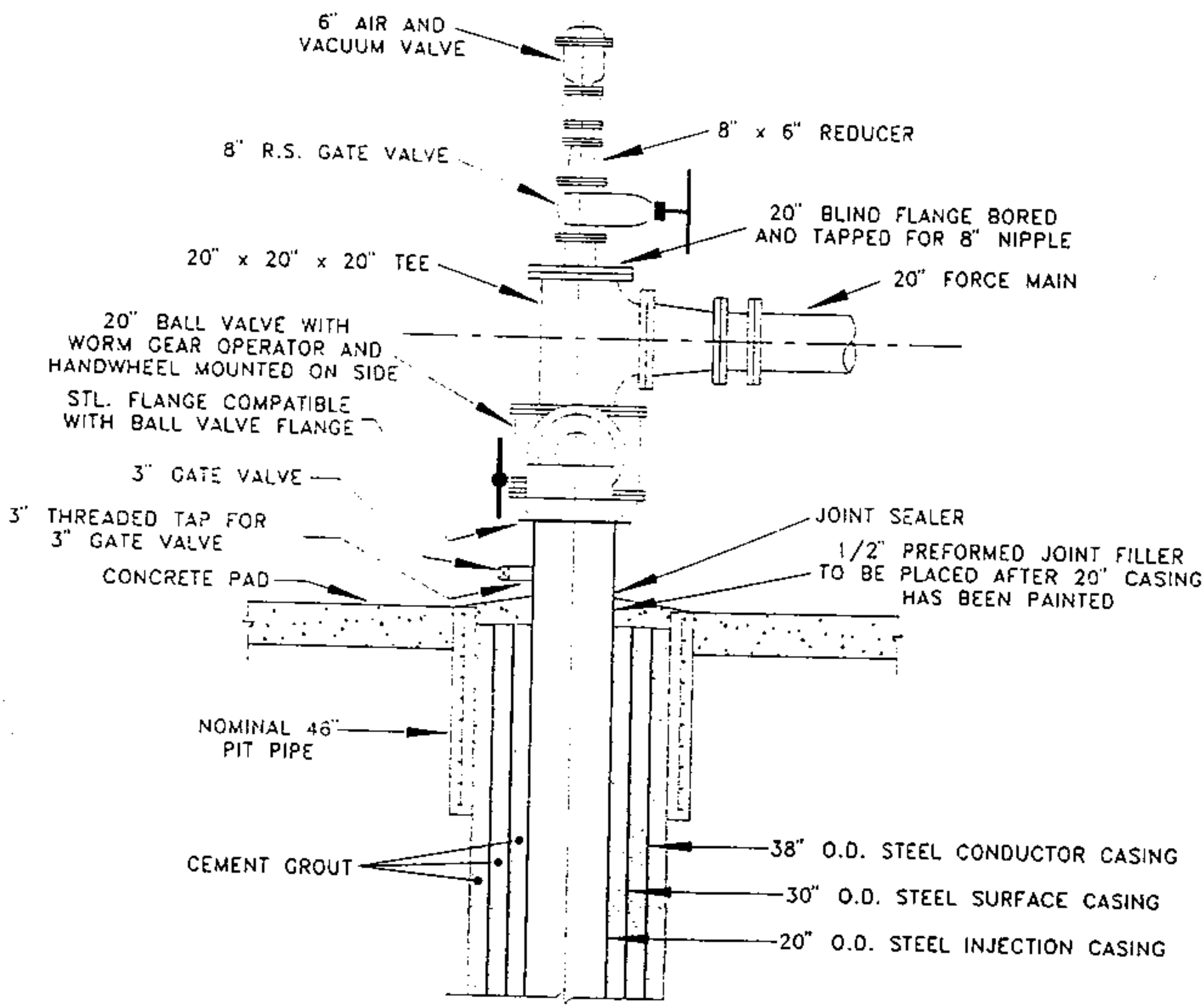
DRN. BY: CAM DWG. NO. A-012574KC-1 DATE: 1/24/97

PROJECT NAME: CHARLOTTE COUNTY IW-2 PROJECT NUMBER: 01-02574.00

FIGURE 3.2-2. SITE DIAGRAM SHOWING LOCATIONS OF WELL PADS, INJECTION WELL No. 1 AND No. 2, DUAL ZONE MONITOR WELL AND SHALLOW PAD MONITOR WELLS.



INJECTION WELL HEAD

NOT TO SCALE

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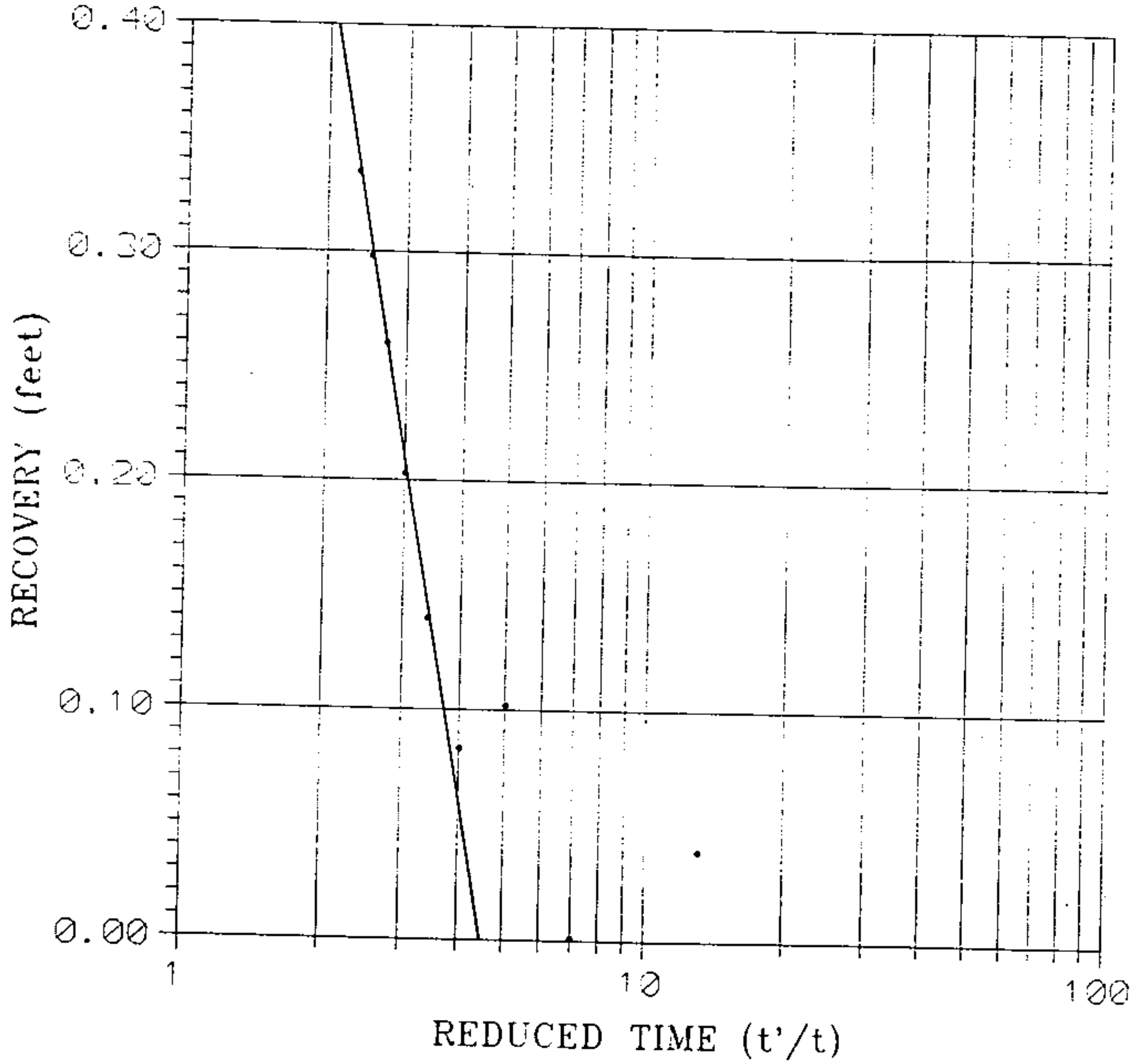
DRN. BY: CAM DWG NO. A-012574NF-1 DATE: 1/23/97

PROJECT NAME: CHARLOTTE CO. IW-2 NUMBER: 01-02574.00

FIGURE 3.4-1. INJECTION WELL No. 2 – WELLHEAD DESIGN.



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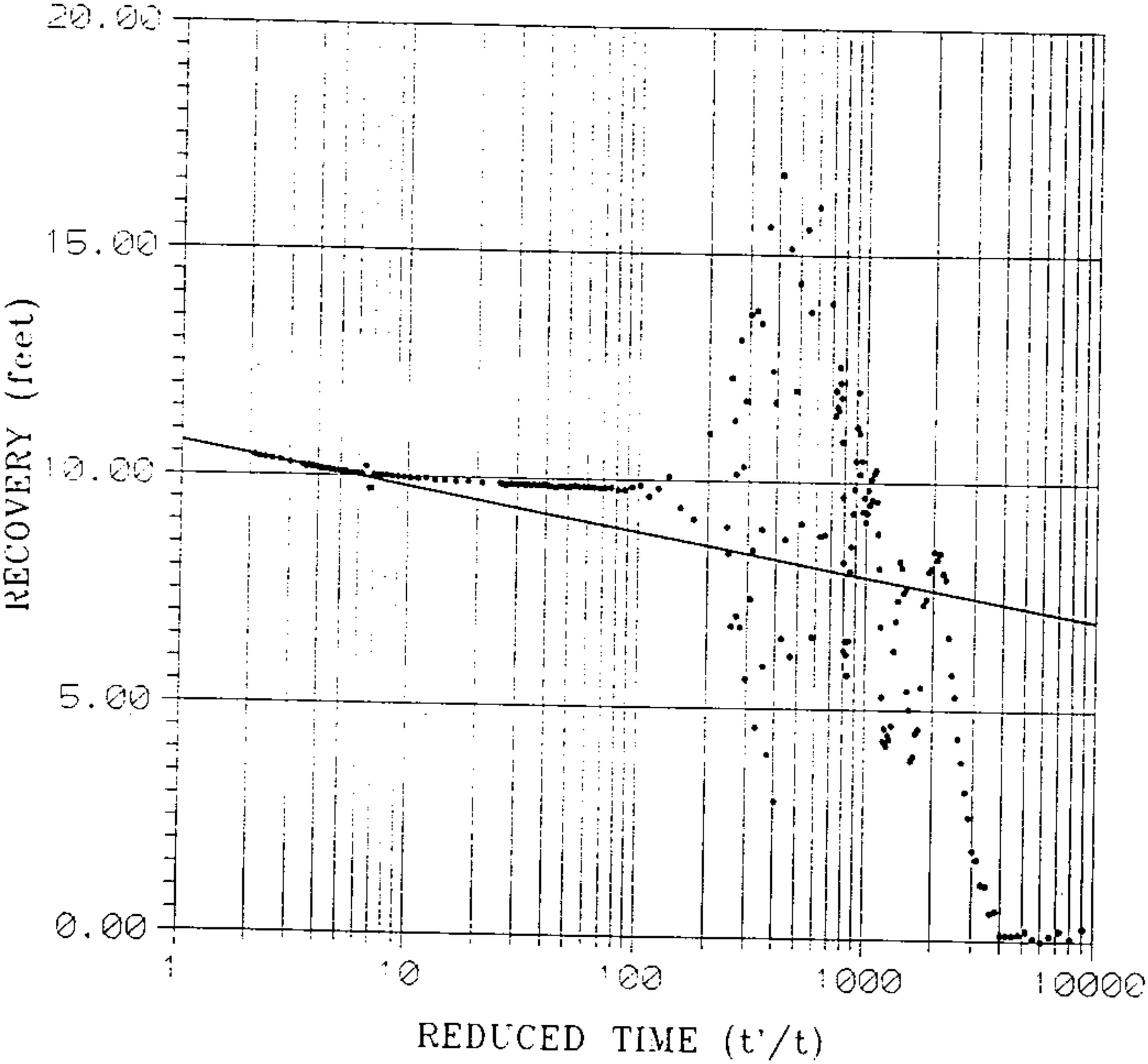
DRN BY: CAM	DWG. NO. A-0125748F-1	DATE: 1/23/97
PROJECT NAME: CHARLOTTE CO. IW-2		NUMBER: 01-02574.00

FIGURE 4.7-1. RECOVERY SEMI-LOG PLOT – PACKER TEST No. 3.



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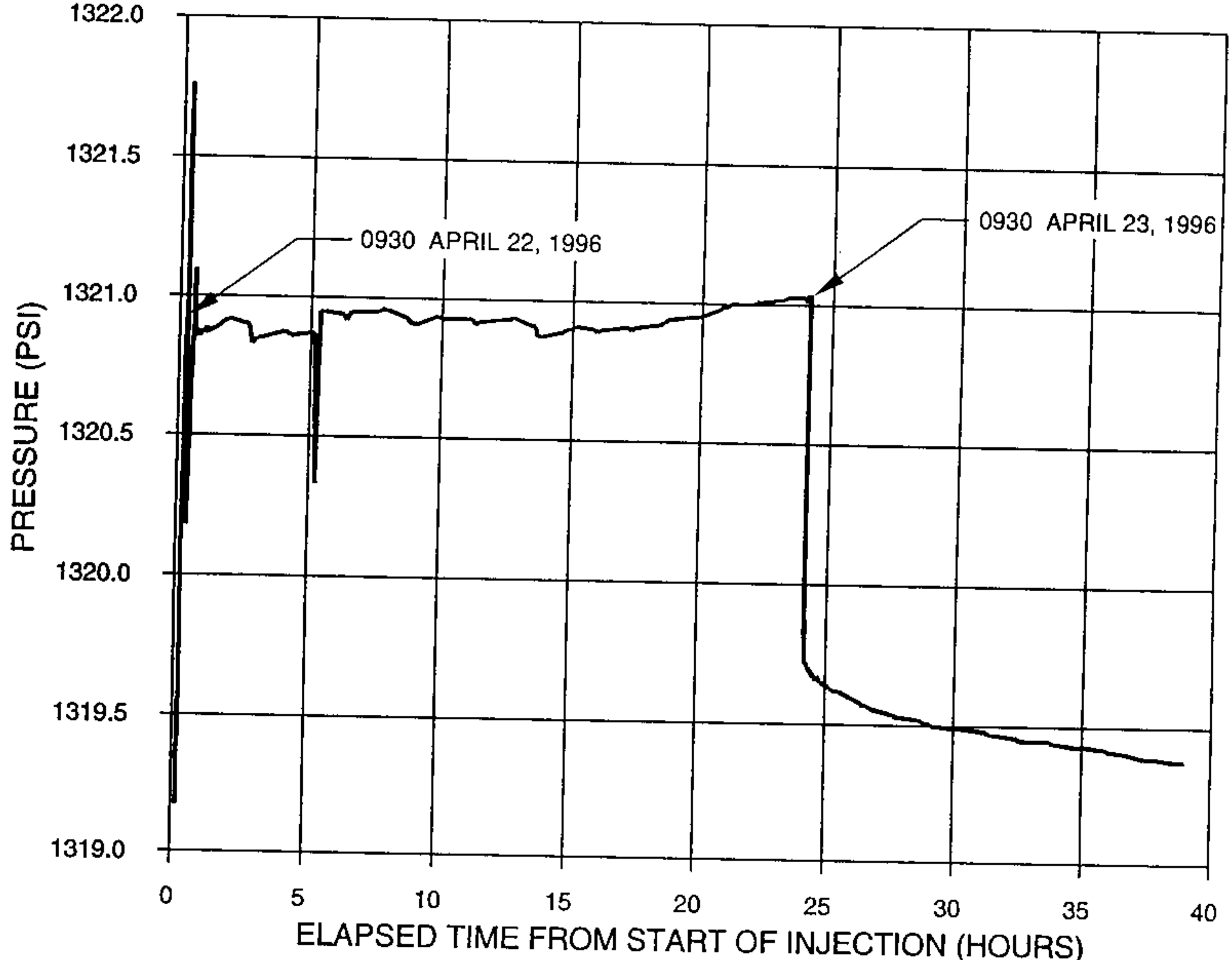
DRN BY: CAM | DWG. NO. A-0125748C-1 | DATE: 1/23/97

PROJECT NAME: CHARLOTTE CO. IW-2 | NUMBER: 01-02574.00

FIGURE 4.7-2. RECOVERY SEMI-LOG PLOT - PACKER TEST No. 5.



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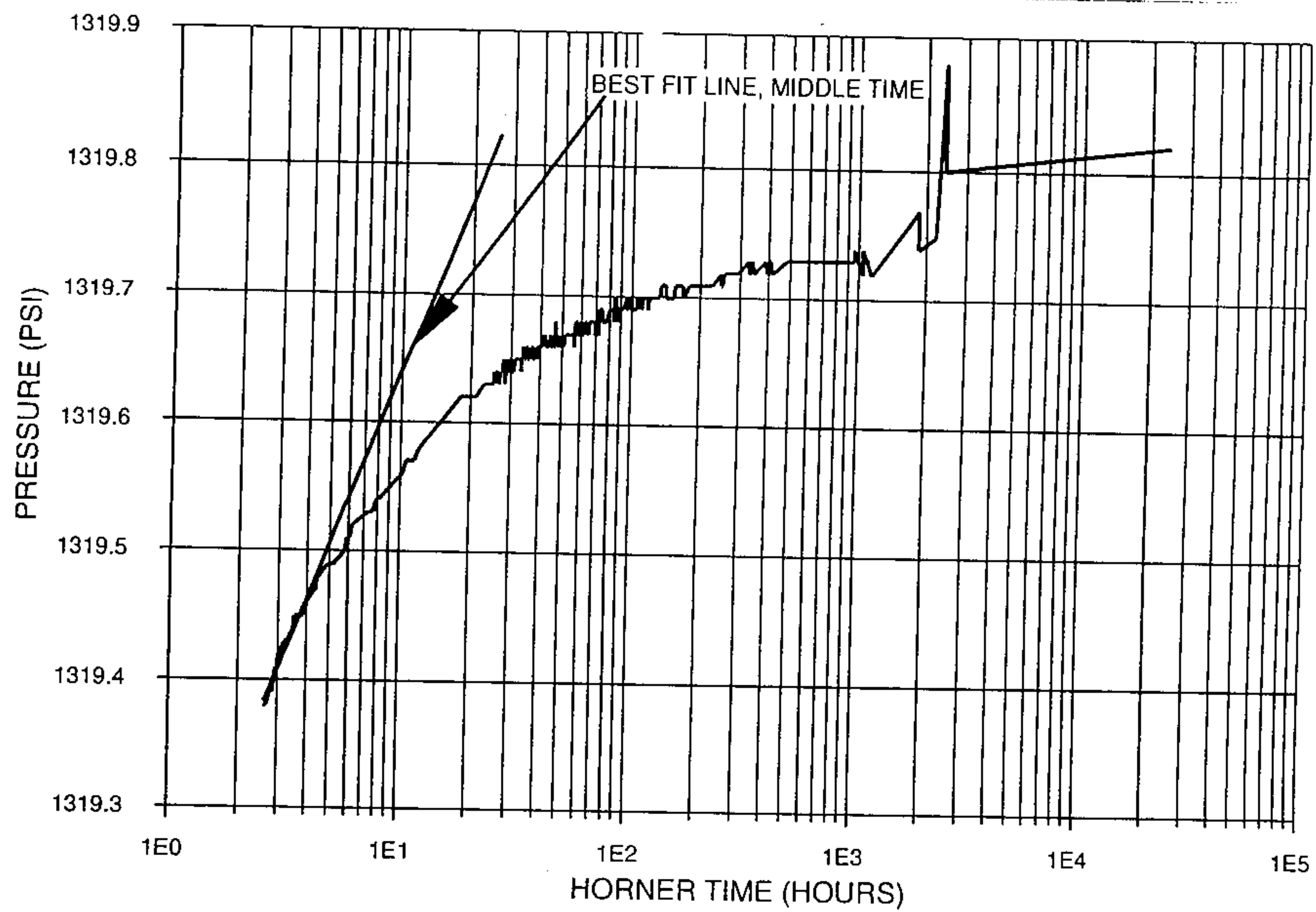
DRN. BY: CAM DWG NO. 0125740A DATE: 1/23/97

PROJECT NAME: CHARLOTTE CO. EAST PORT IW-2 PROJECT NUMBER: 01-02574 00

FIGURE 5.4-1. PLOT OF IW-2 BOTTOMHOLE PRESSURE DURING 24 HOUR INJECTION TEST AND 12 HOUR RECOVERY PERIODS.



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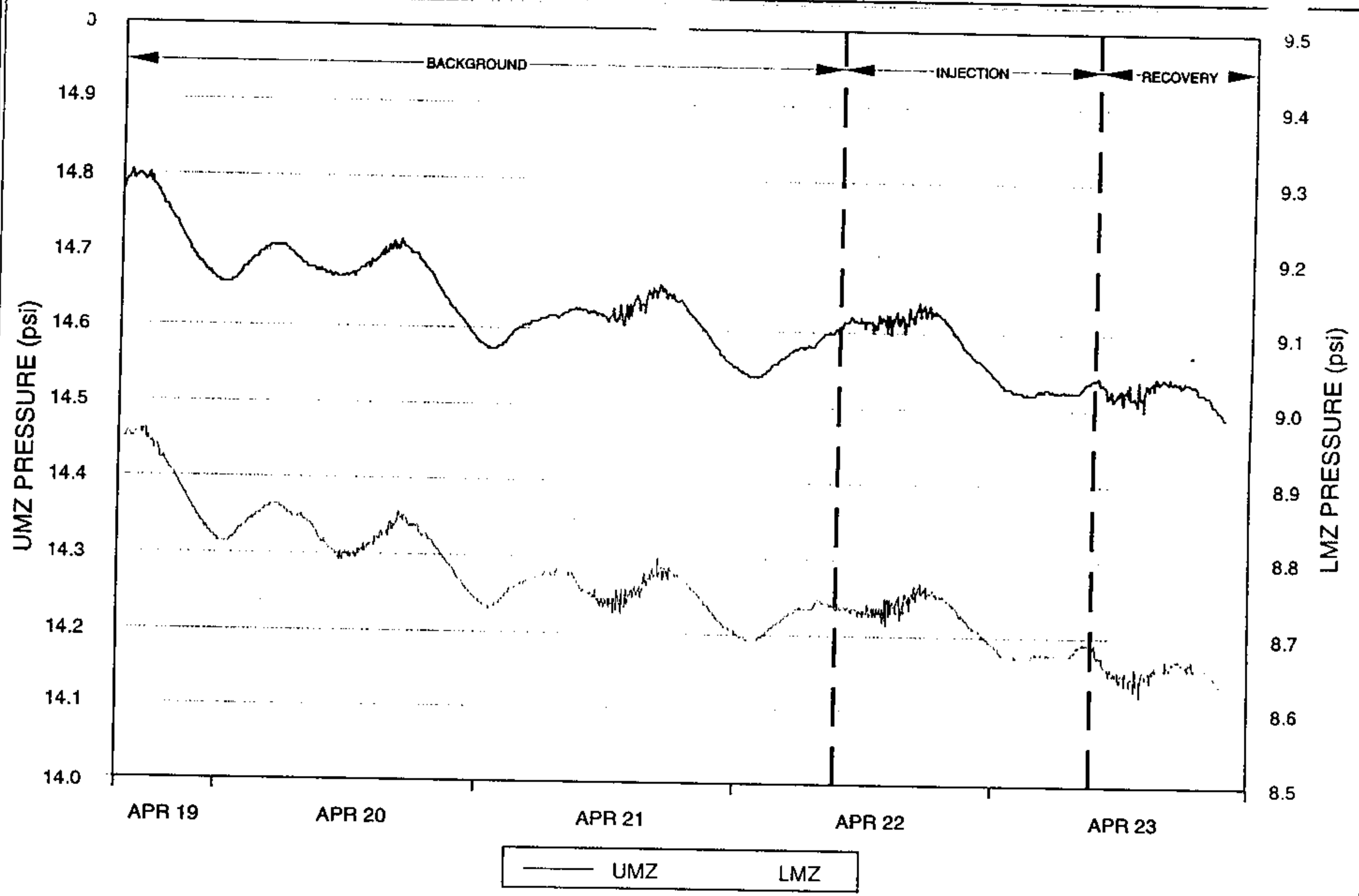
DRN. BY: CAM DWG NO. 012574OB DATE: 1/23/97

PROJECT NAME: CHARLOTTE CO. EAST PORT IW-2

PROJECT NUMBER: 01-02574.00

FIGURE 5.4-2. HORNER PLOT OF IW-2 BOTTOM HOLE PRESSURE RECOVERY DATA.



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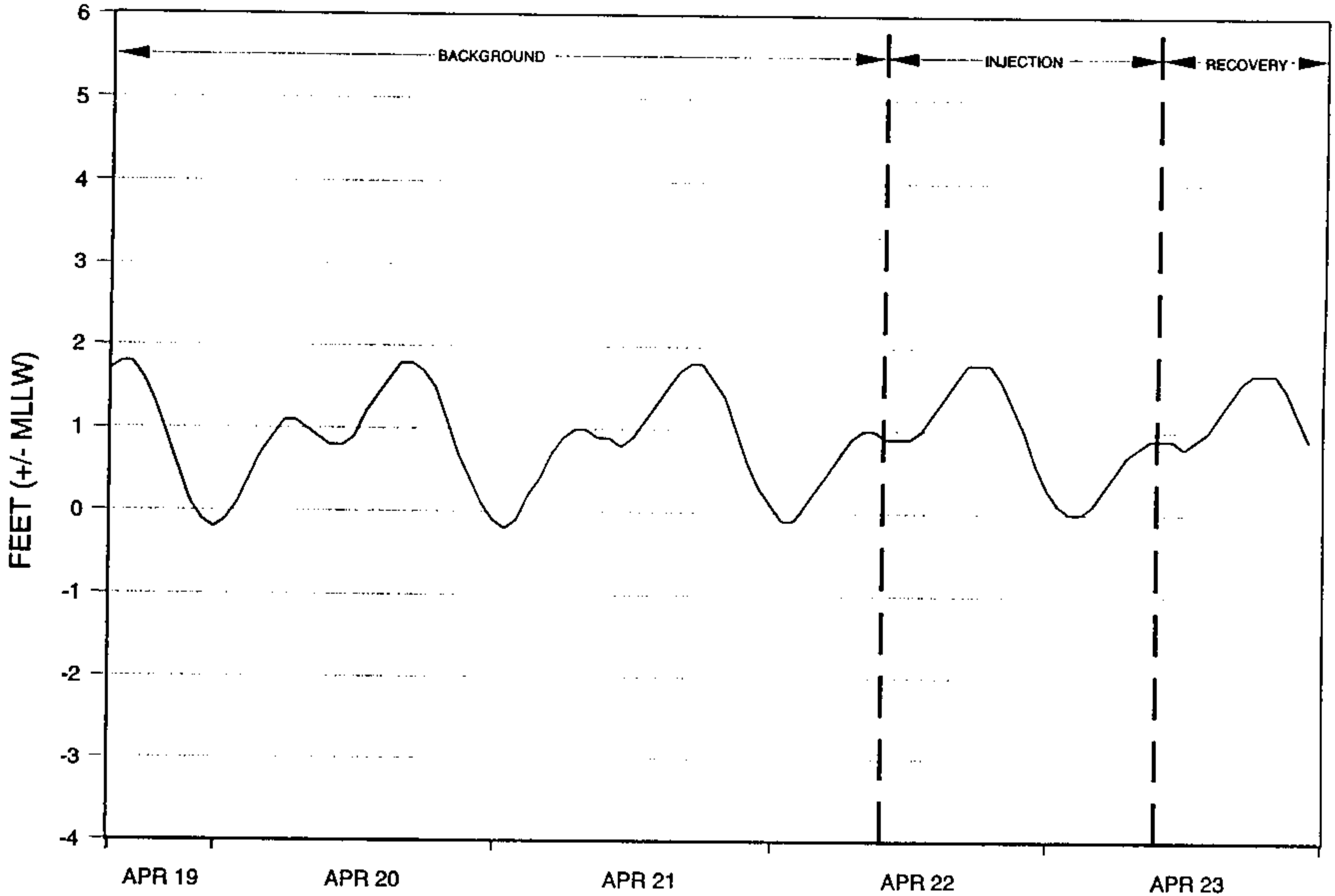
DRN. BY: CAM DWG NO. 012574OF DATE: 1/23/97

PROJECT NAME: CHARLOTTE CO. EAST PORT IW-2 PROJECT NUMBER: 01-02574.00

FIGURE 5.4-3. SURFACE PRESSURES RECORDED FOR UPPER AND LOWER MONITOR ZONES DURING BACKGROUND, INJECTION, AND RECOVERY PERIODS.



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DRN. BY: CAM DWG NO. 0012574OE DATE: 1/23/97

PROJECT NAME: CHARLOTTE CO. EAST PORT IW-2 PROJECT NUMBER: 01-02574.00

FIGURE 5.4-4. TIDAL RANGE AT PUNTA GORDA, FL. DURING BACKGROUND, INJECTION, AND RECOVERY PERIODS.

TABLES

TABLE 3.3-1
WELL CONSTRUCTION CHRONOLOGY
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)

Date(s)	Event
10/4/95	Charlotte County issues notice to proceed to Youngquist Bros. Inc. (YBI).
10/23/95	YBI begins site work and mobilizing drilling equipment.
10/30/95	Installed 2 shallow monitor wells and construction supply well.
11/9/95	Collected first set of weekly water samples from shallow monitor wells.
11/13/95	Completed construction of drilling pad and retaining wall.
11/13 - 16/95	Drilled 48-inch diameter hole from pad level to 410 feet using the rotary mud method.
11/17/95	Ran geophysical logs on 48-inch diameter hole.
11/17/95	Installed 38-inch diameter casing to 393 feet.
11/18/95	Cemented annulus with 1,179 ft^3 12% gel, and 1,112 ft^3 neat cement in one stage.
11/20 - 29/95	Drilled 12 1/4-inch diameter pilot hole from 393 feet to 1,654 feet using the reverse air method.
11/27/95	Ran gamma/caliper log and performed single Packer Test #1 on depth interval between 1,526 and 1,575 feet.
11/29/95	Ran geophysical logs on 12 1/4-inch pilot hole.
11/29 - 30/95	Performed single Packer Test #2 on depth interval between 1,610 and 1,654 feet.
11/30/95 - 12/6/95	Cemented and gravelled 12 1/4-inch pilot hole.
12/7 - 21/95	Reamed nominal 38-inch diameter hole from 393 feet to 1,489 feet.
12/21 - 29/95	Construction activities suspended for Christmas Holidays.
12/30/95 - 1/06/96	Reamed nominal 38-inch diameter hole from 1,489 feet to 1,645 feet.
1/06/96	Ran geophysical logs on 38-inch hole.
1/06 - 07/96	Installed 30-inch diameter casing to 1,638 feet.
1/08 - 15/96 2/20 - 22/96	Cemented annulus of 30-inch diameter casing with 10,061 ft^3 neat cement and 5,036 ft^3 12% gel cement in 26 stages.
1/15/96 - 2/20/96	Pumped gravel into annulus of 30-inch casing with approximately 184,680 ft^3 gravel to fill cavernous areas behind casing.
2/23/96 - 3/07/96	Drilled 12 1/4-inch pilot hole from 1,638 feet to 2,970 feet.
2/26/96	Collected Core #1 from 2,045 to 2,055 feet.

TABLE 3.3-1
WELL CONSTRUCTION CHRONOLOGY
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)
(Continued)

Date(s)	Event
2/26 - 28/96	Ran gamma/caliper log and performed single Packer Test #3 on depth interval between 2,013 and 2,055 feet.
2/29/96	Collected Core #2 from 2,300 to 2,317 feet.
3/01/96	Ran gamma/caliper log and performed single Packer Test #4 on depth interval between 2,280 and 2,317 feet.
3/04/96	Collected Core #3 from 2,802 to 2,815 feet.
3/05/96	Ran gamma/caliper log and performed single Packer Test #5 on depth interval between 2,743 and 2,815 feet.
3/07/96	Ran geophysical logs on 12 1/4-inch pilot hole.
3/08/96	Ran video survey of pilot hole from 1,638 to 2,970 feet.
3/08 - 09/96	Cemented pilot hole from 2,970 to 1,800 feet in 4 stages.
3/10 - 21/96	Reamed nominal 30-inch diameter hole from 1,638 feet to 2,975 feet.
3/21/96	Ran caliper/gamma log on 30-inch hole.
3/21 - 23/96	Installed 20-inch diameter casing to 2,965 feet.
3/24 - 27/96	Cemented annulus of 20-inch casing with 646 ft^3 neat cement and 11,639 ft^3 12% gel cement in 8 stages. Conducted temperature logs after stages one through seven, and ran cement bond logs after seventh and eighth stages.
3/28/96	Conducted pressure test on 20-inch casing.
3/29 - 30/96	Drilled 12 1/4-inch pilot hole from 2,975 feet to 3,246 feet.
3/31/96	Ran geophysical logs on 12 1/4-inch pilot hole.
3/31/96 - 4/01/96	Reamed nominal 20-inch diameter hole from 2,965 feet to 3,246 feet.
3/31/96	Ran gamma/caliper log on 20-inch diameter hole.
4/03/96	Collected water samples from injection zone for laboratory analyses.
4/05/96	Conducted second pressure test on 20-inch diameter casing with single packer set at 2,955 feet.
4/05 - 07/96	Pumped clean water into well prior to conducting TV survey and ran video survey from land surface to 3,100 feet during 3 survey attempts.
4/08/96	Conducted Radioactive Tracer Survey.
4/09/96	Began demobilizing rig and drilling equipment.
4/22 - 23/96	Conducted 24-hour injection test.
4/25/96	Completed demobilizing drilling equipment.

TABLE 3.3.2-1
INTERMEDIATE CASING CEMENT SUMMARY
INJECTION WELL NO. 2 (CH-325)

CASING DIAMETER: 30 INCH					CASING DEPTH: 1638 FEET BPL		
CEMENT STAGE NO.	DATE	CEMENT MIXTURE	BBLS PUMPED	CUBIC FEET PUMPED	SACKS PUMPED	TAG DEPTH (FEET)	FEET OF FILL
1	1/08/96	NEAT	250	1403.65	1190	1617	28
2	1/09/96	NEAT	140	786.04	666	1602	15
3	1/09/96	NEAT w/50# cello-phane flakes	85	477.24	404	1578	24
4	1/10/96	NEAT w/50# cello-phane	100	561.46	476	1571	7
5	1/10/96	NEAT w/50# cello-phane flakes	100	561.46	476	1535	36
6	1/11/96	NEAT	100	561.46	476	1535	0
7	1/11/96	NEAT w/50# cello-phane flakes	100	561.46	476	(1524) (false tag)	(11)
8	1/12/96	NEAT	100	561.46	476	1535	0
9	1/12/96	NEAT w/50# cello-phane	100	561.46	476	1535	0

TABLE 3.3.2-1
INTERMEDIATE CASING CEMENT SUMMARY
INJECTION WELL NO. 2 (CH-325)
(Continued)

CASING DIAMETER: 30 INCH   CASING DEPTH: 1638 FEET BPL

CEMENT STAGE NO.	DATE	CEMENT MIXTURE	BBLS PUMPED	CUBIC FEET PUMPED	SACKS PUMPED	TAG DEPTH (FEET)	FEET OF FILL
10	1/13/96	NEAT w/50# cello-phane	100	561.46	476	1535	0
11	1/13/96	NEAT w/50# cello-phane	100	561.46	476	1532	3
12	1/13/96	NEAT w/50# cello-phane	100	561.46	476	1532	0
13	1/14/96	NEAT w/25# cello-phane	100	561.46	476	1529	3
14	1/14/96	NEAT w/25# cello-phane	50	280.73	238	1528	1
15	1/14/96	NEAT w/25# cello-phane	50	280.73	238	1528	0
16	1/15/96	12% GEL	32	179.67	82	1528	0
17[1]	1/16/96	NEAT	50	280.73	238	1500	28[2]
18[3]	1/22/96	NEAT	25	140.37	119	1485	0[2]

TABLE 3.3.2-1
INTERMEDIATE CASING CEMENT SUMMARY
INJECTION WELL NO. 2 (CH-325)
(Continued)

CASING DIAMETER: 30 INCH						CASING DEPTH: 1638 FEET BPL	
CEMENT STAGE NO.	DATE	CEMENT MIXTURE	BBLS PUMPED	CUBIC FEET PUMPED	SACKS PUMPED	TAG DEPTH (FEET)	FEET OF FILL
19[4]	1/25/96	NEAT	50	280.73	238	1473	80........
20[5]	1/28/96	NEAT	50	280.73	238	1454	--[2]
21[6]	2/20/96	NEAT w/cell flakes	7	39.30	33	1390	-100[7]
22[8]	2/20/96	NEAT w/ 25# cell flakes	10	56.15	48	1276	15[9]
23	2/21/96	NEAT w/75# cell flakes	25	140.37	119	1245	31
24	2/21/96	12% gel	160	898.34	408	1055	190
25	2/22/96	12% gel	360	2021.26	919	639	416
26	2/22/96	12% gel w/ 25# cell flakes	345	1937.04	880	21[10]	618
27	3/27/96	12% gel	12	67.38	31	0	21

1. Stage #17 cement pumped after pumping 891 ft³ of gravel in annulus. Tagged gravel in annulus at 1486 feet bpl prior to pumping stage #17 cement.

2. Annular fill tag is likely a gravel tag. No cement fill apparent on temperature log run on cement.

3. Stage #18 cement pumped after pumping 15,147 ft³ of gravel in annulus. Tagged gravel in annulus at 1420 feet bpl (false tag) prior to pumping stage #18 cement.

TABLE 3.3.2-1
INTERMEDIATE CASING CEMENT SUMMARY
INJECTION WELL NO. 2 (CH-325)
(Continued)

4. Stage #19 cement pumped after pumping 20,169 ft^3 of gravel in annulus. Tagged gravel in annulus at 1473 feet bpl prior to pumping stage #19 cement.

5. Stage #20 cement pumped after pumping 30,861 ft^3 of gravel in annulus. Tagged gravel in annulus at 1441 feet bpl prior to pumping stage #20 cement.

6. Stage #21 cement pumped after pumping 184,032 ft^3 of gravel in annulus. Tagged gravel in annulus at 1290 ft. bpl prior to pumping stage #21 cement.

7. Tagged top of gravel at 1290 feet prior to pumping stage #21 cement. Lost 100 feet of fill after pumping stage #21 cement.

8. Stage #22 cement pumped after pumping 184,680 ft^3 of gravel in annulus. Tagged gravel in annulus at 1291 ft. bpl prior to pumping stage #22 cement.

9. Tagged top of gravel at 1290 feet prior to pumping stage #22 cement. Gained 15 feet of fill after pumping stage #22 cement.

10. Annulus between 30-inch and 38-inch diameter casings topped off with 12 bbls (67.4 ft^3) 12% gel cement on 3/27/96.

TABLE 3.3.3-1
INJECTION CASING CEMENT SUMMARY
INJECTION WELL NO. 2 (CH-325)

CASING DIAMETER: 20 INCH — CASING DEPTH: 2,965 FEET BPL

CEMENT STAGE NO.	DATE	CEMENT MIXTURE	BBLS PUMPED	CUBIC FEET PUMPED	SACKS PUMPED	TAG DEPTH (FEET)	FEET OF FILL
1	3/24/96	12% GEL	260	1459.80	664	2550	425
		NEAT	115	645.68	547		
2	3/24/96	12% GEL	200	1122.92	510	2260	290
3	3/25/96	12% GEL	228	1280.13	582	1984	276
4	3/25/96	12% GEL	150	842.19	383	1756	228
5	3/25/96	12% GEL	154	864.65	393	1721	35
6	3/26/96	12% GEL	252	1414.88	643	1694	27
7	3/26/96	12% GEL	580	3256.47	1480	557	1137
8	3/27/96	12% GEL	249	1398.04	635	0*	557

* - Cement returns observed at land surface.

TABLE 4.0-1
GEOPHYSICAL LOGS SUMMARY
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)

Date Logged	Log Type	Logged Interval (feet bpl)	Comments
11/17/95	Caliper/Gamma Ray	0 - 411	48-inch hole
11/17/95	Dual Induction/SP/GR	0 - 411	48-inch hole
11/18/95	Temperature/GR	0 - 404	Cementing 38-inch casing
11/26/95	Caliper/Gamma Ray	350 - 1550	Pilot hole (packer test #1)
11/29/95	Caliper/Gamma Ray	370 - 1653	Pilot hole (packer test #2)
11/29/95	Dual Induction/SP/GR	385 - 1610	Pilot hole
11/29/95	BHC Sonic	385 - 1610	Pilot hole
11/29/95	Temperature/Fluid Resistivity		Pilot hole
1/06/96	Caliper/Gamma Ray	350 - 1645	38-inch hole
1/08/96 - 2/22/96	Temperature/GR	0 - 1637	Cementing 30-inch casing
2/26/96	Caliper/Gamma Ray	1594 - 2046	Pilot hole (packer test #3)
3/01/96	Caliper/Gamma Ray	1630 - 2300	Pilot hole (packer test #4)
3/05/96	Caliper/Gamma Ray	2275 - 2800	Pilot hole (packer test #5)
3/07/96	Caliper/Gamma Ray	1663 - 2974	Pilot hole
3/07/96	Temperature/Fluid Resistivity	1595 - 2958	Pilot hole
3/07/96	Dual Induction/SP/GR	1657 - 2972	Pilot hole
3/07/96	BHC Sonic	1648 - 2970	Pilot hole
3/21/96	Caliper/Gamma Ray	1620 - 2975	30-inch hole
3/24-26/96	Temperature/GR	0 - 2942	Cementing 20-inch casing
3/27/96	Cement Bond Log	218 - 2942	20-inch casing
3/31/96	Caliper/Gamma Ray	2940 - 3244	Pilot hole
3/31/96	Temperature	2900 - 3244	Pilot hole
3/31/96	Dual Induction/SP/GR	2957 - 3244	Pilot hole
3/31/96	BHC Sonic	2945 - 3244	Pilot hole
4/02/96	Cement Bond Log	22 - 615	20-inch casing
4/02/96	Caliper/Gamma Ray	2933 - 3246	20-inch hole
4/08/96	Temp./Gamma Ray	0 - 3246	Radioactive Tracer Survey

TABLE 4.1-1
INCLINATION SURVEYS
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)

DATE	BORE HOLE DIAMETER (IN.)	DEPTH BELOW PAD (FT.)	INCLINATION (DEGREES)
11/15/95	48	93	0.125
11/15/95	48	185	0.125
11/15/95	48	245	0.375
11/15/95	48	335	0.250
11/20/95	12 1/4	394	0.250
11/20/95	12 1/4	484	0.500
11/20/95	12 1/4	574	0.375
11/21/95	12 1/4	694	0.375
11/21/95	12 1/4	784	0.250
11/21/95	12 1/4	874	0.250
11/21/95	12 1/4	965	0.250
11/21/95	12 1/4	1055	0.375
11/22/95	12 1/4	1145	0.250
11/22/95	12 1/4	1235	0.250
11/22/95	12 1/4	1325	0.125
11/22/95	12 1/4	1415	0.00
11/25/95	12 1/4	1505	0.250
11/28/95	12 1/4	1595	0.125
12/07/95	36 1/2	426	0.125
12/08/95	36 1/2	516	0.250
12/08/96	36 1/2	606	0.250
12/08/95	36 1/2	635	0.125
12/11/95	36 1/2	696	0.250
12/11/95	36 1/2	786	0.250
12/12/95	36 1/2	876	0.250
12/12/95	36 1/2	966	0.250

TABLE 4.1-1
INCLINATION SURVEYS
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)
(Continued)

DATE	BORE HOLE DIAMETER (IN.)	DEPTH BELOW PAD (FT.)	INCLINATION (DEGREES)
12/12/95	36 1/2	1057	0.250
12/13/95	36 1/2	1147	0.250
12/13/95	36 1/2	1237	0.250
12/13/95	36 1/2	1327	0.250
12/14/95	36 1/2	1417	0.250
1/03/96	36 1/2	1507	0.500
1/04/96	22	1597	0.250
2/23/96	12 1/4	1656	0.375
2/24/96	12 1/4	1746	0.125
2/24/96	12 1/4	1836	0.125
2/25/96	12 1/4	1926	0.250
2/25/96	12 1/4	2016	0.375
2/28/96	12 1/4	2106	0.125
2/29/96	12 1/4	2196	0.250
3/02/96	12 1/4	2285	0.250
3/02/96	12 1/4	2376	0.125
3/02/96	12 1/4	2466	0.125
3/03/96	12 1/4	2556	0.125
3/03/96	12 1/4	2646	0.125
3/03/96	12 1/4	2736	0.250
03/06/96	12 1/4	2826	0.250
03/06/96	12 1/4	2917	0.125
03/10/96	28 1/2	1686	0.250
03/13/96	28 1/2	1776	0.125
03/15/96	28 1/2	1866	< 0.125
03/17/96	28 1/2	1956	0.125

TABLE 4.1-1
INCLINATION SURVEYS
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)
(Continued)

DATE	BORE HOLE DIAMETER (IN.)	DEPTH BELOW PAD (FT.)	INCLINATION (DEGREES)
3/17/96	28 1/2	2046	0.250
3/17/96	28 1/2	2136	0.125
3/18/96	28 1/2	2226	0.375
3/19/96	28 1/2	2316	0.375
3/19/96	28 1/2	2406	< 0.125
3/19/96	28 1/2	2496	0.125
3/19/96	28 1/2	2587	0.125
3/20/96	28 1/2	2677	< 0.125
3/20/96	28 1/2	2767	0.125
3/21/96	28 1/2	2857	< 0.125
3/21/96	28 1/2	2947	0.250
3/30/96	12 1/4	3036	0.250
3/30/96	12 1/4	3126	0.250
3/30/96	12 1/4	3216	0.250
4/01/96	18 1/4	3006	0.125
4/01/96	18 1/4	3096	0.125
4/01/96	18 1/4	3187	0.250

TABLE 4.3-1

REVERSE AIR WATER QUALITY SUMMARY
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)

Date Sampled	Sample Depth (Feet bpl)	Chloride Concentration[1] (mg/l)	Conductivity[1,2] (uMHOS/cm)	TDS[1] (mg/l)	Ammonia/TKN[1] (mg/l)
11/20/95	423	140	1350		
11/20/95	453	160	1800		
11/20/95	483	160	1700		
11/20/95	513	380	2050		
11/20/95	543	550	2300		
11/20/95	573	550	2250		
11/20/95	603	600	2300		
11/20/95	633	630	2400		
11/20/95	663	700	2650		
11/20/95	693	690	2650		
11/20/95	723	710	2600		
11/21/95	753	790	2830		
11/21/95	783	790	2800		
11/21/95	813	820	3000		
11/21/95	843	820	2950		
11/21/95	873	830	3100		
11/21/95	903	800	3070		
11/21/95	933	880	3100		
11/21/95	963	840	3100		
11/21/95	993	870	3200		
11/21/95	1023	870	3230		
11/21/95	1054	890	3250		

1 - Sample analyses by CCU East Port Laboratory; field analyses performed by ViroGroup in parentheses.
2 - Temperature not reported, conductivity corrected to 25°C.

TABLE 4.3-1

REVERSE AIR WATER QUALITY SUMMARY
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)
(Continued)

Date Sampled	Sample Depth (Feet bpl)	Chloride Concentration[1] (mg/l)	Conductivity[1,2] (uMHOS/cm)	TDS[1] (mg/l)	Ammonia/TKN[1] (mg/l)
11/21/95	1084	890	3300		
11/21/95	1114	920	3420		
11/21/95	1144	910	3390		
11/22/95	1173	920	3320		
11/22/95	1204	930	3420		
11/22/95	1234	940	3450		
11/22/95	1264	950	3500		
11/22/95	1294	950	3520		
11/22/95	1324	970	3070		
11/22/95	1354	960	3070	2310	
11/22/95	1384	1180	3650		
11/22/95	1414	1190	3600	2836	
11/22/95	1444	1220	3710		
11/22/95	1474	1250	3650	2944	
11/25/95	1504	1580	4800		
11/25/95	1534	2420	8200	5146	
11/26/95	1564	2650	9000		
11/26/95	1575	6100	16900	13314	
11/28/95	1594	10500	27800		
11/28/95	1625	11650	34200		
2/23/96	1655	2649	7100		
2/23/96	1685	4349	8200		

1 - Sample analyses by CCU East Port Laboratory; field analyses performed by ViroGroup in parentheses.
2 - Temperature not reported, conductivity corrected to 25°C.

TABLE 4.3-1

REVERSE AIR WATER QUALITY SUMMARY
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)
(Continued)

Date Sampled	Sample Depth (Feet bpl)	Chloride Concentration[1] (mg/l)	Conductivity[1,2] (uMHOS/cm)	TDS[1] (mg/l)	Ammonia/TKN[1] (mg/l)
2/23/96	1715	5498	11000		
2/23/96	1745	5398	11100		
2/24/96	1775	11896	22200		
2/24/96	1805	11896	23000		
2/24/96	1835	17794	25200		
2/24/96	1865	19394	32200		
2/24/96	1895	19244	32000		
2/25/96	1925	20894	34000		
2/25/96	1955	NA	NA		
2/25/96	1985	18144	33200		
2/25/96	2015	17744	33100		
2/25/96	2045	20394	34000		
2/28/96	2075	(18,400)	(43,800)		
2/29/96	2105	(17,500)	(47,000)		
2/29/96	2135	(21,800)	(46,000)		
2/29/96	2165	(20,800)	(47,000)		
2/29/96	2195	(21,000)	(48,000)		
2/29/96	2225	17794 (19,500)	35420 (47,500)		
3/1/96	2255	18594 (20,200)	36900 (50,000)		
3/1/96	2285	17994 (21,000)	35320 (50,000)		
3/2/96	2315	14445	33420		
3/2/96	2345	16445	35700		

1 - Sample analyses by CCU East Port Laboratory; field analyses performed by ViroGroup in parentheses.
2 - Temperature not reported, conductivity corrected to 25°C.

TABLE 4.3-1

REVERSE AIR WATER QUALITY SUMMARY
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)
(Continued)

Date Sampled	Sample Depth (Feet bpl)	Chloride Concentration[1] (mg/l)	Conductivity[1,2] (uMHOS/cm)	TDS[1] (mg/l)	Ammonia/TKN[1] (mg/l)
3/2/96	2375	15445	34520		
3/2/96	2405	16845	34900		
3/2/96	2435	17445	35520		
3/2/96	2465	16845	35900		
3/3/96	2495	17844 (19,500)	36320 (42,500)		
3/3/96	2525	16545 (16,800)	33900 (41,000)		
3/3/96	2555	NA	NA		
3/3/96	2585	16445	33420		
3/3/96	2615	16445	34300		
3/3/96	2645	16095	NA		0.23 / 0.34
3/3/96	2675	16445	33400		
3/3/96	2705	17595	32520		
3/3/96	2735	17744	NA		0.21 / 0.22
3/3/96	2765	15445	32520		
3/3/96	2795	12246	31900		0.89 / 0.95
3/6/96	2825	11896	NA		0.97 / 2.70
3/6/96	2855	(10,700)	(28,000)		
3/7/96	2885	(10,760)	(28,000)		
3/7/96	2916	9897	NA		1.28 / 3.22
3/7/96	2946	NA	NA		
3/7/96	2970	NA	NA		
3/29/96	3005	(8,250)	(20,140)		

1 - Sample analyses by CCU East Port Laboratory; field analyses performed by ViroGroup in parentheses.
2 - Temperature not reported, conductivity corrected to 25°C.

TABLE 4.3-1

REVERSE AIR WATER QUALITY SUMMARY
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)
(Continued)

Date Sampled	Sample Depth (Feet bpl)	Chloride Concentration[1] (mg/l)	Conductivity[1,2] (uMHOS/cm)	TDS[1] (mg/l)	Ammonia/TKN[1] (mg/l)
3/29/96	3035	(7,600)	(21,600)		
3/30/96	3065	(7,900)	(21,600)		
3/30/96	3095	(3,800)	(9,720)		
3/30/96	3125	(2,400)	(7,560)		
3/30/96	3155	(2,300)	(7,560)		
3/30/96	3185	(1,400)	(4,320)		
3/30/96	3215	(2,600)	(7,452)		

1 - Sample analyses by CCU East Port Laboratory; field analyses performed by ViroGroup in parentheses.
- Temperature not reported, conductivity corrected to 25°C.

TABLE 4.4-1

CORING PROGRAM SUMMARY
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)

Core Number	Date Cored	Interval Cored (feet bpl)	Percent Recovery
1	2/26/96	2,045 - 2,055	98%
2	2/29/96	2,300 - 2,317	54%
3	3/05/96	2,802 - 2,815	92%

TABLE 4.4-2

CORE PERMEABILITY DATA SUMMARY
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)

Core No.	Depth (feet)	Coef. of Permeability		Specific Gravity	Lithology
		Horizontal (cm/sec)	Vertical (cm/sec)		
1	2048.0 - 2049.0	3.1×10^{-9}	3.0×10^{-4}	2.87	Dolomite
1	2049.0 - 2050.0	2.5×10^{-8}	7.8×10^{-5}	2.82	Dolomite
1	2053.3 - 2053.7		9.8×10^{-6}	2.76	Dolomite
1	2053.7 - 2054.0	3.0×10^{-4}		2.76	Dolomite
2	2300.6 - 2301.3	1.8×10^{-7}	9.6×10^{-8}	2.70	Limestone
2	2304.2 - 2304.6	2.7×10^{-6}		2.70	Limestone
2	2304.6 - 2305.2		1.3×10^{-6}	2.70	Limestone
2	2305.2 - 2305.5		6.1×10^{-7}	2.69	Limestone
2	2308.0 - 2309.0	2.6×10^{-8}	8.2×10^{-6}	2.69	Limestone
3	2806.6 - 2807.3	5.0×10^{-7}	1.6×10^{-9}	2.78	Dolomite
3	2808.2 - 2808.5	8.6×10^{-5}		2.83	Dolomite
3	2808.5 - 2809.0		2.3×10^{-5}	2.80	Dolomite
3	2810.5 - 2811.0	5.5×10^{-10}		2.84	Dolomite
3	2811.0 - 2811.4		1.3×10^{-10}	2.81	Dolomite

TABLE 4.7-2

PACKER TEST WATER QUALITY SUMMARY
CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)

Packer Test No.	Interval Tested (feet bpl)	Chloride Concentration (mg/l)	Conductivity (umhos/cm)	Total Dissolved Solids (mg/l)	SO_4 Conc. (mg/l)	Ammonia /TKN (mg/l)
1	1,526 - 1,575	3,500	12,000	8,586	896.4	-
2	1,610 - 1,654	14,650	33,000.	31,032	-	-
3	2,013 - 2,055	18,744	36,500	-	-	-
4	2,280 - 2,317	13,446	26,320	27,910	-	-
5	2,743 - 2,815	980	3,480	-	234.1	3.09/5.10

TABLE 4.8-1
PAD MONITOR WELL CHLORIDE DATA

CHARLOTTE CO. EAST PORT IW-2 MONITOR WELL WATER QUALITY					
Site Activity	Date	Chloride Concentrations			
		Well 1	Well 2	Well 3	Well 4
Daily	16-Nov-95	30	60	32	14
	23-Nov-95	18	56	26	8
	28-Nov-95	38	62	26	10
	29-Nov-95	16	54	28	8
	30-Nov-95	18	30	17	5
	01-Dec-95	13	30	19	9
	02-Dec-95	15	29	19	7
	03-Dec-95	19	27	20	6
	03-Dec-95	21	85	25	12
	05-Dec-95	20	55	48	12
	06-Dec-95	20	64	48	10
	07-Dec-95	22	46	48	19
	08-Dec-95	24	54	18	14
	11-Dec-95	28	54	28	12
	12-Dec-95	32	56	30	8
	14-Dec-95	30	46	34	10
Weekly	21-Dec-95	28	50	20	12
	04-Jan-96	65	45	33	18
	11-Jan-96	130	60	44	30
	18-Jan-96	130	60	40	38
	25-Jan-96	190	40	44	84

TABLE 4.8-1
PAD MONITOR WELL CHLORIDE DATA
(CONTINUED)

CHARLOTTE CO. EAST PORT IW-2 MONITOR WELL WATER QUALITY					
Site Activity	Date	Chloride Concentrations			
		Well 1	Well 2	Well 3	Well 4
Twice Weekly	04-Feb-96	240	65	65	480
	08-Feb-96	280	66	48	486
	11-Feb-96	266	66	44	232
	15-Feb-96	242	55	35	295
	18-Feb-96	298	55	65	88
	22-Feb-96	144	66	42	330
	25-Feb-96	128	66	46	150
	29-Feb-96	82	66	45	83
	04-Mar-96	140	60	44	1120
	07-Mar-96	120	62	56	360
	15-Mar-96	475	175	65	990
	17-Mar-96	260	200	120	120
	21-Mar-96	120	72	80	212
	24-Mar-96	280	78	50	600
	28-Mar-96	210	90	60	410
	31-Mar-96	390	120	80	650
	05-Apr-96	240	80	60	385
	11-Apr-96	370	65	50	220
Weekly	16-Apr-96	340	55	40	450
	23-Apr-96	325	65	40	825
	30-Apr-96	NA	NA	NA	NA
	31-May-96	470	65	NA	NA
	27-Jun-96	275	60	45	345
	31-Jul-96	170	60	36	144
	26-Aug-96	178	56	40	136

TABLE 5.2-1

CHARLOTTE CO. UTILITIES EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)

PRESSURE TEST: 20-INCH DIAMETER CASING
March 29, 1996

Start Pressure: 225 psi
Start Time: 0830 hrs.

TIME (hours)	ELAPSED TIME (minutes)	PRESSURE (PSI)	PERCENT CHANGE +/-
0835	5	224.0	
0840	10	223.0	
0845	15	222.5	
0850	20	222.0	
0855	25	221.0	
0900	30	220.0	-2.2%
0905	35	219.0	
0910	40	218.3	
0915	45	217.5	
0920	50	216.5	
0925	55	216.0	
0930	60	215.0	-4.4%

TABLE 5.2-2

SECOND CASING PRESSURE TEST

VIROGROUP, INC.
CHARLOTTE CO. UTILITIES EAST PORT WRF IW-2
Permit No. UCO8-254545

PRESSURE TEST: 20-INCH DIAMETER CASING
April 5, 1996

Initial Pressure: 175 psi
Start Time: 0905 hrs.

TIME (hours)	ELAPSED TIME (minutes)	PRESSURE (PSI)	PERCENT CHANGE +/-
0910	5	175.0	
0915	10	175.0	
0920	15	175.0	
0925	20	175.0	
0930	25	175.3	
0935	30	176.0	
0940	35	176.0	
0945	40	176.0	
0950	45	176.3	
0955	50	176.5	
1000	55	176.8	
1005	60	177.0	+1.1%

APPENDIX 1.0-1

CONSTRUCTION PERMIT

Department of Environmental Protection

Lawton Chiles
Governor

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

Virginia B. Wetherell
Secretary

PERMITTEE:

Charlotte County Utilities
20101 Peachland Blvd. Suite 301
Port Charlotte, Florida 33954

I.D. No: 5208P00117
Permit/Certification
Number: UC08-254545
Date of Issue: March 1, 1995
Expiration Date: March 1, 2000
County: Charlotte
Latitude: 26° 58′ 26″ N
Longitude: 82° 02′ 17″ W
Section/Town/Range: 20/40S/23E
Project: East Port WRF IW-2

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 62-28. 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 20 inch diameter Class I injection well (IW-2) with cemented steel casing to 3,000 feet below land surface (bls) and a total depth of 3,240 feet bls utilized for the disposal of 10 million gallons per day (MGD) of back-up capacity from the existing reuse/disposal system and proposed reuse system. The existing IW-1 dual zone monitor well will also monitor the discharge from this well.

The application to construct a Class I injection well system, DER Form 17-1.209(9), was received July 15, 1994 with supporting documents and additional information last received November 28, 1994. The certificate of financial responsibility was issued November 18, 1994. Project is located at the East Port WRF injection well site, north of Harborview Road and east of Drance Street, Port Charlotte, Florida.

Subject to General Conditions 1-16 and Specific Conditions 1-8.

PERMITTEE:

Charlotte County Utilities

I.D. No.: 5208P00117
Permit/Cert. No.: UC08-254545
Date of Issue: March 1, 1995
Expiration Date: March 1, 2000

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 located or conducted to:

PERMITTEE:

Charlotte County Utilities

I.D. No.: 5208P00117
Permit/Cert. No.: UC08-254545
Date of Issue: March 1, 1995
Expiration Date: March 1, 2000

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.

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.

PERMITTEE:

Charlotte County Utilities

I.D. No.: 5208P00117
Permit/Cert. No.: UC08-254545
Date of Issue: March 1, 1995
Expiration Date: March 1, 2000

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.

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 62-28.230(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.

PERMITTEE:

Charlotte County Utilities

I.D. No.: 5203P00117
Permit/Cert. No.: UC08-254545
Date of Issue: March 1, 1995
Expiration Date: March 1, 2000

SPECIFIC CONDITIONS:

violation of surface and ground water quality standards. The disposal method shall be approved by the Department prior to start of construction.

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 20 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 62-28 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.

SPECIFIC CONDITIONS:

e. The cementing program, as required in Section 62-28.220(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.

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 Engineer of Record 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 Page B-23 of the June, 1994 technical specifications and in response 16 of the permittee's September 21, 1994 letter to the Department.

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 62-28.350, 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. Quality Assurance/Quality Control Requirements

a. This permit approval is based upon evaluation of the data contained in the application dated July 15, 1994, and the plans and/or specifications submitted in support of the application. Any changes in the plans and/or technical specifications, except as provided elsewhere in this permit, must be approved by the Department before being implemented.

PERMITTEE:

Charlotte County Utilities

I.D. No.: 5208P00117
Permit/Cert. No.: UC08-254545
Date of Issue: March 1, 1995
Expiration Date: March 1, 2000

SPECIFIC CONDITIONS:

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 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 or monitor wells, 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

Southwest Florida Water Management District
Well Construction Permitting
2379 Broad Street
Brooksville, FL 34609-6899

PERMITTEE:

Charlotte County Utilities

I.D. No.: 5208P00117
Permit/Cert. No.: UC08-254545
Date of Issue: March 1, 1995
Expiration Date: March 1, 2000

SPECIFIC CONDITIONS:

United States Environmental Protection Agency
Ground Water Management Unit
345 Courtland Street
Atlanta, Georgia 30065

United States Geological Society
4710 Eisenhower Blvd.
Tampa, FL 33614

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 and 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 and geophysical logs must be submitted with all test data.

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 62-28.330(2) and Rule 62-28.330(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 capacity 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.

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.

PERMITTEE:

Charlotte County Utilities

I.D. No.: 5208P00117
Permit/Cert. No.: UC08-254545
Date of Issue: March 1, 1995
Expiration Date: March 1, 2000

SPECIFIC CONDITIONS:

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.

6. 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.

7. 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 62-28.270(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.

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 62-28.270(9), F.A.C., and the conditions of this permit.

8. 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

PERMITTEE:

Charlotte County Utilities

I.D. No.: 5208P00117
Permit/Cert. No.: UC08-254545
Date of Issue: March 1, 1995
Expiration Date: March 1, 2000

SPECIFIC CONDITIONS:

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 (813)332-6975.

Issued this 1st day of March, 1995.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Peter J. Ware
Director of
District Management

PJW/JBM/klm

APPENDIX 1.0-2

FDEP APPROVAL LETTER FOR OPERATIONAL TESTING

Department of Environmental Protection COPY

Lawton Chiles
Governor

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

Virginia B. Wetherell
Secretary

August 21, 1996

Mr. Richard E. Howell
Director of Utilities
Charlotte County Utilities
18500 Murdock Circle
Port Charlotte, FL 33948-1094

Re: Charlotte County - UIC
East Port WRF
IW-2 Injection Well
Permit #UC08-254545
Operational Testing

Dear Mr. Howell:

The Department has received and hereby approves the request by Charlotte County Utilities to begin operational testing of injection well IW-2 at the East Port Water Reclamation Facility. Charlotte County Utilities may commence operational testing in accordance with specific condition 5 of construction permit UC08-254545 and the specific testing and reporting conditions listed below.

Operational Testing Conditions

a. A qualified representative of the Engineer of Record must be present for the start-up operations and the Department must be notified in writing of the date operation began for the subject well.

b. Only non-hazardous secondary treated effluent generated at the East Port Water Reclamation Facility plants may be injected.

c. Continuous recording of water levels in the two monitor wells shall begin at least 48 hours prior to the start of operational testing.

d. Flow to the injection well shall be monitored at all times to ensure the maximum sustained pressure at the wellhead does not exceed 150 psi on the final casing and a maximum injection rate of 5250 gpm (7.56 MGD).

e. The permittee shall calibrate all pressure gauge(s), flow meter(s), chart recorder(s), and other related equipment associated with the injection well system on a semiannual

Continued . . .

basis. The permittee shall maintain all monitoring equipment and shall ensure that the monitoring equipment is calibrated and in proper operating condition at all times. Laboratory equipment, methods, and quality control will follow EPA guidelines as expressed in Standard Methods for the Examination of Water and Wastewater. The pressure gauge(s), flow meter(s), and chart recorder(s) shall be calibrated using standard engineering methods.

f. Test Injection Well

The specifications for the injection well is as follows:

Well Number	*Casing Diameter/Depth (Inches/Feet)	*Tubing Diameter/Depth (Inches/Feet)	*Total Depth (Ft)
IW-2	20 Steel/2965	NA	3246

* below land surface

The injection well shall be monitored in accordance with the parameters and frequency listed below. The permittee shall submit a Summary of the Monthly Monitoring Data developed from the injection well instrumentation. Injection pressure and injection flow rate shall be recorded continuously and reported at the frequency indicated below. The report shall include the following data:

Parameters	Reporting Frequency
Injection Pressure (p.s.i)	
Monthly Maximum Pressure	Monthly
Monthly Minimum Pressure	Monthly
Monthly Average Pressure	Monthly
Daily Maximum Pressure	Daily
Daily Minimum Pressure	Daily
Daily Average Pressure	Daily
Flow Rate (g.p.m.)	
Monthly Maximum Flow Rate	Monthly
Monthly Minimum Flow Rate	Monthly
Monthly Average Flow Rate	Monthly
Daily Maximum Flow Rate	Daily
Daily Average Flow Rate	Daily
Total Volume Injected (gallons)	Daily
Total Volume Injected (gallons)	Monthly
Injected Fluid Parameters	
Nitrate and Nitrite (as N) (mg/L)	Monthly
Total Kjeldahl Nitrogen (mg/L)	Monthly
Total Nitrogen (mg/L)	Monthly

g. Specific injectivity testing shall be performed monthly while the pumping rate to the well has been set at a predetermined level and reported as the specific injectivity index (gallons per minute/specific pressure), in accordance with Rules 62-528.430(2)(c) and .450(3)(a)7., F.A.C., and procedures outlined in the June 6, 1996, Operation & Maintenance manual. As part of this test, the well shall be shut-in for a period of time necessary to conduct a valid observation of pressure fall-off. The specific injectivity test data shall be submitted monthly along with the monitoring results of the injection well and the monitor wells.

h. <u>Monitor Wells</u>

The specifications for the dual zone monitor well is as follows:

Well Number	*Casing Diameter/Depth (Inches/Feet)	*Monitoring Interval (Ft)	
MW-1	16.00 Steel/1422	1422-1494	(upper monitor zone)
MW-2	6.00 FRP/2249	2249-2330	(lower monitor zone)

* below land surface

The monitor wells shall be monitored in accordance with the frequency and parameters listed below. Pressure and/or water level in each monitor well shall be continuously recorded and reported as indicated below. The permittee shall submit a Summary of the Monthly Monitoring Data developed from the monitor well instrumentation. The report shall include the following data:

Parameters	Reporting Frequency
Monthly Pressure/Water Level (psi or feet NGVD)	
Maximum Pressure or Water Level	Monthly
Minimum Pressure or Water Level	Monthly
Average Pressure or Water Level	Monthly
Daily Pressure/Water Level (psi or feet NGVD)	
Maximum Pressure or Water Level	Daily
Minimum Pressure or Water Level	Daily
Average Pressure or Water Level	Daily
Specific Conductivity (umhos/cm)	*weekly
Chloride (mg/L)	*weekly
Total Dissolved Solids (mg/L)	*weekly
Sulfate (mg/L)	*weekly
Field Temperature (°C)	*weekly
Fecal Coliform (#/100 ml)	*weekly
Total Phosphorus (mg/L)	*weekly
Total Nitrogen (mg/L)	*weekly
Total Kjeldahl Nitrogen (mg/L)	*weekly
pH (standard units)	*weekly

Total Organic Carbon (mg/L)	monthly
Sodium (mg/L)	monthly
Calcium (mg/L)	monthly
Magnesium (mg/L)	monthly
Potassium (mg/L)	monthly

* The permittee may request that these parameters be reduced to monthly analyses after 6 months of data.

i. The permittee shall submit to the Department the results of all monitoring data collected no later than the 15th day of the following month immediately following the end of the sampling period. The results shall be sent to the Department of Environmental Protection, South District Office, 2295 Victoria Ave., Fort Myers, Florida 33901. Copies of the results shall also be sent to the Underground Injection Control Program, Bureau of Wastewater Facilities, Department of Environmental Protection, 2600 Blair Stone Road, Tallahassee, FL 32399-2400.

j. Operational testing of this injection well system shall cease upon expiration of this permit, unless the Department has issued an intent to issue an operation permit, or a timely renewal application (Rule 62-4.090, F.A.C.) for this construction permit has been submitted to the Department. However, under no circumstance shall the duration of the operational testing period exceed two years as specified in Rule 62-528.450(3), F.A.C.

k. A wastestream analysis for primary and secondary drinking water standards and the following minimum criteria shall be performed on the wastestream from the new East Port WWTP. The sample shall be taken within 6 months of startup of the new plant.

Minimum Criteria - Ammonia
Organic Nitrogen
Orthophosphate
Total Phosphorus
Total Kjeldahl Nitrogen
Chloroethane
Chloroform
para-Dichlorobenzene
1,2-Dichloroethylene
Anthracene
Butylbenzylphtallate
Dimethylphthallate
Naphthalene
Phenanthrene
Aldrin
Dieldrin
Dioxin
2-Chlorophenol
Phenol
2,4,6-Trichlorophenol
Conductivity
Biological Oxygen Demand
Temperature

l. Financial responsibility must be maintained in accordance with specific condition 7 of construction permit UC08-254545.

m. Abnormal Events

1. In the event the permittee is temporarily unable to comply with any of the conditions of a permit due to breakdown of equipment, power outages, destruction by hazard of fire, wind or by other cause, the permittee of the facility shall notify the Department. Notification shall be made in person, by telephone or by telegraph within 24 hours of breakdown or malfunction to the office of the Department that issued the permit (2295 Victoria Ave., Suite 364, Fort Myers, FL 33901, phone 941-332-6975).

2. A written report of any noncompliance referenced in 1. above shall be submitted to the district office (2295 Victoria Ave., Suite 364, Fort Myers, FL 33901, phone 941-332-6975) 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.

n. Emergency Discharge

The Department shall be notified in the event that the emergency discharge method has been used. The permittee shall indicate the duration of the emergency discharge and the volume of fluid discharged to the emergency discharge location.

o. Certification

Reports required by this permit and applications shall contain the proper signatories and certification language contained in Rule 62-528.340, F.A.C. (attached).

This letter must be attached to your permit and becomes a part of that permit.

Sincerely,

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

ABA/JBM/klm

Enclosure

cc: Mark S. Pearce, ViroGroup
Joe Haberfeld, FDEP

2-528.340 Signatories to Permit Applications and Reports for Underground Injection Control.

(1) Applications. All permit applications, except those submitted for Class II wells (see subsection (2) of this section), shall be signed as follows:

(a) For a corporation, by a responsible corporate officer. For the purpose of this subsection, a responsible corporate officer means:

1. A president, secretary, treasurer, or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation; or

2. The manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

Note: Specific assignments or delegations of authority to responsible corporate officers identified in subparagraph 1. above is not required. The Department will presume that these responsible corporate officers have the requisite authority to sign permit applications unless the corporation has notified the Department to the contrary. Corporate procedures governing authority to sign permit applications may provide for assignment or delegation to applicable corporate positions under subparagraph 2. above rather than to specific individuals.

(b) For a partnership or sole proprietorship, by a general partner or the proprietor, respectively; or

(c) For a municipality, state, federal, or other public agency, by either a principal executive officer or ranking elected official. For purposes of this subsection, a principal executive officer of a state or federal agency includes the chief executive officer of the agency, or a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

(2) Reports. All reports required by permits and other information requested by the Department shall be signed by a person described in subsection (1) of this section, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(a) The authorization is made in writing by a person described in subsection (1) of this section;

(b) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, or position of equivalent responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and

(c) The written authorization is submitted to the Department.

(3) Changes to authorization. If an authorization under subsection (2) of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of subsection (2) of this section shall be submitted to the Department prior to or together with any reports, information, or applications to be signed by an authorized representative.

(4) Certification. Any person signing a document under subsection (1) or (2) of this section shall make 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 on 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 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."

APPENDIX 2.1-1

EAST PORT LITHOLOGIC LOGS

1. INJECTION WELL #2 (CH-325)
2. SHALLOW PAD MONITOR WELL #1 (CH-322)
3. SHALLOW PAD MONITOR WELL #4 (CH-323

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325) CHARLOTTE CO. UTILITIES EAST PORT WRF	
Depth (feet bpl)	**Sample Description**
0-10	Sand, quartz, light brown, fine to medium grained, subangular to subrounded, poorly sorted, minor phosphate, black (N1).
10-20	Sand, quartz, colorless, coarse to medium grained, subrounded, drusy, poorly sorted; minor phosphate grains, black (N1), coarse to medium grained, subrounded to subangular, good apparent porosity.
20-30	Sand, as above.
30-46	Sand, quartz, as above; minor phosphate, as above; minor shell fragments; lime mud, olive gray (5Y 3/2), soft, fluid; low apparent porosity.
46-60	Sand, quartz, as above; minor shell fragments and phosphate grains, as above.
60-80	Sand, quartz, medium grained, subrounded, moderate sorting; clayey, olive gray (5Y 4/1); trace phosphate, black (N1), subangular; low apparent porosity.
80-90	Sand, quartz, colorless, medium grained, rounded, well sorted; clayey, olive gray (5Y 4/1); limestone fragments, biomicrite, light brown (5YR 6/4), medium grained shell fragments; trace phosphate, black (N1), subangular to subrounded; low apparent porosity.
90-100	Clay, olive gray (5Y 3/2); sandy, quartz, medium grained, rounded, well sorted; minor shell fragments; low apparent porosity.
100-110	Clay, as above; trace phosphate, black (N1), subrounded.
110-120	Clay as above; sandy, quartz, colorless, medium to coarse grained, subrounded, moderate sorting; trace phosphate, black (N1), subrounded; low apparent porosity.
120-128	Clay, olive gray (5Y 4/1); sandy, quartz, colorless, fine to medium grained, subangular to subrounded, moderately sorted; trace phosphate, black (N1), subrounded; minor shell fragments; low apparent porosity.
128-150	Clay, light gray (N7); sandy, quartz, colorless, medium to coarse grained, subangular to subrounded, poorly sorted; minor phosphate, medium to coarse grained, subrounded, poorly sorted; sandy limestone, light gray (N7), micritic matrix, interbedded sand (10%), quartz, colorless, fine to medium grained, angular to subrounded, poorly sorted, interbedded phosphate (5%), black (N1), fine to coarse grained, subangular to subrounded, moderately sorted; moderate apparent porosity.
150-160	Clay, medium light gray (N6, drilling mud) to very light gray (N8); sandy, quartz, smoky to colorless, fine to medium grained, subangular to rounded, moderately sorted; phosphate (20%), black (N1), grain size from medium to 1 cm, subangular to subrounded, poorly sorted; shell fragments; low apparent porosity.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325) CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
160-180	Clay, medium gray (N5); sand, phosphate, shell fragments, and porosity as above.
180-210	Clay, medium gray (N5), very soft, slightly cohesive, sandy, phosphatic with minor shell fragments, as above, low apparent porosity.
210-220	Marl: Limestone, very light gray (N8), sandy, phosphatic, micritic matrix, moderately soft; lime mud, very light gray (N8) to light olive gray (5Y 6/1), soft, fluid, sandy, phosphatic; minor phosphate nodules; low apparent porosity.
220-230	Marl, as above, increased limestone, limestone increasingly sandy.
230-240	Clay, light olive gray (5Y 6/1), highly phosphatic, moderately sandy, soft, slightly cohesive, low apparent porosity.
240-250	Sandstone, light olive gray (5Y 6/1), fine grained, highly phosphatic, carbonate matrix, moderately soft and friable; lime mud, light olive gray (5Y 6/1), sandy (very fine grained sand), silty, fluid; low apparent porosity.
250-260	Limestone, light olive gray to very pale orange (10YR 8/2), dolomitic, sandy, moderately hard but friable, very abundant (5%) black medium-grained phosphate, trace of fine-grained clear to milky quartz, moderate intergranular porosity; and minor dolomite, pinkish gray (5YR 8/1), hard, low porosity.
260-265	Dolomitic limestone, as above, but grading to medium gray (N5) color.
265-270	Dolosilt, medium light gray (N6), soft, sandy, very abundant (4%) black fine-grained phosphate, trace of very fine-grained quartz, low porosity.
270-285	Clay, medium light gray (N6); abundant phosphate, black (N1), fine to medium grained, trace coarse grained; trace sand, quartz, colorless, fine grained, subrounded; low porosity.
285-290	Limestone, light gray (N7), micrite, trace shell fragments, nonfriable, medium grained phosphate (5%); minor amount of clay, medium light gray (N6); trace fine grained quartz, colorless, subrounded; low porosity.
290-300	Limestone as above; and clay, very light gray (N8) to white (N9); accessory minerals and porosity as above.
300-310	Limestone, light gray (N7) sparite, micritic matrix, sandy, phosphatic, moderately soft; and lime mud, light gray (N7), sandy, silty, phosphatic, low apparent porosity, trace vuggy porosity.
310-340	Limestone, as above, limestone component harder, decreased phosphate content.
340-360	Limestone, very light gray (N8) micrite, sandy, phosphatic, soft, friable; and lime mud, very light gray, silty, phosphatic, low apparent porosity.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325) CHARLOTTE CO. UTILITIES EAST PORT WRF	
Depth (feet bpl)	**Sample Description**
360-370	Limestone, yellowish gray (5Y 7/2) micrite and biomicrite, moderately hard, phosphatic, minor quartz sand, moderate moldic porosity.
370-380	Limestone, pale yellowish brown (10YR 6/2) micrite, moderately hard, phosphatic, fossiliferous, low to moderate porosity; common marl, pinkish gray, soft, low porosity; and minor quartz sandstone, phosphatic, medium to coarse grained, moderate porosity.
380-390	Limestone, yellowish gray (5Y 7/2) micrite, hard, dolomitic, phosphatic, fossiliferous, and pale yellowish brown sparite, firm but friable, dolomitic, trace of quartz sand, moderate intergranular porosity; and marl, yellowish gray, soft, phosphatic, low porosity.
390-393	Limestone, as above.
393-404	Marl, yellowish gray (5Y 7/2), soft, phosphatic, low porosity; and limestone (40%), as above.
404-406	Limestone, yellowish gray (5Y 7/2) micrite, moderately hard, dolomitic, phosphatic, calcarenitic in part, moderate to low porosity.
406-410	Marl, yellowish gray (5Y 7/2), soft, very abundant phosphate to granule size, common fine to very fine grained clear quartz, low porosity; limestone (30%), yellowish gray micrite, dolomitic, phosphatic, low porosity.
410-420	Marl, yellowish gray (5Y 7/2) to light olive gray (5Y 6/1), soft dolosilt, low porosity; and minor interbedded limestone (20%), yellowish gray micrite, dolomitic, phosphatic, low porosity.
420-430	Dolosilt, light olive gray (5Y 6/1), soft, trace of phosphate, low porosity.
430-440	Dolosilt, light olive gray (5 Y 6/1) to medium light gray (N6), soft, clayey, very abundant fine to medium grained phosphate (8%), and abundant very fine grained clear quartz (5%), low porosity.
440-450	Dolosilt, as above.
450-454	Dolosilt, as above.
454-460	Limestone, yellowish gray (5Y 7/2) to medium light gray (N6) micrite, hard, dolomitic, phosphatic, fossiliferous, minor moldic porosity; and common to abundant phosphate nodules, some well rounded.
460-463	Marl, yellowish gray (5Y 7/2) to light gray (N7), soft, phosphatic, low porosity.
463-470	Limestone, yellowish gray (5Y 7/2) to medium light gray (N6) micrite, hard, dolomitic, phosphatic, fossiliferous, moderate porosity.
470-480	Limestone, as above.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
480-483	Limestone, yellowish gray (5Y 7/2) micrite, moderately soft, silty, phosphatic, moderate intergranular porosity.
483-490	Limestone, very pale orange (10 YR 8/2) to very light gray (N8), micritic, fossiliferous, moderately indurated, common lime mud, moderate intergrannular porosity, low to moderate apparent permeability.
490-500	Limestone, yellowish gray (5Y 8/1), micritic, fossiliferous, finely to medium phosphatic, minor shell fragments, trace lime mud, moderately indurated, moderate intergranular porosity, moderate apparent permeability.
500-510	Limestone, very pale orange (10 YR 8/2) to light gray (N7), biomicritic finely phosphatic, common shell, moderately indurated, poor to moderate intergranular porosity, poor to moderate apparent permeability.
510-520	Limestone, as above, trace lime mud.
520-530	Limestone, yellowish gray (5Y 7/2) to very light gray (N8), bio micrite, minor calcite spar, fossiliferous, moderate to good intergranular and moldic porosity, moderate to good apparent permeability.
530-540	Limestone, as above.
540-550	Sandstone, yellowish gray (5Y 8/1), fine to medium quartz and fine phosphate grains in a calcareous matrix, minor shell, minor lime mud, moderately indurated, low to moderate apparent permeability.
550-560	Sandstone, as above, lime mud more abundant.
560-570	Dolomitic limestone, pale yellowish brown (10YR 6/2), biomicritic, fossiliferous, moderate moldic porosity, moderate apparent permeability.
570-580	Dolomitic limestone as above (60%), sandstone as in 550-560 interval (40%).
580-590	Sandstone, yellowish gray (5Y 8/1), fine to medium quartz and fine phosphate grains, abundant lime mud, minor shell, low apparent permeability.
590-600	Sandstone as above, shell fraction more abundant.
600-610	Sandy lime mud, yellowish gray (5Y 8/1), fine quartz and phosphate grains, minor shell, low apparent permeability.
610-620	Sandy lime mud as above (70%), sandstone, yellowish gray (5Y 8/1) (30%).
620-630	Sandy lime mud as above (60%), sandstone as above (20%), limestone, very pale orange (10YR 8/2), moderately indurated, common shell, low to moderate apparent permeability (20%).
630-640	Lime mud, as above.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
640-650	Lime mud, as above.
650-660	Sandy lime mud, very light grey (N8), limestone very pale orange (10 YR 8/2), moderate induration, moldic porosity, common shell, fine quartz and phosphate grains, low apparent permeability.
660-670	Limestone, very light gray (N8), biomicritic, moderate induration, moderate interparticle porosity, moderate apparent permeability, abundant lime mud, common fine phosphate grains.
670-680	Limestone, yellowish gray (5Y 8/1), biomicritic, moderate induration, moderate interparticle porosity , moderate apparent permeability, abundant lime mud, common fine phosphate grains.
680-690	Limestone, as above.
690-710	Clay, medium gray, (N 4), cohesive, lime mud very light gray (N 8), poor porosity and apparent permeability, sparse sandstone with interbedded fine phosphate grains.
710-720	Limestone light olive gray (5Y 6/1), micritic, interbedded with yellowish gray (5Y 8/1), biomicritic limestone, moderate porosity and moderate apparent permeability, moderate medium grained phosphate grains, trace very light gray lime mud.
720-730	Limestone, as above.
730-740	Limestone, yellowish gray (5Y 8/1), biomicrite, good interparticle and moldic porosity, good apparent permeability, trace fine phosphate grains and lime mud.
740-750	Marl, very light gray (N8) lime mud, soft, low porosity, and limestone (40%), yellowish gray (5Y 8/1) biomicrite, hard, calcarenitic texture, good porosity.
750-760	Limestone, pinkish gray (5YR 8/1) biomicrite, moderately soft, calcarenitic, excellent intergranular porosity, interbedded with medium light gray(N6) micrite, moderately hard, phosphatic, moderate to low porosity; and trace of lime mud, as above.
760-770	Limestone, pinkish gray (5YR 8/1) to very pale orange (10 YR 8/2) biomicrite to sparite, moderately hard, calcarenitic, trace of very fine grained quartz, good intergranular porosity.
770-780	Limestone, very pale orange (10 YR 8/2) biomicrite, hard, good moldic porosity.
780-790	Limestone, pinkish gray (5YR 8/1) biomicrite, hard, moderate to good porosity.
790-800	Limestone, pinkish gray (5YR 8/1) to very pale orange (10 YR 8/2) biomicrite to sparite, moderately hard, calcarenitic, good intergranular porosity.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
800-810	Marl, very pale orange (10 YR 8/2) lime mud, soft, low porosity, and limestone (40%), yellowish gray (5Y 8/1) biomicrite, moderately hard, moderate porosity.
810-813	Marl, as above.
813-820	Limestone, very pale orange (10 YR 8/2) micrite to biomicrite, moderately soft and friable, marley in part, moderate to good intergranular porosity.
820-830	Limestone, as above.
830-840	Limestone, pinkish gray (5YR 8/1) biomicrite, moderately hard, good moldic and intergranular porosity.
840-850	Limestone, very pale orange (10 YR 8/2), pelmicrite to sparite, moderately hard,fossiliferous, calcarenitic, good porosity.
850-860	Limestone, as above.
860-870	Limestone, very pale orange biopelmicrite, moderately hard, calcarenitic texture, moderate to good interparticle porosity.
870-880	Limestone, very pale orange biopelmicrite, moderately hard, calcarenitic, good interparticle porosity.
880-888	Limestone, as above.
888-895	Marl, yellowish gray (5Y 8/1), lime mud, soft, low porosity with interbedded limestone.
895-898	Dolomite, pale yellowish orange (10 YR 8/2), hard, low apparent permeability.
898-904	Clay, olive gray (5Y 4/1), soft, low permeability, grading to light olive gray (5Y 6/1) with depth, soft, calcareous, low permeability.
904-910	Lime mud, very pale orange (10YR 8/2), soft, minor fossiliferous limestone, minor sucrosic dolomite, low apparent permeability.
910-920	Lime mud, very pale orange (10YR 8/2), moderately stiff, common sucrosic dolomite, minor limestone, low apparent porosity.
920-930	Lime mud, very pale orange (10YR 8/2), soft, common sucrosic dolomite, minor limestone, trace dolosilt, low apparent permeability.
930-940	Limestone,very pale orange (10YR 8/2), moderately indurated, biomicritic, minor calcite spar, minor calcareous dolomite, minor lime mud, moderate interparticle porosity, moderate apparent permeability.
940-950	Lime mud, very pale orange (10YR 8/2),soft, common limestone as above, common cryptocrystalline olive gray (5Y 6/1) dolomite, minor dolosilt,low apparent permeability.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
950-960	Limestone, very pale orange (10YR 8/2), moderately well indurated, arenitic, trace olive gray dolomite, moderate interparticle porosity, low to moderate apparent permeability.
960-970	Limestone, as above.
970-980	Limestone, as above.
980-990	Limestone, as above.
990-1000	Limestone, as above, slightly less indurated.
1000-1010	Limestone, yellowish gray (5Y 7/2),moderately well indurated, arenitic, minor dolomite, moderate interparticle and moldic porosity, moderate apparent permeability.
1010-1020	Limestone, as above, increased moldic porosity, good apparent permeability.
1020-1030	Limestone, as above.
1030-1040	Limestone, yellowish gray (5Y 7/2), arenitic, fossiliferous, moderately indurated, trace dolomite, moderate interparticle porosity, moderate apparent permeability.
1040-1050	Limestone, yellowish gray (5Y 7/2) to light gray (N6), sparry, arenitic, fossiliferous, forams, poorly to moderately indurated, moderate interparticle porosity, moderate apparent permeability.
1050-1060	Limestone, yellowish gray (5Y 8/1), sparry, arenitic, fossiliferous, poorly to moderately indurated, moderate interparticle porosity, moderate apparent permeability.
1060-1070	Limestone, as above, less indurated.
1070-1080	Limestone, as above.
1080-1090	Limestone , as above.
1090-1100	Limestone, yellowish gray (5Y 8/1), calcite spars, fossiliferous, moderate induration, moderate interparticle porosity, and apparent permeability, trace dolosilt and fine phosphate grains.
1100-1110	Limestone, as above, interbedded with sucrosic dolomite, dark yellowish brown (10YR 4/2), poor intercrystalline porosity, moderate apparent permeability.
1110-1120	Dolomite, dark yellowish brown (10YR 4/2), moderate induration, poor intercrystalline porosity and permeability.
1120-1130	Limestone, very pale orange (10YR 8/2) sparry, sucrosic, indurated, poor porosity and apparent permeability, trace very fine phosphate grains.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
1130-1140	Limestone, as above.
1140-1150	Limestone, as above.
1150-1160	Limestone, moderate yellowish brown (10YR 5/4), sparry, sucrosic, indurated, fair intercrystalline porosity, moderate apparent permeability, trace lime mud and fine phosphate grains.
1160-1170	Limestone, moderate yellowish brown (10YR 5/4), to very pale orange (10YR 8/2) sparry, indurated, fair intercrystalline porosity, moderate apparent permeability.
1170-1180	Limestone, very pale orange (10YR 8/2) sparry, sucrosic, indurated, fair intercrystalline porosity, moderate apparent permeability.
1180-1190	Limestone, yellowish gray (5Y 8/1) sparry, sucrosic, poor induration, fair intercrystalline porosity, moderate apparent permeability.
1190-1200	Limestone, yellowish gray (5Y 8/1) sparry, sucrosic, poor induration, fair intercrystalline porosity, moderate apparent permeability, trace brownish gray (5YR 4/1) dolosilt.
1200-1210	Limestone, as above, trace brownish gray (5YR 4/1) dolosilt.
1210-1220	Limestone, very pale orange (10YR 8/2), biosparite, numerous fossils (forams), poor induration, fair to good interparticle porosity, good apparent permeability.
1220-1230	Limestone, very pale orange (10YR 8/2), biosparite, numerous fossils (forams), poor induration, fair to good interparticle porosity, good apparent permeability, trace light gray (N7), clay, moderately hard.
1230-1240	Limestone, very pale orange (10YR 8/2), biosparite, numerous fossils (forams), poor induration, fair to good interparticle porosity, good apparent permeability, minor light gray (N7), clay, moderately hard.
1240-1250	Limestone, very pale orange (10YR 8/2), biosparite, numerous fossils (forams), poor induration, fair to good interparticle porosity, good apparent permeability, minor light gray (N7), clay, moderately hard.
1250-1260	Limestone, very pale orange (10YR 8/2), biosparite, numerous fossils (forams), poor induration, fair to good interparticle porosity, good apparent permeability, minor light gray (N7), clay, moderately hard.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
1260-1270	Limestone, very pale orange (10YR 8/2), biosparite, numerous fossils (forams), poor induration, fair to good interparticle porosity, good apparent permeability, minor light gray (N7), clay, moderately hard.
1270-1280	Limestone, grayish orange (10YR 7/4), sparry, sucrosic, poor induration, fair intercrystalline porosity, moderate apparent permeability, abundant fossils (forams), minor light gray (N7), clay, moderately soft.
1280-1290	Limestone, grayish orange (10YR 7/4), sparry, sucrosic, poor induration, fair intercrystalline porosity, moderate apparent permeability, abundant fossils (forams), minor light gray (N7), clay, moderately soft.
1290-1300	Limestone, grayish orange (10YR 7/4), sparry, sucrosic, poor induration, fair intercrystalline porosity, moderate apparent permeability, abundant fossils (forams), minor light gray (N7), clay, moderately soft.
1300-1310	Limestone, grayish orange (10YR 7/4), sparry, sucrosic, poor to fair induration, fair intercrystalline porosity and apparent permeability, abundant fossils (forams), trace light gray (N7), clay, soft.
1310-1320	Limestone, grayish orange (10YR 7/4), sparry, sucrosic, poor to fair induration, fair intercrystalline porosity and apparent permeability, abundant fossils (forams), trace light gray (N7), clay, soft.
1320-1330	Dolomite, moderate to pale yellowish brown (10YR 5/4 - 6/2), moderately hard but slightly friable, good to excellent interparticle porosity.
1330-1340	Dolomite, moderate to pale yellowish brown (10YR 5/4 - 6/2), moderately hard but slightly friable, good to excellent interparticle porosity.
1340-1350	Dolomite, as above.
1350-1360	Dolomite, as above.
1360-1370	Dolomite, as above, with interbedded limestone (40%), white to pale yellowish orange (10YR 8/2) biopelmicrite, moderately hard, good to excellent moldic and intergranular porosity.
1370-1380	Dolomite and interbedded limestone (30%), as above.
1380-1400	Dolomite, dark to pale yellowish brown (10YR 4-6/2), hard, sucrosic, calcareous in part, moderate interparticle porosity. Interval included several voids ranging from 1 - 5 feet thick (driller).

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325) CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
1400-1410	Dolomite, dark yellowish brown (10YR 4/2), hard, sucrosic, minor limestone, very pale orange (10YR 8/2), biosparite, low to moderate interparticle porosity, moderate apparent permeability.
1410-1420	Dolomite, dark yellowish brown (10YR 4/2), hard, sucrosic, trace limestone, moderate interparticle porosity, moderate apparent permeability.
1420-1430	Dolomite, as above.
1430-1440	Dolomite, moderate yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/2), hard, moderate interparticle and moldic porosity, moderate apparent permeability.
1440-1450	Dolomite, dark yellowish brown (10YR 4/2), hard, sucrosic, trace limestone, moderate interparticle porosity, moderate apparent permeability.
1450-1460	Dolomite, as above.
1460-1470	Dolomite, as above.
1470-1480	Dolomite, dark yellowish brown (10YR 4/2), indurated, sucrosic, trace limestone, moderate interparticle and vug porosity, moderate apparent permeability.
1480-1490	Dolomite, dark yellowish brown (10YR 4/2), indurated, sucrosic, moderate interparticle and vug porosity, moderate apparent permeability.
1490-1500	Dolomite, dark yellowish brown (10YR 4/2), indurated, sucrosic, moderate interparticle and vug porosity, moderate apparent permeability.
1500-1510	Dolomite, dark yellowish brown (10YR 4/2), indurated, sucrosic, poor interparticle porosity and apparent permeability.
1510-1520	Dolomite, moderate to dark yellowish brown (10 YR 5/4) to (10YR 4/2), moderate induration, sucrosic, moderate interparticle and vug porosity and apparent permeability.
1520-1530	Dolomite, dark yellowish brown (10YR 4/2), moderate induration, sucrosic, trace micritic limestone, good interparticle and vug porosity and apparent permeability.
1530-1540	Limestone, intermixed dolomitic dark yellowish brown (10 YR 4/2) and micritic, pale yellowish brown, (10 YR 6/2), sucrosic, fair interparticle porosity, poor apparent permeability.
1540-1550	Limestone, intermixed dolomitic dark yellowish brown (10 YR 4/2) and micritic, pale yellowish brown, (10 YR 6/2), sucrosic, moderate to good interparticle porosity and apparent permeability.
1550-1560	Dolomite, moderate yellowish brown (10 YR 5/4), moderate induration, sucrosic, moderate interparticle and vug porosity and apparent permeability.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
1560-1570	Dolomite, moderate yellowish brown (10 YR 5/4), moderate induration, sucrosic, moderate interparticle and vug porosity and apparent permeability.
1570-1575	Dolomite, as above.
1575-1580	Dolomite, moderate yellowish brown (10YR 4/2), moderately indurated, highly sucrosic, trace limestone fragments, moderate to good interparticle porosity, moderate apparent permeability.
1580-1590	Dolomite, as above.
1590-1600	Dolomite, dark yellowish brown (10YR 4/2) to brownish black (5YR 2/1), moderately well indurated,sucrosic, moderate to good interparticle porosity, moderate apparent permeability, minor interbedded line stone, very pale orange (10YR 8/2), biosparite, moderately indurated, good interparticle porosity, good apparent permeability.
1600-1610	Dolomite, as above, trace limestone as above.
1610-1620	Dolomite, dark yellowish brown (10YR 4/2), moderate to well indurated, sucrosic, moderate to good interparticle porosity, moderate apparent permeability.
1620-1625	Dolomite, as above.
1625-1630	Dolomite, dark to dusky yellowish brown, (10YR 4-2/2), hard, sucrosic, abundant carbonaceous layering, good to excellent intercrystalline porosity; and dolomitic limestone, pale yellow brown (10YR 6/2), hard, dense, recrystallized biopelsparite, low porosity.
1630-1635	Dolomite, moderate to dark yellowish brown (10YR 5/4-4/2), hard, dense, finely crystalline, carbonaceous in part, low overall porosity with minor vuggy porosity.
1635-1640	Dolomite, pale to moderate yellowish brown (10YR 6/2-5/4), hard, dense, microcrystalline to sucrosic, minor carbonaceous streaks, low porosity with minor vuggy intercrystalline porosity.
1640-1645	Dolomite, pale yellow brown (10YR 6/2), hard, dense, very finely crystalline, low porosity.
1645-1650	Dolomite as above; minor lignite.
1650-1660	Dolomite, as above.
1660-1670	Dolomite, dusky brown (5YR 2/2) to dark yellowish brown (10YR 4/2), very fine microcrystalline, minor vugular porosity, low apparent permeability; minor quartz, fine to medium grained, subrounded to subangular; minor lignite.
1670-1680	Dolomite, as above; and limestone, yellowish gray (5Y 8/1), calcarenitic texture, minor vugular porosity, low apparent permeability; minor lime mud; minor lignite.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
1680-1690	Dolomite and limestone, as above.
1690-1700	Dolomite, dusky brown (5YR 2/2) to dark yellowish brown (10YR 4/2), very finely crystalline, slightly friable, low apparent porosity and permeability; limestone, very light gray (N8), micrite; and minor lignite.
1700-1710	Dolomite, dark yellowish brown (10YR 4/2) to dusky brown (5YR 2/2), calcarenitic with interbedded lignite, poor apparent porosity and permeability; minor dolomitic limestone, yellowish gray (5Y 8/1), very fine crystalline; minor lignite.
1710-1720	Dolomite, dark yellowish brown (10YR 1/2) to moderate yellowish brown (10YR 5/4), finely crystalline, low apparent porosity and permeability; limestone, pale yellowish brown (10YR 6/2), micritic; and minor interbedded lignite.
1720-1730	Dolomite, as above.
1730-1740	Dolomite, as above.
1740-1750	Dolomite, as above.
1750-1760	Dolomite, dusky yellowish brown (10YR 2/2) to dark yellowish brown (10YR 4/2), sucrosic, low to moderate apparent porosity and permeability; and interbedded lignite.
1760-1770	Dolomite, dark yellowish brown (10YR 4/2) to moderate yellowish brown (10YR 5/4), finely crystalline, low apparent porosity and permeability; limestone, pale yellowish brown (10YR6/2), micritic; and minor interbedded lignite.
1770-1780	Dolomite, dusky yellowish brown (10YR 2/2) to olive gray (5Y 3/2), finely crystalline, calcareous, low apparent porosity and permeability.
1780-1790	Dolomite, pale yellowish brown (10YR 6/2) to dusky brown (5YR 2/2), medium to very finely crystalline, common moldic porosity, low overall porosity, poor apparent permeability; minor limestone, very light gray (N8); and minor black (N1) lignite.
1790-1800	Dolomite, pale yellowish brown (10YR 6/2) to dusky brown (5YR 2/2), very finely crystalline, poor porosity and permeability; limestone, very light gray (N8); and minor black (N1) lignite.
1800-1810	Dolomite, pale yellowish brown (10YR 6/2) to dusky yellowish brown (10YR 2/2), very finely crystalline; minor lignite, black (N7). Poor apparent porosity and permeability.
1810-1820	Dolomite, as above.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
1820-1830	Dolomite, pale yellowish brown (10YR 6/2) to dusky yellowish brown (10YR 2/2), sucrosic to very fine crystalline, minor vugular porosity, poor apparent porosity; minor lignite.
1830-1840	Dolomite, as above.
1840-1850	Dolomite, as above.
1850-1860	Dolomite, dark yellowish brown (10YR 4/2) to dusky yellowish brown (10YR 2/2), very fine crystalline, hard, fractured, minor lignite, very low apparent porosity and permeability.
1860-1870	Dolomite, as above.
1970-1880	Dolomite, as above.
1880-1890	Dolomite, as above.
1890-1900	Dolomite, dark yellowish brown (10 YR 4/2), medium to very finely crystalline, common vuggy porosity, low apparent permeability, increased lignite content; trace of limestone.
1900-1910	Dolomite, as above.
1910-1920	Dolomite, as above.
1920-1930	Dolomite, dark yellowish brown (10YR 4/2) to dusky yellowish brown (10YR 2/2), coarse to finely crystalline, channeled to vuggy porosity; common lignite, black (N9).
1930-1940	Dolomite, dusky yellowish brown (10YR 2/2) to dark yellowish brown (10YR 4/2), coarse to finely crystalline, vuggy porosity; and common lignite, as above.
1940-1950	Dolomite, as above.
1950-1960	Dolomite, moderate to dark yellowish brown (10YR 5-4/4), finely to coarsely crystalline, minor vuggy porosity, low apparent permeability; minor calcite; lignite, black (N1).
1960-1970	Dolomite, as above.
1970-1980	Dolomite, as above.
1980-1990	Dolomite, as above.
1990-2000	Dolomite, as above, and yellowish gray (5Y 8/1) dolomite, finely crystalline, hard and dense, very minor vuggy porosity, low apparent permeability; minor lignite, black (N1).

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
2000-2010	Dolomite, moderate yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/2), hard and dense, medium to finely crystalline, very minor vuggy porosity, poor apparent permeability; and minor lignite.
2010-2020	Dolomite, dark yellowish brown (10 YR 4/2) to pale yellowish brown (10 YR 6/2), hard and dense, low apparent porosity and permeability; and minor lignite.
2020-2030	Dolomite, dark yellowish brown (10 YR 4/2), hard, microcrystalline, minor vuggy porosity, poor apparent permeability; trace of lignite.
2030-2040	Dolomite, dusky brown to dusky yellowish brown (5-10 YR 2/2) and dark yellowish brown (10 YR 4/2), vuggy porosity, microcrystalline; and minor very pale orange (10 YR 8/2) limestone.
2040-2045	Dolomite, as above.
2045-2055	See core #1 summary.
2055-2060	Dolomite, dusky to (10 YR 2/2) to dark yellowish brown (10 YR 4/2) finely crystalline, hard, low intercrystalline porosity, trace of vug porosity, low apparent permeability; trace of lignite, black (N 1).
2060-2070	Dolomite, dark yellowish brown (10 YR 4/2), sucrosic to microcrystalline, moderate induration, moderate vug porosity, good apparent permeability.
2070-2080	Dolomite, dark yellowish brown (10 YR 4/2), sucrosic, microcrystalline, moderate induration, moderate vug porosity, good apparent permeability.
2080-2090	Dolomite, dusky to (10 YR 2/2) to dark yellowish brown (10 YR 4/2), microcrystalline, moderate induration, poor intercrystalline porosity, low apparent permeability, with minor very pale orange (10 YR 8/2) micritic limestone.
2090-2100	Dolomite, dusky yellowish brown (10 YR 2/2), medium crystalline, poor induration, good intercrystalline porosity and apparent permeability.
2100-2110	Limestone, yellowish gray (5 Y 8/1), biopelmicrite, fossiliferous, poor to moderate induration, moderate intergranular porosity and apparent permeability, minor dusky yellowish brown (10 YR 4/2) dolomite; and trace of lignite.
2110-2120	Limestone, as above.
2120-2130	Limestone, as above.
2130-2140	Limestone, yellowish gray (5 Y 8/1), biopelmicrite, fossiliferous, poor to moderate induration, moderate permeability, trace dusky yellowish brown (10 YR 4/2) dolomite, lignite, black (N 1) and light gray (N 8) lime mud.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
2140-2150	Limestone, pale yellowish brown (10YR 6/2), biosparite, dolomitic, poor to moderate induration, moderate intergranular porosity, and minor dark yellowish brown (10 YR 4/2) sucrosic dolomite.
2150-2160	Limestone, as above.
2160-2170	Limestone, pale yellowish brown (10YR 6/2) to dusky yellowish brown (10YR 2/2), dolomitic, moderately firm, friable in part, calcaranetic texture, common lignite, low to moderate intergranular porosity.
2170-2180	Limestone, as above.
2180-2190	Dolomite, dusky yellowish brown (10 YR 2/2) fine to medium grained, moderate induration, moderate intercrystalline porosity and apparent permeability, with minor limestone as above.
2190-2200	Limestone, very pale orange (10 YR 4/2), biopelmicrite, poor to moderate induration, moderate intergranular porosity, minor dolomite as above, trace of light gray (N8) lime mud.
2200-2210	Limestone, very pale orange (10 YR 4/2), biopelmicrite, moderate induration, slightly friable, moderate intergranular porosity, minor dolomite as above.
2210-2220	Limestone, very pale orange (10 YR 4/2), biopelmicrite, moderate induration, slightly friable, moderate intergranular porosity, minor dolomite as above.
2220-2230	Limestone, as above.
2230-2240	Limestone, very pale orange (10 YR 4/2), biopelmitritic, poor to moderate induration, moderate to good intercrystalline porosity, slightly friable, moderate apparent permeability, minor dolomite as above, and trace dusky yellow brown (10 YR 2/2) dolosilt.
2240-2250	Limestone, very pale orange (10 YR 4/2), biosparite, fossiliferous, moderate induration, moderate to good intergranular porosity, slightly friable, moderate apparent permeability, minor dolomite as above, trace dusky yellow brown (10 YR 2/2) lime mud.
2250-2260	Dolomite, pale yellowish brown (10 YR 6/2), medium to finely crystalline, sucrosic texture, moderately hard, good intercrystalline and vug porosity.
2260-2270	Dolomite, pale (10 YR 4/2) to dark yellow brown (10YR 6/2), hard, micro to medium crystalline, common vug porosity, low to moderate apparent permeability.
2270-2280	Limestone, very pale orange (10 YR 4/2), biomicrite, calcarenitic texture, moderately hard, moderate intergranular porosity, friable, moderate apparent permeability, minor pale yellowish brown (10 YR 6/2) dolomite, trace of lignite.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
2280-2290	Limestone, very pale orange (10 YR 4/2), biopelsparite to micrite, moderately hard, slightly friable, calcarenitic, moderate to good intergranular porosity, moderate to good apparent permeability.
2290-2300	Dolomite, dark (10 YR 4/2) to dusky yellow brown (10YR 6/2), hard, finely crystalline , minor vug porosity, low intercrystalline porosity, low apparent permeability, and limestone (20%), as above.
2300- 2317	Lignite, brownish black (5YR 2/1), firm, fissile, with dark yellowish brown (10YR 4/2) micritic carbonate laminations; and Limestone, very pale yellowish brown (10YR 7/2) micrite (See core #2 Summary).
2317- 2320	Dolomite, pale (10 YR 4/2) to dark yellow brown (10YR 6/2), indurated,fine to micro crystalline,moderate intercrystalline porosity and apparent permeability, minor lignite, black (N 1).
2320-2330	Limestone, pale yellowish brown (10YR 6/2) to dusky yellowish brown (10 YR 2/2), moderate induration, moderate intergranular porosity and apparent permeability, common lignite, black (N 10).
2330-2340	Limestone, very pale orange (10 YR 4/2), to pale yellow brown (10 YR 7/2), biopelsparitic, abundant forams, poor to moderate induration, moderate to good intergranular porosity, moderate to good apparent permeability, trace lignite, black (N 1).
2340-2350	Limestone, very pale orange (10 YR 4/2), biopelsparitic, poor to moderate induration, moderate to good intergranular porosity, moderate to good apparent permeability, minor, lignite, black (N 1).
2350-2360	Limestone, very pale orange (10 YR 4/2), biopelsparitic, poor to moderate induration, moderate to good intergranular porosity, moderate to good apparent permeability, minor, lignite, black (N 1).
2360-2370	Limestone, very pale orange (10 YR 4/2), biopelsparitic, poor to moderate induration, moderate to good intergranular porosity, moderate to good apparent permeability, minor, lignite, black (N 1).
2370-2380	Limestone, very pale orange (10 YR 4/2), biopelsparitic, poor to moderate induration, moderate to good intergranular porosity, moderate to good apparent permeability, common, lignite, black (N 1).
2380-2390	Limestone, very pale orange (10 YR 4/2), biopelsparitic, poor to moderate induration, moderate to good intergranular porosity, moderate to good apparent permeability, minor, lignite, black (N 1).
2390-2400	Limestone, very pale orange (10 YR 4/2), biopelsparitic, poor to moderate induration, moderate to good intergranular porosity, moderate to good apparent permeability, minor, lignite, black (N 1).

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
2400-2410	Limestone, very pale orange (10 YR 4/2), biopelsparitic, poor to moderate induration, moderate to good intergranular porosity, moderate to good apparent permeability, abundant, black (N 1).
2410-2420	Limestone, very pale orange (10 YR 4/2), biopelsparitic, moderate induration, moderate intergranular porosity, moderate apparent permeability, common,lignite, black (N 1).
2420-2430	Dolomite, dark yellow brown (10YR 6/2), indurated, micro to moderate crystalline, sucrosic, low intercrystalline porosity and apparent permeability, slight vugs, trace lignite, black (N 1).
2430-2440	Dolomite, pale yellow brown (10YR 6/2), indurated, fine to medium crystalline, sucrosic, low intercrystalline porosity and apparent permeability, common lignite, black (N 1), limestone, very pale orange (10 YR 8/2), calcarenitic.
2440-2450	Limestone, very pale orange (10 YR 4/2), moderate induration, calcarenitic, moderate intergranular porosity, moderate apparent permeability, abundant,lignite, black (N 1), trace pale yellow brown (10 YR 6/2) dolomite.
2450-2460	Limestone, very pale orange (10 YR 4/2), biopelmicrite, friable, low to moderate induration, calcarenitic, moderate intergranular porosity, moderate apparent permeability, minor lignite, black (N 1), trace pale yellow brown (10 YR 6/2) dolomite.
2460-2470	Limestone, very pale orange (10 YR 4/2), to grayish orange (10 YR 7/4), calcarenitic to biopelsparitic, low to moderate induration, moderate intergranular porosity, moderate apparent permeability, minor lignite, black (N 1).
2470-2480	Dolomite, pale yellow brown (10YR 6/2), indurated, finely crystalline, sucrosic, low intercrystalline porosity and apparent permeability, common limestone,very pale orange (10 YR 4/2), to grayish orange (10 YR 7/4), calcarenitic to biopelsparitic.
2480-2490	Dolomite, pale yellow brown (10YR 6/2), indurated, fine to medium crystalline, sucrosic, low to moderate intercrystalline porosity and apparent permeability, common limestone,very pale orange (10 YR 4/2), to grayish orange (10 YR 7/4), calcarenitic to biopelsparitic.
2490-2500	Limestone, very pale orange (10 YR 4/2), biopelsparitic, low to hard induration, moderate intergranular porosity, moderate apparent permeability, minor lignite, black (N 1), trace dolomite, pale yellow brown (10RY 6/2).
2500-2510	Limestone, very pale orange (10 YR 4/2), to white (N 9), biopelsparitic, low to hard induration, moderate intergranular porosity, moderate apparent permeability, minor lignite, black (N 1), trace dolomite, pale yellow brown (10RY 6/2).

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
2510-2520	Limestone, very pale orange (10 YR 4/2), biopelsparitic, low to hard induration, moderate intergranular porosity, moderate apparent permeability, trace lignite, black (N 1).
2520-2530	Limestone, very pale orange (10 YR 4/2), biopelsparitic, low to hard induration, moderate intergranular porosity, moderate apparent permeability, trace lignite, black (N 1).
2530-2540	Limestone, very pale orange (10 YR 4/2), biopelsparitic, low to hard induration, moderate intergranular porosity, moderate apparent permeability, trace lignite, black (N 1).
2540-2550	Dolomite, pale yellow brown (10YR 6/2), moderate induration, micro to finely crystalline, low intercrystalline porosity and apparent permeability, minor lignite black (N 1), trace limestone, very pale orange (10 YR 4/2).
2550-2560	Limestone, very pale orange (10 YR 4/2), biopelsparitic, moderate induration, moderate intergranular porosity, trace vugs, moderate apparent permeability, minor lignite, black (N 1).
2560-2570	Limestone, very pale orange (10 YR 4/2), biopelsparitic, moderate induration, moderate intergranular porosity, trace vugs, moderate apparent permeability, minor lignite, black (N 1).
2570-2580	Limestone, very pale orange (10 YR 4/2), biopelsparitic, moderate induration, moderate intergranular porosity, trace vugs, moderate apparent permeability, minor lignite, black (N 1).
2580-2590	Limestone, very pale orange (10 YR 4/2), biopelsparitic, moderate induration, moderate intergranular porosity, trace vugs, moderate apparent permeability, trace lignite, black (N 1).
2590-2600	Limestone, very pale orange (10 YR 4/2), biopelsparitic, moderate induration, moderate intergranular porosity, trace vugs, moderate apparent permeability, trace lignite, black (N 1).
2600-2610	Limestone, very pale orange (10 YR 4/2), biopelsparitic, moderate induration, moderate intergranular porosity, trace vugs, moderate apparent permeability, trace lignite, black (N 1).
2610-2620	Limestone, as above.
2620-2630	Limestone, very pale orange (10 YR 4/2), biopelsparitic, poor induration, moderate to good intergranular porosity, trace vugs, moderate apparent permeability, trace lignite, black (N 1).

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
2630-2640	Limestone, very pale orange (10 YR 4/2), biopelsparitic, poor induration, moderate to good intergranular porosity, trace vugs, moderate apparent permeability, trace lignite, black (N 1).
2640-2650	Limestone, pale yellow brown (10 YR 6/2), biopelsparitic to calcarenitic, poor induration, moderate to good intergranular porosity, trace vugs, moderate apparent permeability, trace lignite, black (N 1).
2650-2560	Limestone, pale yellow brown (10 YR 6/2), biopelsparitic to calcarenitic, poor induration, moderate to good intergranular porosity, trace vugs, moderate apparent permeability, trace lignite, black (N 1).
2660-2670	Limestone, pale yellow brown (10 YR 6/2), biopelsparitic to calcarenitic, poor induration, moderate to good intergranular porosity, trace vugs, moderate apparent permeability, trace lignite, black (N 1).
2670-2680	Limestone, pale yellow brown (10 YR 6/2), biopelsparitic to calcarenitic, poor induration, moderate to good intergranular porosity, trace vugs, moderate apparent permeability, trace lignite, black (N 1) and dolomite dusky yellow brown (10YR 4/2).
2680-2690	Limestone, pale yellow brown (10 YR 6/2), biopelsparitic to calcarenitic, poor induration, moderate to good intergranular porosity, trace vugs, moderate apparent permeability,trace dolomite dusky yellow brown (10YR 4/2).
2690-2700	Limestone, pale yellow brown (10 YR 6/2), biopelsparitic to calcarenitic, poor induration, moderate to good intergranular porosity, trace vugs, moderate apparent permeability, trace lignite, black (N 1) and dolomite dusky yellow brown (10YR 4/2).
2700-2710	Limestone, very pale orange (10 YR 8/2), micritic, calcarenitic texture, poor induration, moderate to good intergranular porosity, moderate apparent permeability, trace lignite, black (N 1) and dolomite dusky yellow brown (10YR 4/2).
2710-2720	Limestone, very pale orange (10 YR 8/2), micritic, calcarenitic texture, poor induration, moderate to good intergranular porosity, moderate apparent permeability, trace lignite, black (N 1) and dolomite dusky yellow brown (10YR 4/2).
2720-2730	Limestone, very pale orange (10 YR 8/2), micritic, calcarenitic texture, poor induration, moderate to good intergranular porosity, moderate apparent permeability, trace lignite, black (N 1) and dolomite dusky yellow brown (10YR 4/2).

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
2730-2740	Limestone, very pale orange (10 YR 8/2), micritic, calcarenitic texture, poor induration, moderate to good intergranular porosity, moderate apparent permeability, trace lignite, black (N 1) and dolomite dusky yellow brown (10YR 4/2).
2740-2750	Dolomite, dark yellow brown (10YR 4/2), moderate induration, micro to finely crystalline, low intercrystalline porosity and apparent permeability, minor lignite black (N 1), trace limestone, very pale orange (10 YR 4/2).
2750-2760	Dolomite, dark yellow brown (10YR 4/2), indurated, micro to finely crystalline, low intercrystalline porosity and apparent permeability, minor lignite black (N 1), trace limestone, very pale orange (10 YR 4/2).
2760-2770	Dolomite, dark yellow brown (10YR 4/2), moderate induration, micro to finely crystalline, low intercrystalline porosity and apparent permeability, minor lignite black (N 1) and minor limestone, very pale orange (10 YR 4/2).
2770-2780	Limestone, very pale orange (10 YR 8/2), micritic, calcarenitic texture, poor to moderate induration, low to moderate intergranular porosity, trace vugs, moderate apparent permeability, minor dolomite dusky yellow brown (10YR 4/2) and slight trace lignite, black (N 1)
2780-2790	Dolomite, dark yellow brown (10YR 4/2), moderate induration, micro to finely crystalline, low intercrystalline porosity and apparent permeability, minor lignite black (N 1), trace limestone, very pale orange (10 YR 4/2).
2790-2800	Limestone, very pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), micritic, calcarenitic texture, poor induration, low intergranular porosity, moderate apparent permeability, and dolomite dusky yellow brown (10YR 4/2).
2800-2810	Dolomite, dark yellowish brown (10YR 4/2), fine crystalline, poor apparent porosity and permeability; dolomite with calcitic cement, very light gray (N8) to pinkish gray (5YR 8/1); limestone, light gray (N7), very soft; minor lignite, black (N1); minor clay, light gray (N7).
2810-2820	Dolomite, as above, no clay apparent.
2820-2830	Dolomite, brownish gray (5YR 4/1) to dark yellowish brown (10YR 4/2), finely crystalline, poor apparent porosity and permeability; and dolomite, limestone, and lignite as above.
2830-2840	Limestone, very light gray (N8) to light gray (N7), micritic, soft, low apparent porosity and permeability; dolomite (20%), pale yellowish brown (10YR 6/2) to pale brown (5YR 5/2); lignite, black (N1).
2840-2850	Limestone, light brownish gray (5YR 6/1), pelsparite, soft, friable, moderate porosity; minor dolomite, pale yellowish brown (10YR6/2), minor calcitic cement; trace lignite, black (N1).

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
2850-2860	Limestone, yellowish gray (5Y 7/2), pelsparite, soft, friable, moderate porosity; minor dolomite, pale yellowish orange (10YR8/6); trace lignite, black (N1).
2860-2870	Limestone, as above; less dolomite; lignite, as above.
2870-2880	Limestone, as above.
2880-2890	Limestone, as above; lignite, as above; no apparent dolomite.
2890-2900	Limestone, as above.
2900-2910	Limestone, as above.
2910-2920	Limestone, as above.
2920-2930	Limestone, as above; trace dolomite, pale brown (5YR 5/2).
2930-2940	Limestone, as above; no dolomite, no lignite.
2940-2950	Limestone, as above; trace dolomite, moderate brown (5YR 3/4); trace lignite, black (N1).
2950-2960	Limestone, as above; no apparent dolomite or lignite.
2960-2970	Limestone, yellowish gray (5Y 7/2), pelsparite, soft, friable, moderate apparent porosity.
2970-2980	Limestone, yellowish gray (5Y 7/2), pelsparite, soft, friable, moderate apparent porosity.
2980-2990	Limestone, very pale orange (10 YR 8/2), biomicritic, poor induration, moderate interparticle and trace vug porosity, moderate apparent permeability; trace of lignite, black (N 1).
2990-3000	Limestone, very pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), biomicritic, moderation induration, friable, moderate to good porosity; and medium gray (N 5) micritic limestone, indurated, moderate interparticle porosity, moderate apparent permeability.
3000-3010	Limestone, very pale orange (10 YR 8/2), biopelmicrite, firm but friable, moderate to good interparticle porosity; and light gray (N 7) micritic limestone, indurated, moderate porosity, moderate apparent permeability.
3010-3020	Limestone, very pale orange (10 YR 8/2), foraminiferal biomicrite, moderate induration, friable, moderate to good interparticle and moldic porosity; and medium light gray (N 6) micritic limestone, indurated, moderate interparticle porosity.
3020-3030	Limestone, biomicrite as above.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
3030-3040	Limestone, very pale orange to pale yellowish brown (10 YR 6/2) biopelmicrite, moderate induration, slightly friable, moderate interparticle porosity, minor sparite; and minor dolomite, brownish gray (5 YR 4/1), moderately hard, low intercrystalline porosity and low apparent permeability.
3040-3050	Limestone, pale yellowish brown (10 YR 6/2), dolomitic, moderately hard, moderate intergranular porosity, moderate apparent permeability.
3050-3060	Limestone, pale yellowish brown (10 YR 6/2), poor induration moderate interparticle porosity, moderate apparent permeability, with minor calcite cement, and minor dolomite, brownish gray (5 YR 4/1), moderate induration, low intercrystalline porosity and low apparent permeability.
3060-3070	Limestone, very pale orange (10 YR 8/2) to pinkish gray (5 YR 8/1), biomicrite, good induration, moderate interparticle porosity, minor sparite; and minor dolomite, brownish gray (5 YR 4/1), good induration, low intercrystalline porosity.
3070-3080	Limestone, as above.
3080-3090	Limestone, very pale orange(10 YR 8/2) to pale yellowish brown (10 YR 6/2), biomicritic, moderate induration, moderate intergranular porosity; with minor dolomite, dusky yellowish brown (10 YR 2/2), moderately hard, low intercrystalline porosity and apparent permeability.
3090-3100	Dolomite, pale yellowish brown (10YR 6/2), firm to hard, finely to coarsely crystalline, moderate to low intercrystalline porosity, minor fracture porosity; and minor limestone, as above.
3100-3110	Dolomite, pale to dark yellowish brown (10YR 6-4/2), hard, dense, low to moderate intercrystalline porosity, good vuggy and fracture porosity, good apparent permeability.
3110-3120	Dolomite, pale yellowish brown (10YR 6/2), soft and friable, sucrosic, medium to coarsely crystalline, good intercrystalline porosity.
3120-3130	Dolomite, as above.
3130-3140	Dolomite, pale to dark yellowish brown (10YR 6-4/2), moderately hard, medium to finely crystalline, moderate intercrystalline porosity and apparent permeability.
3140-3150	Dolomite, as above.
3150-3160	Dolomite, brownish gray (5YR 4/1), hard, finely crystalline, low intercrystalline porosity, moderate fracture porosity.
3160-3170	Dolomite, brownish gray (5YR 4/1) to pale yellowish brown (10YR 6/2), hard, low intercrystalline porosity and apparent permeability.

LITHOLOGIC LOG FOR INJECTION WELL #2 (CH-325)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
3170-3180	Dolomite, as above, moderately hard, medium to finely crystalline, moderate intercrystalline to good vuggy porosity, moderate to good apparent permeability.
3180-3190	Dolomite, pale yellowish brown (10YR 6/2), moderately hard, medium to finely crystalline, low to moderate intercrystalline porosity and apparent permeability.
3190-3200	Dolomite, pale to dark yellowish brown (10YR 6-4/2), as above.
3200-3210	Dolomite, pale to dark yellowish brown (10YR 6-4/2), hard, finely crystalline, low to moderate intercrystalline porosity.
3210-3220	Dolomite, as above.
3220-3230	Dolomite, pale to dark yellowish brown (10YR 6-4/2), hard and dense, finely to microcrystalline, low intercrystalline porosity and apparent permeability.
3230-3240	Dolomite, as above.
3240-3246	Dolomite, as above.

LITHOLOGIC LOG FOR SHALLOW PAD MONITOR WELL #1 (CH-322)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
0-3	Sand (80%), quartz, moderate brown (10YR 3/4), medium grained, subangular; shell fragments (10%) and organic materials (10%)
3-10	Sand (80%), quartz, pale yellowish brown (10YR 6/2), medium grained, subrounded; and shell fragments (20%).
10-20	Sand (100%), quartz, pale yellowish brown (10YR 6/2), fine grained, subrounded.

LITHOLOGIC LOG FOR SHALLOW PAD MONITOR WELL #4 (CH-323)
CHARLOTTE CO. UTILITIES EAST PORT WRF

Depth (feet bpl)	Sample Description
0-3	Sand (80%), quartz, moderate brown (10YR 3/4), medium grained, subangular; shell fragments (10%) and organic materials (10%).
3-10	Sand (80%), quartz, pale yellowish brown (10YR 6/2), medium grained, subrounded; and shell fragments (20%).
10-15	Sand (100%), quartz, pale yellowish brown (10YR 6/2), fine grained, subrounded.
15-20	Sand (100%), quartz, pale yellowish brown (10YR 6/2), fine grained, subrounded, interbedded with light brownish gray (5YR 6/1) sand.

APPENDIX 3.3-1

CEMENT MILL TEST REPORT

EASTERN CEMENT CORP.

Post Office Box 10290
Riviera Beach, Flordia 33404

MILL TEST CERTIFICATE

ALL CUSTOMERS

...signed ______ Destination ______

...a 11/13/95 Car/Truck/Ship M/V ROSITA Plant PORT MANATEE

...tland Cement Type II Specifications ASTM C-150
AASHTO M-85

		Percent
Chemical Composition:	Silicon Dioxide (SiO_2)	20.7
	Aluminum Oxide (Al_2O_3)	3.9
	Ferric Oxide (Fe_2O_3)	2.5
	Calcium Oxide (CaO)	63.9
	Magnesium Oxide (MgO)	2.7
	Sulfer Trioxide (SO_3)	3.0
	Loss on Ignition	1.1
	Insoluble Residue	0.2
	Tricalcium Silicate (C_3S)	63.2
	Dicalcium Silicate (C_2S)	----
	Tricalcium Aluminate (C_3A)	6.1
	Tetracalcium Aluminoferrite (C_4AF)	----
Specific Surface:	Blaine	4100
Soundness:	Autoclave Expansion	.04

Time of Setting:
Initial 2 Hrs. 20 Mins
Final 3 Hrs. 40 Mins

Air Content: % by Volumn 7.3

Compressive Strength:
1 day 2700 Lbs. Per Sq. In
3 day 4100 Lbs. Per Sq. In
7 day 5200 Lbs. Per Sq. In

...his certification covers cement in this shipment and all future shipments with this Production Identification.

...his cement conforms to Florida Department of Transportation chemical and physical requirements for cement listed

...ate ...OVEMBER 13, 1995

Mike McCarthy [signature]
QUALITY CONTROL

APPENDIX 3.3.1-1

SURFACE CASING MILL CERTIFICATES

L. B. FOSTER COMPANY

STANDARD CERTIFIED TEST REPORT
TUBULAR PRODUCTS

CUSTOMER	
Name	Youngquist Brothers, Inc.
Address	15465 Pine Ridge Road
City & State	Fort Myers, Florida 33908

Date November 10, 1995

101627

Customer's Order No. 56087

LBF Invoice No.

Material FOSTERWELD

Grade ASTM A139 Gr.B

Coil or Lot. No.	Size O.D.	Wt/Ft. or Wall Thick.	Min. Hydro. Test Pres. P.S.I.	MECHANICAL PROPERTIES			CHEMICAL ANALYSIS (%)				
				Yield Strength P.S.I. Point	Tensile Strength P.S.I.	Elong. in 2" %	C	Mn	P	S	Si
	38"	.375"	415	53,500	80,500	31.	.24	.76	006	.008	.009
550571	38"	.375"	415	47,500	74,000	36.	.19	.81	005	.002	.017

Representing: 17pcs @ 50ft

ALL MATERIALS USED IN THE MANUFACTURE OF THIS PIPE WERE 100% MELTED AND ROLLED IN THE "USA".

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
TAMMY BEALL
2300 Capital Circle
Parkersburg, WV 26101
My Commission Expires April 24, 2005

The undersigned, in behalf of The L. B. Foster Company, 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 ...es of The L. B. Foster Company have been applied. Unless it appears otherwise in the results of such inspection and tests shown above, ... signed agent of The L. B. Foster Company believes that said materials conform to said specifications.

...scribed and sworn to before me
...s 10th day of Nov. 19 95

Tammy Beall

Notary Public

Robert E. Blankensop

Robert E. Blankensop, Purchasing

Agents' Name & Title

L.B. Foster Company

APPENDIX 3.3.1-2

SURFACE CASING JOINT LENGTHS

CHARLOTTE COUNTY EAST PORT WRF
INJECTION WELL #2 (CH-325)
38" DIAMETER CASING TALLY
INSTALLED NOVEMBER 17, 1995

Casing Joint #	Casing Joint Length (feet)	Cumulative String Length (feet)	Time Installed (Hours)
1	54.02	54.02	1202
2	50.00	104.02	1400
3	49.95	153.97	1500
4	50.00	203.97	1645
5	50.05	254.02	1750
6	50.00	304.02	1905
7	50.00	354.02	2100
8	49.99	404.02[1]	2238

1. Casing string to be hung from 11 feet above pad level - casing setting depth = 393 feet bpl.

APPENDIX 3.3.2-1

INTERMEDIATE CASING MILL CERTIFICATES

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS
INSPECTION CERTIFICATE
(TYPE B - IN ACCORDANCE WITH ISO 10474/EN 10204/DIN 50049)

DATE: 12/04/96
TIME: 13:39:24 USXC

14892 (R-1)

MILL ORDER/ITEM NO.	SHIPPER NO.	P.O. NUMBER	VEHICLE NO.
0R58549 02		5040-LT33	

VENDOR
USS TUBULAR PRODUCTS
1807 EAST 28TH ST.
LORAIN, OH 44055

SPECIFICATION AND GRADE

PIPE CARBON SMLS STD PIPE API 5L-*41ST EDITION DTD 4/1/95 GRADE B AND GRADE X42 ASTM A53-*93A ASTM A106-*94 GRADE B QUAD STENCIL ASME SA53-*1992 EDITION 1994 ADDENDUM ASME SA106-*1992 EDITION 1994 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 REG MILL COAT PE BEV 30 DEG MEETING ALL THE APPLICABLE REQUIREMENTS OF NACE STANDARD MR-01-75

MATERIAL COND.: AS ROLLED
OD: 20.000(508.000)
WALL: 0.500 (12.700)

PRODUCT IDENTIFICATION	TENSILE TEST TYPE/ORIENTATION	TEST COND.	GAGE WIDTH IN	YIELD PSI	EXT % .50	TENSILE PSI	Y/T	ELONG % IN 2"	HARDNESS SCALE: HRB	HYDRO PSI	
				MIN 42000		MIN 60000	MAX	MIN	MIN	1090	
				MAX		MAX		29.5	MAX 100.0		
AB2267	STRIP/T/B	AR	1.500	44400	.50	70900	0.63	47.0	B 84.0	1090	S
AB5007	STRIP/T/B	AR	1.500	47700	.50	73600	0.65	44.0	B 84.3	1090	S

** 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	B	V	N	TI	CB	CO	CE MAX
AB2267	HEAT	.16	1.03	.007	.005	.24	.01	.03	.04	.01			.001					.40
AB2267	PROD	.18	1.06	.006	.013	.26	.01	.03	.04	.02			.002					.35
AB2267	PROD	.18	1.07	.006	.013	.26	.01	.03	.04	.01			.002					.37
AB5007	HEAT	.17	1.04	.010	.008	.24	.02	.04	.06	.02			.001					.37
AB5007	PROD	.18	1.06	.012	.012	.26	.02	.04	.06	.02			.002					.38
AB5007	PROD	.16	1.04	.011	.011	.25	.02	.04	.06	.02			.002					.38
																		.35

** END OF DATA THIS SHEET **

[illegible] CE (CE, MZ6) [illegible]

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS
INSPECTION CERTIFICATE
(TYPE 3 - IN ACCORDANCE WITH ISO 10474/DIN 50049/EN 10204)

DATE 12/08/95
TIME 13:39:24 USX

14882 (D62)

MILL ORDER/ITEM NO.	SHIPPER'S NO.	P.O. NUMBER
0R5C540 02		5840-USS

MATERIAL COND. AS ROLLED

TOTAL 20.000(508.000)

NOMINAL WALL 0.500 (12.700)

PRODUCT IDENTIFICATION	FLAT	BEND	DRAW SIZE	COLLAPSE	DIR	TEST LOC	TEMP	SIZE	TEST COND	1	2	3	AVG	1	2	3	AVG
A02267	OK																
A05087	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	REMARKS / COMMENTS
FULL LENGTH VISUAL	X	
FULL LENGTH EMI	X	
FULL LENGTH MPI		OD X OD/ID ___ L X L/T ___
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.

FOR AND ON BEHALF OF THE OFFICE OF D.S. DARKOWSKI MGR. MET. & Q.A. USS TUBULAR PRODUCTS

DATE 12/08/95

YOUNGQUIST BROTHERS, INC.

SUBMITTAL DATA FROM:

YOUNGQUIST BROTHERS, INC.

Project: Charlotte County Utilities - East Port Water Reclamation Facility Class I Test/Injection Well

I have reviewed this submittal for general conformance with the design concepts and contract documents. Generally no conflict with materials or dimensions will arise from the approval of this shop drawing submittal.

Item: Surface Casing - 30" x ..375 A139B Spiralweld

Shop Drawing No.: D-04000-003-A Date: 11/20/95

Section No.: 04000 Specific Sec: 1.04

Subcontractor: ______

By: [signature]

Submittal Package #: 10

Original: X

2nd: ______

15465 PINE RIDGE ROAD · FORT MYERS, FL 33908 · (813) 489-4444 · FAX (813) 489-3877

L. B. FOSTER COMPANY

STANDARD CERTIFIED TEST REPORT
TUBULAR PRODUCTS

CUSTOMER

Name: Youngquist Brothers, Inc.

Address: 15465 Pine Ridge Road

City & State: Fort Myers, Florida 33908

Date: November 27, 1995

Customer's Order No.: 101627

LBF Invoice No.: 56087

Material: FOSTERWELD

Grade: ASTM A139 Gr.B

Coil or Lot. No.	Size O.D.	Wt/Ft. or Wall Thick.	Min. Hydro. Test Pres. P.S.I.	MECHANICAL PROPERTIES			CHEMICAL ANALYSIS (%)				
				Yield Strength P.S.I. Point	Tensile Strength P.S.I.	Elong. In 2" %	C	Mn	P	S	Si
10630	30"	.375"	525	51,900	78,800	31.0	.23	.73	.009	.006	.008
10631	30"	.375"	525	53,500	80,500	31.0	.24	.76	.006	.008	.009
957591	30"	.375"	525	58,270	70,060	35.0	.07	.78	.014	.004	.090

Representing 60pcs at 50ft.

ALL MATERIALS USED IN THE MANUFACTURE OF THIS PIPE WERE 100% MELTED AND ROLLED IN THE "USA".

The undersigned, in behalf of The L. B. Foster Company, 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 characteristics for which no methods of inspecting or testing are prescribed by said specifications, the standard mill inspection and testing practices of The L. B. Foster Company have been applied. Unless it appears otherwise in the results of such inspection and tests shown above, the undersigned agent of The L. B. Foster Company believes that said materials conform to said specifications.

Subscribed and sworn to before me this 27 day of Nov 1995
Notary Public, State of West Virginia
Edward Amundsen
c/o L. B. Foster
Washington, WV 26181
My Commission Expires August 17, 2004

Robert E Blankensop (signature)

Robert E. Blankensop, Purchasing

Agents' Name & Title

L.B. Foster Company,Washington,WV

APPENDIX 3.3.2-2

INTERMEDIATE CASING JOINT LENGTHS

CHARLOTTE COUNTY EAST PORT WRF
INJECTION WELL #2 (CH-325)
30" DIAMETER CASING SUMMARY
INSTALLED JANUARY 6-7, 1996

Casing Joint #	Casing Joint Length (feet)	Cumulative String Length (feet)	Time Installed (Hours)
1	50.00	50.00	1345
2	50.00	100.00	1518
3	50.00	150.00	1610
4	50.00	200.00	1646
5	50.00	250.00	1730
6	50.00	300.00	1815
7	50.00	350.00	1855
8	50.00	400.00	1940
9	50.00	450.00	2025
10	50.00	500.00	2118
11	50.00	550.00	2215
12	50.00	600.00	2307
13	50.00	650.00	2355
14	50.00	700.00	0045
15	50.00	750.00	0136
16	50.00	800.00	0230
17	50.00	850.00	0339
18	50.00	900.00	0451
19	50.00	950.00	0555
20	50.00	1000.00	0732
21	50.00	1050.00	0847
22	50.00	1100.00	0940
23	50.00	1150.00	1026
24	50.00	1200.00	1115

CHARLOTTE COUNTY EAST PORT WRF
INJECTION WELL #2 (CH-325)
30" DIAMETER CASING SUMMARY
INSTALLED JANUARY 6-7, 1996
(Continued)

Casing Joint #	Casing Joint Length (feet)	Cumulative String Length (feet)	Time Installed (Hours)
25	50.00	1250.00	1210
26	50.00	1300.00	1303
27	50.00	1350.00	1342
28	50.00	1400.00	1419
29	529.00	1450.00	1457
30	50.00	1500.00	1531
31	50.00	1550.00	1610
32	50.00	1600.00	1649
33	50.00	1650.00[1]	1746

1. Casing string hung from 12 feet above pad level. Casing setting depth = 1638 feet bpl.

APPENDIX 3.3.2-4

GRAVEL OPERATIONS SUMMARY

VIROGROUP, INC.
CHARLOTTE CO. UTILITIES EAST PORT WRF IW-2
Permit No. UCO8-254545

GRAVEL OPERATIONS SUMMARY
Injection Well No. 2 (CH-325)

CASING DIAMETER: 30 INCH — CASING DEPTH: 1638 FEET BPL

GRAVEL LOAD NUMBER	NO. OF LOADS	CUBIC FEET PUMPED*	TAG DEPTH (FEET bls)	TAG DATE/ TIME	ANNULAR FILL (feet)	TOTAL CUBIC FEET PUMPED
1 - 4	4	324	1,509	1/16/96 0048 hrs	19	324
5 - 11	7	567	1,486	1/16/96 1055 hrs	23	891
Pumped Stage #17 Cement: 50 bbls neat (281 ft^3)						
12 - 18	7	567	1,500	1/16/96 1500 hrs	-14	1,458
19 - 27	9	729	1,496	1/17/96 1025 hrs	4	2,187
28 - 54	27	2,187	1,497	1/18/96 1215 hrs	-1	4,374
55 - 87	33	2,673	1,497	1/19/96 1015 hrs	0	7,047
88 - 178	91	7,371	1,425	1/22/96 1600 hrs	**	14,418
179 - 187	9	729	1,420	1/22/96 2025 hrs	**	15,147
Pumped Stage #18 Cement: 25 bbls neat (140 ft^3)						
188 - 201	14	1,134	1,485	1/23/96 0742 hrs	12	16,281
202 - 233	32	2,592	1,483	1/24/96 2045 hrs	2	18,873
234 - 249	16	1,296	1,473	1/25/96 0805 hrs	10	20,169
Pumped Stage #19 Cement: 50 bbls neat (281 ft^3)						
250 - 292	43	3,483	1,469	1/26/96	4	23,652

VIROGROUP, INC.
CHARLOTTE CO. UTILITIES EAST PORT WRF IW-2
Permit No. UCO8-254545

GRAVEL OPERATIONS SUMMARY
Injection Well No. 2 (CH-325)
(Continued)

CASING DIAMETER: 30 INCH — CASING DEPTH: 1638 FEET BPL

GRAVEL LOAD NUMBER	NO. OF LOADS	CUBIC FEET PUMPED*	TAG DEPTH (FEET bls)	TAG DATE/ TIME	ANNULAR FILL (feet)	TOTAL CUBIC FEET PUMPED
293 - 311	19	1,539	1,469	1/27/96 0151 hrs	0	25,191
312 - 320	9	729	1,454	1/27/96 0950 hrs	15	25,920
321 - 338	18	1,458	1,454	1/27/96 1945 hrs	0	27,378
339 - 363	25	2,025	1,443	1/28/96 0500 hrs	11	29,403
364 -378	15	1,215	1,441	1/28/96 1330 hrs	2	30,619
379 - 381	3	243	1,454***	1/28/96 2326 hrs	-13	30,862
Pumped Stage #20 Cement: 50 bbls neat (281 ft^3)						
382 - 401	20	1,620	1,441	1/29/96 1220 hrs	13	32,481
402 - 423	22	1,782	1,441	1/29/96 1900 hrs	0	34,264
424 - 452	29	2,349	1,431	1/30/96 1100 hrs	10	36,613
453 - 474	22	1,782	1,431	1/30/96 1825 hrs	0	38,395
475 - 502	28	2,268	1,426	1/31/96 0440 hrs	5	40,663
503 - 546	44	3,564	1,426	2/1/96 0028 hrs	0	44,227
547 - 588	42	3,402	1,426	2/2/96 0700 hrs	0	47,629

VIROGROUP, INC.
CHARLOTTE CO. UTILITIES EAST PORT WRF IW-2
Permit No. UCO8-254545

GRAVEL OPERATIONS SUMMARY
Injection Well No. 2 (CH-325)
(Continued)

CASING DIAMETER: 30 INCH — CASING DEPTH: 1638 FEET BPL

GRAVEL LOAD NUMBER	NO. OF LOADS	CUBIC FEET PUMPED*	TAG DEPTH (FEET bls)	TAG DATE/ TIME	ANNULAR FILL (feet)	TOTAL CUBIC FEET PUMPED
589 - 614	26	2,106	1,426	2/2/96 1450 hrs	0	49,735
615 - 704	90	7,290	1,426	2/3/96 1630 hrs	0	57,025
705 - 771	67	5,427	1,430	2/4/96 1240 hrs	-4	62,452
772 - 819	47	3,807	1,419	2/5/96 1200 hrs	11	66,339
820 - 842	23	1,863	1,421	2/5/96 1922 hrs	-2	68,202
843 - 886	44	3872	1418	2/6/96 0550 hrs	3	71,766
887 - 909	23	1863	1419	2/6/96 1215 hrs	-1	73,629
910 - 949	40	3240	1418	2/6/96 2247 hrs	1	76,869
950 - 1007	58	4698	1418	2/7/96 0800 hrs	0	81,567
1008 - 1060	53	4293	1418	2/7/96 1942 hrs	0	85,860
1061 - 1130	70	5670	1418	2/8/95 1742 hrs	0	91,530
1131 - 1168	38	3078	1412	2/9/95 0206 hrs	6	94,608
1169 - 1213	45	3645	1420	2/9/95 1045 hrs	-8	98,253
1214 - 1236	23	1863	1419	2/9/95 1754 hrs	1	100,116

VIROGROUP, INC.
CHARLOTTE CO. UTILITIES EAST PORT WRF IW-2
Permit No. UCO8-254545

GRAVEL OPERATIONS SUMMARY
Injection Well No. 2 (CH-325)
(Continued)

CASING DIAMETER: 30 INCH — CASING DEPTH: 1638 FEET BPL

GRAVEL LOAD NUMBER	NO. OF LOADS	CUBIC FEET PUMPED*	TAG DEPTH (FEET bls)	TAG DATE/ TIME	ANNULAR FILL (feet)	TOTAL CUBIC FEET PUMPED
1237 - 1269	33	2673	1417	2/10/95 0155 hrs	2	102,789
1270 - 1286	17	1377	1418	2/10/95 0835 hrs	-1	104,166
1287 - 1322	36	2916	1418	2/10/95 1716 hrs	0	107,082
1323 - 1361	39	3159	1418	2/11/95 0500 hrs	0	110,241
1362 - 1390	29	2349	1407	2/11/95 1355 hrs	11	112,590
1391 - 1410	20	1620	1406	2/11/95 1905 hrs	1	114,210
1411 - 1440	30	2430	1404	2/12/95 0020 hrs	2	116,640
1441 - 1471	31	2511	1404	2/12/95 0513 hrs	0	119,151
1472 - 1494	23	1863	1406	2/12/95 0935 hrs	-2	121,014
1495 - 1504	10	810	1408	2/12/95 1205 hrs	-2	121,824
1505 - 1551	47	3807	1405.5	2/12/95 2022 hrs	2.5	125,631
1552 - 1612	61	4941	1408	2/13/95 0740 hrs	-2.5	130,572
1613 - 1640	28	2268	1405	2/13/95 1435 hrs	3	132,840
1641 - 1719	79	6399	1402	2/14/95 0815 hrs	3	139,239

VIROGROUP, INC.
CHARLOTTE CO. UTILITIES EAST PORT WRF IW-2
Permit No. UCO8-254545

GRAVEL OPERATIONS SUMMARY
Injection Well No. 2 (CH-325)
(Continued)

CASING DIAMETER: 30 INCH — CASING DEPTH: 1638 FEET BPL

GRAVEL LOAD NUMBER	NO. OF LOADS	CUBIC FEET PUMPED*	TAG DEPTH (FEET bls)	TAG DATE/ TIME	ANNULAR FILL (feet)	TOTAL CUBIC FEET PUMPED
1720 - 1738	19	1539	1405	2/14/95 1438 hrs	-3	140,778
1739 - 1781	43	3483	1405	2/15/95 0207 hrs	0	144,261
1782 - 1803	22	1782	1399	2/15/95 0800 hrs	6	146,043
1804 - 1828	25	2025	1399	2/15/95 1429 hrs	0	148,068
1829 - 1863	35	2835	1392	2/15/96 2212 hrs	7	150,903
1864 - 1909	46	3726	1395	2/16/96 0736 hrs	-3	154,629
1910 - 1938	29	2349	1395	2/16/96 1351	0	156,978
1939 - 1966	28	2268	1395	2/16/96 1805 hrs	0	159,246
1967 - 2041	75	6075	1394	2/17/96 0858 hrs	1	165,321
2042 - 2048	7	567	1392	2/17/96 1846 hrs	2	165,888
2049 - 2108	60	4860	1390	2/18/96 0745 hrs	2	170,748
2109 - 2142	34	2754	1385	2/18/96 1815 hrs	5	173,502
2143 - 2200	58	4698	1385	2/19/96 0825 hrs	0	178,200
2201 - 2229	29	2349	1385	2/19/96 1518 hrs	0	180549

VIROGROUP, INC.
CHARLOTTE CO. UTILITIES EAST PORT WRF IW-2
Permit No. UCO8-254545

GRAVEL OPERATIONS SUMMARY
Injection Well No. 2 (CH-325)
(Continued)

CASING DIAMETER: 30 INCH — CASING DEPTH: 1638 FEET BPL

GRAVEL LOAD NUMBER	NO. OF LOADS	CUBIC FEET PUMPED*	TAG DEPTH (FEET bls)	TAG DATE/ TIME	ANNULAR FILL (feet)	TOTAL CUBIC FEET PUMPED
2230 - 2251	22	1782	1369	2/19/96 2047 hrs	13	182,331
2252 - 2256	5	405	1367	2/20/96 0054 hrs	2	182,736
2257 - 2265	9	729	1380	2/20/96 0745 hrs	-13	183,465
2266 - 2272	7	567	1290	2/20/96 1040 hrs	90	184,032
Pumped stage #21 cement: 7 bbls neat (39 ft^3)						
2273 - 2280	8	648	1291	2/21/96 0306 hrs	99****	184,680
Pumped stage #22 cement: 10 bbls neat (56.15 ft^3) Ended gravel operations 2/21/96						

* - Based on an estimated loader bucket volume of 81 cubic feet.
** - False tag.
*** - Tag depth following pumping cement stage.
****- Gravel tagged at 1390 feet following pumping Stage #21 cement.

APPENDIX 3.3.2-5

SWFWMD PERMITS TO DRILL WELLS

APPLICATION TO CONSTRUCT, REPAIR, MODIFY OR ABANDON WELL
SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
2379 Broad St., Brooksville, Florida 34609-6899, (904) 796-7211

Permit No. 573131.02
Stipulations Required #8
17-524 Well
WUP Application No.
196270
Owner Number

ABOVE THIS LINE FOR OFFICIAL USE ONLY

1. Charlotte Co Utilities — 20101 Peachland Blvd — Port Charlotte — 33954 — 764-7100
Owner, Legal Name of Entity if Corporation / Address / Zip / Telephone Number

2. 3700 Loveland Blvd Port Charlotte
Well Location: Address, Road Name or Number

3. Youngquist Bros. Inc. — 10/20/95 — 2172
Drilling Contractor / Date / License No.

15465, Pine Ridge Rd, Ft. Myers, FL 33908
Address / City / State / Zip Code

4. Number of Wells: 2 Check the Use of the Well:

___ Domestic ___ Irrigation ___ Livestock ___ Test (WUP)
___ Public Water Supply ___ Heat Pump/AC Supply ___ Industrial X Monitor (Type) PAD
___ Recovery ___ Class V, Heat Pump/AC Return ___ Class I Injection Well ___ Other ______

5. Application for:
X New Construction
___ Repair/Modify
___ Abandonment

6. Casing X or Liner ___ (Check One)
___ Black Steel ___ Galvanized X PVC ______ Other (Specify)
2" Diameter
grout Seal Material (Specify)

7. Method of Construction: ___ Rotary ___ Cable Tool ___ Combination ___ Auger ______ Other

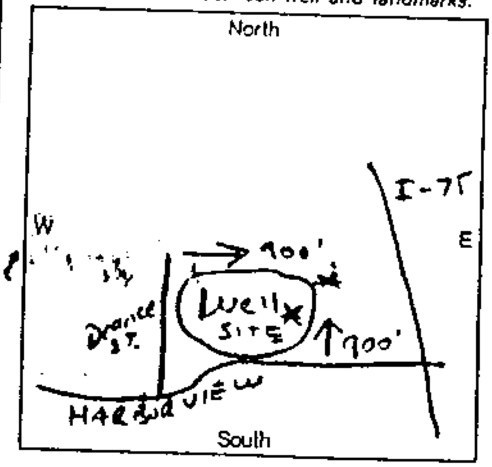
8. Charlotte — 20 40S 23E — ______ — ______ — ______
County / Subdivision Name / Lot / Block / Unit

9. Quarter Quarter Section SE SW (Indicate Well in Chart) NW NE SW SE

10. Section 20 Township 40S Range 23E

11. On 6-inch wells & larger:
26° 58 min 26 sec N — 82° 2 min 17 sec W
Latitude / Longitude

Draw map of well location and indicate well site with an "X". Identify known roads and landmarks; provide distances between well and landmarks.



12. I hereby certify that I will comply with the rules of Chapter 40-D-3, Florida Administrative Code, and that a water use permit or artificial recharge permit, if needed, has or will be obtained prior to commencement of well construction. I further certify that all information provided on this application is accurate and that I will obtain necessary approval from other federal, state, or local governments, if applicable. I agree to provide a well completion report to the District within 30 days after drilling operations cease.

[signature], 2172
Signature of Contractor / License No.

13. Is this well or any other well or water withdrawal on the owner's contiguous property covered under a Water Use Permit (WUP) or WUP application?

Yes ___ No X If yes, provide WUP No. unknown

I certify that I am the owner of the property, that the information provided on well location is accurate, and that I am aware of my responsibilities under Chapter 373, Florida Statutes, to maintain or properly abandon this well; or, I certify that I am the agent for the owner, that the information provided is accurate, and that I have informed the owner of his responsibilities as stated above.

[signature] agent contractor
Owner or Agent's Signature

DO NOT WRITE BELOW THIS LINE — FOR OFFICIAL USE ONLY

Granted by: Eric Eikum Title: Prof. Geo. Date: 10-25-95

Owner Number: ______ Fee Received $: 50.00 Receipt No.: 56008 Check No.: 1406

THIS PERMIT NOT VALID UNTIL PROPERLY SIGNED BY AN AUTHORIZED OFFICER OF SWFWMD(R). IT SHALL BE AVAILABLE AT THE WELL SITE DURING ALL DRILLING OPERATIONS.

SF 306 (3) REV 8/90

DRILLING CONTRACTOR COPY — 2

APPLICATION TO CONSTRUCT, REPAIR, MODIFY OR ABANDON WELL

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

2379 Broad St., Brooksville, Florida 34609-6899, (904) 796-7211

Permit No. 573132.01

Stipulations Required #17

17-524 Well

WUP Application No.

196270 Owner Number

ABOVE THIS LINE-FOR OFFICIAL USE ONLY

1. Charlotte Co. Utilities 25101 Peachland Blvd. Pt. Charlotte FL 33954 351-7100
Owner: Legal Name of Entity if Corporation — Address — Zip — Telephone Number

2. 7700 Loveland Pt. Charlotte FL
Well Location: Address, Road Name or Number

3. Youngquist Brothers Inc. 10-20-95 2172
Drilling Contractor — Date — License No.

15465 Pine Ridge Rd. Ft Myers FL 33908
Address — City — State — Zip Code

4. Number of Wells: 1 . Check the Use of the Well:

___ Domestic ___ Irrigation ___ Livestock ___ Test (WUP)
___ Public Water Supply ___ Heat Pump/AC Supply ___ Industrial ___ Monitor (Type)
___ Recovery ___ Class V, Heat Pump/AC Return ___ Class I Injection Well ___ Other Temporary Construction

5. Application for:
✓ New Construction
___ Repair/Modify
___ Abandonment

6. Casing ___ or Liner ___ (Check One)
___ Black Steel ✓ PVC 4" Diameter
___ Galvanized ___ Other (Specify) ___ Seal Material (Specify)

7. Method of Construction: ✓ Rotary ___ Cable Tool ___ Combination ___ Auger ___ Other

8. Charlotte — 20 40S 23E
County — Subdivision Name — Lot — Block — Unit

[Qu]arter Quarter Section SE SW (Indicate Well in Chart)

NW NE SW SE

10. Section 20 Township 40S Range 23E

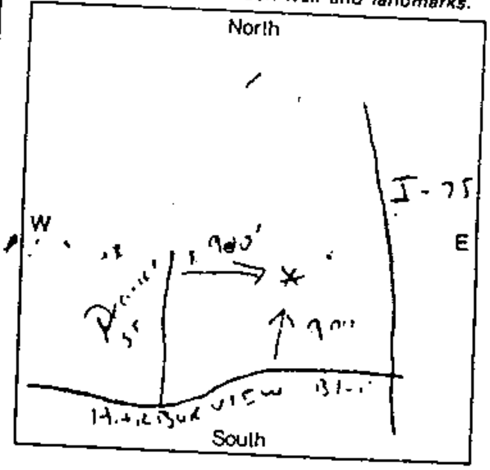
11. On 6-inch wells & larger:

26° 58min 26sec N — 82° 2min 17sec W
Latitude — Longitude

12. I hereby certify that I will comply with the rules of Chapter 40-D-3, Florida Administrative Code, and that a water use permit or artificial recharge permit, if needed, has or will be obtained prior to commencement of well construction. I further certify that all information provided on this application is accurate and that I will obtain necessary approval from other federal, state, or local governments, if applicable. I agree to provide a well completion report to the District within 30 days after drilling operations cease.

Signature of Contractor — 2172 License No.

Draw map of well location and indicate well site with an "X". Identify known roads and landmarks; provide distances between well and landmarks.



13. Is this well or any other well or water withdrawal on the owner's contiguous property covered under a Water Use Permit (WUP) or WUP application?

Yes ___ No X If yes, provide WUP No. Unknown

I certify that I am the owner of the property, that the information provided on well location is accurate, and that I am aware of my responsibilities under Chapter 373, Florida Statutes, to maintain or properly abandon this well; or, I certify that I am the agent for the owner, that the information provided is accurate, and that I have informed the owner of his responsibilities as stated above.

Owner or Agent's Signature — agent contractor

DO NOT WRITE BELOW THIS LINE — FOR OFFICIAL USE ONLY

Granted by: Eric [illegible] Title: Prof. Geo. Date: 10-25-95

[Ord]er Number: Fee Received $: 50.00 Receipt No.: [illegible] Check No.: 1966

THIS PERMIT NOT VALID UNTIL PROPERLY SIGNED BY AN AUTHORIZED OFFICER OF SWFWMD(R). IT SHALL BE AVAILABLE AT THE WELL SITE DURING ALL DRILLING OPERATIONS.

SF 306 (3) REV 4/90

DRILLING CONTRACTOR COPY — 2

APPLICATION TO CONSTRUCT, REPAIR, MODIFY OR ABANDON WELL

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

2379 Broad Street, Brooksville, FL 34609-6899 Ph: (904) 796-7211

573128.01
Permit No. #25
Stipulations Required
17-524 Well
WUP Application No.
196272
Owner No.

ABOVE THIS LINE — FOR OFFICIAL USE ONLY

1. Charlotte Co. Utilities — [illegible] Peachland Blvd. — Pt. Charlotte — FL 33981 — 351-7150
Owner, Legal Name of Entity If Corporation — Address — City — Zip — Telephone Number

2. 3900 Loveland Pt. Charlotte FL.
Well Location — Address, Road Name or Number, City, Zip

3. Youngquist Brothers, Inc. — 10-20-95 — 2172
Drilling Contractor — Date — License No.

15465 Pine Ridge Rd
Address

Ft. Myers — FL. — 33908
City — State — Zip

4. **Number of Wells:** 1 *Check the Use of Well:*

___ Domestic
___ Public Water Supply
___ Recovery
___ Irrigation
___ Heat Pump/AC Supply
___ Class V Heat Pump/AC Return
___ Livestock
___ Industrial
✓ Class I Injection Well
___ Test (WUP)
___ Monitor (type: ___)
___ Other (___)

5. **Application for:**
✓ New Construction
___ Repair/Modify
___ Abandonment

6. **Casing** ✓ **or Liner** ___ (check one)
✓ Black Steel
___ Galvanized
___ PVC
___ Other (specify: ___)
Seal Material: Type II Grout
Diameter: 20" x 3000'

7. **Method of Construction:** ✓ Rotary ___ Cable Tool ___ Combination ___ Auger ___ Other (specify: ___)

Charlotte
County — Subdivision Name — Lot — Block — Unit

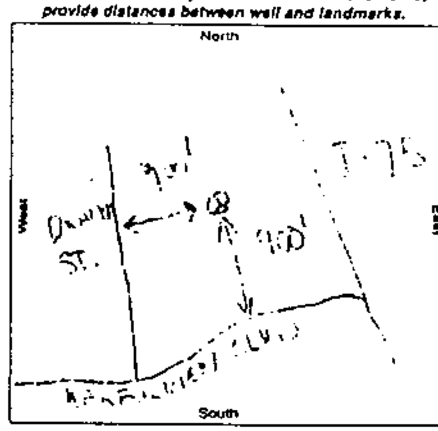
9. **Quarter Quarter Section** SE SW (Indicate Well On Chart)

10. **Section** 20 **Township** 40S **Range** 23E

11. **On 6-Inch Wells or Larger:**
26° 58 min 56 sec N — 82° 2 min 17 sec W.
Latitude — Longitude

NW NE SW SE

Draw a map of well location and indicate well site with an "X." Identify known roads and landmarks; provide distances between well and landmarks.



12. *I hereby certify that I will comply with the rules of Chapter 40-D-3, Florida Administrative Code, and that a water use permit or artificial recharge permit, if needed, has been or will be obtained prior to commencement of well construction. I further certify that all information provided on this application is accurate and that I will obtain necessary approval from other federal, state, or local governments, if applicable. I agree to provide a well completion report to the District within 30 days after drilling operations cease.*

Signature of Contractor — 2172 License No.

13. *Is this well or any other well or water withdrawal on the owner's contiguous property covered under a Water Use Permit (WUP) or WUP Application?* ___ Yes X No

If Yes, provide WUP No. ___ *Well I.D. No.* ___

I certify that I am the owner of the property, that the information provided on well location is accurate, and that I am aware of my responsibilities under Chapter 373, Florida Statutes, to maintain or properly abandon this well; or, I certify that I am the agent for the owner, that the information provided is accurate, and that I have informed the owner of his responsibilities as stated above.

Agent [illegible]
Owner or Agent's Signature

DO NOT WRITE BELOW THIS LINE — FOR OFFICIAL USE ONLY

Granted By: Eric Eldon Title: Prof. Geo. Date: 10-25-95

Owner Number: ___ Fee Received: $ 50.00 Receipt No.: [illegible] Check No.: [illegible]

THIS PERMIT NOT VALID UNTIL PROPERLY SIGNED BY AN OFFICER OF SWFWMD(R). IT SHALL BE AVAILABLE AT THE WELL SITE DURING ALL DRILLING OPERATIONS.

WHITE: SWFWMD FILE COPY
YELLOW: DRILLING CONTRACTOR COPY/1
PINK: DRILLING CONTRACTOR COPY/2

APPENDIX 3.3.3-1

LONG STRING CASING MILL CERTIFICATES

SAGINAW PIPE

Huta Batory

Chorzów

ATEST HUTNICZY No 30/EA/93

CERTIFICAT DE L'USINE — WORKS-CERTIFICATE — WERKS-ATTEST — СЕРТИФИКАТ

Zamawiający
Le client — Ordered by — Besteller — Заказчик

Stalexport - Katowice

Adres wysyłkowy
Adresse — Address — Versandadresse — Адрес получателя

Nr i data zamówienia klienta / No et date de la commande / Order No and date / No und Datum der Bestellung	Nr zlecenia / Ordre No / Order No / Auftrag No	Nr awizu / Avis No / Advice No / Versandanzeige No	Nr wagonu / Wagon No / Car No / Wagen No
PL/000025939/63-1055	4230506/93	85004	

Wyszczególnienie zamówienia
Specification de la commande — Order Specification — Spezifikation der Bestellung — Спецификация заказа

Poz.	Przedmiot i wykonanie (stan obr. termiczn., mech. itp.) / Article et l'execution / Item and specification (heat and mechanical treatment etc.) / Gegenstand und Ausführung	Wymiar lub rysunek / Dimension ou dessin / Dimension or drawing / Abmessung oder Zeichnung	Marka / Marque / Steel type / Marke	Wytop / Coulée / Heat / Abstich	Sztuk / Pieces / Stück	mb / m. ml. / m. mtr.	Theoret. weight kg
	Seamless steel pipes acc.to ASTM-A106 revision 89, outside diameter tolerances acc to ASTM-A53 revision 82 Grade B, bevelled ends acc.to DIN 2559/22. Outside surface double stearin lacquered.	pos. 1 ø 20"x0,500"x 11-12,5m /500x12,7mm/	B	13782	6	71,67	11117

INSTCO NYK LTD 3969/NEW HAVEN

Kontrola techniczna powyższego zamówienia przeprowadził Oddział Technicznej Kontroli. Wyniki badań podano niżej
Le contrôle technique de la commande a été exécuté par le Service de Contrôle. Les résultats des essais sont indiqués ci-après.
The technical investigation of this order has been executed by the Works Control. Results of tests are as follows.
Die technische Prüfung obiger Bestellung wurde von der Prüfabteilung durchgeführt. Die Ergebnisse der Proben sind nachstehend angegeben.

SKŁAD CHEMICZNY — ANALYSE CHIMIQUE — CHEMICAL COMPOSITION — CHEMISCHE ZUSAMMENSETZUNG — ХИМИЧЕСКИЙ СОСТАВ

Marka / Marque / Steel type / Marke	Wytop / Coulée / Heat / Abstich	C	Mn	Si	P	S	Cr	Ni	V	Mo	Cu
B	13782	0,45	0,63	0,21	0,012	0,019	0,11	0,08	trace	0,02	0,12

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS CERTIFIED TEST REPORT

(TYPE B - IN ACCORDANCE WITH ISO 10474 / EN 10204 / DIN50049)

DATE: 01/11/95
TIME: 06:31:57

USX

USS, USX, USX are trademarks of USX Corporation

MILL ORDER/ITEM NO.	SHIPPERS NO.	PO NUMBER	VEHICLE I.D.
D3125K6 05		95-14727	

SOLD TO ADDRESS	MAIL TO ADDRESS	VENDOR
		USS TUBULAR PRODUCTS 1807 EAST 28TH ST. LORAIN, OH 44055

SPECIFICATION AND GRADE

PIPE CARBON SMLS STD PIPE API 5L--41ST EDITION DTD 4/1/95 GRADE B AND GRADE X42 ASTM A53-*93A ASTM A106-*94 GRADE B DUAD STENCIL ASME SA53--*1992 EDITION 1994 ADDENDUM ASME SA106--*1992 EDITION 1994 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 REG MILL COAT PE BEV 30 DEG MEETING ALL THE APPLICABLE REQUIREMENTS OF NACE STANDARD MR-01-75

MATERIAL COND: AS ROLLED — OD: 20.000 (508.0(*)) (MM) — WALL: 0.500 (12.700) (MM)

PRODUCT IDENTIFICATION	TENSILE 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	[illegible]
				MIN 42000 / MAX		MIN 60000 / MAX	MAX	MIN 29.5	MIN / MAX 100.0	1890	5
BOB142	STRIP/T/B	AR	1.500	46700	.50	71000	0.65	45.0	B 83.0	1890	5

** END OF DATA THIS SHEET **

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

PRODUCT IDENTIFICATION	TYPE	C	MN	P	S	SI	CU	NI	CR	MO	AL	N	V	B	TI	CB	CA			CE MAX .40
BOB142	HEAT	.17	.[illegible]	.006	.003	.2[illegible]	.01	.02	.04	.01			.00[illegible]							.4[illegible]
BOB142	PROD	.16	.[illegible]	.007	.011	.2[illegible]	[illegible]	.03	.04	.01			.00[illegible]							.3[illegible]
BOB142	PROD	.17	.[illegible]	.007	.01[illegible]	[illegible]	[illegible]	.03	.05	.01			.00[illegible]							.3[illegible]

** END OF DATA THIS SHEET **

[illegible]

SEAMLESS PIPE

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS
CERTIFIED TEST REPORT
(TYPE B - IN ACCORDANCE WITH ISO 10474 / EN10204 / DIN50049)

DATE: 01/11/96
TIME: 0?:31:57

USX

USS, USX, UEX are trademarks of USX Corporation

MILL ORDER/ITEM NO.	SHIPPERS NO.	PO NUMBER
DS32540 08		95-14727

MATERIAL COND: AS ROLLED

OD: 20.000(508.000) 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.	TMP	SIZE	TEST COND.	FT LBS 1	FT LBS 2	FT LBS 3	FT LBS AVG	% SHEAR 1	% SHEAR 2	% SHEAR 3	% SHEAR AVG
~~B06L42~~	~~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		
FULL LENGTH EMI	X	
FULL LENGTH MPI	X	OD _X_ ID/OD ___ L _X_ L/T ___
FULL LENGTH UT		
END AREA INSPECTION (PLAIN END)		OD ___ ID/OD ___ 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 ABOVE ... SAMPLED, TESTED AND/OR INSPECTED IN ACCORDANCE ... REQUIREMENTS IN SUCH RESPECTS

LONE STAR / N SAGINAW PIPE

APPENDIX 3.3.3-2

LONG STRING CASING JOINT LENGTHS

CHARLOTTE COUNTY EAST PORT WRF INJECTION WELL N0. 2 (CH-325) 20" DIAMETER CASING TALLY INSTALLED MARCH 21-23, 1996			
CASING JOINT #	CASING JOINT LENGTH (feet)	CUMULATIVE STRING LENGTH (feet)	TIME JOINT INSTALLED (hours)
1	29.20	29.20	1805
2	41.50	70.70	1900
3	41.50	112.20	2000
4	41.50	153.70	2040
5	41.50	195.20	2125
6	41.50	236.70	2200
7	41.50	278.20	2251
8	41.50	319.70	2328
9	43.22	362.92	0013
10	40.90	403.82	0100
11	41.80	445.62	0144
12	42.70	488.32	0224
13	40.50	528.82	0303
14	38.30	567.12	0346
15	42.10	609.22	0439
16	41.90	651.12	0535
17	42.00	693.12	0611
18	42.50	735.62	0655
19	40.35	775.97	0740
20	42.40	818.37	0825
21	42.45	860.82	0905
22	39.70	900.52	0945
23	40.30	940.82	1020
24	41.60	982.42	1105
25	43.00	1025.42	1148
26	42.90	1068.32	1225

CHARLOTTE COUNTY EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)
20" DIAMETER CASING TALLY
INSTALLED MARCH 21-23, 1996

CASING JOINT #	CASING JOINT LENGTH (feet)	CUMULATIVE STRING LENGTH (feet)	TIME JOINT INSTALLED (hours)
27	41.50	1109.82	1258
28	42.65	1152.47	1340
29	43.20	1195.67	1418
30	41.80	1237.47	1506
31	41.80	1279.27	1558
32	42.20	1321.47	1639
33	41.50	1362.97	1718
34	42.80	1405.77	1811
35	42.20	1447.97	1849
36	42.30	1490.27	1931
37	41.50	1531.77	2024
38	43.40	1575.17	2110
39	42.90	1618.07	2154
40	42.40	1660.47	2233
41	43.35	1703.82	2315
42	40.90	1744.72	2351
43	39.90	1784.62	0031
44	43.30	1827.92	0104
45	43.00	1870.92	0145
46	41.80	1912.72	0225
47	41.50	1954.22	0302
48	42.20	1996.42	0337
49	42.50	2038.92	0410
50	41.00	2079.92	0445
51	41.70	2121.62	0522
52	40.60	2162.22	0556

CHARLOTTE COUNTY EAST PORT WRF
INJECTION WELL NO. 2 (CH-325)
20" DIAMETER CASING TALLY
INSTALLED MARCH 21-23, 1995

CASING JOINT #	CASING JOINT LENGTH (feet)	CUMULATIVE STRING LENGTH (feet)	TIME JOINT INSTALLED (hours)
53	42.40	2204.62	0632
54	43.40	2248.02	0708
55	36.30	2284.32	0751
56	37.80	2322.12	0837
57	42.20	2364.32	0925
58	40.70	2405.02	1014
59	41.50	2446.52	1107
60	42.80	2489.32	1150
61	42.50	2531.82	1305
62	42.30	2574.12	1350
63	36.60	2610.72	1425
64	36.20	2646.92	1502
65	40.60	2687.52	1548
66	40.00	2727.52	1630
67	42.20	2769.72	1714
68	42.80	2812.52	1809
69	40.50	2853.02	1855
70	42.80	2895.82	1942
71	42.50	2938.32	2029
72	40.20	2978.52[1]	2150

1. Casing string hung from 13.5 feet above pad level. Casing setting depth = 2965 feet below pad level.

APPENDIX 4.4-1

LABORATORY CORE TEST RESULTS

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

July 11, 1996
File Number 96-072

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

JUL 1 5 1996

Attention: Mr. Paul Polokoff
Drilling Superintendent

Subject: Laboratory Test Results on Rock Core Specimens, Charlotte County Utilities, East Port Injection Well No. 2

Gentlemen:

Permeability, unconfined compression and specific gravity tests have been completed on 14 rock core samples provided by your firm from the Charlotte County Utilities East Port Injection Well No. 2. 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 constant-head (Method A) and falling-head (Method C) test methods. The unconfined compression tests were performed in general accordance with ASTM Standard D 2938 "Unconfined Compressive Strength of Intact Rock Core Specimens". The specific gravity was determined in general accordance with ASTM Standard D 854 "Specific Gravity of Soils".

Permeability Tests

The permeability test results are presented in Table 1. Separate vertically and horizontally oriented permeability test specimens were obtained from 5 of the 14 core samples (from depths of 2048, 2049, 2300.6, 2308 and 2806.6 feet). The other 9 core samples were used for either vertical permeability test specimens or horizontal permeability test specimens in accordance with the instructions provided with the samples. Seven of the vertical permeability tests were performed on specimens maintained at the as-received core diameter. The remaining three vertical permeability tests and all of the horizontal permeability tests were performed on specimens cored to diameters of 3.28 to 5.10 cm.

Each permeability test specimen was mounted in a triaxial-type permeameter and encased within a latex membrane. The testing program was started using an average isotropic effective confining stress of 20 lb/in^2, but was subsequently modified, as requested by the project geologist, to use a higher confining stress of 65 lb/in^2. After completion of permeability testing using the requested confining stress, permeability measurements were also made using an average isotropic effective confining stress of 20 lb/in^2 to determine the effect of the different confining stresses on the measured coefficients of permeability. The specimens tested using a confining stress of 20 lb/in^2 displayed coefficients of permeability generally equal to or somewhat greater than measured using a confining stress of 65 lb/in^2. The B-factor, however, was always greater using a confining stress of 20 lb/in^2 because of the higher backpressure.

All specimens were permeated with deaired water under backpressure. 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 coefficient of permeability 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 the coefficient of permeability were measured. The final degree of saturation was calculated upon completion of testing using the final dry mass, moisture content and volume, and the measured specific gravity. Although some of the calculated final degrees of saturation are low, the B-factors indicate satisfactory saturation. The calculated final degree of saturation is potentially affected by occluded voids within the specimens and/or surface irregularities, and the use of final moisture contents for some vertical permeability test specimens from the corresponding horizontal permeability test specimens.

Specific Gravity Tests

The specific gravity of each sample was determined on a representative approximately 100 gram specimen ground to pass the U.S. Standard No. 40 sieve. The specific gravities measured on each core sample are presented in Table 1.

Porosity

The porosity of each permeability test specimen was calculated using the dry density and measured specific gravity. The calculated porosities are presented in Table 1.

Unconfined Compression Tests

Due to the short lengths of the cores, unconfined compression tests could be performed on only 10 of the 14 core samples. The compressive strength and Young's modulus determined from the unconfined compression tests are summarized in Table 2. The stress-strain curves are presented in Figures 1 through 10. The unconfined compression tests were performed on 3.26 to 5.11 cm diameter specimens cored from the 10 cm diameter samples. The specimens were cut to a length of about twice the diameter whenever possible, and capped with a sulfur capping compound. The specimens were loaded at constant rates of deformation of 0.005 to 0.020 cm/minute as listed in Table 2. The Young's modulus was calculated using the slope of the straight-line portion of the stress-strain curve.

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.
Geotechnical Engineer

Thomas S. Ingra

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

TSI/jo
B:\96-072.001

Table 1

PERMEABILITY TEST RESULTS
CHARLOTTE COUNTY UTILITIES EAST PORT INJECTION WELL NO. 2

Sample Depth Interval (feet)	Test Specimen Orientation	G_s	D-5084 Test Method*	Initial Conditions: Length (cm)	Diameter (cm)	w_c (%)	γ_d (lb/ft³)	n	$\bar{\sigma}_c$ (lb/in²)	u_b (lb/in²)	B Factor (%)	Range of Hydraulic Gradient	Final Conditions: w_c (%)	γ_d (lb/ft³)	S (%)	Coefficient of Permeability (cm/sec)
2048.0-2049.0	V H	2.87	C A	6.79 5.71	10.13 5.11	0.1 0.2	168.9 172.3	0.06 0.04	20 20	80 163	87** 99	0.9-4.1 101-173	0.3 0.4	168.9 172.3	14 29	3.0×10^{-4} 3.1×10^{-9}
2049.0-2050.0	V H	2.82	A A	9.18 7.52	10.14 5.11	0.1 0.3	169.6 169.8	0.04 0.04	20 20	169 167	93** 90**	3.1-9.7 20-59	0.6 0.7	169.6 169.8	45 54	7.8×10^{-5} 2.5×10^{-6}
2053.3-2053.7	V	2.76	A	6.41	3.26	--	--	--	65	110	85**	305-319	††	--	--	9.8×10^{-6}
2053.7-2054.0	H	2.76	A	7.28	5.10	4.0	115.4	0.33	20	170	81**	1.9-12.9	16.5	115.4	92	3.0×10^{-4}
2300.6-2301.3	V H	2.70	A A	9.29 6.95	9.56 5.10	-- 6.0	141.2 144.5	0.16 0.14	65 20 65 20	110 165 110 165	79** 94** 82** 97	215-219 66-76 296-300 98-100	6.1† 6.1	141.2 144.5	85 99	6.9×10^{-8} 9.6×10^{-8} 1.7×10^{-7} 1.8×10^{-7}
2304.2-2304.6	H	2.70	A	7.61	5.09	3.2	124.6	0.26	65	110	99	266-269	12.9	124.6	99	2.7×10^{-8}
2304.6-2305.2	V	2.70	A	8.27	5.10	--	122.8	0.27	65	110	95	240-245	13.5	122.8	98	1.3×10^{-8}
2305.2-2305.5	V	2.69	A	9.17	9.39	--	--	--	65 20	110 165	89** 98	215-223 63-78	††	--	--	6.2×10^{-7} 6.1×10^{-7}

Where: G_s = Specific gravity; w_c = Moisture content; γ_d = Dry density; n = Porosity calculated from equation $n = 1 - (\gamma_d / G_s \gamma_w)$ where γ_w = Unit weight of water; $\bar{\sigma}_c$ = Average isotropic effective confining stress; u_b = Backpressure; and S = Calculated degree of saturation.

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

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

† Vertical permeability test specimen was subsequently used for unconfined compression test specimen. Accordingly, the final moisture content of the vertically oriented permeability test specimen was not measured, and was assumed to be the same as the horizontal test specimen.

†† Vertical permeability test specimen was subsequently used for unconfined compression test specimen. Accordingly, a final moisture content measurement after permeability testing was not made.

Table 1 (Continued)

PERMEABILITY TEST RESULTS
CHARLOTTE COUNTY UTILITIES EAST PORT INJECTION WELL NO. 2

Sample Depth Interval (feet)	Test Specimen Orientation	G_s	D-5084 Test Method*	Initial Conditions: Length (cm)	Initial Conditions: Diameter (cm)	Initial Conditions: w_c (%)	Initial Conditions: γ_d (lb/ft³)	Initial Conditions: n	$\bar{\sigma}_c$ (lb/in²)	u_b (lb/in²)	B Factor (%)	Range of Hydraulic Gradient	Final Conditions: w_c (%)	Final Conditions: γ_d (lb/ft³)	Final Conditions: S (%)	Coefficient of Permeability (cm/sec)
2308.0-2309.0	V	2.69	A	7.59	3.28	0.3	120.6	0.28	65	110	93**	260-273	14.4	120.6	99	$8.2x10^{-6}$
	H		A	6.15	3.28	2.2	123.0	0.27	65 20	110 165	90** 98	320-334 102-112	13.3	123.0	98	$2.5x10^{-6}$ $2.6x10^{-6}$
2806.6-2807.3	V	2.78	A	7.78	10.04	0.2	161.8	0.07	65 20	110 165	70** 97	242-260 90-98	2.4†	161.8	92	$5.2x10^{-10}$ $1.6x10^{-9}$
	H		A	7.77	5.10	0.4	162.6	0.06	65 20	110 165	94** 97	259-262 67-84	2.4	162.6	100	$5.2x10^{-7}$ $5.0x10^{-7}$
2808.2-2808.5	H	2.83	A	7.15	5.11	–	144.9	0.18	65	110	95	281-288	7.4	144.9	96	$8.6x10^{-6}$
2808.5-2809.0	V	2.80	A	7.04	9.80	–	–	–	65	110	93**	265-285	††	–	–	$2.3x10^{-8}$
2810.5-2811.0	H	2.84	A	5.82	3.28	0.9	169.2	0.05	65	110	98	359-360	1.6	169.2	96	$5.5x10^{-10}$
2811.0-2811.4	V	2.81	C†††	6.50	9.51	--	--	--	65	35	--	61-83	††	–	–	$1.3x10^{-10}$

Where: G_s = Specific gravity; w_c = Moisture content; γ_d = Dry density; n = Porosity calculated from equation $n = 1 - (\gamma_d / G_s \gamma_w)$ where γ_w = Unit weight of water; $\bar{\sigma}_c$ = Average isotropic effective confining stress; u_b = Backpressure; and S = Calculated degree of saturation.

* Method A = Constant-head test; Method C = Falling-head test with increasing tailwater level.
** B-Factor remained relatively constant for two consecutive increments of applied cell pressure.
† Vertical permeability test specimen was subsequently used for unconfined compression test specimen. Accordingly, the final moisture content of the vertically oriented permeability test specimen was not measured, and was assumed to be the same as the horizontal test specimen.
†† Vertical permeability test specimen was subsequently used for unconfined compression test specimen. Accordingly, a final moisture content measurement after permeability testing was not made.
††† Falling-head test method performed using a constant-volume type permeability test apparatus because of the very low coefficient of permeability.

Youngquist Brothers, Inc.
File Number 96-072
July 11, 1996

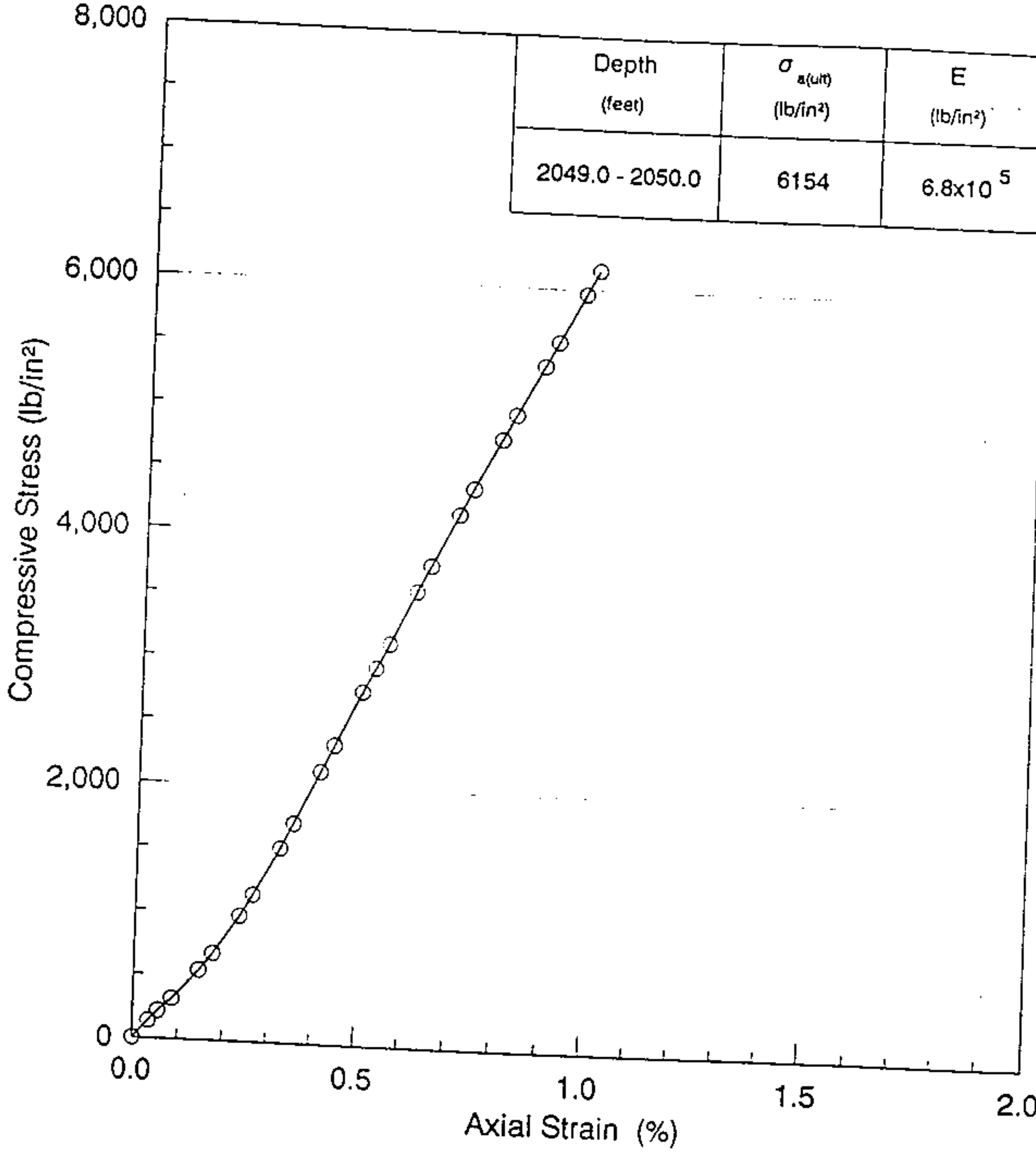
Table 2

UNCONFINED COMPRESSION TEST RESULTS
CHARLOTTE COUNTY UTILITIES EAST PORT INJECTION WELL NO. 2

Sample Depth Interval (feet)	Initial Conditions					$\dot{\varepsilon}$ (cm/minute)	Unconfined Compressive Strength, $\sigma_{a(ult)}$ (lb/in²)		Young's Modulus, E (lb/in²)**
	Height H (cm)	Diameter D (cm)	H/D	w_c (%)	γ_d (lb/ft³)		Measured	Corrected*	
2049.0-2050.0	8.64	5.10	1.7	0.1	171.7	0.0076	6154	6026	6.8x10⁵
2053.3-2053.7	6.42	3.26	2.0	10.8	127.8	0.0076	4744	–	6.3x10⁵
2300.6-2301.3	9.25	5.10	1.8	5.9	142.7	0.0050	5442	5370	5.3x10⁵
2304.6-2305.2	8.85	5.10	1.7	0.2	120.3	0.0076	4154	4068	4.6x10⁵
2305.2-2305.5	9.16	5.10	1.8	9.8	132.1	0.0076	4457	4398	5.3x10⁵
2308.0-2309.0	6.27	3.28	1.9	0.1	120.8	0.0076	3175	3155	5.2x10⁵
2806.0-2807.3	7.72	5.11	1.5	1.7	163.3	0.0076	8334	8022	5.6x10⁵
2808.5-2809.0	6.97	5.11	1.4	4.2	152.9	0.0076	6054	5733	5.4x10⁵
2810.5-2811.0	9.29	5.10	1.8	0.2	170.0	0.020	17,683	17,450	7.8x10⁵
2811.0-2811.4	6.49	5.11	1.3	1.2	168.1	0.0076	11,177	10,498	5.3x10⁵

Where: w_c = Moisture content; γ_d = Dry density; and $\dot{\varepsilon}$ = Displacement rate.

* Unconfined compressive strength corrected for H/D of less than 2 according to ASTM D 2938-86.
** Young's modulus calculated from the slope of the straight-line portion of the stress-strain curve.



Depth (feet)	$\sigma_{a(ult)}$ (lb/in²)	E (lb/in²)
2049.0 - 2050.0	6154	$6.8x10^5$

UNCONFINED COMPRESSION TEST

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

CHARLOTTE COUNTY UTILITIES
EAST PORT INJECTION WELL NO. 2
YOUNGQUIST BROTHERS, INC.

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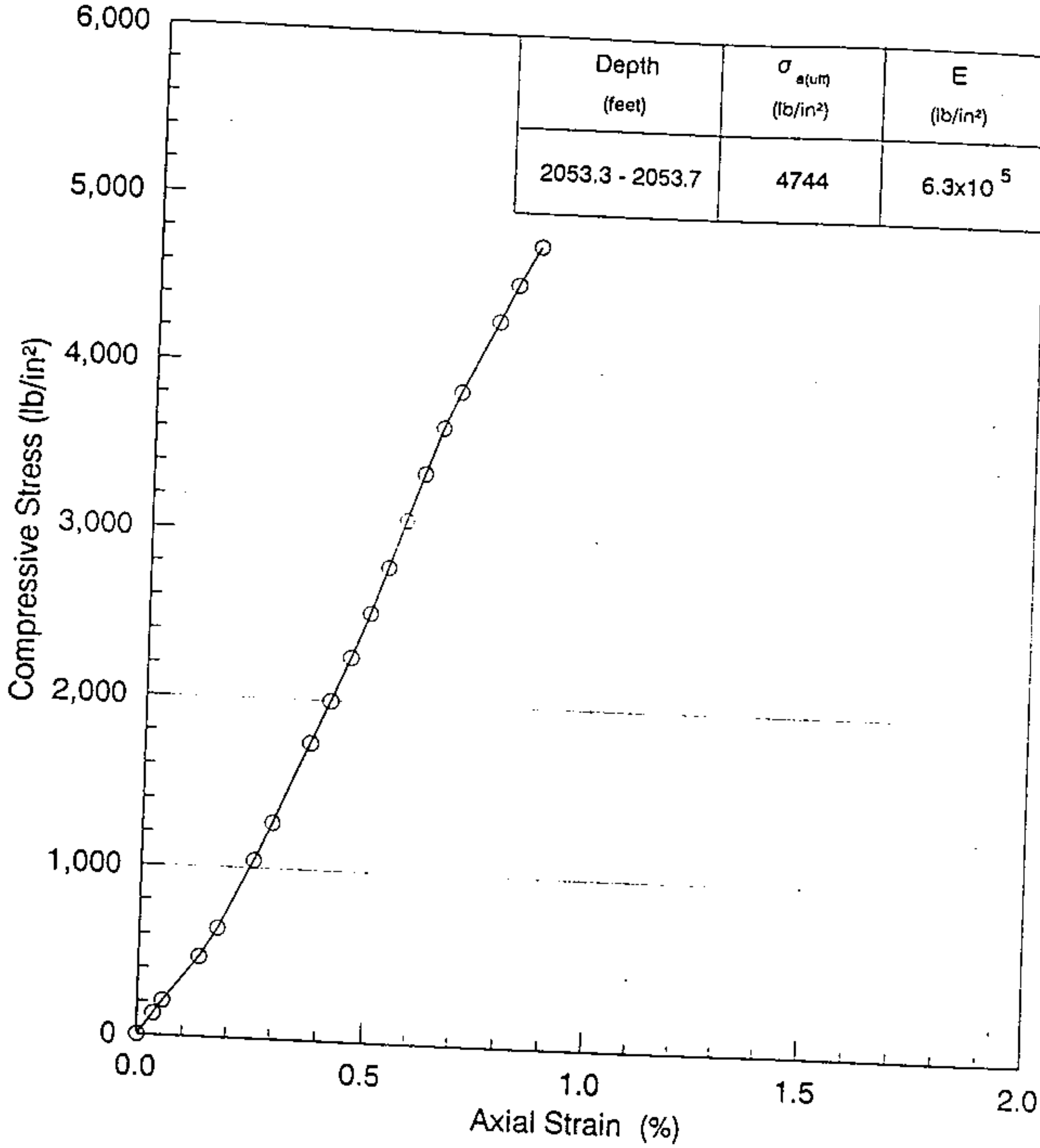
FILE NO.: 96-072	APPROVED BY: [signature]		FIGURE: 1



Depth (feet)	$\sigma_{a(ult)}$ (lb/in²)	E (lb/in²)
2053.3 - 2053.7	4744	6.3×10^5

UNCONFINED COMPRESSION TEST

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CHARLOTTE COUNTY UTILITIES
EAST PORT INJECTION WELL NO. 2
YOUNGQUIST BROTHERS, INC.

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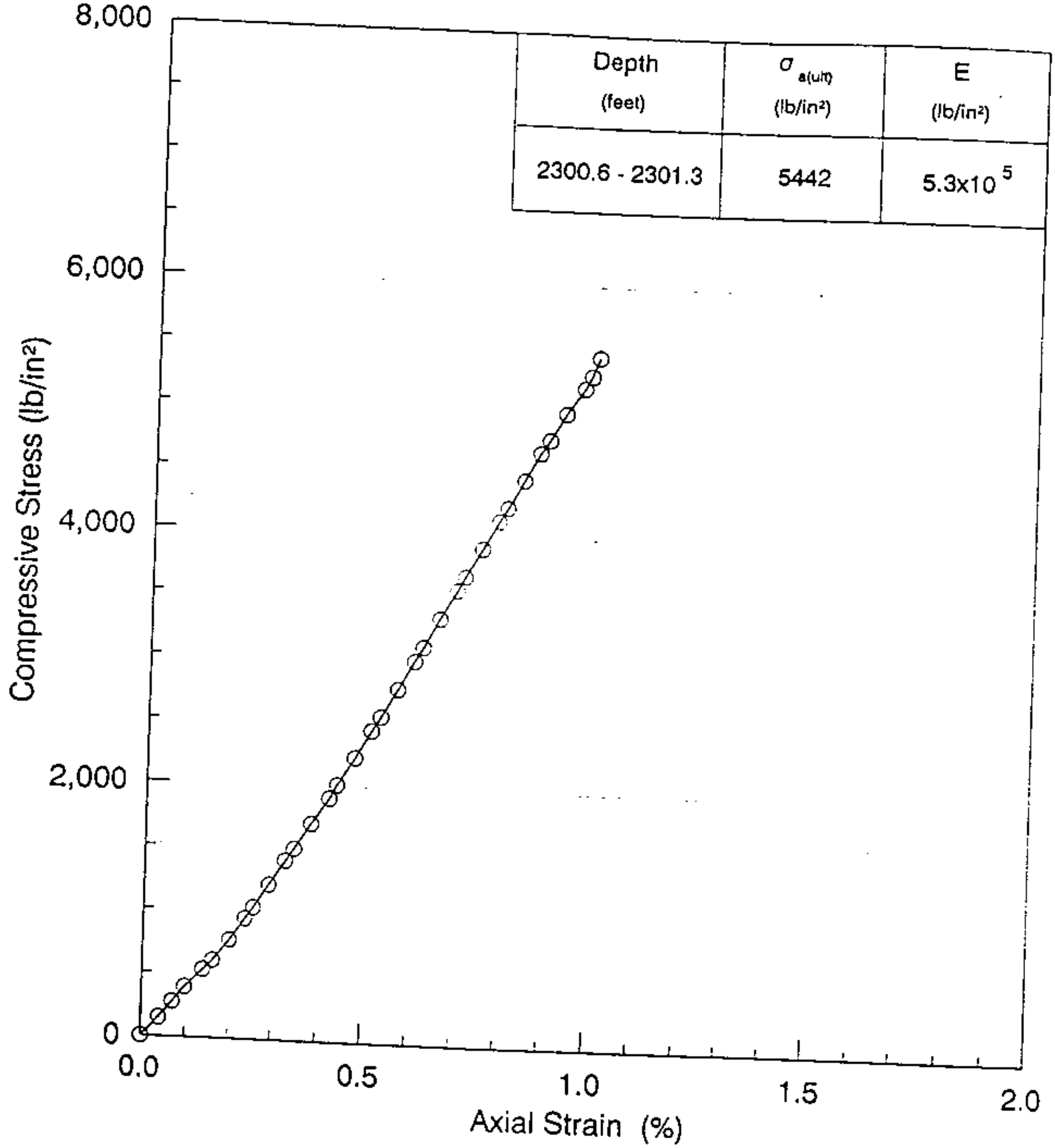
FILE NO.: 96-072	APPROVED BY:	FIGURE: 2



Depth (feet)	$\sigma_{a(ult)}$ (lb/in²)	E (lb/in²)
2300.6 - 2301.3	5442	5.3×10^5

UNCONFINED COMPRESSION TEST

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CHARLOTTE COUNTY UTILITIES
EAST PORT INJECTION WELL NO. 2
YOUNGQUIST BROTHERS, INC.

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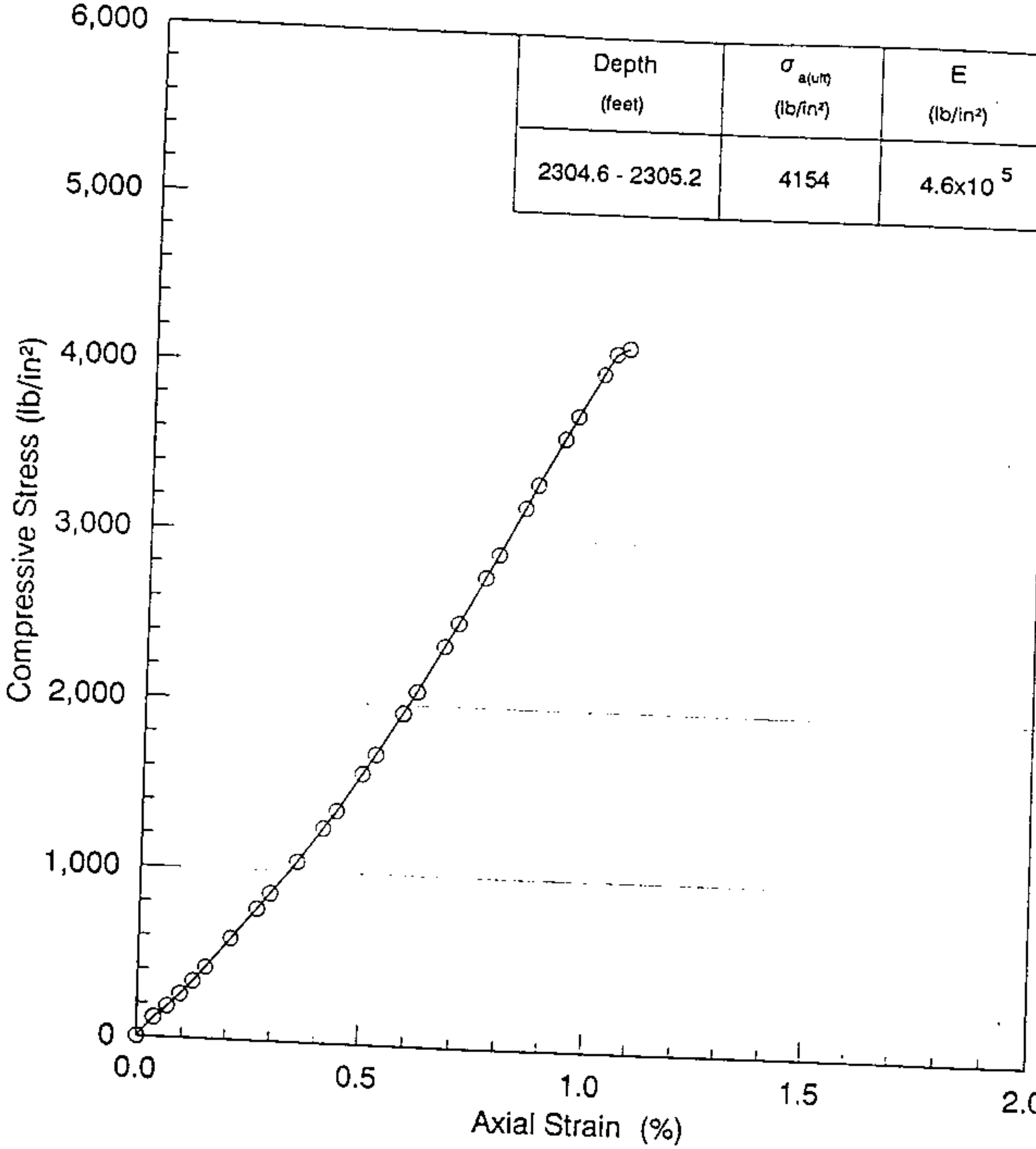
FILE NO.: 96-072 | APPROVED BY: | FIGURE: 3



Depth (feet)	$\sigma_{a(ult)}$ (lb/in²)	E (lb/in²)
2304.6 - 2305.2	4154	4.6×10^5

UNCONFINED COMPRESSION TEST

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CHARLOTTE COUNTY UTILITIES
EAST PORT INJECTION WELL NO. 2
YOUNGQUIST BROTHERS, INC.

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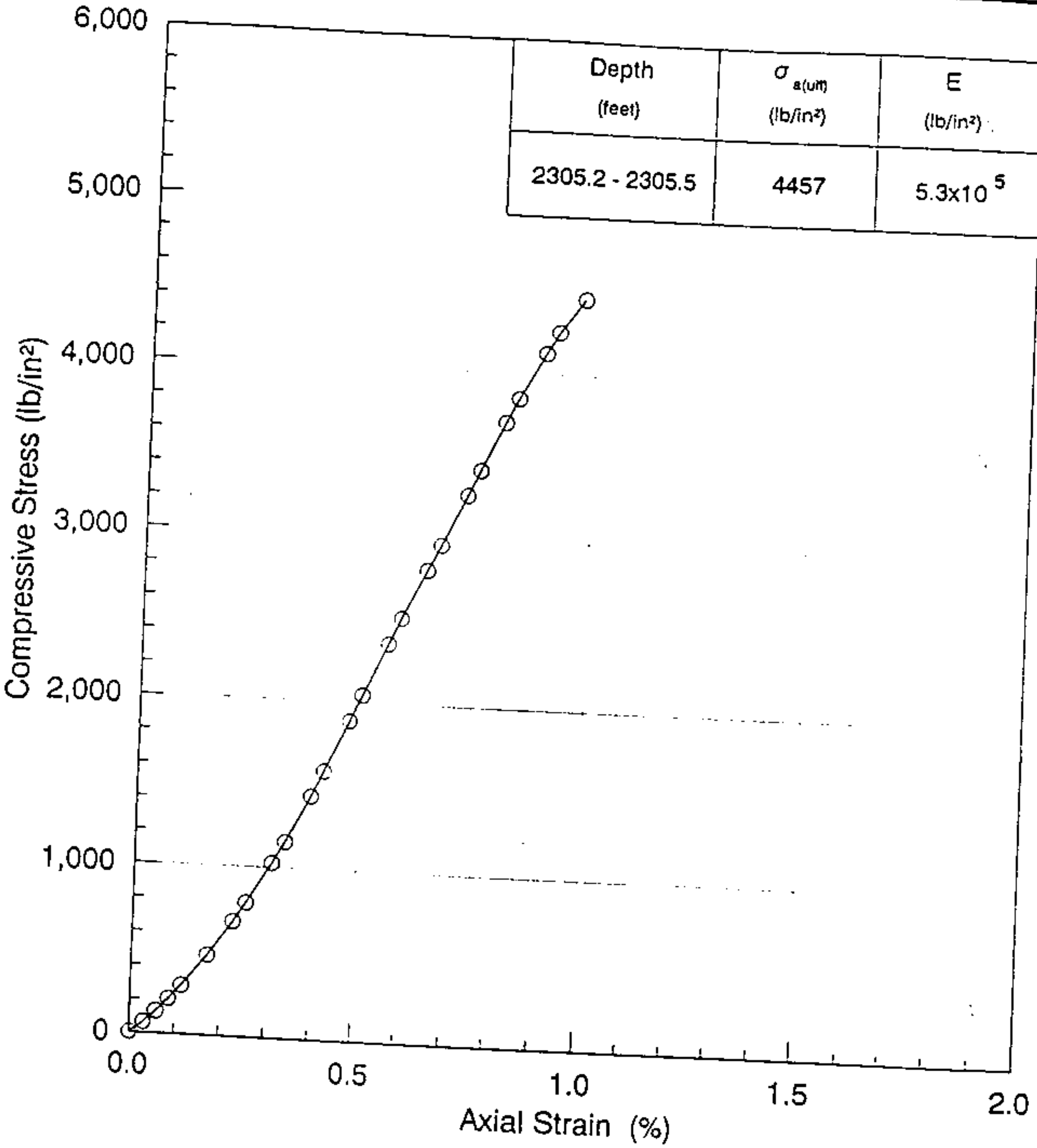
FILE NO.: 96-072	APPROVED BY: [signature]		FIGURE: 4



Depth (feet)	$\sigma_{a(ult)}$ (lb/in²)	E (lb/in²)
2305.2 - 2305.5	4457	5.3×10^5

UNCONFINED COMPRESSION TEST

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YOUNGQUIST BROTHERS, INC.

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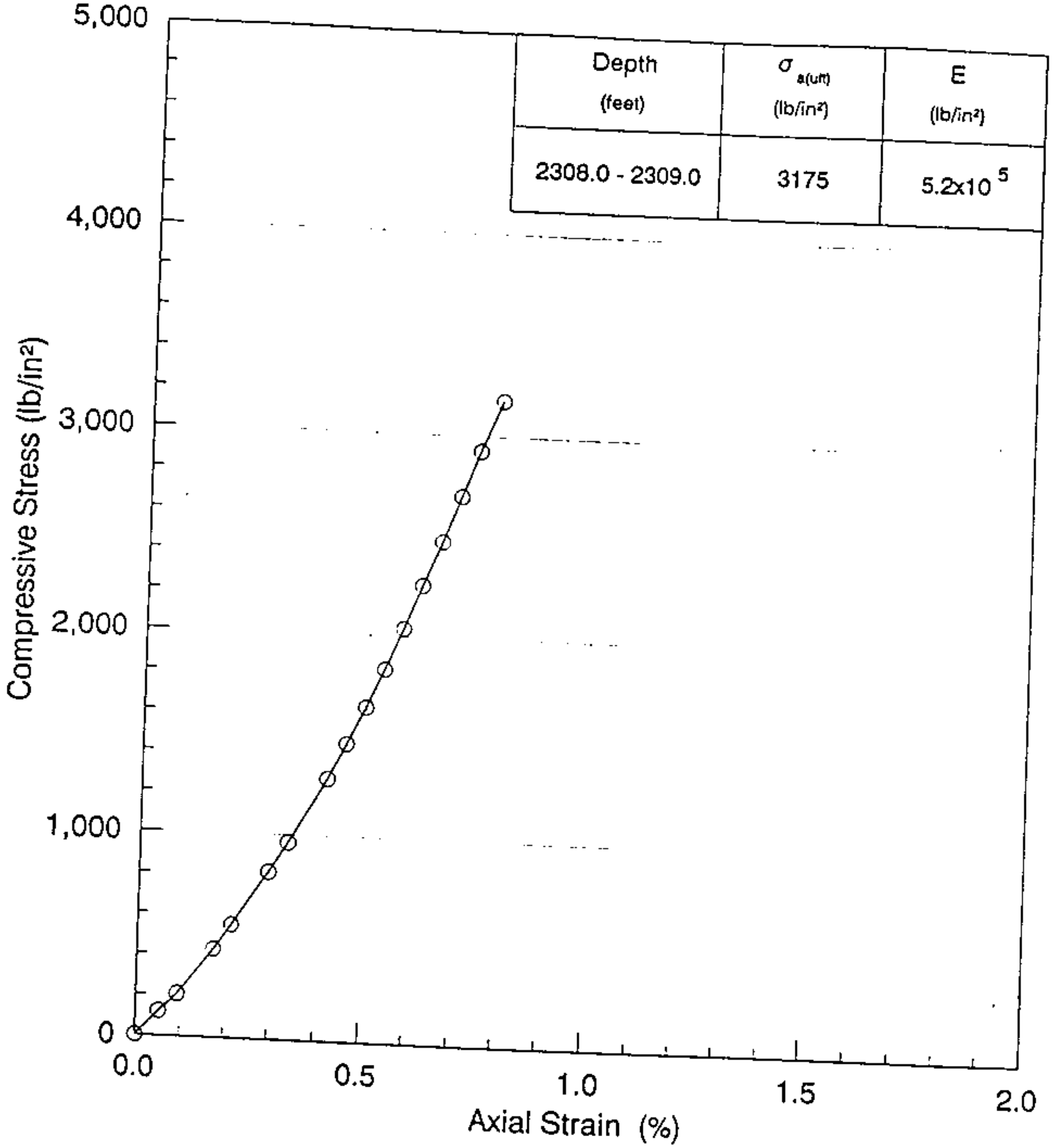
FILE NO.: 96-072	APPROVED BY:		FIGURE: 5



UNCONFINED COMPRESSION TEST

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CHARLOTTE COUNTY UTILITIES
EAST PORT INJECTION WELL NO. 2
YOUNGQUIST BROTHERS, INC.

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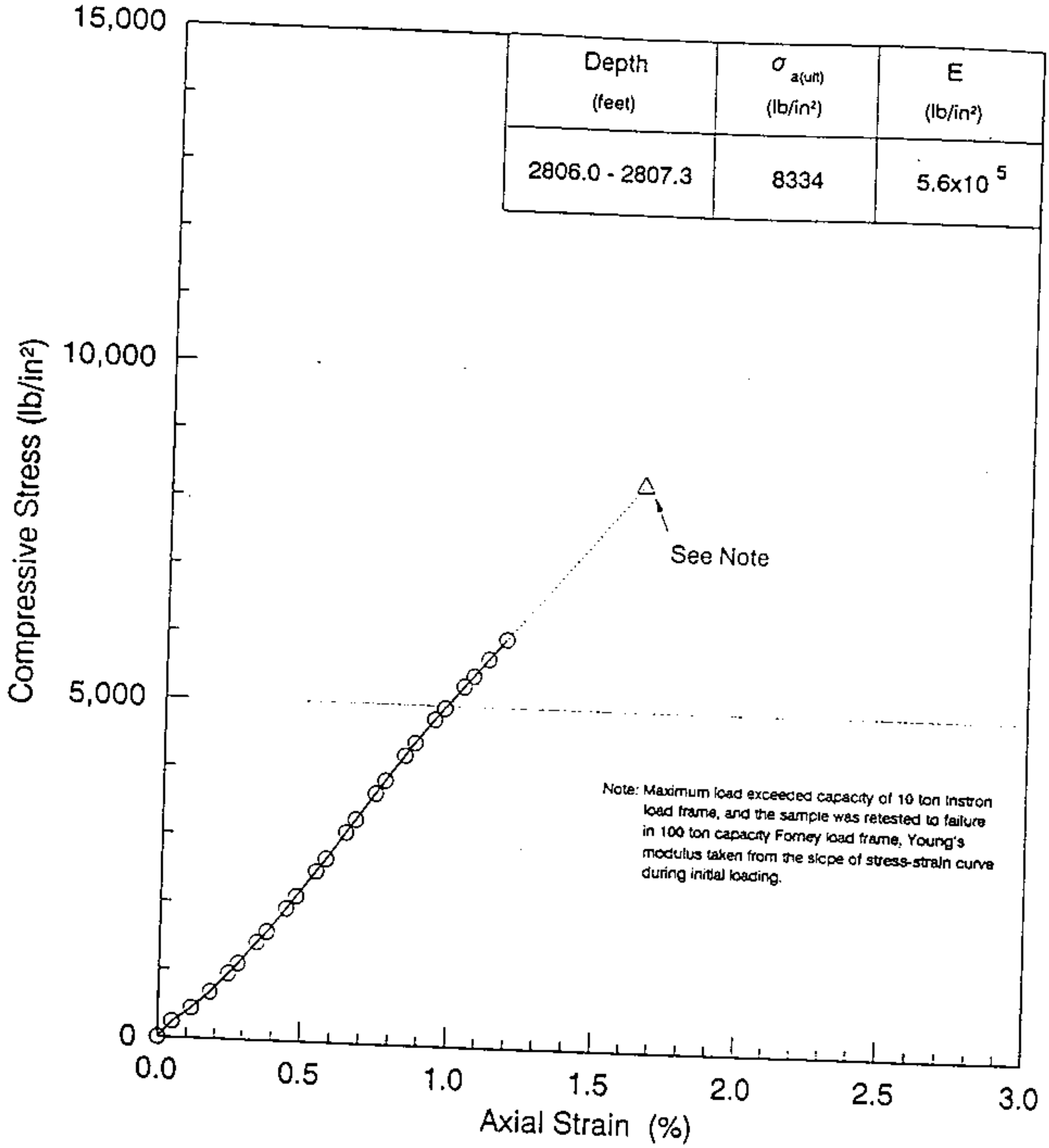
FILE NO.: 96-072	APPROVED BY:	FIGURE: 6



Depth (feet)	$\sigma_{a(ult)}$ (lb/in²)	E (lb/in²)
2806.0 - 2807.3	8334	5.6×10^5

Note: Maximum load exceeded capacity of 10 ton Instron load frame, and the sample was retested to failure in 100 ton capacity Forney load frame. Young's modulus taken from the slope of stress-strain curve during initial loading.

UNCONFINED COMPRESSION TEST

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CHARLOTTE COUNTY UTILITIES
EAST PORT INJECTION WELL NO. 2
YOUNGQUIST BROTHERS, INC.

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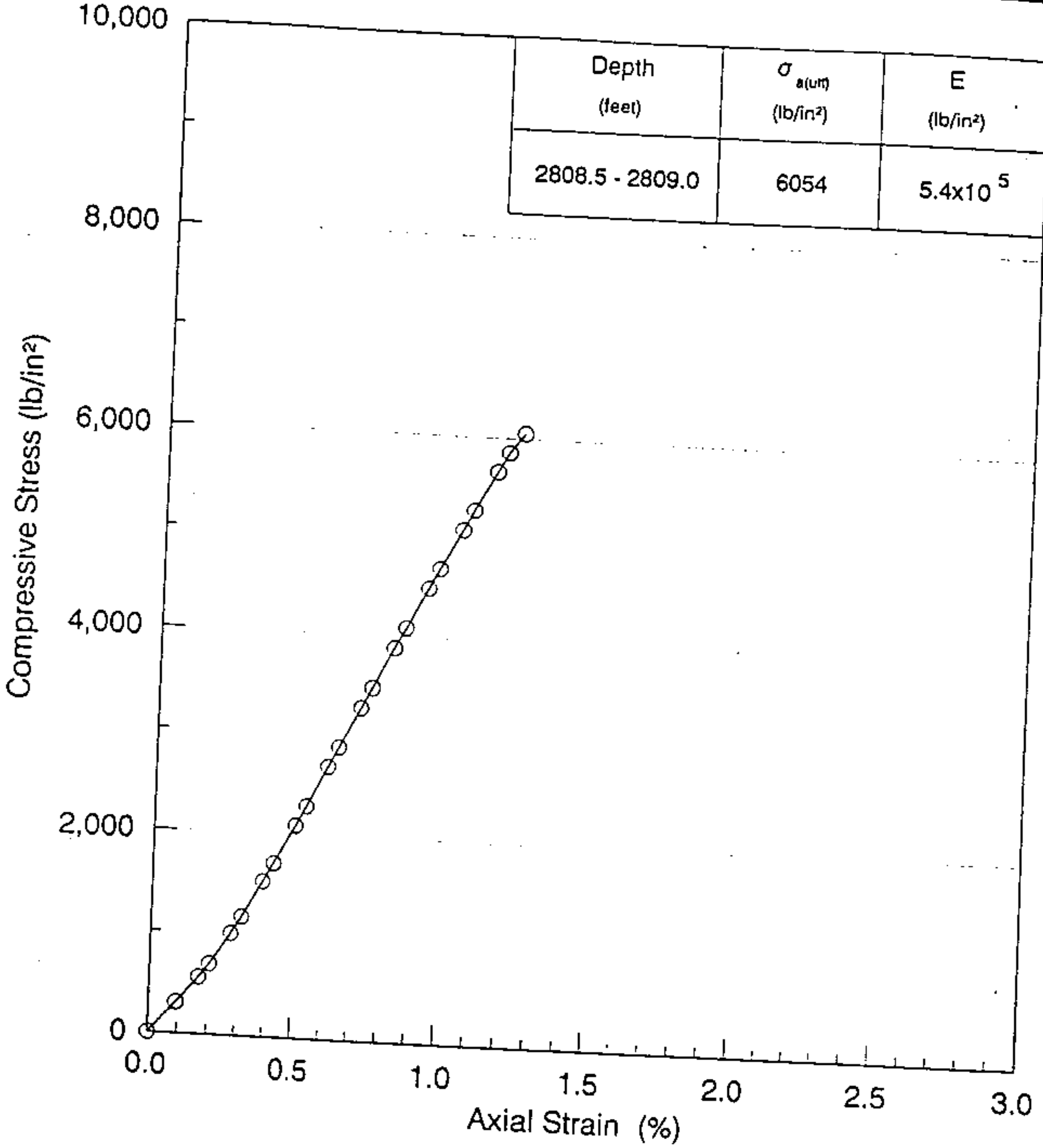

Depth (feet)	$\sigma_{a(ult)}$ (lb/in²)	E (lb/in²)
2808.5 - 2809.0	6054	5.4×10^5

UNCONFINED COMPRESSION TEST

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CHARLOTTE COUNTY UTILITIES
EAST PORT INJECTION WELL NO. 2
YOUNGQUIST BROTHERS, INC.

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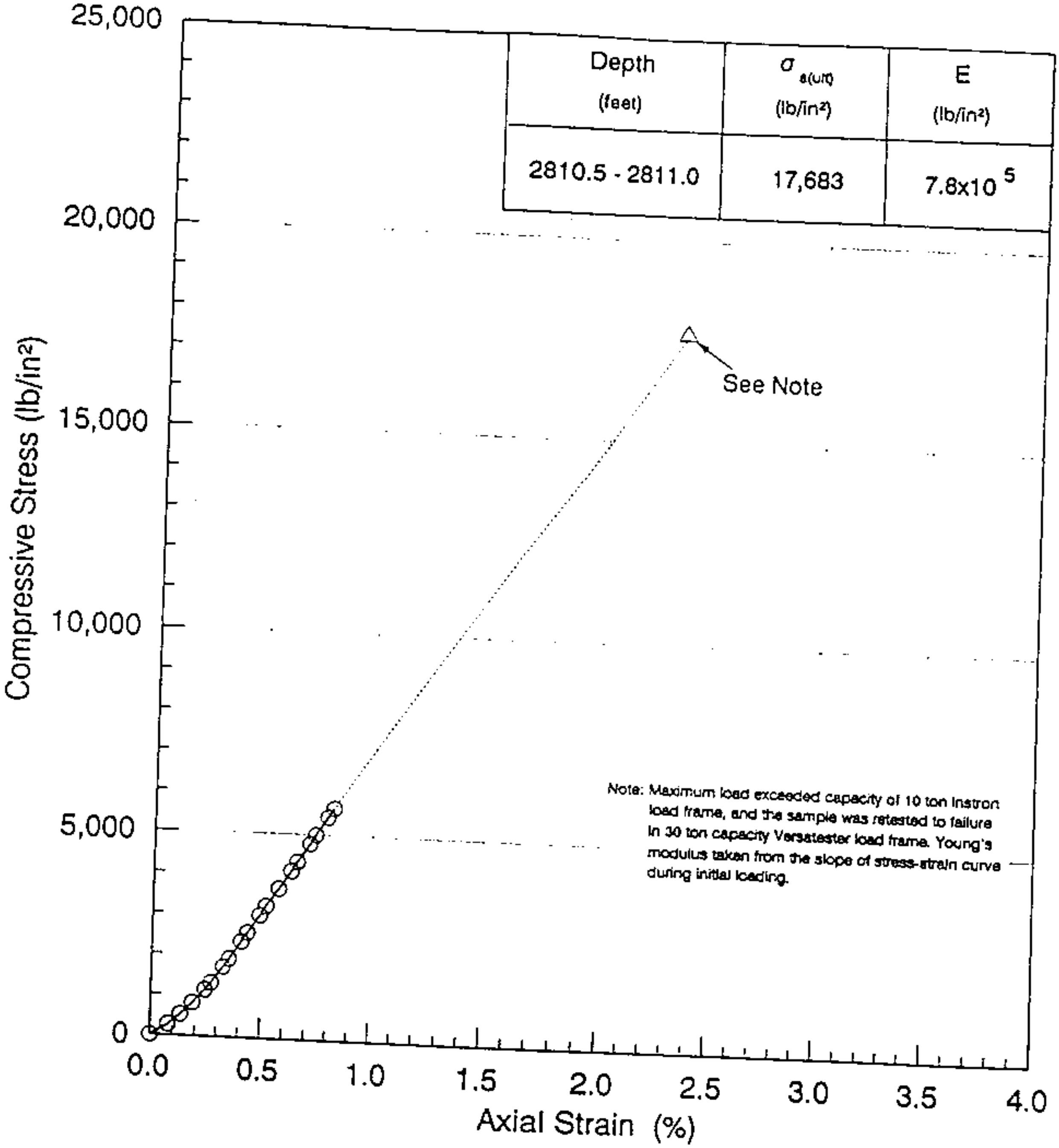
FILE NO.: 96-072	APPROVED BY:	FIGURE: 8



Depth (feet)	$\sigma_{a(ult)}$ (lb/in²)	E (lb/in²)
2810.5 - 2811.0	17,683	7.8×10^{5}

UNCONFINED COMPRESSION TEST

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CHARLOTTE COUNTY UTILITIES
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YOUNGQUIST BROTHERS, INC.

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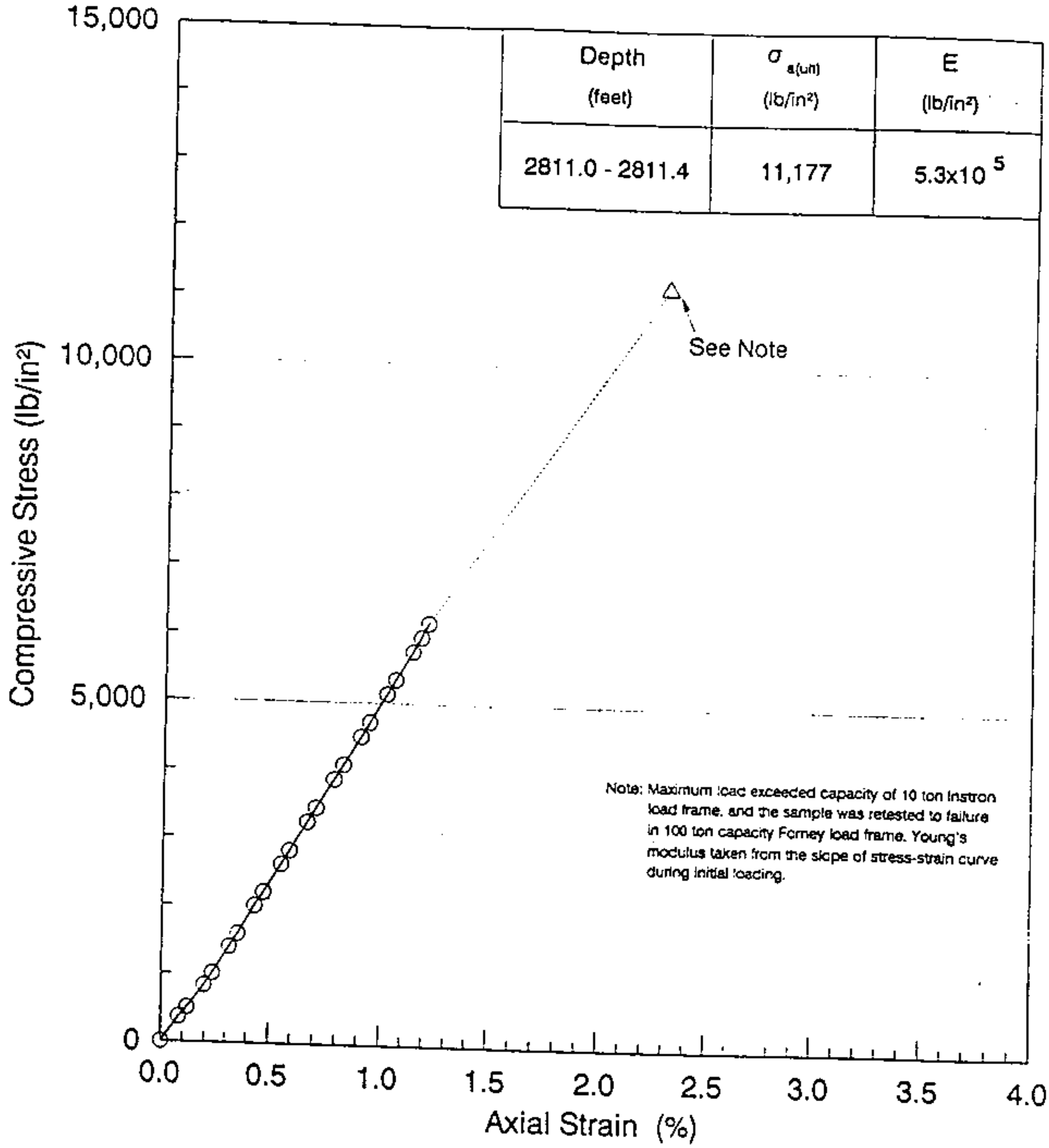
FILE NO.: 96-072	APPROVED BY: [signature]	FIGURE: 9



Depth (feet)	$\sigma_{a(ult)}$ (lb/in²)	E (lb/in²)
2811.0 - 2811.4	11,177	5.3×10^5

UNCONFINED COMPRESSION TEST

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EAST PORT INJECTION WELL NO. 2
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FILE NO.: 96-072	APPROVED BY: [signature]	FIGURE: 10