ARCADIS
Infrastructure, environment, facilities

ARCADIS U.S., Inc.
2081 Vista Parkway
West Palm Beach
Florida 33411
Tel 561.697.7000
Fax 561.697.7751

Transmittal Letter

To:
James Alexander, P.G.
FDEP, UIC Program
2600 Blair Stone Road, MS 3530
Tallahassee, FL 32399-2400
(850) 245-8655

Copies:
David Rhodes – FDEP
Art Dacre - FGUA

Florida License Numbers

Engineering
EB00007917

Geology
GB564

Landscape Architecture
LC26000269

Surveying
LB7062

From:
Rod Miller

Date:
November 20, 2008

Subject:
Golden Gate Injection Well System
Construction and Testing Report

ARCADIS Project No.:
WF004200.G015

We are sending you:

☐ **Attached** ☐ **Under Separate Cover Via** _____ **the Following Items:**

☐ Shop Drawings ☐ Plans ☐ Specifications ☐ Change Order
☐ Prints ☐ Samples ☐ Copy of Letter ☒ Reports
☐ Other:

Copies	Date	Drawing No.	Rev.	Description	Action*
1	11/20/08			Construction and Testing Summary Report	F
1	11/20/08			Borehole Televiewer Log (IW1)	F
1	11/20/08			Volume II MW1 and IW1 Geophysical Logs	F

RECEIVED
NOV 25 2008
UIC PROGRAM

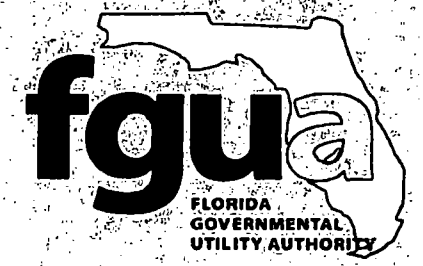
Action*
☐ A Approved ☐ CR Correct and Resubmit ☐ Resubmit _____ Copies
☐ AN Approved As Noted ☒ F File ☐ Return _____ Copies
☐ AS As Requested ☐ FA For Approval ☐ Review and Comment
☐ Other:

Mailing Method
☐ U.S. Postal Service 1st Class ☐ Courier/Hand Delivery ☐ FedEx Priority Overnight ☐ FedEx 2-Day Delivery
☐ Certified/Registered Mail ☐ United Parcel Service (UPS) ☐ FedEx Standard Overnight ☒ FedEx Economy
☐ Other:

Comments

ARCADIS
Infrastructure, environment, facilities

Imagine the result



CONSTRUCTION AND TESTING SUMMARY REPORT

Class I Injection Well System

Golden Gate Wastewater Treatment Facility

November 2008

ARCADIS

Rodney J. Miller for
David K. Smith
Principal Hydrogeologist

Rodney J. Miller
11/20/08
Rodney J. Miller, PG
Hydrogeologist

Construction and Testing Summary Report

Class I Injection Well System,
Golden Gate WWTF

Prepared for:
Florida Governmental Utility Authority

Prepared by:
ARCADIS
2081 Vista Parkway
West Palm Beach
Florida 33411
Tel 561.697.7000
Fax 561.697.7751

Our Ref.:
WF004200.G015

Date:
November 2008

Table of Contents

Tables

Figures

Appendices

Enclosures

Summary

This document provides the construction and testing results of the Class I injection well (IW1) and associated Floridan-aquifer, dual-zone deep monitor well (MW1) at the Golden Gate Wastewater Treatment Facility (WWTF) in Collier County, Florida. A site location map and a site layout map showing the location of the injection well system are presented as **Figure 1 and 2**, respectively.

Secondarily-treated domestic wastewater effluent from the Golden Gate WWTF and potable water treatment by-product (reject/brine) will be disposed by deep well (Class I) injection as the primary disposal method. The injection well system has been designed and constructed to accept a volume of approximately 5.03 million gallons per day (mgd).

MW1 was constructed to monitor for potential upward migration of fluids injected into IW1. The upper monitor zone (from 1,078 feet to 1,128 feet below pad level [bpl]) was installed at the lowermost regional Underground Source of Drinking Water (USDW), the interface defined by the depth at which the total dissolved solids (TDS) concentration of the formation water exceeds 10,000 milligrams per liter (mg/L). At the project site this interface is located at 1,110 feet bpl. The lower monitor zone (from 1,498 feet to 1,550 feet bpl) was installed in a sufficiently transmissive interval below the USDW. The MW1 construction detail (with geologic and hydrogeologic columns) is presented as **Figure 3**.

IW1 was constructed as a "tube and packer" well, with an 18-inch outside diameter (O.D.), 0.500-inch wall thickness, seamless-steel final casing installed to a depth of 2,468 feet bpl, and a 11.97-inch inside diameter (I.D.), 0.66-inch wall thickness, Fiberglass Reinforcement Plastic (FRP) injection tubing installed to 2,448 feet. The total pilot-hole depth of IW1 was 3,200 feet bpl, and the total completed depth (18-inch diameter) is 3,010 feet bpl. The construction detail for IW1 (with geologic and hydrogeologic columns) is presented as **Figure 4**. Construction and testing of the wells were performed in accordance with Chapter 62-528, Florida Administrative Code (FAC), and the provisions of Florida Department of Environmental Protection (FDEP) Construction Permit No. 263889-001-UC/1I. A copy of the construction permit is provided in **Appendix A**.

Youngquist Brothers, Inc. (Contractor) began construction of MW1 in December 2007 and completed construction in March 2008. The Contractor then mobilized to the IW1 location. Construction of IW1 began in March 2008. The construction and testing of

both IW1 and MW1 were completed in September 2008. A summary of the construction and testing activities is presented as **Table 1**.

Findings

The results of the construction and testing of MW1 and IW1 led to the following conclusions:

- The base of the lowermost USDW is located at a depth of approximately 1,110 feet bpl.
- Various degrees of confinement are present between 1,545 feet and 2,470 feet bpl. The primary confining units above the injection zone (that provide the greatest degree of confinement) occur between 1,590 feet and 2,290 feet bpl.
- Results from core samples taken from the primary confining units indicate median horizontal and vertical hydraulic conductivities of approximately $6.6x10^{-6}$, and $1.7x10^{-6}$ centimeters per second (cm/sec), respectively. Hydraulic conductivities determined from seven packer tests located within the confining units indicate slightly higher permeability's with a median horizontal conductivity of $7.95x10^{-5}$ cm/sec. However, non-equilibrium data were obtained from the packer tests, and the large volume of test water within the packer test assembly means reliable analysis is difficult. Hydraulic conductivities are therefore likely to be one order-of magnitude less, i.e. comparable to the core results.
- The specific injectivity of the injection zone penetrated by the open hole (from 2,470 feet to 3,010 feet bpl) is 263 gallons per day per pounds per square inch pressure (gpd/psi), with an approximate transmissivity estimated to be at least 1,900 feet squared per day (ft^2/d).
- The injection zone is sufficiently transmissive to accept combined effluent at the anticipated buildout volume of 5 mgd.

Data Collection Methods and Results

During well construction, data were collected and interpreted to determine the geologic and hydrogeologic characteristics of the strata intercepted by the borehole. These data were used to determine the optimal subsurface design of MW1 and IW1. Data also were collected to ensure both wells were being constructed in accordance with the technical specifications and that regulatory requirements were met. Data-collection methods and results are described below. Daily construction and testing activities

were recorded in daily logs and compiled by onsite field personnel during the majority of the construction period. As required by the construction permit, weekly construction progress reports were prepared (by ARCADIS) and submitted to FDEP and Technical Advisory Committee (TAC) members. A summary of the events described in the construction progress reports is provided in **Table 1**. Weekly construction reports submitted to FDEP and TAC members are included electronically in **Appendix G**.

Pilot-Hole Construction and Testing

Pilot holes were constructed when drilling MW1 and IW, and the data collected during the drilling and testing of the pilot holes provided information that assisted with the final design of the wells. Methods used to collect data during pilot-hole construction and testing and the results obtained are described below.

Lithology and Penetration Rate

During pilot-hole drilling for both MW1 and IW1, cuttings were collected at 10-foot depth intervals and described by an onsite (ARCADIS) geologist in a lithologic summary. Included with the lithologic descriptions are drilling conditions such as revolutions per minute (RPM) of the drill bit and the weight on the bit (WOB). A penetration rate chart of IW1 was created during pilot-hole drilling using the digital data obtained from the Electric Rig. More conventional geolographs were obtained from the pilot hole during drilling of MW-1. The penetration rate charts provide the rate of penetration through the formation during the duration of drilling. The lithologic summaries (Geologic Log) for MW1 and IW1 and the penetration rate charts are provided in **Appendix B**. A description of the major geologic and hydrogeologic units encountered during pilot-hole drilling is described in this report under the section titled "Geology and Hydrogeology". The units also are shown in **Figures 3 and 4**.

Pilot Hole Water Quality

Pilot-hole water quality sampling of the reverse-air discharge was initiated in MW1 at 578 feet bpl and in IW1 at 735 feet bpl. Sampling was performed at each drill rod connection for both MW1 (40-foot intervals) and IW1 (45-foot intervals). The lowermost sampling depth was performed in IW1 at 2,748 feet where there was reasonable assurance that the "Boulder Zone" was penetrated (based on drilling conditions). Each sample was field analyzed for chloride, conductivity and temperature. Pilot-hole water quality reflects a mixture of re-circulated drilling fluids that consist of formation fluids from the open pilot hole and fresh water from the drilling-

fluid storage tanks. This generally results in muted changes in pilot-hole water quality with depth. The reverse-air discharge water-quality summary for MW1 and IW1 is presented as **Table 2**. Associated chloride and conductivity plots for both MW1 and IW1 are presented as **Table 2A**.

In general, the results from MW1 and IW1 show an increasing salinity trend between 578 feet and 1,635 feet bpl as measured by conductivity. Between 1,635 feet and 1,680 feet bpl, a sharp increase in salinity occurred (as seen in IW1), and salinity remained relatively high to 1,800 feet bpl. Below 1,800 feet bpl salinity decreased and then remained relatively lower to approximately 2,208 feet bpl. It should be noted that four rock cores were collected in IW1 between 1,650 feet and 2,149 feet bpl. During the coring process, fresh water was mixed with clay-based drilling-fluid additives and pumped into the well to suppress the artesian head to below pad level. Below 2,149 feet to 2,568 feet bpl, an increasing salinity trend is observed. Salinity remained relatively stable between 2,568 feet and 2,748 feet bpl.

Geophysical Logging

Geophysical logging was performed in the pilot-hole intervals of both MW1 and IW1 wells to correlate drill cuttings and core samples collected during drilling, to correlate vertical offsets between IW-1 and MW-1, and to obtain other specific geologic and hydrogeologic data pertaining to the subsurface formations. These data were used to assist in the selection of the optimum casing setting depths, determine packer-testing intervals and identify transmissive and confining intervals. Reamed-hole caliper logs were performed prior to casing installation to confirm appropriate casing setting depths and provide data for use in calculating theoretical casing-cementing volumes.

Summaries of the geophysical logs performed in MW1 and IWW1 are provided as **Table 3** and **Table 4**, respectively. Copies of the geophysical logs are included in **Volume II** of this report. Detailed interpretations of the geophysical logs previously were provided in the documents listed below. Electronic copies of these logs also are included in **Appendix G** of this report.

Document Title	Date Submitted	Well & Depth Intervals Logged
Dual Zone Monitor Well (MW1) Monitor Zones Recommendation	01/31/08	MW1: 490 – 1,618 feet bpl
28-inch Diameter, Intermediate Casing Seat Recommendation	04/14/08	IW1: 940 – 1,635 feet bpl
Request for Approval Final-Casing Setting Depth of Proposed Injection Well IW1	06/30/08	IW1: 1,635 – 3,006 feet bpl
Injection Test Request	8/28/08	IW1: 0 – 3,108 feet bpl

Core Collection

Four rock cores were collected between 1,650 feet and 1,665 feet bpl during pilot-hole drilling. The rock-core intervals were selected by the onsite geologist based on evaluation of the drill cutting samples. The rock cores were first described onsite and then select sections of the rock cores were sent to Ardaman & Associates, Inc. - Geotechnical Testing Laboratory for horizontal and vertical hydraulic conductivity estimates. Core descriptions and core-analysis reports are included in Appendix B. A summary of the results from the rock-core analyses is provided as Table 5.

The core analytical data (with packer-pumping test data) were utilized to assess the potential degree and extent of confinement between the injection zone (at 2,470 feet bpl) and the regional USDW (at 1,110 feet bpl). The rock-core analyses indicate that the lowest hydraulic conductivity values were obtained between 2,140.7 feet and 2,141.3 feet bpl. As determined by core analyses, the median horizontal and vertical hydraulic conductivities of the primary confining interval (between 1,590 feet and 2,290 feet bpl) are 6.6×10^{-6} centimeters per second (cm/sec) and 1.7×10^{-6} cm/sec, respectively.

Packer Testing

Four packer tests were conducted between 1,013 feet and 1,554 feet bpl in the pilot hole of MW1, and seven packer tests were conducted between 1,554 feet and 2,285 feet bpl in the pilot hole of IW1. These tests were performed to determine the water quality and hydrologic properties of the test intervals. Prior to conducting each packer test, a straddle-packer assembly was installed to the selected interval. The one exception was packer test no. 1 in MW1 where only a single packer was installed to

1,512 feet bpl. Each interval then was pumped (developed) until the field-measured water quality stabilized (conductivity, temperature and chloride concentrations). After development, the water level was allowed to recover to the approximate static water level.

Following the stabilization of the water level after development, the pumping portion of each packer test was conducted at a constant pumping rate. During testing, water levels and field water quality were measured. In general, the pumping portion of each test was considered complete when the water quality and water level had stabilized. Just prior to terminating the pumping portion of each test, a final water sample was collected for laboratory analysis, and a 2-gallon water sample was collected for submittal to Florida State University Department of Geological Sciences. The recovery portion of each test began when the pump was shut off. Water levels were measured during the recovery portion of each test until the water level stabilized to approximately the static level.

Water-level drawdown (pumping portion data) and recovery data were used to estimate the horizontal hydraulic conductivity and transmissivity of each test interval. The horizontal hydraulic conductivity and transmissivity estimates assisted in establishing the boundaries of the confining unit and injection zone. Final water samples were analyzed in a state certified lab for chloride, TDS, specific conductance, sulfate, total phosphorus and ammonia-nitrogen to verify the USDW boundary and to establish the background water quality of each test interval. A summary of the water-sample analytical results from packer testing is presented as **Table 6**. A summary of the hydraulic conductivity estimates from packer testing is presented as **Table 7**. Packer test water-quality summaries and charts are included in **Appendix C**. Electronic transducer data are and laboratory reports for each test are included in **Appendix G**.

Well Construction and Testing

Data were collected during the construction and testing of both MW1 and IW1 to ensure that both wells were being constructed in accordance with the technical specifications and FAC regulatory requirements.

The well construction details, including the type, diameter, and setting depth of each casing (or tubing) string for MW1 and IW1 are presented as **Figure 3** and **Figure 4**, respectively. The casing mill certificates for MW1 and IW1, with FRP tubing-product product sheets for both MW1 and IW1 are included in **Appendix D**. The data-collection

methods used during the construction and testing of both wells, and the results obtained are described below.

Surficial Aquifer Pad Monitor Wells

Six Surficial Aquifer pad monitor wells were installed near each of the four corners of the reinforced-steel drilling pads of MW1 and IW1 to monitor for spillage to groundwater during construction. Each of the wells was constructed to a depth of approximately 15 feet below land surface with 5 feet of 2-inch diameter, Schedule 40 polyvinyl chloride (PVC) casing attached to 10 feet of 2-inch diameter, 0.020-inch slot, threaded PVC screen. Following installation of the monitor wells, samples were collected from each well and analyzed to establish background water quality prior to beginning construction of MW1 and continued during construction of MW1 and IW1. The results of the monitor-well water sampling were included in each Weekly Construction Progress Report (Reports 1 through 40). A summary of the pad monitor well water quality data including plots of conductivity and chloride concentrations are included in **Appendix E**. Concentrations remained stable throughout the duration of construction indicating that no significant spills occurred. The one exception is noted in pad monitor well PMW1 on August 1, 2008. Approximately 50-100 gallons of formation water from the MW1 lower monitor zone leaked outside of the containment. As discussed in Weekly Report 33, PMW1 was developed until water-quality parameters were restored back to near background levels.

Inclination Surveys

Inclination surveys were performed by the Contractor on MW1 and IW1 at 90-foot intervals during pilot-hole drilling and reaming operations. Inclination surveys were performed to ensure that all casing could be set to the required depths with sufficient annular space for proper cementing. The maximum allowable inclination from vertical at any portion of a hole was 1.0 degree. The maximum allowable difference between any two successive survey points was 0.5 degree.

During construction of MW1 and IW1, all inclination surveys met the above criteria. The maximum deviation (0.8 degree) was observed in IW1. The maximum difference between any two successive survey points (0.40 degree) also was observed in IW1. Summaries of inclination survey results for ROIW1 and ROMW1 are presented in **Tables 8 and 9**, respectively.

Hydrostatic Pressure Tests

The Contractor performed hydrostatic pressure tests on the MW1 lower monitor-zone FRP tubing, IW1 final casing (18-inch O.D.) and IW1 FRP injection tubing (12-inch I.D.). Pressure tests were performed to demonstrate mechanical integrity.

The hydrostatic pressure test for the lower monitor-zone tubing of MW1 was performed using a permanently-set inflatable packer ("California" packer) attached to the base of the tubing string. The California packer included a plug at the base which was still intact after the tubing string was cemented in place. This allowed the Contractor to successfully pressurize the inside of the tubing.

The hydrostatic pressure test for the final casing of IW1 was performed by installing a removable inflatable packer inside and near the base of the casing after it was cemented in place. The inflatable packer was then inflated which allowed the Contractor to successfully pressurize the inside of the final casing.

The hydrostatic pressure test for the injection tubing (and the "YBI" positive seal packer) was performed by pressurizing the annulus between the injection tubing and the final casing. The exterior packer mandrel, attached to the base of the FRP injection casing, was set inside the interior packer mandrel, which is attached to the inside and near the base of the final casing, creating a positive seal. This allowed the Contractor to successfully pressure test the injection tubing, packer seal and the final casing.

Each pressure test was considered successful if the pressure did not change more than 5% from its original pressure. After the completion of each test, the pressure was relieved and the volume of water discharged was measured.

The pressure changes during each pressure test for IW1 and MW1 (three tests in total) were within the 5% allowable limit. The hydrostatic pressure-test results for the MW1 lower monitor-zone tubing, the IW1 injection casing and IW1 injection tubing (and the associated pressure-gauge calibration certificates) are included in **Appendix E**. Further discussion of the hydrostatic pressure tests is included in the Technical Memorandum included in **Appendix E**. This Technical Memorandum also was included in the Injection Test Request letter dated August 28, 2008.

Cement-Top Temperature Logs

Temperature logs were performed after each casing cementing stage (where more than 28 cubic feet was installed and where cement returns were not observed at surface). The top of the cement for each stage was estimated from the results of each temperature log (temperature increases indicate the heat released from curing cement). The top of cement also was physically tagged after each cementing stage using steel work pipe inserted inside the annulus. The estimated depth of the top of cement from the temperature log was compared to the physical tag depth (for each stage) to ensure that the formation did not collapse and fall on top of the cement (resulting in cement voids or un-cemented annular sections).

There was a good correlation between the tagged depth for the top of cement and the estimated depth of the top of cement as inferred from the temperature log of each cement stage for MW1 and IW1. "Cement top" temperature logs for both wells are provided in **Volume II** of this report, and electronic copies are included in **Appendix G**. Summaries of the cement stages for MW1 and IW1 are presented as **Tables 10 and 11**, respectively.

Video Surveys

Television surveys were conducted on the MW1 lower monitor-zone FRP tubing, the IW1 final casing and the IW1 FRP injection tubing of IW1. The television surveys were performed to visually inspect the casing/tubing for any damage that may have occurred during or after installation. Prior to performing the video surveys, water was pumped out of the wells to remove suspended sediments and improve the picture clarity. The video camera then was lowered inside the casing/tubing and the open holes. No damage was observed during any of the surveys. The surveys were recorded onto DVD and are provided in **Volume II** of this report.

Cement Bond Logging

In MW1 the lower monitor-zone tubing was cemented between the base of the upper monitor zone and the top of the lower monitor zone (between 1,128 feet and 1,498 feet bpl) to isolate the two intervals. A cement-bond log (CBL) with a variable-density log (VDL) display was performed on the tubing before and after the Contractor cemented the tubing in place. The amplitude of the signal is greatly reduced on the post-cementing CBL in the interval from 1,128 feet to 1,494 feet bpl compared to the same interval on the pre-cementing CBL. The reduced signal amplitude indicates presence

of cement with likely good bonding of cement to casing. Additionally, the reduced signal return on the variable-density log (VDL) display confirms the cement-to-casing bond and indicates that there is good cement to formation bond. It should be noted that FRP sections within the open hole between approximately 1,138 feet and 1,495 feet bpl had a sand-impregnated rough coat surface to enhance the cement-to-tubing bond.

The Contractor installed and cemented in place the IW1, 18-inch O.D. final casing to a depth of 2,472 feet bpl. The uppermost 472 feet of the casing was not cemented until after the completion of the CBL (with VDL display) to allow the logging tool to be calibrated to the free-pipe signal of the un-cemented portion of the casing. In general the log indicates lower signal amplitude below the uppermost 472 feet of un-cemented casing which indicates the presence of cement. Several intervals displayed higher signal amplitude than the majority of the cemented interval (i.e., 1,110 feet, 1,305 feet, 1,515 feet and 1,916 feet bpl). However, the VDL display indicates the cement is bonded to the casing and the formation within these intervals. Copies of the cement bond logs (CBLs) performed on the final tubing of MW1 and the final casing of IW1 are provided in **Volume II** of this report, and electronic copies are provided in **Appendix G**.

High Resolution Temperature Log

A high-resolution temperature log was conducted in IW1 to demonstrate mechanical integrity. The temperature parameter inside the injection tubing (and outer casing) is a function of a combination of factors, including the water temperature of the formation, the number, diameter and wall thickness of casings that penetrate the formation, the density and quality of the cement slurry used during casing cementing and the concentration of a corrosion inhibitor that fills the annulus between injection casing and injection tubing.

The data collected from the high-resolution temperature log indicated that IW1 has mechanical integrity. A copy of the high-resolution temperature log is provided in **Volume II** of this report, and an electronic copy is provided in **Appendix G**. Further discussion of the high-resolution temperature log is included in the Technical Memorandum in **Appendix E**.

Radioactive Tracer Survey (RTS)

A RTS was performed to determine whether IW1 had external mechanical integrity (including the integrity of the cement sheath and adjacent formation). The RTS logging

tool used for the survey consisted of three gamma-ray detectors: one near the top (GRT), the middle (GRM) and bottom (GRB) of the tool. The RTS logging-tool ejector port is located between the GRT and the GRM. For the RTS test, the tool was loaded with 5.0 millicuries (mCi) of Iodine 131. A magnetic casing-collar locator (CCL), attached to the base of the RTS logging tool, indicated that the base of the 18-inch O.D. final casing was located at a depth of approximately 2,472 feet bpl.

A RTS consists of background gamma-ray logging, dynamic monitoring, out-of-position logging and final gamma-ray logging. During dynamic monitoring, potable water pumped down the well forced the Iodine 131 tracer material downward where it was detected by the GRM and GRB (located below the ejector). The GRT can detect the Iodine 131 if the Iodine 131 moves upward outside the injection casing (due to spaces between the cement and casing or the cement and formation, or if fractures exist in the formation near the well).

The primary purpose of the "out-of-position" logs and the final gamma-ray log was to determine the extent (if any) of upward migration of Iodine 131 through the formation or through annuli adjacent to the well bore or casing. Because the recorded readings of all three detectors from each "out-of-position" log and the final gamma-ray log resembled the recorded readings of the background gamma-ray log, and because the GRT did not record any elevated readings after ejection during either dynamic monitoring tests, we conclude that the cement sheath around the injection casing is intact and an adequate bond is present between the cement and the formation, as well as between the casing and the cement. Further discussion of the RTS test is included in the Technical Memorandum in **Appendix E**.

MW1 and IW1 Final Water Quality Results

Water quality samples were collected in the upper and lower monitor zones of MW1 on February 27, 2008. Approximately 4 well volumes were purged in the upper zone and 10 volumes were purged in the lower zone prior to collecting the samples. The samples were analyzed for parameters listed as Florida Primary and Secondary Drinking Water Standards and "municipal minimum-criteria" parameters, and an electronic copy of the analytical report for each zone is included in **Appendix G**.

A water quality sample was collected in IW1 on July 7, 2008. IW1 was developed by pumping from the well until field parameters stabilized prior to collecting the final sample. The sample was analyzed for parameters listed as Florida Primary and Secondary Drinking Water Standards and "municipal minimum-criteria" parameters,

and an electronic copy of the analytical report for each zone is included in **Appendix G**.

Injection Testing

Following completion of construction and mechanical integrity testing of IW1, an injection test was performed to demonstrate the ability of the injection well to accept fluid and to test the effectiveness of the confining units between the injection zone and the monitoring zones.

Surface water from the adjacent freshwater canal located at the site boundary was the water source for the injection test of IW1. The Contractor was issued a General Use Permit by the South Florida Water Management District (SFWMD) on August 12, 2008 to withdraw up to 2.6 million gallons from the canal. A copy of the permit was included in the Injection Test Request dated August 28, 2008. The Contractor retained an analytical laboratory to collect a water sample from the canal on June 11, 2008. The sample was analyzed for parameters listed as Florida Primary and Secondary Drinking Water Standards and "municipal minimum-criteria" parameters. An electronic copy of the analytical report is included in **Appendix G**.

Prior to beginning the injection test, the wellhead pressures of MW1 (upper and lower zones) and IW1 were monitored for approximately 60 hours to gather background data. After background data were collected, water from a canal located north and adjacent to the Golden Gate WWTF was pumped into IW1 at an average rate of 3,495 gallons per minute (gpm) for approximately 12 hours while the monitoring of MW1 and IW1 wellhead pressures continued. Following injection, wellhead pressure monitoring for MW1 and IW1 continued for approximately 36 more hours. Simultaneously with pressure well data, site barometric and tidal area data were collected before, during and after the injection portion of the test.

Only minor changes were observed in the pressure data in the upper and lower monitor zones of MW1 throughout the monitoring period, and these pressure changes correlate with tidal fluctuations. Based on the injection test results, the injection of more than 5 mgd does not affect the pressures of the MW1 monitoring zones. This supports the interpretation that the monitor zones are isolated from the injection zone by one or more suitable, overlying confining intervals. The results also demonstrate that the section of the injection zone tapped by the open hole of IW1 (from 2,472 feet to 3,110 feet bpl) is sufficiently transmissive to accept the anticipated buildout volume of 5

mgd. Wellhead pressure data, plots of the data, and transducer calibration sheets are presented in **Appendix F**.

Geology and Hydrogeology

A summary of the geologic and hydrogeologic settings of the area surrounding the Golden Gate WWTF is provided below. A general stratigraphic summary with hydrogeologic units encountered during construction and testing is included in **Figures 3 and 4**. A regional geologic and hydrogeologic setting is illustrated on a north-south hydro-stratigraphic cross section in **Figure 6** and a west-east hydrostratigraphic cross section in **Figure 7**.

Undifferentiated Sediments and Surficial Aquifer System

The Surficial Aquifer System is composed mainly of unconsolidated sand, silt and shell with varying amounts of limestone. This system is divided into two aquifers, the Water-Table (or Upper Tamiami) Aquifer and the Lower Tamiami Aquifer. The two aquifers are separated by a leaky confining interval, referred to as the Tamiami Confining Beds. At the project site the base of the Surficial Aquifer System is located at a depth of approximately 180 feet bpl.

Miocene Series (Hawthorn Group) and Intermediate Aquifer System

Underlying the Surficial Aquifer is the Hawthorn Group generally form a confining sequence between the Surficial Aquifer and the Oligocene to Eocene limestones and dolomites of the Floridan Aquifer. The Hawthorn Group is a relatively thick sequence of clayey silts interbeded with beds of limestone and phosphatic sands. At the project site, the base of the Hawthorn Group and the Intermediate Aquifer System is located at a depth of 675 feet bpl.

Geology of the Floridan Aquifer System

The Floridan Aquifer underlies all of Florida and southern Georgia and includes parts or all of the Suwannee Limestone (where present), Ocala Group, Avon Park Formation and Oldsmar Formation.

Suwannee and Ocala Limestones

Underlying the Hawthorn Group are limestones of Oligocene and Upper Eocene age referred to as Suwannee Limestones and the Ocala Group. The Suwannee Limestones are typically difficult to distinguish between the Upper Eocene Ocala Group limestones without adequate cores and diagnostic fossil assemblages. The lithology in this sequence typically is a cream to white, fine-grained, poorly indurated, fossiliferous limestone. At the project site, the base of the Suwannee Limestones and Ocala Group sequence is located at a depth of approximately 1,770 feet bpl.

Avon Park Formation

Underlying the Ocala Limestones are the Upper to Middle Eocene age limestones and dolostones referred to as the Avon Park Formation. This formation predominantly consists of yellowish brown limestones and orange to brown dolostones. The uppermost Avon Park Formation contains brown fossiliferous limestone and fine crystalline dolostone. At the project site, the base of the Avon Park Formation is located at a depth of approximately 2,480 feet bpl.

Oldsmar Formation

Underlying the Avon Park Formation is the Lower Eocene age limestones and dolostones referred to as the Oldsmar Formation. The Oldsmar Formation primarily consists of a dark brownish, fine crystalline dolostone. At the project site, the total depth of the pilot hole (3,200 feet bpl) did not intercept the base of the formation.

Hydrogeology of the Floridan Aquifer System

The Floridan Aquifer System serves as a regionally significant water-yielding unit under confined conditions. The principal recharge areas for the artesian Floridan Aquifer in southern Florida are centered in Polk and Pasco Counties. The potentiometric surface of the aquifer slopes gently toward the east-northeast and southeast, except where locally affected by withdrawals.

Water quality in the Floridan Aquifer is poor in comparison to the Surficial Aquifer. Water from the Floridan Aquifer in the area contains TDS concentrations that exceed drinking water standards. Although the desalination treatment required results in higher consumer costs, use of Floridan Aquifer water has become an established necessity in south Florida in order to both mitigate potential impacts to environmentally

sensitive wetlands and to reduce the potential for saltwater intrusion in the Surficial Aquifer System. For purposes of this application, the hydrogeologic units of the Floridan Aquifer System are divided into the Upper Floridan Aquifer (UFA), confining units and the "Boulder Zone".

Upper Floridan Aquifer (UFA)

The UFA is located directly below the Hawthorn Group clays. At the project site, the top of the UFA is located at approximately 675 feet below land surface. The UFA generally increases in salinity with increased depth. Production wells in South Florida that withdraw from the Floridan Aquifer typically only extend to the uppermost producing zones in the UFA where higher quality (less saline) water is present. However, potentially usable sources of underground drinking water (referred to as USDWs) are defined as waters containing concentrations of TDS less than 10,000 mg/L. At the project site, the depth at which formation waters exceed TDS concentrations of 10,000 mg/L is approximately 1,110 feet bpl.

Floridan Aquifer Confining Units

Underlying the UFA and the lowermost USDW are strata within the lower Avon Park Formation and upper Oldsmar Formation that are primarily un-fractured limestones and dolostones that have low-permeability. These low-permeability formation intervals will serve as a barrier between the fluids injected in the "Boulder Zone" and the lowermost USDW. Based on the data collected during construction and testing of the injection well system, there appears to be sufficient confining units present at the project site between approximately 1,600 feet and 2,285 feet bpl.

Floridan Aquifer "Boulder Zone"

Underlying the confining units within the Floridan Aquifer, is a highly transmissive karst zone known in south Florida as the "Boulder Zone". The absence of a USDW, the overlying confining units and the high transmissivity provides an ideal formation for underground disposal and storage. The top of the "Boulder Zone" and the top of the injection zone for IW1 is at a depth of 2,472 feet bpl.

Table 1. Summary of Construction and Testing Activities
Golden Gate WWTF Injection Well System

Monitor Well MW1		
Weekly Report #	**Date**	**Description**
Pre-Reports	01/09/07	Contractor installed six water table monitor wells
		Contractor installed 62-inch diameter steel pit casing to 8 feet bls at the MW1 and IW1 locations
1	12/18/07	Contractor began drilling borehole at MW1 with a 40.5-inch bit using mud-rotary drilling method
	12/20/07	Contractor extended borehole to 52 feet bpl
		Contractor installed 34-inch O.D. (0.375-inch thick) pit casing to 52 feet bpl and cemented pit casing in place from base of casing to 11 feet bpl
	12/22/07	Contractor began drilling pilot hole using 12.25-inch drill bit from top of cement plug (47 feet bpl)
2	12/28/07	Contractor extended pilot hole to 550 feet bpl
		Contractor conducted geophysical logging (XY caliper, gamma and dual induction) of pilot hole
	12/29/07	Contractor began reaming borehole using 32.5-inch drill bit
3	01/05/08	Contractor extended borehole to 500 feet bpl
4	01/08/08	Contractor conducted geophysical logging (XY caliper and gamma ray logs) on 32-inch diameter open hole
		Contractor installed and cemented 24-inch O.D. steel casing at 490 feet bpl
5	01/14/08	Contractor began drilling out cement plug/drilling pilot hole with 12.25-inch drill bit
	01/19/08	Contractor extended pilot hole to 1618 feet bpl
	01/20/08	Contractor performed geophysical logging of pilot hole under static and pumping conditions
6	01/21/08	Contractor began straddle-packer pumping test (Packer Test No. 1) from 1,512 to 1554.4 feet bpl
	01/23/08	Contractor completed Packer Test No. 1; began Packer Test No. 2 from 1,102.5 to 1,130.1 feet bpl
	01/25/08	Contractor completed Packer Test No. 2; began Packer Test No. 3 from 1,222.6 to 1,250 feet bpl
7	01/28/08	Contractor completed Packer Test No. 3; began Packer Test No. 4 from 1,013 to 1,045 feet bpl
	01/29/08	Contractor completed Packer Test No. 4
	02/01/08	Contractor filled pilot interval with cement from 1,618 feet to 1,550 feet bpl
	02/02/08	Contractor placed gravel in LMZ section of pilot hole from 1,550 feet to 1,493 feet bpl
8	02/04/08	Contractor began reaming pilot with a 22-inch drill bit from 490 feet bpl
	02/05/08	Contractor extended reamed hole to 1,080 feet bpl
	02/07/08	Contractor performed caliper and gamma-ray logging from 490 feet to 1,080 feet bpl
	02/10/08	Contractor installed and cemented in place 16-inch O.D. UMZ casing from 1,078 feet to pad level
9	02/11/08	Contractor began reaming pilot hole with 14.75-inch drill bit from base of UMZ casing
	02/12/08	Contractor completed reaming with a 14.75-inch bit to 1,490 and began reaming with a 12.25-inch bit
	02/13/08	Contractor completed reaming with 12.25-inch bit to 1,550 feet bpl
	02/15/08	Contractor performed caliper and gamma-ray logging from 1,078 feet to 1,550 feet bpl
	02/16/08	Contractor installed 6.625-inch FRP tubing to 1,498 feet bpl (**LMZ Interval: 1,498 feet to 1,550 feet bpl**)
		Contractor performed background CBL inside FRP tubing
10	02/19/08	Contractor completed cementing FRP tubing in place from the top of the LMZ to the base of the UMZ in 4 cement stages (**UMZ Interval: 1,078 feet to 1,128 feet bpl**)
	02/21/08	Contractor performed CBL inside FRP tubing
		Contractor performed pressure test in FRP tubing at 120.5 psi for 1 hour (psi decrease of 2.5% observed)
11	02/27/08	Contractor collected final water samples of the UMZ and LMZ for primary and secondary drinking water standards and municipal minimum parameters (after sufficient development of the zones occurred)
	03/01/08	Contractor performed TV survey of LMZ tubing and open hole (open hole obstructed at 1,539 feet bpl with fine rock fragments)
31, 32, 33	7/30/08	Contractor mobilized back to the site to perform cleaning of the Lower Monitor Zone in the MW1. Set-up containment pad.
	7/31/08	Contractor cleaned MW1 Lower Monitor Zone with air-lifting and jetting method.
	8/1/08	Contractor performed video survey of the MW1 Lower Monitor Zone to confirm cleaning effectiveness: bottom observed at 1547.9 ft bpl.

Table 1. Summary of Construction and Testing Activities
Golden Gate WWTF Injection Well System

Injection Well IW1		
Weekly Report #	**Date**	**Description**
12, 13, 14	03/03/08	Contractor began demobilizing from MW1 to IW1 location
	03/22/08	Contractor completed mobilization to IW1
		Contractor began drilling borehole with a 56-inch drill bit from pad level
	03/23/08	Contractor completed drilling borehole with 56-inch drill bit to 56 bpl
		Contractor set and cemented 48-inch O.D. steel casing to 55 feet bpl.
15	03/25/08	Contractor began drilling borehole with a 46.5-inch bit from 55 feet bpl
	03/29/08	Contractor completed borehole with 46.5-inch bit to 494 feet bpl
	03/30/08	Contractor performed geophysical logging of the borehole
	03/31/08	Contractor set and cemented a 36-inch O.D. casng to 490 feet bpl
16	04/01/08	Contractor began drilling pilot hole with a 12.25-inch drill bit from 490 feet bpl
	04/04/08	Contractor completed pilot hole to 1,635 feet bpl
	04/05/08	Contractor performed geophysical logging of the pilot hole
	04/06/08	Contractor completed Packer Test No. 5 between 1,554 feet and 1,635 feet bpl
17	04/10/08	Contractor completed Packer Test No. 6 between 1,559 feet and 1,577 feet bpl
	04/11/08	Contractor cemented back the pilot hole from 1,635 feet to 572 feet bpl by pumping a total of 1920 cubic feet in two cement stages.
	04/11/08	Contractor began reaming the cemented pilot hole using a 34.5-inch diameter drill bit
18	04/18/08	Contractor completed borehole with 34.5-inch bit to 1,584 feet bpl
	04/19/08	Contractor performed geophysical logging of the borehole
19	04/23/08	Contractor set and cemented 28-inch O.D. steel casing to 1,580 feet bpl
	04/25/08	Contractor began drilling pilot hole with a 12.25-inch drill bit from 1,635 feet bpl
20	05/04/08	Contractor extended pilot hole to 2,705. A total of 4 cores were collected during drilling
21	05/11/08	Contractor completed pilot hole to 3,205 feet bpl
22	05/15/08	Contractor completed static geophysical logging
	05/16/08	Contractor set bridge plug at approximately 2,478 feet bpl
	05/17/08	Contractor completed dynamic geophysical logging at a rate of 80 gpm
	05/19/08	Contractor completed packer test #7 and began development for packer test #8
23	05/19/08	Contractor performed packer tests #8 - #11
	05/24/08	
	05/25/08	Contractor began cementing back pilot hole
24	05/26/08	Contractor completed cementing back pilot hole to 1611 ft bpl, 31 feet below 28-inch diameter casing seat.
	05/27/08	Contractor began reaming the cemented pilot hole using a 26.5-inch diameter drill bit
	06/01/08	Contractor completed borehole with 26.5-inch bit to 2,468 feet bpl
25	06/03/08	Contractor began reaming 12-inch diameter pilot hole using an 18-inch diameter drill bit
	06/08/08	Contractor extended 18-inch borehole to 2,720 ft bpl.
26	06/15/08	Contractor extended 18-inch borehole to 2,827 ft bpl.
27	06/22/08	Contractor completed nominal 18-inch diameter borehole to 3110 ft bpl. And began final wiper trip.
28	06/24/08	Contractor performed geophysical logging of the borehole and began 18-inch diameter injection casing installation
	06/26/08	Contractor set 18-inch O.D. steel casing to 2,472 feet bpl and began cementing.
	06/29/08	Contractor cemented injection casing to 476 ft bpl and performed CBL log.
		Contractor completed cementing of the injection casing to the surface.

Table 1. Summary of Construction and Testing Activities
Golden Gate WWTF Injection Well System

Injection Well IW1		
Weekly Report #	**Date**	**Description**
29	07/01/08	Contractor performed pressure test in 18-inch casing at 155.8 psi for 1 hour (3.2 psi decrease observed)
		Contractor conducted TV survey of the injection casing and casing seat (surface to 2473 ft bpl).
	07/04/08	Contractor completed FRP tubing installation. Set FRP tubing at 2461 ft bpl confirmed by a camera view. Contractor pumped 12,000 gals of 1.1% Baracor mix in the FRP tubing annulus.
		Contractor performed video survey of the completed well from surface to the bottom (3110 ft bpl).
	07/06/08	Contractor began well (injection zone) development.
30	07/07/08	Contractor completed well development and collected final water sample. Contractor begin demobilizing from the site.
34, 35, 36	8/18/08	Contractor mobilized to the site and began injecting fresh water into IW1 in preparation for RTS test.
	8/19/08	Contractor completed fresh water injection into IW1. Total of 60,000 gallons injected.
	8/20/08	Contractor performed RTS test. Contractor conducted 1 hr annular pressure test (0.25 psi decrease of 0.2% observed).
37, 38, 39		The Contractor constructed MW1 and IW1 containment pads and laid down pipeline for the injection test between IW1 and the canal.
40	09/15/08	The Contractor conducted 12 hr injection test. Average injection rate was 3495 gpm, annular pressure approximately 45.9 psi. After completion of the test the Contractor collected post-test data for at least 24 hrs.

Table 2. Summary of Reverse-Air Discharge Water-Quality Results
Golden Gate WWTF Injection Well System

Date	Depth Sampled (ft below pad level)	Field Parameters		
		Temp. (^{0}C)	Conductivity (µS/cm)	Chloride (mg/L)
MONITOR WELL 1				
1/14/2008	578	22.6	1,198	80
1/14/2008	618	23.4	1,266	80
1/14/2008	658	23.8	1,304	80
1/14/2008	698	23.9	1,341	80
1/14/2008	738	22.6	1,328	120
1/15/2008	778	21.5	1,365	260
1/15/2008	818	21.7	1,400	280
1/15/2008	858	21.8	1,433	300
1/15/2008	898	21.9	1,515	340
1/15/2008	938	22.3	1,535	360
1/15/2008	978	22.4	1,578	400
1/15/2008	1,018	22.4	1,680	480
1/16/2008	1,058	22.5	2,720	1,000
1/16/2008	1,098	23.2	3,170	1,140
1/16/2008	1,138	24.1	3,750	1,500
1/16/2008	1,178	24.4	3,640	1,500
1/16/2008	1,218	21.8	4,830	2,000
1/16/2008	1,258	21.9	4,580	2,500
1/16/2008	1,298	23.0	6,800	3,000
1/16/2008	1,338	22.7	7,750	3,500
1/17/2008	1,378	22.8	6,850	3,000
1/17/2008	1,378	23.5	6,990	2,500
1/17/2008	1,418	22.3	6,890	2,500
1/17/2008	1,450	22.6	7,790	3,000
1/17/2008	1,458	22.8	7,920	3,000
1/17/2008	1,498	23.7	8,410	3,500
1/18/2008	1,538	22.8	8,530	3,500
1/18/2008	1,578	23.5	7,240	3,000
1/18/2008	1,618	23.8	7,440	3,500
INJECTION WELL 1				
4/2/2008	735	25.6	2,770	800
4/2/2008	780	25.7	2,640	760
4/3/2008	825	26.0	2,380	620
4/3/2008	870	25.9	2,420	680
4/3/2008	915	25.8	2,480	700
4/3/2008	960	25.9	4,590	1,020
4/3/2008	1,005	26.2	2,370	700
4/3/2008	1,050	25.7	2,570	760
4/3/2008	1,095	26.4	2,920	880
4/3/2008	1,140	27.0	2,950	900
4/3/2008	1,185	27.2	3,530	1,060
4/3/2008	1,230	24.0	3,570	1,140
4/3/2008	1,275	26.7	3,810	1,500
4/3/2008	1,320	26.7	6,530	2,000
4/4/2008	1,365	26.6	4,390	1,500
4/4/2008	1,410	26.5	4,920	1,500
4/4/2008	1,455	26.5	5,270	2,000

Golden Gate WWTF Injection Well System
Reverse-Air Discharge Water Quality

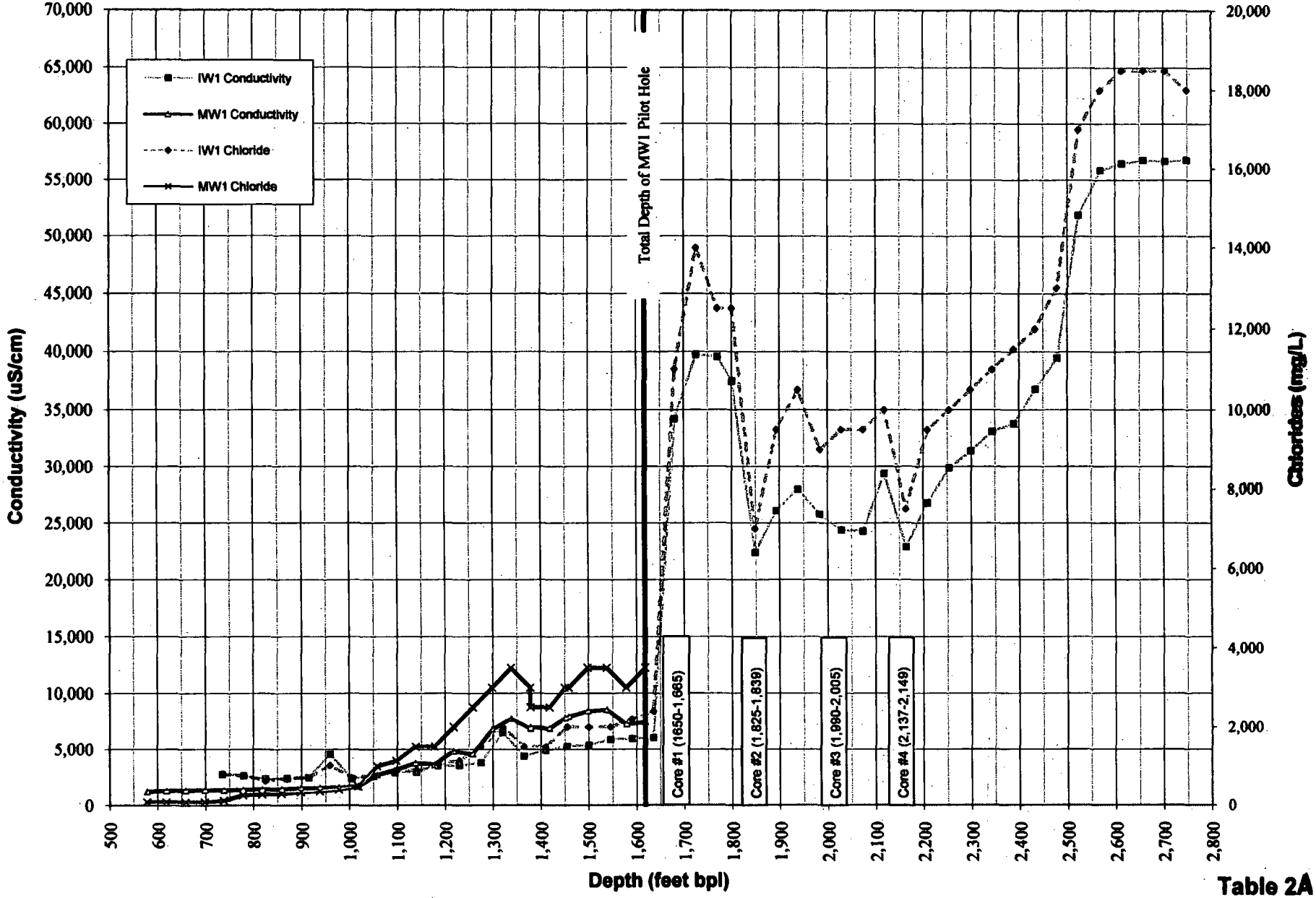


Table 2A

Table 3. Summary of Geophysical Logs Performed in Deep Monitor Well MW1 Golden Gate WWTF Injection Well System

Date	Geophysical Survey Performed	Casing Depth (feet bpl)	Open Hole Depth (feet bpl)	Casing/Drilled Hole Diameter (inches)
12/28/2007	XY Caliper, Gamma Ray	52	550	12.3
12/28/2007	Dual Induction, LL2/SP	52	550	12.25
1/8/2008	XY Caliper, Gamma Ray	52	500	32.50
1/20/2008	XY Caliper, Gamma Ray	490	1618	12.25
1/20/2008	Fluid Conductivity, Temperature (Static and Dynamic)	490	1618	12.25
1/20/2008	Dual Induction, LL3/SP	490	1618	12.25
1/20/2008	Flowmeter (Static and Dynamic)	490	1618	12.25
1/20/2008	Borehole Compensated Sonic with VDL&Log Derived TDS	490	1618	12.25
2/7/2008	XY Caliper, Gamma Ray	490	1080	22.00
2/10/2008	Cement Top Temperature (Stages 1-3)	1078	1082	16.00
2/15/2008	XY Caliper, Gamma Ray	1078	1550	12.25/14.75
2/16/2008	Cement Bond Log with VDL(6.625 FRP before cementing)	1498	1550	6.625
2/19/2008	Cement Top Temperature (6.625" FRP, Stages 1-4)	1498	1550	6.625
2/21/2008	Cement Bond Log with VDL (6.625 FRP after cementing)	1498	1550	6.625
3/1/2008	6.625" FRP Final Video Survey (MW1)	1498	1550***	6.625

"bpl" denotes below (drilling) pad level.

"LL3/SP" denotes lateral resistivity and spontaneous potential logs

"VDL" denotes a variable density log display.

*** Total depth of the MW1 (Lower Monitor Zone) at the time of Survey was 1539 feet bpl.

Table 4. Summary of Geophysical Logs Performed in Injection Well IW1
Golden Gate WWTF Injection Well System

Date	Geophysical Survey Performed	Casing Depth (feet bpl)	Open Hole Depth (feet bpl)	Casing/Drilled Hole Diameter (inches)
3/30/2008	XY Caliper, Gamma Ray	54	494	46.50
3/30/2008	Dual Induction, LL3/SP	54	494	46.50
4/5/2008	XY Caliper, Gamma Ray	490	1634	12.25
4/5/2008	Fluid Conductivity, Temperature (Static and Dynamic)	490	1634	12.25
4/5/2008	Dual Induction, LL3/SP	490	1634	12.25
4/5/2008	Flowmeter (Static and Dynamic)	490	1634	12.25
4/5/2008	Borehole Compensated Sonic with VDL&Log Derived TDS	490	1634	12.25
4/5/2008	Borehole Televiewer Survey	490	1634	12.25
4/19/2008	XY Caliper, Gamma Ray	490	1585	34.50
4/21/2008	28" Casing Cement Top (Stages 1-4)	1580	1585	28.00
5/15/2008	XY Caliper, Gamma Ray	1580	3205*	12.25
5/15/2008	Dual Induction, LL3/SP	1580	3205*	12.25
5/15/2008	Borehole Compensated Sonic/ VDL	1580	3205*	12.25
5/15/2008	Fluid Resistivity, Temperature (Static and Dynamic)	1580	3205*	12.25
5/15/2008	Flowmeter (Static and Dynamic)	1580	3205*	12.25
5/15/2008	IW1 Pilot Hole Video Survey	2472	3205*	12.25
6/24/2008	XY Caliper, Gamma Ray	2472	3110	18.00
6/29/2008	18" Final Casing Cement Top Temperature (Stages 1- 4)	2472	3110	18.00
6/30/2008	18" Final Casing Cement Bond Log w/ VDL	2472	3110	18.00
7/1/2008	Final Casing Video Survey	2472	3110	18.00
7/4/2008	IW1 Final Video Survey	2472	3110	18.00
8/20/2008	High Resolution Temperature Log	2472	3110**	18.00
8/20/2008	Radioactive Tracer Survey	2472	3110**	18.00

"bpl" denotes below (drilling) pad level.
* Pilot Hole logging limited to a depth of 3,006 ft bpl due to obstruction.
** logging limited to a depth of 2,870 ft bpl due to obstruction.
"LL3/SP" denotes lateral resistivity and spontaneous potential logs
"VDL" denotes a variable density log display.

Table 5. Summary of Hydraulic Conductivities from Core Analyses of Injection Well IW1
Golden Gate WWTF Injection Well System

Core Number	Cored Interval (feet bpl)	Core Sample Interval (feet bpl)	Horizontal Hydraulic Conductivity (cm/sec)	Vertical Hydraulic Conductivity (cm/sec)
1	1,650-1,665	1,652.3-1,652.7	2.0×10^{-5}	1.7×10^{-5}
2	1,825-1,839	1825.7-1826.4	6.7×10^{-6}	1.6×10^{-6}
		1830.65-1831.1	2.1×10^{-5}	4.4×10^{-5}
3	1,990-2,005	1995.15-1995.5	2.9×10^{-6}	1.1×10^{-6}
		2000.7-2001.5	8.7×10^{-6}	6.6×10^{-6}
4	2,136.5-2,148.5	2136.5-2136.95	2.0×10^{-6}	1.4×10^{-6}
		2140.65-2141.3	1.3×10^{-6}	1.7×10^{-6}

"bpl" denotes below pad level

"cm/sec" denotes hydraulic conductivity in centimeters per second

Table 6. Summary of Packer-Pumping Test, Final Water Sample Results, Golden Gate WWTF Injection Well System

Test Number	Test Date	Packer Pumping-Test Depth Interval (feet below pad level)	Ammonia Nitrogen (mg/L)	Specific Conductance (µmhos/cm)	Chloride (mg/L)	Total Phosphorus (mg/L)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Total Kjeldahl Nitrogen (mg/L)	pH (pH units)
MW1										
1	23-Jan-08	1512-1554	0.05	44,600	15,800	n/a	2,300	24,900	0.15	7.47
2	25-Jan-08	1103-1130	0.53	17,500	6,300	n/a	800	10,000	0.91	7.48
3	26-Jan-08	1223-1250	0.44	30,100	11,000	n/a	1,420	18,300	0.86	7.31
4	29-Jan-08	1013-1045	0.46	9,320	2,600	n/a	701	5,120	0.59	7.38
IW1										
5	6-Apr-08	1554-1635	0.05	51,900	20,500	7.11**	2,580	32,000	0.59	7.32
6	10-Apr-08	1559-1577	0.34	61,700	19,200	*0.025*	2,420	33,400	0.17	7.2
7*	18-May-08	1619-1637	0.08	55,200	20,800	0.074	3,420	34,200	0.41	6.2
8*	20-May-08	1705-1723	0.24	51,900	19,700	*0.025*	2,870	33,500	0.31	6.36
9*	22-May-08	1814-1832	0.23	49,000	18,800	0.068	2,830	32,700	0.38	6.19
10*	23-May-08	2139-2157	0.34	46,500	17,800	0.068	2,730	31,600	0.44	5.96
11	24-May-08	2267-2285	0.09	47,900	18,500	0.064	2,860	31,000	0.33	7.46

"n/a" denotes analyte not analyzed

"n/d" denotes analyte not detected

"mg/L" denotes concentration in units of milligrams per liter.

"µmhos/cm" denotes specific conductance in units of micromos per centimeter.

Values in italics indicate that results are less than the noted method detection limit

Packer pumping-test depth intervals are measured from inflation-element centerlines.

" * " Samples collected from test intervals #7-10 are not representative because formation did not yield enough water to purge one work-pipe storage volume.

"**" The analyte was detected in both the sample and the associated method blank.

Table 7. Summary of Packer Test Data and Horizontal Hydraulic Conductivity Estimates
Golden Gate WWTF Injection Well System

Packer Test	Date	Well	Depth Interval (feet bpl)	Tested Aquifer Thickness (feet)	Pumping Rate (gpm)	Specific Capacity (gpm/ft)	Estimated Transmissivity (gpd/ft)		Estimated Horizontal Hydraulic Conductivity (gpd/sq ft)		Estimated Horizontal Hydraulic Conductivity (cm/sec)		Method of Interpretation
							Drawdown	Recovery	Drawdown	Recovery	Drawdown	Recovery	
1	1/23/08	MW1	1,512-1,554	43	84.5	11.1							Turcan (1963)
2	1/25/08	MW1	1,103-1,130	27	89	1.71	2,993	2,993	111	111	0.01	0.01	Turcan (1963)
								447		17		0.00	Cooper-Jacob (1946)
3	1/26/08	MW1	1,223-1,250	27	65.2	0.61	1,068	1,068	39.6	39.6	1.87E-03	1.87E-03	Turcan (1963)
							298.0	217	11.0	8.0	5.21E-04	3.79E-04	Cooper-Jacob (1946)
4	1/29/08	MW1	1,013-1,045	28	89.5	2.02	3,535	3,535	126.3	126.3	5.95E-03	5.95E-03	Turcan (1963)
								544.0	0.0	19.4		9.16E-04	Cooper-Jacob (1946)
5	4/6/08	IW1	1,554-1,635	81	36.3	0.26	455	455	5.6	5.6	2.65E-04	2.65E-04	Turcan (1963)
							478		5.9		2.78E-04		Papadopulos-Cooper (1967)
							95	112	1.2	1.4	5.53E-05	6.52E-05	Cooper-Jacob (1946)
6	4/10/08	IW1	1,559-1,577	18	16.5	0.1	175	175	9.7	9.7	4.59E-04	4.59E-04	Turcan (1963)
							39.6	38.0	2.2	2.1	1.04E-04	9.96E-05	Cooper-Jacob (1946)
7	5/18/08	IW1	1,619-1,637	18	0.67	<0.008	16		0.9		4.19E-05		Turcan (1963)
8	5/20/08	IW1	1,705-1,723	18	0.81	<0.006	12		0.7		3.14E-05		Turcan (1963)
9	5/22/08	IW1	1,814-1,833	18	0.67	<0.01	20		1.1		5.24E-05		Turcan (1963)
10	5/23/08	IW1	1,559-1,577	18	0.77	<0.01	20		1.1		5.24E-05		Turcan (1963)
11	5/24/08	IW1	2,267-2,285	18	14.75	0.15	300		16.7		7.86E-04		Turcan (1963)

bpl denotes below pad level.

gpm denotes gallons per minute.

gpm/ft denotes specific capacity in units of "gallons per minute per feet of drawdown".

gpd/ft denotes transmissivity in units of "gallons per day per foot", and is estimated using a method by Cooper-Jacob, Turcan and/or Papadopulous-Cooper.

gpd/sq ft denotes horizontal hydraulic conductivity in "gallons per day per square foot".

cm/sec denotes hydraulic conductivity in units of "centimeters per second".

Note: The estimated horizontal hydraulic conductivity value was calculated by assuming that the packer interval was the effective aquifer thickness. Thus, the estimated horizontal hydraulic conductivity reported represent probable "maximum" horizontal hydraulic coductivity for each interval tested.

Table 8. Summary of Inclination Survey Results in Deep Monitor Well MW1 Golden Gate WWTF Injection Well System

Date	Open Hole Diameter (inches)	Inclination Survey Depth (ft)	Survey Result (degrees)	
			Deviation Total	Deviation Change
12/26/2007	12	90	0.80	0.80 (Repeated 12/28/07)
12/27/2007	12	180	0.50	0.30
12/27/2007	12	270	0.50	0.00
12/27/2007	12	360	0.50	0.00
12/27/2007	12	450	0.50	0.00
12/28/2007	12	540	0.40	0.10
12/28/2007	12	90	0.30	0.30
12/31/2007	32	90	0.50	n/a
1/1/2008	32	180	0.60	0.10
1/2/2008	32	270	0.60	0.00
1/2/2008	32	360	0.70	0.10
1/5/2008	32	450	0.50	0.20
1/14/2008	12	630	0.30	0.10
1/14/2008	12	720	0.20	0.10
1/15/2008	12	810	0.40	0.20
1/15/2008	12	900	0.20	0.20
1/15/2008	12	990	0.30	0.10
1/16/2008	12	1080	0.30	0.00
1/16/2008	12	1170	0.50	0.20
1/16/2008	12	1260	0.50	0.00
1/17/2008	12	1350	0.50	0.00
1/17/2008	12	1440	0.50	0.00
1/19/2008	12	1530	0.50	0.00
1/20/2008	12	1618	0.60	0.10
2/4/2008	24	540	0.40	0.10
2/4/2008	24	630	0.50	0.10
2/5/2008	24	720	0.50	0.00
2/5/2008	24	810	0.50	0.00
2/5/2008	24	900	0.40	0.10
2/5/2008	24	990	0.50	0.10
2/5/2008	24	1080	0.40	0.10
2/11/2008	16	1170	0.50	0.10
2/11/2008	16	1260	0.60	0.10
2/11/2008	16	1350	0.60	0.00
2/12/2008	16	1440	0.60	0.00

The maximum allowable deviation from the vertical of any survey point is 1 degree

The maximum allowable difference between any two successive survey points is 0.5 degree.

"bpl "denotes below pad level

Table 9. Summary of Inclination Survey Results in Injection Well IW1
Golden Gate WWTF Injection Well System

Date	Open Hole Diameter (inches)	Inclination Survey Depth (ft)	Survey Result (degrees)	
			Deviation Total	Deviation Change
3/26/2008	48	90	0.00	0.00
3/26/2008	48	180	0.20	0.20
3/28/2008	48	270	0.00	0.20
3/28/2008	48	360	0.10	0.10
3/29/2008	48	450	0.00	0.10
4/2/2008	12	540	0.00	0.00
4/2/2008	12	630	0.00	0.00
4/2/2008	12	720	0.00	0.00
4/3/2008	12	810	0.00	0.00
4/3/2008	12	900	0.00	0.00
4/3/2008	12	990	0.00	0.00
4/3/2008	12	1080	0.00	0.00
4/3/2008	12	1170	0.00	0.00
4/3/2008	12	1260	0.00	0.00
4/4/2008	12	1350	0.00	0.00
4/4/2008	12	1440	0.00	0.00
4/4/2008	12	1530	0.00	0.00
4/7/2008	12	1620	0.00	0.00
4/12/2008	36	580	0.50	0.00
4/13/2008	36	670	0.25	0.25
4/13/2008	36	760	0.50	0.25
4/13/2008	36	850	0.50	0.25
4/15/2008	36	940	0.50	0.00
4/15/2008	36	1030	0.25	0.25
4/15/2008	36	1120	0.40	0.15
4/16/2008	36	1210	0.80	0.40
4/17/2008	36	1300	0.40	0.40
4/17/2008	36	1390	0.50	0.10
4/18/2008	36	1480	0.50	0.00
4/18/2008	36	1570	0.30	0.20
4/24/2008	12	1670	0.10	0.00
4/28/2008	12	1760	0.40	0.30
4/30/2008	12	1850	0.60	0.20
4/30/2008	12	1940	0.20	0.40
4/30/2008	12	2030	0.50	0.30
5/2/2008	12	2120	0.70	0.20
5/2/2008	12	2210	0.70	0.00
5/2/2008	12	2300	0.40	0.30
5/3/2008	12	2390	0.60	0.20
5/3/2008	12	2480	0.30	0.30
5/4/2008	12	2570	0.20	0.10
5/5/2008	12	2660	0.50	0.30
5/5/2008	12	2750	0.20	0.30
5/28/2008	28	1670	0.50	0.00
5/28/2008	28	1760	0.50	0.00
5/29/2008	28	1850	0.20	0.30
5/29/2008	28	1940	0.40	0.40
5/31/2008	28	2030	0.80	0.40
5/31/2008	28	2120	0.70	0.10
6/1/2008	28	2210	0.70	0.00
6/1/2008	28	2300	0.60	0.10
6/1/2008	28	2390	0.80	0.20

The maximum allowable deviation from the vertical of any survey point is 1 degree

The maximum allowable difference between any two successive survey points is 0.5 degree.

bpl denotes below pad level

Table 10. Cementing Summary of Deep Monitor Well MW1, Golden Gate WWTF Injection Well System

Casing String	Outside Diameter (inches)	Inside Diameter (inches)	Casing Wall Thickness (inches)	Casing Depth (feet bpl)	Date	Cement Stage	Type of Cement	Quantity of Cement (cubic feet)	Remarks
Conductor	34	33.25	0.375	52	12/20/2007	1	Neat	377	Pressure grout, cement returns to surface.
Surface	24	23.25	0.375	490	1/8/2008	1	6% bentonite	1,264	Pressure grout. Cement returns to surface.
							Neat	686	
Upper Monitor Zone Casing	16	15	0.5	1078.5	2/9/2008	1	Neat	28	Packer at 1080 ft bpl.
					2/9/2008	2	Neat	118	Tagged cement top at 1,025 feet bpl. Tremied in place.
							6% bentonite	966	
					2/10/2008	3	6% bentonite	562	Tagged cement top at 840 feet bpl. Tremied in place.
					2/10/2008	4	6% bentonite	910	Tagged cement at 507 feet bpl, cemented to the surface.
Lower Monitor Zone FRP Tubing	6.625	5.605	0.51	1,498	2/17/2008	1	Neat	281	Tagged packer at 1498 ft bpl. Tremied in place.
					2/18/2008	2	Neat	337	Tagged cement top at 1,387 feet bpl. Tremied in place.
					2/18/2008	3	Neat	112	Tagged cement top at 1,1200 feet bpl. Tremied in place.
					2/19/2008	4	Neat	51	Tagged cement top at 1,160 feet bpl. Tremied in place.
					2/20/2008	-	-	-	Tagged cement top at 1,128 feet bpl. Cementing completed.
							Total (ft^3):	**5,692**	

"bpl" denotes beolow pad level

Neat cement refers to Portland Type I/II cement with no additives

6% bentonite refers to Portland Type I/II cement with a 6% (by weight) bentonite additive

Table 11. Cementing Summary of Injection Well IW1, Golden Gate WWTF Injection Well System

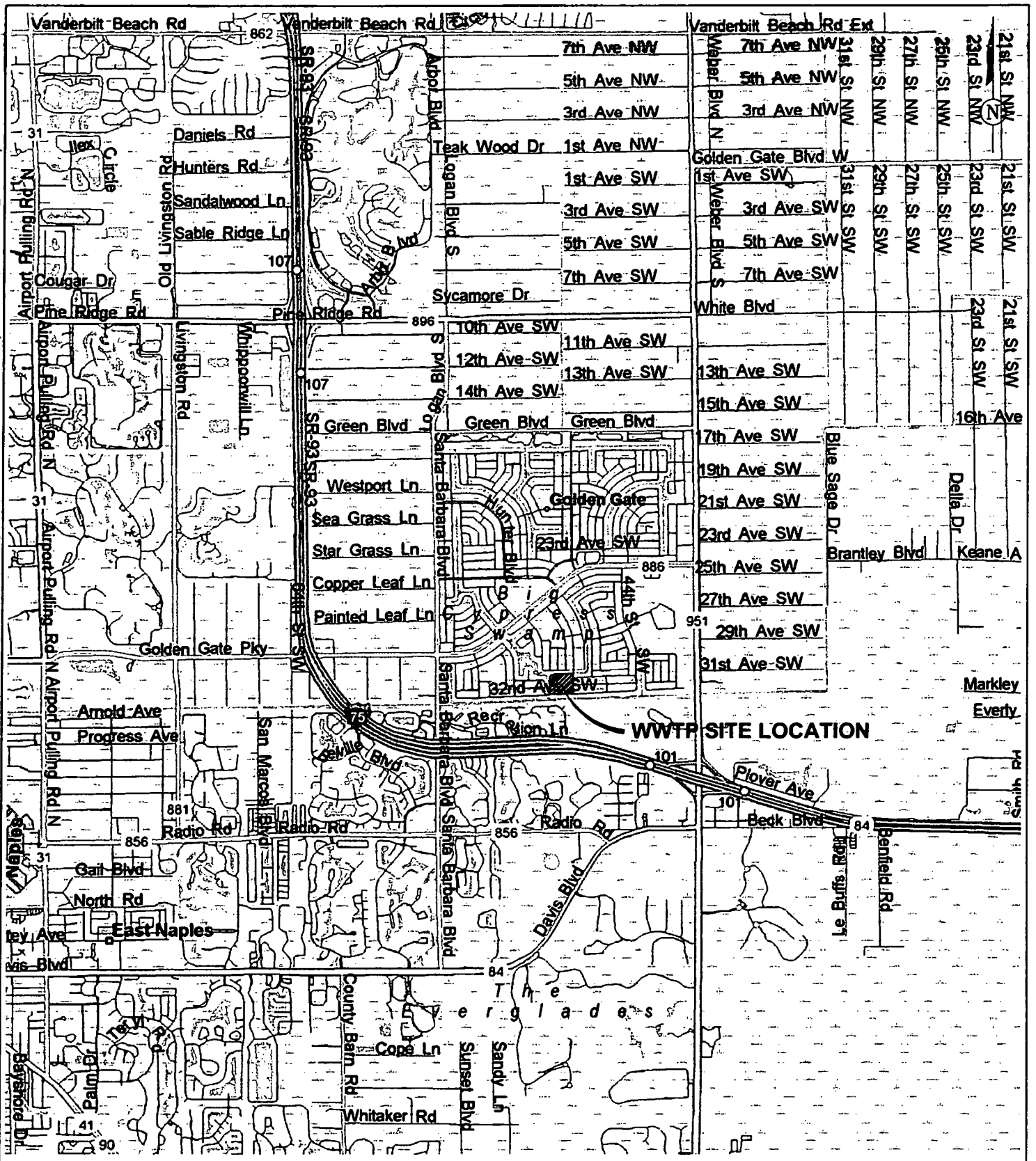
Casing String	Outside Diameter (inches)	Inside Diameter (inches)	Casing Wall Thickness (inches)	Casing Depth (feet bpl)	Date	Cement Stage	Type of Cement	Quantity of Cement (cubic feet)	Remarks
Conductor	48	47.25	0.375	54.5	3/23/2008	1	neat	607	Borehole depth: 56 feet bpl.
Surface	36	35.25	0.375	494	3/30/2008	1	bentonite mix	2,248	Pressure grout. Cement returns observed on surface.
							neat	528	
Intermediate	28	27.25	0.375	1580	4/20/2008	1	6% bentonite	1,113	Pressure grout. Bottom well tagged at 1584 ft bpl
							Neat	84	
					4/21/2008	2	6% bentonite	1,405	Tagged cement top at 1348 feet bpl. Tremied in place.
					4/22/2008	3	6% bentonite	1,501	Tagged cement top at 1021 feet bpl. Tremied in place.
					4/23/2008	4	6% bentonite	197	Tagged cement top at 670 feet bpl. Tremied in place.
					4/23/2008	5	6% bentonite	1,821	Tagged cement top at 575 feet bpl. Tremied in place. Observe cement return on surface.
Final	18	17	0.500	2,472	6/27/2008	1	neat	703	Tagged top of plug at 2,448 feet bpl. Tremied in place.
					6/27/2008	2	6% bentonite	2,248	Tagged cement top at 2,249 feet bpl
					6/28/2008	3	6% bentonite	337	Tagged cement top at 1,638 feet bpl. Tremied in place.
							12% bentonite	1,349	
					6/29/2008	4	12% bentonite	1,236	Tagged cement top at 984 feet bpl. Tremied in place.
					6/30/2008	5	12% bentonite	1,214	Tagged cement top at 472 feet bpl. Tremied in place. Observed cement return on surface.
FRP Injection Tubing	12	13.375	0.68	2,461	7/4/2008	Not Cemented			Fluid Filled Annulus/Corrosion Inhibitor
							Total (ft^3):	**16,591**	

"bpl" denotes beolow pad level

Neat cement refers to Portland Type I/II cement with no additives

6% bentonite refers to Portland Type I/II cement with a 6% (by weight) bentonite additive

12% bentonite refers to Portland Type I/II cement with a 12% (by weight) bentonite additive



Area Manager: T.JENSEN	ARCADIS	FLORIDA GOVERNMENTAL UTILITY AUTHORITY GOLDEN GATE WWTP	Project Number: WF004200.0G15
Project Director: W.LYNCH	2081 Vista Parkway West Palm Beach, Florida 33411 Tel: 561.697.7000 Fax: 561.697.7751 www.arcadis-us.com	**SITE LOCATION MAP** GOLDEN GATE, FLORIDA	Drawing Date: 11NOV08
Task Manager: R.MILLER			Figure: 1
Technical Review: W.LYNCH			

Current Plotstyle : ByColor
Layout Tab: F1_Site Location_Street Map
Data\Time : Tue, 11 Nov 2008 - 11:37am
Path\Name : G:\Projects\WF\WF PROJECTS\WF004200.0G15 - Golden Gate Injection Well\Background Data\Construction Permit App Data\CadAs-Built\WF004200G00-SLM.dwg
Acad Version : R17.1s (LMS Tech)
User Name : bdlwo

RIB NO. 4

RIB NO. 3

RIB NO. 2

RIB NO. 1

EXISTING AERATION BASIN #1

EXISTING CLARIFIER #2

EXISTING THREE-STAGE BIOSOLIDS DIGESTER

STAIRS TO BE RELOCATED

WOODEN FENCE TO BE REMOVED

RAS/WAS PUMPS

WSC ROOM

ASPHALT

EXISTING PLANT LIFT STATION

INJECTION WELL

MONITORING WELL

100'

180'

SCALE
0 100
FEET

Area Manager	T.JENSEN
Project Director	W.LYNCH
Task Manager	R.MILLER
Technical Review	W.LYNCH

ARCADIS
2081 Vista Parkway
West Palm Beach, Florida 33411
Tel: 561.697.7000 Fax: 561.697.7751
www.arcadis-us.com

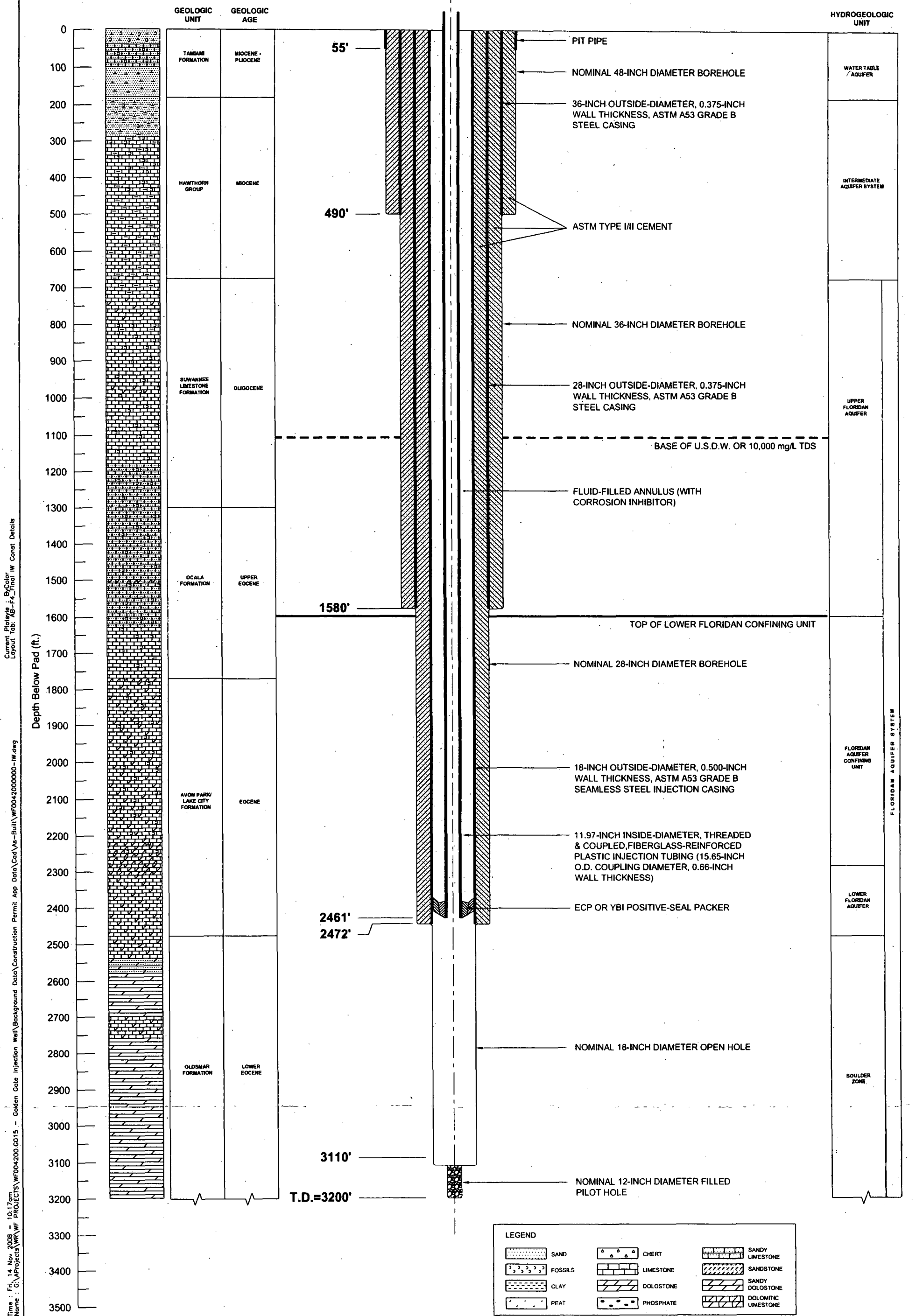
FLORIDA GOVERNMENTAL UTILITY AUTHORITY
GOLDEN GATE WWTP

SITE LAYOUT

GOLDEN GATE, FLORIDA

Project Number	WF004200.0G15
Drawing Date	11NOV08
Figure	2

Acad Version : R17.1s (LMS Tech)
User Name : bolivo
Date\Time : Tue, 11 Nov 2008 - 11:35am
Path\Name : G:_AProjects\WR_WF PROJECTS\WF004200.0015 - Golden Gate Injection Well\Background Data\Construction Permit App Data\Cad\Xs-Built\WF004200000-SM.dwg
Current Plotstyle : ByColor
Layout Tab: F2_Site Layout



Drawing not to scale

Area Manager	T.JENSEN
Project Director	W.LYNCH
Task Manager	R.MILLER
Technical Review	W.LYNCH

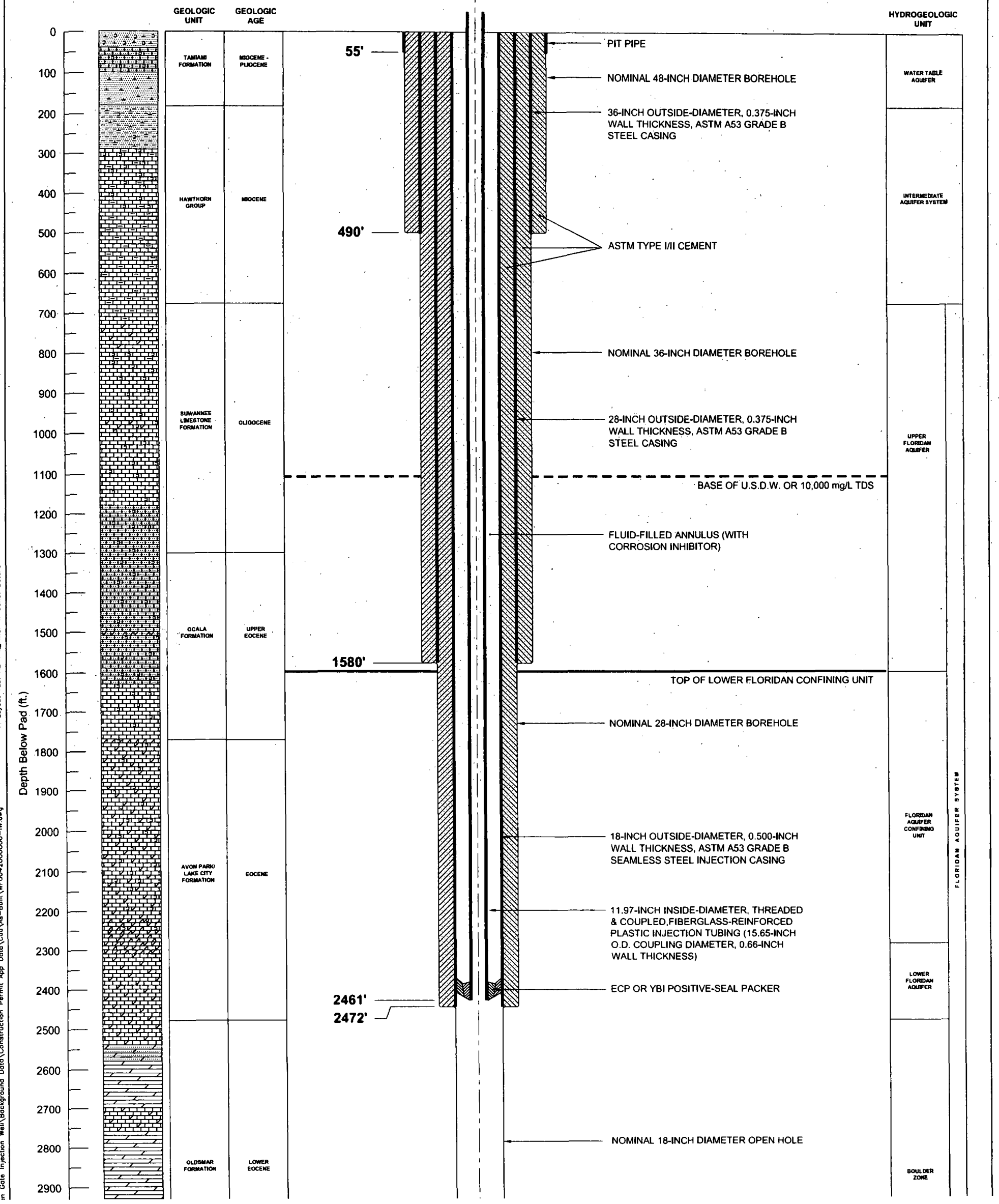
ARCADIS
2081 Vista Parkway
West Palm Beach, Florida 33411
Tel: 561.697.7000 Fax: 561.697.7751
www.arcadis-us.com

FLORIDA GOVERNMENTAL UTILITY AUTHORITY
GOLDEN GATE WWTP

FINAL CONSTRUCTION DETAIL
INJECTION WELL IW1

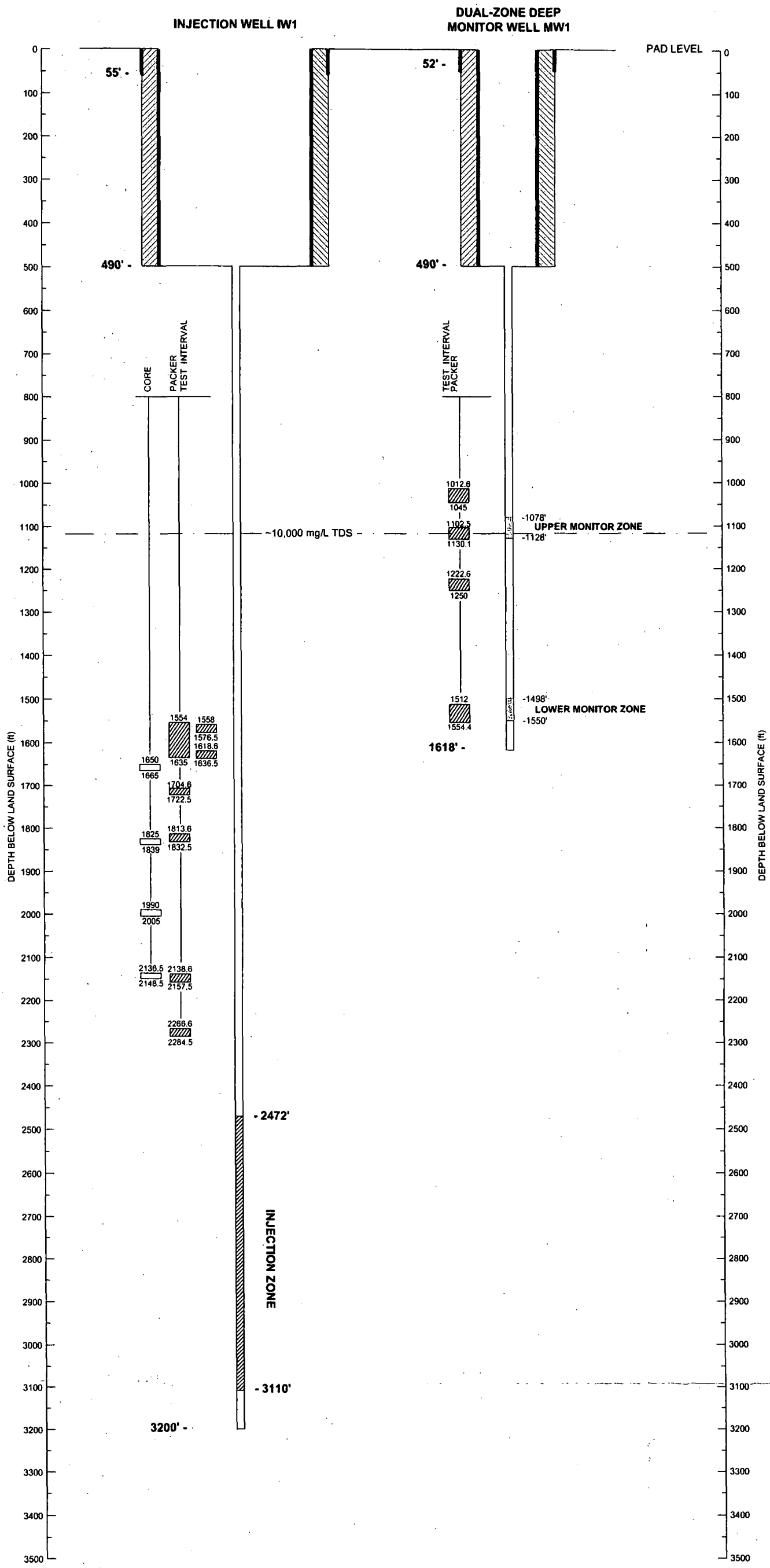
GOLDEN GATE, FLORIDA

Project Number	WF004200.0G15
Drawing Date	11NOV08
Figure	4



Current Plotstyle : ByColor
Layout Tab: AB-F4_Final IW Const Details

n Gate Injection Well\Background Data\Construction Permit App Data\Cad\As-Built\WF0042000000-IW.dwg



Drawing not to scale

Area Manager	T.JENSEN
Project Director	W.LYNCH
Task Manager	R.MILLER
Technical Review	W.LYNCH

ARCADIS
2081 Vista Parkway
West Palm Beach, Florida 33411
Tel: 561.697.7000 Fax: 561.697.7751
www.arcadis-us.com

FLORIDA GOVERNMENTAL UTILITY AUTHORITY
GOLDEN GATE WWTP

ACTUAL CORING AND PACKER TESTING PROGRAM

GOLDEN GATE, FLORIDA

Project Number	WF004200.0G15
Drawing Date	11NOV08
Figure	5

Acad Version : R17.1s (LMS Tech) Date\Time : Tue, 11 Nov 2008 - 4:26pm
User Name : bolivo Path\Name : C:\AProjects\WR\WF_PROJECTS\WF004200.G015 - Golden Gate Injection Well\Background Data\Construction Permit App Data\Cad\As-Built\00109006 18-TST.dwg
Current Plotstyle : ByColor
Layout Tab: AB-F5_Actual Test Intervals

DISTANCE (miles)

4.55 | 4.42 | 3.17 | 5.50 | 18.30 | 8.40 | 5.34

NORTH

SOUTH

N. FT. MYERS UTILITY | WA-68 | WA-98 | HUMBLE OIL | FT. MYERS BEACH WWTP | N. COLLIER COUNTY RECLAMATION FACILITY | GOLDEN GATE WWTP IW1 | COLLIEER COUNTY SOUTH COUNTY REGIONAL

GEOLOGIC UNITS

HYDROGEOLOGIC UNITS

DEPTH (feet)

0
500
1,000
1,500
2,000
2,500
3,000
3,500

UNDIFFERENTIATED SEDIMENTS / TAMIAMI FORMATION

SURFICIAL AQUIFER

HAWTHORN GROUP

INTERMEDIATE AQUIFER

TAMPA LIMESTONE

SUWANNEE LIMESTONE FORMATION

UPPER FLORIDAN AQUIFER

OCALA FORMATION

U.S.D.W

U.S.D.W

LOWER FLORIDAN AQUIFER

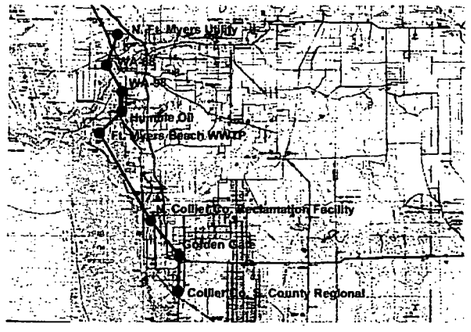
AVON PARK/LAKE CITY LIMESTONE FORMATION

FLORIDAN AQUIFER CONFINING UNIT (1,600-2,285)

LOWER FLORIDAN AQUIFER (Top of Injection Zone at 2,472)

OLDSMAR FORMATION

CEDAR KEYS FORMATION



HORIZONTAL SCALE
0 4.0
MILES

References:

1. Water Resource Solutions, "Well Completion Report for IW-1 and DZMW, Volume I, Collier County", N. Collier Water Reclamation Facility, 2004.
2. CH2MHill, "Lee County Utilities, Ft. Myers Beach WWTP Deep Injection Well Operational Permit Application", September 2002.
3. Rust Environmental & Infrastructure, Inc., "MIT Plan for the Wastewater Disposal Deep Injection Well at the North Ft. Myers Utility Site", July 1997.
4. Missimer International, Inc., "Collier County South County Regional WWTP Injection Well IW-1 Completion Report, Volume I – Text", February 1997.
5. Bennett, Michael W., "Hydrologic Investigation of the Florida Aquifer System at the I-75 Canal Site, Collier County, Florida. Technical Publication NS-7, 2001.

Area Manager	T.JENSEN
Project Director	W.LYNCH
Task Manager	R.MILLER
Technical Review	W.LYNCH

ARCADIS
712 U.S. Highway One
Suite 200
North Palm Beach, Florida 33408
Tel: 561.881.0077 Fax: 561.881.0012
www.arcadis-us.com

FLORIDA GOVERNMENTAL UTILITY AUTHORITY
GOLDEN GATE WWTP

NORTH - SOUTH HYDROGEOLOGIC CROSS SECTION

GOLDEN GATE, FLORIDA

Project Number	PF001090.0G18
Drawing Date	11NOV08
Figure	6

DISTANCE (miles)

11.00 | 18.7 | 8.40 | 24.20

WEST — **EAST**

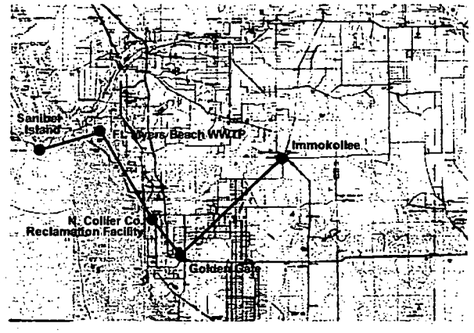
SANIBEL ISLAND | FT. MYERS BEACH WWTP | NORTH COLLIER COUNTY RECLAMATION FACILITY | GOLDEN GATE WWTP IW1 | IMMOKOLEE

DEPTH (feet)

GEOLOGIC UNITS	HYDROGEOLOGIC UNITS
UNDIFFERENTIATED SEDIMENTS / TAMIAMI FORMATION	SURFICIAL AQUIFER
HAWTHORN GROUP	INTERMEDIATE AQUIFER
SUWANNEE LIMESTONE FORMATION	UPPER FLORIDAN AQUIFER
OCALA FORMATION	LOWER FLORIDAN AQUIFER
AVON PARK/LAKE CITY LIMESTONE FORMATION	FLORIDAN AQUIFER CONFINING UNIT (1,600-2,285)
OLDSMAR FORMATION	LOWER FLORIDAN AQUIFER (Top of Injection Zone at 2,472)

U.S.D.W

0 | 500 | 1,000 | 1,500 | 2,000 | 2,500 | 3,000 | 3,500



HORIZONTAL SCALE
0 — 5.0
MILES

References:

1. Missimer International, Inc., "Island Water Association, City of Sanibel Injection Well IW-1 Request to Start Operational Testing", March 2000.
2. Water Resource Solutions, "Well Completion Report for IW-1 and DZMW, Volume I, Collier County", N. Collier Water Reclamation Facility, 2004.
3. CH2MHill, "Lee County Utilities, Ft. Myers Beach WWTP Deep Injection Well Operational Permit Application", September 2002.
4. CH2MHill, "Application to Construct a Deep Injection Well and Single Zone Monitor Well", March 2000.
5. Bennett, Michael W., "Hydrologic Investigation of the Florida Aquifer System at the I-75 Canal Site, Collier County, Florida. Technical Publication NS-7, 2001.

Area Manager	T.JENSEN
Project Director	W.LYNCH
Task Manager	R.MILLER
Technical Review	W.LYNCH

ARCADIS
712 U.S. Highway One
Suite 200
North Palm Beach, Florida 33408
Tel: 561.881.0077 Fax: 561.881.0012
www.arcadis-us.com

FLORIDA GOVERNMENTAL UTILITY AUTHORITY
GOLDEN GATE WWTP

WEST - EAST HYDROGEOLOGIC CROSS SECTION

GOLDEN GATE, FLORIDA

Project Number	PF001090.0G18
Drawing Date	11nov08
Figure	7

ARCADIS

Appendix A

Construction Permit

Florida Department of Environmental Protection

SENT VIA ELECTRONIC MAIL:

In the Matter of an
Application for Permit by:

June 27, 2007

Charles L. Sweat, Director of Operations
Florida Governmental Utility Authority
280 Wekiva Springs Road, Suite 2000
Longwood, Florida 32779
Email: csweat@govmserv.com

CollierCounty - UIC
File Number: 263889-001-UC/1I
FGUA Golden Gate WWTP
Class 1 Injection Well Construction

NOTICE OF PERMIT ISSUANCE

Enclosed is Permit Number 263889-001-UC/1I to operate a Class I Injection Well (IW-1) system, issued pursuant to Section(s) 403.087, Florida Statutes.

Any party to this Order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000; and by filing a copy of the Notice of appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this Notice is filed with the Clerk of the Department.

Executed in Lee County, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Jon M. Iglehart
Director of District Management

CERTIFICATE OF SERVICE

The undersigned designated clerk hereby certifies that this PERMIT and all copies were mailed before the close of business on June 27, 2007 to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGMENT

FILED, on this date, pursuant to Section 120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Julia D. La Mere

6/27/07

Clerk

Date

JMI/DR/jgh

Enclosure

Cc Nancy Marsh, EPA (marsh.nancy@epa.gov)
Steve Anderson, SFWMD (sanderso@sfwmd.gov)
Ron Reese, USGS (rsreese@usgs.gov)
Joe Haberfeld, FDEP (joe.haberfeld@dep.state.fl.us)
James T. Macon, P.E., (jmacon@arcadis-us.com)

Florida Department of Environmental Protection

PERMIT

PERMITTEE:
Charles L. Sweat, Director of Operations
Florida Governmental Utility Authority
280 Wekiva Springs Road, Suite 2000
Longwood, Florida 32779
Email: csweat@govmserv.com

Collier County - UIC
File Number: 263889-001-UC/1I
Date of Issue: June 27, 2007
Expiration Date: June 26, 2012
Latitude: 26.0° 10.0' 13.00" N
Longitude: - 81.0° 42.0' 09.00" W
FGUA Golden Gate WWTP
Class 1 Injection Well Construction

This permit is issued under the provisions of Chapter 403, Florida Statutes (F.S.), and Florida Administrative Code (F.A.C.) Rules 62-4, 62-520, 62-528, 62-550, 62-600, 62-601, 62-620 and 62-660. 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 one (1) nominal eighteen-inch (18) inch diameter steel casing Class I injection well (IW-1), with cemented eighteen-inch (18) steel casing to approximately 2750 feet below land surface (bls) and 11.97-inch ID FRP injection tubing and packer assembly placed to approximately 2730 feet bls and a total depth of approximately 3450 feet bls. The annular space will be fluid filled with Halliburton Baracor 100 or equivalent and water solution. Injection will be into the Oldsmar Formation for the primary means of disposal of non-hazardous reverse osmosis concentrate from the Golden Gate WTP and non-hazardous secondary treated domestic wastewater from the Golden Gate WWTP at a maximum injection rate of 10 feet per second, (fps), in the 11.97-inch ID FRP injection tubing or 3510 GPM (gallons per minute). In no case shall the maximum disposal volume of 5.0 million gallons per day (MGD) be exceeded. The dual zone monitoring well (DZMW-1) will be completed approximately from 950 to 1000 feet bls and approximately from 1250 to 1300 feet bls.

The Application to Construct/Operate/Abandon Class I, III, or V Injection well System, DEP Form 62-528.900(1), was received April 7, 2006, with supporting documents and additional information last received January 8, 2007. The Certificate of Demonstration of Financial Responsibility was approved July 27, 2006. The project is located at the 32nd Avenue S.W. at Golden Gate City, Florida, Collier County, Florida.

Subject to Specific Conditions 1-14.

SPECIFIC CONDITIONS:

1. GENERAL CRITERIA

a. Any permit noncompliance constitutes a violation of the Safe Drinking Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

b. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

c. The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit.

d. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures.

e. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation or reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

f. When requested by the Department, the permittee shall furnish, within the time specified, any information needed to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit.

g. Signatories and Certification Requirements

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

(2) In accordance with Rule 62-528.340(4), F.A.C., all reports shall contain the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my 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."

h. The permittee shall notify the Department and obtain approval prior to any physical alterations or additions to the injection or monitor well, including removal of the well head.

i. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or injection activity that may result in noncompliance with permit requirements.

j. The permittee shall report any noncompliance that may endanger health or the environment, including:

(1) Any monitoring or other information which indicates that any contaminant may cause an endangerment to an underground source of drinking water; or

(2) 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.

(3) Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause, the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

k. No underground injection is allowed that causes or allows movement of fluid into an underground source of drinking water.

l. The permittee shall retain all records of all monitoring information concerning the nature and composition of injected fluid until five years after completion of any plugging and abandonment procedures specified under Rule 62-528.435, F.A.C. The permittee shall deliver the records to the Department office that issued the permit at the conclusion of the retention period unless the permittee elects to continue retention of the records.

m. If injection is to continue beyond the expiration date of this permit the permittee shall apply for, and obtain an operation permit. If necessary to complete the two-year operational testing period, the permittee shall apply for renewal of the construction permit at least 60 days prior to the expiration date of this permit.

2. 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.

c. Specific drilling pad dimensions and design details shall be provided to and approved by the Department prior to commencing construction (and shortly after selection of drilling contractor).

d. The water table monitoring wells surrounding the injection well and monitor well pads 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. Pursuant to Rule 62-528.455(1)(c)6., F.A.C., 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.

3. CONSTRUCTION AND TESTING REQUIREMENTS
   a. The permittee shall contact the Technical Advisory Committee (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.

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

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

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

      (1) Intermediate casing seat selection for injection and monitor wells.

      (2) Final casing seat selection for injection and monitor wells.

      (3) Prior to conducting the short term injection test. A revised testing plan for the short-term injection test must be submitted and approved prior to running the test.

      (4) Prior to operational (long term) testing with effluent.

      (5) The permittee shall submit all necessary supporting documentation/data, with interpretation, to the TAC for review.

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

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

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

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

   i. The injection zone and monitoring zones shall be sampled for background water quality prior to commencement of any injection testing. Parameters to be measured are the primary and secondary drinking water standards (except asbestos, dioxin, epichlorhydrin, and acrylamide) and the minimum criteria for municipal effluent.

   j. The injection and monitor well(s) at the site shall be abandoned when no longer usable for their intended purpose, or when posing potential threat to the quality of the waters of the State. Within 180 days of well

abandonment, the permittee shall submit to the Department and the TAC the proposed plugging method, pursuant to Rule 62-528.435, F.A.C.

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

l. All dual induction, sonic and caliper geophysical logs run on the pilot holes of the injection well and monitor wells shall be submitted with scales of one inch equals one hundred feet (1"=100'), two inches equals one hundred feet (2"=100'), and five inches equals one hundred feet (5"=100')

m. An engineering drawing showing the drill pad construction (including material used) and locations of the injection well, dual zone monitor well, and the water table monitor wells shall be provided for Department approval prior to pad construction and well construction.

4. QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

a. This permit approval is based upon evaluation of the data contained in the application dated August 2005 and the plans and/or specifications submitted in support of the application. Any proposed modifications to this permit shall be submitted in writing to the Underground Injection Control program manager, the TAC for review and clearance prior to implementation. Changes of negligible impact to the environment and staff time will be reviewed by the program manager, cleared when appropriate and incorporated into this permit. Changes or modifications other than those described above will require submission of a completed application and appropriate processing fee as per Rule 62-4.050, F.A.C.

b. A professional engineer registered pursuant to Chapter 471, Florida Statutes shall be retained throughout the construction period to be responsible for the construction operation and to 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 that are submitted to the Department for public record shall be signed and sealed by the professional(s) who approved or prepared them.

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

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

5. 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
P.O. Box 2549
Fort Myers, FL 33902-2549

Florida Department of Environmental Protection
Bureau of Water Facilities Regulation
UIC Program, MS 3530
2600 Blair Stone Rd.
Tallahassee, FL 32399-2400

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

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

b. Members of the TAC shall receive a weekly summary of the daily log kept by the contractor. The reporting period shall run for seven (7) days and reports shall be mailed or emailed within 48 hours of the last day of the reporting period. 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, deviation survey results, 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, including pad monitor wells.

(7) Copies of the driller's log are to be submitted with the weekly summary.

c. The Department must be notified seventy-two (72) hours prior to all testing for mechanical integrity on the injection well. 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, with interpretation, for intermediate and final casing seat selection approvals by the Department.
e. An interpretation of all test results must be submitted with all test data and geophysical logs.

f. After completion of construction and testing, a final report, certified by a P.E. and P.G., shall be submitted to the Department and the TAC. The report shall include, but not be limited to, all information and data collected under Rule 62-528.450(2) and Rule 62-528.450(3), F.A.C., with appropriate interpretations. Mill certificates for the casing(s) shall be included in this report. To the extent possible, the transmissivity of the injection zone and maximum injection rate within safe pressure limits shall be estimated.

6. The construction permit includes a period of temporary injection operation for the purposes of long term testing. Prior to commencement of operational testing:

a. Construction of the injection well shall be complete and the permittee shall submit a notice of completion of construction certified by a P.E. to the Department.

b. Each well shall first be tested for integrity of construction, and shall be followed by a short-term injection test of such duration to allow for the prediction of the operating pressure.

c. The permittee shall submit the following information to each member of the Technical Advisory Committee:

(1) A copy of the borehole television survey(s)

(2) Geophysical logs

(3) Mechanical integrity test data

(4) Data obtained during the short term injection testing conducted pursuant to Rules 62-528.405(3)(a) and 62-528.410(7)(e), and 62-528.450(3)(a)2., F.A.C.

(5) Confining zone data

(6) Background water quality data for the injection and monitor zones

(7) Waste stream analysis

(8) As-built well construction specifications

(9) Draft operation and maintenance manual with emergency procedures

(10) Other data obtained during well construction needed by the Department to evaluate whether the well will operate in compliance with Department rules.

d. The emergency discharge method shall be fully operational and no emergency discharge shall occur until the permittee has obtained all necessary permits.

e. Any corrective action required under Rule 62-528.300(5)(c)2., F.A.C., has been completed.
f. Written authorization shall be obtained from the Department. Authorization shall be for up to two years or the expiration date of the construction permit, whichever is less, and is nonrenewable. The authorization shall specify the conditions under which operational testing is approved. The authorization shall include:

(1) Injection pressure limitation

(2) Injection flow rate limitation

(3) Monthly specific injectivity testing

(4) Reporting requirements, and

(5) An expiration date for the operational testing period not to exceed two years.

g. Before authorizing operational testing the Department shall conduct an inspection of the facility to determine if the conditions of the permit have been met.

7. OPERATIONAL TESTING REQUIREMENTS

a. Operational Testing Conditions - Injection Well System

(1) The injection system shall be monitored in accordance with rule 62-528.425(1)(g) and 62-528.430(2), F.A.C.

(2) The following injection well performance data shall be recorded and reported at the frequency indicated from the injection well instrumentation in the Monthly Operating Report as indicated below. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

The permittee shall use continuous indicating and recording devices to monitor injection flow rate, annular pressure, and injection pressure. 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.

INJECTION WELL IW-1. The proposed specifications for the injection well are as follows:

Casing Diameter and Type	*Depth (bls) Cased*	*Open Hole (bls)*
48" Steel	50'	
36" Steel	500'	
28" Steel	1350'	
18" Steel	2750'	
11.97" ID FRP	2730'	
		from 2750 to 3450

Parameters	*Reporting Frequency*
Injection Pressure (psi)	Daily/Monthly
Maximum Injection Pressure	Daily/Monthly
Minimum Injection Pressure	Daily/Monthly
Average Injection Pressure	Daily/Monthly
Annular Pressure (psi)	Daily/Monthly
Maximum Annular Pressure	Daily/Monthly
Minimum Annular Pressure	Daily/Monthly
Average Annular Pressure	Daily/Monthly
Fluid added to/removed from Annulus (gallons)	Daily/Monthly
Pressure added to/removed from Annulus (psi)	Daily/Monthly
Flow Rate (gpm)	Daily/Monthly
Maximum Flow Rate	Daily/Monthly
Minimum Flow Rate	Daily/Monthly
Average Flow Rate	Daily/Monthly
Total Volume WRF Effluent Injected (gallons)	Daily/Monthly
Total Volume WTP Concentrate Injected (gallons)	Daily/Monthly

Injectate Water Quality

WRF Effluent Water Quality

Parameters	*Reporting Frequency*
Ammonia (mg/l)	Monthly
Total Kjeldahl Nitrogen (TKN) (mg/L)	Monthly
Nitrate + Nitrite as N (mg/l)	Monthly

WTP Concentrate Water Quality

Parameters	*Reporting Frequency*
Specific Conductivity (µmhos/cm)	Monthly
Total Dissolved Solids (mg/L)	Monthly
pH (std. units)	Monthly
Chloride (mg/L)	Monthly
Sulfate (mg/L)	Monthly
Field Temperature (°C)	Monthly
Total Kjeldahl Nitrogen (TKN) (mg/L)	Monthly
Sodium (mg/L)	Monthly
Calcium (mg/L)	Monthly
Potassium (mg/L)	Monthly

Magnesium (mg/L)	Monthly
Iron (mg/L)	Monthly
Bicarbonate (mg/L)	Monthly
Radium 226 (pCi/L)	Monthly
Radium 228 (pCi/L)	Monthly
Gross Alpha (pCi/L)	Monthly

b. Operational Testing Conditions - Monitor Well System.

(1) The monitor well system will consist of one Dual Zone Monitor Well, (DZMW-1) as described below:

Well Name	*Casing Diameter and Type*	*Depth Cased (bls)/Total (bls)*
DZMW-1	24" Steel	500'
DZMW-1 (Upper)	16" Steel	950'
DZMW-1 (Upper)		from 950 to 1000
DZMW-1 (Lower)	6.625" FRP	1250'
DZMW-1 (Lower)		from 1250 to 1300

(2) All monitor wells shall be monitored in accordance with rule 62-528.425 and 62-528.430, F.A.C. The following monitor well performance data shall be recorded and reported at the frequency indicated from the monitor well instrumentation in the Monthly Operating Report as indicated below. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. The permittee shall use continuous indicating and recording devices to monitor the monitor zone pressures or water levels. 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.

DZMW-1

Parameters	*Reporting Frequency*
Maximum Water Level/Pressure (Ft NAVD or psi)	Daily/Monthly
Minimum Water Level/Pressure (Ft NAVD or psi)	Daily/Monthly
Average Water Level/Pressure	Monthly

Water Quality

Parameters	*Reporting Frequency*
Specific Conductivity (µmhos/cm)	Weekly
Total Dissolved Solids (mg/L)	Weekly
pH (std. units)	Weekly
Chloride (mg/L)	Weekly
Sulfate (mg/L)	Weekly
Field Temperature (°C)	Weekly
Ammonia (mg/l)	Weekly
Total Kjeldahl Nitrogen (TKN) (mg/L)	Weekly
Sodium (mg/L)	Monthly

Calcium (mg/L)	Monthly
Potassium (mg/L)	Monthly
Magnesium (mg/L)	Monthly
Iron (mg/L)	Monthly
Bicarbonate (mg/L)	Monthly
Gross Alpha (pCi/L) **	Monthly
Radium 226 (pCi/L) **	Monthly
Radium 228 (pCi/L) **	Monthly

** Deep zone monitor well only.

(3) Water quality data may be reduced to monthly analyses after a minimum six months of data if the conditions of Rule 62-528.450(3)(d), F.A.C., have been met and with Department approval.

c. 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 semi-annual 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.

d. The permittee shall submit monthly to the Department the results of all injection well and monitor well data required by this permit no later than the last day of the month immediately following the month of record. The results shall be sent to the Department of Environmental Protection, P.O. Box 2549, Fort Myers, Florida 33902-2549. A copy of this report shall also be sent to the Department of Environmental Protection, Underground Injection Control Program, MS 3530, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400.

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

8. ABNORMAL EVENTS

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

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

9. EMERGENCY DISPOSAL

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

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

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

10. FINANCIAL RESPONSIBILITY

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

b. The permittee shall update annually the plugging and abandonment cost estimate. A certified (By Professional Geologist or Professional Engineer) copy of the annual update shall be submitted to the Department's UIC Program each year within 60 days after the anniversary date of issuance of this permit to the following addresses:

Underground Injection Control Program
Bureau of Water Facilities Regulation
Department of Environmental Protection
2600 Blair Stone Road, Mail Station #3530
Tallahassee, FL 32399-2400

Underground Injection Control Program
Department of Environmental Protection
South District Office
2295 Victoria Avenue, Ste 364
Ft Myers, FL 33902-2549

c. Upon the occurrence of the annual plugging and abandonment cost estimate exceeding, by 10 percent or more, (Section b. previously), the cost estimate upon which the current financial responsibility is based; the permittee shall submit to the Department certified financial documentation necessary to amend, renew, or otherwise replace the existing financial responsibility pursuant to Rule 62-528.435(9), F.A.C. and the conditions of this permit. Local governments shall include an updated *Certificate of Financial Responsibility* form and the comprehensive annual financial report for the latest completed fiscal year of that local entity.

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

11. MECHANICAL INTEGRITY

a. Injection is prohibited until the permittee affirmatively demonstrates that the well has mechanical integrity. Prior to operational testing the permittee shall establish, and thereafter maintain, mechanical integrity of the well at all times.

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

SPECIFIC CONDITIONS:

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

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

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

13. The permittee shall be aware of and operate under the general conditions in Rule 62-528.307(1)(a) through (x) and Rule 62-528.307(2)(a) through (f), F.A.C. These general conditions are binding upon the permittee and enforceable pursuant to Chaper 403 of the Florida Statutes.

Note: In the event of an emergency the permittee shall contact the Department by calling (850) 488-1320. During normal business hours, the permittee shall call (239) 332-6975.

Issued this _27__ day of June 2007.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Jon M. Iglehart
Director of District Management

JMI/DR/jgh

ARCADIS

Appendix B

Geologic Logs, Penetration Rate Chart and Core Description and Analysis Report

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
Fill: sand, limerock and clay.		0 – 4	4.0
LIMESTONE AND SAND: Limestone, 60%, light olive gray (5Y 5/2), grainstone, soft to moderately hard, poorly cemented; Sand, 40%, quartz, some calcareous, clear to yellowish gray (5Y 8/1), fine grained, sub-rounded; Shell, trace, small (0.1-inch) fragments.	WOB=3-4K, RPM=6-10 ROP=10-12min/ft	4-10	6.0
CAP ROCK; LIMESTONE WITH LITTLE SAND; Limestone, 90%, yellowish gray (5Y 8/1), grainstone, hard, moderately well cemented; Sand, 10%, mostly yellowish gray, calcareous, little quartz, clear, very fine- to fine- grained, sub-angular.	WOB=3-4K, RPM=6-10 ROP=10-12min/ft	10-18	8.0
CALCAREOUS SAND, LITTLE SHELL AND LIMESTONE; Sand, 80%, very light gray (N6), calcareous, little quartz, clear, very fine- to fine- grained, sub-angular; Shell, 10%, white (N9), small tests; Limestone, 10%, light olive gray (5Y 6/1), grainstone, very soft to soft, poorly cemented; Phosphate, trace, black, grains <1mm.	WOB=3-4K, RPM=6-10 ROP=1min/ft	18-30	12
SHELL WITH SOME SAND AND LIMESTONE; Shell, 60%, white (N9) to medium gray (N5), tests to 0.4-inch, mollusks; Sand, 20%, very light gray (N6), calcareous, little quartz, clear, very fine- to fine grained, sub-angular; Limestone, 20%, light olive gray (5Y 6/1), grainstone, very soft to soft, poorly cemented.	WOB=3-4K, RPM=6-10 ROP=3-5min/ft	30-46	16
FOSSILIFEROUS LIMESTONE WITH LITTLE SAND AND SHELL; Limestone, 80%, light olive gray (5Y 6/1), very fossiliferous (coquina), with shell intraclasts (mollusks, corals), moderately hard, moderately well cemented, vuggy; Sand, 10%, very light gray (N6), calcareous, very little quartz, clear, very fine- to fine-grained, sub-angular; Shell,10%, white (N9) to medium gray (N5), tests to 0.4-inch, mollusks; Phosphate, trace, black, grains <1mm.	WOB=3-4K, RPM=6-10 ROP=7-10min/ft	46-52	6
SAND; Sand, 100%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), calcareous, very fine- to fine- grained, sub- angular; Clay, trace, yellowish gray, calcareous, chalky, very soft, non- plastic; Phosphate, trace, black, very soft, grains <1mm.	WOB=5K RPM=15 ROP=<1min/ft	52-70	18

SAND AND LITTLE LIMESTONE; Sand, 85%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), calcareous, little quartz, clear, very fine- to fine- grained, sub-angular; Limestone, 15%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), fossiliferous grainstone, very soft to soft, poorly cemented, vuggy; Clay, trace, yellowish gray, calcareous, chalky, very soft, non- plastic. Phosphate, trace, black, very soft.	WOB=5K RPM=25 ROP=<1min/ft	70-80	10
SAND, SOME LIMESTONE AND LITTLE SHELL; Sand, 70%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), calcareous, little quartz, clear, very fine- to fine- grained, sub-angular; Limestone, 20%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), fossiliferous grainstone, trace of forams, very soft to soft, poorly cemented, vuggy; Shell, 10%, very pale orange (10YR 8/2), small tests to 0.2-inch, mollusks; Phosphate, trace, black, very soft.	WOB=5K RPM=25 ROP=3-5min/ft	80-100	20
LIMESTONE WITH SOME SAND AND SHELL; Limestone, 60%, yellowish gray (5Y 8/1) to light gray (N7), very fossiliferous (coquina), mollusks, trace of forams, some quartz grains, fine grained, soft, mostly poorly cemented, vuggy; Sand, 20%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), calcareous, some quartz, clear, very fine- to fine- grained, sub-angular; Shell, 20%, very pale orange (10YR 8/2), small tests to 0.2-inch, mollusks; Phosphate, trace, black, very soft.	WOB=5K RPM=25 ROP=1-2min/ft	100-110	10
SAND; Sand, 100%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), calcareous, very little quartz, clear, very fine- to fine- grained, sub- angular; Shell, trace, very pale orange (10YR 8/2), very small tests to 0.1-inch; Phosphate, trace, black, very soft.	WOB=2-3K RPM=90 ROP=<1min/ft	110-130	20
LIMESTONE WITH LITTLE SAND AND SHELL; Limestone, 80%, yellowish gray (5Y 8/1) to light gray (N7), fossiliferous (coquina), some grainstone, mollusks shells fragments, rare quartz grains, fine grained, moderately hard to soft, moderately well- to poorly-cemented, vuggy; Sand, 10%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), calcareous, some quartz, clear, very fine- to fine- grained, sub-angular; Shell, 10%, very pale orange (10YR 8/2), tests to 0.3-inch, mollusks.	WOB=2-3K RPM=90 ROP=3-5min/ft	130-140	10
SAND, SOME LIMESTONE AND LITTLE SHELL; Sand, 70%, quartz, clear, very fine- to fine- grained, sub-rounded, some calcareous, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2); Limestone, 20%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), fossiliferous grainstone (coquina), soft, poorly cemented, vuggy; Shell, 10%, very pale orange (10YR 8/2), small tests to 0.2-inch, mollusks; Phosphate, trace, black, very soft, grains <1mm.	WOB=1-3K RPM=90 ROP=2-5min/ft	140-160	20

SAND, LIMESTONE AND SHELL; Sand, 50%, quartz, clear, very fine- to fine- grained, often poorly cemented, little calcareous; Limestone, 30%, light gray (N7) to yellowish gray (5Y 8/1), fossiliferous grainstone, with quartz grains and shell intraclasts, soft, poorly cemented, vuggy; Shell, 20%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), small tests to 0.2-inch, mollusks; Phosphate, trace, black, very soft.	WOB=1-3K RPM=90 ROP=<1min/ft	160-175	15
CLAY; Clay, 100%, greenish gray (5GY 6/1), slightly calcareous and sandy (up to 10% clear, fine quartz grains), very soft, cohesive, non plastic, phosphatic (soft, fine, black grains).	WOB=12-13K RPM=90 ROP=<1min/ft	175-190	15
LIMESTONE WITH LITTLE CLAY AND SAND; Limestone, 80%, yellowish gray (5Y 8/1) to medium gray (N5), fossiliferous grainstone with quartz grains and shell intraclasts, soft to moderately hard, mostly poorly cemented, vuggy; Clay, 10%, greenish gray (5GY 6/1), slightly sandy (up to 10% clear, fine quartz grains), very soft, cohesive, non plastic; Sand, 10%, very pale orange (5Y 8/2), calcareous, little quartz and clear, very fine- to fine- grained, sub-angular.	WOB=14-16K RPM=90 ROP=<1min/ft	190-200	10
CLAY; Clay, 100%, greenish gray (5GY 6/1), slightly calcareous and sandy (up to 10% clear, fine quartz grains), very soft, cohesive, non plastic, phosphatic (soft, fine, black grains).	WOB=14-16K RPM=90 ROP=<1min/ft	200-230	30
CLAY AND SOME LIMESTONE; Clay, 70%, greenish gray (5GY 6/1) to yellowish gray (5Y 8/1), calcareous and sandy (up to 10% clear, fine quartz grains), very soft, cohesive, non plastic, phosphatic (soft, fine, black grains); Limestone, 30%, yellowish gray (5Y 8/1) to medium gray (N5), fossiliferous grainstone, with quartz grains and shell intraclasts, soft to moderately hard, mostly poorly cemented, vuggy .	WOB=14-16K RPM=90 ROP=<1min/ft	230-280	50
SANDY CLAY; Clay, 60%, greenish gray (5GY 6/1), slightly calcareous, very soft, very phosphatic (up to 10%), cohesive, non-plastic; Sand, 40%, quartz and calcareous, clear to very pale orange (10YR 8/2), very fine- to fine - grained.	WOB=14-16K RPM=90 ROP=<1min/ft	280-290	10
SANDY CLAY AND SOME LIMESTONE; Clay, 50%, pale olive (10Y 6/2), little dusky green (5G 3/2), calcareous, very soft, cohesive, non plastic, phosphatic (soft, fine, black grains); Sand, 30%, quartz and calcareous, clear to very pale orange (10YR 8/2), very fine- to medium- grained, sub-angular; Limestone, 20%, yellowish gray (5Y 8/1) to medium gray (N5), fossiliferous grainstone with quartz grains and shell intraclasts, soft to moderately hard, mostly poorly cemented, vuggy.	WOB=14-16K RPM=90 ROP=<1min/ft	290-300	10

SANDY CLAY; Clay, 70%, dark greenish gray (5G 4/1), slightly calcareous, very soft, phosphatic, cohesive, non-plastic; Sand, 30%, quartz and calcareous, clear to very pale orange (10YR 8/2), very fine- to fine- grained; Limestone, trace, yellowish gray (5Y 8/1) to medium gray (N5), rare fragments to 0.2-inch. .	WOB=14-16K RPM=90 ROP=<1min/ft	300-310	10
SANDY CLAY AND LIMESTONE; Clay, 40%, pale olive (10Y 6/2), dusky green (5G 3/2) and little white(N9), calcareous, very soft, cohesive, non plastic, very phosphatic (soft, fine, black grains); Sand, 30%, quartz and calcareous, clear to very pale orange (10YR 8/2), very fine- to medium- grained, sub-angular; Limestone, 30%, yellowish gray (5Y 8/1) to medium gray (N6), fossiliferous grainstone with shell intraclasts, soft to moderately hard, mostly poorly cemented, vuggy.	WOB=14-16K RPM=90 ROP=<1min/ft	310-330	20
LIMESTONE; Limestone, 100%, yellowish gray (5Y 8/1) to medium gray (N5), fossiliferous grainstone with shell intraclasts, moderately hard, moderately well cemented, vuggy; Sand, trace, calcareous, very pale orange (10YR 8/2), very fine- to medium- grained, sub-angular; Clay, trace, pale olive (10Y 6/2), calcareous, very soft, cohesive, non plastic.	WOB=15-17K RPM=90 ROP=<1min/ft	330-340	10
LIMESTONE WITH LITTLE SAND AND CLAY; Limestone, 80%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), fossiliferous grainstone with shell intraclasts, soft to moderately hard, poorly- to moderately well- cemented, vuggy; Sand, 10%, calcareous, very pale orange (10YR 8/2), very fine- to medium- grained, sub-angular; Clay, 10%, pale olive (10Y 6/2) to yellowish gray (5Y 8/1), calcareous, very soft, cohesive, non plastic.	WOB=15-17K RPM=90 ROP=<1min/ft	340-370	30
LIMESTONE; Limestone, 100%, yellowish gray (5Y 8/1) to medium light gray (N6), fossiliferous grainstone with shell intraclasts, phosphatic, moderately hard, moderately well cemented, vuggy; Sand, trace, calcareous, very pale orange (10YR 8/2), very fine- to medium- grained, sub-angular; Clay, trace, pale olive (10Y 6/2) to greenish gray (5G 6/1),calcareous, very soft, cohesive, non plastic.	WOB=15-17K RPM=90 ROP=<1min/ft	370-380	10
SANDY CLAY AND LIMESTONE; Clay, 40%, pale olive (10Y 6/2), dusky green (5G 3/2) and little white(N9), calcareous, very soft, cohesive, non plastic, very phosphatic (soft, fine, black grains); Sand, 30%, quartz and calcareous, clear to very pale orange (10YR 8/2), very fine to medium grained, sub-angular; Limestone, 30%, yellowish gray (5Y 8/1) to medium gray (N5), fossiliferous grainstone with shell intraclasts, soft to moderately hard, mostly poorly cemented, vuggy.	WOB=15-17K RPM=90 ROP=<1min/ft	380-390	10

LIMESTONE; Limestone, 100%, yellowish gray (5Y 8/1) to medium light gray (N6), fossiliferous grainstone with shell intraclasts, phosphatic, moderately hard, moderately well cemented, vuggy; Sand, trace, calcareous, very pale orange (10YR 8/2), very fine- to medium- grained, sub-angular; Clay, trace, pale olive (10Y 6/2) to greenish gray (5G 6/1),calcareous, very soft, cohesive, non plastic.	WOB=15-17K RPM=90 ROP=<1min/ft	390-400	10
LIMESTONE, SOME SAND AND LITTLE CLAY; Limestone, 70%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), fossiliferous grainstone with shell intraclasts, soft, poorly cemented, vuggy; Sand, 20%, calcareous, very pale orange (10YR 8/2), very fine- to medium- grained, sub-angular; Clay, 10%, pale olive (10Y 6/2) to yellowish gray (5Y 8/1), calcareous, very soft, cohesive, non plastic.	WOB=15-17K RPM=90 ROP=<1min/ft	400-410	10
LIMESTONE , SAND AND CLAY; Limestone, 40%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), fossiliferous grainstone, calcitic with shell intraclasts, very soft to soft, poorly cemented, vuggy; Sand, 30%, calcareous, very pale orange (10YR 8/2), very fine- to medium- grained, sub-angular; Clay, 30%, pale olive (10Y 6/2) to yellowish gray (5Y 8/1), calcareous, very phosphatic, very soft, cohesive, non plastic.	WOB=16-18K RPM=90 ROP=<1min/ft	410-420	10
SANDY CLAY; Clay, 50%, pale olive (10Y 6/2) on top, than mostly yellowish gray (5Y 7/2), calcareous, very soft, cohesive, non plastic, very phosphatic; Sand, 50%, calcareous, very pale orange (10YR 8/2), very fine to medium grained, sub-angular; Limestone, trace, yellowish gray (5Y 8/1), very soft, poorly cemented.	WOB=16-18K RPM=90 ROP=<1min/ft	420-440	20
SANDY CLAY (MARL) AND VERY LITTLE LIMESTONE; Clay, 50%, yellowish gray (5Y 7/2), trace of white (N9), calcareous (marl), very soft, cohesive, non plastic, phosphatic; Sand, 45%, calcareous, very pale orange (10YR 8/2), very fine- to medium- grained, sub-angular; Limestone, 5%, yellowish gray (5Y 8/1), very soft, poorly cemented.	WOB=16-18K RPM=90 ROP=<1min/ft	440-460	20
CLAY WITH LITTLE SAND AND VERY LITTLE LIMESTONE; Clay, 85%, pale olive (10Y 6/2), to light olive gray (5Y 3/2), very slightly calcareous, very soft, cohesive, non plastic, slightly phosphatic; Sand, 10%, very pale orange (10YR 8/2), calcareous, very fine- to medium-grained, sub-angular; Limestone, 5%, yellowish gray (5Y 8/1), fossiliferous grainstone, very soft, poorly cemented, vuggy.	WOB=16-18K RPM=90 ROP=3-5min/ft	460-470	10

LIMESTONE , SAND AND CLAY (MARL); Limestone, 40%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), fossiliferous grainstone, calcitic with shell intraclasts, very soft to soft, poorly cemented, vuggy; Sand, 30%, calcareous, very pale orange (10YR 8/2), very fine- to medium- grained, sub-angular; Clay, 30%, yellowish gray (5Y 8/1) with white (N9) smudges, calcareous (marl), phosphatic, very soft, cohesive, non plastic.	WOB=16-18K RPM=90 ROP=<1min/ft	470-490	20
LIMESTONE, SOME SAND AND LITTLE CLAY; Limestone, 60%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), fossiliferous grainstone with shell intraclasts, soft to moderately hard, poorly- to moderately well- cemented, vuggy; Sand, 30%, very pale orange (10YR 8/2), calcareous, very fine- to medium- grained, sub-angular; Clay, 10%, pale olive (10Y 6/2) to yellowish gray (5Y 8/1), calcareous (marl), very soft, cohesive, non plastic.	WOB=16-18K RPM=90 ROP=1-5min/ft	490-500	10
LIMESTONE , SAND AND CLAY; Limestone, 40%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), fossiliferous grainstone, calcitic with shell intraclasts, very soft to soft, poorly cemented, vuggy; Sand, 30%, calcareous, very pale orange (10YR 8/2), very fine- to medium- grained, sub-angular; Clay, 30%, dusky yellow green (5GY 5/2) to yellowish gray (5Y 8/1), some calcareous (marl), phosphatic, very soft, cohesive, non plastic.	WOB=18-20K RPM=95 ROP=3-5min/ft	500-510	10
LIMESTONE, SOME SAND AND LITTLE CLAY; Limestone, 60%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), fossiliferous grainstone with shell intraclasts, soft to moderately hard, poorly- to moderately well- cemented, vuggy; Sand, 30%, calcareous, very pale orange (10YR 8/2), very fine- to medium- grained, sub-angular; Clay, 10%, pale olive (10Y 6/2) to yellowish gray (5Y 8/1), mostly calcareous (marl), very soft, cohesive, non plastic.	WOB=18-20K RPM=95 ROP=3-5min/ft	510-520	10
LIMESTONE , SAND AND CLAY (MARL); Limestone, 40%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), fossiliferous grainstone, calcitic with shell intraclasts, very soft to soft, poorly cemented, vuggy; Sand, 30%, calcareous, very pale orange (10YR 8/2), very fine- to medium- grained, sub-angular; Clay, 30%, yellowish gray (5Y 8/1) with smudges of dusky yellow green (5GY 5/2), calcareous (marl), phosphatic, very soft, cohesive, non plastic.	WOB=18-20K RPM=95 ROP=3-5min/ft	520-550	30

LIMESTONE; Limestone, 100%, very light gray (N8) to medium light gray (N6) and some light olive gray (5Y 6/1), mudstone, fossiliferous with shell intraclasts, very fine grained, slightly vuggy, phosphatic, moderately hard, moderately well- to well- cemented; Shell, trace, yellowish gray (5Y 8/1), fragments to 0.5-inch.	WOB=18-20K RPM=95 ROP=3-5min/ft Numerous cement fragments.	550-560	10
CLAY WITH SOME LIMESTONE; Clay, 80%, yellowish gray (5Y 8/1) to dark greenish gray (5GY 4/1), mostly calcareous (marl), sandy (up to 20% of fine calcareous sand), soft, medium plasticity; Limestone, 20%, very light gray (N8) to medium light gray (N6), moderately hard, moderately well cemented, slightly vuggy.	WOB=18-20K RPM=95 ROP=3-5min/ft Numerous cement fragments.	560-570	10
LIMESTONE WITH LITTLE CLAY (MARL); Limestone, 90%, yellowish gray (5Y 5/2), little light gray (N7), oolitic grainstone, fossiliferous, small, up to 2-mm shell fragments, slightly phosphatic, very fine grained, soft to moderately hard, moderately well cemented, slightly vuggy; Clay, 10%, yellowish gray (5Y 8/1), calcareous (marl), very soft, cohesive, low plasticity.	WOB=18-20K RPM=95 ROP=1-2min/ft Numerous cement fragments.	570-590	20
LIMESTONE AND CLAY (MARL); Limestone, 60%, yellowish gray (5Y 5/2), oolitic grainstone, fossiliferous, small, up to 2-mm shell fragments, slightly phosphatic, very fine grained, soft to moderately hard, moderately well cemented, slightly vuggy; Clay, 40%, yellowish gray (5Y 8/1), calcareous (marl), very soft, low plasticity.	WOB=20-22K RPM=95 ROP=1-2min/ft Numerous cement fragments.	590-600	10
LIMESTONE WITH VERY LITTLE CLAY (MARL); Limestone, 95%, yellowish gray (5Y 5/2), little light gray (N7), oolitic grainstone, fossiliferous, small, up to 2-mm shell fragments, slightly phosphatic, very fine grained, soft to moderately hard, moderately well cemented, slightly vuggy; Clay, 5%, yellowish gray (5Y 8/1), calcareous (marl), very soft, cohesive, low plasticity.	WOB=20-22K RPM=95 ROP=1-2min/ft Abundant (50-60%) Cement cuttings.	600-620	20
LIMESTONE WITH SOME CLAY (MARL); Limestone, 80%, yellowish gray (5Y 5/2), grainstone, oolitic, slightly fossiliferous, small, up to 2-mm shell fragments, phosphatic, very fine grained, soft, poorly cemented, slightly vuggy; Clay, 20%, yellowish gray (5Y 8/1), calcareous (marl), very soft, cohesive, low plasticity.	WOB=20-22K RPM=95 ROP=1-2min/ft Numerous cement fragments.	620-630	10
CLAY (MARL) WITH SOME LIMESTONE; Clay, 80%, light olive gray (5Y 6/1), calcareous (marl), slightly sandy (up to 10% of fine- to medium- grained calcareous sand), very soft, low plasticity; Limestone, 20%, yellowish gray (5Y 5/2), oolitic grainstone, slightly fossiliferous, small, up to 2-mm shell fragments, phosphatic, very fine grained, soft, poorly cemented, slightly vuggy.	WOB=20-22K RPM=95 ROP=1-2min/ft Few cement fragments.	630-650	20

CLAY (MARL); Clay, 100%, light olive gray (5Y 6/1), calcareous (marl), very soft, cohesive, low plasticity, trace of calcareous sand; Limestone, trace, yellowish gray (5Y 5/2), grainstone, slightly fossiliferous, slightly phosphatic, very fine grained, soft.	WOB=20-22K RPM=95 ROP=1-2min/ft Few cement fragments.	650-660	10
LIMESTONE AND CLAY (MARL); Limestone, 60%, yellowish gray (5Y 5/2), oolitic grainstone, fossiliferous, small, up to 2-mm shell fragments, slightly phosphatic, fine grained, soft, poorly cemented, slightly vuggy; Clay, 40%, yellowish gray (5Y 8/1), calcareous (marl), very soft, low plasticity to non plastic.	WOB=20-22K RPM=95 ROP=1-2min/ft	660-670	10
CLAY WITH LIMESTONE; Clay, 50%, dark greenish gray (5GY 4/1), slightly calcareous, , very soft, cohesive, non plastic; Limestone, 50%, yellowish gray (5Y 5/2), oolitic grainstone, fossiliferous, slightly phosphatic, very fine grained, soft, poorly cemented, slightly vuggy.	WOB=20-22K RPM=95 ROP=1-2min/ft	670-680	10
LIMESTONE AND SOME CLAY; Limestone, 70%, yellowish gray (5Y 5/2), mostly (90%) oolitic grainstone, fossiliferous, phosphatic, little dolomitic limestone, very fine grained, soft to moderately hard, poorly- to moderately well- cemented; Clay, 30%, medium light gray (N6), slightly calcareous, soft, cohesive, low plasticity.	WOB=20-22K RPM=95 ROP=1-2min/ft	680-690	10
CLAY (MARL) AND LITTLE LIMESTONE; Clay, 90%, yellowish gray (5 Y 5/2), calcareous (marl), soft to moderately hard, medium plasticity; Limestone, 10%, yellowish gray (5Y 5/2), oolitic grainstone, soft, poorly cemented.	WOB=20-22K RPM=95 ROP=1-2min/ft	690-700	10
LIMESTONE AND CLAY (MARL); Limestone, 60%, mostly medium gray (N5), dolomitic, slightly phosphatic, fine crystalline , some yellowish gray (5Y 5/2), packstone, oolitic, moderately hard, moderately well cemented, slightly vuggy; Clay, 40%, yellowish gray (5Y 5/2), calcareous (marl), soft and cohesive to moderately hard, low plasticity to non plastic.	WOB=20-22K RPM=95 ROP=1-2min/ft	700-710	10
LIMESTONE AND LITTLE CLAY (MARL); Limestone, 90%, yellowish gray (5Y 5/2), mostly (90%) oolitic grainstone, fossiliferous, 10% dolomitic limestone, medium gray (N5), crystalline, phosphatic, soft to moderately hard, poorly- to moderately well- cemented; Clay, 10%, yellowish gray (5Y 5/2), calcareous (marl), very soft to soft, low plasticity to non plastic.	WOB=20-22K RPM=95 ROP=1-2min/ft	710-720	10
LIMESTONE; Limestone, 100%, yellowish gray (5Y 5/2), oolitic grainstone, trace of fossils, rare medium gray (N5) dolomitic, slightly phosphatic, fine grained, very soft to soft, poorly cemented, slightly vuggy; Clay, trace, yellowish gray (5Y 5/2), calcareous (marl), very soft, cohesive, non plastic.	WOB=20-22K RPM=95 ROP=1-2min/ft	720-730	10

DOLOSTONE AND LIMESTONE; Dolostone, 50%, light olive gray (5Y 6/1), crystalline, very fine grained, hard, well cemented, vuggy; Limestone, 50%, yellowish gray (5Y 7/2), ooilitic grainstone, fossiliferous with shell intraclasts, partly dolomitic, soft to moderately hard, moderately well cemented, slightly vuggy.	WOB=20-22K RPM=95 ROP=1-2min/ft	730-740	10
DOLOSTONE; Dolostone, 100%, yellowish gray (5Y 7/2), microcrystalline, hard, brittle, with few vugs.	WOB=3K RPM=95 ROP=<1-1min/ft	740-750	10
LIMESTONE WITH SOME DOLOSTONE; Limestone, 80%, yellowish gray (5Y 7/2), ooilitic grainstone, fossiliferous with shell intraclasts, partly dolomitic, soft to moderately hard, moderately well cemented, slightly vuggy; Dolostone, 20%, light olive gray (5Y 6/1) and yellowish gray (5Y 7/2), very fine- to micro-crystalline, hard, brittle, with few vugs.	WOB=3K RPM=95 ROP=<1-1min/ft	750-770	20
LIMESTONE WITH LITTLE DOLOSTONE; Limestone, 90%, yellowish gray (5Y 7/2), ooilitic grainstone, fossiliferous with shell intraclasts, mollusks and corals, very slightly dolomitic, soft to moderately hard, poorly- to moderately well- cemented, slightly vuggy; Dolostone, 10%, yellowish gray (5Y 7/2), microcrystalline, brittle, moderately hard.	WOB=3K RPM=95 ROP=<1-1min/ft	770-790	20
DOLOSTONE AND LIMESTONE; Dolostone, 50%, light olive gray (5Y 6/1), fine crystalline, hard, well cemented, vuggy; Limestone, 50%, yellowish gray (5Y 7/2), ooilitic grainstone, fossiliferous with shell intraclasts, partly dolomitic, soft to moderately hard, moderately well cemented, slightly vuggy..; Clay, trace, yellowish gray (5Y7/2), calcareous, very soft, non plastic.	WOB=3K RPM=95 ROP=<1-1min/ft	790-800	10
CLAY (MARL), LIMESTONE AND LITTLE DOLOSTONE; Clay, 60%, very light gray (N8) to white (N9), calcareous (marl), chalky, cohesive, soft, low- to medium- plasticity; Limestone, 30%, yellowish gray (5Y 7/2), ooilitic grainstone, fossiliferous with shell intraclasts, very soft to soft, poorly cemented; Dolostone, 10%, light olive gray (5Y 6/1), crystalline, very fine grained, hard, well cemented, slightly vuggy.	WOB=3K RPM=95 ROP=<1-1min/ft	800-810	10
LIMESTONE AND LITTLE DOLOSTONE; Limestone, 90%, yellowish gray (5Y 7/2), ooilitic grainstone, fossiliferous, dolomitic, fine grained, soft to moderately hard, poorly cemented, vuggy; Dolostone, 10%, light gray (N7), crystalline, moderately hard, moderately well cemented; Clay, trace, yellowish gray (5Y7/2), calcareous, very soft, non plastic.	WOB=3K RPM=95 ROP=<1-1min/ft	810-820	10

CLAY (MARL), LIMESTONE AND DOLOSTONE; Clay, 50%, very light gray (N8), calcareous (marl), chalky, very soft, COHESIVE, non plastic; Limestone, 30%, yellowish gray (5Y 7/2), ooilitic grainstone, fossiliferous with shell intraclasts, very soft to soft, poorly cemented; Dolostone, 20%, light olive gray (5Y 6/1), crystalline, very fine grained, moderately hard, moderately well cemented.	WOB=3K RPM=95 ROP=<1-1min/ft	820-830	10
DOLOSTONE; Dolostone, 100%, yellowish gray (5Y 7/2), fine crystalline, very soft, disintegrating, mostly in a form of dolomitic sand, few moderately hard fragments.	WOB=3K RPM=95 ROP=<1-1min/ft	830-840	10
LIMESTONE AND VERY LITTLE DOLOSTONE; Limestone, 95%, yellowish gray (5Y 7/2), ooilitic grainstone, fossiliferous with shell intraclasts, very soft to soft, poorly cemented; Dolostone, 5%, medium light gray (N6), crystalline, very fine grained, moderately hard, moderately well cemented.	WOB=3K RPM=95 ROP=<1-1min/ft	840-850	10
CLAY (MARL); Clay, 100%, yellowish gray (5Y7/2), calcareous (marl), moderately hard, cohesive, low plasticity.	WOB=3K RPM=95 ROP=<1-1min/ft	850-860	10
LIMESTONE; Limestone, 100%, yellowish gray (5Y 7/2), ooilitic grainstone, slightly dolomitic, few fossils, very soft to soft, poorly cemented, vuggy; Dolostone, trace, medium light gray (N6), crystalline, very fine grained, moderately hard, moderately well cemented.	WOB=3K RPM=95 ROP=<1-1min/ft	860-870	10
LIMESTONE AND LITTLE DOLOSTONE; Limestone, 90%, yellowish gray (5Y 8/1), ooilitic grainstone and packstone, dolomitic, trace of fossils, very soft to soft, poorly cemented, vuggy; Dolostone10%, medium light gray (N6) to yellowish gray (5Y 8/1), fine- and micro-crystalline, moderately hard, moderately well cemented.	WOB=3K RPM=95 ROP=<1-1min/ft	870-890	20
LIMESTONE AND VERY LITTLE DOLOSTONE; Limestone, 95%, yellowish gray (5Y 7/2), ooilitic grainstone, trace of fossils, very soft to soft, poorly cemented; Dolostone, 5%, medium light gray (N6), fine crystalline, moderately hard, moderately well cemented.	WOB=3K RPM=95 ROP=<1-1min/ft	890-900	10
CLAY, LIMESTONE AND DOLOSTONE; Clay, 50%, light olive gray (5Y 6/1), slightly calcareous, very soft, cohesive, non plastic; Limestone, 30%, yellowish gray (5Y 7/2), ooilitic grainstone, fossiliferous with shell intraclasts, very soft to soft, poorly cemented; Dolostone, 20%, medium light gray (N6), fine crystalline, moderately hard, moderately well cemented.	WOB=3K RPM=95 ROP=<1-1min/ft	900-910	10

LIMESTONE AND VERY LITTLE DOLOSTONE; Limestone, 95%, yellowish gray (5Y 7/2), ooilitic grainstone, trace of fossils, dolomitic, very soft to soft, poorly cemented; Dolostone, 5%, medium light gray (N6), very fine crystalline, moderately hard, moderately well cemented.	WOB=3K RPM=95 ROP=<1-1min/ft	910-930	20
LIMESTONE; Limestone, 100%, yellowish gray (5Y 7/2), ooilitic grainstone, trace of fossils, very soft to soft, poorly cemented; Dolostone, trace, medium light gray (N6), very fine crystalline, moderately hard, moderately well cemented.	WOB=3K RPM=95 ROP=<1-1min/ft	930-940	10
DOLOSTONE AND VERY LITTLE CLAY (MARL); Dolostone, 95%, pale yellowish brown (10YR 6/2), fine crystalline, mostly in a form of dolomitic sand, very soft, poorly cemented; Clay, 5%, pale yellowish brown (10YR 6/2), calcareous (marl), soft to moderately hard, non plastic.	WOB=5K RPM=95 ROP=<1-1min/ft	940-950	10
LIMESTONE AND SOME CLAY (MARL); Limestone, 70%, yellowish gray (5Y 7/2), ooilitic grainstone, trace of fossils, very soft to soft, poorly cemented; Clay, 30%, yellowish gray (5Y 7/2), calcareous, phosphatic, very soft, cohesive, non plastic; Dolostone, trace, medium light gray (N6), crystalline, very fine grained, moderately hard, moderately well cemented	WOB=7K RPM=95 ROP=<1-1min/ft	950-960	10
LIMESTONE AND CLAY (MARL); Limestone, 50%, yellowish gray (5Y 7/2), ooilitic grainstone, trace of fossils, very soft to soft, poorly cemented; Clay, 50%, yellowish gray (5Y 8/1), calcareous (marl), phosphatic, very soft, cohesive, non plastic; Dolostone, trace, medium light gray (N6), very fine crystalline, moderately hard, moderately well cemented.	WOB=7K RPM=95 ROP=<1-1min/ft	960-980	20
DOLOSTONE AND VERY LITTLE CLAY (MARL) AND LIMESTONE; Dolostone, 90%, pale yellowish brown (10YR 6/2), fine crystalline, little (up to 10%) of microcrystalline, mostly in a form of dolomitic sand, very soft to moderately hard, poorly cemented; Clay, 5%, pale yellowish brown (10YR 6/2), calcareous (marl), soft to moderately hard, non plastic; Limestone, 5%, yellowish gray (5Y 7/2), oolitic grainstone, trace of fossils, very soft to soft, poorly cemented.	WOB=9K RPM=95 ROP=<1-1min/ft	980-1000	20
LIMESTONE; Limestone, 100%, yellowish gray (5Y 8/1), grainstone, very fine grained, trace of fossils, slightly phosphatic, soft to moderately hard, moderately well cemented, few vugs.	WOB=8K RPM=95 ROP=1min/ft	1000-1020	20

LIMESTONE AND SOME CLAY (MARL); Limestone, 80%, yellowish gray (5Y 8/1), grainstone, very fine grained, trace of fossils, slightly phosphatic, soft to moderately hard, moderately well cemented, few vugs; Clay, 20%, yellowish gray (5Y 7/2), calcareous, very soft, non plastic.	WOB=8K RPM=95 ROP=1min/ft	1020-1030	10
LIMESTONE; Limestone, 100%, yellowish gray, (5Y 8/1), grainstone, very fine grained, partly oolitic, fossiliferous (shell fragments to 2-mm), soft, poorly cemented, vuggy.	WOB=8K RPM=95 ROP=1min/ft	1030-1040	10
LIMESTONE; Limestone, 100%, light olive gray (5Y 5/2), mostly dolomitic and fine crystalline, some (30%) oolitic grainstone, yellowish gray (5Y 7/2), with fossils, fine grained, vuggy, very soft, poorly cemented.	WOB=8K RPM=95 ROP=1min/ft	1040-1060	20
LIMESTONE; Limestone, 100%, yellowish gray (5Y 8/1), grainstone, very fine grained, trace of fossils, slightly phosphatic, soft to moderately hard, moderately well cemented, few vugs.	WOB=8K RPM=95 ROP=1min/ft	1060-1070	10
LIMESTONE; Limestone, 100%, light olive gray (5Y 5/2), dolomitic, fine crystalline, little (10%) oolitic grainstone, yellowish gray (5Y 7/2), with fossils, fine grained, vuggy, very soft, poorly cemented.	WOB=8K RPM=95 ROP=1min/ft	1070-1080	10
LIMESTONE AND SOME DOLOSTONE; Limestone, 80%, yellowish gray (5Y 8/1), grainstone, very fine grained, trace of fossils, slightly phosphatic, soft to moderately hard, moderately well cemented, few vugs; Dolostone, 20%, light olive gray (5Y 6/1), microcrystalline, hard.	WOB=8K RPM=95 ROP=1min/ft	1080-1090	10
LIMESTONE; Limestone, 100%, light olive gray (5Y 5/2), dolomitic, fine crystalline, fossiliferous, vuggy, very soft, poorly cemented, mostly in a form of fine sand.	WOB=8K RPM=95 ROP=1min/ft	1090-1100	10
LIMESTONE; Limestone, 100%, yellowish gray (5Y 8/1), grainstone, very fine grained, trace of fossils, slightly phosphatic, soft to moderately hard, poorly- to moderately well- cemented, few vugs.	WOB=8K RPM=95 ROP=1min/ft	1100-1110	10
LIMESTONE AND SOME DOLOSTONE; Limestone, 70%, yellowish gray (5Y 7/2), packstone and grainstone, fossiliferous, fine grained, , soft, poorly cemented, few vugs; Dolostone, 30%, yellowish gray (5Y 8/1), microcrystalline, moderately hard.	WOB=8K RPM=95 ROP=1min/ft	1110-1130	20
LIMESTONE; Limestone, 100%, yellowish gray (5Y 8/1), oolitic grainstone, fine grained, fossiliferous, very soft to soft, poorly cemented, few vugs.	WOB=8K RPM=95 ROP=1min/ft	1130-1190	60

CLAY (MARL), SOME DOLOSTONE, AND SOME LIMESTONE; Clay, 60%, light olive gray (5Y 6/1), calcareous (marl), very soft, cohesive, non-plastic; Dolostone, 20%, medium gray (N5), soft, microcrystalline; Limestone, 20%, medium light gray (N6), grainstone, fine grained, medium hard.	WOB=8K RPM=95 ROP=1min/ft	1190-1200	10
LIMESTONE; Limestone, 100%, yellowish gray (5Y 8/1), oolitic grainstone, fossiliferous (mollusks shells tests), fine grained, soft, poorly cemented.	WOB=8K RPM=95 ROP=1min/ft	1200-1260	60
LIMESTONE AND VERY LITTLE CLAY (MARL); Limestone, 95%, yellowish gray (5Y 8/1), phosphatic, soft, poorly cemented; Clay, 95%, light olive gray (5Y 6/1), calcareous (marl), very soft, cohesive, non-plastic.	WOB=5K RPM=60 ROP=1min/ft	1260-1280	20
LIMESTONE; Limestone, 100%, yellowish gray (5Y 8/1), grainstone, soft, friable, shell fragments, poorly cemented.		1280-1290	10
LIMESTONE; Limestone, 100%, yellowish gray (5Y 8/1), grainstone, fossiliferous, very soft to soft, poorly cemented, slightly sandy, increasing sand content with depth.	WOB=5K RPM=60 ROP=1min/ft	1290-1320	30
LIMESTONE; Limestone, 100%, light olive gray (5Y 6/1), oolitic grainstone, phosphatic, fossiliferous with small shell fragments (<2-mm), very soft, poorly cemented, slightly sandy.	WOB=6K RPM=55 ROP=1min/ft	1320-1350	30
LIMESTONE; Limestone, 100%, yellowish gray (5Y 8/1), oolitic grainstone, trace of phosphate, fossiliferous, very soft, poorly cemented, mostly in a form of sand.	WOB=6K RPM=60 ROP=1min/ft	1350-1370	20
LIMESTONE; Limestone, 100%, yellowish gray (5Y 8/1), oolitic grainstone with trace of dolomitic limestone, very light gray (N8), fine crystalline, phosphatic, fossiliferous with small shell fragments (0.1-inch), soft to very soft, poorly cemented, with few moderately well cemented fragments, sandy.	WOB=6K RPM=60 ROP=1min/ft	1370-1410	40
LIMESTONE; Limestone, 100%, yellowish gray (5Y 8/1), oolitic grainstone, trace of phosphate, fossiliferous, very soft, poorly cemented, mostly in a form of sand.	WOB=6K RPM=60 ROP=1min/ft	1410-1420	10
LIMESTONE; Limestone, 100%, yellowish gray (5Y 8/1), oolitic grainstone with trace of dolomitic limestone, fine to microcrystalline, very light gray (N8), phosphatic, fossiliferous with small shell fragments (<2-mm), soft to very soft, poorly cemented, with few moderately well cemented fragments, sandy.	WOB=6K RPM=60 ROP=1min/ft	1420-1480	60

LIMESTONE; Limestone, 100%, yellowish gray (5Y 7/2) oolitic grainstone, fossiliferous, little very light gray, dolomitic, fine grained, very soft to soft , poorly cemented, trace phosphatic, sandy.	WOB=2K RPM=60 ROP=1min/ft Bit plugging-off	1480-1530	50
SANDSTONE AND SOME LIMESTONE; Sandstone, 70%, medium gray (N5), quartz with calcareous matrix, moderately hard, moderately well cemented, vuggy; Limestone, 70%, yellowish gray (5Y 8/1), lightly fossiliferous oolitic grainstone and some very light gray (N8) dolomitic limestone, fine grained to micro crystalline, fossiliferous, soft, poorly cemented.	WOB=2K RPM=60 ROP=1min/ft Bit plugging-off	1530-1540	10
LIMESTONE; Limestone, 100%, yellowish gray (5Y 7/2) oolitic grainstone, fossiliferous, with up to 10% of very light gray, dolomitic, fine grained limestone, soft to moderately hard, poorly- to moderately well- cemented, trace phosphatic, sandy.	WOB=2K RPM=40 ROP=1min/ft Bit plugging-off	1540-1550	10
LIMESTONE, 100%, light gray (N7) to very light gray (N8), dolomitic to slightly dolomitic with up to 10% of yellowish gray (5Y 8/1), oolitic grainstone, crystalline, fine grained, trace of fossils (fragments to 0.1-inch), moderately hard to soft, moderately well cemented, small vugs.	WOB=2K RPM=40 ROP=1min/ft Bit plugging-off	1550-1560	10
LIMESTONE, 100%, very pale orange (10YR 8/2) to very light gray (N8), wackstone, slightly dolomitic with little grainstone, fossiliferous, soft to moderately hard, poorly- to moderately well- cemented, slightly vuggy, rare black phosphate grains.	WOB=2K RPM=40 ROP=2-3min/ft	1560-1570	10
LIMESTONE, 100%, light gray (N7) to very light gray (N8), dolomitic to slightly dolomitic with up to 40% of yellowish gray (5Y 8/1) of fossiliferous grainstone, micro crystalline to fine grained, slightly phosphatic, moderately hard to soft, moderately well cemented, small vugs.	WOB=5K RPM=40 ROP=2-3min/ft	1570-1590	20
LIMESTONE, 100%, very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), grainstone and wackstone, with trace of slightly dolomitic, very light gray (N8) fine crystalline limestone, soft to moderately hard, poorly- to moderately well-cemented, slightly vuggy.	WOB=5K RPM=40 ROP=2-3min/ft	1590-1600	10
LIMESTONE, 100%, very pale orange (10YR 8/2), fossiliferous grainstone and wackstone, with trace of dolomitic, very light gray (N8) fine crystalline limestone, soft, poorly cemented, slightly vuggy, oolitic grainstone, fossiliferous, soft to moderately hard, poorly cemented, slightly vuggy.	WOB=6K RPM=40 ROP=2-3min/ft	1600-1618	18

"RPM" denotes rotation speed in "revolutions per minute".
"WOB" denotes "weight on the bit" in thousands of pounds per square inch.

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
Fill: sand, limerock and clay.		0 - 4	4.0
SAND: Sand 100%, very light gray (N6), little yellowish gray (5Y 8/1), 90% calcareous, 10% quartz, clear to yellowish gray (5Y 8/1), fine- to medium- grained, angular to sub-rounded; Shell, trace, very small (<0.1-inch) fragments.	WOB=4-5K, RPM=6-7	4-10	6.0
CAP ROCK; LIMESTONE WITH LITTLE SAND; Limestone, 90%, yellowish gray (5Y 8/1), some light gray (N5), grainstone, hard, well cemented; Sand, 10%, mostly yellowish gray, calcareous, little quartz, clear, very fine- to fine- grained, sub-angular.	WOB=8-9K, RPM=6-7	10-18	8.0
CALCAREOUS SAND, LITTLE SHELL AND LIMESTONE; Sand, 80%, very light gray (N6), calcareous, little quartz, clear, very fine to fine grained, sub-angular; Shell, 10%, light olive gray (5Y 6/1), tests to 1-inch; Limestone, 10%, light olive gray (5Y 6/1), grainstone, fine grained, very soft to soft, poorly cemented; Phosphate, trace, black, very fine grains.	WOB=5-6K, RPM=6-7	18-30	12
SHELL WITH LITTLE SAND AND LIMESTONE; Shell, 80%, mostly medium gray (N5), 10% white (N9), few large tests to 1-inch, mollusks; Sand, 10%, very light gray (N6), calcareous, little quartz, clear, very fine- to fine- grained, sub-angular; Limestone, 10%, light olive gray (5Y 6/1), grainstone, fine grained, very soft to soft, poorly cemented.	WOB=8-10K, RPM=6-7	30-40	10
FOSSILIFEROUS LIMESTONE, LITTLE SAND AND SHELL; Limestone, 80%, light olive gray (5Y 6/1) to yellowish gray (5Y 8/1), very fossiliferous (coquina), with shell intraclasts (mollusks, corals), moderately hard, moderately well cemented, vuggy; Sand, 10%, very light gray (N6), calcareous, very little quartz, clear, very fine- to fine- grained, sub-angular; Shell, 10%, white (N9) to medium gray (N5), tests to 0.4-inch, mollusks; Phosphate, trace, black, very fine grains.	WOB=8-10K, RPM=6-7	40-56	16
LIMESTONE ; Limestone, 100%, yellowish gray (5Y 8/1) to very light gray (N8), oolitic grainstone, very fine- to fine- grained, with little fossils (shell fragments to 0.2-inch), very soft (mostly in form of calcareous sand), poorly cemented, slightly phosphatic; Clay, trace, yellowish gray, calcareous, chalky, very soft, non- plastic; Phosphate, trace, black, very soft, fine grains.	WOB=10-12K RPM=5-6	56-70	14
FOSSILIFEROUS LIMESTONE WITH LITTLE SAND AND SHELL; Limestone, 80%, yellowish gray (5Y 8/1) to light gray (N7), fossiliferous (coquina), some grainstone, mollusks, rare quartz, clear grains, slightly phosphatic, fine grained, moderately hard to hard, moderately well- to well- cemented, vuggy; Sand, 10%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), calcareous, some quartz, clear, very fine- to fine- grained, sub-angular; Shell, 10%, very pale orange (10YR 8/2), tests to 0.2-inch, mollusks	WOB=12-14K RPM=6-7	70-90	20

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
FOSSILIFEROUS LIMESTONE WITH SOME SAND AND LITTLE SHELL; Limestone, 60%, yellowish gray (5Y 7/2) to very light gray (N8), oolitic, fossiliferous (coquina), mollusks, few quartz grains, fine grained, moderately hard to soft, poorly- to moderately-well cemented, vuggy; Sand, 30%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), calcareous, some quartz, clear, very fine- to fine- grained, sub-angular; Shell, 10%, very pale orange (10YR 8/2), small tests to 0.2-inch, mollusks; Phosphate, trace, black, very soft, fine grains.	WOB=12-14K RPM=6-7	90-100	10
SAND AND SOME LIMESTONE; Sand, 70%, yellowish gray (5Y 7/2) to very light gray (N8), calcareous, little quartz, clear, slightly phosphatic, very fine- to fine- grained, sub-rounded; Limestone, 30%, yellowish gray (5Y 7/2) to very light gray (N8), oolitic grainstone, trace of fossils (shell fragments to 0.1-inch), soft, poorly cemented, vuggy; Shell, trace, very pale orange (10YR 8/2), small tests to 0.1-inch, mollusks.	WOB=12-14K RPM=6-7	100-120	20
LIMESTONE AND SAND; Limestone, 60%, light gray (N7) to medium gray (N5) and little (15%) yellowish gray (5Y 7/2), mudstone, very fine grained, soft to moderately hard, poorly cemented; Sand, 40%, yellowish gray (5Y 8/1), calcareous and quartz (clear), fine- to medium- grained, sub-angular to sub-rounded; Shell, trace, very pale orange (10YR 8/2), very small tests to 0.1-inch; Phosphate, trace, black, very soft, fine grains.	WOB=12-14K RPM=6-7	120-130	10
SAND; Sand, 100%, quartz, clear, very fine- to fine- grained, sub-rounded, occasionally cemented, little, up to 10%, calcareous, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2); Phosphate, trace, black, very soft, fine grains.	WOB=12-14K RPM=6-7	130-140	10
SAND, SOME LIMESTONE AND LITTLE SHELL; Sand, 60%, quartz, clear, very fine- to fine- grained, partly very poorly cemented, little calcareous; Limestone, 30%, light gray (N7) to yellowish gray (5Y 8/1), fossiliferous grainstone, with quartz grains and shell intraclasts, soft, poorly cemented, vuggy; Shell, 10%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), small tests to 0.2-inch, mollusks; Phosphate, trace, black, very soft, fine grains.	WOB=20-25K RPM=16-19	140-150	10
SAND; Sand, 100%, quartz, clear, very fine- to fine- grained, sub-rounded, trace of calcareous, yellowish gray (5Y 8/1), slightly phosphatic; Limestone, trace, light gray (N7) to yellowish gray (5Y 8/1), fossiliferous grainstone, with quartz grains and shell intraclasts, soft, poorly cemented, vuggy; Shell, trace, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), small tests to 0.2-inch, mollusks.	WOB=20-25K RPM=16-19	150-160	10

SAND AND SOME LIMESTONE ; Sand, 70%, quartz, clear, and calcareous, yellowish gray (5Y 7/2) very fine- to medium- grained, partly poorly cemented; Limestone, 30%, light gray (N7) to yellowish gray (5Y 8/1), oolitic grainstone, with quartz grains and few shell intraclasts, very soft, poorly cemented, vuggy; Shell, trace, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), small tests to 0.1-inch; Phosphate, trace, black, very soft, fine grains.	WOB=20-25K RPM=16-19	160-180	20
SANDY CLAY; Clay, 50%, dusky yellow green (5GY 5/2), very slightly calcareous, soft, low plasticity, trace of black phosphate; Sand, 50%, quartz, clear , very fine to fine grained, sub-rounded.	WOB=20-25K RPM=16-19	180-200	20
SANDY CLAY; Clay, 70%, dusky yellow green (5GY 5/2), very slightly calcareous, very soft, cohesive, medium plasticity, trace of black phosphate; Sand, 30%, quartz, clear , very fine- to fine-grained, sub-rounded; Shell, trace, very pale orange (10YR 8/2), small tests to 0.1-inch; Limestone, trace, yellowish gray (5Y 8/1), small fragments to 0.2-inch.	WOB=20-25K RPM=16-19	200-210	10
SANDY CLAY WITH VERY LITTLE LIMESTONE; Clay, 50%, dusky yellow green (5GY 5/2), very slightly calcareous, soft, low plasticity to non-plastic, trace of phosphate; Sand, 45%, clear, quartz, fine- to coarse- grained, sub-rounded to sub-angular; Limestone, 5%, yellowish gray (5Y 8/1), small fragments to 0.2-inch; Shell, trace, very pale orange (10YR 8/2), small tests to 0.1-inch.	WOB=20-25K RPM=16-19	210-220	10
CLAY AND LITTLE SAND; Clay, 90%, greenish gray (5GY 6/1), soft, cohesive, medium to high plasticity, slightly phosphatic with up to 10% of clear, quartz sand, very fine grained, sub-rounded; Limestone, trace, yellowish gray (5Y 8/1), small fragments to 0.1-inch; Shell, trace, very pale orange (10YR 8/2), small tests to 0.1-inch.	WOB=20-25K RPM=16-19	220-230	10
LIMESTONE WITH SAND AND SOME CLAY; Limestone, 50%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), mostly oolitic grainstone with shell intraclasts, little mudstone, fine grained, soft, poorly cemented, vuggy; Sand, 30%, clear, quartz,, fine- to medium- grained, sub-rounded; Clay, 20%, pale olive (10Y 6/2), soft, cohesive, low plasticity; Phosphate, trace, black, very soft, fine grains.	WOB=20-23K RPM=5-6	230-240	10
CLAY, LIMESTONE AND SHELL; Clay, 50%, greenish gray (5GY 6/1), slightly calcareous and sandy (up to 10% clear, fine quartz grains), very soft, cohesive, non plastic, phosphatic (soft, fine, black grains); Limestone, 30%, yellowish gray (5Y 8/1) to medium gray (N5), fossiliferous grainstone, with quartz grains and shell intraclasts, fine grained, soft to moderately hard, mostly poorly cemented, vuggy; Shell, 20%, yellowish gray (5Y 8/1), mostly fragments, few whole shells to 0.4-inch, mollusks .	WOB=20-23K RPM=5-6	240-250	10

CLAY AND LITTLE LIMESTONE; Clay, 90%, pale olive (10Y 6/2) to yellowish gray (5Y 8/1), sandy (up to 10% of calcareous and quartz), very soft, cohesive, non plastic, phosphatic; Limestone, 10%, yellowish gray (5Y 8/1) to medium gray (N5), oolitic, fossiliferous grainstone, with quartz grains and shell intraclasts, soft, mostly poorly cemented, vuggy.	WOB=21-23K RPM=5-6	250-260	10
LIMESTONE WITH SOME SHELL AND LITTLE CLAY; Limestone, 70%, yellowish gray (5Y 8/1) to medium gray (N5), fossiliferous grainstone with quartz grains and shell intraclasts, very soft , poorly cemented, vuggy; Shell, 20%, yellowish gray (5Y 8/1), small fragments to 0.2-inch, mollusks; Clay, 10%, greenish gray (5GY 6/1), slightly sandy, very soft, cohesive, non plastic; Sand, trace, very pale orange (5Y 8/2), calcareous, little quartz and clear, very fine- to fine- grained, sub-angular.	WOB=21-23K RPM=5-6	260-270	10
SANDY, PHOSPHATIC CLAY; Clay, 70%, dark greenish gray (5G 4/1), slightly calcareous, very soft, phosphatic, cohesive, non-plastic; Sand, 20%, quartz and calcareous, clear to very pale orange (10YR 8/2), very fine- to fine- grained; Phosphate, 10%, black, very fine, sub-rounded grains; Limestone, trace, yellowish gray (5Y 8/1) to medium gray (N5), rare fragments to 0.2-inch..	WOB=21-23K RPM=5-6	270-290	20
LIMESTONE, SHELL AND LITTLE SAND; Limestone, 50%, yellowish gray (5Y 8/1) to medium gray (N5), very fossiliferous grainstone with shell intraclasts, phosphatic, soft, poorly cemented, vuggy; Shell, 40%, very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), small tests to 0.2-inch, mollusks; Sand, 10%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), calcareous, very fine- to medium- grained, sub-angular; Clay, trace, pale olive (10Y 6/2), calcareous, very soft, cohesive, non-plastic.	WOB=19-21K RPM=17-21	290-330	40
SHELL AND LIMESTONE; Shell, 60%, very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), mostly small tests to 0.2-inch, few large fragments to 1.5-inch; Limestone, 40%, yellowish gray (5Y 8/1) to medium light gray (N6), fossiliferous grainstone with shell intraclasts, phosphatic, soft, poorly cemented, vuggy; Sand, trace, calcareous, very pale orange (10YR 8/2), very fine- to medium-grained, sub-angular; Clay, trace, pale olive (10Y 6/2) to greenish gray (5G 6/1), calcareous, very soft, cohesive, non plastic	WOB=7-9K RPM=12-17	330-360	30
LIMESTONE, SHELL AND LITTLE CLAY; Limestone, 60%, yellowish gray (5Y 8/1), little medium gray (N5), fossiliferous oolitic grainstone with shell intraclasts, trace of phosphate, soft, poorly cemented, vuggy; Shell, 30%, very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), mostly small tests to 0.2-inch, few large fragments to 1-inch, mollusks; Clay, 10%, pale olive (10Y 6/2), slightly calcareous, very soft, cohesive, non plastic; Sand, trace, yellowish gray (5Y 8/2) to very pale orange (10YR 8/2), calcareous, very fine- to medium- grained, sub-angular.	WOB=7-9K RPM=12-17	360-370	10

SHELL, LIMESTONE AND LITTLE CLAY; Shell, 60%, very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), mostly small tests to 0.2-inch, numerous large fragments to 2-inch; Limestone, 30%, yellowish gray (5Y 8/1) to medium light gray (N6), fossiliferous oolitic grainstone with shell intraclasts, trace of black phosphate, soft, poorly cemented, vuggy; Clay, 10%, pale olive (10Y 6/2) to greenish gray (5G 6/1), slightly calcareous, very soft, cohesive, non plastic; Sand, trace, calcareous, very pale orange (10YR 8/2), very fine- to medium- grained, sub-angular.	WOB=7-9K RPM=12-17	370-380	10
LIMESTONE, SOME SHELL AND LITTLE CLAY; Limestone, 70%, yellowish gray (5Y 8/1) , little medium gray (N5), fossiliferous oolitic grainstone with shell intraclasts, trace of phosphate, soft, poorly cemented, vuggy; Shell, 20%, very pale orange (10YR 8/2 to yellowish gray (5Y 8/1), mostly small tests to 0.2-inch, few fragments to 0.5-inch, mollusks; Clay, 10%, pale olive (10Y 6/2), slightly calcareous, very soft, cohesive, non plastic; Sand, trace, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), calcareous, very fine- to medium- grained, sub-angular.	WOB=7-9K RPM=12-17	380-410	30
LIMESTONE AND SOME CLAY; Limestone, 80%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), oolitic grainstone with occasional shell intraclasts, very phosphatic, very fine- to fine-grained, very soft, poorly cemented; Clay, 20%, yellowish gray (5Y 8/1), very soft, cohesive, non plastic.	WOB=7-9K RPM=12-17	410-420	10
LIMESTONE WITH SOME SHELL; Limestone, 80%, yellowish gray (5Y 7/2), fossiliferous oolitic grainstone, phosphatic, mostly very soft to soft, poorly cemented, some larger (to 0.5-inch) fragments, moderately hard, moderately-well cemented; Shell, 20%, very pale orange (10YR 8/2) to yellowish gray (5Y 7/2), small tests to 0.2-inch.	WOB=7-9K RPM=12-17	420-430	10
LIMESTONE AND SOME SHELL; Limestone, 70%, yellowish gray (5Y 8/1), fossiliferous oolitic grainstone with shell intraclasts, phosphatic, soft to moderately hard and hard, poorly- to moderately-well cemented, slightly vuggy; Shell, 30%, very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), mostly small tests to 0.2-inch, frequent large fragments to 1.5-inch, mollusks; Clay, trace, yellowish gray (5Y 7/2), calcareous, very soft, cohesive, non plastic.	WOB=16-18K RPM=17-19	430-440	10
CLAY, SAND AND LITTLE LIMESTONE ; Clay, 50%, yellowish gray (5Y 7/2), slightly calcareous, very phosphatic, very soft, lightly cohesive, low plasticity to non plastic; Sand, 40%, calcareous, yellowish gray (5Y 8/1), very fine- to- medium grained, sub-angular; Limestone, 10%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), fossiliferous grainstone, very soft to soft, poorly cemented; Shell, trace, very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), mostly small tests to 0.2-inch..	WOB=7-9K RPM=12-17	440-450	10

LIMESTONE SOME SAND AND CLAY (MARL); Limestone, 40%, yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), fossiliferous grainstone with shell intraclasts, very soft to soft, poorly cemented; Sand, 30%, very pale orange (10YR 8/2), calcareous, very fine- to medium- grained, sub-angular; Clay, 30%, pale olive (10Y 6/2) to yellowish gray (5Y 8/1) with white smudges, calcareous, chalky, very phosphatic, very soft, non plastic; Shell, very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), mostly small tests to 0.2-inch.	WOB=7-9K RPM=12-17	450-460	10
FOSSILIFEROUS LIMESTONE AND LITTLE CLAY (MARL); Limestone, 90%, yellowish gray (5Y 7/2) fossiliferous grainstone with numerous shell intraclasts, phosphatic, very fine to fine grained, vuggy, few fragments of dark gray (N3) massive limestone, very fine- to fine- grained, moderately hard to hard, mostly well cemented; Clay, 10%, pale olive (10Y 6/2), calcareous (marl), phosphatic, very soft, cohesive, non plastic.	WOB=26-28K RPM=12-17	460-470	10
LIMESTONE AND LITTLE CLAY(MARL); Limestone, 85%, yellowish gray (5Y 7/2) to very pale orange (10YR 8/2), fossiliferous oolitic grainstone with some shell intraclasts, phosphatic, very fine- to fine- grained, moderately hard, moderately well cemented, vuggy; Clay, 15%, pale olive (10Y 6/2) to yellowish gray (5Y 8/1), calcareous (marl), phosphatic, very soft, cohesive, non plastic.	WOB=8-10K RPM=5-6 Few cement fragments	470-520	50
LIMESTONE, 100%, yellowish gray (5Y 7/2), fine crystalline, partly oolitic, slightly phosphatic, very fine- to fine grained, moderately hard, moderately well cemented, vuggy	WOB=8-10K RPM=5-6 Few cement fragments	520-530	10
LIMESTONE AND LITTLE CLAY (MARL); Limestone, 80%, mostly (70%) yellowish gray (5Y 7/2), fine crystalline, moderately hard, moderately well cemented, some (20%) light gray (N7), oolitic grainstone, fossiliferous, very fine grained, soft, poorly cemented, slightly vuggy; Clay, 20%, pale yellow (5Y 8/4), calcareous (marl), very soft, non plastic.	WOB=8-10K RPM=5-6 Numerous cement fragments	530-550	20
LIMESTONE WITH LITTLE CLAY (MARL); Limestone, 90%, yellowish gray (5Y 7/2) to medium dark gray (N4), mostly (80%) fine crystalline, fossiliferous with shell intraclasts, very phosphatic, very fine grained, moderately hard, moderately well cemented, little (20%) oolitic grainstone, fossiliferous, small, up to 0.1-inch shell fragments, slightly phosphatic, fine- to very fine- grained, soft, poorly cemented, slightly vuggy; Clay, 10%, pale yellow (5Y 7/4), calcareous (marl), soft, low plasticity.	WOB=8-10K RPM=5-6 Abundant cement cuttings	550-560	10
LIMESTONE AND LITTLE CLAY (MARL); Limestone, 85%, yellowish gray (5Y 7/2), little light gray (N7), oolitic grainstone, fossiliferous, very fine- to fine grained, very soft to moderately hard, poorly cemented, slightly vuggy; Clay, 20%, yellowish gray (5Y 8/1), calcareous (marl), very soft, cohesive, low plasticity.	WOB=8-10K RPM=5-6 Numerous cement fragments	560-580	20

LIMESTONE AND VERY LITTLE CLAY, Limestone, 95%, yellowish gray (5Y 7/2), little light gray (N7), oolitic grainstone, fossiliferous, very fine- to fine- grained, very soft to moderately hard, poorly cemented, slightly vuggy; Clay, 5%, yellowish gray, (5Y 7/2), low plasticity, calcareous (marl)	WOB=8-10K RPM=5-6 Few cement fragments	580-600	20
CLAY (MARL) WITH SOME LIMESTONE; Clay, 80%, light olive gray (5Y 7/3), calcareous (marl), slightly sandy (<10% fine- to medium- grained calcareous sand), very soft, low plasticity; Limestone, 20%, yellowish gray (5Y 7/2), oolitic grainstone, very fine grained, soft, poorly cemented, slightly vuggy.	WOB=8-10K RPM=5-6	600-610	10
LIMESTONE WITH SOME SAND; Limestone, 70%, yellowish gray (5Y 7/2), oolitic grainstone, very fine- to fine- grained, soft, poorly cemented, slightly vuggy; Sand, 30%, yellowish gray (5Y 7/2), poorly cemented, very fine grained, sub-angular.	WOB=8-10K RPM=5-6	610-620	10
LIMESTONE WITH SOME CLAY (MARL); Limestone, 80%, yellowish gray (5Y 7/2), oolitic grainstone, little fossils, up to 0.1-inch shell fragments, phosphatic, very fine grained, soft, poorly cemented, slightly vuggy; Clay, 20%, pale yellow (5Y 8/3), calcareous, very soft, low plasticity.	WOB=8-10K RPM=5-6	620-630	10
CLAY (MARL); Clay, 100%, pale olive (5Y 6/4), calcareous (marl), very soft, low plasticity, trace calcareous sand; Limestone, trace, yellowish gray (5Y 7/2), grainstone, very soft, poorly cemented.	WOB=8-10K RPM=5-6	630-640	10
LIMESTONE AND CLAY (MARL); Limestone, 60%, yellowish gray (5Y 7/2), oolitic grainstone, fossiliferous, up to 0.1-inch shell fragments, phosphatic, fine grained, soft, poorly cemented, slightly vuggy; Clay, 40%, pale yellow (5Y 7/3), calcareous (marl), very soft, cohesive, low plasticity to non plastic.	WOB=8-10K RPM=5-6	640-660	20
CLAY (MARL) AND VERY LITTLE LIMESTONE; Clay, 95%, olive gray (5Y 5/2), calcareous (marl), very soft, cohesive, low plasticity to non plastic; Limestone, 5%, yellowish gray (5Y 7/2), oolitic grainstone, soft, poorly cemented.	WOB=8-10K RPM=5-6	660-670	10
CLAY (MARL) AND LIMESTONE; Clay, 50%, pale olive (10Y 6/2), calcareous (marl), very soft, cohesive, non plastic; Limestone, 50%, yellowish gray (5Y 7/2), grainstone, fossiliferous, phosphatic, very soft, poorly cemented; trace dolomitic limestone, dark gray (N3), very fine grained, moderately hard, moderately well cemented.	WOB=8-10K RPM=5-6	670-680	10
LIMESTONE AND SOME CLAY (MARL); Limestone, 70%, yellowish gray (5Y 7/2), oolitic grainstone, fossiliferous, phosphatic, very fine grained, soft to moderately hard, moderately well cemented; Clay, 30%, pale olive (10Y 6/2), calcareous, very soft, cohesive, non plastic.	WOB=8-10K RPM=5-6	680-700	20
LIMESTONE; Limestone, 100%; 80%, medium gray (N5), fine crystalline, very phosphatic, very fine grained, hard, well cemented, slightly vuggy; 20%, yellowish gray (5Y 7/2), oolitic grainstone, fossiliferous, soft, poorly cemented, slightly vuggy.	WOB=8-10K RPM=5-6	700-710	10

LIMESTONE AND LITTLE CLAY (MARL); Limestone, 90%, yellowish gray (5Y 7/2), oolitic grainstone, fossiliferous, phosphatic, trace of slightly dolomitic limestone, fine crystalline, very fine grained, soft to moderately hard, poorly- to moderately well- cemented; Clay, 10%, very light gray (N8), calcareous (marl), very soft, low plasticity to non plastic.	WOB=8-10K RPM=5-6	710-720	10
LIMESTONE; Limestone, 100%; 70% medium gray (N5), fine crystalline, slightly dolomitic, very phosphatic, fossiliferous, with few shell intraclasts, very fine grained, moderately hard, well cemented, slightly vuggy; 30%, yellowish gray (5Y 7/2), oolitic grainstone, very fossiliferous (frequent shell intraclasts), slightly phosphatic, soft, poorly cemented, vuggy.	WOB=8-10K RPM=5-6	720-730	10
DOLOSTONE AND LITTLE LIMESTONE; Dolostone, 90% , light olive gray (5Y 6/1), fine crystalline, with trace of phosphate, slightly vuggy, moderately hard, brittle, well cemented; Limestone, 10%, yellowish gray (5Y 7/2), mostly oolitic, fossiliferous grainstone, fine grained, little fine crystalline, dolomitic, soft to moderately hard, poorly- to moderately-well cemented.	WOB=8-10K RPM=5-6	730-740	10
LIMESTONE AND VERY LITTLE DOLOSTONE; Limestone, 95%, yellowish gray (5Y 7/2), fine crystalline, dolomitic, little oolitic grainstone, fossiliferous with shell intraclasts, slightly phosphatic, soft to moderately hard, moderately well cemented; Dolostone, 5%, light olive gray (5Y 6/1), fine crystalline, slightly vuggy, moderately hard, brittle, well cemented.	WOB=8-10K RPM=5-6	740-750	10
LIMESTONE AND SOME DOLOSTONE; Limestone, 80%, yellowish gray (5Y 7/2), fine crystalline, dolomitic, little oolitic grainstone, fossiliferous with shell intraclasts, slightly phosphatic, soft to moderately hard, moderately well cemented; Dolostone, 20%, light olive gray (5Y 6/1), fine crystalline, moderately hard, brittle, well cemented, slightly vuggy.	WOB=1-2K RPM=35-39	750-760	10
LIMESTONE AND LITTLE DOLOSTONE; Limestone, 90%, yellowish gray (5Y 7/2), some light gray (N7), fine crystalline, dolomitic, little oolitic grainstone, fossiliferous with shell intraclasts, trace of phosphate, soft to moderately hard, moderately well cemented; Dolostone, 10%, light olive gray (5Y 6/1), fine crystalline, moderately hard, brittle, well cemented, slightly vuggy.	WOB=1-2K RPM=35-39	760-780	20
DOLOSTONE; Dolostone, 100%, pale yellowish brown (10YR 6/2), very fine crystalline, moderately hard, brittle, well cemented, slightly vuggy; Limestone, trace, yellowish gray (5Y 7/2), yellowish gray (5Y 7/2), oolitic grainstone, fossiliferous, soft, poorly cemented.	WOB=1-2K RPM=35-39	780-790	10
SANDSTONE; Sandstone, 100%, light olive gray (5Y 6/1), clear, quartz, very fine grained, moderately hard to hard, moderately well- to well cemented; Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fossiliferous, soft, poorly cemented.	WOB=1-2K RPM=35-39	790-800	10

LIMESTONE AND SOME CLAY (MARL), Limestone, 70%, pale yellowish brown (10YR 6/2), mostly dolomitic, fine crystalline, some oolitic, slightly fossiliferous, moderately hard to soft, moderately well-to poorly- cemented, vuggy, sometimes porous; Clay, 30%, pale yellowish brown (10YR 6/2), calcareous (marl), very soft, cohesive, low plasticity.	WOB=1-2K RPM=35-39	800-810	10
LIMESTONE; Limestone, 100%, yellowish gray (5Y 7/2), oolitic grainstone, mostly in a form of calcareous sand, rare larger (to 0.5-inch) fragments, calcitic, few fossils, trace of black phosphate, very soft to soft, poorly cemented, vuggy.	WOB=1-2K RPM=35-39	810-840	30
LIMESTONE; Limestone, 100%, yellowish gray (5Y8/1), oolitic grainstone, very fossiliferous with forams, trace of black phosphate, very soft to soft, poorly- to moderately-well cemented, vuggy	WOB=1-2K RPM=35-39	840-890	50
LIMESTONE; Limestone, 100%, yellowish gray (5Y 7/2), to pale yellowish brown (10YR 6/2), oolitic grainstone, mostly in a form of calcareous sand, rare larger (to 0.5-inch) fragments, calcitic, few fossils, trace of black phosphate, very soft to soft, poorly cemented, vuggy, up to 20% of medium light gray (N6), fine crystalline, moderately hard, moderately well cemented.	WOB=2-5K RPM=39-42	890-970	80
LIMESTONE AND DOLOSTONE; Limestone, 60%, yellowish gray (5Y 7/2), oolitic grainstone, mostly in the form of calcareous sand, soft, poorly cemented, vuggy; Dolostone, 40%, medium light gray (N6), very fine grained, moderately hard, slightly vuggy.	WOB=2-5K RPM=39-42	970-980	10
LIMESTONE AND LITTLE DOLOSTONE; Limestone, 90%, dusky yellow (5Y 6/4), oolitic grainstone, mostly in the form of calcareous sand, soft, poorly cemented, vuggy; Dolostone, 10%, light gray (N7), very fine grained, moderately hard, slightly vuggy.	WOB=2-5K RPM=39-42	980-990	10
LIMESTONE; Limestone, 100%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, fossiliferous, very soft to soft, poorly cemented, slightly vuggy.	WOB=2-5K RPM=39-42	990-1060	70
LIMESTONE; Limestone, 100%, yellowish gray (5Y 7/2), dolomitic, fine crystalline, little oolitic grainstone, with fossils, fine grained, poorly cemented, vuggy, soft.	WOB=2-5K RPM=39-42	1060-1110	50
LIMESTONE; Limestone, 100%, yellowish gray (5Y 7/2), slightly dolomitic, fine crystalline, little oolitic grainstone, with fossils to 0.2-inch, trace phosphatic, fine grained, poorly cemented, slightly vuggy, soft.	WOB=2-5K RPM=39-42	1110-1170	60
LIMESTONE; Limestone, 100%, yellowish gray (5Y 7/2), oolitic grainstone, slightly phosphatic, fine grained, poorly cemented, vuggy, soft.	WOB=2-5K RPM=39-42	1170-1180	10
LIMESTONE; Limestone, 100%; 80% yellowish gray (5Y 7/2), oolitic grainstone, trace of fossils, trace of phosphate, very fine to fine grained, very soft, poorly cemented (mostly in a form of calcareous sand), moderately vuggy, 20% light gray (N7), dolomitic, fine crystalline, moderately hard, moderately well cemented, slightly vuggy.	WOB=2-5K RPM=39-42	1180-1230	50

CALCAREOUS SAND; Sand, 100%, yellowish gray (5Y 7/2), product of poorly cemented, weathered oolitic limestone, trace of fossils (sporadic forams), trace of phosphate, fine- to medium-grained, trace of light gray (N7) dolomitic limestone; Clay, trace, yellowish gray (5Y 7/2), calcareous (marl), very soft, non plastic.	WOB=2-5K RPM=39-42	1230-1250	20
CALCAREOUS SAND AND SOME CLAY (MARL); Sand, 80%, yellowish gray (5Y 7/2), product of poorly cemented, weathered oolitic limestone, trace of fossils (sporadic forams), trace of phosphate, fine- to medium- grained, trace of light gray (N7) dolomitic limestone; Clay, 20%, yellowish gray (5Y 7/2), light olive gray (5Y 6/1) to very light gray (N8), calcareous (marl), phosphatic, very soft, low plasticity.	WOB=2-5K RPM=39-42	1250-1270	20
SAND; Sand, 100%; 70% yellowish gray (5Y 7/2), product of poorly cemented, weathered oolitic limestone, trace of fossils (sporadic forams), trace of phosphate, fine to medium grained, 30%, quartz, clear, fine grained, sub-rounded; Clay, trace, yellowish gray (5Y 7/2), calcareous (marl), very soft, non plastic.	WOB=2-5K RPM=39-42	1270-1280	10
LIMESTONE AND SAND; Limestone, 60%; 60% medium light gray (N6), dolomitic, fine crystalline, soft to moderately hard, moderately well cemented; 40%, yellowish gray (5Y 7/2), oolitic grainstone, trace of fossils, trace of phosphate, very fine- to fine-grained, very soft, poorly cemented, up to 50% in a form of calcareous sand, yellowish gray (5Y 7/2), product of poorly cemented, weathered oolitic limestone, some quartz, clear, fine grained, sub-rounded; Clay, trace, yellowish gray (5Y 7/2), calcareous (marl), very soft, non plastic.	WOB=2-5K RPM=39-42	1280-1290	10
LIMESTONE; Limestone, 100%; 90% yellowish gray (5Y 7/2), oolitic grainstone, fossiliferous (forams), slightly phosphatic, very fine- to fine- grained, very soft to moderately hard, poorly- to moderately- well cemented (mostly in a form of calcareous sand), moderately vuggy; 10% light gray (N7), dolomitic, fine crystalline, moderately hard, moderately well cemented, slightly vuggy.	WOB=2-5K RPM=39-42	1290-1300	10
LIMESTONE; Limestone, 100%, mostly yellowish gray (5Y 7/2)), oolitic grainstone, fossiliferous, some very pale orange (10YR 8/2) and white (N9), chalky, trace of phosphate, very fine- to fine-grained, very soft to moderately hard, poorly- to moderately- well cemented, slightly vuggy.	WOB=2-5K RPM=39-42	1300-1310	10
LIMESTONE; Limestone, 100%, medium gray (5N) to very light gray (N8), oolitic, fossiliferous, with numerous shell intraclasts, slightly dolomitic, phosphatic, vuggy , trace to 10% of yellowish gray (5Y 7/2)), oolitic grainstone, soft to moderately hard, moderately well cemented; Shell, trace, white, small tests to 0.1-inch.	WOB=2-5K RPM=39-42	1310-1340	30

LIMESTONE; Limestone, 100%; 90% yellowish gray (5Y 7/2), oolitic grainstone, fossiliferous, trace of phosphate, very fine- to fine- grained, very soft to soft, few fragments to 1-inch, poorly cemented (mostly in a form of calcareous sand), moderately vuggy; 10% light gray (N7), dolomitic, fine crystalline, moderately hard, moderately well cemented, slightly vuggy.	WOB=2-5K RPM=39-42	1340-1370	30
LIMESTONE; Limestone, 100%; 60% yellowish gray (5Y 7/2), oolitic grainstone, fossiliferous, trace of phosphate, very fine- to fine- grained, very soft to soft, few fragments to 1-inch, poorly cemented (mostly in a form of calcareous sand), moderately vuggy; 40% light gray (N7), dolomitic, fine crystalline, moderately hard, moderately well cemented, slightly vuggy.	WOB=2-5K RPM=39-42	1370-1400	30
LIMESTONE; Limestone, 100%, yellowish gray (5Y 7/2), oolitic grainstone, few fossils (shell fragments to 0.1-inch), calcitic, trace of phosphate, very fine- to fine- grained, very soft to soft, poorly cemented (mostly in a form of calcareous sand), slightly vuggy; trace of light gray (N7), dolomitic, fine crystalline, moderately hard, moderately well cemented, slightly vuggy.	WOB=2-5K RPM=39-42	1400-1450	50
LIMESTONE; Limestone, 100%, yellowish gray (5Y 7/2), oolitic grainstone, only trace of fossils, calcitic, slightly phosphatic, very fine- to fine- grained, very soft to moderately hard, few fragments to 0.5-inch, poorly- to moderately- well cemented, up to 5% of light gray (N7), dolomitic, fine crystalline, moderately hard, moderately well cemented, slightly vuggy.	WOB=2-5K RPM=39-42	1450-1470	20
CALCAREOUS SAND; Sand, 100%, yellowish gray (5Y 7/2), product of poorly cemented, weathered oolitic limestone, single fragments to 0.4-inch, calcitic and little quartz, trace of phosphate, fine- to medium- grained, trace of light gray (N7) small fragments of dolomitic limestone.	WOB=2-5K RPM=39-42	1470-1510	40
DOLOSTONE AND LIMESTONE; Dolostone, 70%,moderate olive brown (5Y 4/4), fine crystalline, moderately hard, moderately well cemented, slightly vuggy; Limestone, 30%, yellowish gray (5Y 7/2), slightly fossiliferous, oolitic grainstone; trace of very light gray (N8) dolomitic limestone, fine grained to fine crystalline, moderately hard, moderately well cemented.	WOB=2-5K RPM=39-42	1510-1520	10
LIMESTONE; Limestone, 100%; 60%, medium gray (N5), very light gray (N8) to light olive gray (5Y 5/2), dolomitic, fine crystalline, moderately hard, moderately well cemented, vuggy; 40%, yellowish gray (5Y 7/2), oolitic grainstone, fossiliferous, very fine- to fine- grained, very soft to moderately hard, poorly cemented, trace phosphatic, partly in a form of calcareous sand.	WOB=2-5K RPM=39-42	1520-1540	20
LIMESTONE; Limestone, 100%; 50%, light gray (N7), to very light gray (N8), dolomitic, very fine grained, moderately hard to hard, moderately well- to well- cemented, vuggy; 50%, yellowish gray (5Y 7/2), oolitic grainstone, fossiliferous, very fine- to fine-grained, very soft to soft, poorly cemented, trace of phosphate, partly in a form of calcareous sand.	WOB=2-5K RPM=39-42	1540-1580	40

LIMESTONE; Limestone, 100%, yellowish gray (5Y 7/2), oolitic grainstone, trace of fossils and phosphate, very soft to moderately hard, poorly- to moderately- well cemented, frequent fragments to 0.3-0.5-inch, some in the form of calcareous sand, trace of very light gray (N8), dolomitic, very fine grained.	WOB=2-5K RPM=39-42	1580-1630	50
LIMESTONE; Limestone, 100%, very pale orange (10YR 8/2), grainstone, trace of fossils and phosphate, soft to moderately hard, moderately well cemented, frequent fragments to 1-2 mm, single fragments to 10 mm, some shell fragments (1-2 mm) .	WOB=2-5K RPM=39-42	1630 -1650	20
LIMESTONE: Limestone 100%, yellowish gray (5Y 8/1), very fine grained, no visible bedding planes, soft, massive, no apparent macro-porosity (see core description for more details)	Core #1 (~4.3 ft of recovery)	1650-1665	15
LIMESTONE: Limestone 100%, yellowish gray (5Y 8/1), very fine to fine grained, fossiliferous, partially oolitic, soft, poorly cemented, trace amount of black specs (phosphate).	WOB: Between 3-6K	1660-1690	30
LIMESTONE: Limestone, 100%, yellowish gray (5Y 8/1), similar lithology as above except slightly more consolidated.		1690-1710	20
LIMESTONE: Limestone, 100%, yellowish gray (5Y 8/1), very fine grained, soft, poorly- to moderately well- cemented, fossiliferous.		1710-1730	20
LIMESTONE: Limestone, 100%, yellowish gray (5Y 8/1), very fine grained, soft, poorly cemented; Clay, trace, yellowish gray (5Y 7/2), very soft, non plastic.	WOB: 15K RPM=18-19	1730-1740	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), very fine grained, soft, poorly- to moderately well- cemented, oolitic; Dolomite, trace, moderate yellowish brown (10YR 5/4), fine crystalline.	WOB: 10K, Penetration Rate 2-3 min/ft	1740-1770	30
DOLOSTONE AND SOME LIMESTONE: Dolostone, 80%, moderate yellowish brown (10YR 5/4), fine crystalline, moderately hard, well cemented with limestone and fossil intraclasts; Limestone, 20%, yellowish gray (5Y 7/2), oolitic, fossiliferous grainstone, soft, poorly cemented.		1770-1780	10
DOLOMITIC LIMESTONE: Limestone, 70%, pale yellowish brown (10YR 6/2), very fine grained, oolitic, fossiliferous, poorly- to moderately well- cemented; Dolostone, 30%, moderate yellowish brown (10YR 5/4), very fine grained, moderately hard, moderately well cemented (dolomite crystals within the limestone).		1780-1810	30
DOLOSTONE AND LIMESTONE: Dolostone, 60%, pale yellowish brown (10YR 6/2) and moderate yellowish brown (10YR 5/4), fine crystalline, moderately hard, moderately well cemented, fossil intraclasts; Limestone, 40%, yellowish gray (5Y 8/1), oolitic grainstone, very fine grained, soft, moderately well cemented.		1810-1825	15
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to pale yellowish brown (10 YR 6/2), mudstone, few fossils, very fine grained, hard, well cemented, occasional diagonally fractured, competent rock.	Core #2 in the interval 1825-1839 ft bpl.	1825-1830	5

LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to pale yellowish brown (10 YR 6/2), grainstone, fossiliferous with shell intraclasts and forams, very fine- to fine- grained, vuggy (increasing porosity and fossils with depth), moderately hard and moderately well cemented , deeper (from approx. 1835 ft bpl) becoming softer and disintegrating .	Core #2 in the interval 1825-1839 ft bpl.	1830-1840	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), oolitic grainstone, slightly fossiliferous, fine grained, soft, poorly cemented,	WOB=18-20K RPM=18-19	1840-1850	10
DOLOSTONE AND SOME LIMESTONE: Dolostone, 70%, dark yellowish brown (10YR 4/2), very fine- to fine- crystalline, moderately hard; Limestone, 30%, very pale orange (10YR 8/2), oolitic grainstone, soft, poorly cemented.	WOB=18-20K RPM=18-19	1850-1860	10
CLAYEY LIMESTONE: Limestone, 100%, primarily yellowish gray (5Y 7/2) with some very pale orange (10YR 8/2), wackstone (primarily calcareous clay, soft, low plasticity), very fine grained, trace amount of dolomitic crystals.	WOB=18-20K RPM=18-19	1860-1870	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), grainstone, very fine grained, soft, poorly cemented, trace amount of clayey limestone between 1870-1880 ft bpl, trace of fossils, increasingly crystalline with depth.	WOB=18-20K RPM=18-19	1870-1940	70
LIMESTONE AND LITTLE DOLOSTONE: Limestone, 90%, yellowish gray (5Y 7/2), fine grained, grainstone, primarily crystalline, poorly- to moderately well- cemented; Dolostone, 10%, moderate yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/2), fine crystalline, hard, amount of dolostone slightly decreases with depth.	WOB=18-20K RPM=18-19	1940-1970	30
LIMESTONE AND SOME CLAY (MARL): Limestone, 80%, pale yellowish brown (10YR 6/2), grainstone, very fine- to fine- grained, trace of fossils, trace of phosphate, very soft, poorly cemented (crumbling into a sand); Clay (marl), 20%, medium gray (N5) to medium dark gray (N4), calcareous, soft, non-plastic, to low plasticity.	WOB=18-20K RPM=18-19	1970-1983	13
LIMESTONE: Limestone, 100%, yellowish gray (5Y 8/1), mudstone, very fine grained, trace of fossils, soft to moderately hard, poorly- to moderately well- cemented.	WOB=18-20K RPM=18-19	1983-1990	7
LIMESTONE: Limestone, 100%, yellowish gray (5Y 8/1), grainstone, fine crystalline, partly oolitic, very fine grained, slightly phosphatic, trace of fossils (shells intraclasts), hard, well cemented, few shallow vugs, thin, occasional horizontal smudges of black material (phosphate concentrations), isolated diagonal fractures.	Core No. 3 interval from 1990 to 2005 ft bpl.	1990-2010	20
LIMESTONE: Limestone, 100%, pale yellowish brown (10YR 6/2), oolitic grainstone, fine grained, very calcitic (light brown grains of calcite), slightly phosphatic, very soft, poorly cemented (crumbling into a sand), few small fragments (3-5 mm) of moderately hard; Clay (Marl), trace, pale yellowish brown (10YR 6/2), calcareous, very soft, non plastic.	WOB=15-20K RPM=19-20	2010-2070	60

LIMESTONE AND LITTLE CLAY (MARL): Limestone, 90%, pale yellowish brown (10YR 6/2), oolitic grainstone, fine grained, calcitic, slightly phosphatic, very soft, poorly cemented, mostly in a form of sand, few small fragments (3-5 mm) moderately hard; Clay, 10%, yellowish gray (5Y 7/2), calcareous, very soft, non plastic.	WOB=15-20K RPM=19-20	2070-2090	20
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, calcitic, slightly phosphatic, seldom light gray (N7) and micritic, soft to moderately hard, poorly cemented (calcareous sand) to moderately well cemented; Clay (Marl), trace, very light gray (N8),calcareous, chalky, very soft, non plastic.	WOB=15-20K RPM=19-20	2090-2110	20
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), oolitic grainstone, some wackstone, fine grained, slightly dolomitic, trace of fossils, slightly phosphatic, seldom light gray (N7) and micritic, soft to hard, poorly- (calcareous sand) to moderately well-cemented.	WOB=15-20K RPM=19-20	2110-2135	25
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), mostly wackstone, little grainstone, very fine- to fine- grained, trace of fossils, trace of phosphate, moderately hard to hard, well cemented, competent, few diagonal fractures, very slightly vuggy, abundant worm burrows, moderately well- to well- cemented.	Core No. 4 interval from 2136.5 to2148.5 ft bpl.	2135-2143	8
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), mudstone, with frequent horizontal, irregular laminas of black material (phosphate), very fine grained, trace of fossils, moderately hard to hard, well cemented, massive, isolated diagonal fracturing.	Core No. 4 interval from 2136.5 to2148.5 ft bpl.	2143-2150	7
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), mostly grainstone, partly oolitic, fine grained, trace of fossils, slightly phosphatic, trace of light gray (N7), fine crystalline, soft to moderately hard, poorly- to moderately well- cemented.	WOB=19-20K RPM=19-20	2150-2170	20
LIMESTONE: Limestone, 100%, light olive gray (5Y 5/2), grainstone, fine grained, trace of fossils and phosphate, little light gray (N7), crystalline, soft, poorly cemented (calcareous sand).	WOB=19-20K RPM=19-20	2170-2210	40
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, trace of fossils and phosphate, trace of light gray (N7), fine crystalline, soft, poorly cemented.	WOB=19-20K RPM=19-20	2210-2220	10
DOLOSTONE AND SOME LIMESTONE: Dolostone, 80%, olive gray (5Y 3/2), fine crystalline, vuggy, moderately hard, moderately well cemented; Limestone, 20%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, trace of fossils and phosphate, trace of light gray (N7), fine crystalline, soft, poorly cemented.	WOB=19-20K RPM=19-20	2220-2230	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, trace of fossils and phosphate, trace of light gray (N7), fine crystalline, soft, poorly cemented; Dolostone, trace, olive gray (5Y 3/2), fine crystalline, vuggy, hard, well cemented.	WOB=19-20K RPM=19-20	2230-2240	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, trace of fossils and phosphate, trace of light gray (N7), fine crystalline, soft, poorly cemented, only few better cemented fragments 0.2 x 0.5-inch size.	WOB=19-20K RPM=19-20	2240-2310	70

LIMESTONE AND SOME DOLOSTONE: Limestone, 70%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, moderately well cemented; Dolostone, 30%, olive gray (5Y 3/2), fine crystalline, moderately hard, moderately well cemented; Phosphate, trace, black, fine grained;.	WOB=19-20K RPM=19-20	2310-2340	30
LIMESTONE AND SOME DOLOSTONE: Limestone, 80%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, moderately hard, moderately well cemented; Dolostone, 20%, medium gray (N5) to medium dark gray (N4), fine crystalline, hard; Phosphate, trace, black, fine grained.	WOB=19-20K RPM=19-20	2340-2350	10
DOLOSTONE AND LIMESTONE: Dolostone, 50%, medium dark gray (N4), finely crystalline, saccharoidal, hard; Limestone, 50%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, trace phosphate, sandy, soft to moderately hard, poorly- to moderately well- cemented.	WOB=19-20K RPM=19-20	2350-2360	10
LIMESTONE AND SOME DOLOSTONE: Limestone, 80%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, moderately hard to soft, moderately well cemented, slightly phosphatic; Dolostone, 20%, medium dark gray (N4), hard, fine crystalline, some saccharoidal.	WOB=19-20K RPM=19-20	2360-2370	10
DOLOSTONE AND LIMESTONE: Dolostone, 50%, medium dark gray (N4), hard, fine crystalline, some saccharoidal; Limestone, 50%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft to moderately hard, poorly- to moderately well- cemented; Phosphate, trace, black, fine grained.	WOB=19-20K RPM=19-20	2370-2380	10
DOLOSTONE AND SOME LIMESTONE: Dolostone, 80%, medium dark gray (N4) to dark gray (N3) with little light olive brown (5Y 5/6), fine crystalline, little saccharoidal, hard, vuggy, fragments to 1-inch diameter; Limestone, 20%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, very soft, poorly cemented, mostly in a the form of calcareous sand; Phosphate, trace, black, fine grained.	WOB=19-20K RPM=19-20	2380-2400	20
LIMESTONE AND VERY LITTLE DOLOSTONE: Limestone, 95%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft to moderately hard, moderately well cemented; Dolostone, 5%, medium gray (N5), fine crystalline, hard; Phosphate, trace, black, fine grained	WOB=19-20K RPM=19-20	2400-2420	20
LIMESTONE AND DOLOSTONE: Limestone, 60%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft, moderately well cemented; Dolostone, 40%, medium dark gray (N4) with light olive brown (5Y 5/6), fine crystalline, some saccharoidal, hard, fragments to 1-inch diameter; Phosphate, trace, black, fine grained. .	WOB=19-20K RPM=19-20	2420-2430	10
LIMESTONE AND SOME DOLOSTONE: Limestone, 80%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft, moderately well cemented; Dolostone, 20%, medium dark gray (N4) and light olive brown (5Y 5/6), fine crystalline, some saccharoidal, hard, fragments to 1-inch diameter, vuggy; Phosphate, trace, black, fine grained.	WOB=19-20K RPM=19-20	2430-2440	10

LIMESTONE AND VERY LITTLE DOLOSTONE: Limestone, 95%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft to moderately hard, moderately well cemented; Dolostone, 5%, medium gray (N5), microcrystalline, hard, vuggy; Phosphate, trace, black, fine grained.	WOB=15-20K RPM=15-19	2440-2478	38
DOLOSTONE: Dolostone, 100%, brownish black (5YR 2/1) to brownish gray (5YR 4/1), fine crystalline, some saccharoidal, hard, well cemented, vuggy; Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fine grained; Phosphate, trace, black small grains.	WOB=15-20K RPM=15-19	2478-2490	12
LIMESTONE AND LITTLE DOLOSTONE: Limestone, 90%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, little light gray (N7) to medium gray (N5), microcrystalline, very soft to soft, poorly cemented (mostly calcareous sand); Dolostone, 10%, brownish black (5YR 2/1) to brownish gray (5YR 4/1), fine crystalline, little saccharoidal, moderately hard, moderately well cemented, vuggy; Clay (Marl), trace, white (N9), calcareous, very soft, non plastic; Phosphate, trace, black, fine grained.	WOB=15-20K RPM=15-19	2490-2500	10
LIMESTONE AND DOLOSTONE: Limestone, 60%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, little light gray (N7) to medium gray (N5), microcrystalline, very soft to soft, poorly cemented (mostly calcareous sand); Dolostone, 40%, moderate yellowish brown (10YR 4/2) to brownish black (5YR 2/1), fine crystalline, some saccharoidal, moderately hard, moderately well cemented, very vuggy; Phosphate, trace, black, soft, fine grained.	WOB=15-20K RPM=15-19	2500-2520	20
DOLOSTONE: Dolostone, 100%, brownish black (5YR 2/1) to brownish gray (5YR 4/1), fine crystalline, some saccharoidal, mostly soft, little moderately hard, poorly cemented (mostly in a form of dolomitic sand), vuggy; Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft, poorly cemented; Phosphate, trace, black, soft.	WOB=15-20K RPM=15-19	2520-2530	10
LIMESTONE AND DOLOSTONE: Limestone, 60%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, light gray (N7) to medium gray (N5), microcrystalline, dolomitic, with trace of phosphate, very soft to soft, poorly cemented (mostly calcareous sand); Dolostone, 40%, moderate yellowish brown (10YR 4/2) to brownish black (5YR 2/1), fine crystalline, some saccharoidal, soft, poorly cemented, very vuggy; Phosphate, trace, black, fine grained.	WOB=15-20K RPM=15-19	2530-2540	10
DOLOSTONE: Dolostone, 100%, brownish black (5YR 2/1) to brownish gray (5YR 4/1), fine crystalline, some saccharoidal, soft, little moderately hard, poorly cemented (mostly dolomitic sand), vuggy; Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft, poorly cemented, slightly phosphatic.	WOB=15-20K RPM=15-19	2540-2550	10
DOLOMITIC SAND: Dolostone, 100%, moderate brown (5YR 4/4), mostly in a form of medium grained sand, poorly sorted, sub-rounded, little dusky brown (5YR 2/2)/1), fine crystalline, moderately hard, vuggy.	WOB=15-20K RPM=15-19	2550-2560	10

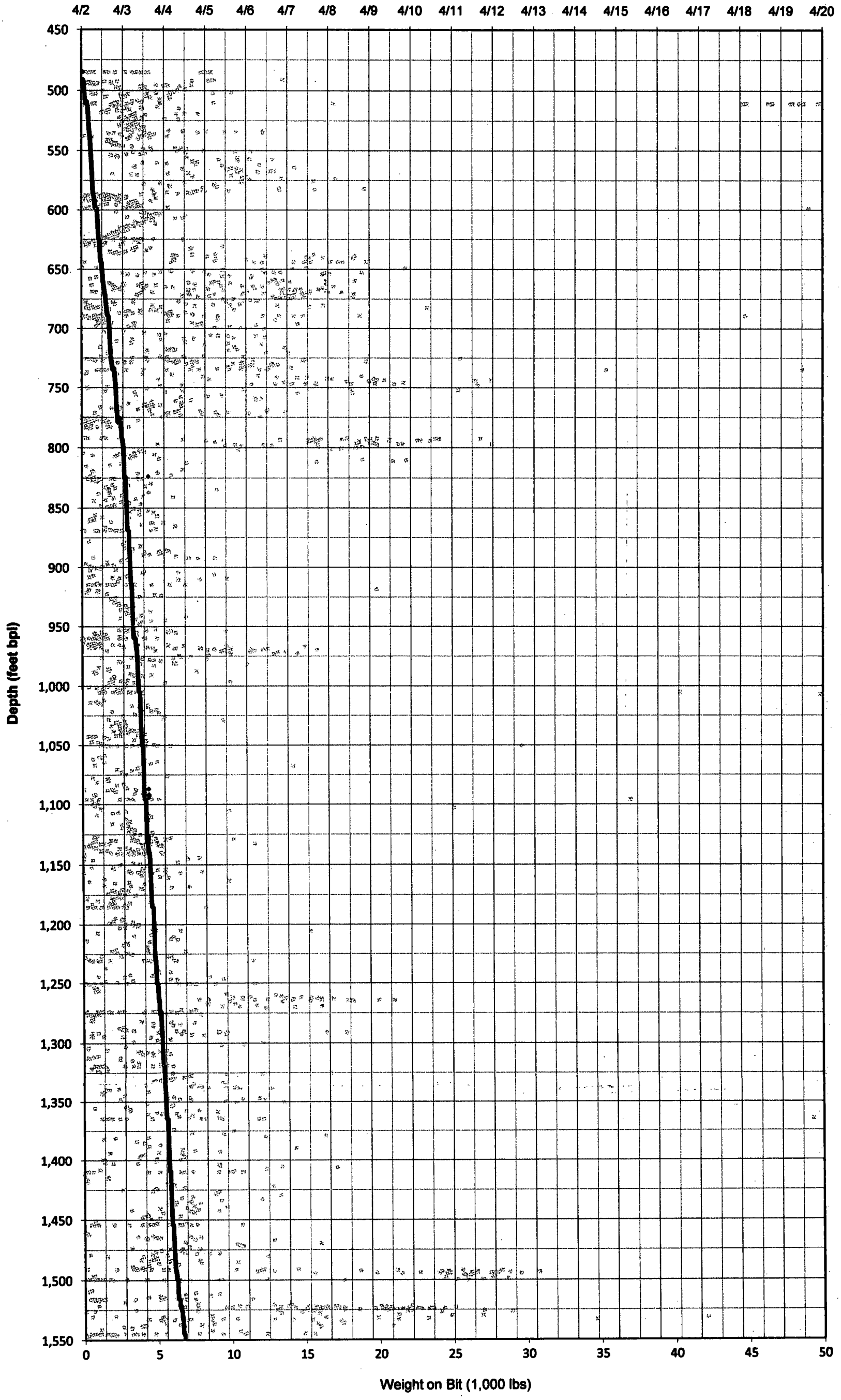
DOLOSTONE: Dolostone, 100%, brownish black (5YR 2/1) to moderate brown (5YR 4/4), fine crystalline, some saccharoidal, mostly soft, some moderately hard to hard, poorly cemented (mostly in a form of dolomitic sand) to well cemented, vuggy.	WOB=15-20K RPM=15-19	2560-2580	20
DOLOSTONE AND VERY LITTLE LIMESTONE: Dolostone, 95%, pale yellowish brown (10YR 6/2) to dark yellowish brown (10YR 4/2), fine crystalline, some saccharoidal, hard to very hard, moderately well- to well- cemented; Limestone, 5%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft to very soft.	WOB=15-20K RPM=15-19	2580-2590	10
DOLOSTONE: Dolostone, 100%; 70% olive gray (5Y 4/1) fine- to micro-crystalline; 30% brownish black (5YR 2/1) saccharoidal, hard to very hard, well cemented, little vugs, up to 20% of dolomitic sand (occasional cavities up to 1 ft wide, filled with loose material); Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft to very soft.	WOB=31-32K, RPM=18-19	2590-2610	20
DOLOSTONE: Dolostone, 100%, olive gray (5Y 4/1) to pale brown (5YR 5/2), fine- to micro-crystalline, hard to very hard, brittle, well cemented.	WOB=32-33K, RPM 17-18.	2610-2620	10
DOLOSTONE: Dolostone, 100%; 80% brownish black (5YR 2/1) saccharoidal and fine crystalline; 20% olive gray (5Y 4/1) fine- to micro-crystalline, hard to very hard, well cemented, few vugs; Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft to very soft.	WOB=32-33K, RPM=19-20	2620-2630	10
DOLOSTONE: Dolostone, 100%; 90% olive gray (5Y 4/1) fine- to micro-crystalline; 10% brownish black (5YR 2/1), saccharoidal, hard, brittle, well cemented, few vugs; Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft to very soft.	WOB=32-33K, RPM=19-20	2630-2640	10
DOLOSTONE: Dolostone, 100%; 80% brownish black (5YR 2/1), 20% olive gray (5Y 4/1), fine- to micro-crystalline, hard to very hard, brittle, well cemented; Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft to very soft.	WOB=32-33K, RPM=19-20	2640-2660	20
DOLOSTONE: Dolostone, 100%; 90% olive gray (5Y 4/1) fine- to micro-crystalline, 10% brownish black (5YR 2/1), saccharoidal, hard, brittle, well cemented, few vugs; Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft to very soft.	WOB=32-33K, RPM=19-20	2660-2670	10
DOLOSTONE: Dolostone, 100%; 70% brownish black (5YR 2/1), 30% olive gray (5Y 4/1), fine- to micro-crystalline, hard to very hard, brittle, well cemented; Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft to very soft.	WOB=32-33K, RPM=19-20	2670-2700	30
DOLOSTONE AND LITTLE LIMESTONE: Dolostone, 80%; 70% moderate olive brown (5Y 4/4), 30% medium gray (N4), fine- to micro-crystalline, hard to very hard, brittle, well cemented; Limestone, 20%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft, poorly cemented; Clay, trace, brownish black (5YR 2/1), low plasticity, cohesive, very soft.	WOB=32-33K, RPM=19-20	2700-2710	10

DOLOSTONE AND LITTLE LIMESTONE: Dolostone, 80%; 70% moderate olive brown (5Y 4/4), 30% medium gray (N4), fine- to micro-crystalline, hard to very hard, brittle, well cemented; Limestone, 20%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft.	WOB=27-34K RPM=20-25	2710-2720	10
DOLOSTONE AND LITTLE LIMESTONE: Dolostone, 90%; 70% moderate olive brown (5Y 4/4), 30% dark gray (N3), fine- to micro-crystalline, hard to very hard, brittle, well cemented; Limestone, 10%, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft, poorly cemented.	WOB=27-34K RPM=20-25	2720-2730	10
DOLOSTONE: Dolostone, 100%; 70% brownish black (5YR 2/1), 30% olive gray (5Y 4/1), fine- to micro-crystalline, hard to very hard, brittle, poorly cemented (up to 60% in a form of dolomitic sand); Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft to very soft, poorly cemented.	WOB=27-34K RPM=20-25	2730-2750	20
LIMESTONE AND SOME DOLOSTONE: Limestone, 75%, light olive brown (5Y 5/6), grainstone, fine grained, soft to moderately hard, poorly cemented, some in a form of calcareous sand; Dolostone, 25%, brownish gray (5YR 4/1), hard to very hard, saccharoidal.	WOB=27-34K RPM=20-25	2750-2760	10
DOLOSTONE: Dolostone, 100%; 70% brownish black (5YR 2/1), 30% olive gray (5Y 4/1), fine- to micro-crystalline, hard to very hard, brittle, up to 20% poorly cemented (dolomitic sand); Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft, poorly cemented.	WOB=27-34K RPM=20-25	2760-2770	10
DOLOSTONE: Dolostone, 100%, olive gray (5Y 4/1) with 20% moderate yellowish brown (10YR 5/4), fine- to micro-crystalline, hard to very hard, saccharoidal, few cavities.	WOB=27-34K RPM=20-25	2770-2780	10
DOLOSTONE: Dolostone, 100%, olive gray (5Y 4/1), fine- to micro-crystalline, hard to very hard, brittle.	WOB=27-34K RPM=20-25	2780-2790	10
DOLOSTONE: Dolostone, 100%; 80% brownish black (5YR 2/1), 20% olive gray (5Y 4/1), fine- to micro-crystalline, hard to very hard, brittle, poorly cemented (up to 70% in the form of dolomitic sand); Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft to very soft, poorly cemented.	WOB=15-20K RPM=19-20	2790-2800	10
DOLOSTONE: Dolostone, 100%; 80% brownish black (5YR 2/1) with 20% dark gray (N3), fine- to micro-crystalline, hard to very hard, brittle, moderately well cemented, little dolomitic sand, fine to medium grained.	WOB=15-20K RPM=19-20	2800-2820	20
DOLOSTONE: Dolostone, 100%; 70% brownish black (5YR 2/1), 30% olive gray (5Y 4/1), fine- to micro-crystalline, hard to very hard, brittle, poorly cemented (mostly in the form of dolomitic sand); Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft to very soft, poorly cemented.	WOB=15-20K RPM=19-20	2820-2830	10

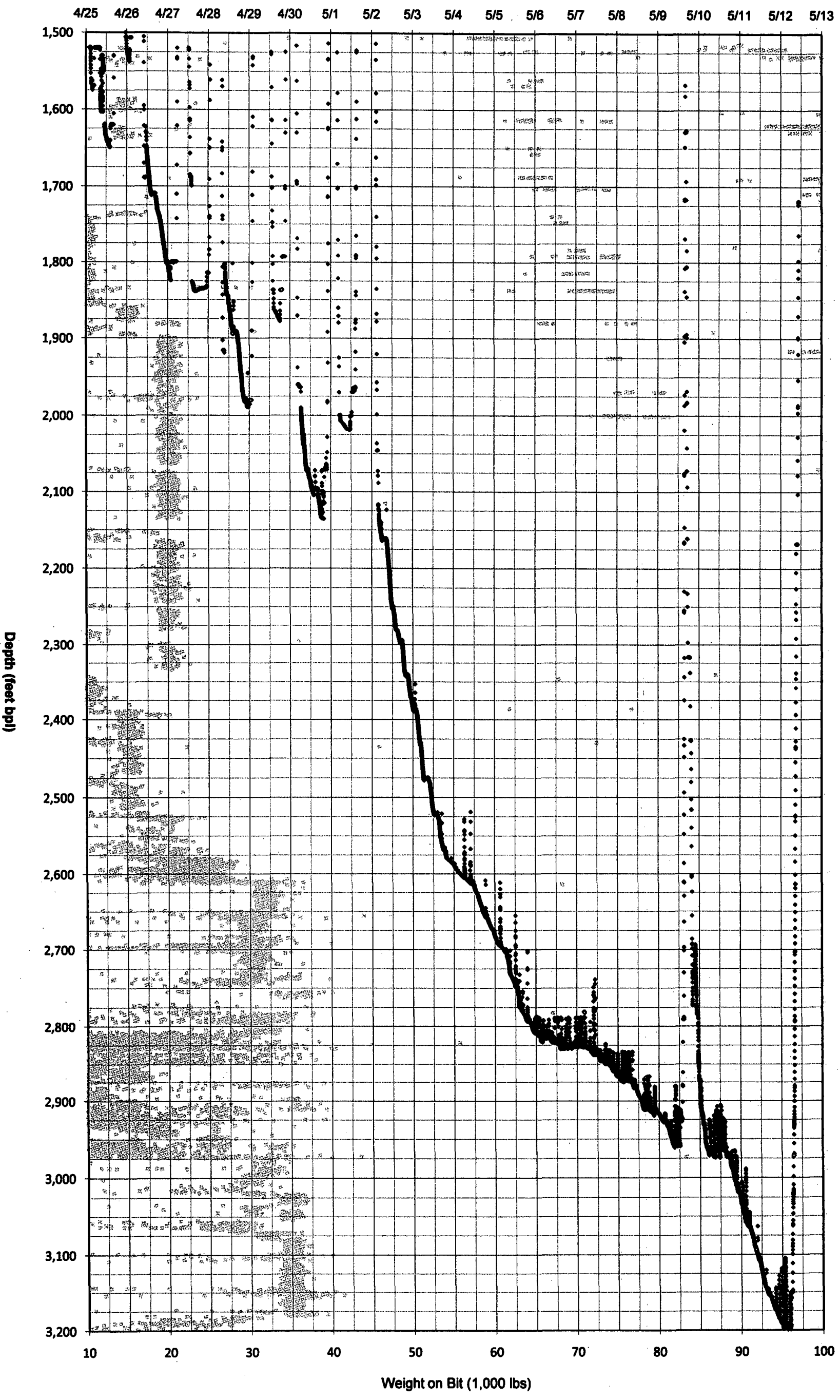
DOLOSTONE: Dolostone, 100%; 80% brownish black (5YR 2/1), 20% olive gray (5Y 4/1), fine- to micro-crystalline, hard to very hard, brittle, poorly cemented (mostly in the form of dolomitic sand); Limestone, trace, yellowish gray (5Y 7/2), oolitic grainstone, fine grained, soft to very soft, poorly cemented.	WOB=15-20K RPM=19-20	2830-2840	10
DOLOSTONE: Dolostone, 100%; 80 % olive gray (5Y 4/1), microcrystalline, hard to very hard, brittle, well cemented, 20% yellowish gray (5Y 7/2), fine crystalline, soft, poorly cemented (in a form of dolomitic sand).	WOB=10-12K, RPM=29-30	2840-2860	20
DOLOSTONE: Dolostone, 100%, light olive gray (5Y 6/1) to yellowish gray (5Y 7/2), soft, mostly in the form of fine- to coarse-grained dolomitic sand causing fall-outs and dredging, approx. 20% of fine crystalline, better cemented fragments.	WOB=10-12K, RPM=29-30	2860-2880	20
DOLOSTONE: Dolostone, 100%; 80 % olive gray (5Y 4/1), microcrystalline, hard to very hard, brittle, well cemented, 20% yellowish gray (5Y 7/2), fine crystalline, soft, poorly cemented (some in a form of dolomitic sand).	WOB=10-12K, RPM=29-30	2880-2900	20
DOLOSTONE: Dolostone, 100%, light olive gray (5Y 6/1) to yellowish gray (5Y 7/2), micro- to fine- crystalline, hard, brittle, well cemented, trace of dolomitic sand.	WOB=10-12K, RPM=29-30	2900-2910	10
DOLOSTONE: Dolostone, 100%, olive gray (5Y 3/2) to light olive gray (5Y 6/1), fine crystalline, hard, brittle, well cemented, approx. 20% in a form of fine- to coarse- grained dolomitic sand.	WOB=30-32K, RPM=29-30	2910-2930	20
DOLOSTONE: Dolostone, 100%, olive gray (5Y 3/2), light olive gray (5Y 6/1), little yellowish gray (5Y 7/2, micro- and fine-crystalline, hard, brittle, well cemented, trace of dolomitic sand.	WOB=32-34K, RPM=29-30	2930-2940	10
DOLOSTONE: Dolostone, 100%, olive gray (5Y 3/2), light olive gray (5Y 6/1) and little yellowish gray (5Y 7/2), microcrystalline, hard, brittle, well cemented, approx. 30% in a form of fine- to coarse- grained dolomitic sand.	WOB=32-34K, RPM=29-30	2940-2950	10
DOLOSTONE: Dolostone, 100%, olive gray (5Y 3/2) to light olive gray (5Y 6/1), microcrystalline, hard, brittle, well cemented, trace of dolomitic sand.	WOB=13-15K, RPM=30-33	2950-2960	10
DOLOSTONE: Dolostone, 100%; 80% in a form of light olive gray (5Y 3/2) dolomitic sand, medium- to coarse- grained, interbeded with layers of olive gray (5Y 3/2), olive black (5Y 2/1) and light olive gray (5Y 6/1) microcrystalline dolomite, hard, well cemented, brittle.	WOB=13-15K, RPM=30-33	2960-2970	10
DOLOSTONE: Dolostone, 100%; 80% olive gray (5Y 3/2), 20% medium gray (N5) and yellowish gray (5Y 7/2), microcrystalline, hard to very hard, well cemented, some brittle; up to 20 % in a form of fine- to coarse- grained dolomitic sand.	WOB=34-35K, RPM=33-36	2970-2980	10
DOLOSTONE: Dolostone, 100%; 80% in a form of yellowish gray (5Y 7/2) dolomitic sand, fine- to coarse- grained; 20% olive gray (5Y 3/2) and light olive gray (5Y 6/1) microcrystalline dolostone, hard, well cemented, brittle.	WOB=34-35K, RPM=33-36	2980-3000	20

DOLOSTONE: Dolostone, 100%, moderate yellowish brown (10YR 5/4), little dark yellowish brown (10YR 4/2) and dusky yellowish brown (10YR 2/2), fine crystalline, hard, few vugs.	WOB=34-35K, RPM=33-36	3000-3010	10
DOLOSTONE: Dolostone, 100%; 60% moderate yellowish brown (10YR 5/4) in a form of fine- to coarse- grained dolomitic sand with trace of very light gray (N8), calcareous; 40% moderate yellowish brown (10YR 5/4), little dark yellowish brown (10YR 4/2) and dusky yellowish brown (10YR 2/2), fine crystalline, hard, few vugs.	WOB=34-35K, RPM=33-36	3010-3020	10
DOLOSTONE: Dolostone, 100%; 80% pale yellowish brown (10YR 6/2), in a form of fine- to coarse- grained dolomitic sand with trace of very light gray (N8) calcareous grains; 20% moderate yellowish brown (10YR 5/4), little dark yellowish brown (10YR 4/2) and dusky yellowish brown (10YR 2/2) fine- to medium-crystalline, saccharoidal, moderately hard, brittle.	WOB=34-35K, RPM=33-36	3020-3060	40
DOLOSTONE: Dolostone, 100%, mostly olive black (5Y 2/1) and dusky brown (5YR 2/2), some pale yellowish brown (10YR 6/2), fine crystalline, hard, trace of vugs.	WOB=34-35K, RPM=33-36	3060-3080	20
DOLOSTONE: Dolostone, 100%, moderate yellowish brown (10YR 5/4) to pale yellowish brown (10YR 6/2), little dark yellowish brown (10YR 4/2) and dusky yellowish brown (10YR 2/2) fine crystalline, hard, some brittle, slightly vuggy.	WOB=34-35K, RPM=33-36	3080-3100	20
DOLOSTONE: Dolostone, 100%, olive gray (5Y 4/1) fine crystalline, hard, brittle; Limestone, trace, very light gray (N8), dolomitic, fine crystalline.	WOB=34-35K, RPM=33-36	3100-3120	20
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR 6/2), little medium light gray (N6), fine crystalline, hard, approx. 10% in a form of fine- to coarse- grained dolomitic sand.	WOB=34-35K, RPM=33-36	3120-3130	10
DOLOSTONE: Dolostone, 100%, medium dark gray (N5), trace of light olive gray (5Y 6/1), fine- to micro-crystalline, hard, brittle.	WOB=34-35K, RPM=33-36	3130-3140	10
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR6/2) to dark yellowish brown (10YR 4/2), little dusky yellowish brown (10YR 2/2), fine crystalline, hard, some brittle, approx. 20% in a form of fine- to coarse- grained dolomitic sand.	WOB=34-35K, RPM=33-36	3140-1360	20
DOLOSTONE: Dolostone, 100%, dark yellowish gray (10YR 4/2) to pale yellowish brown (10YR 6/2), fine crystalline, hard, some brittle, approx. 20% in a form of fine- to coarse- grained dolomitic sand.	WOB=34-35K, RPM=33-36	3160-3180	20
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR 6/2), some dusky yellowish brown (10YR 2/2), little medium dark gray (N5), fine crystalline, hard, some brittle, approx. 30% in a form of fine- to coarse- grained dolomitic sand.	WOB=34-35K, RPM=33-36	3180-3200	20

Penetration Rate & Weight on Bit
Golden Gate WWTF Injection Well IW1
450 - 1,550 Feet BPL



Penetration Rate & Weight on Bit
Golden Gate WWTF Injection Well IW1
1,500 - 3,200 Feet BPL



ARCADIS

Core Samples for Laboratory Analysis

FGUA Golden Gate WWTP Injection Well System

Golden Gate, Florida

Injection Well IW1

Summary of Core Samples for Laboratory Analysis

Core Number	Cored Interval (feet bpl)	Total Core Length (feet)	Percent of Recovery	Core Sample Interval (feet bpl)	Core Sample Length (feet)	Description
1	1650-1665	4.5	30.0	1650.20-1650.5	0.30	Limestone, solid, hard, well indurated.
				1652.3-1652.7	0.40	Limestone, solid, vuggy, mod.well cem.
				1652.7-1653.15	0.45	Limestone, solid, sl.vuggy, mod.well cem.
2	1825-1839	9.6	67.1	1825.7-1826.4	0.70	Limestone, massive, hard
				1828.5-1829.1	0.60	Limestone, massive, hard, few vugs
				1830.65-1831.1	0.45	Limestone, massive, hard
3	1990-2005	11.5	76.7	1990.0-1990.4	0.40	Limestone, massive, hard
				1995.15-1995.5	0.35	Limestone, massive, hard
				2000.7-2001.5	0.80	Limestone, massive, hard
4	2136.5-2148.5	9.0	75.0	2136.5-2136.95	0.45	Limestone, massive, hard
				2140.65-2141.3	0.65	Limestone, solid, hard w/trace of fracture
				2142.8-2143.45	0.65	Limestone, massive, hard

"bpl" denotes "below pad level"

pad level is 4.0 feet below rig floor

Core Barrel is 6.75 inches outside diameter (4-inch inside diameter)

ARCADIS

CORE LOG SUMMARY

Golden Gate WWTP Injection Well System

Golden Gate, Florida

Injection Well- IW-1
Core Sample No. 1

Total Depth Drilled:	1650-1665 feet
Core Barrel Length:	30 feet
Core Barrel Diameter ID:	4-inches
Drilling Fluid Used:	water

Date:	4/26/2008
Sampling Interval:	1,650 to 1,665 feet bpl
Hole Diameter:	12 inches

Depth feet bpl		Interval Length	WOB	RPM	Pressure	
From	To	feet	x 1000 lbs		(PSI)	
1650	1651	1	4.5	10.5	17	LIMESTONE: Limestone, 100%, yellowish gray (5Y 8/1), very fine grained, no visible bedding structure, little to no macroporosity, generally poorly to moderately indurated, some fossils. Only 3 pieces of core are at or just greater than 10 cm; in some portions limestone broke down into a calcareous soft mud.
1651	1652	1	5	10.5	17	
1652	1653	1	5	10.5	17	
1653	1654	1	5.5	10.5	23	
1654	1655	1	5.5	10.5	21	
1655	1656	1	5.5	10.5	22.4	
1656	1657	1	5.5	10.5	22.4	
1657	1658	1	5.5	10.5	35	
1658	1659	1	5.5	10.5	32	
1659	1660	1	5.5	10.5	32	
1660	1661	1	5.5	10.5	23.2	
1661	1662	1	5.5	10.6	60	
1662	1663	1	5.5	10.6	41	
1663	1664	1	4.9	10.8	66	
1664	1665	1	4.6	10.7	38	
Total Cored (feet):		**15.0**				

"bpl" denotes below pad level
"RPM" denotes rate per minute of coring barrel
"WOB" denotes weight on coring barrel
"lbs" denotes pounds

ARCADIS

CORE LOG SUMMARY

Golden Gate WWTP Injection Well System

Golden Gate, Florida

Injection Well IW1
Core Sample No. 1

Total Depth Drilled:	1650-1665 feet	**Date:**	4/26/2008
Core Barrel Length:	30 feet	**Sampling Interval:**	1,650 to 1,665 feet bpl
Core Barrel Diameter ID:	4-inches	**Core Recovery (%):**	30
Drilling Fluid Used:	water	**Hole Diameter:**	12 inches

Depth feet bpl		Core Length feet	Core Description
From	To		
1650.00	1650.2	0.2	Multiple small fragments 1-3-inches.
1650.20	**1650.5**	**0.3**	**Solid, massive core.**
1650.50	1651.5	1	Horizontaly broken fragments, 1-2.5-inches long, 4-inches in diameter.
1651.50	1652.3	0.8	Numerous, irregular fragments up 1-4-inches long.
1652.30	**1652.7**	**0.40**	**Solid core, vuggy.**
1652.70	**1653.15**	**0.45**	**Solid fragment, but uneven bottom.**
1653.15	1654.40	1.35	Numerous, irregular fragments up 1-4-inches long.
Total Recovery (feet):		**4.5**	

"bpl" denotes below pad level

Bold letters indicate core fragments suitable for lab. Analysis.

ARCADIS

CORE LOG DESCRIPTION

Golden Gate WWTP Injection Well System

Golden Gate, Florida

InjectionWell IW 1
Core Sample No. 2

Total Depth Drilled:	1824.7-1839 feet	**Date:**	4/27/2008
Core Barrel Length:	30 feet	**Coring Interval Length:**	14.3
Core Barrel Diameter ID:	4-inches	**Core Recovery (%):**	67.1
Drilling Fluid Used:	water	**Hole Diameter:**	12 inches

Depth feet bpl From	Depth feet bpl To	Interval Length feet	RPM	WOB x 1000 lbs	Pressure (PSI)	Core Description
1824.74	1825.74	1	14.7	17	17	LIMESTONE: Limestone, 100%, yellowish gray ((5Y 7/2) to pale yellowish brown (10 YR 6/2), mudstone, few fossils, very fine grained, hard, well cemented, occasional diagonally fractured, competent rock.
1825.74	1826.74	1	14.7	28	28	
1826.74	1827.74	1	14.8	32	32	
1827.74	1828.74	1	14.9	31	31	
1828.74	1829.74	1	14.9	31	31	
1829.74	1830.74	1	14.9	33	33	
1830.74	1831.74	1	14.9	31	31	LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to pale yellowish brown (10 YR 6/2), grainstone, fossiliferous with shell intraclasts and forams, very fine to fine grained, vuggy (increasing porosity and fossils with depth), moderately hard and moderately well cemented, deeper (from approx. 1835 ft bpl) becoming softer and disintegrating (poorly cemented).
1831.74	1833.24	1.5	14.8	30	30	
1833.24	1834.24	1	14.8	29	29	
1834.24	1836.74	2.5	14.8	28	28	
1836.74	1837.74	1	14.8	29	29	
1837.74	1838.74	1	14.8	27	27	
1838.74	1838.94	0.2	14.8	29	29	
1838.94	1839.04	0.1	14.8	29	29	
Total Cored (feet):		**14.3**				

"bpl" denotes below pad level

"RPM" denotes rate per minute of coring barrel

"WOB" denotes weight on coring barrel

ARCADIS

CORE LOG SUMMARY

Golden Gate WWTP Injection Well System

Golden Gate, Florida

Injection Well IW1
Core Sample No. 2

Total Depth Drilled:	1824.7-1839 feet	**Date:**	4/27/2008
Core Barrel Length:	30 feet	**Coring Interval Length:**	14.3
Core Barrel Diameter ID:	4-inches	**Core Recovery (%):**	67.1
Drilling Fluid Used:	water	**Hole Diameter:**	12 inches

Depth feet bpl		Core Length	Core Description
From	To	feet	
1825.00	1825.35	0.35	Solid, massive, hard, well cemented.
1825.35	1825.7	0.35	Solid, massive, hard, well cemented.
1825.70	1826.4	0.7	**Solid, massive, hard, well cemented.**
1826.40	1826.65	0.25	Solid, massive, hard, well cemented.
1826.65	1827.00	0.35	Solid, massive, hard, well cemented.
1827.00	1827.40	0.40	Solid, massive, hard, well cemented.
1827.40	1827.90	0.50	Solid, massive, hard, well cemented.
1827.90	1828.50	0.60	Solid but diagonally fractured.
1828.50	1829.10	0.60	**Solid, massive, hard, well cemented.**
1829.10	1829.50	0.40	Solid, massive, hard, well cemented with 2 smaller pieces 2x3 inches..
1829.50	1829.90	0.40	Solid, hard, well cemented but with increasing amount of vugs.
1829.90	1830.40	0.50	Solid, hard, well cemented but with increasing amount of vugs.
1830.40	1830.65	0.25	Solid, hard, well cemented but with increasing amount of vugs.
1830.65	1831.10	0.45	**Solid, hard, well cemented but with increasing amount of vugs.**
1831.10	1831.40	0.30	Solid, hard, well cemented but with increasing amount of vugs.
1831.40	1831.50	0.10	Solid, but vuggy, poorer cemented, crumbling.
1831.50	1832.00	0.50	Solid, but vuggy, poorer cemented, crumbling, diagonaly fractured.
1832.00	1832.50	0.50	Solid, but vuggy, poorer cemented, crumbling, diagonaly fractured.
1832.50	1833.10	0.60	Solid, but vuggy, poorer cemented, crumbling, diagonaly fractured.
1833.10	1833.60	0.50	Solid, but vuggy, poorer cemented, crumbling, diagonaly fractured.
1833.60	1834.60	1.00	Very soft, poorly cemented, disintegrating, very vuggy, irregular fragments 3-4 inches.
Total Recovery:		**9.6**	

"bpl" denotes below pad level

ARCADIS

CORE LOG DESCRIPTION

Golden Gate WWTP Injection Well System

Golden Gate, Florida

Injection Well IW 1
Core Sample No. 3

Total Depth Drilled:	1990-2005 ft bpl	**Date:**	4/29/2008
Core Barrel Length:	30 feet	**Coring Interval Length:**	15 feet
Core Barrel Diameter ID:	4-inches	**Core Recovery (%):**	76.7
Drilling Fluid Used:	water	**Hole Diameter:**	12 inches

Depth feet bpl		Interval Length	WOB	RPM	Pressure	Core Description
From	To	feet	x 1000 lbs		(PSI)	
	Start	0	3.2	11.8	24.5	LIMESTONE: Limestone, 100%, yellowish gray (5Y 8/1), grainstone, partly oolitic, very fine grained, slightly phosphatic, trace of fossils (shells intraclasts), locally frequent worm burrows, hard, well cemented, few shallow vugs, thin, occasional horizontal laminas of black material (phosphate concentrations), isolated diagonal fractures.
1990	1991	1	3.2-3.8	11.7-11.9	37-53	
1991	1992	1	3.2-3.8	11.7-11.9	37-63	
1992	1993	1	3.2-3.8	11.7-11.9	36-57	
1993	1994	1	3.8-4.2	11.7-11.9	39-57	
1994	1995	1	3.4-4.4	11.7-11.9	44-71	
1995	1996	1	3.5-4.5	11.7-11.9	32-49	
1996	1997	1	3.7-4.4	11.7-11.9	32-56	
1997	1998	1	4.0-4.5	11.7-11.9	32-54	
1998	1999	1	3.2-4.6	11.7-11.9	35-52	
1999	2000	1	3.5-4.4	11.7-11.9	30-51	
2000	2001	1	3.1-4.1	11.7-11.9	31-50	
2001	2002	1	2.6-3.4	11.7-11.9	28-49	
2002	2003	1	3.8-4.4	11.7-11.9	27-52	
2003	2004	1	3.5-4.2	11.7-11.9	29-51	
2004	2005	1	1.4-3.0	11.7-11.9	31-45	
Total Cored (feet):		**15.0**				

"bpl" denotes below pad level

"RPM" denotes rate per minute of coring barrel

"WOB" denotes weight on coring barrel

ARCADIS

CORE LOG SUMMARY

Golden Gate WWTP Injection Well System

Golden Gate, Florida

Injection Well IW1
Core Sample No. 3

Total Depth Drilled:	1990-2005 ft bpl	**Date:**	4/29/2008
Core Barrel Length:	30 feet	**Coring Interval Length:**	15 feet
Core Barrel Diameter ID:	4-inches	**Core Recovery (%):**	76.7
Drilling Fluid Used:	water	**Hole Diameter:**	12 inches

Depth feet bpl		Core Length	Core Description
From	To	feet	
1990.00	1990.4	0.4	**Solid, massive.**
1990.4	1990.8	0.4	Solid, massive.
1990.8	1991.1	0.3	Solid, massive.
1991.1	1991.4	0.3	Massive, but diagonally cut.
1991.4	1991.65	0.2	Massive, but diagonally cut.
1991.65	1992.00	0.35	Massive, but diagonally cut.
1992.00	1992.5	0.5	Solid, massive.
1992.5	1993.4	0.9	**Solid, massive.**
1993.4	1993.8	0.4	Uneven cut.
1993.8	1994.05	0.3	Solid, massive.
1994.05	1994.5	0.4	Solid, massive.
1994.5	1994.70	0.2	Diagonal cut (fracture) on top.
1994.70	1995.15	0.5	Uneven cuts on top and bottom.
1995.15	1995.5	0.35	Solid, massive.
1995.51	1997.55	2.05	Solid, massive.
1997.55	1998.5	0.94	Solid, massive. Diagonal cut (fracture) on the bottom.
1998.5	1999.20	0.7	Solid, massive. Diagonal cut (fracture) on top.
1999.20	1999.8	0.6	1/3 cut.
1999.8	2000.1	0.3	Solid, massive.
2000.1	2000.7	0.55	1/3 cut.
2000.7	2001.5	0.80	**Solid, massive.**
	Total Recovery:	11.5	

ARCADIS

CORE LOG DESCRIPTION

Golden Gate WWTP Injection Well System

Golden Gate, Florida

Injection Well IW 1
Core Sample No. 4

Total Depth Drilled:	2136.5-2148.5	**Date:**	5/1/2008
Core Barrel Length:	30 feet	**Coring Interval Length:**	12.0 feet
Core Barrel Diameter ID:	4-inches	**Core Recovery (%):**	75.0
Drilling Fluid Used:	water	**Hole Diameter:**	12 inches

Depth feet bpl		Interval Length	WOB	RPM	Pressure	Core Description
From	To	feet	x 1000 lbs		(PSI)	
	Start	0	4.5	12		LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), mostly wackstone, little grainstone, very fine to fine grained, trace of fossils, trace of phosphate, moderately hard to hard, well cemented, competent, few diagonal fractures, very slightly vuggy, abundant worm burrows, moderately-well to - well cemented.
2136.5	2137	0.5	5.3	11.9	27.4	
2137	2138	1	5.3	11.9	27-36	
2138	2139	1	4.8-5.5	11.9	30-51.6	
2139	2140	1	5.1-5.4	11.9-12.1	34-51	
2140	2141	1	3.8-4.2	11.9-12	32-60	
2141	2142	1	4.9-5.5	11.9-12.0	26-56	
2142	2143	1	3.8-4.1	11.9	28-41	
2143	2144	1	4.2-4.8	11.9-12.0	29-50	LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), mudstone, with frequent, horizontal, irregular laminas of black material (phosphate), very fine grained, trace of fossils, moderately hard to hard, well cemented, massive, isolated diagonal fracturing.
2144	2145	1	3.7-5.5	11.0-12.0	25-37	
2145	2146	1	5.0-5.4	11.9-12.0	35-49	
2146	2147	1	4.1-5.0	11.9-12.0	21-46	
2147	2148	1	4.1-4.6	11.9-12.0	23-37	
2148	2148.5	0.5	4.1-4.8	11.9-12.0	23-42	
2148.5	Stop					
Total Cored (feet):		**12.0**				

"bpl" denotes below pad level

"RPM" denotes rate per minute of coring barrel

"WOB" denotes weight on coring barrel

ARCADIS

CORE LOG SUMMARY

Golden Gate WWTP Injection Well System

Golden Gate, Florida

Injection Well IW1
Core Sample No. 4

Total Depth Drilled:	2136.5-2148.5	**Date:**	5/1/2008
Core Barrel Length:	30 feet	**Coring Interval Length:**	12.0 feet
Core Barrel Diameter ID:	4-inches	**Core Recovery (%):**	75.0
Drilling Fluid Used:	water	**Hole Diameter:**	12 inches

Depth feet bpl		Core Length feet	Core Description
From	To		
2136.5	2136.95	0.4	**Solid, massive.**
2136.95	2137.25	0.3	Fragments 1x3 to 2x5 inches.
2137.25	2137.9	0.65	Solid, massive.
2137.9	2139.2	1.3	Solid, massive.
2139.2	2139.95	0.75	Massive but with partial, cemented diagonal fracture.
2139.95	2140.65	0.70	Massive but with partial, cemented diagonal fracture.
2140.65	2141.3	0.65	**Massive but with partial, cemented diagonal fracture.**
2141.3	2142.0	0.7	Solid, massive.
2142.0	2142.8	0.8	Massive but with uneven breaks on the top and bottom.
2142.8	2143.45	0.6	**Massive but with uneven breaks on the top and bottom.**
2143.45	2143.85	0.40	Half core vertical break.
2143.85	2144.3	0.45	2/3 of the core vertically broken.
2144.3	2145.05	0.75	Massive but with uneven breaks on the top and bottom and long diagonal fracture.
2145.05	2145.5	0.45	Multiple fragments up to 2x3 inches.
Total Recovery (feet):		**9.0**	

"bpl" denotes below pad level

Bold letters indicate core fragments suitable for lab. analysis.

Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

August 19, 2008
File Number 08-113

RECEIVED
AUG 21 2008

Youngquist Brothers, Inc.
15465 Pine Ridge Road
Ft. Myers, FL 33908

Attention: Wu Fei

Subject: Rock Core Testing, Golden Gates Injection Well

Ms. Fei:

As requested, vertical and horizontal permeability, unconfined compression and specific gravity tests have been completed on limestone rock cores provided for testing by your firm. The samples were received on 06/10/08. The designations of the 12 samples are listed below.

Core	Depth (feet)
1	1650.2-1650.5
1	1652.3-1652.7
1	1652.7-1653.15
2	1825.7-1826.4
2	1828.5-1829.1
2	1830.65-1831.1
3	1990.0-1990.4
3	1995.15-1995.5
3	2000.5-2001.7
4	2136.5-2136.95
4	2140.65-2141.3
4	2142.8-2143.45

The permeability tests were performed in general accordance with ASTM Standard D 5084 "Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter" using the constant head test method (Method A). The permeability test results are presented on the attached hydraulic conductivity test reports.

The unconfined compression tests were performed in general accordance with ASTM Standard D 7012 "Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures" using the unconfined test method (Method C). The unconfined compression test results are presented on the attached test reports.

The measured mineral specific gravities are presented on the attached test reports. The specific gravity tests were performed in general accordance with ASTM Standard D 854 "Specific Gravity of Soil Solids by Water Pycnometer" using 55 to 75 gram specimens ground to pass the U.S. Standard No. 40 sieve.

The specimens were reported to be from the samples designated herein. The test results are indicative of only the specimens that were actually tested. The test results presented are based upon accepted industry practice as well as test method(s) listed. Ardaman & Associates, Inc. neither accepts responsibility for, nor makes claims to the final use and purpose of the material.

Archie's cementation exponent and coefficient tests are in-progress. The test results will be submitted as the tests are completed.

Please contact us if you have any questions about the test results or require additional information.

Very truly yours,
ARDAMAN & ASSOCIATES, INC.

Thomas S. Ingra, P.E.
Laboratory Director
Florida License No. 31987

TSI/ed

C:\Documents and Settings\jan.wildman\Documents\Projects\08\08-113\report01.wpd

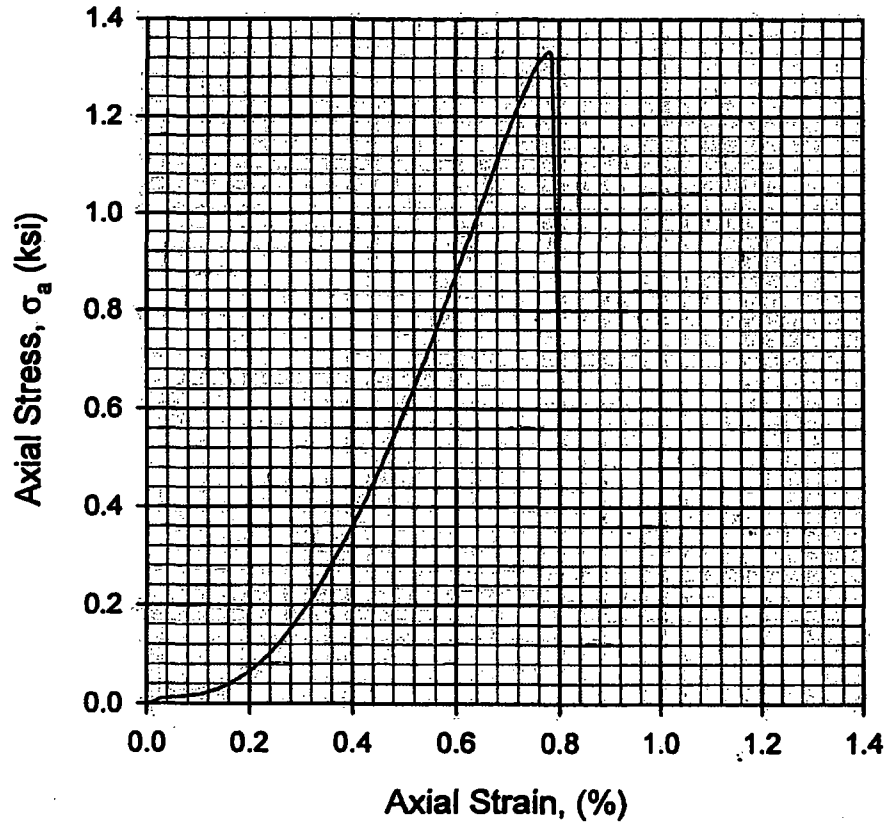
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
INTACT ROCK CORE UNCONFINED COMPRESSION TEST REPORT

CLIENT: Youngquist Brothers, Inc.
PROJECT: Golden Gates Injection Well
FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08
DATE TEST SET-UP: 07/13/08
DATE REPORTED: 08/19/08

INCOMING SAMPLE NO.: Core 1
BORING - SAMPLE -
DEPTH 1652.7-1653.15 ⊠ ft; □ m
LABORATORY IDENTIFICATION NO.: 08113/C1
SAMPLE DESCRIPTION: Light Brown Limestone

Specimen Dimensions			Initial Conditions			Rate of Loading		Time to Failure (minutes)	Unconfined Compressive Strength, σ_a(ult) (lb/in^2)	Young's Modulus, E (lb/in^2)
H (cm)	D (cm)	H/D	w_o (%)	γ_d (lb/ft^3)	S (%)	$\dot{\varepsilon}$ (cm/minute)	$\dot{\varepsilon}$ (%/minute)			
8.98	5.04	1.78	9.2	109.3	44	0.013	0.14	5.5	1334	2.8×10^5 at 50% σ_a(ult)



TEST PROCEDURES

⊠ ASTM Standard D 7012, Method C

Air Temperature (°C): 21.0

Capping Material: □ None ⊠ Lab-Stone □ Sulfur

Comments: Tested on Instron 4206 with 10,000 lb load cell

SPECIMEN PREPARATION

Original Core Diameter (inch): 4

Specimen Sub-Cored for Testing: ⊠ Yes □ No

G_s: 2.76 □ Assumed ⊠ Measured

FAILURE SKETCH

Where: H = Specimen height; D = Specimen diameter; w_o = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\dot{\varepsilon}$ = Vertical displacement rate; and G_s = Specific gravity.

Checked By: RM Date: 08/19/08

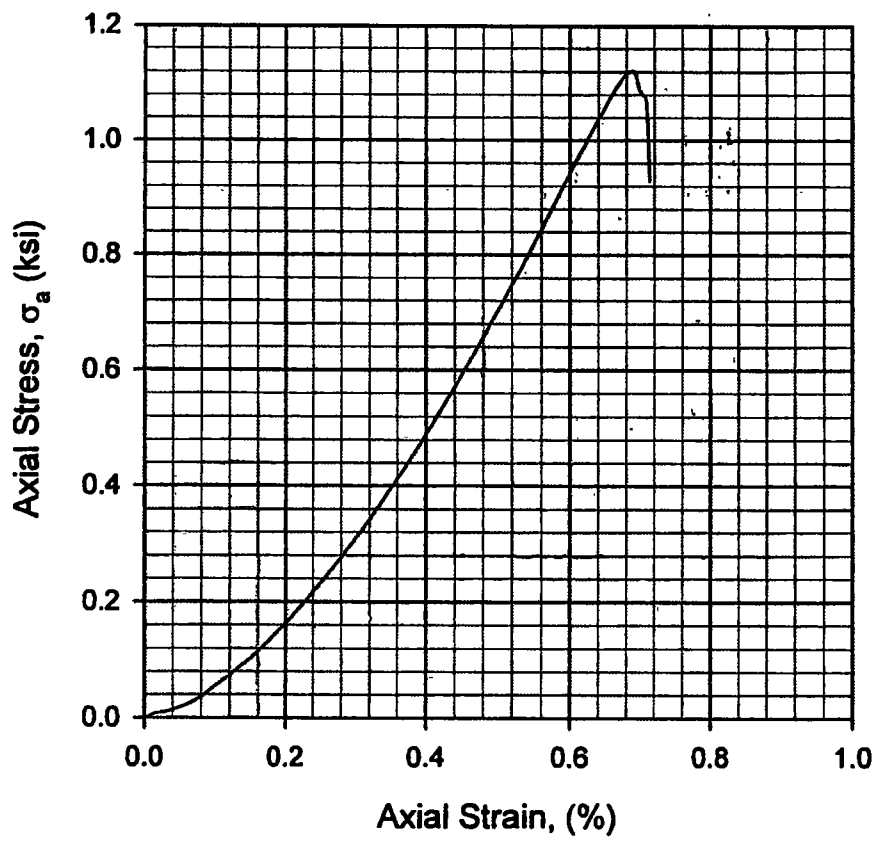
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
INTACT ROCK CORE UNCONFINED COMPRESSION TEST REPORT

CLIENT: Youngquist Brothers, Inc.
PROJECT: Golden Gates Injection Well
FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08
DATE TEST SET-UP: 07/13/08
DATE REPORTED: 08/19/08

INCOMING SAMPLE NO.: Core 2
BORING - SAMPLE -
DEPTH 1828.5-1829.1 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 08113/C2
SAMPLE DESCRIPTION: Light Brown Limestone

Specimen Dimensions			Initial Conditions			Rate of Loading		Time to Failure (minutes)	Unconfined Compressive Strength, σ_a(ult) (lb/in^2)	Young's Modulus, E (lb/in^2)
H (cm)	D (cm)	H/D	w_o (%)	γ_d (lb/ft^3)	S (%)	$\dot{\varepsilon}$ (cm/minute)	$\dot{\varepsilon}$ (%/minute)			
10.15	5.04	2.01	7.1	110.9	36	0.013	0.13	5.5	1121	2.1×10^5 at 50% σ_a(ult)



TEST PROCEDURES

☒ ASTM Standard D 7012, Method C

Air Temperature (°C): 21.0

Capping Material: ☐ None ☒ Lab-Stone ☐ Sulfur

Comments: Tested on Instron 4206 with 10,000 lb load cell

SPECIMEN PREPARATION

Original Core Diameter (inch): 4

Specimen Sub-Cored for Testing: ☒ Yes ☐ No

G_s: 2.73 ☐ Assumed ☒ Measured

FAILURE SKETCH

The test data and all associated project information presented hereon shall be held in confidence and disclosed to other parties only with the authorization of the Client or Ardaman & Associates, Inc. Physical and electronic records of each project are kept for a minimum of 7 years. Test samples are kept in storage for at least 10 working days after mailing of the test report, prior to being discarded, unless a longer storage period is requested in writing and accepted by Ardaman & Associates, Inc.

Where: H = Specimen height; D = Specimen diameter; w_o = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\dot{\varepsilon}$ = Vertical displacement rate; and G_s = Specific gravity.

Checked By: [signature] Date: 08/19/08

C:\Documents and Settings\jan.wildman\Documents\Projects\08\08-113\UC tests.wpd

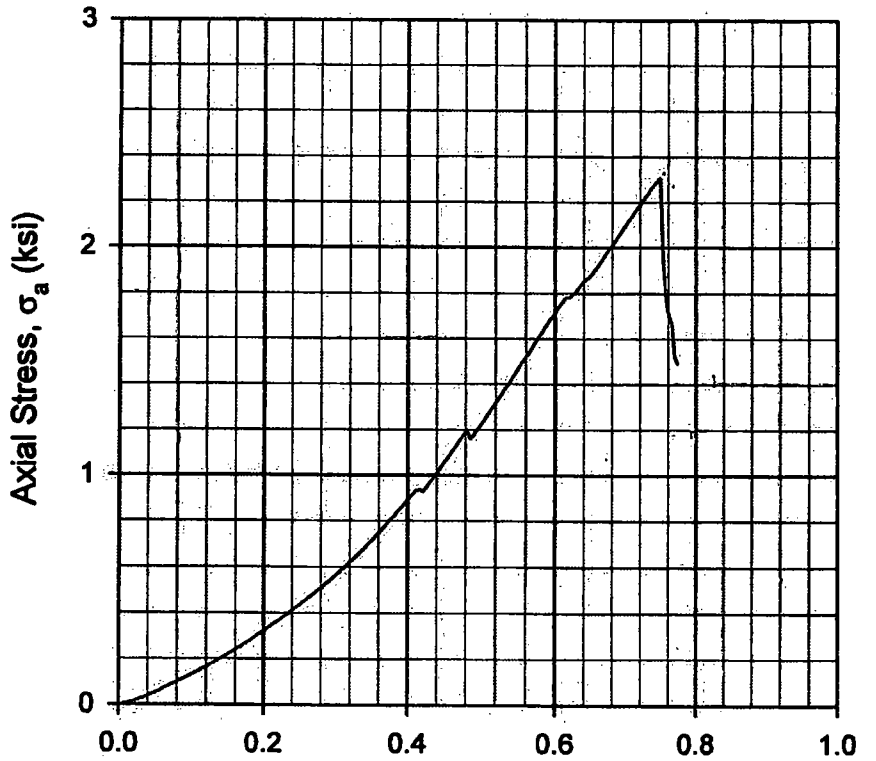
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
INTACT ROCK CORE UNCONFINED COMPRESSION TEST REPORT

CLIENT: Youngquist Brothers, Inc.
PROJECT: Golden Gates Injection Well
FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08
DATE TEST SET-UP: 07/13/08
DATE REPORTED: 08/19/08

INCOMING SAMPLE NO.: Core 3
BORING - SAMPLE -
DEPTH 1990.0-1990.4 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 08113/C3
SAMPLE DESCRIPTION: Light Brown Limestone

Specimen Dimensions			Initial Conditions			Rate of Loading		Time to Failure (minutes)	Unconfined Compressive Strength, σ_a(ult) (lb/in^2)	Young's Modulus, E (lb/in^2)
H (cm)	D (cm)	H/D	w_o (%)	γ_d (lb/ft^3)	S (%)	$\dot{\varepsilon}$ (cm/minute)	$\dot{\varepsilon}$ (%/minute)			
10.46	5.04	2.07	4.3	133.3	42	0.013	0.12	6.1	2308	3.8×10^5 at 50% σ_a(ult)



TEST PROCEDURES

☒ ASTM Standard D 7012, Method C

Air Temperature (°C): 21.0

Capping Material: ☐ None ☒ Lab-Stone ☐ Sulfur

Comments: Tested on Instron 4206 with 10,000 lb load cell

SPECIMEN PREPARATION

Original Core Diameter (inch): 4

Specimen Sub-Cored for Testing: ☒ Yes ☐ No

G_s: 2.73 ☐ Assumed ☒ Measured

FAILURE SKETCH

Where: H = Specimen height; D = Specimen diameter; w_o = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\dot{\varepsilon}$ = Vertical displacement rate; and G_s = Specific gravity.

Checked By: TM Date: 08/19/08

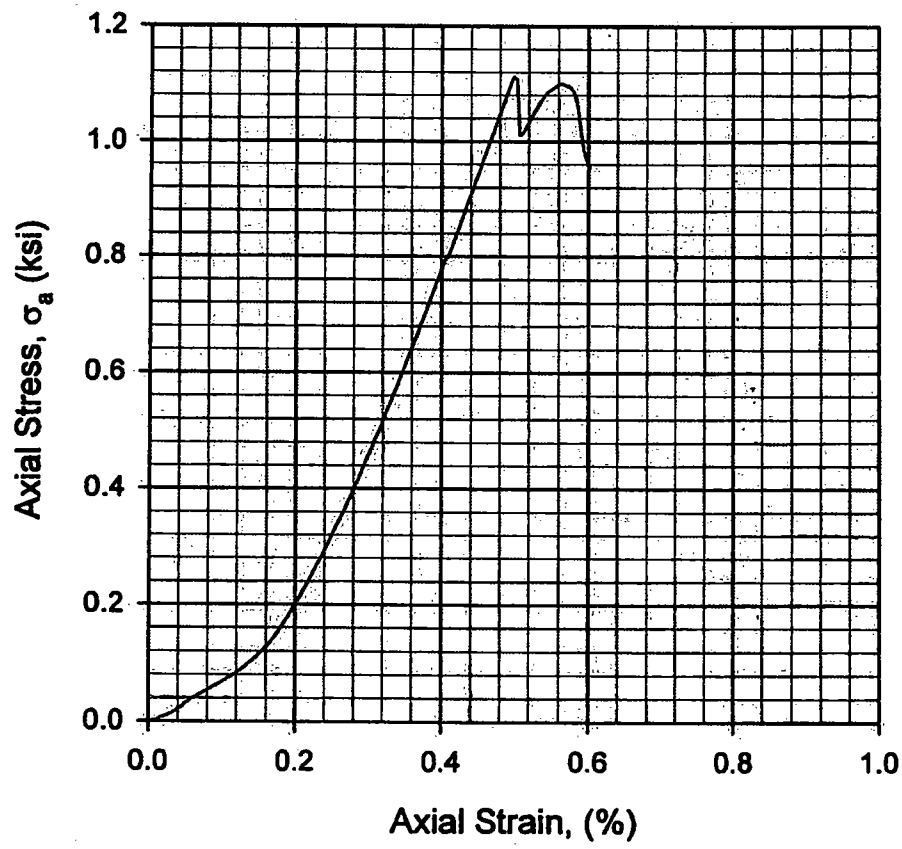
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
INTACT ROCK CORE UNCONFINED COMPRESSION TEST REPORT

CLIENT: Youngquist Brothers, Inc.
PROJECT: Golden Gates Injection Well
FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08
DATE TEST SET-UP: 07/13/08
DATE REPORTED: 08/19/08

INCOMING SAMPLE NO.: Core 4
BORING - SAMPLE -
DEPTH 2142.8-2143.45 ⊠ ft; □ m
LABORATORY IDENTIFICATION NO.: 08113/C4
SAMPLE DESCRIPTION: Light Brown Limestone

Specimen Dimensions			Initial Conditions			Rate of Loading		Time to Failure (minutes)	Unconfined Compressive Strength, σ_a(ult) (lb/in^2)	Young's Modulus, E (lb/in^2)
H (cm)	D (cm)	H/D	w_o (%)	γ_d (lb/ft^3)	S (%)	$\dot{\varepsilon}$ (cm/minute)	$\dot{\varepsilon}$ (%/minute)			
10.26	5.04	2.04	8.0	117.8	50	0.013	0.12	4.0	1114	3.2×10^5 at 50% σ_a(ult)



TEST PROCEDURES

⊠ ASTM Standard D 7012, Method C

Air Temperature (°C): 21.0

Capping Material: □ None ⊠ Lab-Stone □ Sulfur

Comments: Tested on Instron 4206 with 10,000 lb load cell

SPECIMEN PREPARATION

Original Core Diameter (inch): 4

Specimen Sub-Cored for Testing: ⊠ Yes □ No

G_s: 2.70 □ Assumed ⊠ Measured

FAILURE SKETCH

Where: H = Specimen height; D = Specimen diameter; w_o = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\dot{\varepsilon}$ = Vertical displacement rate; and G_s = Specific gravity.

Checked By: [signature] Date: 08/19/08

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/14/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: Core 1, 1652.3-1652.7'

LABORATORY IDENTIFICATION NO.: 081131V

SAMPLE DESCRIPTION: Light Brown Limestone

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 70 (stable) %

- ☒ Beginning of Test;
- ☐ End of Test

$\Delta\sigma_c$ (psi): 21, 28, 37

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☐ Yes ☒ No

As-Received Length (inch): 4.5/3.1* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☒ Vertical ☐ Horizontal

SPECIFIC GRAVITY, G_s: 2.74

- ☐ Assumed
- ☒ Measured (ASTM D 854)

PERMEANT: ☒ Deaired Tap Water ☐ Other

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
7.76	9.58	559.14	18.1	104.9	0.386	79	30	160	36	2.5	1	940.12	19.9	87	1.7 x 10-5

COMMENTS: (1) Core sample selected for permeability testing was cut to length, air-dried, deaired under vacuum for a minimum of 24 hours, and then saturated with deaired tap water from the bottom up while still under vacuum. (2) Final w_c from horizontal permeability test specimen. WDS calculated from measured wet weight and final w_c.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: JM Date: 08/19/08

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/14/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: Core 1, 1652.3-1652.7'

LABORATORY IDENTIFICATION NO.: 081131V

SAMPLE DESCRIPTION: Light Brown Limestone

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 70 (stable) % ☒ Beginning of Test; ☐ End of Test

$\Delta\sigma_c$ (psi): 21, 28, 37

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☐ Yes ☒ No

As-Received Length (inch): 4.5/3.1* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☒ Vertical ☐ Horizontal

SPECIFIC GRAVITY, G_s: 2.74 ☐ Assumed ☒ Measured (ASTM D 854)

PERMEANT: ☒ Deaired Tap Water ☐ Other _____

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
7.76	9.58	559.14	18.1	104.9	0.386	79	30	160	36	2.5	1	940.12	19.9	87	1.7 x 10-5

COMMENTS: (1) Core sample selected for permeability testing was cut to length, air-dried, deaired under vacuum for a minimum of 24 hours, and then saturated with deaired tap water from the bottom up while still under vacuum. (2) Final w_c from horizontal permeability test specimen. WDS calculated from measured wet weight and final w_c.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: TM Date: 08/19/08

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/23/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: Core 1, 1652.3-1652.7'

LABORATORY IDENTIFICATION NO.: 081131H

SAMPLE DESCRIPTION: Light Brown Limestone

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 75 (stable) % ☒ Beginning of Test; ☐ End of Test

$\Delta\sigma_c$ (psi): 21, 31, 39

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☒ Yes ☐ No

As-Received Length (inch): 4.5/3.1* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☐ Vertical ☒ Horizontal

SPECIFIC GRAVITY, G_s: 2.74 ☐ Assumed ☒ Measured (ASTM D 854)

PERMEANT: ☒ Deaired Tap Water ☐ Other

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
7.10	5.03	141.12	17.6	105.8	0.381	78	30	160	27	1.7	1	239.34	19.9	89	2.0 x 10-5

COMMENTS: (1) Horizontal permeability test specimen was cross-cored from the corresponding vertical test specimen.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: TM Date: 08/19/08

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/23/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: Core 1, 1652.3-1652.7'

LABORATORY IDENTIFICATION NO.: 081131H

SAMPLE DESCRIPTION: Light Brown Limestone

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 75 (stable) % ☒ Beginning of Test; ☐ End of Test

$\Delta\sigma_c$ (psi): 21, 31, 39

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☒ Yes ☐ No

As-Received Length (inch): 4.5/3.1* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☐ Vertical ☒ Horizontal

SPECIFIC GRAVITY, G_s: 2.74 ☐ Assumed ☒ Measured (ASTM D 854)

PERMEANT: ☒ Deaired Tap Water ☐ Other

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
7.10	5.03	141.12	17.6	105.8	0.381	78	30	160	27	1.7	1	239.34	19.9	89	2.0 x 10-5

COMMENTS: (1) Horizontal permeability test specimen was cross-cored from the corresponding vertical test specimen.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: TM Date: 08/19/08

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/16/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: Core 2, 1825.7-1826.4'

LABORATORY IDENTIFICATION NO.: 081132V1826

SAMPLE DESCRIPTION: Light Brown Limestone

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 92 (stable) %

- ☐ Beginning of Test;
- ☒ End of Test

$\Delta\sigma_c$ (psi): 30; 36; 43

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☐ Yes ☒ No

As-Received Length (inch): 8.0/4.1* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☒ Vertical ☐ Horizontal

SPECIFIC GRAVITY, G_s: 2.74

- ☐ Assumed
- ☒ Measured (ASTM D 854)

PERMEANT: ☒ Dealred Tap Water ☐ Other

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	I_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
10.28	9.94	795.60	17.3	115.1	0.327	98	30	160	28	0.6	1	1468.0	17.3	98	1.6 x 10-6

COMMENTS :(1) Core sample selected for permeability testing was cut to length, air-dried, dealred under vacuum for a minimum of 24 hours, and then saturated with dealred tap water from the bottom up while still under vacuum. (2) Final w_c from horizontal permeability test specimen. WDS calculated from measured wet weight and final w_c.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; I_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: TW Date: 08/19/08

C:\Documents and Settings\jan.wildman\Documents\Projects\08\08-113\k- tests.wpd

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/22/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: **Core 2, 1825.7-1826.4'**

LABORATORY IDENTIFICATION NO.: 081132H1826

SAMPLE DESCRIPTION: Light Brown Limestone

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 93 (stable) %

- ☒ Beginning of Test;
- ☐ End of Test

$\Delta\sigma_c$ (psi): 11;17

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☒ Yes ☐ No

As-Received Length (inch): 8.0/4.1* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☐ Vertical ☒ Horizontal

SPECIFIC GRAVITY, G_s: 2.74

- ☐ Assumed
- ☒ Measured (ASTM D 854)

PERMEANT: ☒ Deaired Tap Water ☐ Other _____

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
7.64	5.03	151.71	17.2	114.7	0.329	96	30	160	39	1.0	1	278.84	17.3	96	**6.7 x 10-6**

COMMENTS: (1) Horizontal permeability test specimen was cross-cored from the corresponding vertical test specimen.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: JM Date: 08/19/08

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/17/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: **Core 2, 1830.65-1831.1'**

LABORATORY IDENTIFICATION NO.: 081132V1831

SAMPLE DESCRIPTION: Light Brown Limestone with solution cracks and some small vugs

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 94 (stable) %

- ☐ Beginning of Test;
- ☒ End of Test

$\Delta\sigma_c$ (psi): 12; 19; 27; 36

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☐ Yes ☒ No

As-Received Length (inch): 5.0/4.0* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☒ Vertical ☐ Horizontal

SPECIFIC GRAVITY, G_s: 2.72

- ☐ Assumed
- ☒ Measured (ASTM D 854)

PERMEANT: ☒ Deaired Tap Water ☐ Other

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
8.33	9.76	622.83	17.2	113.0	0.334	93	30	160	20	2.9	1	1127.8	17.7	96	4.4 x 10-5

COMMENTS: (1) Core sample selected for permeability testing was cut to length, air-dried, deaired under vacuum for a minimum of 24 hours, and then saturated with deaired tap water from the bottom up while still under vacuum. (2) w_c from initial total weight after saturation and assuming WDS equals initial air-dry weight.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: TM Date: 08/19/08

C:\Documents and Settings\jan.wildman\Documents\Projects\08\08-113\k- tests.wpd

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/13/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: Core 3, 1995.15-1995.5'

LABORATORY IDENTIFICATION NO.: 081133V1995

SAMPLE DESCRIPTION: Light Brown Limestone

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 87 (stable) % ☒ Beginning of Test; ☐ End of Test

$\Delta\sigma_c$ (psi): 16; 23; 32

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☐ Yes ☒ No

As-Received Length (inch): 4.3/2.8* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☒ Vertical ☐ Horizontal

SPECIFIC GRAVITY, G_s: 2.72 ☐ Assumed ☒ Measured (ASTM D 854)

PERMEANT: ☒ Deaired Tap Water ☐ Other

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
7.15	9.84	543.86	15.9	114.7	0.324	90	30	160	102	1.5	1	999.83	16.6	94	1.1 x 10-6

COMMENTS:(1) Core sample selected for permeability testing was cut to length, air-dried, deaired under vacuum for a minimum of 24 hours, and then saturated with deaired tap water from the bottom up while still under vacuum. (2) Final w_c from horizontal permeability test specimen. WDS calculated from measured wet weight and final w_c.
* First length is total sample length. Second length is useable length at full core diameter.

The test data and all associated project information presented hereon shall be held in confidence and disclosed to other parties only with the authorization of the Client or Ardaman & Associates, Inc. Physical and electronic records of each project are kept for a minimum of 7 years. Test samples are kept in storage for at least 10 working days after mailing of the test report, prior to being discarded, unless a longer storage period is requested in writing and accepted by Ardaman & Associates, Inc.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: TM Date: 08/19/08

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/23/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: Core 2, 1830.65-1831.1'

LABORATORY IDENTIFICATION NO.: 081132H1831

SAMPLE DESCRIPTION: Light Brown Limestone with solution cracks and some small vugs

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 96 %

- ☒ Beginning of Test;
- ☐ End of Test

$\Delta\sigma_c$ (psi) 13

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☒ Yes ☐ No

As-Received Length (inch): 5.0/4.0* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☐ Vertical ☒ Horizontal

SPECIFIC GRAVITY, G_s: 2.72

- ☐ Assumed
- ☒ Measured (ASTM D 854)

PERMEANT: ☒ Deaired Tap Water ☐ Other

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
6.02	5.02	119.30	16.9	114.4	0.326	95	30	160	46	0.9	1	218.76	17.3	98	2.1 x 10-5

COMMENTS: (1) Horizontal permeability test specimen was cross-cored from the corresponding vertical test specimen.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: JM Date: 08/19/08

Form SR-2B: Rev. 0

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/22/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: Core 3, 1995.15-1995.5'

LABORATORY IDENTIFICATION NO.: 081133H1995

SAMPLE DESCRIPTION: Light Brown Limestone

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 89 (stable) % ☒ Beginning of Test; ☐ End of Test

$\Delta\sigma_c$ (psi): 11, 17

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☒ Yes ☐ No

As-Received Length (inch): 4.3/2.6* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☐ Vertical ☒ Horizontal

SPECIFIC GRAVITY, G_s: 2.72 ☐ Assumed ☒ Measured (ASTM D 854)

PERMEANT: ☒ Deaired Tap Water ☐ Other

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
7.13	5.03	141.74	16.0	115.4	0.320	92	30	160	49	1.0	1	262.18	16.6	96	2.9 x 10-6

COMMENTS: (1) Horizontal permeability test specimen was cross-cored from the corresponding vertical test specimen.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: TM Date: 08/19/08

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/17/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: Core 3, 2000.5-2001.7'

LABORATORY IDENTIFICATION NO.: 081133V2001

SAMPLE DESCRIPTION: Light Brown Limestone

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 91 (stable) % ☐ Beginning of Test; ☒ End of Test

$\Delta\sigma_c$ (psi): 12; 19; 27; 36

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☐ Yes ☒ No

As-Received Length (inch): 10.0/6.0* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☒ Vertical ☐ Horizontal

SPECIFIC GRAVITY, G_s: 2.71 ☐ Assumed ☒ Measured (ASTM D 854)

PERMEANT: ☒ Deaired Tap Water ☐ Other

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
10.08	9.81	762.42	16.9	114.1	0.326	95	30	160	20	0.8	1	1393.3	17.1	96	6.6 x 10-6

COMMENTS: (1) Core sample selected for permeability testing was cut to length, air-dried, deaired under vacuum for a minimum of 24 hours, and then saturated with deaired tap water from the bottom up while still under vacuum. (2) Final w_c from horizontal permeability test specimen. WDS calculated from measured wet weight and final w_c.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: TM Date: 08/19/08

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/23/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: Core 3, 2000.5-2001.7'

LABORATORY IDENTIFICATION NO.: 081133H2001

SAMPLE DESCRIPTION: Light Brown Limestone

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 92% (stable) %
- ☒ Beginning of Test;
- ☐ End of Test

$\Delta\sigma_c$ (psi): 21; 31; 39

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☒ Yes ☐ No

As-Received Length (inch): 10.0/6.0* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☐ Vertical ☒ Horizontal

SPECIFIC GRAVITY, G_s: 2.71
- ☐ Assumed
- ☒ Measured (ASTM D 854)

PERMEANT: ☒ Deaired Tap Water ☐ Other

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
6.74	5.03	133.68	16.3	115.9	0.315	96	30	160	36	1.0	1	248.22	17.0	100	8.7 x 10-6

COMMENTS: (1) Horizontal permeability test specimen was cross-cored from the corresponding vertical test specimen.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: TM Date: 08/19/08

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/16/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: Core 4, 2136.5-2136.95'

LABORATORY IDENTIFICATION NO.: 081134V2136

SAMPLE DESCRIPTION: Light Brown Limestone

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 93 (stable) % ☐ Beginning of Test; ☒ End of Test

$\Delta\sigma_c$ (psi): 30; 36; 43

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☐ Yes ☒ No

As-Received Length (inch): 4.5/4.0* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☒ Vertical ☐ Horizontal

SPECIFIC GRAVITY, G_s: 2.70 ☐ Assumed ☒ Measured (ASTM D 854)

PERMEANT: ☒ Dealred Tap Water ☐ Other

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
9.79	9.15	644.46	15.0	118.8	0.295	97	30	160	45	3.5	1	1227.4	15.0	97	1.4 x 10-6

COMMENTS: (1) Core sample selected for permeability testing was cut to length, air-dried, dealred under vacuum for a minimum of 24 hours, and then saturated with dealred tap water from the bottom up while still under vacuum. (2) Final w_c from horizontal permeability test specimen. WDS calculated from measured wet weight and final w_c.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: TM Date: 08/19/08

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/22/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: Core 4, 2136.5-2136.95'

LABORATORY IDENTIFICATION NO.: 081134H2136

SAMPLE DESCRIPTION: Light Brown Limestone

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 89 (stable) % ☒ Beginning of Test; ☐ End of Test

$\Delta\sigma_c$ (psi): 11; 17

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☒ Yes ☐ No

As-Received Length (inch): 4.5/4.0* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☐ Vertical ☒ Horizontal

SPECIFIC GRAVITY, G_s: 2.70 ☐ Assumed ☒ Measured (ASTM D 854)

PERMEANT: ☒ Deaired Tap Water ☐ Other

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
6.47	5.03	128.58	15.0	119.9	0.288	100	30	160	38	1.4	1	247.11	15.0	100	2.0 x 10-6

COMMENTS: (1) Horizontal permeability test specimen was cross-cored from the corresponding vertical test specimen.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: TM Date: 08/19/08

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/16/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: Core 4, 2140.65-2141.3'

LABORATORY IDENTIFICATION NO.: 081134V2141

SAMPLE DESCRIPTION: Light Brown Limestone

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 97 %

- ☐ Beginning of Test;
- ☒ End of Test

$\Delta\sigma_c$ (psi): 29

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☐ Yes ☒ No

As-Received Length (inch): 8.0/6.0* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☒ Vertical ☐ Horizontal

SPECIFIC GRAVITY, G_s: 2.71

- ☐ Assumed
- ☒ Measured (ASTM D 854)

PERMEANT: ☒ Deaired Tap Water ☐ Other

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
10.03	9.94	778.33	13.6	123.2	0.271	99	30	160	31	1.0	1	1536.9	13.6	99	1.7 x 10-6

COMMENTS: (1) Core sample selected for permeability testing was cut to length, air-dried, deaired under vacuum for a minimum of 24 hours, and then saturated with deaired tap water from the bottom up while still under vacuum. (2) Final w_c from horizontal permeability test specimen. WDS calculated from measured wet weight and final w_c.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: [signature] Date: 08/19/08

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
ROCK CORE HYDRAULIC CONDUCTIVITY TEST REPORT

CLIENT: Youngquist Brothers, Inc.

PROJECT: Golden Gates Injection Well

FILE NO.: 08-113

DATE SAMPLE RECEIVED: 06/10/08 SET UP: 07/21/08

DATE REPORTED: 08/19/08

INCOMING LABORATORY SAMPLE NO.: Core 4, 2140.65-2141.3'

LABORATORY IDENTIFICATION NO.: 081134H2141

SAMPLE DESCRIPTION: Light Brown Limestone

ASTM D 5084 TEST METHOD:

- ☒ A - Constant Head
- ☐ B - Falling Head; Constant Tailwater
- ☐ C - Falling Head; Rising Tailwater
- ☐ F - Constant Volume; Falling Head - Rising Tailwater

B-FACTOR: 93 (stable) % ☐ Beginning of Test; ☒ End of Test

$\Delta\sigma_c$ (psi): 12; 19

SPECIMEN DATA:

As-Received Diameter (inch): 4 Diameter Trimmed: ☒ Yes ☐ No

As-Received Length (inch): 8.0/6.0* Length Trimmed: ☒ Yes ☐ No

TEST SPECIMEN ORIENTATION: ☐ Vertical ☒ Horizontal

SPECIFIC GRAVITY, G_s: 2.71 ☐ Assumed ☒ Measured (ASTM D 854)

PERMEANT: ☒ Deaired Tap Water ☐ Other

Initial Conditions							Test Conditions					Final Conditions			Hydraulic Conductivity
H (cm)	D (cm)	V (cm^3)	w_c (%)	γ_d (pcf)	n	S (%)	$\bar{\sigma}_c$ (psi)	u_b (psi)	i_{avg}	Q (cm^3)	t (days)	WDS (g)	w_c (%)	S (%)	k_{20} (cm/sec)
6.99	5.03	138.84	13.7	123.4	0.270	100	30	160	26	0.8	1	274.53	13.7	100	1.3 x 10-6

COMMENTS: (1) Horizontal permeability test specimen was cross-cored from the corresponding vertical test specimen.
* First length is total sample length. Second length is useable length at full core diameter.

Where: H = Specimen height; D = Specimen diameter; V = Volume; WDS = Dry mass; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; $\bar{\sigma}_c$ = Isotropic effective confining stress; u_b = Back-pressure; i_{avg} = Average hydraulic gradient; Q = Flow volume; t = Test duration; k_{20} = Saturated hydraulic conductivity at 20°C; n = Total porosity; and G_s = Specific gravity.

Checked By: TM Date: 08/19/08

Form SR-2B: Rev. 0

Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

September 18, 2008
File Number 08-113

Youngquist Brothers, Inc.
15465 Pine Ridge Road
Ft. Myers, FL 33908

Attention: Wu Fei

Subject: Rock Core Testing, Golden Gates Injection Well

Dear Fei:

As requested, Archie's formation factor and cementation exponent have been measured on four limestone rock cores provided for testing by your firm. The tests were subcontracted to New England Research, Inc. The designations of the four samples are listed below.

Core	Depth
1	1650.2-1650.5
2	1825.7-1826.4
3	2000.7-2001.5
4	2140.65-2141.3

The report from New England Research, Inc. is attached.

The specimens were reported to be from the samples designated herein. The test results are indicative of only the specimens that were actually tested. The test results presented are based upon accepted industry practice as well as test method(s) listed. Ardaman & Associates, Inc. neither accepts responsibility for, nor makes claims to the final use and purpose of the material.

If you have any questions about the test results or require additional information, please contact us. We will forward additional test results as the tests are completed.

Very truly yours,
ARDAMAN & ASSOCIATES, INC.

Thomas S. Ingra, P.E.
Laboratory Director
Florida License No. 31987

TSI/ed

C:\Documents and Settings\jan.wildman\Documents\Projects\08\08-113\report02-ner.wpd

Resistivity of Golden Gate Carbonates

Report prepared for
Ardaman and Associates, Inc.
September 10, 2008

by

New England Research, Inc.
331 Olcott Drive, Ste L1
White River Junction, VT 05001

Summary

Ardaman and Associates, Inc. delivered four whole core samples of carbonate for measurement of resistivity. The samples were cored from the Golden Gate site in a depth range of 1650.2 ft to 2141.3 ft.

Four cylindrical samples were sub-cored from the whole core and were approximately 38 mm in diameter and 46 mm to 54 mm in length. The samples were very high porosity chalky carbonate. The grain densities averaged 2.72 g/cc. Sample porosity as a volume fraction ranged from 0.28 to 0.38.

All samples were saturated with brine containing 35 grams of sodium chloride per liter of water. Complex impedance of each sample was measured over a frequency range of 0.1 Hz to 100 kHz.

Temperature corrections were applied to the brine conductivity. The frequency response of the samples' impedance was uniform over the frequency range of 0.1 to 100,000 Hz. No cable corrections were applied.

The cementation coefficients for these very high porosity rocks are clustered around 2 and show little variation with porosity. The resistivity of these samples was quite low. Low resistivity generally indicates good pore space connectivity and high permeability.

Resistivity of Golden Gate Carbonates

Resistivity of Golden Gate Carbonates

Introduction

Ardaman and Associates, Inc. delivered four whole core samples of carbonate for measurement of resistivity. The samples were cored from the Golden Gate sites. Four of the samples were cored from the Golden Gate site in a depth range of 1650.2 ft. to 2141.3 ft.

Procedures and Techniques

Sample Description

The samples are fine grained "chalky" carbonates and fairly homogeneous.

Sample Preparation

Four cylindrical samples were sub-cored from the whole core supplied by Ardaman. The diameter of the sub-cored plugs was 38 mm. The length of the plug samples varied from 45 mm to 54 mm. The ends of the plugs were ground smooth and parallel to within 0.001 inches.

The sample plugs were dried in an oven at 80 degrees centigrade for 48 hours. Sample dimensions and mass were measured and the dry bulk density was computed. The samples were vacuum saturated for 24 hours in brine containing 35 grams of NaCl per liter of distilled water. The grain density of the samples was determined using an Archimedes technique. The porosity was determined from the dry bulk density and average grain density using the formula $\phi=1-(\rho_{dry\text{-}bulk}/\rho_{grain})$.

Petrophysical Data

The average grain density of the samples ranged from 2.72 to 2.73 g/cc and was within 1 per cent of the grain density of calcite, 2.71 g/cc, the major component of carbonate rocks.

Sample porosity was generally high, ranging from 28.8% to 37.8%. All sample mass and volumetric data is reported in Table 1.

Resistivity Tests

Four electrode complex electrical impedance measurements were performed on the samples in the AutoLab 1000 system. The saturated sample was jacketed in a viton sleeve and mounted in the four-electrode core holder. Figure 1 diagrams the coreholder used in the four-electrode measurement. The core holder is inserted in the pressure vessel of the AutoLab 1000.

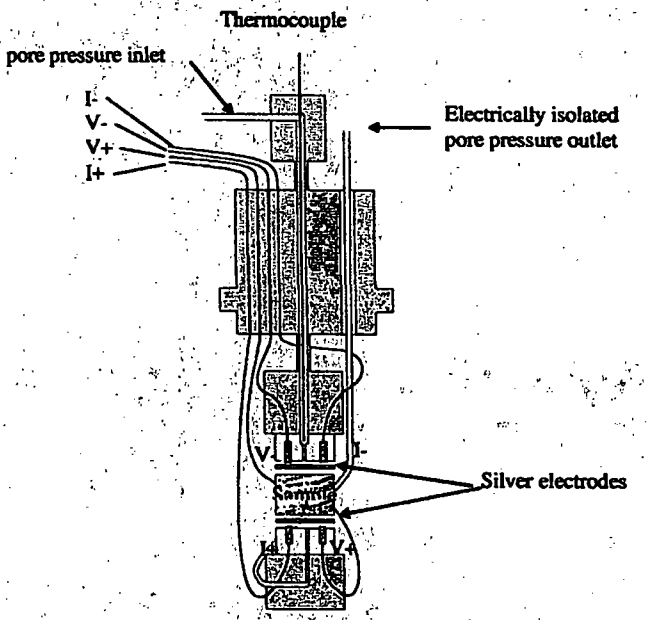


Figure 1. Four-electrode resistivity coreholder

A function generator is used to apply a sinusoidal current across the sample and a reference resistor. The current varied in frequency from 0.1 Hz to 100,000 Hz. The amplitude and phase of the voltage drop across the sample is compared to the amplitude and phase of the voltage drop across the reference resistor, and the values are used to compute the complex impedance at a given frequency.

The samples were confined at a pressure consistent with their depth, assuming an overburden gradient of approximately 1.0 psi/ft and a normal hydrostatic fluid pressure gradient of approximately 0.46 psi/ft. As an example, sample Golden Gate Core 1 had an

applied confining pressure of 1650 psi (11.4 MPa) and a pore pressure of 759 psi (5.2 MPa).

Formation Factor and Cementation Coefficient

A cementation factor can be calculated from Archie's empirical formation factor-porosity relationship (Archie, 1942),

$$F = \alpha * \phi^{-m}.$$

F is the formation factor, that is, the ratio of the conductivity of the saturating fluid to the conductivity of the rock-fluid system. α is the tortuosity parameter, ϕ is the porosity and m is the cementation factor. If we assume that the α parameter is 1 (an assumption often made for carbonates) the cementation factor can be computed from the measured porosity and formation factor. Cementation factors are reported in Table 1.

Discussion

Resistivity Data

Resistivity data, formation factors and cementation factors for each sample are compiled in the Table I in the Data Section II.

The frequency response of complex resistivity data for these samples was flat over the frequency range. No cable correction was applied since the parasitic impedances were virtually non-existent over the frequency range of 0.1 to 100,000.0 Hz. A temperature correction was applied to the brine conductivity.

The formation factor at a frequency of 20,000 Hz was used to calculate the cementation coefficient. The frequency of 20,000 Hz was chosen to be consistent with past practice; however, any frequency may be used.

The cementation coefficients for these very high porosity rocks are close to 2.0 and show little variation with porosity. For rocks with moldic porosity the cementation coefficient tends to increase with porosity and with overburden pressure, whereas for lime and dolomitic grainstones the cementation coefficient is little affected by the overburden. The overburden pressure variation for the Golden Gate samples was

approximately four MPa. The data for these rocks are consistent with a carbonate grainstone interpretation.

Conclusions

Complex impedance was measured on four samples of carbonate. The frequency response of the impedance was flat for the samples over the measured frequency range. Consequently, no cable corrections were applied.

The resistivity of these high porosity samples was quite low and the cementation coefficients were approximately 2. There was no significant variation of the cementation factor with porosity. Low resistivity generally indicates good pore space connectivity and high permeability.

References

Archie, G. E. "The electrical resistivity log as an aid in determining some reservoir characteristics." Trans., AIME, (1942), **146**, p 54.

Focke, J. W. and Munn D., "Cementation Exponents in Middle Eastern Carbonates," SPE Formation Evaluation 2 (1987), p 155-167.

Lucia, F.J., Carbonate Reservoir Characterization, Springer-Verlag, Berlin, 1999.

Section II: Data

Table 1
Data Summary
Golden Gate

	Core Depth Feet	Length (cm)	Diameter (cm)	Bulk Volume (cm^3)	PreTest Dry Mass (g)	PreTest Dry Bulk Density (g/cm^3)	PreTest Sat. Mass (g)	PreTest Sat. Bulk Density (g/cm^3)	Archimedes Mass (g)	Average Grain Density (g/cm^3)	Porosity Vol. Fraction
GG Core 1	1650.2-1650.5	5.40	3.79	61.06	103.23	1.69	125.94	2.06	63.895	2.72	0.378
GG Core 2	1825.7-1826.4	4.68	3.81	53.24	94.18	1.77	112.07	2.11	58.470	2.73	0.352
GG Core 3	2000.7-2001.5	4.48	3.80	50.64	91.92	1.82	108.32	2.14	57.061	2.73	0.335
GG Core 4	2140.65-2141.3	5.16	3.80	58.54	115.19	1.97	131.06	2.24	71.361	2.72	0.277

	Core Depth Feet	Brine Concentration (g/liter)	Corrected Brine Conductivity (mS/cm)	Resistivity at 100 Hz (ohm-m)	Resistivity at 1000 Hz (ohm-m)	Resistivity at 20 kHz (ohm-m)	Formation Factor at 100 Hz	Formation Factor at 1000 Hz	Formation Factor at 20 kHz		Cementation Factor at 20 kHz
GG Core 1	1650.2-1650.5	35	64.8	1.27	1.27	1.26	8.22	8.21	8.19		2.16
GG Core 2	1825.7-1826.4	35	51.9	1.52	1.52	1.52	7.92	7.90	7.88		1.98
GG Core 3	2000.7-2001.5	35	51.6	1.60	1.60	1.60	8.27	8.27	8.25		1.93
GG Core 4	2140.65-2141.3	35	60.3	2.15	2.14	2.13	12.95	12.92	12.87		1.99

Resistivity Measurement Report

Sample and Experiment Information for File Golden_Gate_Core_1			
Well:	Golden Gate Core 1	Organization:	Ardaman
Depth:	503.0 m		
Formation:	Carbonate	Rock type:	Limestone
Dry bulk density:	1.69	Porosity:	37.8%
Sat. bulk density:	2.06	Pore fluids:	NaCl Brine
Diameter:	37.90 mm	Entered Length:	54.00 mm

Comments: User: ner on elk at Thur Aug 28 1:35 EDT 2008
Expt name: 1220987119
Expt date: Thu Aug 28 13:39:35 2008
Print date: Fri Sep 12 14:56:57 2008
A2D File: Golden_Gate_Core_1.a2d

Pressure Information for File Golden_Gate_Core_1					
Event	System	Conf	Pore	Diff	Temp
		MPa	MPa	kN	°C
0	zmeter4	11.4	5.2	—	24.8

Resistivity for File Golden_Gate_Core_1							
	Requested	Actual	Impedance				
Event	Frequency	Frequency	R	X	C	$C_{corrected}$	F
	Hz	Hz	Ωm	Ωm	μS/cm	μS/cm	
0	1.00	0.720	1.26	0.00769	6.51e+04	6.48e+04	8.171
0	10.0	10.0	1.27	0.00254	6.51e+04	6.48e+04	8.243
0	100.	72.0	1.27	-0.00203	6.51e+04	6.48e+04	8.223
0	1.00e+03	1.00e+03	1.27	-0.00177	6.51e+04	6.48e+04	8.210
0	1.00e+04	7.20e+03	1.27	-0.00633	6.51e+04	6.48e+04	8.204
0	2.00e+04	1.39e+04	1.26	-0.00999	6.51e+04	6.48e+04	8.191

Resistivity Measurement Report

Sample and Experiment Information for File Golden_Gate_Core_2			
Well:	Golden Gate Core 2	Organization:	Ardaman
Depth:	556.5 m		
Formation:	Carbonate	Rock type:	Limestone
Dry bulk density:	1.77	Porosity:	35.2%
Sat. bulk density:	2.11	Pore fluids:	NaCl Brine
Diameter:	38.10 mm	Entered Length:	46.80 mm

Comments:	User: ner on elk at Wed Aug 27 11:15EDT 2008
Expt name:	1220471265
Expt date:	Wed Aug 27 11:16:15 2008
Print date:	Thu Sep 11 16:31:52 2008
A2D File:	Golden_Gate_Core_2.a2d

Pressure Information for File Golden_Gate_Core_2					
Event	System	Conf	Pore	Diff	Temp
		MPa	MPa	kN	°C
0	zmeter4	12.6	5.6	—	24.1

Resistivity for File Golden_Gate_Core_2							
	Requested	Actual	Impedance				
Event	Frequency	Frequency	R	X	C	$C_{corrected}$	F
	Hz	Hz	Ωm	Ωm	μS/cm	μS/cm	
0	1.00	0.720	1.52	-0.00823	5.29e+04	5.19e+04	7.904
0	10.0	10.0	1.53	0.00183	5.29e+04	5.19e+04	7.920
0	100.	72.0	1.52	-0.00107	5.29e+04	5.19e+04	7.915
0	1.00e+03	1.00e+03	1.52	-0.00198	5.29e+04	5.19e+04	7.904
0	1.00e+04	7.20e+03	1.52	-0.00624	5.29e+04	5.19e+04	7.894
0	2.00e+04	1.39e+04	1.52	-0.0100	5.29e+04	5.19e+04	7.884

Resistivity Measurement Report

Sample and Experiment Information for File Golden_Gate_Core_3			
Well:	Golden Gate Core 3	Organization:	Ardaman
Depth:	609.8 m		
Formation:	Carbonate	Rock type:	Limestone
Dry bulk density:	1.82	Porosity:	33.5%
Sat. bulk density:	2.14	Pore fluids:	NaCl Brine
Diameter:	38.00 mm	Entered Length:	44.80 mm

Comments:	User: ner on elk at Wed Aug 27 2:00 EDT 2008
Expt name:	Golden Gate Core 3
Expt date:	Wed Aug 27 14:02:55 2008
Print date:	Thu Sep 11 16:07:06 2008
A2D File:	Golden_Gate_Core_3.a2d

Pressure Information for File Golden_Gate_Core_3					
Event	System	Conf	Pore	Diff	Temp
		MPa	MPa	kN	°C
0	zmeter4	13.7	6.1	—	24.0

Resistivity for File Golden_Gate_Core_3							
	Requested	Actual	Impedance				
Event	Frequency	Frequency	R	X	C	$C_{corrected}$	F
	Hz	Hz	Ωm	Ωm	μS/cm	μS/cm	
0	1.00	0.720	1.64	-0.0278	5.28e+04	5.16e+04	8.452
0	10.0	10.0	1.61	-0.00643	5.28e+04	5.16e+04	8.292
0	100.	72.0	1.60	-0.00224	5.28e+04	5.16e+04	8.271
0	1.00e+03	1.00e+03	1.60	-0.00192	5.28e+04	5.16e+04	8.266
0	1.00e+04	7.20e+03	1.60	-0.00576	5.28e+04	5.16e+04	8.256
0	2.00e+04	1.39e+04	1.60	-0.00911	5.28e+04	5.16e+04	8.246

Resistivity Measurement Report

Sample and Experiment Information for File Golden_Gate_Core_4			
Well:	Golden Gate Core 4	Organization:	Ardaman
Depth:	652.7 m		
Formation:	Carbonate	Rock type:	Linmestone
Dry bulk density:	1.97	Porosity:	27.7%
Sat. bulk density:	2.24	Pore fluids:	NaCl Brine
Diameter:	38.00 mm	Entered Length:	51.60 mm

Comments:	User: ner on elk at Thur Aug 28 2:30 EDT 2008
Expt name:	1220984765
Expt date:	Thu Aug 28 14:29:35 2008
Print date:	Thu Sep 11 16:09:49 2008
A2D File:	Golden_Gate_Core_4.a2d

Pressure Information for File Golden_Gate_Core_4					
Event	System	Conf	Pore	Diff	Temp
		MPa	MPa	kN	°C
0	zmeter4	14.6	6.6	—	24.1

Resistivity for File Golden_Gate_Core_4							
	Requested	Actual	Impedance				
Event	Frequency	Frequency	R	X	C	$C_{corrected}$	F
	Hz	Hz	Ωm	Ωm	μS/cm	μS/cm	
0	1.00	0.720	2.18	-0.0107	6.15e+04	6.03e+04	13.15
0	10.0	10.0	2.16	-0.0143	6.15e+04	6.03e+04	13.02
0	100.	72.0	2.15	-0.00644	6.15e+04	6.03e+04	12.95
0	1.00e+03	1.00e+03	2.14	-0.00514	6.15e+04	6.03e+04	12.92
0	1.00e+04	7.20e+03	2.14	-0.0175	6.15e+04	6.03e+04	12.89
0	2.00e+04	1.39e+04	2.13	-0.0295	6.15e+04	6.03e+04	12.87

ARCADIS

Appendix C

Packer Test Summaries and Charts

ARCADIS

PACKER TEST WATER QUALITY SUMMARY

FGUA Golden Gate WWTP Injection Well System

Golden Gate, Florida

MW1

Packer Test No. 1

Start date: 1/22/2008

End date: 1/23/2008

Flowmeter Total-Start (gal) :	**340860**	**Open Hole Total Depth (feet bpl) :**	**1,618**
Flowmeter Total- End (gal) :	**364680**	**Packer Depth Interval (feet bpl):**	**1512-1554.4**
Average Test Pumping Rate (gpm) :	**84.5**	**Pump Setting Depth (feet bpl):**	**168.7**
Development Duration (min):	**649**	**Transducer Depth (feet bpl):**	**158.7**
Static DTW Before Test (feet apl):	**9.67**	**Pipe and open hole volume:**	**2200+700= 2900 gals.**

Date	Time	Elapsed Time (min)	Pump Rate (gpm)	Total Volume (gal)	Water Level (feet apl)	Temp. (°C)	Cond. (mS/cm)	Chlorides (mg/L)	Comments
Development									
1/21/08	16:55	0							Start air lifting development.
1/21/08	17:45	50	~250	12,000		26.4	29,400	10,500	
1/21/08	18:15	80	~300	21,000		25.3	25,700	9,500	
1/21/08	18:45	110	~300	31,500		26.2	32,100	10,500	
1/21/08	18:55	120	~300	34,500		26.6	32,400	11,000	
1/21/08	19:00	125	~300	36,000		26.9	32,700	11,000	
1/21/08	19:01	126							Complete air lifting development (pits are full).
1/22/08	10:22		107	173.43 ft static transducer reading (14.73 ft apl)					Start dev. wth submersible pump (fl. mtr. tot. 292170).
1/22/08	10:55	159	107	39,831	6.21	27.1	34,200	12,500	8.52 ft of drawdown
1/22/08	11:25	189	107	43,041	6.01	27.8	35,200	13,000	8.32 ft of drawdown
1/22/08	11:55	219	101	46,071	5.65	27.9	35,800	13,500	41.60 ft in annulus
1/22/08	12:25	249	102	49,131	5.60	28.1	36,600	14,000	41.78 ft in annulus
1/22/08	12:55	279	105	52,281	n/m	18.2	37,200	14,000	42.03 ft in annulus
1/22/08	13:25	309	104	55,401	5.42	28.3	37,900	14,500	
1/22/08	13:55	339	104	58,521	n/m	28.5	38,400	15,000	
1/22/08	14:25	369	103	61,611	5.20	28.6	38,800	15,500	9.53 ft drawdown
1/22/08	14:55	396	102	64,671		28.6	39,100	15,500	
1/22/08	15:25	429	102	67,731		28.7	39,400	15,500	
1/22/08	15:55	459	103	70,821	5.20	28.8	39,700	16,000	9.60 ft drawdown
1/22/08	16:25	489	100	73,821	5.13		40,100	16,000	
1/22/08	16:55	519	99	76,791	4.83	28.8	40,300	16,000	9.90 ft drawdown
1/22/08	17:25	549	96	79,671	4.82	28.8	40,500	16,500	9.91 ft drawdown
1/22/08	17:55	579	92	82,431	4.85	28.8	40,700	16,500	9.88 ft drawdown
1/22/08	18:25	609	92	85,191		28.9	41,000	16,500	
1/22/08	18:59	643	92	87,951		28.4	41,200	16,500	
1/22/08	19:05	649	92	90,711					Pre-set pump rate to 85 gpm. Pump-off. End development.
									Totalizer = 340860; Approx. 90,700 gals. removed during development

ARCADIS

PACKER TEST WATER QUALITY SUMMARY

FGUA Golden Gate WWTP Injection Well System

Golden Gate, Florida

MW1

Packer Test No. 1

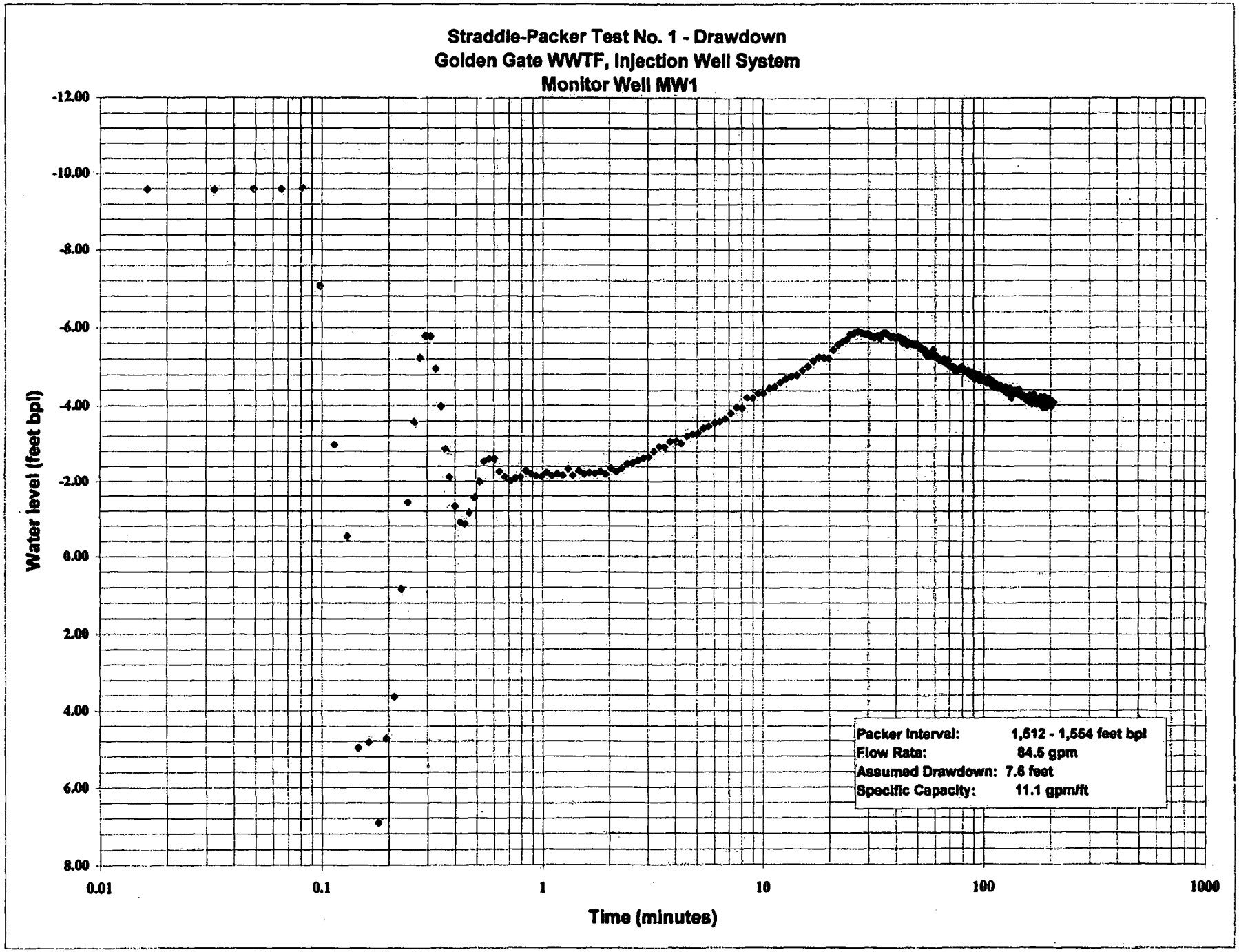
Start date: 1/22/2008

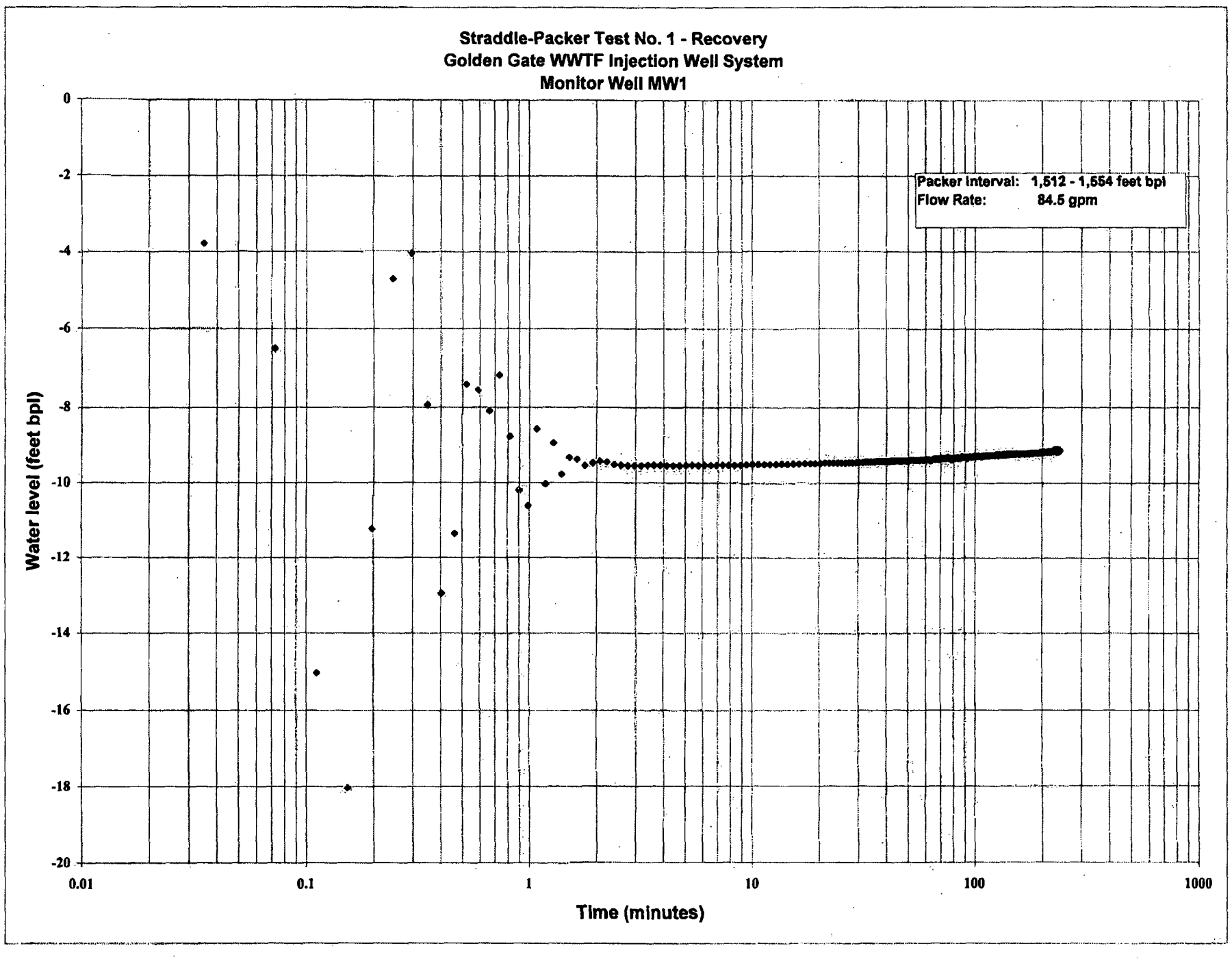
End date: 1/23/2008

Flowmeter Total-Start (gal) :	**340860**	**Open Hole Total Depth (feet bpl) :**	**1,618**
Flowmeter Total- End (gal) :	**364680**	**Packer Depth Interval (feet bpl):**	**1512-1554.4**
Average Test Pumping Rate (gpm) :	**84.5**	**Pump Setting Depth (feet bpl):**	**168.7**
Development Duration (min):	**649**	**Transducer Depth (feet bpl):**	**158.7**
Static DTW Before Test (feet apl):	**9.67**	**Pipe and open hole volume:**	**2200+700= 2900 gals.**

Date	Time	Elapsed Time (min)	Pump Rate (gpm)	Total Volume (gal)	Water Level (feet apl)	Temp. (°C)	Cond. (mS/cm)	Chlorides (mg/L)	Comments
Pumping Test									
1/23/08	7:31	0	97	0	9.67				Start test: pump-on
1/23/08	8:01	30	85	2,910	5.79	27.0	38,300	15,000	
1/23/08	8:43	72	86	6,522	4.99	27.8	39,700	16,000	Packer pressure = 340 psi
1/23/08	9:30	119	86	8,326	4.44	28.4	40,900	16,500	
1/23/08	10:05	154	85	11,336	4.24	28.4	41,500	16,500	Packer pressure = 355 psi; pH = 6.89
1/23/08	10:45	194	84	14,696	3.99	28.7	41,800	16,500	pH = 6.84
1/23/08	11:20	229	84	17,636	3.97	29.1	42,200	16,500	Packer pressure = 368 psi; pH = 7.26
1/23/08	11:55	264	85	20,611	3.77	29.1	42,500	16,500	Collect lab. sample.
1/23/08	12:10	279	84	23,586	3.82	29.1	42,600	16,500	pH = 7.27
1/23/08	12:13	282	84	23,820					End pump test, start recovery test
1/23/08	16:00				8.67				
1/23/08	16:13				8.67				End of recovery, retrieve data.

"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"feet apl" denotes feet above pad level.
"°C" denotes degrees celcius.
"mS/cm" denotes milliSiemans per centimeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.
"N/M" denotes not measured.
Static depth to water (DTW) was measured just prior to pumping test startup.


Straddle-Packer Test No. 1 - Drawdown
Golden Gate WWTF, Injection Well System
Monitor Well MW1
Water level (feet bpl)
-12.00
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
0.01
0.1
1
10
100
1000
Time (minutes)
Packer Interval: 1,512 - 1,554 feet bpl
Flow Rate: 84.5 gpm
Assumed Drawdown: 7.6 feet
Specific Capacity: 11.1 gpm/ft


Straddle-Packer Test No. 1 - Recovery
Golden Gate WWTF Injection Well System
Monitor Well MW1
Packer Interval: 1,512 - 1,554 feet bpl
Flow Rate: 84.5 gpm
Water level (feet bpl)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0.01
0.1
1
10
100
1000
Time (minutes)

ARCADIS

PACKER TEST WATER QUALITY SUMMARY

FGUA Golden Gate WWTP Injection Well System

Golden Gate, Florida

MW1

Packer Test No. 2

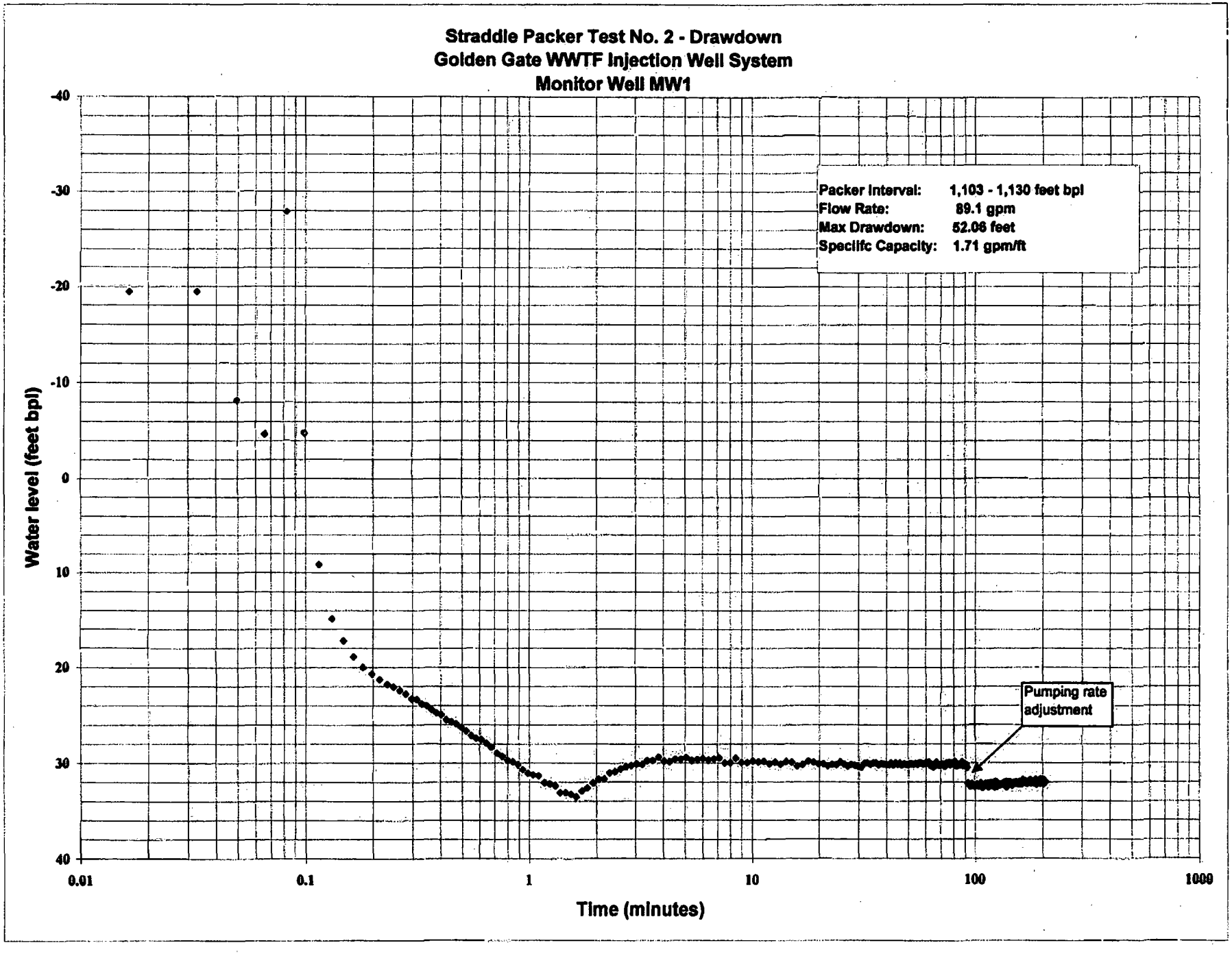
Start date: 1/25/2008

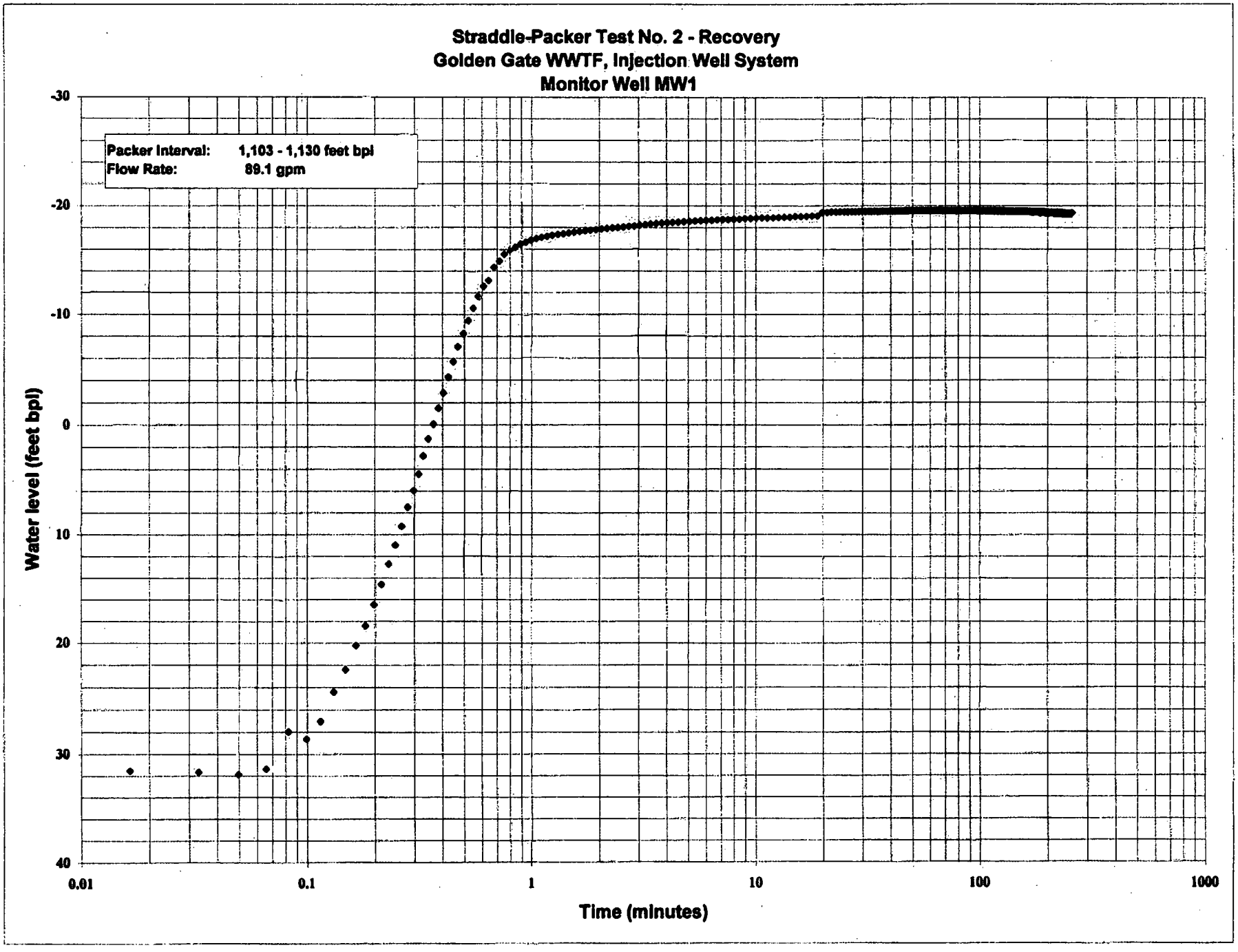
End date: 1/25/2008

Flowmeter Total-Start (gal) :	**373700**	**Open Hole Total Depth (feet bpl) :**	**1,618**
Flowmeter Total- End (gal) :	**396860**	**Packer Depth Interval (feet bpl):**	**1102.6-1130.1**
Average Test Pumping Rate (gpm) :	**89.0**	**Pump Setting Depth (feet bpl):**	**168.7**
Development Duration (min):	**597**	**Transducer Depth (feet bpl):**	**168.7**
Static DTW Before Test (feet apl):	**20.07**	**Pipe and open hole volume:**	**1600+480= 2080 gals.**

Date	Time	Elapsed Time (min)	Pump Rate (gpm)	Total Volume (gal)	Water Level (feet apl)	Temp. (°C)	Cond. (mS/cm)	Chlorides (mg/L)	Comments
Development									
1/24/08	10:30	0							Start air lifting development.
1/24/08	11:50	80	~100	8,000		27.3	18,510	7,500	
1/24/08	12:50	140	~100	14,000		26.9	18,950	7,500	
1/24/08	13:40	190	~100	19,000		26.8	18,860	7,500	
1/24/08	15:00	270	~100	27,000		26.9	18,900	7,500	
1/24/08	15:20	290	~100	29,000					Complete air lifting development.
1/24/08	16:30	290	96.0	29,000					Start dev. with submersible pump (flow.tot. 364680).
1/24/08	17:00	320	96.0	31,880		28.0	19,200	8,000	
1/24/08	17:30	350	94.0	34,760					Lower development rate to 10 gpm (free flow)
1/24/08	20:55	555	10.0	36,810	5.77	26.6	19,200	8,000	
1/24/08	21:35	585	10.0	37,110	5.64	26.5	19,250	8,000	
1/24/08	21:47	597	10.0	37,230					Pump-off; begin pre-test recovery.
									37230 gallons pumped during development.
Pumping Test									
1/25/08	0:09	0	95.0	0	19.53				Start test: pump-on
1/25/08	0:40	31	90.0	2,790	30.17 bpl	27.7	19,260	8,000	
1/25/08	1:19	70	90.0	6,300	30.29 bpl	27.5	19,290	8,000	Packer pressure = 325 psi
1/25/08	1:49	100.0	90.0	9,000	30.37 bpl	27.6	19,310	8,000	Adjust (increase) rate to 94 gpm.
1/25/08	2:19	130.0	92.0	11,760	32.53 bpl	27.7	19,240	8,000	Packer pressure = 325 psi; pH = 6.99
1/25/08	2:49	160.0	92.0	11,760	32.47 bpl	27.7	19,230	8,000	pH = 7.01
1/25/08	3:19	190.0	92.0	11,760	32.43 bpl	27.6	19,220	8,000	Packer pressure = 368 psi; pH = 7.26
1/25/08	3:49	220.0	92.0	11,760	32.69 bpl	27.5	19,200	8,000	
1/25/08	4:19	250.0	90.0	22,740	32.20 bpl	27.4	19,160	8,000	pH = 7.27
1/25/08	4:25	256.0	90.0	23,280					Collect lab. sample.
1/25/08	4:29	260.0	90.00	23,640					End pump test, start recovery test

"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"feet apl" denotes feet above pad level.
"C" denotes degrees celcius.
"mS/cm" denotes milliSiemens per centimeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.
"N/M" denotes not measured.
Static depth to water (DTW) was measured just prior to pumping test startup.


Straddle Packer Test No. 2 - Drawdown
Golden Gate WWTF Injection Well System
Monitor Well MW1
Packer Interval: 1,103 - 1,130 feet bpl
Flow Rate: 89.1 gpm
Max Drawdown: 52.06 feet
Specilfc Capacity: 1.71 gpm/ft
Pumping rate adjustment
Water level (feet bpl)
-40
-30
-20
-10
0
10
20
30
40
0.01
0.1
1
10
100
1000
Time (minutes)


Straddle-Packer Test No. 2 - Recovery
Golden Gate WWTF, Injection Well System
Monitor Well MW1
Packer Interval: 1,103 - 1,130 feet bpl
Flow Rate: 89.1 gpm
Water level (feet bpl)
-30
-20
-10
0
10
20
30
40
0.01
0.1
1
10
100
1000
Time (minutes)

ARCADIS

PACKER TEST WATER QUALITY SUMMARY

FGUA Golden Gate WWTP Injection Well System

Golden Gate, Florida

MW1

Packer Test No. 3

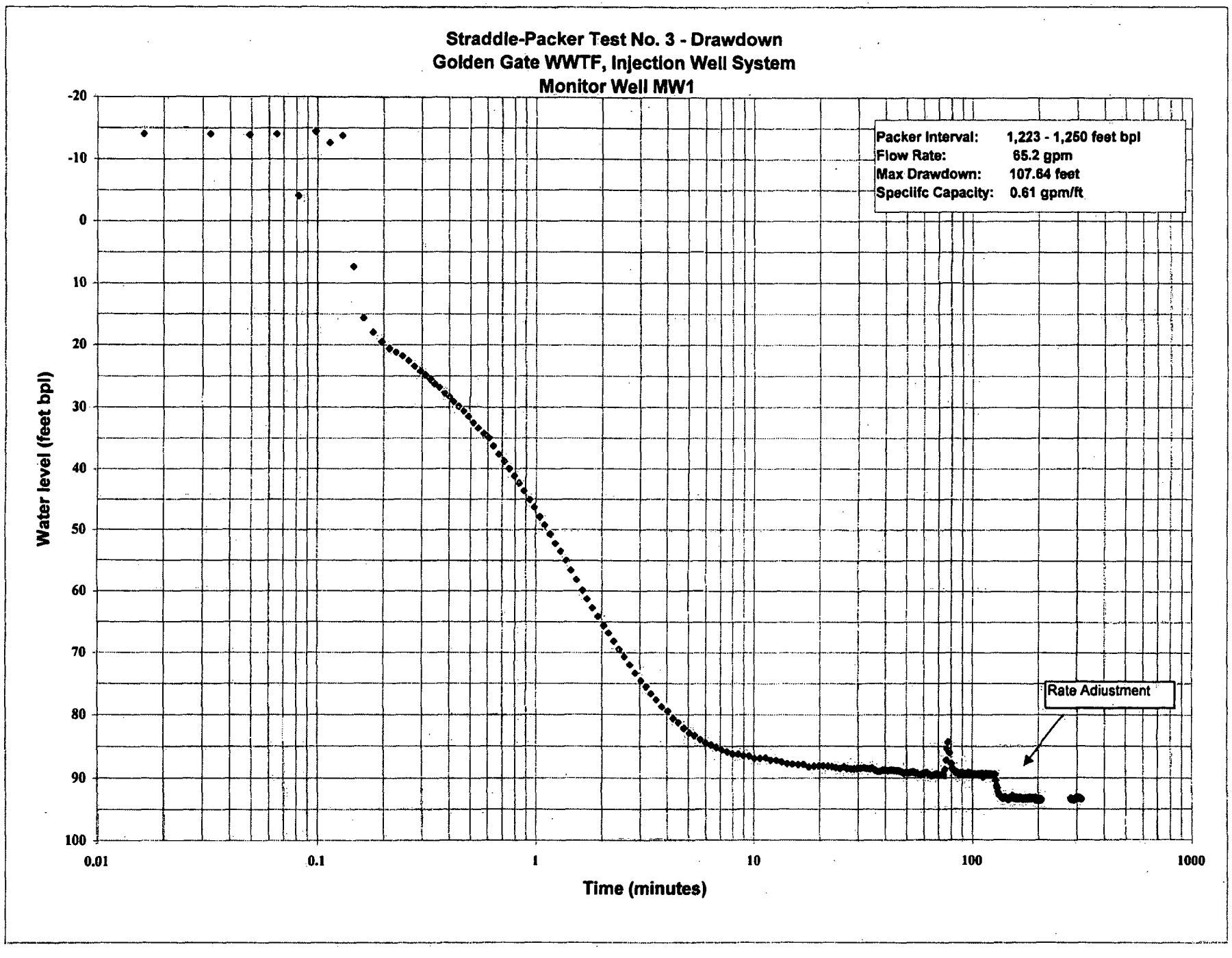
Start date: 1/26/2008

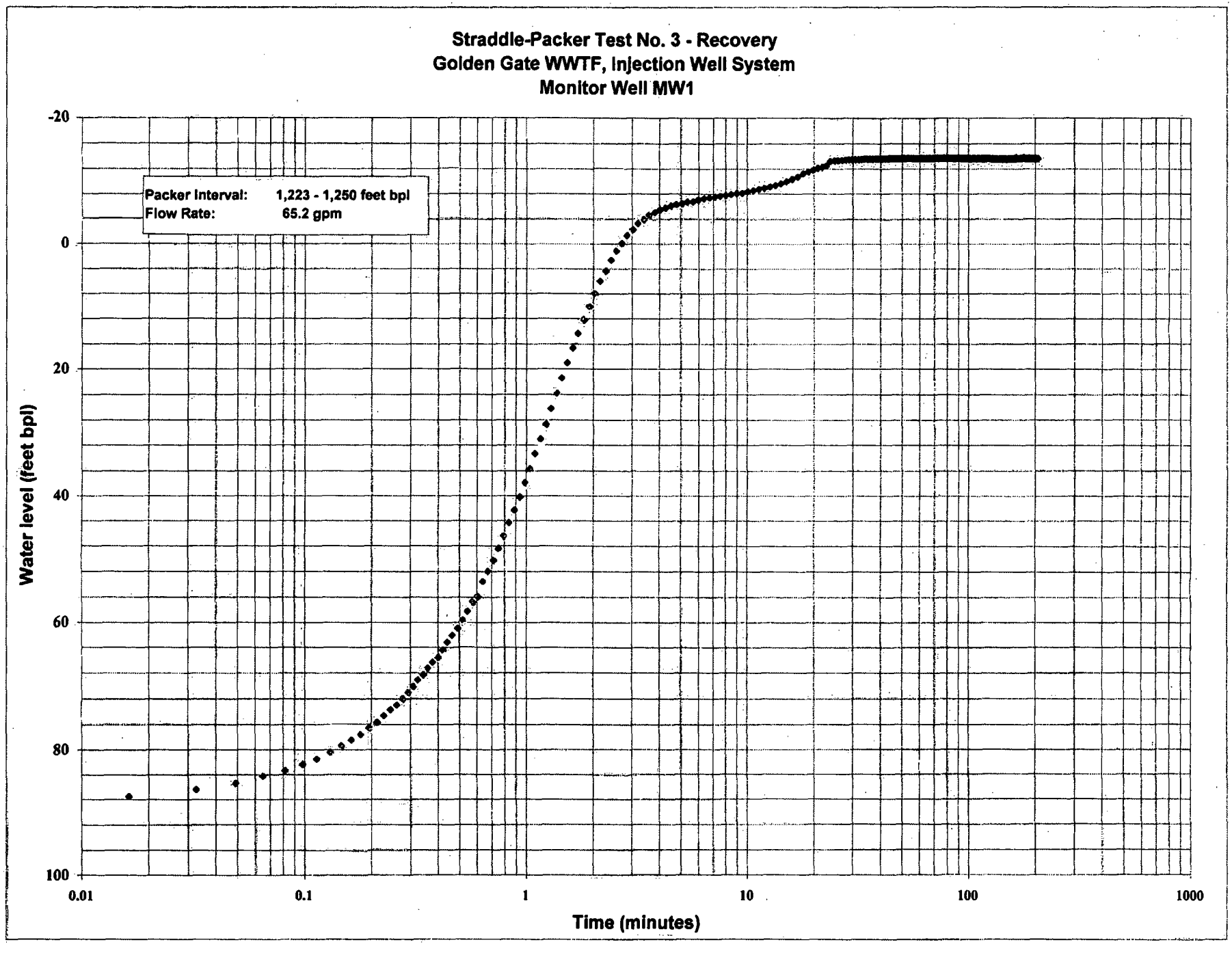
End date: 1/26/2008

Flowmeter Total-Start (gal) :	**413360**	**Open Hole Total Depth (feet bpl) :**	**1,618**
Flowmeter Total- End (gal) :	**429130**	**Packer Depth Interval (feet bpl):**	**1222.6-1250.1**
Average Test Pumping Rate (gpm) :	**65.2**	**Pump Setting Depth (feet bpl):**	**168.7**
Development Duration (min):	**392**	**Transducer Depth (feet bpl):**	**168.7**
Static DTW Before Test (feet apl):	**13.99**	**Pipe and open hole volume:**	**1770+390= 2160 gals.**

Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bpl)	Temp. (°C)	Cond. (mS/cm)	Chlorides (mg/L)	Comments
Development									
1/25/08	16:25	0							Start air lifting development.
1/25/08	18:30	125	~30	~3750		25.3	23,600	10,000	Stop air lifting, water clear. Packer pr. 325 psi.
1/25/08	19:05	125	23	3,750					Start dev. with submersible pump (flow.tot. 396760).
1/25/08	20:00	178	23	5,000	~10 bpl				Stop- replace pump with a bigger one
1/25/08	20:50	178	90	5,000					Resume development. Packer pr. 305 psi.
1/25/08	21:10	188	78	6,600		27.3	26,800	11000	
1/25/08	21:40	218	78	8,940	111.62	27.3	28,800	11,500	
1/25/08	22:10	248	75	11,190	112.20	27.1	29,700	12,000	
1/25/08	22:40	278	75	13,440	111.75	27.0	30,900	12,500	Packer press. Down to 200 psi. Add pressure to 310 psi.
1/25/08	23:10	308	76	15,730	112.10	27.3	31,100	12,500	Packer pressure: 305 psi.
1/25/08	23:40	338	76	18,010	112.42	27.9	31,300	12,500	
1/26/08	0:10	368	75	20,260	112.20	28.0	31,400	12,500	Packer pressure 300 psi
1/26/08	0:34	392	75	22,060					Pump-off, start pre-test recovery.
									Approx. 22,100 gals. Were removed during development.
Pumping Test									
1/26/08	3:03	0	80	0	13.99 apl				Start test: pump-on; packer press. 300-340 psi.
1/26/08	3:35	32	68	2,244	88.48	27.4	31,200	12,500	
1/26/08	4:05	62	62	4,104	89.43	27.7	31,600	12,500	Adjust rate to 66 gpm
1/26/08	4:35	92	65	4,104	89.55	27.6	31,700	12,500	
1/26/08	5:05	122	62	5,964	89.26	27.6	31,900	12,000	Adjust rate again to 66 gpm.
1/26/08	5:35	152	62	7,824	93.19	27.7	32,300	12,500	
1/26/08	6:05	182	62	9,684	93.20	27.7	32,400	12,500	
1/26/08	6:35	212	62	11,544	93.15	27.6	32,300	12,500	
1/26/08	6:65	232	63	14,750	93.16	27.7	32,200	12,500	
1/26/08	7:00	237	63	15,100					Collect lab. Sample.
1/26/08	7:05	242	63	15,400					End pump test, start recovery

"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"feet apl" denotes feet above pad level.
"°C" denotes degrees celcius.
"mS/cm" denotes milliSiemens per centimeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.
"N/M" denotes not measured.
Static depth to water (DTW) was measured just prior to pumping test startup.


Straddle-Packer Test No. 3 - Drawdown
Golden Gate WWTF, Injection Well System
Monitor Well MW1
Packer Interval: 1,223 - 1,250 feet bpl
Flow Rate: 65.2 gpm
Max Drawdown: 107.64 feet
Specilfc Capacity: 0.61 gpm/ft
Rate Adiustment
Water level (feet bpl)
-20
-10
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000
Time (minutes)


Straddle-Packer Test No. 3 - Recovery
Golden Gate WWTF, Injection Well System
Monitor Well MW1
Packer Interval: 1,223 - 1,250 feet bpl
Flow Rate: 65.2 gpm
Water level (feet bpl)
-20
0
20
40
60
80
100
0.01
0.1
1
10
100
1000
Time (minutes)

ARCADIS

PACKER TEST WATER QUALITY SUMMARY

FGUA Golden Gate WWTP Injection Well System

Golden Gate, Florida

MW1

Packer Test No. 4

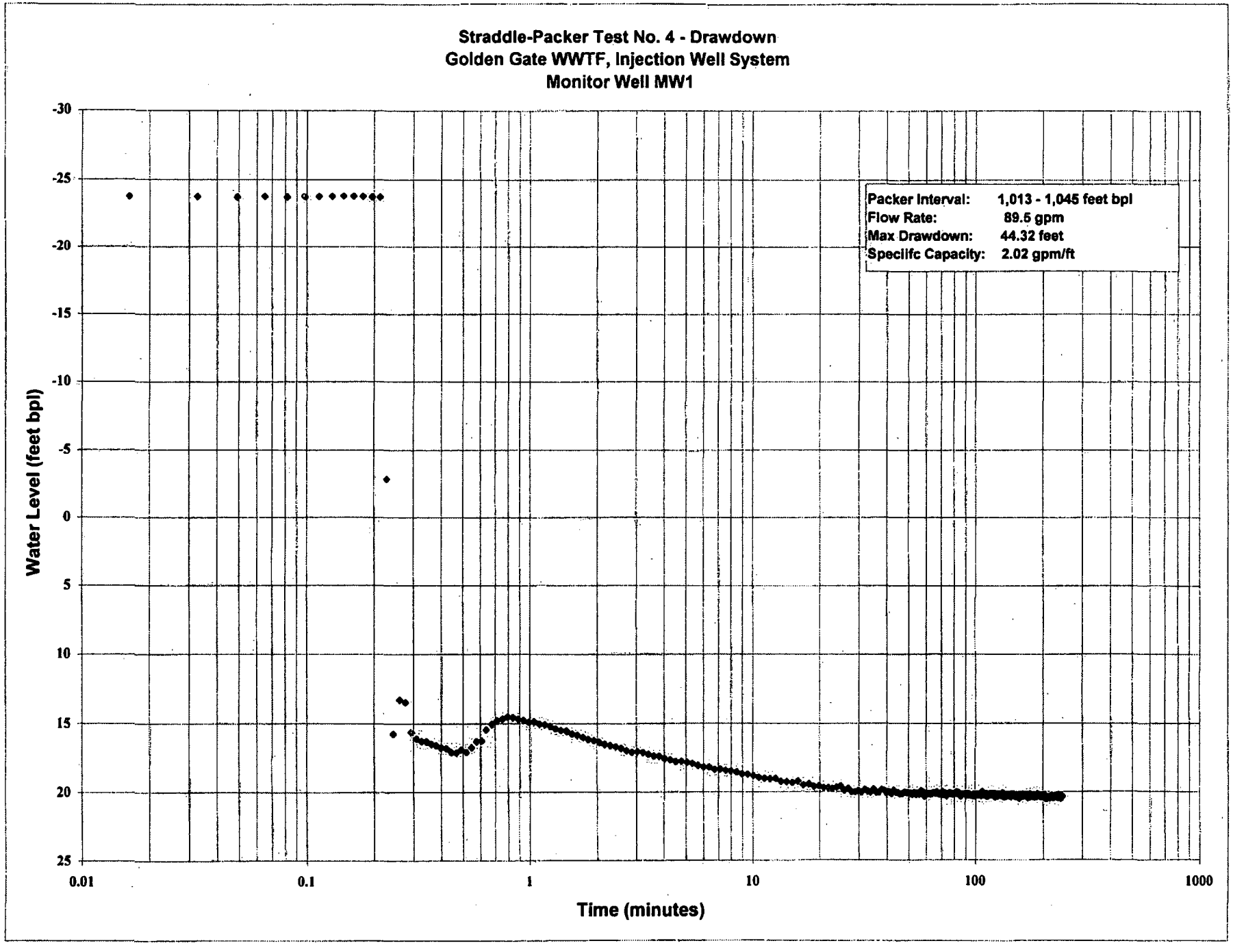
Start date: 1/28/2008

End date: 1/29/2008

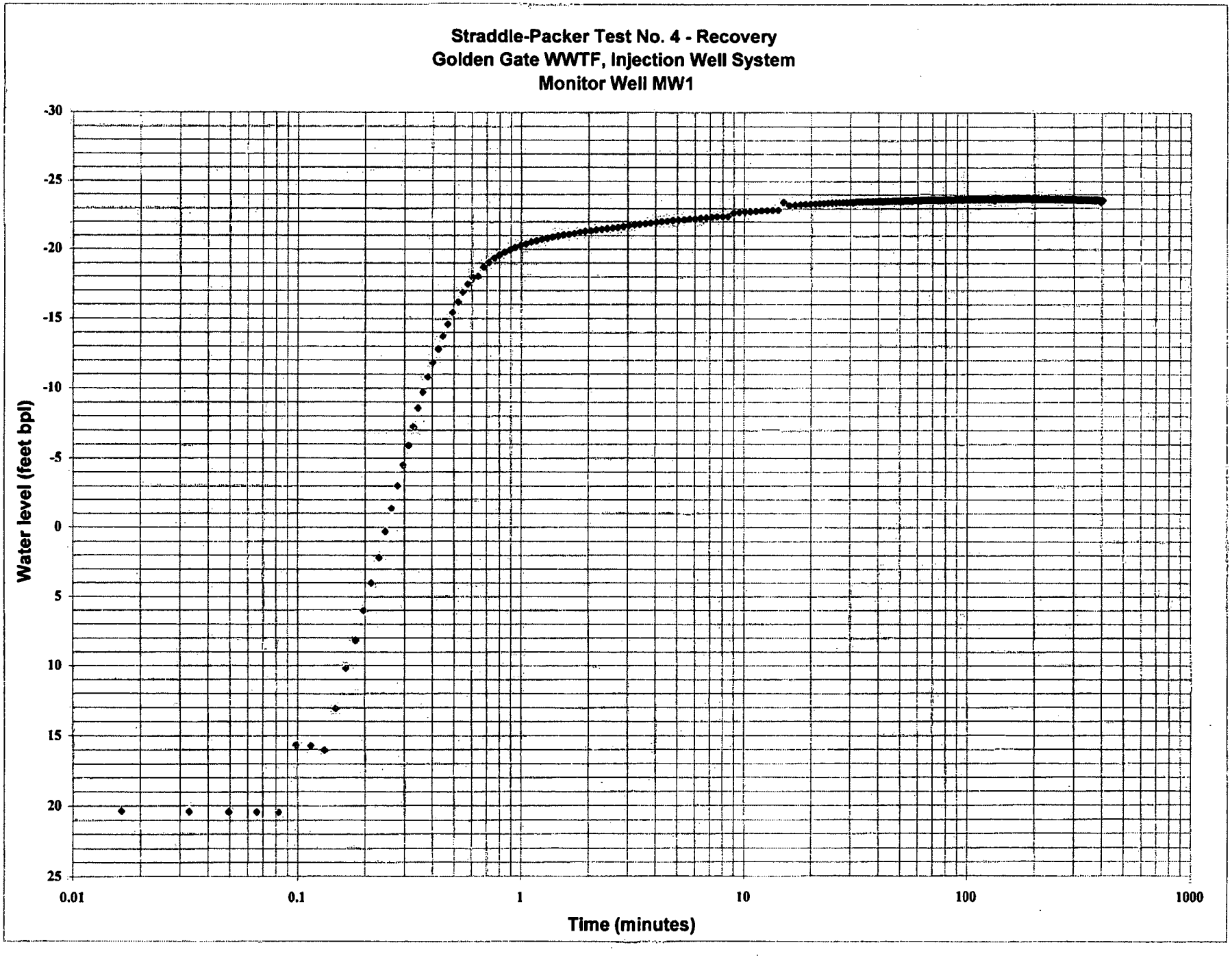
Flowmeter Total-Start (gal) :	**438168**	**Open Hole Total Depth (feet bpl) :**	**1,618**
Flowmeter Total- End (gal) :	**459910**	**Packer Depth Interval (feet bpl):**	**1012.6-1045**
Average Test Pumping Rate (gpm) :	**89.5**	**Pump Setting Depth (feet bpl):**	**168.7**
Development Duration (min):	**220**	**Transducer Depth (feet bpl):**	**158.7**
Static DTW Before Test (feet apl):	**23.82**	**Pipe and open hole volume:**	**1480+540= 2020 gals.**

Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bpl)	Temp. (°C)	Cond. (mS/cm)	Chlorides (mg/L)	Comments
Development									
1/28/08	14:45	0							Start air lifting development.
1/28/08	15:45	60	~40	~2400		26.5	9,240	3,500	
1/28/08	16:45	120	~40	~4800		27	9,300	3,500	
1/28/08	16:55	130	~40	~5250					Stop air lifting, water clear. Packer pr. 350 psi. Stable.
1/28/08	18:30	130	~105	5,250					Start dev. with submersible pump (flow.tot. 429130).
1/28/08	18:38	138	101	5,250	~23	27.3	9,240	3,500	Packer pressure 350 psi.
1/28/08	19:00	160	98	5,250	26.65	27.1	9,240	3,500	
1/28/08	19:25	185	100	7,750	26.88	27.3	9,260	3,500	
1/28/08	19:50	210	100	10,250	27.04	27.4	9,260	3,500	
1/28/08	20:00	220	100	14,214					Pump-off, start pre-test recovery.
Pumping Test									
1/28/08	22:16	0	93	0	23.82 ft apl				Start test: pump-on; packer press. 345 psi. Ann. 32.77
1/28/08	22:40	24	89	2,136	19.81	27.3	9,260	3,500	Annulus; 32.81ft
1/28/08	23:05	49	89	4,361	20.22	27.6	9,240	3,500	
1/28/08	23:30	74	88	6,561	20.32	27.9	9,230	3,500	Annulus: 32.21
1/28/08	23:55	99	89	8,786	20.42	27.8	9,240	3,500	
1/29/08	0:20	124	87	10,961	20.50	27.8	9,240	3,500	Annulus: 32.21, pH=6.94
1/29/08	0:45	149	90	13,211	20.55	27.7	9,230	3,500	
1/29/08	1:10	174	90	15,461	20.61	27.6	9,220	3,500	
1/29/08	1:35	199	89	17,686	20.64	27.8	9,240	3,500	Annulus: 33.90
1/29/08	2:00	224	90	19,936	20.54	27.7	9,230	3,500	
1/29/08	2:15	239	91	22,211	20.39	27.7	9,240	3,500	Collect lab. Sample.
1/29/08	2:19	243	91	22,575					End pump test, start recovery

"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"feet apl" denotes feet above pad level.
"°C" denotes degrees celcius.
"mS/cm" denotes milliSiemens per centimeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.
"N/M" denotes not measured.
Static depth to water (DTW) was measured just prior to pumping test startup.



G:\AProjects\WR\WF PROJECTS\WF004200.G015 - Golden Gate Injection Well\Construction Oversight\Field Forms & Data\Forms MW\Packer Tests\Packer Test 04\PT4drawd.xls



G:\AProjects\WR\WF PROJECTS\WF004200.G015 - Golden Gate Injection Well\Construction Oversight\Field Forms & Data\Forms MW\Packer Tests\Packer Test 04\PT4rec.xls

ARCADIS

PACKER TEST WATER QUALITY SUMMARY

FGUA Golden Gate WWTP Injection Well System

Golden Gate, Florida

IW1

Packer Test No. 5 (single packer)

Tested interval:1554-1635 ft bpl

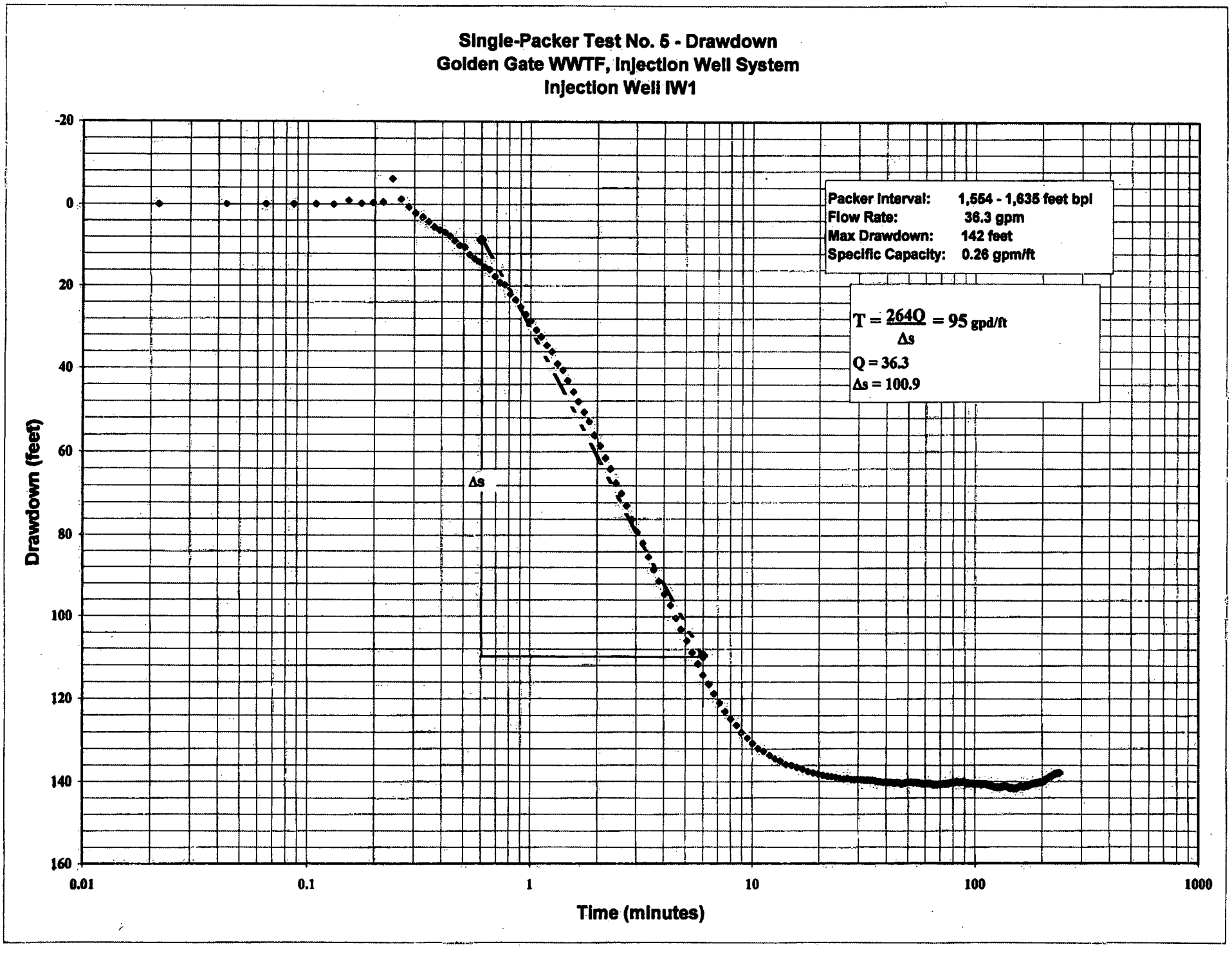
Start date: 4/6/2008

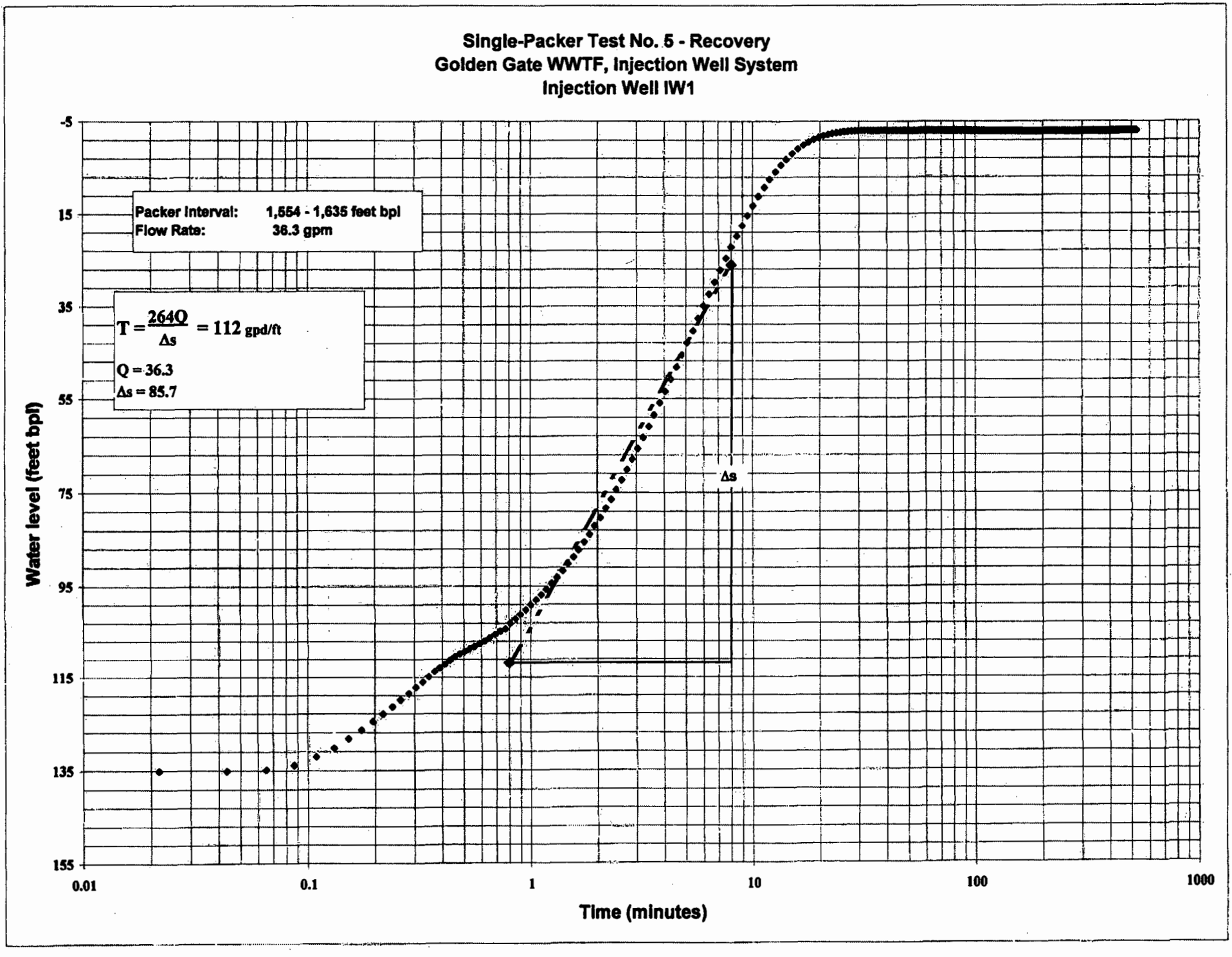
End date: 4/6/2008

Flowmeter Total-Start (gal) :	**10165**	**Open Hole Total Depth (feet bpl) :**	**1,635**
Flowmeter Total- End (gal) :	**18920**	**Packer Depth Interval (feet bpl):**	**1,554**
Average Test Pumping Rate (gpm) :	**36.3**	**Pump Setting Depth (feet bpl):**	**183**
Development Duration (min):	**547**	**Transducer Depth (feet bpl):**	**166.42**
Static DTW Before Test (feet apl):	**3.07**	**Pipe and open hole volume:**	**2278+572=2850 gals**

Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bpl)	Temp. (°C)	Cond. (mS/cm)	Chlorides (mg/L)	Comments
Development									
4/6/08	2:05	0	~20	0	n/a	n/a	n/a	n/a	Start air lifting development. Packer press. 365 psi.
4/6/08	6:45	280	~50	~14000	n/a	23.8	47,900	16,000	
4/6/08	7:55	350	~50	~17500	n/a	27.2	49,800	17,500	
4/6/08	8:00	355	~50	~17750	n/a	n/a	n/a	n/a	Stop air lifting, water clearing. Packer pr.325psi.
4/6/08	9:45	355	45	17,750	n/a	n/a	n/a	n/a	Start dev. with submersible pump (flowmtr.tot. 3260).
4/6/08	10:35	405	36	19,550	32.00	28.6	49,900	17,500	Packer pressure 365 psi.
4/6/08	11:20	450	36	21,170	n/a	28.8	50,600	18,500	
4/6/08	12:00	490	36	22,610	n/a	28.9	50,500	18,500	
4/6/08	12:45	535	36	24,230	n/a	29.0	50,500	18,500	Annular space reading: 27.80ft above tramsducer.
4/6/08	12:57	547	36	26,660	n/a	n/a	n/a	n/a	Pump-off, start pre-test recovery. pH=7.07
Pumping Test									
4/6/08	16:08	0	43	0	3.07	n/a	n/a	n/a	Pump-on, begin pumping rate test.
4/6/08	16:58	50	37	1,800	136.03	29.4	51,400	18,000	Annular space reading: 28.97 ft above tramsducer.
4/6/08	17:28	80	36	2,880	137.31	29.6	50,500	18,000	1 volume purged.
4/6/08	18:18	130	36	4,680	138.12	29.7	51,000	18,500	Annular space reading: 30.96 ft above tramsducer.
4/6/08	19:08	180	36	6,480	138.35	28.8	51,000	18,500	Water lab. sample collected at 19:20 by YBI
4/6/08	19:50	222	36	7,992	136.41	29.9	51,000	18,500	pH=7.43, water-level is bouncing back.
4/6/08	20:09	241	36	8,676	136.26	n/a	n/a	n/a	Pump-off, begin recovery.

"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"feet apl" denotes feet above pad level.
"°C" denotes degrees celcius.
"mS/cm" denotes milliSiemans per centimeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.
"N/M" denotes not measured.
Static depth to water (DTW) was measured just prior to pumping test startup.


Single-Packer Test No. 5 - Drawdown
Golden Gate WWTF, Injection Well System
Injection Well IW1
Packer Interval: 1,554 - 1,635 feet bpl
Flow Rate: 36.3 gpm
Max Drawdown: 142 feet
Specific Capacity: 0.26 gpm/ft
T = 264Q/Δs = 95 gpd/ft
Q = 36.3
Δs = 100.9
Δs
Drawdown (feet)
-20
0
20
40
60
80
100
120
140
160
0.01
0.1
1
10
100
1000
Time (minutes)


Single-Packer Test No. 5 - Recovery
Golden Gate WWTF, Injection Well System
Injection Well IW1
Packer Interval: 1,554 - 1,635 feet bpl
Flow Rate: 36.3 gpm
T = 264Q / Δs = 112 gpd/ft
Q = 36.3
Δs = 85.7
Δs
Water level (feet bpl)
-5
15
35
55
75
95
115
135
155
0.01
0.1
1
10
100
1000
Time (minutes)

ARCADIS

PACKER TEST WATER QUALITY SUMMARY

FGUA Golden Gate WWTP Injection Well System

Golden Gate, Florida

IW1

Packer Test No. 6 (straddle packer)

Tested interval:1558.6-1576.5 ft bpl

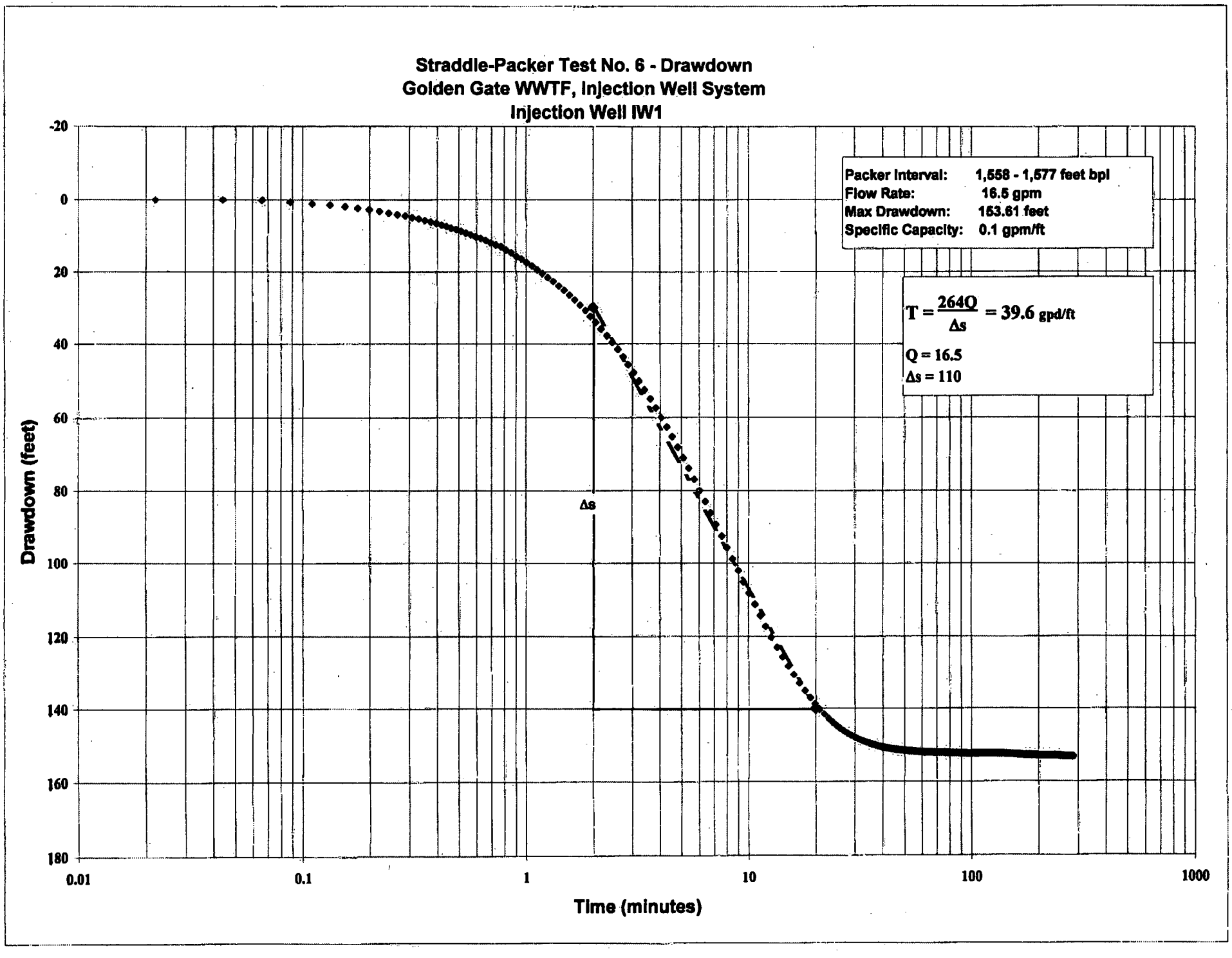
Start date: 4/9/2008

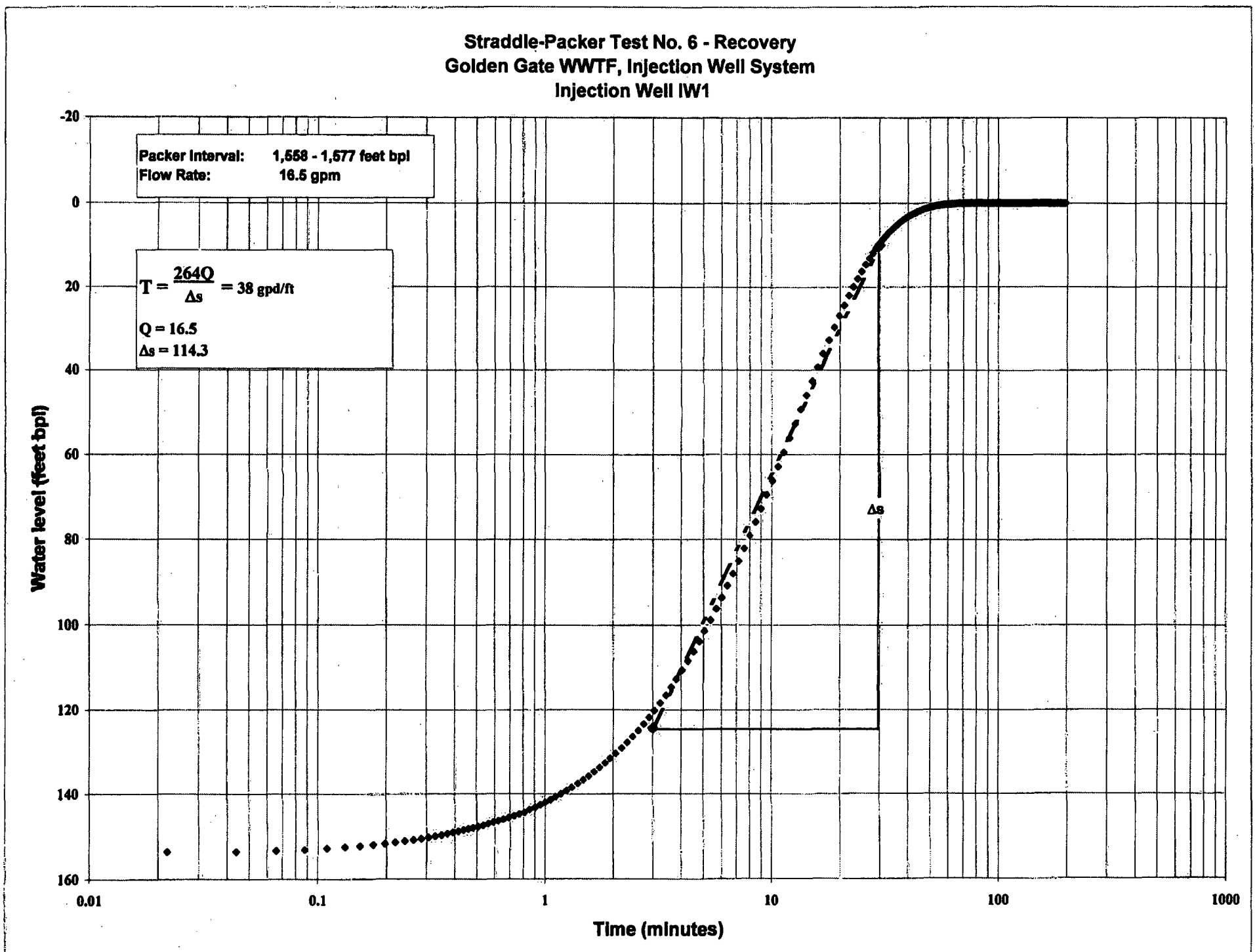
End date: 4/10/2008

Flowmeter Total-Start (gal) :	21780	**Open Hole Total Depth (feet bpl) :**	1,635
Flowmeter Total- End (gal) :	26490	**Packer Depth Interval (feet bpl):**	1558.6-1576.5
Average Test Pumping Rate (gpm) :	16.5	**Pump Setting Depth (feet bpl):**	183
Development Duration (min):	386	**Transducer Depth (feet bpl):**	166.67
Static DTW Before Test (feet apl):	0.23	**Pipe and open hole volume:**	2290+150=2240 gals

Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bpl)	Temp. (°C)	Cond. (mS/cm)	Chlorides (mg/L)	Comments
Development									
4/9/08	13:55	0	n/a	0	n/a	n/a	n/a	n/a	Start air lifting development. Packer press. 285 psi.
4/9/08	15:00	65	~15	n/a	n/a	n/a	n/a	n/a	v. turbid, milky, full of sediments
4/9/08	17:25	210	~15	~3150	n/a	26.9	49,400	19,000	clearing, slightly turbid.
4/9/08	17:30	215	~15	~3225	n/a	n/a	n/a	n/a	Stop air lifting. Packer press. 335 psi.
4/9/08	18:45	215	n/a	~3225	n/a	n/a	n/a	n/a	Start dev. with submersible pump (flowmtr.tot. 18,920).
4/9/08	19:35	265	16	4,240	153.02	28.8	50,600	19,500	
4/9/08	20:15	305	16	4,880	153.31	28.7	50,700	19,500	
4/9/08	20:55	345	16	5,520	153.61	28.8	50,700	19,500	
4/9/08	21:25	375	16	6,000	153.41	28.9	50,700	19,500	Packer pressure 300 psi. Annular reading: 41.26 feet.
4/9/08	21:36	386	16	6,180	153.38	n/a	n/a	n/a	Pump-off, start pre-test recovery. pH=7.20
Pumping Test									
4/10/08	0:01	0	31	0	0.23 apl	n/a	n/a	n/a	Pump-on, packer test #6.
4/10/08	0:45	44	17	860	151.61	28.8	50,800	19,500	Annular space reading: 41.23 ft above tramsducer.
4/10/08	1:30	89	17	1,625	152.88	28.7	50,800	19,500	Packer pressure:302psi. Annulus:41.35 feet a.tr.
4/10/08	2:15	135	16	2,345	152.91	28.6	50,900	19,500	Annular space reading: 41.47 ft above tramsducer.
4/10/08	3:01	180	16	3,065	153.34	28.8	50,900	19,500	Annular space reading: 41.60 ft above tramsducer.
4/10/08	3:31	210	16	3,545	153.50	n/a	n/a	n/a	
4/10/08	4:01	240	16	4,025	153.48	28.7	50,900	19,500	Collect Lab. Sample. pH=7.38
4/10/08	4:45	284	16	4,730	153.45	n/a	n/a	n/a	Water levels bouncing back since 04:20.
4/10/08	4:47	286	16	4,760	n/a	n/a	n/a	n/a	Pump-off; begin rcovery.

"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"feet apl" denotes feet above pad level.
"°C" denotes degrees celcius.
"mS/cm" denotes milliSiemans per cenitmeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.
"N/M" denotes not measured.
Static depth to water (DTW) was measured just prior to pumping test startup.


Straddle-Packer Test No. 6 - Drawdown
Golden Gate WWTF, Injection Well System
Injection Well IW1
Packer Interval: 1,558 - 1,577 feet bpl
Flow Rate: 16.5 gpm
Max Drawdown: 153.61 feet
Specific Capacity: 0.1 gpm/ft
$T = \frac{264Q}{\Delta s} = 39.6$ gpd/ft
Q = 16.5
Δs = 110
Δs
Drawdown (feet)
-20
0
20
40
60
80
100
120
140
160
180
0.01
0.1
1
10
100
1000
Time (minutes)


Straddle-Packer Test No. 6 - Recovery
Golden Gate WWTF, Injection Well System
Injection Well IW1
Packer Interval: 1,558 - 1,577 feet bpl
Flow Rate: 16.5 gpm
T = 264Q / Δs = 38 gpd/ft
Q = 16.5
Δs = 114.3
Δs
Water level (feet bpl)
-20
0
20
40
60
80
100
120
140
160
0.01
0.1
1
10
100
1000
Time (minutes)

ARCADIS

PACKER TEST WATER QUALITY SUMMARY

FGUA Golden Gate WWTP Injection Well System

Golden Gate, Florida

IW1

Packer Test No. 7

Tested Interval:1618.6-1628.5 ft bpl

Start date: 5/17/2008

End date: 5/19/2008

Flowmeter Total-Start (gal) : n/a		**Open Hole Total Depth (feet bpl) :**	**3007 (obstruction)**
Flowmeter Total- End (gal) : n/a		**Packer Depth Interval (feet bpl):**	**1618.6-1636.6**
Average Test Pumping Rate (gpm) :	**0.67**	**Pump Setting Depth (feet bpl):**	**178**
Development Duration (min):	**252**	**Transducer Depth (feet bpl):**	**166**
Static DTW Before Test (feet bpl):	**5.56**	**Pipe and open hole volume:**	**2360+240=2600 gals**

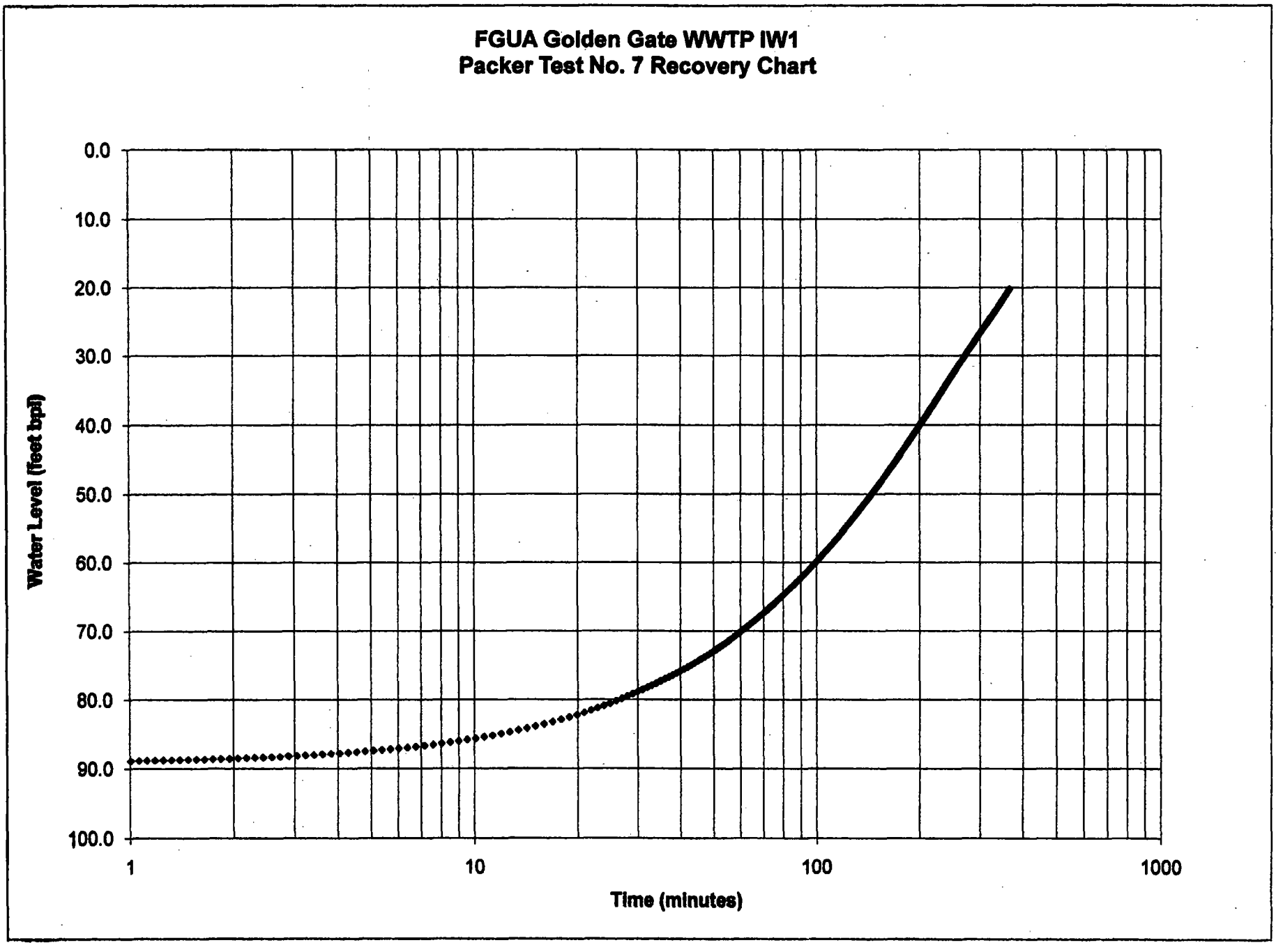
Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bpl)	Temp. (°C)	Cond. (mS/cm)	Chlorides (mg/L)	Comments
Development									
5/17/08	19:05	0	n/a	0	n/a	n/a	n/a	n/a	Start air lifting development. Packer press. 320 psi.
5/17/08	19:55	50	<1	~50	n/a	25.5	72,100	23,000	cloudy
5/17/08	20:50	110	<1	<110	n/a	26	n/a	n/a	clearing, slightly turbid.
5/17/08	21:00	115	<1	<115	n/a	n/a	n/a	n/a	Stop air lifting. Packer press. 320 psi.
5/17/08	23:08	115	15	<115	~90	n/a	n/a	n/a	Start dev.with pump (measurements in calibrated container)
5/17/08	23:35	142	0.86	~170	127.30	27.2	55,500	17,500	Pumping rate stabilized.
5/18/09	0:05	172	0.82	195	131.89	29.0	56,200	18,000	Water clear. Annulus: 12.32 ft.
5/18/09	0:35	202	0.82	220	133.55	27.9	56,700	18,000	
5/18/09	1:05	232	0.90	247	142.13	28.9	57,300	18,000	Packer pressure 315 psi. Annular reading: 12.43 feet.
5/18/09	1:25	252	0.85	263	n/a	n/a	n/a	n/a	Pump-off, start pre-test recovery.
Pumping Test									
5/18/08	13:52	0	0	0	5.56	n/a	n/a	n/a	Pump-on, begin packer test # 7. Adjust pump rate.
5/18/08	13:56	4	0.78	~6	n/a	n/a	n/a	n/a	Pump rate stable.
5/18/08	14:22	30	0.75	26	23.12	28.3	56,500	18,000	Annulus: 12.79 ft.
5/18/08	14:52	60	0.70	47	33.49	27.9	58,700	18,500	
5/18/08	15:22	90	0.69	68	44.32	27.8	58,700	18,500	
5/18/08	15:52	120	0.67	88	54.10	27.6	58,400	18,500	
5/18/08	16:22	150	0.65	88	62.18	27.9	58,700	18,500	Annulus: 12.92 ft.
5/18/08	16:52	180	0.64	127	69.09	28.1	59,000	18,500	
5/18/08	17:22	210	0.64	146	75.29	28	59,100	18,500	Annuuls: 12.80 ft.
5/18/08	17:52	240	0.63	146	80.07	27.9	58,900	18,500	
5/18/08	18:22	270	0.61	164	85.14	28	58,600	18,500	Drillers collect lab. Sample. Ann:=12.72
5/18/08	18:52	300	0.60	182	89.01	27.8	58,400	18,500	
5/18/08	18:54	302	n/a	183	n/a	n/a	n/a	n/a	Pump-off, begin recovery.

"al" denotes gallons.
"pm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"eet apl" denotes feet above pad level.
"C" denotes degrees celcius
"mS/cm" denotes milliSiemans per centimeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.
"N/M" denotes not measured.
Static depth to water (DTW) wass measured just prior to pumping test startup.

FGUA Golden Gate WWTP IW1
Packer Test No. 7 Drawdown Chart

C:\Documents and Settings\Golden Gate\GG IW1 final csg request\Append-C- Packer Test WQ data\IW1 Packer Tests\PT #7\PT #7 Tables and Charts\
PT #7 DD.xls

FGUA Golden Gate WWTP IW1
Packer Test No. 7 Recovery Chart



C:\Documents and Settings\Golden Gate\GG IW1 final csg request\Append-C- Packer Test WQ data\IW1 Packer Tests\PT #7\PT #7 Tables and Charts\
PT #7 Rec.xls

ARCADIS

PACKER TEST WATER QUALITY SUMMARY

FGUA Golden Gate WWTP Injection Well System
Golden Gate, Florida

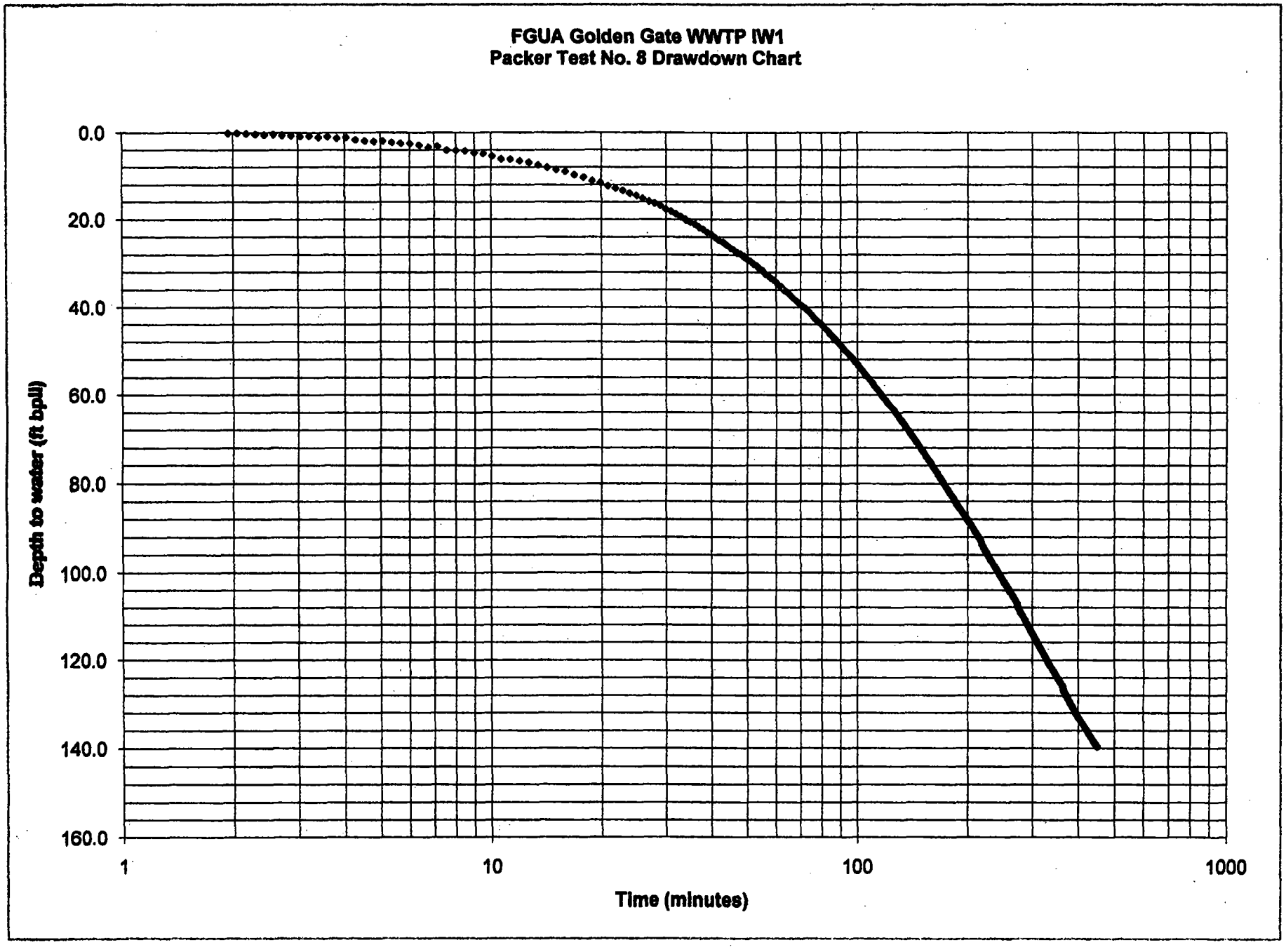
IW1
Packer Test No. 8 (straddle packer)
Tested interval:1704.6-1722.5 ft bpl

Start date: 5/19/2008
End date: 5/20/2008

Flowmeter Total-Start (gal) : n/a		**Open Hole Total Depth (feet bpl) :**	**3007 (obstruction)**
Flowmeter Total- End (gal) : n/a		**Packer Depth Interval (feet bpl):**	**1704.6-1722.5**
Average Test Pumping Rate (gpm) :	**0.81**	**Pump Setting Depth (feet bpl):**	**178**
Development Duration (min):	**486**	**Transducer Depth (feet bpl):**	**166.1**
Static DTW Before Test (feet bpl):	**1.4 apl**	**Pipe and open hole volume:**	**2470+240=2710 gals**

Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bpl)	Temp. (°C)	Cond. (mS/cm)	Chlorides (mg/L)	Comments
Development									
5/19/2008	6:20	0	1.0	0	n/a	n/a	n/a	n/a	Start development with a pump.
5/19/2008	6:45	25	~15	15	151.00	n/a	n/a	n/a	Pump-on for the 1 st surge.
5/19/2008	6:51	31	~30	~200	145.40	28.7	57,200	19,000	Pump-off.
5/19/2008	8:33	133	~10	~200	94.50	n/a	n/a	n/a	Pump-on for 2nd surge.
5/19/2008	8:38	138	~10	270	147.10	28	57,000	19,000	Pump-off.
5/19/2008	10:47	267	~8	270	94.90	n/a	n/a	n/a	Pump-on for 3rd surge.
5/19/2008	10:51	271	~8	245	146.50	28.1	58,400	19,000	Pump-off.
5/19/2008	12:41	381	1.1	245	100.20	n/a	n/a	n/a	Pump-on for rate adjustment. Annulus=12.7 ft.
5/19/2008	12:50	390	0.87	253	n/a	n/a	n/a	n/a	Rate adjusted, monitor drawdown.
5/19/2008	14:26	486	0.87	336	124.60	28.3	58,700	19,500	Rate stable, pump-off, begin pre-test recovery.
Pumping Test									
5/20/2008	10:00	0	0.86	0	1.4*	n/a	n/a	n/a	Pump-on, begin packer test # 8, Packer psi=300
5/20/2008	10:11	11	0.91	10	n/a	n/a	n/a	n/a	
5/20/2008	10:20	20	0.88	18	na	na	na	na	
5/20/2008	10:31	31	0.90	28	19.60	28.2	58500	20,500	Annulus = 12.828, Packer=300 psi
5/20/2008	10:57	60	0.87	53	34.00	28.4	58400	20,500	Annulus=12.837, Packer=300 psi
5/20/2008	11:30	90	0.86	79	49.52	28.5	58900	21,500	Annulus=12.843, Packer=300 psi
5/20/2008	11:58	118	0.83	102	61.34	28.9	59400	22,500	Annulus=12.844, Packer=300 psi
5/20/2008	12:30	149	0.81	127	71.66	28.8	59300	22,500	Annulus=12.841, Packer=300 psi
5/20/2008	13:00	179	0.80	151	82.98	29.1	59600	20,000	Annulus=12.841, Packer=300 psi
5/20/2008	13:31	211	0.78	176	90.82	28.5	59400	20,000	Annulus=12.841, Packer=300 psi, re-adjust pump rate to 0.82 gpm
5/20/2008	14:01	241	0.80	200	100.14	29.2	59600	21,500	Annulus=12.841, Packer=300 psi
5/20/2008	14:29	269	0.78	222	107.26	n/a	n/a	n/a	Annulus=12.836, Packer=300psi, re-adjust pump rate
5/20/2008	14:34	274	0.85	226	108.50	29.3	59700	19,500	Annulus=12.836, Packer=300psi
5/20/2008	15:01	301	0.82	248	114.54	29.5	59900	21,000	Annulus=12.830, Packer=300 psi
5/20/2008	15:31	331	0.80	272	120.67	29.5	59900	21,000	Annulus=12.812, Packer=300 psi
5/20/2008	15:58	358	0.79	294	125.41	n/a	n/a	n/a	Annulus=12.794, Packer=300 psi - Adjust pump rate
5/20/2008	16:05	365	0.85	300	127.241	29.6	59600	20,000	Annulus=12.788, Packer=300 psi
5/20/2008	16:31	391	0.82	321	131.012	29.7	59800	19,500	Annulus=12.773, Packer=300 psi
5/20/2008	16:59	419	0.77	343	135.637	n/a	n/a	n/a	Annulus=12.773, Packer=300 psi
5/20/2008	17:05	426	0.81	348	136.608	29.9	59900	20,500	Annulus=12.773, Packer=300 psi
5/20/2008	17:29	449	0.79	366	139.30	29.9	60000	20,500	Annulus 12.713, Packer=295 psi, Pump-off, begin recovery.

"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"°C" denotes degrees celcius.
"mS/cm" denotes milliSiemans per centimeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.
"N/M" denotes not measured.
Static depth to water (DTW) wass measured just prior to pumping test startup.
* Denotes water level above pad level (feet).


FGUA Golden Gate WWTP IW1
Packer Test No. 8 Drawdown Chart
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
Depth to water (ft bpll)
1
10
100
1000
Time (minutes)

ARCADIS

PACKER TEST WATER QUALITY SUMMARY

FGUA Golden Gate WWTP Injection Well System

Golden Gate, Florida

IW1

Packer Test No. 9 (straddle packer)

Tested interval:1813.6 -1832.5 ft bpl

Start date: 5/21/2008

End date: 5/22/2008

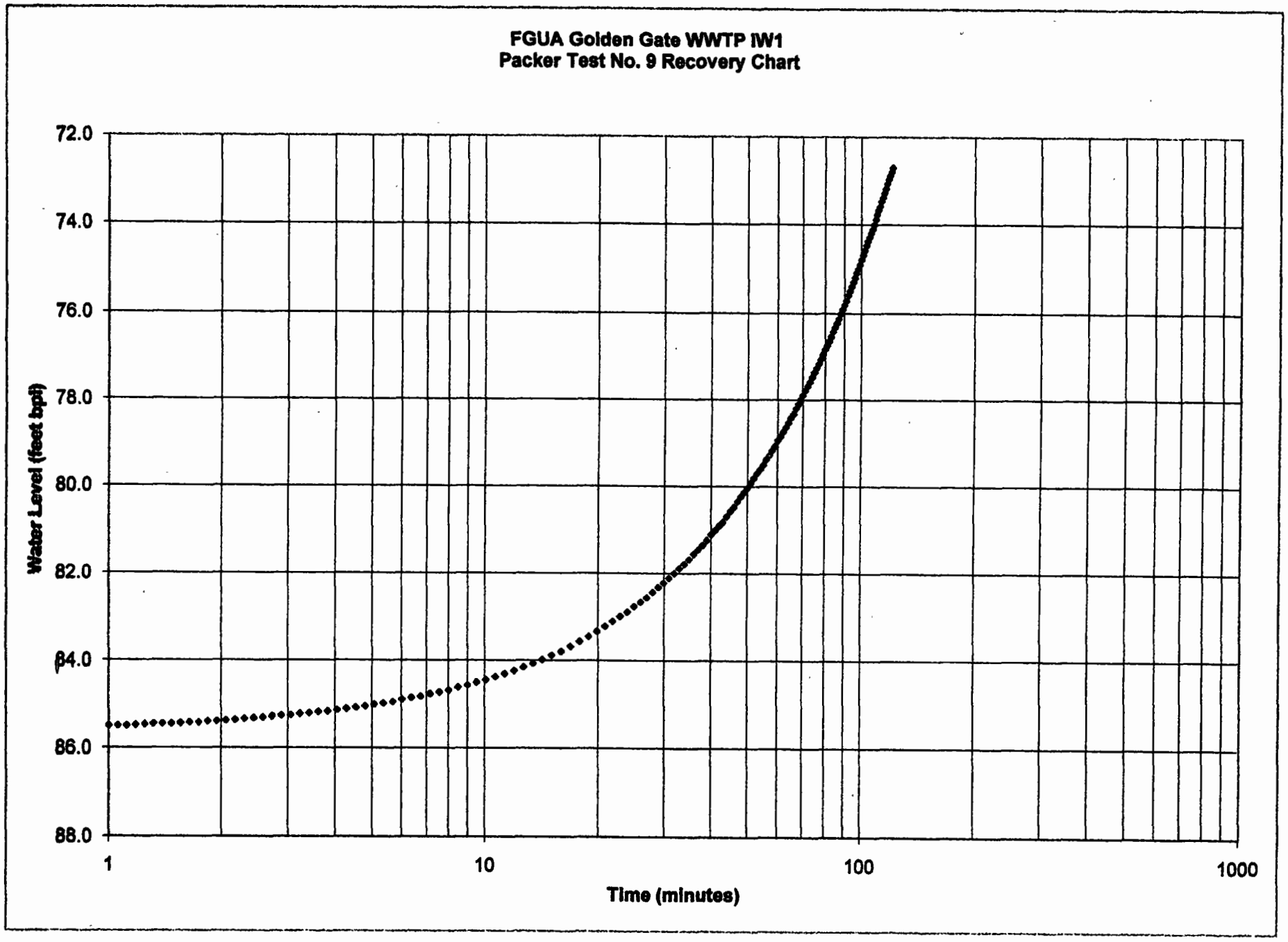
Flowmeter Total-Start (gal) :	n/a	**Open Hole Total Depth (feet bpl) :**	3007 (obstruction)
Flowmeter Total- End (gal) :	n/a	**Packer Depth Interval (feet bpl):**	1813.6-1832.5
Average Test Pumping Rate (gpm) :	0.67	**Pump Setting Depth (feet bpl):**	178
Development Duration (min):	468	**Transducer Depth (feet bpl):**	166.1
Static DTW Before Test (feet bpl):	22.90	**Pipe and open hole volume:**	2670+240=2910 gals

Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bpl)	Temp. (°C)	Cond. (mS/cm)	Chlorides (mg/L)	Comments
Development									
5/21/08	7:34	0	0.0	0	6.09	n/a	n/a	n/a	Start development with pump. #5=160.012, Surge 1
5/21/08	7:40	6	29.08	174.5	146.51	26.4	56,300	19,500	Pump off, will allow to recover
5/21/08	9:23	109	0.0	174.5	130.46	n/a	n/a	n/a	Resume development with pump. Surge 2
5/21/08	9:24	110	26.5	201	147.08	27.5	54,800	19,000	Pump off, will allow to recover, Annulus=17.959
5/21/08	11:25	229	0.0	201	124.19	n/a	n/a	n/a	recovering, Annulus=17.947, packer = 300 psi
5/21/08	12:43	307	0.0	201	111.19	n/a	n/a	n/a	
5/21/08	12:46	310	0.0	203	115.66	n/a	n/a	n/a	Pump on, Start establishing flow rate
5/21/08	13:07	331	0.62	216	118.23	n/a	n/a	n/a	
5/21/08	13:34	358	0.60	232	126.36	n/a	n/a	n/a	
5/21/08	14:07	391	0.57	251	134.59	28.8	59,400	20,500	
5/21/08	14:34	418	0.55	268	140.60	28.9	60,100	21,500	Annulus = 18.044, Packer = 300 psi
5/21/08	14:58	442	0.53	279	145.83	28.8	57,000	18,500	
5/21/08	15:24	468	0.53	292	150.43	n/a	n/a	n/a	Stop development, start pre-test recovery
Pumping Test									
5/22/08	12:28	0	0.00	0	22.88	n/a	n/a	n/a	Pump-on, begin packer test #9; annulus=17.96
5/22/08	12:30	2	0.70	1	n/a	n/a	n/a	n/a	Packers press.=295 psi.
5/22/08	12:34	6	0.70	4	n/a	n/a	n/a	n/a	
5/22/08	12:58	30	0.67	17	42.63	28.6	58,200	18,500	
5/22/08	13:28	60	0.66	37	55.32	28.5	58,500	18,500	
5/22/08	13:58	90	0.65	56	68.04	28.6	58,300	18,500	
5/22/08	14:28	120	0.65	76	80.30	28.7	59	18,500	
5/22/08	14:30	122	n/a	n/a	n/a	n/a	n/a	n/a	Pump-off, begin recovery. Annulus level: 18.01

"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"feet apl" denotes feet above pad level.
"°C" denotes degrees celcius.
"mS/cm" denotes milliSiemans per centimeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.
"N/M" denotes not measured.
Static depth to water (DTW) was measured just prior to pumping test startup.

FGUA Golden Gate WWTP IW1
Packer Test No. 9 Drawdown Chart.

C:\Documents and Settings\Golden Gate\GG IW1 final cag request\Append-C- Packer Test WQ data\IW1 Packer Tests\PT#9\Test data and charts\
PT #9 DD.xls



C:\Documents and Settings\Golden Gate\GG IW1 final csg request\Append-C- Packer Test WQ data\IW1 Packer Tests\PT#9\Test data and charts\
PT #9 Rec.xls

ARCADIS

PACKER TEST WATER QUALITY SUMMARY

FGUA Golden Gate WWTP Injection Well System

Golden Gate, Florida

IW1

Packer Test No. 10

Tested Interval: 2138.6-2157.5 ft bpl

Start date: 5/23/2008

End date: 5/23/2008

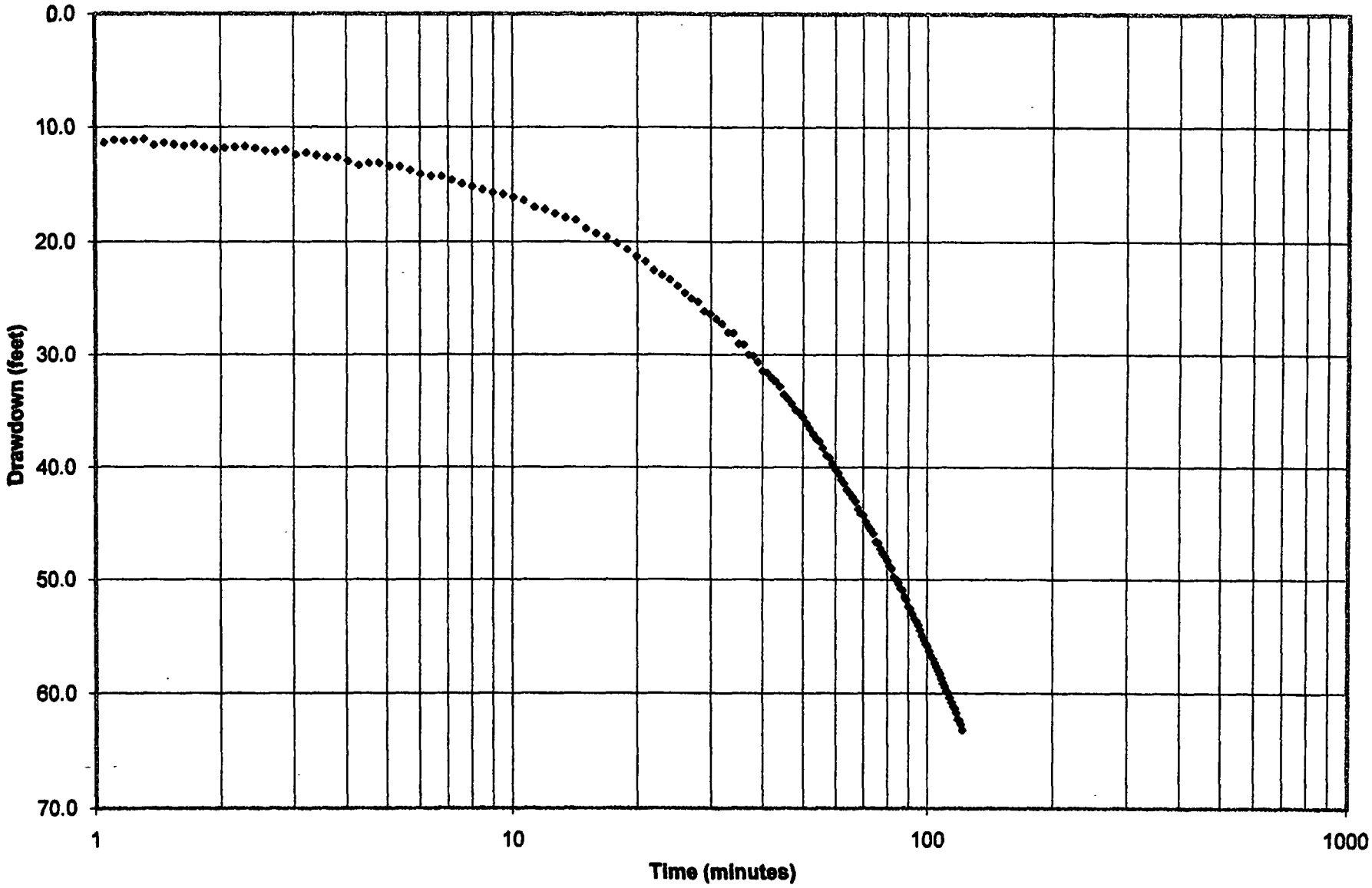
Flowmeter Total-Start (gal) : n/a	**96**	**Open Hole Total Depth (feet bpl) :**	**3007 (obstruction)**
Flowmeter Total- End (gal) : n/a	**188**	**Packer Depth Interval (feet bpl):**	**2138.6-2157.5**
Average Test Pumping Rate (gpm) :	**0.77**	**Pump Setting Depth (feet bpl):**	**178**
Development Duration (min):	**277**	**Transducer Depth (feet bpl):**	**166.1**
Static DTW Before Test (feet bpl):	**12.86**	**Pipe and open hole volume:**	**3150+240=3390 gals**

Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bpl)	Temp. (°C)	Cond. (mS/cm)	Chlorides (mg/L)	Comments
Development									
5/23/08	0:10	0	35	0	3.40	n/a	n/a	n/a	Start development with pump.Surge # 1. Annulus:12.65 ft.
5/23/08	0:16	6	33	175	140.70	27.7	54,300	18,500	Pump off.
5/23/08	1:49	99	27.0	175	105.75	n/a	n/a	n/a	Pump- on for surge # 2.
5/23/08	1:52	102	27.0	230	146.10	27.6	54,600	18,500	Pump-off.
5/23/08	3:16	186	0.0	230	111.90	n/a	n/a	n/a	Pump-on, adjusting rate for pump test. Annulus: 12.56 ft.
5/23/08	3:25	195	2.0	248	122.00	n/a	n/a	n/a	
5/23/08	3:37	207	2.0	272	133.50	n/a	n/a	n/a	Lower pumping rate to 1 gpm.
5/23/08	4:15	245	1.00	310	144.30	27.5	54,200	18500	Lower pumping rate to 0.85 gpm.
5/23/08	4:18	248	0.85	312	144.10	n/a	n/a	n/a	Pump-off.
5/23/08	4:40	270	0.00	312	134.74	n/a	n/a	n/a	Pump-on for last check.
5/23/08	4:47	277	0.75	317	135.45	27.7	53,900	18,500	Pump-off, begin pre-test recovery.
Pumping Test									
5/23/08	15:46	0	0.00	0	12.86	n/a	n/a	n/a	Packers: 300 psi, annulus: 12.86 ft.
5/23/08	15:48	0	0.81	0	n/a	n/a	n/a	n/a	Pump-on, begin packer test #10 with pre-set rate.
5/23/08	16:18	30	0.80	24	27.18	27.9	54,100	18,500	
5/23/08	16:48	60	0.78	46.5	40.33	28	54,000	18,500	
5/23/08	17:18	90	0.77	69	52.00	28.1	53,800	18,500	
5/23/08	17:46	118	0.76	91	62.99	28.1	53,500	18,500	Annulus: 12.81 ft. Packers pressure: 300 psi.
5/23/08	17:48	120	n/a	92	n/a	n/a	n/a	n/a	Pump-off, begin recovery.

Notes:

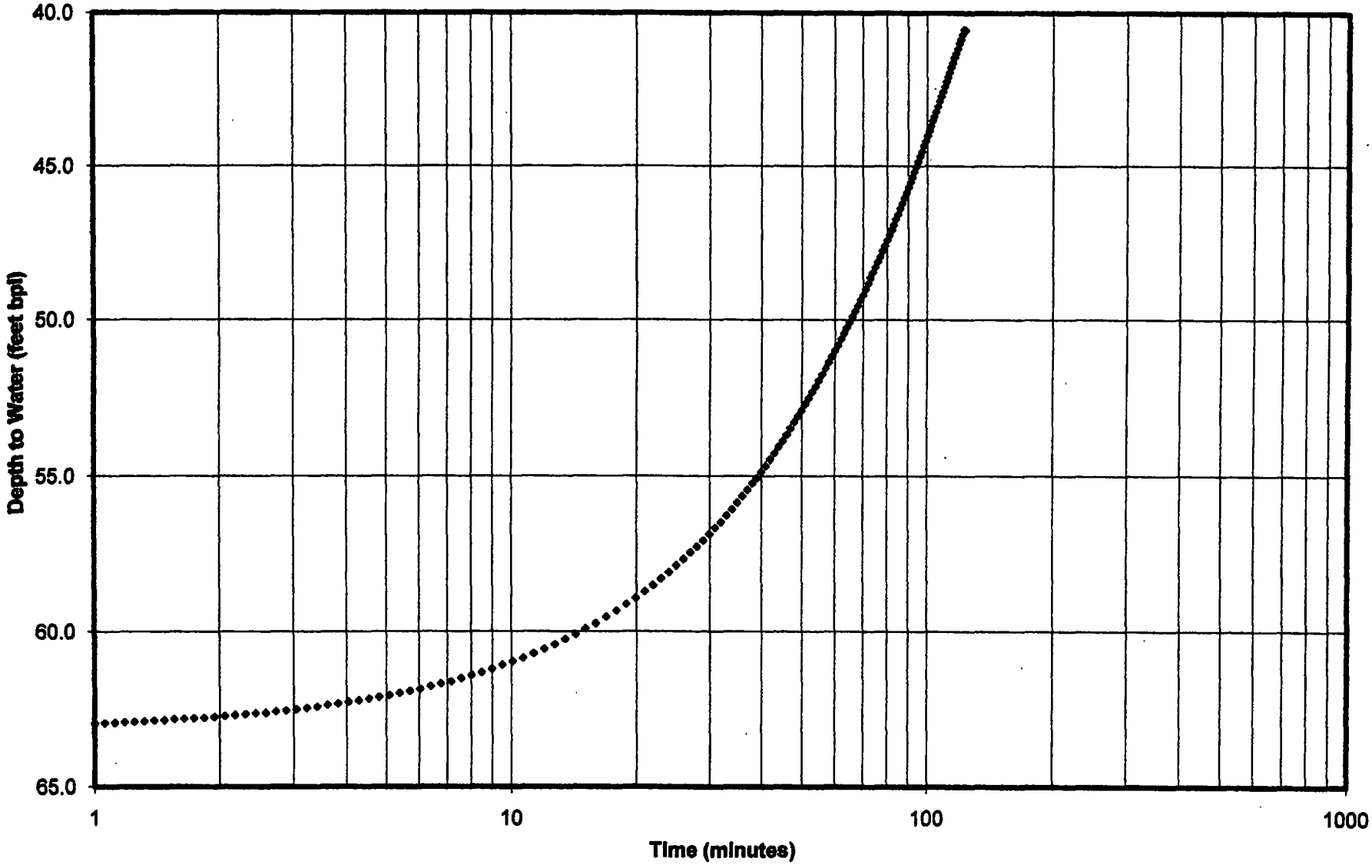
"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"feet apl" denotes feet above pad level.
"°C" denotes degrees celcius.
"mS/cm" denotes milliSiemans per centimeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.
"NM" denotes not measured.

FGUA Golden Gate WWTP IW1
Packer Test No.10 Drawdown Chart.



C:\Documents and Settings\Golden Gate\GG IW1 final csg request\Append-C- Packer Test WQ data\IW1 Packer Tests\PT#10\Tables and charts\
PT #10 DD.xls

FGUA Golden Gate WWTP IW1
Packer Test No. 10 Recovery Chart



C:\Documents and Settings\Golden Gate\GG IW1 final cag request\Append-C- Packer Test WQ data\IW1 Packer Tests\PT#10\Tables and charts\
PT#10 Rec.xls

ARCADIS

PACKER TEST WATER QUALITY SUMMARY

FGUA Golden Gate WWTP Injection Well System
Golden Gate, Florida

IW1
Packer Test No. 11 (straddle packer)
Tested interval: 2266.6-2284.5 ft bpl

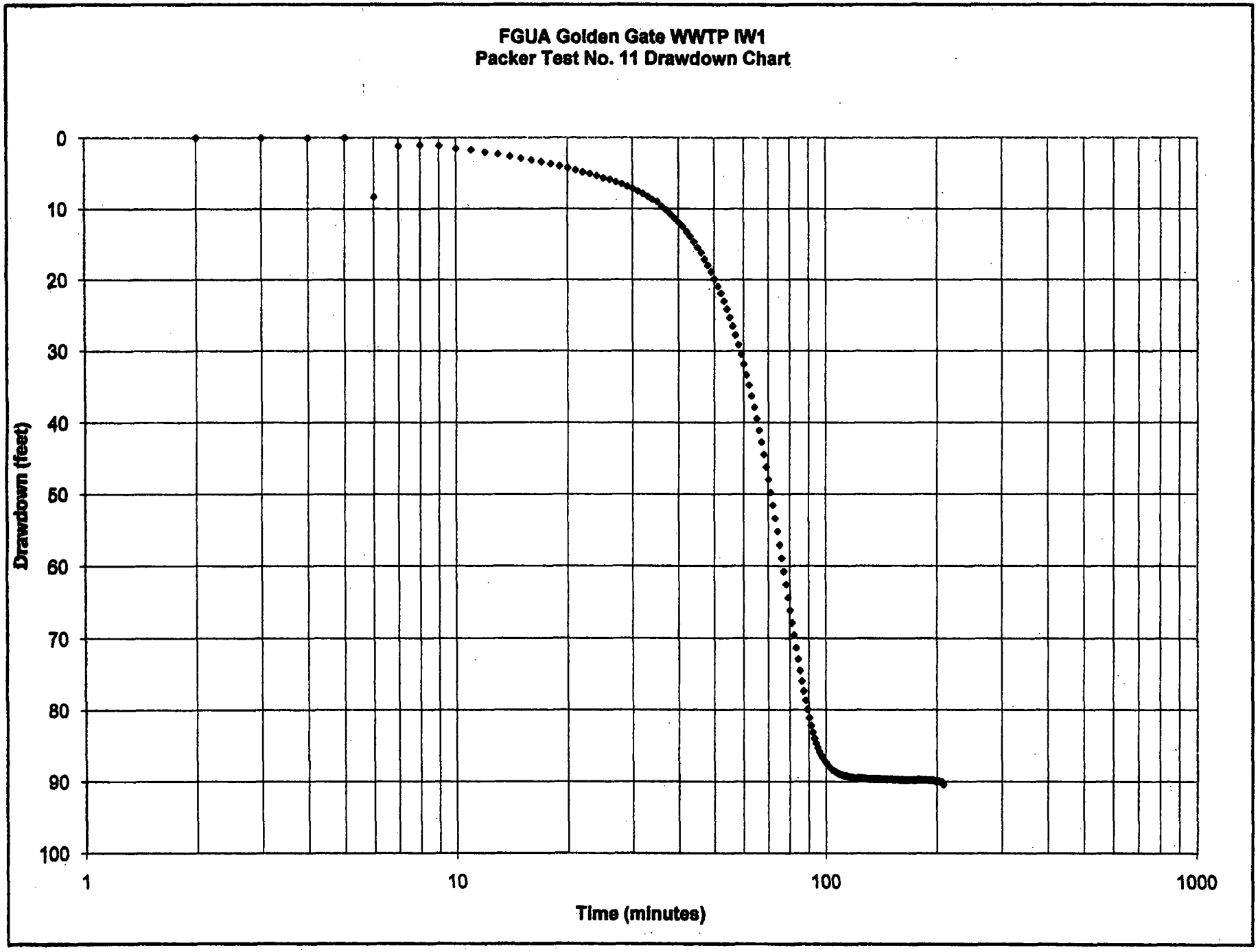
Start date: 5/24/2008
End date: 5/24/2008

Flowmeter Total-Start (gal) : n/a	87710	Open Hole Total Depth (feet bpl) :	3007 (obstacle)
Flowmeter Total- End (gal) : n/a	91545	Packer Depth Interval (feet bpl):	2266.6-2284.5
Average Test Pumping Rate (gpm) :	14.75	Pump Setting Depth (feet bpl):	178
Development Duration (min):	250	Transducer Depth (feet bpl):	166.1
Static DTW Before Test (feet apl):	5.28	Pipe and open hole volume:	3330+300=3660 gals

Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bpl)	Temp. (°C)	Cond. (mS/cm)	Chlorides (mg/L)	Comments
Development									
5/24/08	23:48	0	40	0	6.63 apl	n/a	n/a	n/a	Pump-on, start development. Annulus: 13.32
5/24/08	0:14	26	19	810	128.10	26.8	49,900	17,000	Packers: 320 psi. Annulus: 12.00 ft.
5/24/08	0:36	48	19.4	1410	129.33	n/a	n/a	n/a	
5/24/08	1:11	83	18.9	2060	129.90	27.4	49,200	16,500	Annulus 12.05 ft.
5/24/08	1:48	120	18.8	2190	130.81	28.3	48,900	16,500	Annulus 12.12 ft.
5/24/08	2:38	170	18.8	3125	130.26	28.1	54,300	18,500	Water cloudy; annulus: 12.23 ft.
5/24/08	3:18	210	19.1	3890	130.32	28.3	54,600	18,500	Water clear, annulus: 12.3 ft.
5/24/08	3:48	240	19.0	4460	130.46	28.2	54,700	18,500	Adjust rate to 17 gpm.
5/24/08	3:58	250	17.0	4620	n/a	n/a	n/a	n/a	Pump-off, start pre-test recovery.
Pumping Test									
5/24/08	11:40	0	16.5	0	5.28 apl	n/a	n/a	n/a	Pump-on, start test. Annulus: 13.71 ft.
5/24/08	11:45	5	15.2	80	83.64	28.3	54,800	18,500	Annulus: 12.91ft.
5/24/08	12:13	33	15.1	505	83.64	28.3	54,800	18,500	Annulus: 12.91ft.
5/24/08	12:50	70	14.8	1,055	84.65	28.4	55,000	18,500	Annulus: 12.84ft.
5/24/08	13:20	100	14.6	1,500	84.70	n/a	n/a	n/a	Annulus: 12.88ft.
5/24/08	13:50	130	14.3	1,930	84.76	28.1	54,200	18,000	Increase rate. Water slightly cloudy.
5/24/08	14:05	145	15.1	2,155	93.80	n/a	n/a	n/a	Water clear.
5/24/08	14:35	175	14.8	2,600	96.14	28.3	54,100	18,000	Annulus:12.85 ft.
5/24/08	15:10	210	14.6	3,110	96.33	n/a	n/a	n/a	
5/24/08	15:40	240	14.6	3,545	96.39	n/a	n/a	n/a	Annulus:12.89 ft.
5/24/08	15:56	256	14.6	3,780	96.39	n/a	54,000	18,000	Collect lab. Sample.
5/24/08	16:00	260	14.6	3,835	n/a	n/a	n/a	n/a	Pump-off, begin recovery.

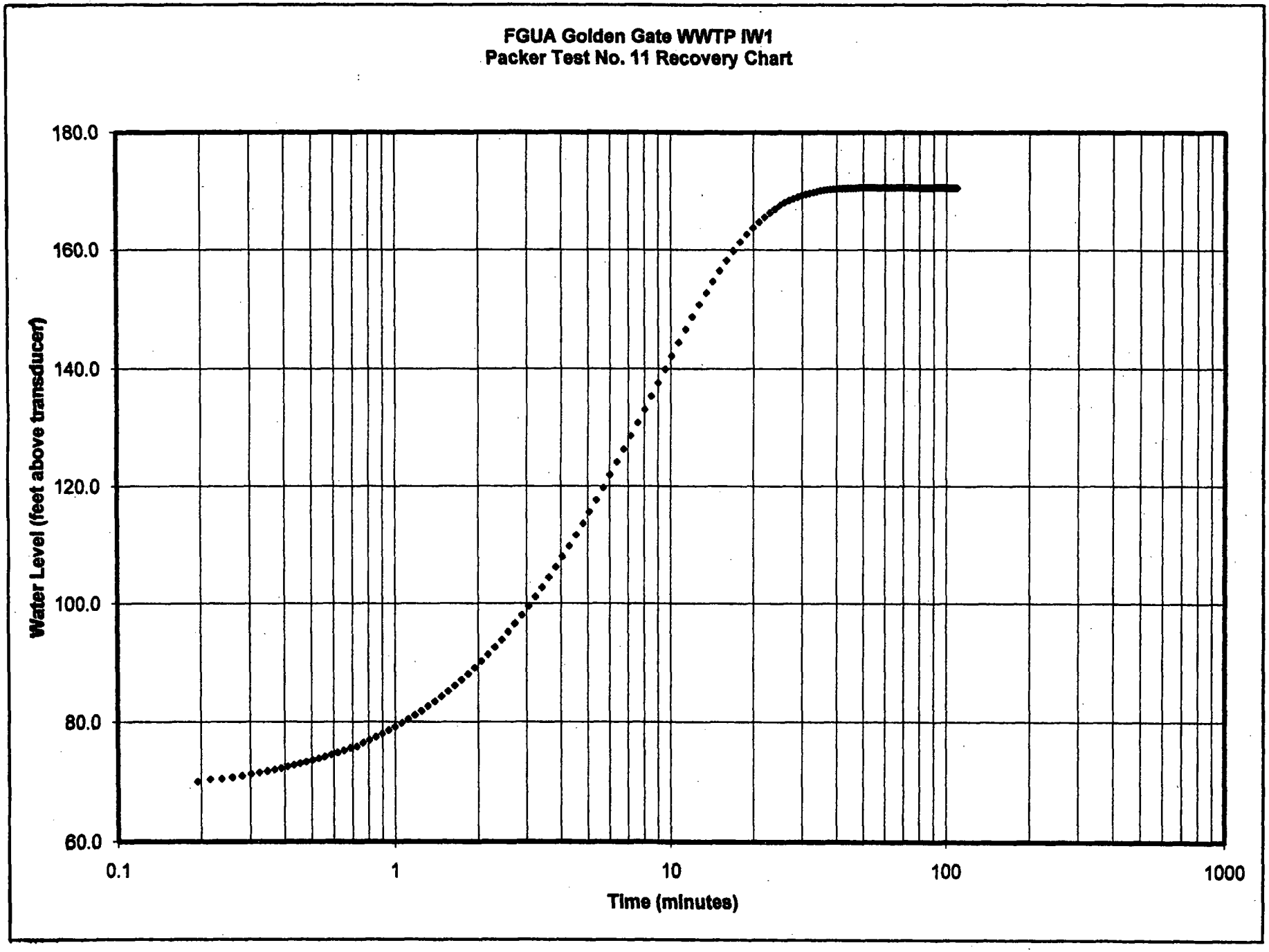
Notes:

"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"feet apl" denotes feet above pad level.
"°C" denotes degrees celsius.
"mS/cm" denotes milliSiemans per centimeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.
"N/M" denotes not measured.



C:\Documents and Settings\Golden Gate\GG IW1 final cag request\Append-C- Packer Test WQ data\IW1 Packer Tests\PT#11\Tables and charts\
PT # 11 DD.xls

FGUA Golden Gate WWTP IW1
Packer Test No. 11 Recovery Chart



C:\Documents and Settings\Golden Gate\GG IW1 final csg request\Append-C- Packer Test WQ data\IW1 Packer Tests\PT#11\Tables and charts\
PT # 11 Rec.xls

ARCADIS

Appendix D

Casing Mill Certificates and FRP Product Sheets

GOLDEN GATE WASTEWATER TREATMENT FACILITY

CLASS I INJECTION WELL SYSTEM

MILL CERTIFICATIONS

MONITOR WELL MW1

24-INCH O.D., 0.375-INCH WALL THICKNESS, STEEL CASING

YOUNGQUIST BROTHERS, INC.
Has Received This Shop Drawing/Submittal
FBI/Section No# 11360-020-A
Date: 1/04/08
Signature: [illegible]

YIEH CORPORATION LIMITED

MILL CERTIFICATE

COMMODITY: CARBON STEEL PIPE PER SALES CONTRACT
NO. SEUSFP6C02TD3 DATED DECEMBER 11, 2006.
CUSTOMER: OZONE INDUSTRIES CORPORATION
15465 PINE RIDGE ROAD
FORT MYERS, FL 33908

CERTIFICATE NO:PSCNJN6C01TC5
DATE OF ISSUE:4/29/2007

Invoice No. SEUSFP6C02TD3
LC NUMBER.: 5279996

The CARBON STEEL PIPES are tested according to ASTM A139 GR.B
This is to certify that in accordance with the relevant specifications and contracts.
The CARBON STEEL PIPES manufactured were tested and qualified by our Quality Control Department.

TOTAL : 746 PCS / 29840FT / 1769.619MT

Pipes No.	Heat Numbers	Steel	Size			Quantity			Dimensional	TESTING RESULTS										Flattening	UT Test
			O.D.	W.T.	Length					CHEMICAL PROPERTIES(%)					PHYSICAL PROPERTIES			Welding properties	Hydrostatic Test Holding time/Pis		
		Grade	In	In	ft	Pcs	ft	MT	Inspection	C	Si	Mn	P	S	σs(Mpa)	σb(Mpa)	δ5(%)	σb	P = Psi	Test (B)	Test (B)
18	238404	B	20	0.375	40	5	200	7.138	OK	0.18	0.21	0.40	0.014	0.029	310	425	31	OK	678	OK	OK
19	238403	B	20	0.375	40	5	200	7.138	OK	0.17	0.25	0.44	0.013	0.030	310	425	32	OK	678	OK	OK
20	175702	B	20	0.375	40	4	160	5.710	OK	0.19	0.26	0.45	0.016	0.033	300	420	31.5	OK	678	OK	OK
21	176807	B	20	0.375	40	5	200	7.138	OK	0.18	0.18	0.39	0.008	0.030	315	435	31	OK	678	OK	OK
22	176501	B	20	0.375	40	2	80	2.854	OK	0.15	0.19	0.38	0.009	0.028	315	425	31.5	OK	678	OK	OK
23	010505√	B	24	0.375	40	4	160	6.874	OK	0.19	0.26	0.46	0.013	0.033	305	420	31.5	OK	563	OK	OK
24	010506√	B	24	0.375	40	4	160	6.874	OK	0.17	0.23	0.45	0.014	0.027	295	420	32	OK	563	OK	OK
25	012602	B	24	0.375	40	4	160	6.874	OK	0.18	0.22	0.43	0.013	0.028	315	430	31.5	OK	563	OK	OK
26	013201√	B	24	0.375	40	4	160	6.874	OK	0.18	0.24	0.48	0.011	0.033	320	425	32.5	OK	563	OK	OK
27	012005	B	24	0.375	40	4	160	6.874	OK	0.17	0.25	0.44	0.012	0.032	315	420	32	OK	563	OK	OK
28	012604√	B	24	0.375	40	4	160	6.874	OK	0.16	0.19	0.40	0.011	0.030	310	420	31.5	OK	563	OK	OK
29	011705	B	24	0.375	40	4	160	6.874	OK	0.17	0.21	0.44	0.013	0.031	315	420	32	OK	563	OK	OK
30	011701	B	24	0.375	40	4	160	6.874	OK	0.17	0.25	0.43	0.013	0.032	315	425	30.5	OK	563	OK	OK
31	011505√	B	24	0.375	40	4	160	6.874	OK	0.18	0.21	0.42	0.012	0.030	310	425	32	OK	563	OK	OK
32	011702√	B	24	0.375	40	4	160	6.874	OK	0.18	0.24	0.46	0.010	0.033	305	420	32.5	OK	563	OK	OK
33	011504√	B	24	0.375	40	4	160	6.874	OK	0.17	0.23	0.44	0.012	0.031	320	425	31.5	OK	563	OK	OK
34	015001	B	24	0.375	40	4	160	6.874	OK	0.17	0.22	0.43	0.011	0.032	305	425	32	OK	563	OK	OK

YIEH CORPORATION LIMITED

GOLDEN GATE WASTEWATER TREATMENT FACILITY

CLASS I INJECTION WELL SYSTEM

MILL CERTIFICATIONS

MONITOR WELL MW1

16-INCH O.D., 0.375-INCH WALL THICKNESS, STEEL CASING

성적서 번호
CERTIFICATE NO. : 6A02409
발행일자
DATE OF ISSUE. : 2007/01/22
계약번호
CONTRACT(P/O) NO. : 58699
품명
COMMODITY : E.R.W. STEEL PIPE
제품규격
SPECIFICATION : API 5L X42/AP; 5LB PSL1/ASTM A53B/ASME SA53B

페이지
PAGE 1 of 2

200002548

검 사 증 명 서(A)

MILL INSPECTION CERTIFICATE

EN10204 TYPE 3.1 B-1991

고 객 사
CUSTOMER : 현대종합상사

HYUNDAI HYSCO 현대하이스코주식회사 HYUNDAI HYSCO

본사·공장 (ULSAN PLANT) : 울산광역시 북구 염포동 265번지 683-040
#265 YUMPO-DONG, BUK-KU, ULSAN,KOREA
TEL:82-52-280-014, FAX:82-52-287-8916

서울사무소 (SEOUL OFFICE) : 서울시 강남구 역삼동 837-36번지 랜드마크타워 135-080
LANDMARK TOWER 837-36, YEOKSAM-DONG, GANGNAM-KU, SEOUL, KOREA
TEL:82-2-2112-8114, FAX:82-2-775-7095

관종 TYPE OF PIPE END	치수 DIMENSION 외경 × 두께 × 길이 (OUTDIA × THICK × LENGTH)			수량 QUAN-TITY	중량 WEIGHT	수압시험 HYDRO-STATIC TEST		제강번호 HEAT NO.	인장시험 TENSILE TEST (Gage Length : 2 INCH)				화학성분(%); CHEMICAL COMPOSITION																경도 HARD-NESS	충격시험 IMPACT TEST (℃)		도막시험 COATING TEST			비고 REM-ARK
						PSI	※5		항복강도 YIELD STRENGTH	인장강도 TENSILE STRENGTH ※7 B	인장강도 TENSILE STRENGTH ※7 W	연신율 E.L		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Ti	Nb			Al	CEQ ※9		흡수에너지 ABSORBED ENERGY	전단파면율 SHEAR AREA	아연부착량 WEIGHT OF ZINC COAT	균일성 DIP TEST	TIMES	※5	
※1	※2	※3	※4	(PCS)	(KG)				※6	Mpa/PSI		%	※6	×100			×1000		×100									×1000		HV	JOULE	%	g/㎡	TIMES		
EB BE	NB	14" X .375" X 42.000'		110	114,160	1,910	G	SB52384		300	464	486	36		18	1	76	13	10	2	2	1	1	TR	TR	TR									
										44,000	66,000	71,100																						
				27	28,021	1,910	G	SB52387		298	453	472	37		17	2	77	15	7	2	2	1	1	TR	TR	TR									
										43,800	65,400	68,200																						
EB BE	NB	14" X .500" X 42.000'		76	104,474	2,550	G	SB52230		313	484	509	37		19	2	86	14	6	2	1	2	1	TR	TR	TR									
										45,500	69,700	72,000																						
				1	1,375	2,550	G	SR18481		328	477	501	36		17	2	85	12	3	2	2	1	1	TR	TR	TR									
										48,300	69,700	72,500																						
EB BE	NB	[redacted]		165	260,428	2,230	G	[redacted]		345	474	496	38		16	3	75	15	9	2	2	1	1	TR	TR	TR									
										49,700	68,200	72,500																						
						2,230	G	C633979		300	440	481	37		15	3	80	14	7	2	2	1	1	TR	TR	TR									
										44,000	64,000	69,800																						
						2,230	G	C624349		299	452	471	38		18	2	76	12	8	2	2	1	1	TR	TR	TR									

※10 HEAT TREATMENT	※11 VISUAL & DIMENSION TEST	※12 FLATTENING, BEND, GUIDED BEND TEST	※13 R-FLATTENING TEST	※14 FLARING TEST	※15 NONDESTRUCTIVE TEST (U.T)	※16 R.M.T	※17 CRUSH TEST	※18 DRIFT TEST	※19 FLANGE TEST
GOOD	GOOD	GOOD			GOOD	GOOD			

NOTE 1 ※1 Type of pipe End 관형

EB:ERW흑관(일반)	RB:SAW흑관(일반)	TC:Thread Coupling
EA:ERW흑스폿관	RG:SAW백관(일반)	RG:Roll Grooving
EG:ERW백관(일반)	RS:SAW스파이럴관	VG:Victaulic Grooving
EC:ERW흑나사관	PE:Plain End	PC:Plain End + Coupled
ED:ERW백나사관	BE:Bevel End	PB:Plain End + Bevel End
EN:ERW백단관비계	TE:Thread End	BD:Bell End

※2 NB:Nominal Bore 호칭경, OD:Outside Diameter
※3 Unit 단위(M:mm, I:inch)
※4 Unit 단위(M:Meter, F:Feet, I:inch)
※5 G:GOOD
※6 L:Longitudinal 압연방향, T:Transverse 원주방향
※7 B:Base Metal 모재부, W:Weld Part 용접부
※8 H:Heat(Ladle) Analysis 용연분석, P:Product Analysis 제품분석, WP:Weld Product Analysis 용접부 제품분석
※9 CEQ=C+Mn/6+(Ni+Cu)/15+(Cr+Mo+V)/5 용기탄소량
※10:Heat Treatment 열처리
※11 Visual & Dimension Test 육안 및 치수검사
※12 Flattening/Bend/Guided Bend Test 편평/벤드/굽힘시험
※13:Reverse Flattening Test 전개시험
※14 Flaring Test 압확시험
※15 Nondestructive Test 비파괴검사
※16:Residual Magnetism Test 잔류자장시험
※17:Crush Test 충압시험
※18:Drift Test 관통시험
※19:Flange Test 플랜지시험

NOTE 2 • SPEC YEAR – API 2004/ASTM 2004/ASME 2004

본 제품은 관련 규격에 합격되었음을 보증합니다.
WE HEREBY CERTIFY THAT MATERIAL DESCRIBED HEREIN HAS BEEN ACCEPTED IN ACCORDANCE WITH THE PRESCRIBED SPECIFICATION AND ORDER
• 본 검사증명서에 명기된 규격외도의 사용시 안전상 문제가 발생할 수 있으며, 검사증명서 위,변조시 사문서 위조로 법이익을 당하실 수 있습니다.

H. J. KIM
INSPECTION MANAGER

YOUNGQUIST BROTHERS, INC.
Has Reviewed this Shop Drawing/Submittal
For/Section No. # 15360-006-A
Transmittal No. # ____ Date: 1/25
Signature MBK
-CS

성적서 번호
CERTIFICATE NO. : 6A02409
발행일자
DATE OF ISSUE. : 2007/01/22
계약번호
CONTRACT(P/O) NO. : 58699
품명
COMMODITY : E.R.W. STEEL PIPE
제품규격
SPECIFICATION : API 5L X42/API 5LB PSL1/ASTM A53B/ASME SA53B

페이지
PAGE 2 of 2

200002548

검 사 증 명 서(A)

MILL INSPECTION CERTIFICATE
EN10204 TYPE 3.1 B-1991

고 객 사
CUSTOMER : 현대종합상사

HYUNDAI HYSCO
현대하이스코주식회사
HYUNDAI HYSCO

본사·공장 (ULSAN PLANT) : 울산광역시 북구 염포동 265번지 683-040
#265 YUMPO-DONG, BUK-KU, ULSAN,KOREA
TEL:82-52-280-014, FAX:82-52-287-8916

서울사무소 (SEOUL OFFICE) : 서울시 강남구 역삼동 837-36번지 랜드마크타워 135-080
LANDMARK TOWER 837-36, YEOKSAM-DONG, GANGNAM-KU, SEOUL, KOREA
TEL:82-2-2112-8114, FAX:82-2-775-7095

관종 TYPE OF PIPE END	치수 DIMENSION 외경 × 두께 × 길이 (OUTDIA × THICK × LENGTH)			수량 QUAN-TITY	중량 WEIGHT	수압시험 HYDRO-STATIC TEST		처강번호 HEAT NO.	인장시험 TENSILE TEST (Gage Length : 2 INCH)				화학성분(%) CHEMICAL COMPOSITION															경도 HARD-NESS	충격시험 IMPACT TEST (℃)		도막시험 COATING TEST			비고 REMARK
									항복강도 YIELD STRENGTH	인장강도 TENSILE STRENGTH		연신율																					
										※7 B	※7 W		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Ti	Nb			Al	CEQ ※9					
※1	※2	※3	※4	(PCS)	(KG)	PSI	※5		※6	Mpa/PSI		%	※8	×100			×1000		×100									×1000	HV	JOULE	%	g/㎡	TI-MES	※5	
						2,230	G	C624250		305	460	485	37		16	2	80	15	9	2	2	1	1	TR	TR	TR								
						[illegible]		[illegible]		315	455	477	37		16	2	78	11	6	2	2	1	1	TR	TR	TR								
						[illegible]		[illegible]		380	474	497	38		15	2	80	15	6	2	2	1	1	TR	TR	TR								
	TOTAL →			379	508.459																												

※10 HEAT TREATMENT	※11 VISUAL & DIMENSION TEST	※12 FLATTENING, BEND, GUIDED BEND TEST	※13 R-FLATTENING TEST	※14 FLARING TEST	※15 NONDESTRUCTIVE TEST (U.T)	※16 R.M.T	※17 CRUSH TEST	※18 DRIFT TEST	※19 FLANGE TEST
GOOD	GOOD	GOOD			GOOD	GOOD			

NOTE 1 ※1 Type of pipe End 관종

EB:ERW흑관(일반)	RB:SAW흑관(일반)	TC:Thread Coupling
EA:ERW흑소둔관	RG:SAW백관(일반)	RG:Roll Grooving
EG:ERW백관(일반)	RS:SAW스파이럴관	VG:Victaulic Grooving
EC:ERW흑나사관	PE:Plain End	PC:Plain End + Coupled
ED:ERW백나사관	BE:Bevel End	PB:Plain End + Bevel End
EN:ERW백단관비계	TE:Thread End	BD:Bell End

※2 NB:Nominal Bore 호칭경, OD:Outside Diameter
※3 Unit 단위(M:mm, Inch)
※4 Unit 단위(M:Meter, F:Feet, Inch)
※5 G:GOOD
※6 L:Longitudinal 인연방향, T:Transverse 원주방향
※7 B:Base Metal 모재부, W:Weld Part 용접부
※8 H:Heat(Ladle) Analysis 염연분석, P:Product Analysis 제품분석, WP:Weld Product Analysis 용접부 제품분석
※9 CEQ=C+Mn/6+(Ni+Cu)/15+(Cr+Mo+V)/5 등가탄소량
※10:Heat Treatment 열처리
※11 Visual & Dimension Test 육안 및 치수검사
※12 Flattening/Bend/Guided Bend Test 편평/벤드/굴요시험
※13:Reverse Flattening Test 전개시험
※14 Flaring Test 압확시험
※15 Nondestructive Test 비파괴검사
※16:Residual Magnetism Test 잔류자장시험 ※17:Crush Test 압압시험
※18:Drift Test 관통시험
※19:Flange Test 플랜지시험

NOTE 2 • SPEC YEAR – API 2004/ASTM 2004/ASME 2004

본 제품은 검정 규격에 합격되었음을 보증합니다.
WE HEREBY CERTIFY THAT MATERIAL DESCRIBED HEREIN HAS BEEN ACCEPTED IN ACCORDANCE WITH THE PRESCRIBED SPECIFICATION AND ORDER
• 본 검사증명서에 명기된 규격외도외 사용시 인정상 문제가 발생할 수 있으며, 검사증명서 위,변조시 사문서 위조로 법적책임을 당하실 수 있습니다.

H. J. KIM
INSPECTION MANAGER

YOUNGQUIST BROTHERS, INC.
Has Reviewed this Shop Drawing/Submittal
YBI/Section No. # HG60-006-A1
Transmittal No. # Date: 1/25
Signature MBE

성적서 번호
CERTIFICATE NO. : 6B00326
발행일자
DATE OF ISSUE. : 2006-11-06
계약번호
CONTRACT(P/O) NO. : 58699
품명
COMMODITY : E.R.W. STEEL PIPE
제품규격
SPECIFICATION : API 5L X42/API 5LB PSL1/ASTM A53B/ASME SA53B

200002548

검 사 증 명 서(A)
MILL INSPECTION CERTIFICATE

고 객 사
CUSTOMER : 현대종합상사

HYUNDAI HYSCO 현대하이스코주식회사
HYUNDAI HYSCO

본사·공장
(ULSAN PLANT) : 울산광역시 북구 염포동 285번지 683-040
#285 YUMPO-DONG, BUK-KU, ULSAN, KOREA
TEL:82-52-280-014, FAX:82-52-287-8918

서울사무소
(SEOUL OFFICE) : 서울시 강남구 역삼동 837-36번지 랜드마크타워 135-080
LANDMARK TOWER 837-36, YEOKSAM-DONG, GANGNAM-KU, SEOUL, KOREA
TEL:82-2-2112-8114, FAX:82-2-775-7095

관형 TYPE OF PIPE END	치수 DIMENSION 외경 × 두께 × 길이 (OUTDIA × THICK × LENGTH)	수량 QUAN-TITY	중량 WEIGHT	수압시험 HYDRO-STATIC TEST		제강번호 HEAT NO.	인장시험 TENSILE TEST (Gage Length : 2 INCH)				화학성분(%) CHEMICAL COMPOSITION																경도 HARD-NESS	충격시험 IMPACT TEST (℃)		도막시험 COATING TEST		비고 REMARK
				PSI	※5		항복강도 YIELD STRENGTH	인장강도 TENSILE STRENGTH ※7 B	인장강도 TENSILE STRENGTH ※7 W	연신율 E.L		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Ti	Nb			Al	CEQ ※9		흡수에너지 ABSORBED ENERGY	전단파면율 SHEAR AREA	아연부착량 WEIGHT OF ZINC COAT	균일성 DIP TEST	
※1	※2 ※3 ※4	(PCS)	(KG)				※6	Mpa/PSI		%	※6	× 100			× 1000		× 100									× 1000	HV	JOULE	%	g/㎡	TIMES	※5	
EB BE	[redacted]	7	11,049	2,230	G	[redacted]	317	489	510	37		19	2	39	14	3	2	1	2	1	TR	TR	TR								
							46,000	71,100	73,900																						
		3	4,735	2,230	G	[redacted]	299	456	483	36		17	2	39	19	8	2	2	1	1	TR	TR	TR								
							44,000	66,000	69,700																						
EB BE	NB 24" X .250" X 42.000"	18	21,954	790	G	8Q91572	300	454	475	36		15	TR	67	15	7	2	2	1	1	TR	TR	TR								
							44,000	66,000	69,700																						
	TOTAL →	28	37,738																												

※10 HEAT TREATMENT	※11 VISUAL & DIMENSION TEST	※12 FLATTENING, BEND, GUIDED BEND TEST	※13 R-FLATTENING TEST	※14 FLARING TEST	※15 NONDESTRUCTIVE TEST (U.T)	※16 R.M.T	※17 CRUSH TEST	※18 DRIFT TEST	※19 FLANGE TEST
GOOD	GOOD	GOOD			GOOD	GOOD			

NOTE 1 ※1 Type of pipe End 관종

EB:ERW흑관(일반)	RB:SAW흑관(일반)	TC:Thread Coupling
EA:ERW흑스로관	RG:SAW백관(일반)	RG:Roll Grooving
EG:ERW백관(일반)	RS:SAW스테이관	VG:Victaulic Grooving
EC:ERW흑나사관	PE:Plain End	PC:Plain End + Coupled
ED:ERW백나사관	BE:Bevel End	PB:Plain End + Bevel End
EN:ERW백관비계	TE:Thread End	BD:Bell End

※2 NB:Norminal Bore 호칭경, OD:Outside Diameter
※3 Unit 단위(M:mm, I:Inch)
※4 Unit 단위(M:Meter, F:Feet, I:Inch)
※5 G:GOOD
※6 L:Longitudinal 압연방향, T:Transverse 원주방향
※7 B:Base Metal 모재부, W:Weld Part 용접부
※8 H:Heat(Ladle) Analysis 얼런분석, P:Product Analysis 제품분석, WP:Weld Product Analysis 용접부 제품분석
※9 CEQ=C+Mn/6+(Ni+Cu)/15+(Cr+Mo+V)/5 등가탄소량
※10:Heat Treatment 열처리
※11 Visual & Dimension Test 육안 및 치수검사
※12 Flattening/Bend/Guided Bend Test 편평/밴드/굽힘시험
※13:Reverse Flattening Test 전개시험
※14 Flaring Test 압확시험
※15 Nondestructive Test 비파괴검사
※16:Residual Magnetism Test 잔류자장시험 ※17:Crush Test 충압시험
※18:Drift Test 관통시험
※19:Flange Test 플랜지시험

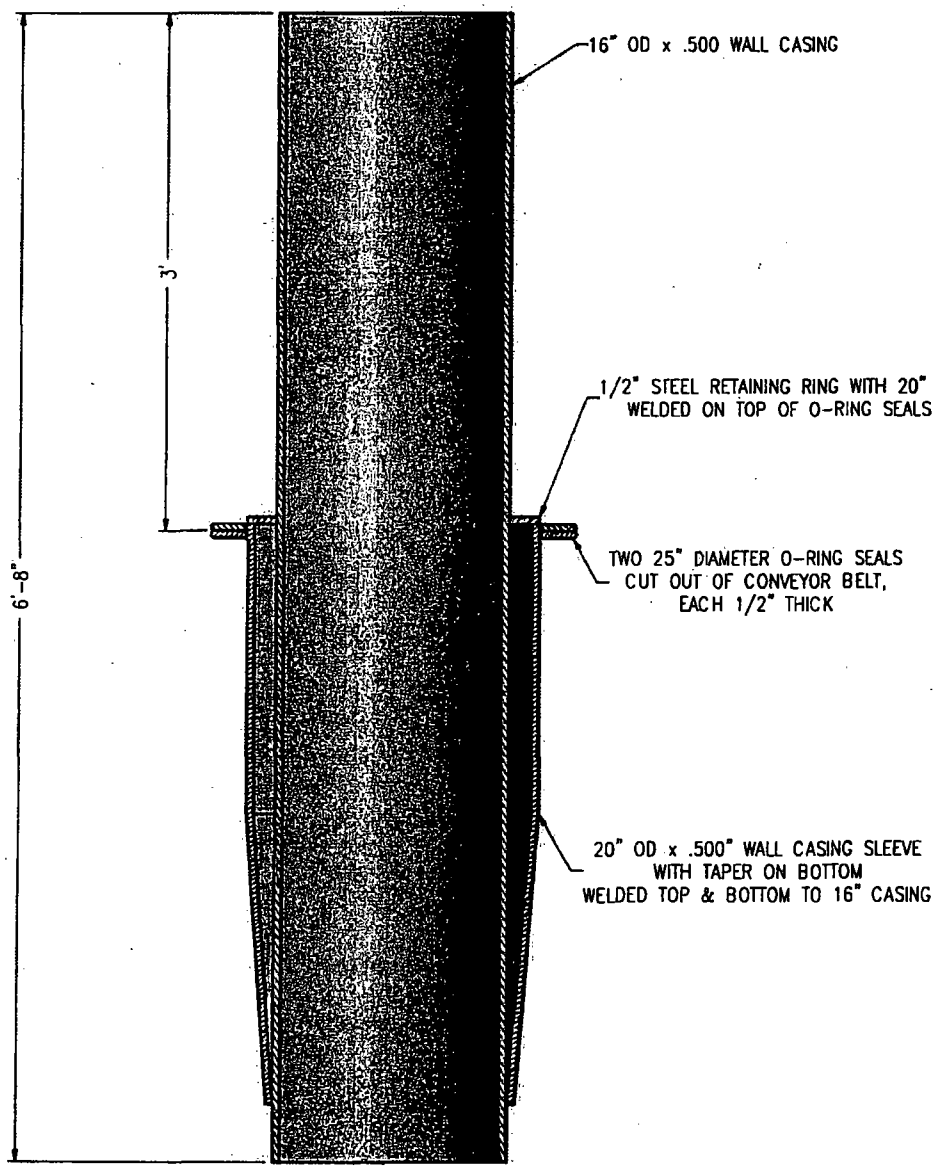
NOTE 2 * SPEC YEAR - API 2004/ASTM 2004/ASME 2004

본 제품은 관련 규격에 합격되었음을 보증합니다.
WE HEREBY CERTIFY THAT MATERIAL DESCRIBED HEREIN HAS BEEN ACCEPTED IN ACCORDANCE WITH THE PRESCRIBED SPECIFICATION AND ORDER
* 본 검사증명서에 명기된 규격외도의 사용시 안전상 문제가 발생할 수 있으며, 검사증명서 위·변조시 사본서 위조로 불이익을 당하실 수 있습니다.

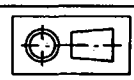
H. J. KIM
INSPECTION MANAGER

YOUNGQUIST BROTHERS, INC.
Has Reviewed this Shop Drawing/Submittal
YBI/Section No. #: 16300-006-H
Transmittal No. #: _____ Date: 1/23
Signature MBE
-CS

YOUNGQUIST BROTHERS, INC.
Has Received This Shop Drawing/Submittal
Bl/Section No: 11360-031-A
Date: 2/6/08
Signature: [signature]



* THIS WILL BE WELDED ONTO THE BOTTOM OF OUR FIRST JOINT OF CASING WITH THE O-RING SEALS SET AT 1080'.

TOLERANCES (UNLESS SPECIFIED) FRACTIONS: BELOW 1" 1/64" 1"-12" 1/32" ABOVE 12" 1/16" DECIMALS: .XX ±.01 .XXX ±.005 ANGLES ±1/4° SURFACE FINISH VALUES IN Ra MICRONS	Material  DRAWN TO ANSI STDS DIMENSIONS IN INCHES DO NOT SCALE	YOUNGQUIST BROTHERS, INC. 15465 Pine Ridge Road, Fort Myers, Florida 33908 GOLDEN GATE WASTE WATER TREATMENT PLANT MONITOR WELL (MW-1) 16" CASING ON UPPER ZONE 16" SEAL ASSEMBLY	Drawn JAM — Date 2/5/2008 Checked — Date Approved — Date Sheet Size B — Scale — Project No Drawing Number 16 - Seal Assembly.idw Sh 1 of 1 — Revision 0

GOLDEN GATE WASTEWATER TREATMENT FACILITY

CLASS I INJECTION WELL SYSTEM

PRODUCT SHEET

MONITOR WELL MW1

NOMINAL $6^{5}/_{8}$-INCH DIAMETER FRP TUBING

FUTURE PIPE INDUSTRIES
Complete Pipe System Solutions

RED BOX 1750

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

DIMENSIONAL SPECIFICATIONS

February 2005

Nominal Size (inches)	Nominal I.D. (inches)	Minimum Drift Dia (inches)	Nominal O.D. (inches)	Nominal Wall (inches)	Pin Upset O.D. (inches)	Max Box OD* (inches)	Nominal Weight (lbs/ft)	Nominal Weight (lbs/it)	Connection Type API 5B, Table 14*, 7**, 6*** Fourteenth Edition August 88
2-3/8	2.00	1.91	2.29	0.15	2.69	3.45	0.9	27	2-3/8" 8Rd EUE Long*IJ
2-7/8	2.47	2.37	2.83	0.18	3.19	3.95	1.4	41	2-7/8" 8Rd EUE Long*IJ
3-1/2	3.00	2.90	3.44	0.22	3.85	4.84	2.0	61	3-1/2" 8Rd EUE Long*IJ
4	3.33	3.24	3.81	0.24	4.35	5.33	2.6	78	4" 8Rd EUE Long* TC
4-1/2	3.98	3.89	4.57	0.29	4.85	5.95	3.5	105	4-1/2" 8Rd EUE Long*IJ
5-1/2	4.42	4.33	5.06	0.32	5.60	6.74	4.4	131	5-1/2" 8Rd Csg Long*"IJ
6-5/8	5.43	5.33	6.21	0.39	6.73	8.02	6.6	197	6-5/8" 8Rd Csg Long*"IJ
7	6.21	6.11	7.11	0.45	7.10	8.61	8.1	243	7" 8Rd Csg Long*"IJ
7-5/8	6.21	6.11	7.11	0.45	7.73	9.40	8.7	262	7-5/8" 8Rd Csg Long*"IJ
9-5/8	7.84	7.75	8.98	0.57	9.73	11.88	14.0	419	9-5/8" 8Rd Csg*** IJ
10-3/4	8.85	8.76	10.12	0.64	10.85	13.50	17.5	526	10-3/4" 8Rd Csg***IJ
11-3/4	10.72	10.62	12.11	0.70	12.61	15.20	24.1	724	11-3/4 8/6Rd L Csg TC
13-3/8	11.97	11.87	13.53	0.78	14.06	17.35	30.4	913	13-3/8 8/6Rd L Csg TC
16	14.48	14.39	16.37	0.95	16.96	22.20	45.8	1,374	16 6Rd Csg L TC
18	16.60	16.50	18.76	1.08	19.40	26.70	61.7	1,851	18 6Rd Csg L TC
20	17.88	17.89	20.33	1.17	21.00	30.00	74.0	2,220	20 6Rd Csg L TC

*Depending on the application, smaller maximum box diameters are available.

Thread lengths may exceed API LA

30 ft Standard Joint Length

PERFORMANCE AND RATINGS (-60 deg F to +210 deg F)

Nominal Size	Internal Pressure Rating (psi)	Mill Test Pressure (psi)	Collapse Rating (psi)	Axial Tension Rating (lbs)	Stretch vs Tension-Over-Pipe-Wt Stretch (ft) = Coeff. x P x L
2-3/8	1,750	2,100	1,600	15,000	0.393
2-7/8	1,750	2,100	1,600	22,500	0.217
3-1/2	1,750	2,100	1,600	32,000	0.148
4	1,750	2,100	1,500	40,000	0.126
4-1/2	1,750	2,100	1,600	46,500	0.084
5-1/2	1,750	2,100	1,500	55,500	0.072
6-5/8	1,750	2,100	1,600	72,500	0.047
7	1,750	2,100	1,600	76,500	0.035
7-5/8	1,750	2,100	1,600	86,500	0.035
9-5/8	1,750	2,100	1,600	140,500	0.022
10-3/4	1,750	2,100	1,500	161,500	0.018
11-3/4	1,750	2,100	1,200	127,194	0.020
13-3/8	1,750	2,100	1,200	156,000	0.016
16	1,750	2,100	1,200	197,000	0.011
18	1,750	2,100	1,200	226,000	0.008
20	1,750	2,100	1,200	245,000	0.007

Where: P = Tensile Load (1,000 lbs)
L = String Length (1,000 ft)

MECHANICAL AND PHYSICAL PROPERTIES

TUBING/CASING BODY PROPERTIES	UNIT	VALUE 2-3/8 - 10-3/4	VALUE 11-3/4 - 20	TEST METHOD
Tensile Strength, Hoop	psi	31,300	31,300	ASTM D1599
Tensile Strength, Axial	psi	30,000	12,000	ASTM D2105
Modulus of Elasticity, Axial	10E+06 psi	3.0	2.0	ASTM D2105
Specific Gravity	---	1.9	1.9	ASTM D792
Density	lbs/in^3	0.07	0.07	ASTM D792
Thermal Conductivity	Btu/hr/ft^2/in/degF	2.4	2.4	ASTM C177
Thermal Expansion Coefficient (Linear)	10E-05in/in/degF	1.1	1.2	ASTM D696
Flow Factor	---	150	150	Hazen Williams

ISO 9001 CERTIFIED

11811 Proctor Road • Houston, Texas 77038 • Phone: (281) 847-2967 • Fax: (281) 847-1931
Email: houston@future-pipe.com • website: www.futurepipe.com

FUTURE PIPE INDUSTRIES

Inspection Certificate

Job No: 110000074 January 15, 2008

Purchaser: Youngquist SO #: 62L000413

Destination: Golden Gate, Florida

Product: 6 5/8" RB 1750 Quantity: 1180 Ft

We hereby certify that the materials & fittings supplied have been tested and comply with API 15 HR spec's.

Material Certificate

Material: 6 5/8" RB 1750

Test pressure: 2100 psi

Certificate Number: FPI-2007-39

Customer: Youngquist

Sales Order: 62L000413

Produced By: Future Pipe Industries, Inc. - Houston, TX

FPI Order Number: 110000074

Pipe System: Aromatic Amine heat cured epoxy

YOUNGQUIST BROTHERS, INC.
Has Received This Shop Drawing Submittal
YBI/Section No# 11360-007-A
Date: 1/16/08
Signature:

Raw Material Specifications:

Resin type- Epoxy
Curing Agent- Aromatic Amine
Glass Fiber- E-Type

Non Destructive Tests:

Dimensional Exam - ASTM D 3567
Visual Standards – API 15 HR Table 2

We hereby certify that the materials described above have been tested and comply with API 15 HR.

Certificate of conformity Statement:
All items delivered under this certificate number were manufactured in accordance with API 15 HR specifications:

We hereby certify that the materials described above have been tested and comply API 15 HR.

_____

QC Supervisor
Future Pipe Industries
11811 Proctor Rd Houston TX, 77038

FUTURE PIPE INDUSTRIES

Inspection Certificate

Job No: 100000135 February 11, 2008

Purchaser: Youngquist SO #: 62L000648

Destination: Golden Gate, Florida

Product: 6 5/8" RB 2500 T&C Quantity: 360 Ft

We hereby certify that the materials & fittings supplied have been tested and comply with API 15 HR spec's.

Material Certificate

Material: 6 5/8" RB 2500

Test pressure: 2850 psi

Certificate Number: FPI-2007-42

Customer: Youngquist

Sales Order: 62L000648

Produced By: Future Pipe Industries, Inc. - Houston, TX

FPI Order Number: 100000135

Pipe System: Aromatic Amine heat cured epoxy

YOUNGQUIST BROTHERS, INC.
Has Received This Shop Drawing/Submittal
FBI/Section No# 11360-022-A
Date: 2/12/08
Signature: M. Fe

Raw Material Specifications:

Resin type- Epoxy
Curing Agent- Aromatic Amine
Glass Fiber- E-Type

Non Destructive Tests:

Dimensional Exam - ASTM D 3567
Visual Standards – API 15 HR Table 2

We hereby certify that the materials described above have been tested and comply with API 15 HR.

Certificate of conformity Statement:
All items delivered under this certificate number were manufactured in accordance with API 15 HR specifications:

We hereby certify that the materials described above have been tested and comply API 15 HR.

Raymond Jones
QC Supervisor
Future Pipe Industries
11811 Proctor Rd Houston TX, 77038

GOLDEN GATE WASTEWATER TREATMENT FACILITY

CLASS I INJECTION WELL SYSTEM

MILL CERTIFICATIONS

INJECTION WELL IW1

48-INCH O.D., 0.375-INCH WALL THICKNESS, STEEL CASING

Golden Gate

YOUNGQUIST BROTHERS, INC
Has Received This Shop Drawing/Submittal
YBI/Section No#: 11360-008-A
Date: 3/21/08
Signature: Wm Te,

YIEH CORPORATION LIMITED

MILL CERTIFICATE

COMMODITY: CARBON STEEL PIPES AS PER ASTM A139 GR.B SPIRAL WELDED, NORMAL MILL BLACK LACQUER FOR RUST PROTECTION, ONE END OF THE PIPE SHALL HAVE A BEVEL OF 30 DEGREES WITH A TOLERANCE PLUS FIVE, MINUS ZERO DEGREES. THE OTHER END OF THE PIPE WILL BE PLAIN, RIGHT AND ANGLE CUT. ALL BURRS REMOVED.

CERTIFICATE NO:PSCNJN7601TC5
DATE OF ISSUE:9/13/2007

CUSTOMER: OZONE INDUSTRIES CORPORATION
15465 PINE RIDGE ROAD
FORT MYERS, FL 33908

The CARBON STEEL PIPES are tested according to ASTM A139 GR.B
This is to certify that in accordance with the relevant specifications and contracts.
The CARBON STEEL PIPES manufactured were tested and qualified by our Quality Control Department.

Invoice No. SEUSFP7601TD3
LC NUMBER.: 64405427
TOTAL : 112 PCS / 4368 FT / 330.631 MT

Pipes No.	Heat Numbers	Steel	Size			Quantity			Dimensional	TESTING RESULTS										Flattening	UT Test
			O.D.	W.T.	Length					CHEMICAL PROPERTIES(%)					PHYSICAL PROPERTIES			Welding properties	Hydrostatic Test Holding time:10s		
		Grade	In	In	ft	Pcs	ft	MT	Inspection	C	Si	Mn	P	S	σs(Mpa)	σb(Mpa)	δ5(%)	σb	P = Psi	Test (B)	Test (B)
1	1-9160	B	52	0.375	39	14	546	51.258	OK	0.16	0.19	0.48	0.029	0.029	330	460	30	OK	505	OK	OK
2	1-9161	B	50	0.375	39	14	546	49.272	OK	0.17	0.19	0.47	0.030	0.038	325	455	33	OK	505	OK	OK
3	1-9161	B	48	0.375	39	14	546	47.286	OK	0.17	0.19	0.47	0.030	0.038	325	455	33	OK	505	OK	OK
4	1-9161	B	42	0.375	39	28	1092	82.658	OK	0.17	0.19	0.47	0.030	0.038	325	455	33	OK	505	OK	OK
5	1-9160	B	36	0.375	39	28	1092	70.743	OK	0.16	0.19	0.48	0.029	0.029	330	460	30	OK	505	OK	OK
6	1-9161	B	30	0.375	39	14	546	29.414	OK	0.17	0.19	0.47	0.030	0.038	325	455	33	OK	522	OK	OK
TOTAL						112	4368	330.631													

YIEH CORPORATION LIMITED

GOLDEN GATE WASTEWATER TREATMENT FACILITY

CLASS I INJECTION WELL SYSTEM

MILL CERTIFICATIONS

INJECTION WELL IW1

36-INCH O.D., 0.375-INCH WALL THICKNESS, STEEL CASING

YOUNGQUIST BROTHERS, INC.
Has Received This Shop Drawing/Submittal
/SI/Section No#: 11260-005-A
Date: 3/27/08
Signature: Wte

YIEH CORPORATION LIMITED

MILL CERTIFICATE

COMMODITY: CARBON STEEL PIPES AS PER ASTM A139 GR.B SPIRAL WELDED, NORMAL MILL BLACK LACQUER FOR RUST PROTECTION, ONE END OF THE PIPE SHALL HAVE A BEVEL OF 30 DEGREES WITH A TOLERANCE PLUS FIVE, MINUS ZERO DEGREES. THE OTHER END OF THE PIPE WILL BE PLAIN, RIGHT AND ANGLE CUT. ALL BURRS REMOVED.

CERTIFICATE NO:PSCNJN7601TC5
DATE OF ISSUE:9/13/2007

CUSTOMER: OZONE INDUSTRIES CORPORATION
15465 PINE RIDGE ROAD
FORT MYERS, FL 33908

The CARBON STEEL PIPES are tested according to ASTM A139 GR.B
This is to certify that in accordance with the relevant specifications and contracts.
The CARBON STEEL PIPES manufactured were tested and qualified by our Quality Control Department.

Invoice No. SEUSFP7601TD3
LC NUMBER.: 64405427
TOTAL : 112 PCS / 4368 FT / 330.631 MT

Pipes No.	Heat Numbers	Steel	Size			Quantity			Dimensional	TESTING RESULTS										Flattening	UT Test
			O.D.	W.T.	Length					CHEMICAL PROPERTIES(%)					PHYSICAL PROPERTIES			Welding properties	Hydrostatic Test Holding time:10s		
		Grade	in	in	ft	Pcs	ft	MT	Inspection	C	Si	Mn	P	S	σs(Mpa)	σb(Mpa)	δ5(%)	σb	P = Psi	Test (B)	Test (B)
1	1-9160	B	52	0.375	39	14	546	51.258	OK	0.16	0.19	0.48	0.029	0.029	330	460	30	OK	505	OK	OK
2	1-9161	B	50	0.375	39	14	546	49.272	OK	0.17	0.19	0.47	0.030	0.038	325	455	33	OK	505	OK	OK
3	1-9161	B	48	0.375	39	14	546	47.286	OK	0.17	0.19	0.47	0.030	0.038	325	455	33	OK	505	OK	OK
4	1-9161	B	42	0.375	39	28	1092	82.658	OK	0.17	0.19	0.47	0.030	0.038	325	455	33	OK	505	OK	OK
5	1-9160	B	36	0.375	39	28	1092	70.743	OK	0.16	0.19	0.48	0.029	0.029	330	460	30	OK	505	OK	OK
6	1-9161	B	30	0.375	39	14	546	29.414	OK	0.17	0.19	0.47	0.030	0.038	325	455	33	OK	522	OK	OK
TOTAL						112	4368	330.631													

YIEH CORPORATION LIMITED

YIEH CORPORATION LIMITED

MILL CERTIFICATE

COMMODITY: CARBON STEEL PIPE PER SALES CONTRACT
NO. SBUSFP6C02TD3 DATED DECEMBER 11, 2006.

CUSTOMER: OZONE INDUSTRIES CORPORATION
15465 PINE RIDGE ROAD
FORT MYERS, FL 33908

CERTIFICATE NO:PSCNJN6C01TC3
DATE OF ISSUE:4/29/2007

Invoice No. SBUSFP6C02TD3
LC NUMBER.: 5279996

The CARBON STEEL PIPES are tested according to ASTM A139 GR.B
This is to certify that in accordance with the relevant specifications and contracts.
The CARBON STEEL PIPES manufactured were tested and qualified by our Quality Control Department.

TOTAL : 746 PCS / 29840FT / 1769.619MT

Pipes No.	Heat Numbers	Steel	Size			Quantity			Dimensional	TESTING RESULTS										Flattening	UT Test
										CHEMICAL PROPERTIES(%)					PHYSICAL PROPERTIES			Welding properties	Hydrostatic Test Holding time:10s		
		Grade	In	In	ft	Pcs	ft	MT	Inspection	C	Si	Mn	P	S	σs(Mpa)	σb(Mpa)	δ5(%)	σb	P = Psi	Test (B)	Test (B)
171	058823	B	36	0.375	40	3	120	7.774	OK	0.14	0.14	0.35	0.016	0.029	305	425	32	OK	500	OK	OK
172	112002	B	36	0.375	40	2	80	5.183	OK	0.17	0.26	0.48	0.012	0.033	320	430	31.5	OK	500	OK	OK
173	010103	B	36	0.375	40	3	120	7.774	OK	0.15	0.19	0.37	0.009	0.028	305	425	31.5	OK	500	OK	OK
174	014402	B	36	0.375	40	3	120	7.774	OK	0.17	0.22	0.44	0.014	0.032	315	420	32	OK	500	OK	OK
175	014401	B	36	0.375	40	2	80	5.183	OK	0.16	0.21	0.41	0.012	0.029	280	420	31.5	OK	500	OK	OK
176	012201	B	36	0.375	40	3	120	7.774	OK	0.18	0.25	0.46	0.015	0.032	285	420	32	OK	500	OK	OK
177	056002	B	36	0.375	40	3	120	7.774	OK	0.17	0.24	0.47	0.011	0.031	320	430	31.5	OK	500	OK	OK
178	048307	B	36	0.375	40	2	80	5.183	OK	0.16	0.19	0.42	0.010	0.028	300	425	31	OK	500	OK	OK
179	048305	B	36	0.375	40	3	120	7.774	OK	0.14	0.17	0.39	0.008	0.030	305	425	32.5	OK	500	OK	OK
180	053804	B	36	0.375	40	3	120	7.774	OK	0.16	0.24	0.43	0.012	0.032	300	420	32.5	OK	500	OK	OK
181	056406	B	36	0.375	40	3	120	7.774	OK	0.15	0.22	0.39	0.012	0.029	300	425	31	OK	500	OK	OK
182	048701	B	36	0.375	40	2	80	5.183	OK	0.17	0.22	0.40	0.011	0.031	305	425	32	OK	500	OK	OK
183	047504	B	36	0.375	40	2	80	5.183	OK	0.16	0.19	0.41	0.008	0.028	310	425	31	OK	500	OK	OK
184	238201	B	36	0.375	40	5	200	12.961	OK	0.18	0.24	0.45	0.013	0.033	320	435	32.5	OK	500	OK	OK
185	238402	B	36	0.375	40	2	80	5.183	OK	0.17	0.17	0.42	0.010	0.030	315	430	31	OK	500	OK	OK
186	238202	B	36	0.375	40	3	120	7.774	OK	0.16	0.19	0.36	0.009	0.029	315	420	31.5	OK	500	OK	OK
187	238002	B	36	0.375	40	3	120	7.774	OK	0.19	0.23	0.46	0.015	0.032	285	420	32	OK	500	OK	OK

YIEH CORPORATION LIMITED

GOLDEN GATE WASTEWATER TREATMENT FACILITY

CLASS I INJECTION WELL SYSTEM

MILL CERTIFICATIONS

INJECTION WELL IW1

28-INCH O.D., 0.375-INCH WALL THICKNESS, STEEL CASING

YIEH CORPORATION LIMITED

NO 6, E-DA RD, YA .AO TOWNSHIP
KAOHSIUNG COUNTY YANCHAO,
TAIWAN
TEL:886-7-615-1000
FAX:886-7-615-3000

MILL CERTIFICATE

COMMODITY: CARBON STEEL PIPES AS PER ASTM A139 GR.B SPIRAL WELDED, NORMAL MILL BLACK LACQUER FOR RUST PROTECTION, ONE END OF THE PIPE SHALL HAVE A BEVEL OF 30 DEGREES WITH A TOLERANCE PLUS FIVE, MINUS ZERO DEGREES. THE OTHER END OF THE PIPE WILL BE PLAIN, RIGHT AND ANGLE CUT. ALL BURRS REMOVED.

CERTIFICATE NO:PSCNJN7601TC5-3
DATE OF ISSUE:10/23/2007

CUSTOMER: OZONE INDUSTRIES CORPORATION
15465 PINE RIDGE ROAD
FORT MYERS, FL 33908

The CARBON STEEL PIPES are tested according to ASTM A139 GR.B
This is to certify that in accordance with the relevant specifications and contracts.
The CARBON STEEL PIPES manufactured were tested and qualified by our Quality Control Department.

Invoice No. SEUSFP7601TD3-3
LC NUMBER.: 64405427
TOTAL : 271 PCS / 10840 FT / 497.812 MT

Pipes No.	Heat Number	Steel	O.D.	W.T.	lenth	Quantity			Dimensional	CHEMICAL PROPERTIES(%)					PHYSICAL PROPERTIES			Welding properties	Hydrostatic Test Holding time:10s	Flattening	UT Test
		Grade	in	in	ft	根(Pcs)	英尺 (ft)	吨(MT)	Inspection	C	Si	Mn	P	S	σs(Mpa)	σb(Mpa)	δ5(%)	σb	P = Psi	Test (B)	Test (B)
1	1-9160	B	52	0.375	40	1	40	3.757	OK	0.16	0.19	0.48	0.029	0.029	330	460	30	OK	505	OK	OK
2	1-9160	B	42	0.375	40	20	800	60.555	OK	0.16	0.19	0.48	0.029	0.029	330	460	30	OK	505	OK	OK
3	1-9160	B	36	0.375	40	21	840	54.418	OK	0.16	0.19	0.48	0.029	0.029	330	460	30	OK	505	OK	OK
4	7-C03099	B	28	0.375	40	27	1080	54.254	OK	0.16	0.19	0.33	0.018	0.027	325	455	33	OK	525	OK	OK
5	7-C03099	B	26	0.375	40	22	880	41.007	OK	0.16	0.19	0.33	0.018	0.027	325	455	33	OK	525	OK	OK
6	7-C03099	B	24	0.375	40	71	2840	122.01	OK	0.16	0.19	0.33	0.018	0.027	325	455	33	OK	525	OK	OK
7	7-C03099	B	20	0.375	40	27	1080	38.643	OK	0.16	0.19	0.33	0.018	0.027	325	455	33	OK	525	OK	OK
8	1-7588	B	16	0.500	40	82	3280	123.268	OK	0.15	0.16	0.42	0.023	0.022	330	485	31.5	OK	525	OK	OK
TOTAL						271	10840	497.812													

YIEH CORPORATION LIMITED

YOUNGQUIST BROTHERS, INC.
Has Received This Shop Drawing/Submittal
YBI/Section No# 11360-010-B
Date: 5/13/08
Signature: Wu Tao

YIEH CORPORATION LIMITED

MILL CERTIFICATE

COMMODITY: CARBON STEEL PIPE PER SALES CONTRACT
NO. SEUSFP6C02TD3 DATED DECEMBER 11, 2006.

CUSTOMER: OZONE INDUSTRIES CORPORATION
15465 PINE RIDGE ROAD
FORT MYERS, FL 33908

CERTIFICATE NO:PSCNIN6C01TC5
DATE OF ISSUE:4/29/2007

Invoice No. SEUSFP6C02TD3
LC NUMBER.: 5279996

The CARBON STEEL PIPES are tested according to ASTM A139 GR.B
This is to certify that in accordance with the relevant specifications and contracts.
The CARBON STEEL PIPES manufactured were tested and qualified by our Quality Control Department.

TOTAL : 746 PCS / 29840FT / 1769.619MT

Pipes No.	Heat Numbers	Steel	Size			Quantity			Dimensional	TESTING RESULTS										Flattening	UT Test
			O.D.	W.T.	Length					CHEMICAL PROPERTIES(%)					PHYSICAL PROPERTIES			Welding properties	Hydrostatic Test Holding time:10s		
		Grade	in	in	ft	Pcs	ft	MT	Inspection	C	Si	Mn	P	S	σs(Mpa)	σb(Mpa)	δ5(%)	σb	P = Psi	Test (B)	Test (B)
35	011703	B	24	0.375	40	2	80	3.435	OK	0.16	0.20	0.40	0.010	0.029	310	425	31	OK	563	OK	OK
36	011703	B	26	0.375	40	2	80	3.727	OK	0.17	0.25	0.42	0.013	0.030	305	425	32	OK	519	OK	OK
37	012204	B	26	0.375	40	3	120	5.592	OK	0.18	0.21	0.44	0.011	0.031	305	420	32	OK	519	OK	OK
38	011103	B	26	0.375	40	4	160	7.456	OK	0.18	0.22	0.45	0.014	0.032	315	425	32	OK	519	OK	OK
39	012004	B	26	0.375	40	4	160	7.456	OK	0.16	0.24	0.47	0.012	0.031	310	425	32	OK	519	OK	OK
40	008304	B	26	0.375	40	3	120	5.592	OK	0.17	0.24	0.46	0.013	0.032	315	420	31.5	OK	519	OK	OK
41	012606	B	26	0.375	40	4	160	7.456	OK	0.17	0.26	0.47	0.011	0.031	320	430	31.5	OK	519	OK	OK
42	015003	B	28	0.375	40	3	120	6.028	OK	0.17	0.25	0.45	0.015	0.033	325	435	32.5	OK	500	OK	OK
43	008503	B	28	0.375	40	4	160	8.038	OK	0.18	0.21	0.42	0.012	0.030	300	425	31	OK	500	OK	OK
44	011704	B	28	0.375	40	3	120	6.028	OK	0.17	0.26	0.43	0.016	0.031	305	420	31.5	OK	500	OK	OK
45	012208	B	28	0.375	40	3	120	6.028	OK	0.14	0.17	0.35	0.011	0.026	310	420	31.5	OK	500	OK	OK
46	008304	B	28	0.375	40	4	160	8.038	OK	0.19	0.27	0.46	0.014	0.030	295	425	31.5	OK	500	OK	OK
47	008502	B	28	0.375	40	3	120	6.028	OK	0.18	0.20	0.40	0.014	0.028	300	425	31.5	OK	500	OK	OK
48	011806	B	28	0.375	40	4	160	8.038	OK	0.17	0.22	0.44	0.011	0.032	305	435	31	OK	500	OK	OK
49	010502	B	28	0.375	40	3	120	6.028	OK	0.15	0.16	0.34	0.013	0.029	305	425	31.5	OK	500	OK	OK
50	016606	B	28	0.375	40	4	160	8.038	OK	0.19	0.25	0.46	0.014	0.033	295	425	32	OK	500	OK	OK
51	012603	B	28	0.375	40	3	120	6.028	OK	0.17	0.18	0.40	0.009	0.030	310	420	32.5	OK	500	OK	OK

YIEH CORPORATION LIMITED

YOUNGQUIST BROTHERS, INC.
Has Received This Shop Drawing/Submittal
CSI Section No. 11360-010-B
Date: 5/13/08
Signature: M. Tran

GOLDEN GATE WASTEWATER TREATMENT FACILITY

CLASS I INJECTION WELL SYSTEM

MILL CERTIFICATIONS

INJECTION WELL IW1

18-INCH O.D., 0.500-INCH WALL THICKNESS,

SEAMLESS-STEEL CASING

Has Received This Shop Drawing/Submittal
/SI/Section No: 11300-011-A
Date: 5/2/06
Signature:

Huta „BATORY" S.A.
UL. Dyrekcyjna 6
41-506 Chorzów
POLAND

ŚWIADECTWO ODBIORU № 1111/EXP/R/02

CERTYFICAT DE RECEPTION INSPECTION CERTIFICATE
ABNAHMEPRÜFZEUGNIS СЕРТИФИКАТ
acc.to EN 10204/3.1.B
по нормі

Zamawiający STALEXPORT S.A. - KATOWICE
Le client-Ordered by-Besteller-Заказчик

Adres wysyłkowy
Adresse-Address-Versandadresse-Адрес получателя

Nr i data zamówienia klienta No et date la commande Order No and date No und Datum der Bestellung № и число заказа	Nr zlecenia Ordre No Manuf. Order No Auftrag No № наряда	Nr awizu Avis No Advice No Versandanzeige No № извещения	Nr wagonu Wagon No Car No Wagon No № вагона
PL/271936361/22/1041	4228530/02		

Wyszczególnienie zamówienia:
Spécyfication de la commande-Order Specification-Spizifikation der Bestellung-Спецификация заказа

Przedmiot i wykonanie (stan obr. Termicz.,mech. itp.) L'objet et l'exécution (traitement thermique et l'usinage) Item and specification (Heat and mechanical treatment etc.) Gegenstand und Ausführung (therm und mechan. Bearbeitung usw.) Предмет и исполнение (состояние терм. и механ.обраб. и пр.)	Wymiar lub rysunek Dimensions ou dessin Dimensions or drawing Abmessung oder Zeichnung Размер чертеж	Marka Marque Steel type Marke Марка	Wytop Coulée Heat Abstich Плавка	Sztuk Pièces Pieces Stück Штук	mb. ft (a. mtr.) a. mtr. l. M. пог. м	Kg lb (kg) кг
Seamless steel pipes acc.to API 5L - PSL1/2000/ ASTM - A106/A 53/99/ ASME SA 106/01/ SA 53/98. Diameter tolerances +/- 0,75 %. Bevelled ends Acc .to API - 5L Outside surface double lacquered.	18" x 0,500" (457 x 12,7 mm) 36 - 44 ft (10,97 - 13,41 m)	B / C / X42	818648	8	325,9 (99,34)	30474 (13823)

Kontrolę techniczną powyższego zamówienia przeprowadził Oddział Technicznej Kontroli. Wyniki badań podano niżej.
Le controle technique de la été exécuté par le Service de Controle. Les resultats des essais sont indiqués ci-après.
The testnical 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 Fabrikationskontrolle durchgeführt. Die Ergebnisse der Proben sind nachstehend angeführt.
Техническая контроль вышеуказанного заказа провел Отдел Технического Контроля. Результат испытания представлен ниже.

1. **SKŁAD CHEMICZNY** - ANALYSE CHIMIQUE – CHEMICAL COMPOSITION – CHEMISCHE ZUSAMMENSETZUNG ХИМИЧЕСКИЙ СОСТАВ

Wytop Coulée Heat Abstich Плавка	C	Mn	Si	P	S	Cr	Ni	Cu
818648	0,19	1,00	0,41	0,017	0,006	0,12	0,14	0,18
	Mo 0,03	V 0,00	Al 0,020	Ti 0,004	Nb 0,0000	Ce 0,41		

2. BADANIA MECHANICZNE – ESSAIS MECANIQUES – MECHANICAL TESTS – MECHANISCHE UNTERSUCHUNGEN МЕХАНИЧЕСКИЕ ИСПЫТАНИЯ

Nr wytopu lub próby No de la coulée ou De l'eprouvette Heat No Or, Tests No Abstich Oder Probe No На плавки или пробы	Stan obróbki Termicznej Traitement thermique Heat treatment Therm. Bearbeitung Термич. обработка	Re psi (MPa)	Rm psi (MPa)	A 2" %	Z %	U	Twardość Durete Hardness Härte Твердость
818648/14369	Hardnes lim't Higher than 22 HRc.Pipes in accordance to NACE MR 01-75 Test transferse Type E	53229 (367)	84847 (585)	44,7			

2. BADANIA TECHNOLOGICZNE – ESSAIS TECHNOLOGIQUES – TECHNOLOGICAL TESTS – TECHNOLOGISCHE PRÜFUNGEN

Flattening test - positive results

4. BADANIA METALOGRAFICZNE – ESSAIS METALLOGRAPHIQUES – METALLOGRAPHIC TESTS – METALLOGRAPHISCHE UNTERSUCHUNGEN – МЕТАЛЛОГРАФИЧЕСКИЕ ИСПЫТАНИЯ

5. INNE BADANIA – AUTRES ESSAIS – OTHER TESTS – ANDERE UNTERSUCHUNGEN – ДРУГИЕ ИСПЫТАНИЯ

Each pipes hydrostatically tested by pressure 1980 psi - positive results time 5 s

6. UWAGI DODATKOWE – ADDITIONAL REMARKS – AUTRESOBSERVATIONS – ANDERE BEMERUNGEN

Powierzchnia i wymiary zbadano w 100% - Surface et dimensions ont été controlés et 100% - Surface and dimensions tested at 100% Oberfläche und Abmessungen geprüft zu 100% - Наружный осмотр и проверка измерений произведены в 100%

Materiał oznaczono – La materiel est marqué – Material marked – Das Material wurde bezeichnet – Материал обозначен

Mill's symbol . Seamless. Acc.to API 5 L/ B /X42/ PSL 1 / A106/ /B/ C/ A53/ B/ S A106/ B / C/ SA53 / B . Size in inches. Heat number.

Na podstawie wyżej przeprowadzonych prób materiał zwolniono – Sur la base des essais ci-dessus le materiel est délivré According to the carried out tests the material released – Unterauchungen wurde das Material freigegeben – На основании вышеизложенных Испытаний партия годится.

Kontrola Jakości Contrôle de Fabrication Control of Manufacture Fabrikationskontrolle Технический контроль	Dyrekcja Huty Direction de l'Usine Works Management Hütten - Direktion Дирекция Завода	
KIEROWNIK ODDZIAŁU TECHNICZNYCH ROCH LIBOR		dn. 25.06. 2002 r.

江苏诚德钢管股份有限公司
JIANGSU CHENGDE STEEL TUBE SHARE CO., LTD

产品质量证明书
MILL CERTIFICATE

江苏省江都市诚德路1号
1 CHENGDE ROAD,JIANGDU CITY JIANGSU PROVINCE
TEL：0514-6529011, 6529012 FAX：0514-6520240

ORIGINAL

订货单位: OZONE INDUSTRIES CORPORATION / YOUNGQUIST BROTHERS PURCHARSER:
合同号 Order No: WXDX-20070110
签发日期: 2007年3月14日 Date Of Issue:
编号: 48514 No:

产品名称 Product	无缝钢管 CARBON STEEL PIPE	钢号(级) Steel Gr.	GR.B PSL 1	标准 Specification	API5L-2000	制造方法 Making Method	热轧 Hot Rolled
总捆数 Total		总支数 Total Pieces	22	总重量 (Short Ton) Total Weight	34.848	交货状态 Delivery	正火 Normalize
热处理温度 Heat Temp							

序号 No.	规格 Size (IN)	长度 Length (FT)	钢度卡号 Production No.	冶炼号 Heat No.	批号 Lot No.	捆数 Bundles	支数 Pieces	重量 Weight (Short Ton)	力学性能 Tensile Test: 屈服 Y.S MPa	抗拉 T.S MPa	伸长率 E.L %	冲击试验 (AKV) Impact Test(J): 常温	℃低温	压扁 Flattening	扩口 Expansion	冷弯 Bending	环圈拉伸 Ring Tensile Test
1	18" *0.5"	751.77		070166	4533		22	34.848	315 305	445 450	30.0 30.5			合格 Good		合格 Good	

序号 No.	金相 Metallography: 显微组织 Microstructure	晶粒度 GrainSize (级)	总脱碳层 (mm) 外壁 OutSide	内壁 InSide	魏氏组织 Weistructure (级)	带状组织 Zonalstructure (级)	非金属夹杂物(级) Non-mepallic Inclusion: A粗	A细	B粗	B细	C粗	C细	D粗	D细	低倍检验 Macro-structure	硬度 Hard-ness	外观&尺寸 Visual& Dimension	涡流探伤 Eddy	超声波探伤 U.T	静水压试验 Hydrostatic Test
																	合格 Good		合格 Good	合格 Good

序号 No.	熔炼成分 % Chemical Composition: C	Mn	Si	S	P	Cr	Ni	Cu	Mo	Al	V	Ti	Nb	W	As	Sn	Pb	B	Sb	Bi
1	0.22	0.53	0.18	0.011	0.009	0.05	0.02	0.013												
复验																				

备注 Note	许可证号 License	
	5L-0369	

签发人: 周维育 Signed by:
审核人: Previewed by:
质量负责人: Chief of Previewed by:
盖章: Seal:

江苏诚德钢管股份有限公司 质检专用章

江苏诚德钢管股份有限公司
JIANGSU CHENGDE STEEL TUBE SHARE CO., LTD

产品质量证明书
INSPECTION CERTIFICATE

江苏省江都市诚德路1号
1 CHENGDE ROAD,JIANGDU CITY JIANGSU PROVINCE
TEL：0514-6529011, 6529012 FAX：0514-6520240

订货单位: OZONE INDUSTRIES/YOUNGQUIST BROTHERS　　合同号 Order No: WXDX-20070110　　签发日期: 2007年6月5日　　编号: 48724　　Page:1/1

PURCHARSER:　　Date Of Issue:　　No:

产品名称 Product	无缝钢管 Seamless steel tubes	钢号(级) Steel Gr.	GR.B PSL 1	标准 Specification	API5L-2000	制造方法 Making Method	热轧 Hot Rolled
总捆数 Total		总支数 Total Pieces	68	总重量 (Short Ton) Total Weight	83.531	交货状态 Delivery	正火 Normalize
热处理温度 Heat Temp							

序号 No.	规格 Size (IN)	长度 Length (FT)	调度卡号 Production No.	冶炼号 Heat No.	批号 Lot No.	捆数 Bundles	支数 Pieces	重量 Weight (ShortTon)	力学性能 Tensile Test: 屈服 Y.S MPa	抗拉 T.S MPa	伸长率 E.L %	冲击试验 (AKV) Impact Test(J): 常温	℃低温	压扁 Flattening	扩口 Expansion	冷弯 Bending	环圆拉伸 Ring Tensile Test
1	18" *0.5"	1762.99		070561	5103		68	83.531	330 320	430 435	32.0 32.5			合格 Good		合格 Good	

序号 No.	金相 Metallography: 显微组织 Microstructure	晶粒度 GrainSize (级)	总脱碳层 (mm) 外壁 OutSide	内壁 InSide	魏氏组织 Weistructure (级)	带状组织 Zonalstructure (级)	非金属夹杂物(级) Non-mapallic Inclusion: A粗	A细	B粗	B细	C粗	C细	D粗	D细	低倍检验 Macro-structure	硬度 Hard-ness	外观& 尺寸 Visual& Dimension	涡流探伤 Eddy	超声波探伤 U.T	静水压试验 Hydrostatic Test
																	合格 Good		合格 Good	合格 Good

序号 No.	熔炼成分 % Chemical Composition: C	Mn	Si	S	P	Cr	Ni	Cu	Mo	Al	V	Ti	Nb	W	As	Sn	Pb	B	Sb	Bi
1	0.21	0.54	0.17	0.009	0.009	0.05	0.02	0.03												
复验																				

备注 Note　　许可证号 License: 5L-0369

签发人: 周维青 Signed by:　　审核人: Previewed by:　　质量负责 Chief of Previewed by:　　盖章: Seal:

江苏诚德钢管股份有限公司 质检专用章

沧州乾成钢管有限公司

CANGZHOU QIANCHENG STEEL PIPE CO.,LTD

产品质量证明书

MILL CERTIFICATE

ORIGINAL

河北省沧州市盐山城南工业区

TEL：86-317-6322101 FAX：86-317-6320919

DATE:2008 01 29

订货单位 CUSTOMER	OZONE INDUSTRIES CORPORATION/YOUNGQUIST BROTHERS	产品名称 PRODUCT	无缝钢管 CARBON STEEL PIPE	交货状态 DELIVERY CONDITION	正火 NORMALIZE
收货单位 PURCHASER	OZONE INDUSTRIES CORPORATION/YOUNGQUIST BROTHERS	合同号码 CONTRACT NO.	OZ110707003	质保书号 CERTIFICATION	I306CQ801012
标准 SPECIFICATION	API 5L -2000	钢级 STEEL GRADE	GR.B PSLI	总支数（支） TOTAL PIECES	56

合格

序号 NO.	熔炼号 HEAT NO.	批号 LOT NO.	规格 SIZE		数量 QUANTITY			化学成分% CHEMICAL COMPOSITION(*100)								机械性能 PHYSICAL PROPERTIES		
			直径 OD IN	壁厚 WT IN	支数 PIECES	长度 LENGTH FT	重量 WEIGHT MT	碳 C	锰 Mn	硫 S	磷 P	镍 Su	铬 Cr	钒 V	铝 Al	抗拉强度 T.S. Mpa	伸长率 E.L. %	屈服强度 Y.S. Mpa
1	456741	80	24"	0.5"	23	575	32.68	22	54	1.2	1.3	2.5	2.5			430	31	335
2	254813	80	18"	0.5"	8	240	10.18	21	53	1.1	1.2	2.0	3.0			436	35	340
3	456742	80	24"	0.5"	25	625	35.52	23	54	1.3	1.3	2.5	2.5			430	31	335
Total					56	1440	78.38											

超声波探伤 U.T	涡轮探伤 E.T	硬度 HARDNESS	热处理工艺 H.T	表面和尺寸 DIMENSIONAL	显微组织 MICROSTRUCTURE	晶粒度 GRAIN SIZE	压扁 P FLATTENING	水压试验 HYDRO TEST	冷弯 BENDING	冲击试验 IMPACT TEST AK
合格 GOOD	/	/	/	合格 GOOD	/	/	合格 GOOD	合格 GOOD	合格 GOOD	合格 GOOD

注释 NOTE

兹证明本表所列产品，均依标准规定制造。取样，试验和检验，并符合标准及合同要求

We here certify that material ,herein described has been manufactured, sampled, tested and Inspected in Accordance with the requirements of above specifications and purchase order, and the requirements

检验员: INSPECTOR: 张德芳

许可证号: LICENCE: API5L-0006

沧州乾成钢管有限公司 Cangzhou qiancheng steel pipe co.,ltd 彭文政

沧州新华钢管有限公司 产品质量证明书

CANGZHOU XINCHENG STEEL PIPE CO.,LTD MILL CERTIFICATE

河北省沧州市盐山城南工业园区
TEL：86-317-6322101 FAX：86-317-6320919

买方单位 CUSTOMER	OZONE INDUSTRIES CORPORATION/YOUNGQUIST BROTHERS	产品名称 PRODUCT	无缝钢管 SEAMLESS PIPE	交货状态 DELIVERY CONDITION	正火 NORMALIZE
收货单位 PURCHASER	OZONE INDUSTRIES CORPORATION/YOUNGQUIST BROTHERS	合同号码 CONTRACT NO.	OZ110707003	质保书号 CERTIFICATION	1306C080)017
标准 SPECIFICATION	API 5L -2000	钢级 STEEL GRADE	GR.B PSL1	总支数（支） TOTAL PIECES	56

序号 NO.	炉号 HEAT NO.	批号 LOT NO.	规格 SIZE 直径 OD IN	壁厚 WT. IN	数量 QUANTITY 支数 PIECES	长度 LENGTH FT	重量 WEIGHT MT	化学成分% CHEMICAL COMPOSITION(+100) 碳 C	锰 Mn	硫 S	磷 P	镍 Su	铬 Cr	钒 V	铝 Al	机械性能 PHYSICAL PROPERTIES 抗拉强度 T.S. Mpa	伸长率 E.L. %	屈服强度 Y.S. Mpa
1	872087	80	24"	0.5"	23	575	32.68	22	54	1.2	1.1	2.4	2.5			445	32	335
2	872088	60	18"	0.5"	8	240	10.18	22	54	1.2	1.3	2.4	2.5			430	31	335
3	872058	80	24"	0.5"	25	625	35.52	22	54	1.2	1.3	2.4	2.5			430	31	335
Total					56	1440	78.38											

超声波探伤 UT	涡轮探伤 ET	硬度 HARDNESS	热处理工艺 HT	表面和尺寸 DIMENSIONAL	显微组织 MICROSTRUCTURE	晶粒度 GRAIN SIZE	压扁 P FLATTENING	水压试验 HYDRO TEST	冷弯 BENDING	冲击 IMPACT TEST
合格 GOOD	/	/	/	合格 GOOD			合格 GOOD	合格 GOOD	合格 GOOD	/

注释 NOTE：我证明本表所列产品，均依标准规定制造、取样、试验和检验，并符合标准及合同要求
We here certify that material herein described has been manufactured, sampled, tested and inspected in accordance with the requirements of above specifications and purchase order, and the requirements

检验员：
INSPECTOR 张德芳

许可证号：
LICENEC: API5L0054

交货日期：Date: 2008.02.06

GOLDEN GATE WASTEWATER TREATMENT FACILITY

CLASS I INJECTION WELL SYSTEM

PRODUCT SHEET

INJECTION WELL IW1

11.97-INCH INSIDE DIAMETER FRP TUBING

FUTURE PIPE INDUSTRIES
Complete Pipe System Solutions

RED BOX 1500

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

DIMENSIONAL SPECIFICATIONS

February 2006

Nominal Size (inches)	Nominal I.D. (inches)	Minimum Drift Dia (inches)	Nominal O.D. (inches)	Nominal Wall (inches)	Pin Upset O.D. (inches)	Max Box OD* (inches)	Nominal Weight (lbs/ft)	Nominal Weight (lbs/it)	Connection Type API 5B, Table 34*, 7**, 8*** Fourteenth Edition August 96
2-3/8	2.00	1.91	2.26	0.13	2.69	3.45	0.8	25	2-3/8" 8Rd EUE Long*U
2-7/8	2.47	2.37	2.77	0.15	3.19	3.95	1.2	35	2-7/8" 8Rd EUE Long*U
3-1/2	3.00	2.90	3.37	0.19	3.85	4.84	1.8	53	3-1/2" 8Rd EUE Long*U
4	3.33	3.24	3.75	0.21	4.35	5.26	2.3	70	4" 8Rd EUE Long* TC
4-1/2	3.98	3.89	4.48	0.25	4.85	5.77	3.0	90	4-1/2" 8Rd EUE Long*U
5-1/2	4.42	4.33	4.96	0.27	5.60	6.71	3.8	115	5-1/2" 8Rd Csg Long**U
6-5/8	5.43	5.33	6.10	0.34	6.73	8.00	5.7	171	6-5/8" 8Rd Csg Long**U
7	6.21	6.11	6.97	0.38	7.10	8.61	6.9	208	7" 8Rd Csg Long**U
7-5/8	6.21	6.11	6.97	0.38	7.73	9.38	7.6	227	7-5/8" 8Rd Csg Long**U
9-5/8	7.84	7.75	8.80	0.48	9.73	11.84	12.0	361	9-5/8" 8Rd Csg**U
10-3/4	8.65	8.76	9.94	0.54	10.85	13.15	15.3	459	10-3/4" 8Rd Csg**U
11-3/4	10.72	10.62	11.90	0.59	12.61	14.70	21.1	632	11-3/4 8/8Rd L Csg TC
13-3/8	11.97	11.87	13.29	0.66	13.48	15.65	24.0	721	13-3/8" 8/8Rd Csg**TC
16	14.48	14.39	16.08	0.80	16.20	19.20	35.1	1,054	16" 6Rd Csg TC
18	16.60	16.50	18.43	0.92	18.71	23.10	47.7	1,432	18" 6Rd Csg TC
20	17.98	17.89	19.97	1.00	20.06	24.80	54.9	1,648	20" 6Rd Csg TC

*Depending on the application, smaller maximum box diameters are available.

Thread lengths may exceed API L4

30 ft Standard Joint Length

PERFORMANCE AND RATINGS (-60 deg F to +210 deg F)

Nominal Size	Internal Pressure Rating (psi)	Mill Test Pressure (psi)	Collapse Rating (psi)	Axial Tension Rating (lbs)	Stretch vs Tension-Over-Pipe-Wt Stretch (ft) = Coeff. x P x L
2-3/8	1,500	1,850	1,200	13,000	0.383
2-7/8	1,500	1,850	1,000	19,000	0.266
3-1/2	1,500	1,850	1,100	26,000	0.178
4	1,500	1,850	1,100	35,000	0.138
4-1/2	1,500	1,850	1,100	46,500	0.098
5-1/2	1,500	1,850	1,000	55,500	0.084
6-5/8	1,500	1,850	1,100	72,500	0.054
7	1,500	1,850	1,000	76,500	0.042
7-5/8	1,500	1,850	1,000	86,500	0.042
9-5/8	1,500	1,850	1,000	140,500	0.027
10-3/4	1,500	1,850	1,000	161,500	0.021
11-3/4	1,500	1,850	750	126,500	0.024
13-3/8	1,500	1,850	760	136,000	0.019
16	1,500	1,850	750	167,000	0.013
18	1,500	1,850	750	194,000	0.010
20	1,500	1,850	750	208,000	0.008

Where: P = Tensile Load (1,000 lbs)
L = String Length (1,000 ft)

MECHANICAL AND PHYSICAL PROPERTIES

TUBING/CASING BODY PROPERTIES	UNIT	VALUE 2-3/8 - 10-3/4	VALUE 11-3/4 - 20	TEST METHOD
Tensile Strength, Hoop	psi	31,300	31,300	ASTM D1599
Tensile Strength, Axial	psi	30,000	12,000	ASTM D2105
Modulus of Elasticity, Axial	10E+06 psi	3.0	2.0	ASTM D2105
Specific Gravity	—	1.9	1.9	ASTM D792
Density	lbs/in^3	0.07	0.07	ASTM D792
Thermal Conductivity	Btu/hr/ft^2/in/degF	2.4	2.4	ASTM C177
Thermal Expension Coefficient (Linear)	10E-05in/in/degF	1.1	1.2	ASTM D696
Flow Factor	—	150	150	Hazen Williams

ISO 9001 Certified

11811 Proctor Road • Houston, Texas 77038 • Phone: (281) 847-2987 • Fax: (281) 847-1931
Email: houston@future-pipe.com • website: www.futurepipe.com

FUTURE PIPE INDUSTRIES

Inspection Certificate

Job No: 110000070 July 2, 2008

Purchaser: Ozone SO #: 62L000413

Destination: Fort Myers, Florida

Product: 13 3/8" RB 1500 Quantity: 2790' Ft

We hereby certify that the materials & fittings supplied have been tested and comply with API 15 HR spec's.

Material Certificate

Material: 13 3/8" RB 1500

Test pressure: 1850 psi

Certificate Number: FPI-2008-08

Customer: Ozone

Sales Order: 62L000413

Produced By: Future Pipe Industries, Inc. - Houston, TX

FPI Order Number: 110000070

Pipe System: Aromatic Amine heat cured epoxy

Raw Material Specifications:

Resin type- Epoxy
Curing Agent- Aromatic Amine
Glass Fiber- E-Type

Non Destructive Tests:

Dimensional Exam - ASTM D 3567
Visual Standards – API 15 HR Table 2

We hereby certify that the materials described above have been tested and comply with API 15 HR.

Certificate of conformity Statement:
All items delivered under this certificate number were manufactured in accordance with API 15 HR specifications:

We hereby certify that the materials described above have been tested and comply API 15 HR.

Raymond Jones Raymond Jones
QC Supervisor
Future Pipe Industries
11811 Proctor Rd Houston TX, 77038

ARCADIS

Appendix E

Surficial Aquifer Pad Monitor Well Data and Charts; Technical Memorandum with Mechanical Integrity Results

Table 1. Summary of Water Table Monitor, Water Quality Data
FGUA Golden Gate WWTP Injection Well System

Well Location	TOC Elevation	Date	Depth to Water	Water Level Elevation	Temperature	Conductivity	Chloride	pH
	(feet msl)		(feet b.t.o.c.)	(feet msl)	(°C)	(µS/cm)	(mg/L)	
PMW-1	10.92	11/28/07	5.93	4.99	26.7	1133	180	7.15
T.D.: 14.5	**12.15**	12/13/07	5.86	5.06	26.4	1148	180	7.09
(feet btoc)		12/20/07	5.78	5.14	24.8	1128	180	7.02
		12/27/07	5.83	5.09	25.2	1110	180	7.03
		01/03/08	5.93	4.99	22.6	1107	180	7.09
		01/09/08	5.92	5.00	24.2	1118	180	7.11
		01/17/08	6.01	4.91	23.8	1120	180	7.27
		01/24/08	5.98	4.94	23.9	1124	180	7.15
		01/30/08	6.04	4.88	24.3	1139	180	7.17
		02/08/08	6.24	4.68	25.4	1164	160	7.08
		02/14/08	6.02	4.90	23.5	1151	160	6.99
		02/19/08	5.80	5.12	24.2	1163	180	6.89
		02/27/08	5.83	5.09	23.3	1150	180	7.17
		03/06/08	6.02	4.90	24.8	1168	160	7.11
		03/22/08	6.37	4.55	24.1	1164	160	7.10
		03/28/08	6.43	4.49	24.7	1160	160	7.15
		04/03/08	6.22	4.70	26.3	1068	160	6.62
		04/09/08	6.56	4.36	25.5	1151	180	7.07
		07/07/08	5.44	5.48	26.7	1189	200	7.15
		08/01/08	5.89	5.03	28.3	3350	1340	6.84
		08/06/08	5.72	5.20	28.3	1310	280	6.69
		08/20/08	3.32	7.60	27.5	724	100	6.78
		09/12/08	5.76	6.39	28.6	1127	140	6.70
		09/15/08	6.33	5.82	28.4	1204	160	6.73
PMW-2	(11.49)	11/28/07	5.99	5.50	26.4	1063	200	7.21
T.D.: 13.6	9.48	12/13/07	5.93	5.56	26.2	1072	180	7.13
(feet btoc)	**12.9**	12/20/07	5.83	5.66	25.4	1106	180	7.06
		12/27/07	5.92	5.57	25.2	1012	200	7.13
		01/03/08	5.99	5.50	23.4	1121	200	7.08
		01/09/08	5.98	5.51	23.8	1136	180	7.12
		01/17/08	6.10	5.39	23.4	1124	180	7.12
		01/24/08	6.03	5.46	23.7	1113	180	7.08
		01/30/08	6.10	5.39	24.1	1149	200	7.14
		02/08/08	6.32	5.17	24.4	1159	180	7.14
		02/14/08	6.08	5.41	23.2	1157	160	7.07
		02/19/08	5.87	5.62	23.7	1143	180	7.15
		02/27/08	5.91	5.58	23.2	1157	180	7.18
		03/06/08	6.10	5.39	24.6	1149	160	7.20
		03/22/08	4.81	4.67	23.2	1105	140	7.12
		03/28/08	5.10	4.38	24.1	1148	180	7.18
		04/03/08	4.84	4.64	24.5	1138	180	6.66
		04/09/08	5.12	4.36	25.0	1179	160	7.20
		04/17/08	4.38	5.10	25.0	1166	160	7.06
		04/23/08	4.58	4.90	24.9	1198	160	6.89

Well Location	TOC Elevation (feet msl)	Date	Depth to Water (feet b.t.o.c.)	Water Level Elevation (feet msl)	Temperature (°C)	Conductivity (µS/cm)	Chloride (mg/L)	pH
PMW-2	(11.49)	05/01/08	4.65	4.83	24.7	1149	180	7.08
T.D.: 13.6	9.48	05/08/08	4.88	4.60	25.2	1251	180	6.85
(feet btoc)	**12.9**	05/14/08	5.08	4.40	25.5	1318	180	6.83
		05/22/08	5.40	4.08	26.8	1315	160	6.91
		05/28/08	5.65	3.83	25.9	1303	180	6.88
		06/04/08	5.62	3.86	25.3	1280	200	6.85
		06/11/08	5.29	4.19	26.0	1295	180	6.98
		06/17/08	4.62	4.86	26.1	1310	200	6.63
		06/26/08	4.37	5.11	26.2	1420	220	6.70
		07/03/08	4.05	5.43	26.3	1498	240	6.62
		07/07/08	4.02	5.46	27.5	1389	220	7.01
		08/01/08	4.43	5.05	28.8	1471	320	6.79
		08/06/08	4.28	5.20	28.8	1520	280	6.82
		08/20/08	2.06	7.42	27.0	1328	120	7.14
		09/12/08	6.48	6.42	28.8	1422	220	6.74
		09/15/08	7.11	5.79	28.6	1342	200	7.00
PMW-3	11.44	11/28/07	6.46	4.98	26.4	1102	200	7.13
T.D.: 13.4	**12.76**	12/13/07	6.39	5.05	26.1	1027	180	7.11
(feet btoc)		12/20/07	6.28	5.16	25.0	1140	200	6.85
		12/27/07	6.31	5.13	25.3	1182	200	7.07
		01/03/08	6.45	4.99	22.8	1167	180	7.03
		01/09/08	6.43	5.01	23.8	1147	220	6.89
		01/17/08	6.55	4.89	23.7	1160	180	7.06
		01/24/08	6.49	4.95	23.8	1180	180	6.85
		01/30/08	6.56	4.88	24.1	1275	200	6.85
		02/08/08	6.78	4.66	24.2	1221	180	7.09
		02/14/08	6.55	4.89	23.0	1217	180	7.13
		02/19/08	6.32	5.12	23.8	1213	180	7.19
		02/27/08	6.38	5.06	23.4	1228	180	7.14
		03/06/08	6.54	4.90	24.1	1233	180	7.12
		03/22/08	6.86	4.58	22.7	1181	180	7.13
		03/28/08	7.04	4.40	23.8	1228	200	7.15
		04/03/08	6.77	4.67	24.4	1159	180	6.87
		04/09/08	7.02	4.42	24.1	1179	160	7.19
		04/17/08	6.32	5.12	24.0	1254	160	7.12
		04/23/08	6.51	4.93	24.9	1217	160	7.10
		05/01/08	6.60	4.84	24.8	1249	220	6.77
		05/08/08	6.81	4.63	25.4	1299	180	7.05
		05/14/08	7.00	4.44	25.3	1374	220	7.08
		05/22/08	7.35	4.09	26.3	1360	180	6.97
		05/28/08	7.59	3.85	26.5	1347	180	7.10
		06/04/08	7.57	3.87	25.8	1265	200	7.06
		06/11/08	7.25	4.19	25.5	1280	200	7.08
		06/17/08	6.57	4.87	26.0	1285	200	6.68
		06/26/08	6.31	5.13	25.8	1125	140	6.96
		07/03/08	5.98	5.46	25.9	1185	160	7.02
		07/07/08	5.97	5.47	27.4	1141	160	6.64
		08/01/08	n/s	n/s	n/s	n/s	n/s	n/s
		08/06/08	6.22	5.22	28.5	1210	160	7.03
		08/20/08	3.92	7.52	27.4	920	100	6.55
		09/12/08	6.31	6.45	28.7	1116	120	6.85
		09/15/08	6.98	5.78	28.3	1127	140	7.13

Well Location	TOC Elevation	Date	Depth to Water	Water Level Elevation	Temperature	Conductivity	Chloride	pH
	(feet msl)		(feet b.t.o.c.)	(feet msl)	(°C)	(µS/cm)	(mg/L)	
PMW-4	(8.82)	11/28/07	3.98	4.84	26.5	686	80	7.03
T.D.: 13.7	8.93	12/13/07	3.93	4.89	26.3	1045	160	7.06
(feet btoc)	**11.75**	12/20/07	3.81	5.01	24.5	994	140	6.99
		12/27/07	3.89	4.93	25.2	918	120	7.12
		01/03/08	3.97	4.85	22.6	992	140	7.08
		01/09/08	3.97	4.85	24.2	985	160	7.21
		01/17/08	4.07	4.75	24.5	1032	140	7.25
		01/24/08	N/M	N/M	N/M	N/M	N/M	N/M
		01/30/08	N/M	N/M	N/M	N/M	N/M	N/M
		02/08/08	3.54	5.28	24.3	1210	180	7.20
		02/14/08	3.50	5.32	23.8	1234	180	7.12
		02/19/08	3.82	5.00	23.9	1102	160	7.10
		02/27/08	3.88	4.94	23.3	1176	180	7.22
		03/06/08	4.07	4.75	24.6	1200	180	7.18
		03/22/08	4.34	4.59	24.1	1130	180	7.13
		03/28/08	4.52	4.41	24.6	1054	140	7.20
		04/03/08	4.26	4.67	25.0	1269	180	6.88
		04/09/08	4.59	4.34	24.7	1175	160	7.15
		07/07/08	3.54	5.39	27.0	1277	160	7.08
		08/01/08	Not sampled- access blocked.					
		08/06/08	Not sampled- access blocked.					
		08/20/08	1.37	7.56	27.1	1205	160	6.97
		09/12/08	5.12	6.63	28.7	1521	220	6.79
		09/15/08	5.94	5.81	28.4	1557	220	6.46
PMW-5	(11.11)	11/28/07	6.12	4.99	26.4	1001	200	7.05
T.D.: 11.90	9.51	12/13/07	6.08	5.03	26.2	990	180	7.02
(feet btoc)	**12.83**	12/20/07	5.98	5.13	25.4	1006	180	7.02
		12/27/07	6.05	5.06	25.4	1014	160	7.11
		01/03/08	6.14	4.97	22.8	993	160	7.09
		01/09/08	6.12	4.99	24.2	1022	180	7.05
		01/17/08	6.23	4.88	23.5	1002	180	7.06
		01/24/08	6.18	4.93	23.5	1024	180	7.16
		01/30/08	6.24	4.87	23.4	1047	160	7.04
		02/08/08	6.47	4.64	24.0	1059	140	7.10
		02/14/08	6.23	4.88	22.8	1113	140	7.02
		02/19/08	6.01	5.10	23.5	1091	160	7.06
		02/27/08	6.07	5.04	23.0	1089	160	7.17
		03/06/08	6.23	4.88	24.6	1181	160	7.23
		03/22/08	4.95	4.56	23.1	1102	140	6.94
		03/28/08	5.12	4.39	24.3	1028	140	7.23
		04/03/08	4.84	4.67	25.4	1008	140	6.85
		04/09/08	5.14	4.37	23.9	966	120	7.14
		04/17/08	4.40	5.11	24.1	1093	140	7.14
		04/23/08	4.48	5.03	25.3	1080	140	7.05
		05/01/08	4.68	4.83	24.7	1055	180	6.97
		05/08/08	4.90	4.61	24.9	1081	140	7.06
		05/14/08	5.10	4.41	24.8	1168	140	6.97
		05/22/08	5.41	4.10	26.1	1207	160	6.94
		05/28/08	5.65	3.86	25.9	1223	160	6.86
		06/04/08	5.64	3.87	25.2	1158	180	6.84
		06/11/08	5.28	4.23	25.8	1175	180	7.03
		06/17/08	4.64	4.87	25.8	1255	160	6.76

Well Location	TOC Elevation	Date	Depth to Water	Water Level Elevation	Temperature	Conductivity	Chloride	pH
	(feet msl)		(feet b.t.o.c.)	(feet msl)	(°C)	(µS/cm)	(mg/L)	
PMW-5	(11.11)	06/26/08	4.40	5.11	26.1	1310	180	6.84
T.D.: 11.90	9.51	07/03/08	4.08	5.43	26.3	1325	180	6.88
(feet btoc)	**12.83**	07/07/08	4.06	5.45	27.1	1137	160	6.99
		08/01/08	4.46	5.05	28.6	1181	200	6.54
		08/06/08	4.29	5.22	28.7	1195	200	6.75
		08/20/08	2.17	7.34	27.0	1191	160	7.16
		09/12/08	6.38	6.45	28.6	1116	140	6.72
		09/15/08	7.02	5.81	28.2	1108	140	7.02
PMW-6	(11.17)	11/28/07	6.16	5.01	26.6	1017	260	7.09
T.D.: 12.30	9.44	12/13/07	6.10	5.07	26.1	1012	160	7.07
(feet btoc)	**12.85**	12/20/07	6.00	5.17	25.0	985	140	6.80
		12/27/07	6.08	5.09	24.9	1011	160	7.09
		01/03/08	6.17	5.00	23.0	1027	140	6.99
		01/09/08	6.14	5.03	23.6	1046	160	6.94
		01/17/08	6.26	4.91	23.0	1064	180	7.02
		01/24/08	6.20	4.97	22.9	1034	160	6.98
		01/30/08	6.26	4.91	23.2	1049	160	6.97
		02/08/08	6.49	4.68	23.4	1069	140	7.09
		02/14/08	6.24	4.93	22.5	966	120	7.14
		02/19/08	6.04	5.13	22.9	1033	140	7.08
		02/27/08	6.08	5.09	22.7	1040	120	7.11
		03/06/08	6.25	4.92	23.6	1046	120	7.13
		03/22/08	4.90	4.54	22.5	1094	140	6.96
		03/28/08	5.06	4.38	23.8	1082	140	7.03
		04/03/08	4.80	4.64	24.5	978	120	6.91
		04/09/08	5.04	4.40	23.9	1003	120	7.13
		04/17/08	4.35	5.09	23.3	1140	160	7.13
		04/23/08	4.54	4.90	24.1	1170	160	7.12
		05/01/08	4.68	4.76	23.9	1051	160	6.79
		05/08/08	4.83	4.61	24.6	1150	140	7.01
		05/14/08	5.04	4.40	25.0	1292	160	7.00
		05/22/08	5.38	4.06	26.1	1255	160	6.88
		05/28/08	5.63	3.81	26.3	1228	140	6.94
		06/04/08	5.59	3.85	25.3	1110	140	6.90
		06/11/08	5.27	4.17	25.1	1050	140	6.83
		06/17/08	4.59	4.85	25.7	1165	160	6.86
		06/26/08	4.34	5.10	25.6	960	120	7.02
		07/03/08	4.02	5.42	26.1	770	120	7.04
		07/07/08	3.99	5.45	27.2	958	120	6.88
		08/06/08	4.30	5.14	28.9	1080	120	6.79
		08/20/08	2.01	7.43	27.2	1034	120	6.94
		09/12/08	6.39	6.46	28.6	1038	100	6.38
		09/15/08	7.06	5.79	28.4	1059	100	7.01

Note: casing on wells PMW-2, PMW-5 and PMW-6 was cut down prior to 03/22/08 sampling event. Wells were resurveyed on April 3, 2008.

Top of casing data was recalculated back. Values in parenthesis show original TOC values.

Note: casing on all wells were modified and resurveyed prior to 09/12//08 sampling event. New TOC values are in bold letters.

"btoc" denotes "below top of casing"

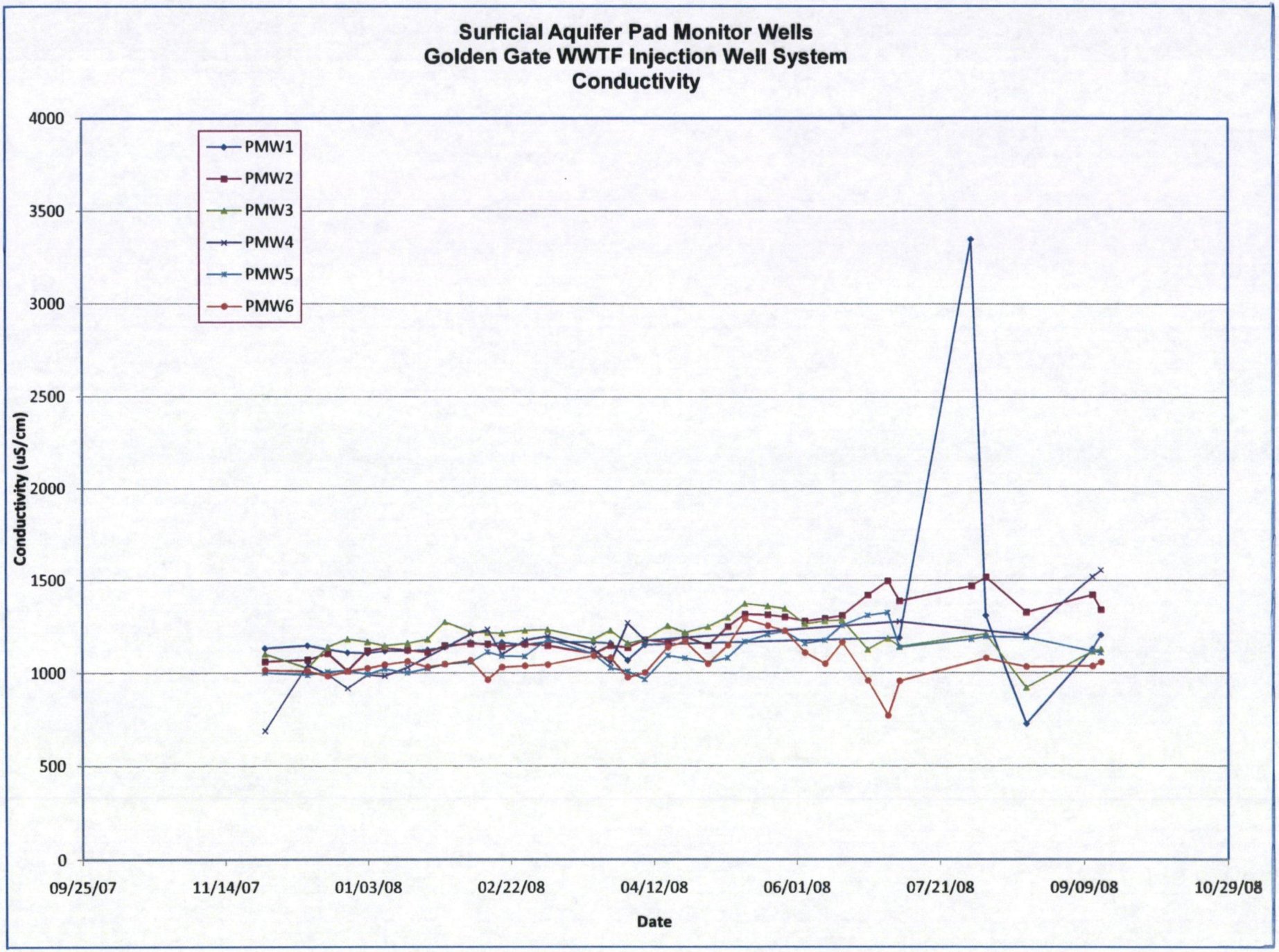
"feet msl" denotes feet relative to mean sea level

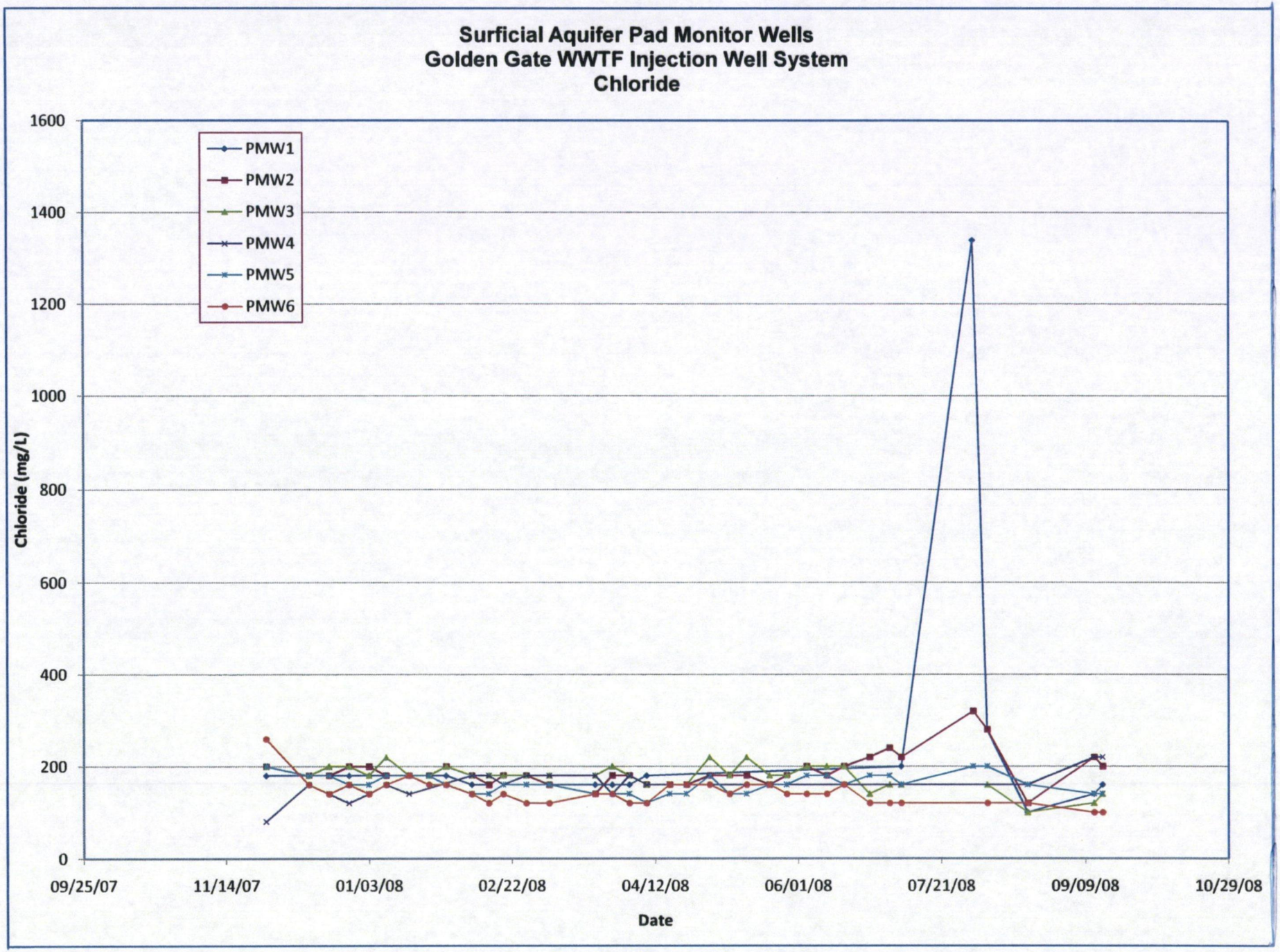
"°C" denotes degrees Celsius

"µS/cm" denotes microSiemens per centimeter

"mg/L" denotes milligrams per Liter

Only wells adjacent to the IW1 drilling pad were sampled after April 9, 2008


Surficial Aquifer Pad Monitor Wells
Golden Gate WWTF Injection Well System
Conductivity
PMW1
PMW2
PMW3
PMW4
PMW5
PMW6
Conductivity (uS/cm)
4000
3500
3000
2500
2000
1500
1000
500
0
09/25/07
11/14/07
01/03/08
02/22/08
04/12/08
06/01/08
07/21/08
09/09/08
10/29/08
Date


Surficial Aquifer Pad Monitor Wells
Golden Gate WWTF Injection Well System
Chloride
PMW1
PMW2
PMW3
PMW4
PMW5
PMW6
Chloride (mg/L)
1600
1400
1200
1000
800
600
400
200
0
09/25/07
11/14/07
01/03/08
02/22/08
04/12/08
06/01/08
07/21/08
09/09/08
10/29/08
Date

Demonstration of Mechanical Integrity

GOLDEN GATE WWTF INJECTION WELL SYSTEM

MW1 FRP (LOWER MONITOR ZONE) HYDROSTATIC PRESSURE TEST

On February 21, 2008 the Contractor performed a pressure test of the FRP tubing in MW1. The tubing was pressurized to 120.5 pounds per square inch (psi). It should be noted that the removable plug at the bottom of the "California" packer was still in place. After 60 minutes, the pressure inside the FRP tubing decreased 3.0 psi, to 117.5 psi (decrease of 2.5%) and testing was terminated with the FRP tubing successfully passing the test. The pressure from the tubing was gradually released and the volume of water removed during this procedure was measured. A volume of 14 gallons of water were collected during pressure release. A pressure test data table and pressure gauge calibration certificate are attached. The Contractor then re-pressurized the FRP tubing in order to remove the stainless steel plug from the bottom of the "California" packer. The plug was successfully removed when pressure inside the tubing reached 185 psi.

IW1 18-INCH O.D. FINAL CASING HYDROSTATIC PRESSURE TEST

On June 26, 2008, the Contractor installed the 18-inch outside diameter (O.D.), seamless-steel final casing to 2,472 feet below pad level (bpl). Prior to cementing the casing in place, the Contractor installed an inflatable packer at 2,446 feet bpl and performed a hydrostatic pressure test. The casing was pressurized to 155 psi. After one hour, the pressure decreased 0.5 psi to 154.5 psi (a decrease of 0.3%).

On June 30, 2008, (after cementing the final casing in place) the Contractor installed an inflatable packer to 2,440 feet bpl and inflated it to 480 psi in preparation to perform the permit required hydrostatic pressure of the cemented final casing. On July 1, 2008, the final casing was pressurized to 155.8 psi, and the pressure was monitored for 1 hour. Within the 1-hour period, the pressure increased by 3.2 psi representing a pressure change of 2.1%. Because the pressure change was less than 5%, the test was considered successful. The pressure then was released and 17 gallons of water was removed from the well. Mr. James Harcourt (FDEP South District Representative) was onsite to witness the test. A pressure test data table and pressure gauge calibration certificate are attached.

IW1 ANNULAR HYDROSTATIC PRESSURE TEST

On July 4, 2008, the Contractor installed the FRP injection tubing string (11.97-inch inside diameter [I.D.] and 13.29-inch O.D.) in IW1 to just above the internal packer mandrel attached to the 18-inch O.D. final casing wall. The Contractor then pumped 12,000 gallons of a 1.1% corrosion inhibitor solution (Baracor 100) in the annular space. After the corrosion inhibitor was installed, the Contractor seated the external packer mandrel (attached to the base of the FRP tubing) into the internal packer mandrel. A TV survey then was performed in ensure a proper seat.

On August 20, 2008, the Contractor installed a calibrated pressure gauge to monitor the annular space between the FRP injection tubing and the final casing. The annulus then was pressurized

with potable water. A pressure gauge, with the capacity to measure pressures up to 200 psi, graduated in increments of 1 psi, was connected for the hydrostatic pressure test. The Contractor then performed a one-hour hydrostatic-pressure test of the annulus at an initial pressure of 150.0 psi. The test was witnessed by Lech Kwapinski (ARCADIS) and David Rhodes, P.G., (FDEP, Southwest District office). There was a minimal loss of pressure (0.25 psi) within the first 15 minutes the test, and for the reminder of testing no further deviation occurred. These results demonstrate that the final casing and injection tubing have internal mechanical integrity. The hydrostatic pressure-test results and the pressure-gauge calibration certificates are included in **Appendix B**.

HIGH-RESOLUTION TEMPERATURE LOG

Prior to undertaking the RTS logging, the Contractor injected approximately 60,000 gallons of tap water (more than 4 injection well volumes) into the well to establish a fresh water "bubble" below injection casing seat. A high-resolution temperature log was performed on August 20, 2008. The Contractor conducted a temperature log in IW1 from pad level to approximately 2,870 feet bpl. The survey tool could not pass below 2,870 feet bpl due to a large cavity at this depth. The temperature inside the injection casing is a function of a combination of factors, including the water temperature of the formation, and the diameter and wall thickness of the casings.

The temperature log plot shows a starting temperature of 84.8 degrees Fahrenheit (°F) at pad level, increasing to approximately 86.0 °F at 22 feet bpl. Between 22 feet and 2,410 feet bpl the temperature gradually increased to 97 degrees (increase of 11 degrees). The temperature then began to decrease from 97 degrees to 95 degrees to a depth of 2,510 feet bpl. For the remainder of the survey, the temperature remained between 95 and 96 degrees. Based on the temperature log, there is no indication that IW1 lacks mechanical integrity. The high-resolution temperature log is enclosed.

RADIOACTIVE TRACER SURVEY

A RTS was performed to determine whether IW1 had external mechanical integrity (including the integrity of the cement sheath and adjacent formation). The RTS logging tool used for the survey consisted of three gamma-ray detectors: one near the top (GRT), the middle (GRM) and bottom (GRB) of the tool. Readings from the detectors are reported in GAPI units (Note: GAPI units are standard American Petroleum Institute units; 16.5 GAPI units are equivalent to 1 microgram ra-eq/ton). The RTS logging-tool ejector port is located between the GRT and the GRM. A tool diagram is included in the enclosed RTS log plot. A magnetic casing-collar locator (CCL), attached to the base of the RTS logging tool, indicated that the base of the 18-inch O.D. final casing was located at a depth of approximately 2,472 feet bpl.

Background Gamma-Ray Log

Following completion of the high-resolution temperature log a gamma-ray log was performed as an "out-of-position" background log on the upward pass. The background gamma-ray log serves as a means of comparison for each of the subsequent "out-of-position" log passes. An "out-of-position" log pass refers to the RTS tool traveling up the well at a nearly constant speed of 33 feet per minute

while recording. The background gamma-ray log was conducted from 2,870 feet bpl to pad level. During "out-of-position" logging, readings were collected from each of the detectors (GRT, GRM and GRB).

Monitoring Test #1: Dynamic Monitoring

Starting from the bottom section of the RTS log plot, the various surveys are discussed in the same sequence as they were performed. Following the background log, the RTS tool ejector port was loaded with 5.0 millicuries (mCi) of Iodine 131. The Iodine 131 assay label is included in **Appendix B**. For (dynamic) Monitoring Test #1, the Contractor set the ejector of the RTS tool at a depth of 2,467 feet bpl, approximately 5 feet above the base of the injection casing (as recorded by the CCL), and established a constant injection flow rate of 30 gallons per minute (gpm) using potable water. The flowmeter calibration certificate is included in **Appendix B**. During dynamic ('time-drive") monitoring, the RTS tool remained stationary, and "time-drive logging" was shown on the log plot. The vertical segments of the time-drive log indicate time in 20-second intervals and the horizontal segments (for each detector) indicate the change in GAPI units. For other RTS survey logs (background, out-of-position and final gamma-ray logs), the vertical segments of the log plot indicate a change in depth.

After setting the RTS tool and monitoring for 1 minute, the Contractor ejected a 1.0 mCi slug of Iodine 131 and continued "time-drive monitoring" of gamma-ray levels for 60 minutes after the release. The time at which the tracer slug was ejected is noted on the log. Each standard division represents 20 seconds on the time-drive log. The Iodine 131 was first detected by the GRM within approximately 25 seconds after the ejection began (1.0 mCi of Iodine 131 takes approximately 7.0 seconds to eject). The maximum reading (2,649 GAPI) at the GRM occurred within 40 seconds after initial detection. Approximately 5.5 minutes after ejection, the readings at the GRM decreased to approximately 34 GAPI. Approximately 2.5 minutes after ejection, the tracer was detected in the GRB and reached a maximum level of 2,026 GAPI after 3 minutes since ejection. After 15 minutes, the GRM readings decreased to near background levels (less than 20 GAPI). Readings at the GRB decreased gradually until 24 minutes after ejection and remained stable at low levels (30-40 GAPI) for the remainder of (dynamic) Monitoring Test #1. The tracer was not detected in the GRT during Monitoring Test #1.

Monitoring Test #1: Out-of-Position Log and Log After Flush

After 60 minutes of dynamic logging, the Contractor performed an "out-of-position" log (labeled "LOP Test # 1" on the log plot for Log Out of Position) from the base of the final casing to a depth of 2,270 feet bpl. The Contractor performed the "out-of-position" log at an uphole rate of approximate 30 feet per minute. The injection flow rate during the "out-of-position" log remained at approximately 30 gpm. Except for the elevated reading near the bottom of the injection casing, at 2,458 feet bpl, the recorded readings from the GRT and GRM detectors closely resemble the recorded readings from the background gamma-ray log. This was most likely caused by tracer remnant at the ejector lost during RTS tool sudden move during lifting. This "staining" is not present after the flush with potable water.

After conducting the "out-of-position" log, the Contractor flushed IW1 using potable water to flush any excess Iodine 131 off the RTS tool and the inside of the casing. The injection flow rate was approximately 105 gpm. The Contractor then lowered the RTS tool back to 2,467 feet bpl (original ejector depth). After approximately 3,100 gallons of water were pumped down the well, the Contractor returned the flow rate of the potable water to approximately 30 gpm. To monitor for residual Iodine 131 on the RTS tool or casing, the Contractor again performed logging up to 2,560 feet bpl (labeled "LAF # 1" on the log plot for Log After Flush). From 2,470 feet to 2,270 feet bpl, the recorded readings from all three detectors closely resemble the recorded readings from the background gamma-ray log.

Monitoring Test #2: Dynamic Monitoring

For Monitoring Test #2, the Contractor again set the RTS tool with the ejector at a depth of 2,467 feet bpl and established an injection flow rate of approximately 30 gpm. The Contractor then monitored gamma-ray levels for one minute before ejecting a 1.5 mCi slug of Iodine 131, and monitored levels for 60 minutes after release. The Iodine 131 was first detected by the GRM within approximately 45 seconds after the ejection began. A high GRM reading (2649 GAPI units) occurred 40 seconds after the initial detection. Approximately 30 minutes after ejection the readings at the GRM decreased to approximately 34 GAPI units, and after 37 minutes decreased to background levels. Approximately 2.5 minutes after ejection, tracer was detected in the GRB and reached maximum level of 2,027 GAPI after 3 minutes since detection. Readings at the GRB decreased gradually until 37 minutes after ejection and remained stable at low levels (20-30 GAPI units) for the remainder of (dynamic) Monitor Test #1. As during the previous test, tracer was not detected in the GRT.

Monitoring Test #2: Out-of-Position Log

After dynamic logging, the Contractor performed an "out-of-position" log (LOP #2) up to 2,270 feet bpl at an approximate travel rate of 30 feet per minute. The injection flow rate during the "out-of-position" log remained at 30 gpm. The readings from the GRT, GRM and GRB closely resemble the recorded readings from the background gamma-ray log.

Final Gamma-Ray Log

After conducting the "out-of-position" log, IW1 was flushed using potable water to remove any excess Iodine 131 from the RTS tool and the inside of the casing. The injection flow rate was approximately 105 gpm. The tool was then lowered to 2,870 feet bpl and the remaining 2.5 mCi of Iodine 131 was ejected. The Contractor then performed gamma-ray logging from 2,870 to pad level.

Between 2,570 feet and 2,520 feet bpl, elevated readings were observed in all three detectors. This indicates the shallowest major flow zone below the base of casing, and is labeled "Point of Injection" on the log plot. Above this interval, the readings from all three detectors closely resemble the recorded readings from the background gamma-ray log. Slightly elevated readings were observed between 1,810 feet and 1,670 feet bpl in the final gamma-ray log plot compared to the background plot (an increase of approximately 10 to 12 GAPI). However the signatures between the

background plot and final plot are nearly identical (minor "peaks" and "dips" are the same for both plots). If a compromise of well integrity is present, the elevated readings in the final plot would not match this closely to the background plot; and therefore these elevated readings do not indicate a lack of mechanical integrity.

RTS Interpretation

During dynamic monitoring, potable water pumped down the well forced the Iodine 131 tracer material downward where it was detected by the GRM and GRB (located below the ejector). The GRT can detect the Iodine 131 if the Iodine 131 moves upward outside the injection casing (due to spaces between the cement and casing or the cement and formation, or if fractures exist in the formation near the well).

The primary purpose of the "out-of-position" logs and the final gamma-ray log was to determine the extent (if any) of upward migration of Iodine 131 through the formation or through annuli adjacent to the well bore or casing. Because the recorded readings of all three detectors from each "out-of-position" log and the final gamma-ray log resembled the recorded readings of the background gamma-ray log, and because the GRT did not record any elevated readings after ejection during either dynamic monitoring tests, we conclude that the cement sheath around the injection casing is intact and an adequate bond is present between the cement and the formation, as well as between the casing and the cement.

RX#222149
I – 131 Liquid
Youngquist Brothers Inc.
10 mCi **14:00**
MEDICINAL GRADE
08/18/2008 14:00
Box: 12:00 – 2

CAUTION
RADIOACTIVE MATERIALS

RX#222149
I – 131 Liquid
10 mCi
Cal Date 08/18/2008
Cal Time 14:00
MEDICINAL GRADE

MedTech Diag. Services/Triad (239) 277 – 0990 (800) 690 – 909
1840 Boy Scout Drive, Unit A Fort Myers, FL 33907
RX#222149

Account Name: Youngquist Brothers Inc.
Delivery D/T: 08/18/2008 12:00 Container:2

Patient: MEDICINAL GRADE
Product: I – 131 Liquid
Procedure: Pipe Leak Test
Physician: Clay Ferguson
Ordered Amount: 10 mCi Quantity: 1 Inj. Amt: _____ mCi
Cal Date/Time: 08/18/2008 14:00
Actual Amount: 11.062 mCi Quantity: 1 Volume: 10.00 ml (1.11 mCi/ml)
Exp Date/Time: 08/29/2008 18:00
Filled By: Geoff Becker BCNP
Lot #(s): I071908D 0.057
NOTES: BLUE. NA THIO. FINAL 10CC. MEDICINAL GRADE

CAUTION: TO BE USED UNDER THE DIRECT SUPERVISION OF A PHYSICIAN

WATER METER
ACCURACY TEST REPORT

6/3/2008

#	MAKE	SERIAL #	LOW FLOW	INT.FLOW	HIGH FLOW
1	2"	*6205001*	99.2	100.0	100.5
2	USG				
3	MJ				
4	METERS				
5					
6					
7			2 GPM	8 GPM	80 GPM
8					
9		*USAGE*			
10		*1687300*			
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					

MASTER METER

101 Regency Parkway
Mansfield, Texas
817-842-8000
(800) 765-6518
FAX# 817-842-8100
RMA# 19323

CUSTOMER: YOUNGQUIST BROS. INC
TEST DATE: 6/3/2008
TESTER: STEVE WHITE

NOTE:
Accuracy limits according to AWWA C708-96

*** 97% - 103% for Low Flows**

*** 98.5% - 101.5% for Intermediate and High Flows**

*** Accuracy limits for meters removed from service according to M-6 Manual Table 5-1**

***80% - 104.0% for Low Flows**

***96% - 102.0% for Intermediate and High Flows**

HYDROSTATIC PRESSURE TEST RESULTS

ARCADIS

HYDROSTATIC PRESSURE-TEST DATA
FGUA GOLDEN GATE WASTEWATER TREATMENT PLANT
INJECTION WELL SYSTEM
DEEP MONITOR WELL MW1
COLLIER COUNTY, FLORIDA

Hydrostatic pressure test on nominal 6-inch FRP Tubing ($6^5/_8$-inch-size Red Box™ 1750 and 2500, manufactured by Future Pipe Industries)

Date: February 21, 2008

Project Site: Golden Gate Wastewater Treatment Plant

ARCADIS Proj. No. WF004200.G015

Time (hours)	Delta Time (min.)	Pressure (psi)
13:10	0	120.5
13:15	5	120.9
13:20	10	119.7
13:25	15	119.5
13:30	20	119.3
13:35	25	119.1
13:40	30	118.9
13:45	35	118.7
13:50	40	118.4
13:55	45	118.2
14:00	50	118.0
14:05	55	117.8
14:10	60	117.5

The 0 - 300 pound-per-square-inch, McDaniel-brand pressure gauge (Serial No.06806-2) was calibrated on October 12, 2007.

I, Lech Kwapinski, certify that the above data is true and accurate.

Lech Kwapinski, P. G.

Blue Ribbon / GP: 50
2770 Long Road
Grand Island, NY 14072-0297
(716) 773-9300 FAX: (716) 773-5019 Internet: http://www.gp50.com

CERTIFICATE OF COMPLIANCE AND CALIBRATION

Customer: YOUNGQUIST BROTHERS **Work Order Number:** N/A

Equipment Serial Number: 060806-2 **Insulation Check:** N/A

Pressure Reference ID: 11900-401 **Reference Meter ID:** N/A

Equipment Pressure Range: 0-300 PSI **Barometric Pressure:** N/A **PSIA**

Target Pressure	Step %	Linearity	Hysteresis	Non-Repeatability
0	0	0		
60	20%	60		
120	40%	121		
180	60%	180		
240	80%	240		
300	100%	300		
FSO				
Shunt				

Technician Initial: JR **Date:** 10/12/2007

This certificate will certify that your equipment authorized for calibration on your Purchase Order VERBAL-Ted, tested this date, and is in calibration. The equipment tested is identified as a 6.0", GAUGE 300PSI.

This gauge was tested on a Mensor Indicator Model 11900-401 Serial Number 040613; Calibration expires on August 14, 2008 and is to be accurate to within +/-.25%, traceable to NIST standards.

The subject gauge performed to within +/-1.5% accuracy.

Blue Ribbon is a GP: 50 Company. Certificate expires 1 year from date issue.

N:\Aerospace\AeroFinalCalCards\1AAA_MasterCalCards\Final Calibration Datasheet.doc

ARCADIS

HYDROSTATIC PRESSURE-TEST DATA
FGUA GOLDEN GATE WASTEWATER TREATMENT PLANT
INJECTION WELL SYSTEM
DEEP MONITOR WELL MW1
COLLIER COUNTY, FLORIDA

Hydrostatic pressure test on nominal 18-inch outside-diameter injection casing.

Date: July 1, 2008

Project Site: Golden Gate Wastewater Treatment Plant

ARCADIS Project No. WF004200.G015

Time (hours)	Delta Time (min.)	Pressure (psi)
16:40	0	155.8
16:45	5	155.9
16:51	11	156.2
16:56	16	156.8
17:00	20	157.0
17:06	26	157.2
17:12	32	157.5
17:16	36	157.9
17:20	40	158.1
17:25	45	158.2
17:32	52	158.5
17:36	56	158.8
17:40	60	159.0

The 0 - 300 pound-per-square-inch, 6-inch Blue Ribbon Corp . brand pressure gauge (Serial No. 101504-3) was calibrated on February 22,2008.

BLUE
RIBBON

Blue Ribbon Sales & Services
1940 Howell Branch Rd.
Winter Park, FL 32792

Phone: (877) 677-8899
Fax: (407) 657-6622
www.blueribboncorp.com

CALIBRATION CERTIFICATE
2/22/08

Youngquist Brothers, Inc
15465 Pine Ridge Rd.
Fort Myers, FL 33908

P.O. 27877

S/N: 101504-3

This certificate will certify that your gauge authorized for calibration on your Purchase Order 27877, tested this date, and is in calibration. The gauge tested is identified as a 6", Blue Ribbon Corp gauge 0-300 PSI.

This gauge was tested on a Mansfield & Green Deadweight Tester model T-100 Serial Number 11353, certified by GP:50 Mfg., Calibration expires on December 14, 2008 and is to be accurate to within +/-.25%, traceable to NIST standards.

The subject gauge performed to within +/-1.5% accuracy.

Sincerely,

Juan Nova

ARCADIS

HYDROSTATIC PRESSURE-TEST DATA
FGUA GOLDEN GATE WASTEWATER TREATMENT PLANT
INJECTION WELL SYSTEM
INJECTION WELL IW1
COLLIER COUNTY, FLORIDA

Annular Pressure Test

Date: August 20, 2008

Project Site: Golden Gate Wastewater Treatment Plant

ARCADIS Project No. : WF004200.G015

Time (hours)	Delta Time (min.)	Pressure (psi)
16:22	0	150.0
16:27	5	150.0
16:33	11	149.9
16:37	15	149.8
16:42	20	149.75
16:47	25	149.75
16:52	30	149.75
16:57	35	149.75
17:02	40	149.75
17:07	45	149.75
17:12	50	149.75
17:17	55	149.75
17:22	60	149.75

The 0 - 200 pound-per-square-inch, 6-inch Kimball Electronic Laboratory, Inc. brand pressure gauge (Serial No.KEL-127528) was calibrated on July 9,2008.

Certificate of Calibration

 # KELC-51714

Kimball Electronic Laboratory, Inc.

Precision Measurement Equipment Specialists

Purchase Order # 028849

Calibration Performed By:

KIMBALL ELECTRONIC LABORATORY, INC
8081 W 21 LANE
HIALEAH, FL. 33016

For: YOU410

YOUNGQUIST BROTHERS, INC.
15465 PINE RIDGE ROAD
FT MYERS FL 33908

Equipment Information KELI I.D.: KEL-127528

Description:	PRESSURE GAUGE
Manufacturer:	MCDANIEL
Model Number:	200 PSI
Part Number:	N/A
Range:	0-200 PSI
Serial Number:	040605-2
Customer I.D.:	N/A
Cust. Barcode:	N/A
Cust. Location:	N/A
Specifications:	+/-0.25% F.S.

Cal Date:	09-Jul-08
Cal. Due Date:	09-Oct-08
Cal. Interval:	3 MONTHS
Received:	IN TOLERANCE
Calibration Result:	PASS
Environmental Conditions:	72 DEG F / 50 % RH
Performed By:	ELIU LAGO
Procedure:	SYN54

This is to certify that the above listed instrument meets or exceeds all specifications as stated in the referenced procedure at the points tested (unless otherwise noted). It has been calibrated using measurement standards traceable to the National Institute of Standards and Technology (NIST), or to NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques. This calibration is in accordance with Kimball Electonic Laboratory, Inc Quality Assurance Manual. KELI's Quality system is A2LA-Accredited to ISO/IEC-17025 and compliant with MIL-STD-45662A and ANSI/NCSL Z540-1-1994. TURS when applicable are greater than or equal to 4:1; with expanded uncertainty used to calculate the Test Uncertainty Ratio, with a coverage factor of K=2 at a confidence level of approximately 95%, unless otherwise noted.

Any number of factors may cause the calibration item to drift out of calibration before the recommended interval has expired.

Calibration Remarks

THIS UNIT WAS FOUND TO BE IN TOLERANCE AT THE TIME OF CALIBRATION.
PERFORMED ROUTINE CALIBRATION/CERTIFICATION

Standards Used To Calibrate Equipment

Company	I.D.	Description	Last Cal.	Cal. Due Date
KIM001	391	EATON UPS 3000BAA PRESSURE INDICATOR	20-Nov-07	30-Nov-09

Signatures:

Certified by: ELIU LAGO 09-Jul-08 6:44:11 PM

Approved By: JAVIER BALCEIRO 10-Jul-08 4:54:17 PM

CONTROL # : KEL-127528

CUSTOMER : YOU410

8081 W. 21 LANE
HIALEAH, FL. 33016
PH # 305-822-5792
FAX # 305-362-3125

CALIBRATION DATA FORM

MFR:	MCDANIEL	DESCRIPTION :	PRESSURE GAUGE
MODEL # :	200 PSI .25%	TECHNICIAN :	098
SERIAL # :	040605-2	CAL DATE :	09-JUL-2008
CUST ID #:	N/A	DUE DATE :	09-JUL-2009

* IF NO "AS LEFT" READING IS SHOWN ON THIS CHART, IT MEANS THE UNIT WAS IN TOLERANCE AND THERE WERE NO ADJUSTMENTS MADE TO IT.

RANGE	NOMINAL	AS FOUND	AS LEFT *	LOW LIMIT	HIGH LIMIT
0 – 200 PSI					
	40	40.0		39.5	40.5
	80	80.0		79.5	80.5
	120	120.2		119.5	120.5
	160	160.2		159.5	160.5
	200	200.2		199.5	200.5

ARCADIS

Appendix F

Injection Test Data

ARCADIS

12 hr Injection Test

FGUA Golden Gate WWTF Injection Well System
Golden Gate, Florida
Date: 09/15/08

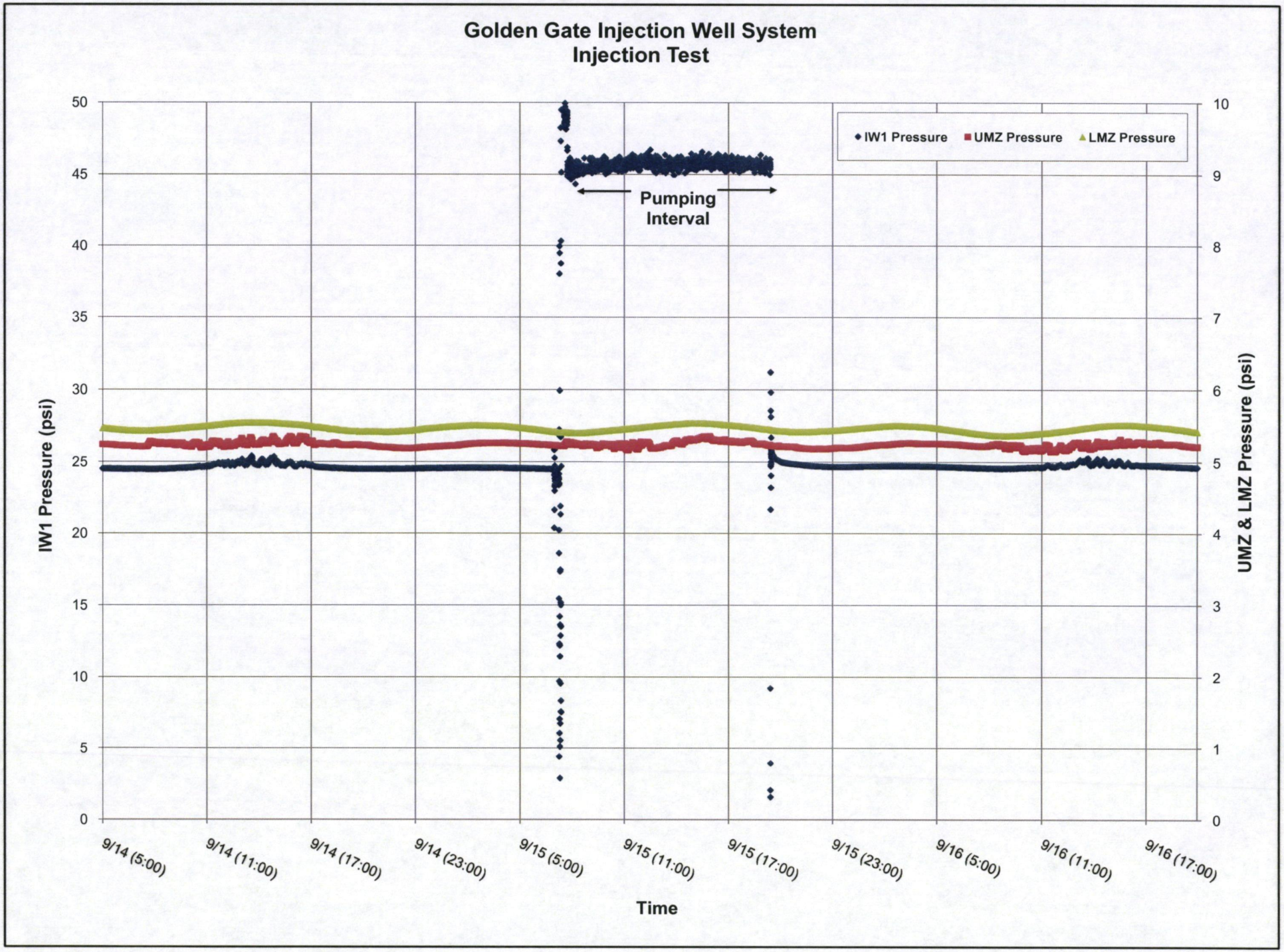
Static IW1 Well Head Pressure (PSI):	24.5	Totalizer Reading (start):	22,751,000
Static Upper Zone Pressure (PSI):	4.7	Totalizer Reading (finish):	25,277,800
Static Lower Zone Pressure (PSI):	n/a	Average pumping rate (gpm):	3,495

Time	Elapsed Time (minutes)	Flow Rate (GPM)	IW1 Well-Head Pressure (PSI)	Upper Zone Pressure (PSI)	Lower Zone Pressure* (PSI)	Totalizer (gallons)	Temp. (F)	Static Annular PSI:	Comments
7:23	0	4,900	66.0	n/a	n/a	22,751,000	68.8	45.0	Start injection test
7:31	8	4,300	55.0	4.8	n/a	n/a		46.0	Lowering rate
7:36	13	3,850	51.0	n/a	n/a	n/a	n/a	44.7	Lowering rate
7:43	20	3,800	51.0	4.9	n/a	n/a		n/a	Lowering rate
7:49	26	3,470	46.5	5.0	n/a	n/a	80.0	40.5	Rate stabilized
7:55	32	3,480	46.5	5.0	n/a	n/a	80.0	39.3	
8:12	49	3,510	46.5	5.2	n/a	22,933,000	80.0	n/a	
8:32	69	3,490	45.8	5.5	n/a	23,003,000	81.0	34.3	
8:52	89	3,480	45.8	5.6	n/a	23,072,000	81.0	32.0	
9:32	120	3,490	45.8	5.5	n/a	n/a	81.0	29.5	
10:07	165	3,490	45.8	5.4	n/a	23,334,000	82.0	26.8	
10:43	200	3,500	45.6	5.3	n/a	23,460,000	82.0	28.0	
11:23	240	3,500	45.8	5.3	n/a	23,600,000	82.0	24.8	
11:54	271	3,490	45.6	5.3	n/a	23,708,000	82.5	24.8	
12:23	300	3,490	45.6	5.3	n/a	23,809,500	82.5	24.6	
12:53	330	3,500	45.6	5.3	n/a	23,914,600	83.0	24.5	
13:23	360	3,490	45.5	5.3	n/a	24,018,700	83.0	24.3	
13:53	390	3,490	45.5	5.3	n/a	241,232,000	83.0	25.5	
14:27	424	3,490	45.6	5.3	n/a	24,241,400	84.0	26.0	
14:54	451	3,500	45.6	5.2	n/a	24,332,800	85.0	27.3	
15:23	480	3,490	45.8	5.2	n/a	24,436,100	85.0	28.0	
15:54	511	3,480	45.9	5.2	n/a	24,543,800	75.0	28.2	

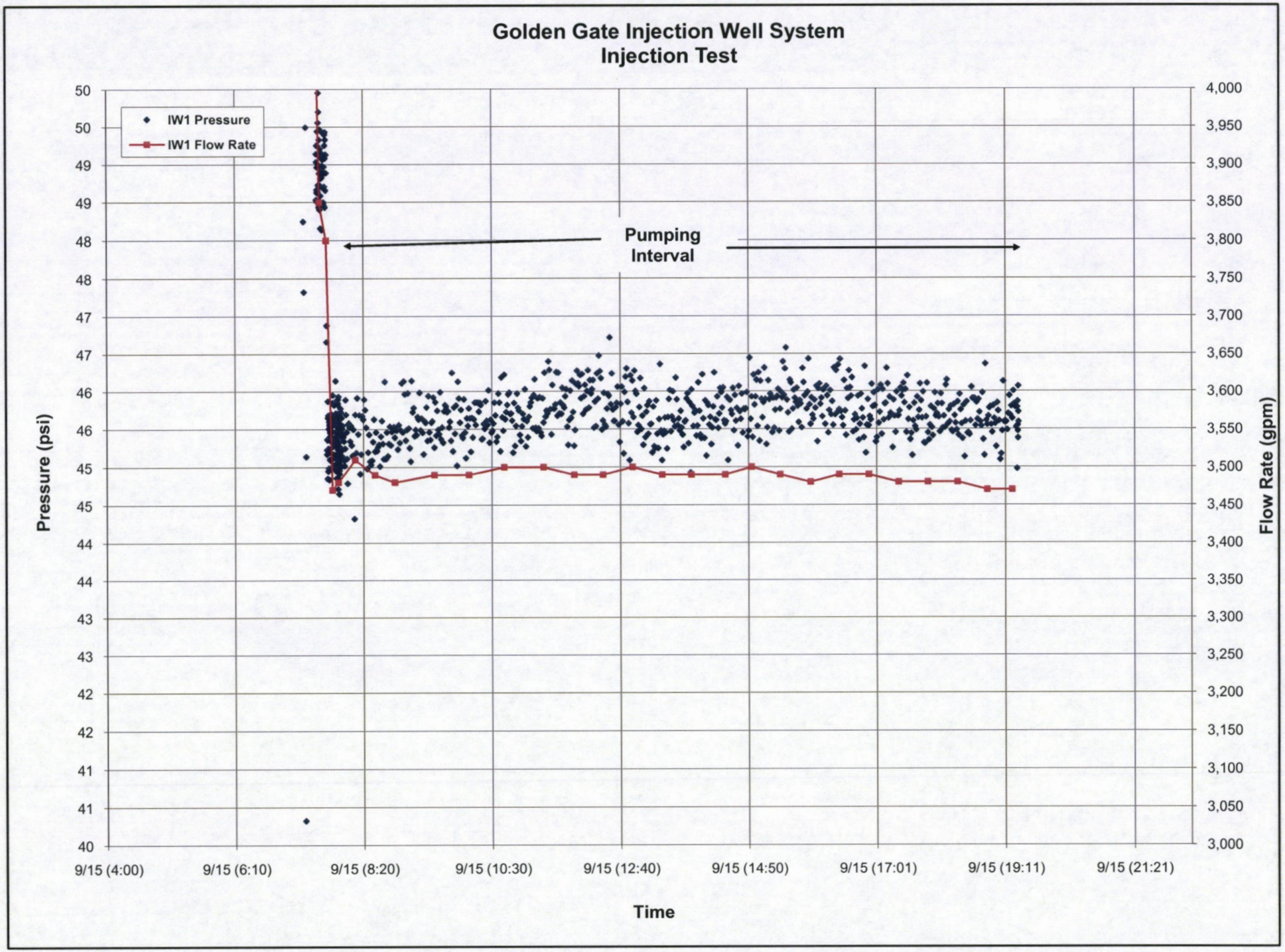
Static IW1 Well Head Pressure (PSI):	24.5	Totalizer Reading (start):	22,751,000
Static Upper Zone Pressure (PSI):	4.7	Totalizer Reading (finish):	25,277,800
Static Lower Zone Pressure (PSI):	n/a	Average pumping rate (gpm):	3,495

Time	Elapsed Time (minutes)	Flow Rate (GPM)	IW1 Well-Head Pressure (PSI)	Upper Zone Pressure (PSI)	Lower Zone Pressure* (PSI)	Totalizer (gallons)	Temp. (F)	Static Annular PSI:	Comments
16:23	540	3,490	46.0	5.2	n/a	24,644,400	79.0	28.5	
16:53	570	3,490	45.9	5.2	n/a	24,748,900	79.0	33.4	
17:23	600	3,480	45.8	5.2	n/a	24,854,500	80.0	38.7	
17:53	630	3,480	45.8	5.1	n/a	24,956,200	80.0	38.7	
18:23	660	3,480	45.8	5.1	n/a	25,060,000	80.0	38.7	
18:53	690	3,470	45.9	5.0	n/a	25,163,500	83.0	38.0	
19:18	715	3,470	46.0	4.9	n/a	25,250,200	83.0	38.0	
19:25	722	n/a	n/a	n/a	n/a	n/a	80.0	n/a	
19:26	723	n/a	n/a	n/a	n/a	25,277,900	78.0	n/a	Pump-off, end of test
					Recovery				
19:28	2	0	26.5	4.8	n/a	n/a	82.0	34	
19:32	6	0	26.3	4.8	n/a	n/a	82.0	34	
19:40	14	0	26.3	4.8	n/a	n/a	82.0	34	End of field data

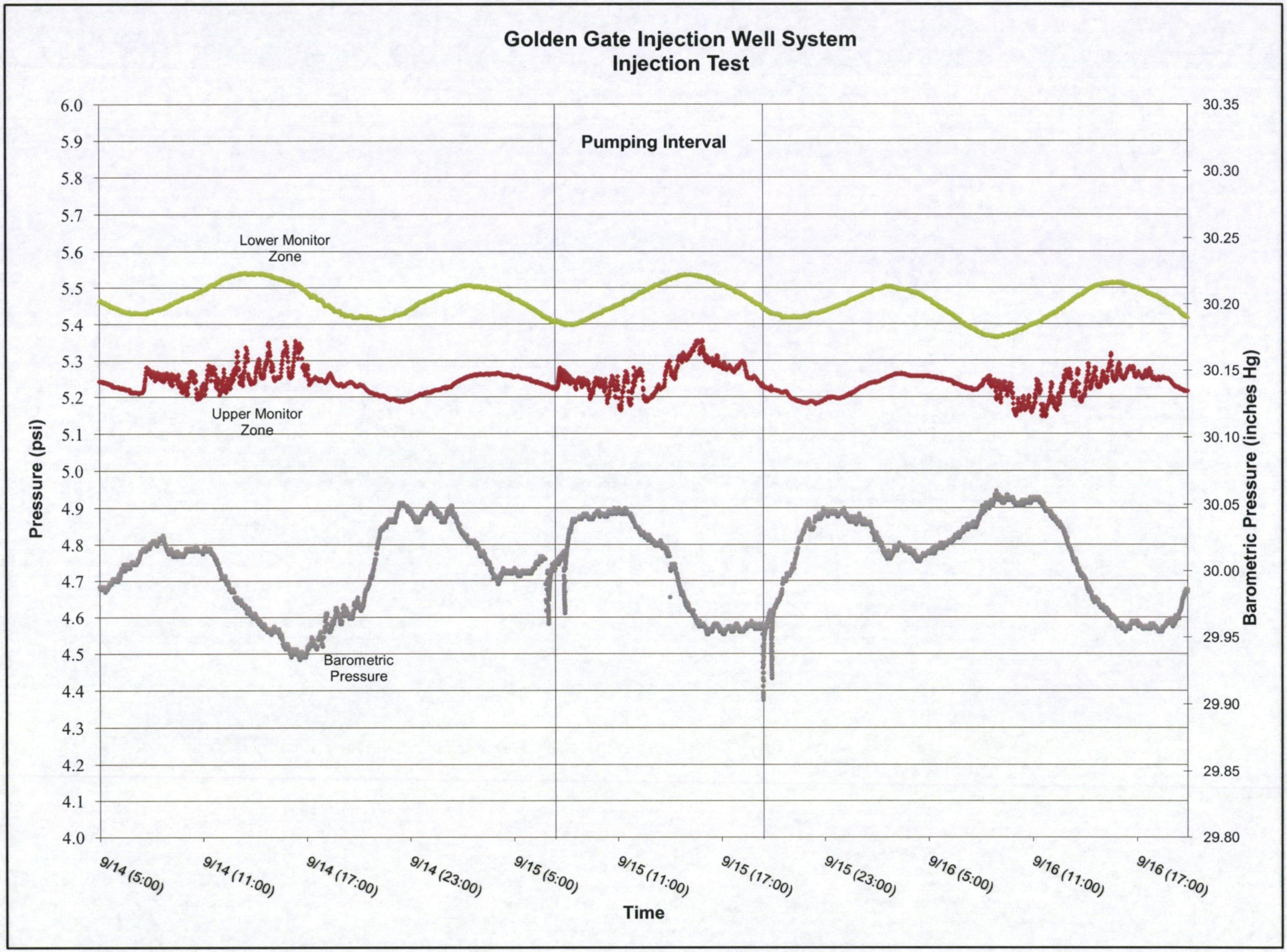
Upper Monitor Zone Transducers and pressure gauge were set approximately 3.2 feet above pad level.
Lower Monitor Zone Transducers were set approximately 10 feet below pad level.
IW Transducers and pressure gauge were set approximately 6.1 feet above pad level.
* Water level was below ground surface. No gauge was installed on the LMZ wellhead



g:aproject\reesemacon\pf001152.0004\Op. Testing Request\Injection Test\Combined Data.xlsx\24-12-24 Chart



g:aproject\reesemacon\pf001152.0004\Op. Testing Request\Injection Test\Combined Data.xlsx\3-12-3 Chart



g:aproject\reesemacon\pf001152.0004\Injection Test\Combined Data.xlsx\MWs & B. Pressure - #9

ARCADIS

Appendix G

Electronic Files of:

-Weekly Construction Reports

-Geophysical Logs

- Packer Test Raw Data and Analytical Reports

-MW1 Monitor Zones and IW1 Injection Zone WQ Analytical Reports

-Injection Test Source WQ Analytical Report

-Injection Test Raw Data