WELL COMPLETION REPORT

SEACOAST UTILITY AUTHORITY
SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL
BR-21B

PALM BEACH GARDENS, FLORIDA

Prepared for:

Seacoast Utility Authority

and

Holtz Consulting Engineers, Inc.
50 South U.S. Highway 1, Suite 203
Jupiter, Florida 33477

January 2015

Prepared by:

JLA Geosciences, Inc.
1931 Commerce Lane, Suite 3
Jupiter, Florida 33458

James L. Andersen
Registered Professional Geologist
State of Florida License #1103

JLA Geosciences, Inc.
HYDROGEOLOGIC CONSULTANTS

1931 Commerce Lane Suite 3
Jupiter, Florida 33458
(561) 746-0228
Fax (561) 746-0119

January 23, 2015

David Holtz
Holtz Consulting Engineers, Inc.
50 South U.S. Highway 1, Suite 203
Jupiter, Florida 33477

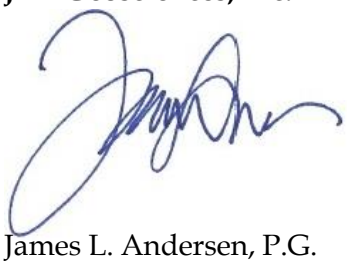
RE: ***Seacoast Utility Authority, Surficial Aquifer Replacement Production Well BR-21B Well Completion Report***

Dear David,

We are pleased to submit four (4) copies of the Well Completion Report for Seacoast Utility Authority, Surficial aquifer replacement production well BR-21B well completion report. This report summarizes construction, development, and testing of one (1) Surficial aquifer replacement production well, constructed for the Seacoast Utility Authority Hood Road Water Treatment Plant.

If we can do anything further, please call us.

Sincerely,
JLA Geosciences, Inc.



James L. Andersen, P.G.
Principal Hydrogeologist

JLA/jla
Encls.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

EXECUTIVE SUMMARY

Between December 2013 and September 2014, JLA Geosciences, Inc. (JLA) provided hydrogeologic consulting services for the construction of one (1) Surficial aquifer production well for Seacoast Utilities Authority (SUA) and Holtz Consulting Engineers, Inc. (HCE). Production Well BR-21B will serve as replacement Surficial aquifer production well to supply the new SUA, nanofiltration membrane water treatment plant at the Hood Road Water Treatment Plant site (HRWTP), located in Palm Beach Gardens, Florida. Southeast Drilling Services, Inc. (SDS) of Tampa, Florida was contracted by SUA to construct the replacement production well.

The final completion interval of the replacement well was determined by on site specific conditions and well performance. The replacement well was completed as follows:

	BR-21B
Well Screened Interval (feet BLS) 16-inch diameter, 316L Stainless Steel 0.090-inch slot size	155 – 180

feet BLS: feet below land surface

A step drawdown (SDD) test was performed at the replacement production well following completion of well development. SDD testing included four (4) steps at two (2) hours per step. Rates ranged between 300 gallons per minute (gpm) and 450 gpm. The specific capacity at the design pumping rate, 300 gpm, during the step drawdown was 5.0 gallons per minute per foot of drawdown (gpm/ft). Water quality measurements during SDD testing at the design rate of 300 gpm are as follows:

Design Rate (gpm)	300
Chloride* (mg/L)	89
Hydrogen Sulfide (ppm)	2.0
Sand Concentration (ppm)**	<0.1
Silt Density Index**	1.7

**Laboratory Analysis during final well video*
***Field Analysis*

Recommended Silt Density Index (SDI) values for nanofiltration membrane facilities are 3.0 units with ideal values less than 1.0. Well BR-21B met the SDI Nano criteria at the maximum design pumping rate after 120 minutes of sustained pumping.

Laboratory testing results of the water quality analysis indicated that the formation water meets Florida Department of Environmental Protection (FDEP) requirements for primary and secondary drinking water standards with the exception of color and odor. Exceedance of color and odor in groundwater in South Florida is common.

Based on drilling and testing results, JLA recommends the following:

Monitoring of the production wells should include, at a minimum the following (frequency of measurement should be monthly):

- Water Quality: specific conductance, chloride concentration, sand content, and silt density.
- Well Performance: static water levels, pumping water levels, pumping rates, and specific capacity calculation.
- Water level and water quality monitoring must include all applicable requirements as determined by the SUA, SFWMD Consumptive Use Permit (CUP) 50-00365-W (Permit).

Maintenance personnel should implement a program of continuous water level monitoring. Monitoring should include monthly measurements of pumping rate, static and pumping water levels in each production well. Data should be recorded with dates, times of measurement, and personnel performing measurements.

All data should be plotted electronically in time series format for periodic well performance evaluation. Consistently low pumping water levels or a specific capacity loss of 20% or greater than reported in this report may indicate the need for evaluation and potential well rehabilitation.

1.0 INTRODUCTION

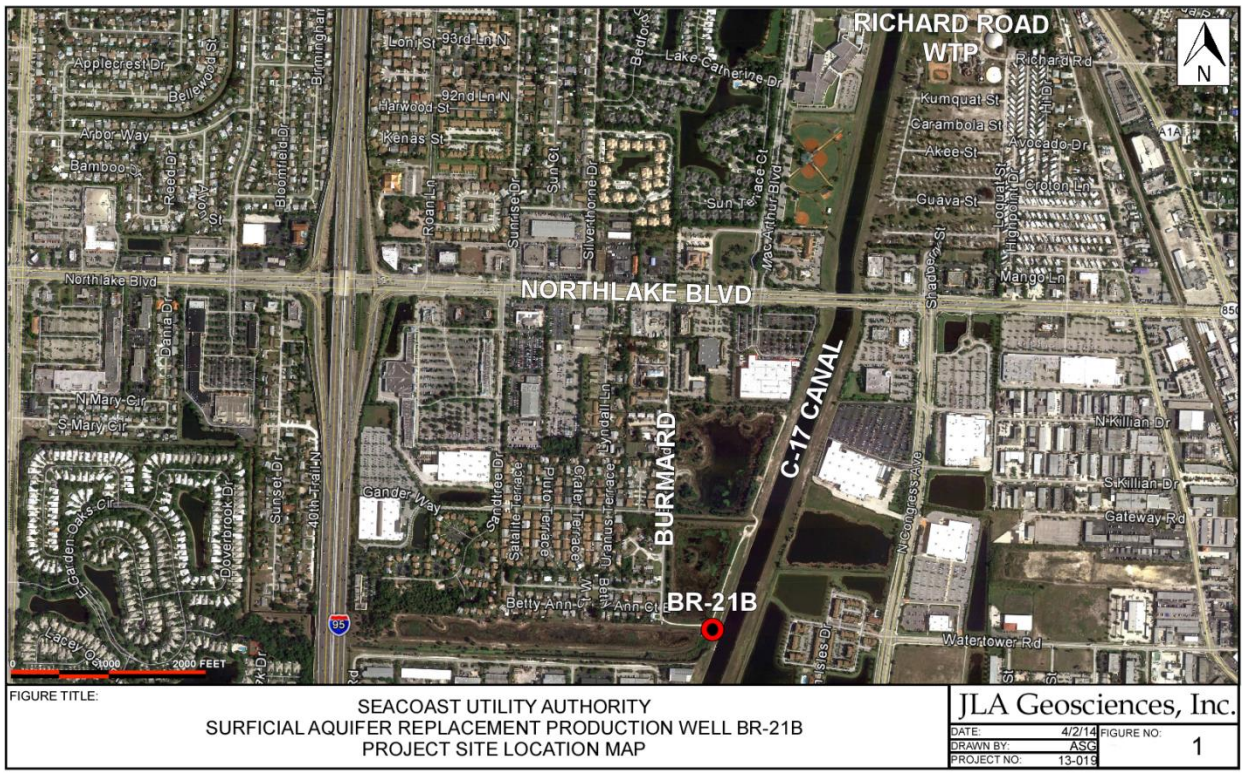
JLA was contracted by Holtz Consulting Engineers, Inc. (Holtz) to provide hydrogeologic consulting services associated with the construction of one (1) surficial aquifer production well, identified as BR-21B, to provide raw water supply for the Seacoast Utility Authority (SUA), Hood Road Water Treatment Plant (HRWTP) located at 4200 Hood Road, Palm Beach Gardens, Florida.

JLA provided the following services during construction of the HRWTP production well: observation of field construction during profile well drilling, testing and sampling, geophysical and video logging, production well construction, measurement and testing services; interpretation of hydrogeologic, water quality and geophysical data; and providing recommendations as to the depths of boreholes, well casings, and screened completion intervals.

Southeast Drilling Services, Inc. (SDS) of Tampa, Florida was contracted by SUA to construct the production well. SDS complied with the standards of the American Water Works Association for Deep Wells (AWWA A100-06), as referenced in the specifications. A copy of the Driller Well Completion Report is included in Appendix A.

The site location and well location are shown on Figure 1. Construction of the production well began in December 2013 and was completed in September 2014. Production well BR-21B was completed with a 16-inch diameter, 0.090-inch slot sized stainless steel screen from 155 feet BLS and 180 feet BLS.

Figure 1, Project Site Location Map



2.0 WELL CONSTRUCTION AND TESTING

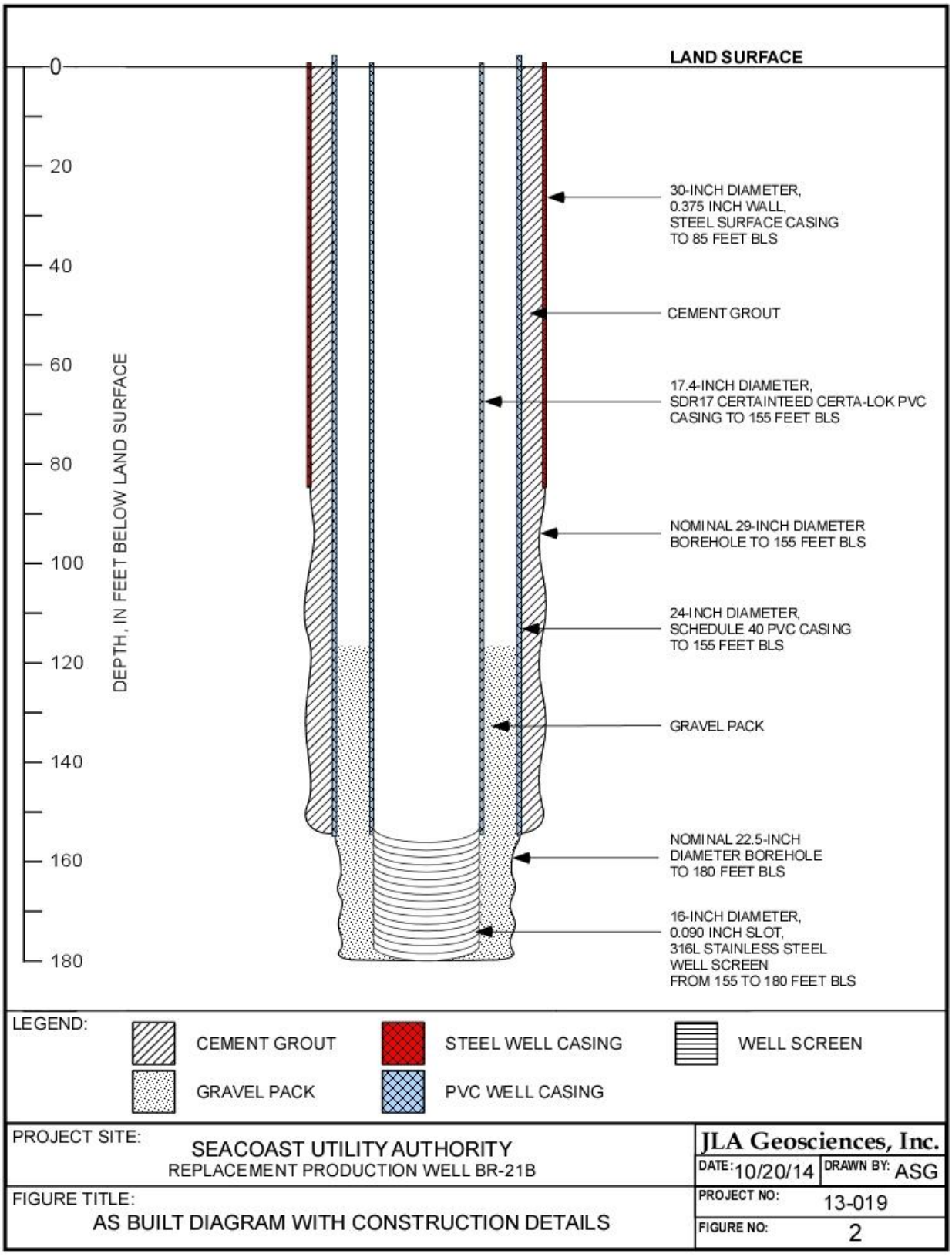
JLA performed onsite hydrogeologic observation during rotary drilling of pilot well, geophysical logging, casing installations, casing grouting, and reverse air drilling of completion intervals, development, and pump testing. The construction details for BR-21B are provided in Table 1 and an as-built diagram is provided as Figure 2.

Table 1, Well Construction Details

	BR-21B
Pilot Hole Depth (feet BLS) *7⅞-inch diameter borehole*	205
Total Depth (feet BLS)	180
Surface Casing Depth (feet BLS) *30-inch diameter steel, 0.375-inch wall thickness*	85
Intermediate Well Casing Depth (feet BLS) *24-inch diameter Schedule 40 PVC*	155
Riser Casing Interval (feet BLS) 17.4-inch diameter, SDR17 PVC CertainTeed Certa-Lok	0 – 155
Well Screened Interval (feet BLS) *16-inch diameter, 316L Stainless Steel* *0.090-inch slot size*	155 – 180
Well Screen Length (feet)	25
Gravel Pack Interval (feet BLS) *Edgar Mineral 4 by 9*	120

feet BLS - feet below land surface

Figure 2, As-Built Diagram



2.1 Pilot Hole Drilling

Prior to production well construction, a nominal 7⅞-inch diameter exploratory pilot hole was drilled using the mud rotary method to obtain lithologic data at the well site. Pilot hole drilling was completed on December 18, 2013. The borehole was drilled to a depth of 205 feet-BLS. Lithologic samples were collected every five (5) feet during borehole drilling in order to evaluate the geologic character of the aquifer with depth. A copy of the lithologic log compiled from the collected samples is included as Appendix B. Upon completion of borehole drilling the drilling fluid was circulated to clear the hole of cuttings in preparation for geophysical logging.

2.1.1 Geophysical Logging

Borehole geophysical logging was conducted by MV Geophysical of Fort Myers, FL (MVGS) on December 18, 2013. The suite of geophysical logs included caliper, resistivity, dual induction, and gamma ray logs. An electronic copy of the borehole geophysical logs are included in Appendix C. Results of the geophysical logging and analysis of the lithologic samples from the 7⅞-inch borehole were used to select appropriate intervals for water quality and performance testing in the test well and final casing and well screen setting depth for the replacement production well.

2.1.2 Test Well Construction

Upon completion of geophysical logging, a test well was constructed to obtain water quality and aquifer performance data with depth for replacement well design. Interval testing at various depths allowed the JLA hydrogeologist to determine the optimum

completion interval for the production zone of each replacement well based on water quality and capacity data. Test well construction began on December 19, 2013 and was complete December 20, 2013. Sampling and testing was conducted on December 21, 2013 and December 22, 2013.

The test well was constructed using 2-inch diameter PVC casing attached to a 5-foot section of 0.040 inch slot well screen. The test well was installed to the deepest test interval selected for each respective test well and the annular space between the casing/screen and the 7⅞-inch diameter borehole was then filled with 6/14 gravel pack to a depth of approximately 50-feet above the shallowest test interval. The selected screened interval was then developed by airlift development and treated with a mud dispersant to reduce the amount of mud 'cake' buildup on the walls of the borehole, in order for the production capacity of the zone to be more accurately determined. Development continued until turbidity and sand content were consistently low.

Following the initial air lift development a 1-inch diameter submersible pump was installed in the test well and pumped in order to test the interval. Testing for each zone included field water quality sampling and performance testing to determine specific capacity. Measured field water quality parameters included temperature, specific conductance, total dissolved solids, turbidity, pH, hydrogen sulfide, total iron, soluble iron, and chloride. Chloride analysis was performed by JLA using a Hach titrator and silver nitrate titrant. Measurement of pumping rate (Q) and drawdown in the well (dh), at each depth interval, allowed for calculation of the specific capacity (Cs) of the zone to be approximated using the formula Cs = Q/dh (Freeze and Cherry, 1979). Performance testing was conducted by pumping the well with a centrifugal pump for approximately 20 minutes to 90 minutes at each test interval depth, and comparing the pumping water level to the static water level.

Following depth interval testing, the casing and screen were raised to the next selected depth, gravel pack was added as needed, and the process was repeated. This process was performed for approximately six (6) intervals. Table 2 provides a summary of the

water quality data and calculated values for specific capacity from the pump tests conducted during the test well interval sampling.

Table 2 (excerpt), Test Well Water Quality and Performance Data

Test Well Depth (Feet BLS)	Interval #1 177-182	Interval #2 165-170	Interval #3 155-160	Interval #4 144-149	Interval #5 135-140	Interval #6 121-126
Drawdown Data						
Pumping Rate (gpm)	*9.84*	*9.38*	*8.84*	*9.25*	*9.94*	*8.26*
Static Water Level (feet bls)	*2.69*	*1.4*	*3.1*	*2.97*	*2.82*	*2.73*
Pumping Water Level (feet bls)	*10.85*	*9.98*	*8.61*	*6.73*	*5.75*	*9.36*
Maximum Drawdown (feet)	*8.16*	*8.58*	*5.51*	*3.76*	*2.93*	*6.63*
Specific Capacity (gpm/ft)	***1.2***	***1.1***	***1.6***	***2.4***	***3.3***	***1.2***
Water Quality Data						
Temperature (deg. C)	*25.4*	*25.5*	*25.5*	*25.6*	*25.6*	*25.9*
Specific Conductance (uS/cm)	*1133*	*1009*	*938*	*745*	*598*	*527*
Total Dissolved Solids (mg/L)	*736*	*655*	*610*	*484*	*389*	*343*
pH	*7.4*	*7.4*	*7.2*	*7.3*	*7.4*	*7.5*
Salinity (ppt)	*0.6*	*0.5*	*0.5*	*0.4*	*0.3*	*0.3*
Soluble Iron (ppm)	*0.3*	*0.2*	*0.2*	*0.2*	*0.1*	*0.1*
Total Iron (ppm)	*0.3*	*0.2*	*0.2*	*0.2*	*0.1*	*0.1*
Hydrogen Sulfide (ppm)	*3.0*	*2.0*	*1.5*	*0.9*	*0.4*	*0.4*
Turbidity (NTU)	*-*	*7.31*	*9.94*	*6.67*	*5.77*	*7.81*
Chloride (mg/L)	*162*	*184*	*153*	*109*	*82*	*54*

gpm - gallons per minute
mg/l - milligrams per liter
µS/cm - microsiemens per cm
bls - below land surface
ppm - parts per million
NTU - nephelometric turbidity units

Upon completion of interval testing, the test well casing and screen were removed, the borehole was cleaned out to total depth, and abandoned using neat cement grout. The test well was abandoned on December 22, 2013. Water quality, hydrogeologic and geophysical data were analyzed, and a completion interval and construction details were determined for the replacement production well.

2.2 Well Construction

2.2.1 30-Inch Surface Casing Installation

By contract, SDS was responsible for all aspects of the production well construction and performed all of the construction elements. Construction began with SDS using the vibration method to install the 30-inch diameter, 0.375-inch wall thick carbon steel pipe with factory-beveled, butt welded joints, surface casing to approximately 85 feet BLS, outlined in Table 1 and Figure 2. Vibrating of the surface casing was performed using a hydraulically powered, American Piledriving Equipment, Inc. (APE) vibratory hammer. JLA personnel provided oversight during the vibrating and installation of the production well surface casing.

Table 1 (excerpt), Well Construction Details

	BR-21B
Surface Casing Depth (feet BLS) 30-inch dia. steel, 0.375-inch wall thickness	85

feet BLS - feet below land surface

2.2.2 24-Inch Intermediate Casing Installation

Following installation of the surface casing, a nominal 29-inch diameter borehole was drilled using the mud rotary method. Upon completion of borehole drilling, drilling fluid was circulated to clear the hole of cuttings. Based on the analysis of the lithologic samples (drill cuttings) from the pilot hole, drilling penetration, and geophysical logs, JLA recommended casing setting depth of 155-feet BLS for the 24-inch diameter PVC casing strings. The well construction details are presented in Table 1 and Figure 2.

Table 1 (excerpt), Well Construction Details

	BR-21B
Intermediate Casing Depth (feet BLS) 24-inch diameter schedule 40 PVC	155

feet BLS - feet below land surface

Centering guides were strapped to the outside of the casing beginning at 5-feet from the base of the casing and at subsequent 30-foot intervals. The guides position the casing in the center of the borehole to help ensure more uniform grouting of the casing. Upon completion of the casing installation, the annular space was grouted to land surface using API Class B Portland neat cement. The cement was allowed 48 hours to cure before drilling was resumed.

2.2.3 Reverse Air Borehole Drilling

After grouting the 24-inch diameter casing string, drilling operations resumed with the drilling of a nominal 11 $^{7}/_{8}$-inch diameter borehole from 155 feet BLS to 180 feet BLS using the using the reverse air method. Reverse air drilling is accomplished by installing an airline supplying compressed air down the center of the drill string. The compressed air creates an airlift within the drill pipe and drill cuttings from the borehole to rise up the drill pipe to the surface. Reverse air is the preferred method because it does not introduce drilling mud to the production zone and allows for flow and water quality testing of the interval with depth.

A JLA hydrogeologist was on site during drilling of the completion interval to collect lithologic and water quality samples and perform flow tests at five (5) foot intervals. Water levels in the well were measured during the flow tests and compared to static, non-pumping conditions measured at the beginning of each day and after each test interval to calculate specific capacity. Table 3 provides a summary of the water quality data and calculated values for specific capacity during reverse air drilling.

Table 3, Reverse Air Drilling Flow Test Summary

Depth (feet BLS)	Specific Conductivity (µS/cm)	Chloride (mg/L)	Static Water Level (feet BLS)	Pumping Water Level (feet BLS)	Pumping Rate (gpm)	Specific Capacity (gpm/ft)
165	589	67	18.35	31.05	73.5	5.78
170	633	66	-	-	-	-
175	636	66	6.06	24.65	68.9	3.70
180	700	73	10.53	22.93	94.6	7.63

feet BLS - Feet below land surface
µS/cm - microsiemens per centimeter
mg/L – milligrams per liter
gpm - gallons per minute
gpm/ft - gallons per minute per foot of drawdown

2.2.4 Acidization

Due to the relatively low specific capacity of well BR-21B after airlift and pump development, acid treatment was recommended to maximize the specific capacity. The acidization treatment procedure called for 32 percent hydrochloric acid (HCL) to be pumped into the production zone, increasing the permeability of the limestone in the immediate vicinity of the borehole. Acid treatment has a proven track record of increasing the capacities of wells completed in limestone formations. By increasing the specific capacity in a well, the total dynamic head required of the pump at the design pumping rate is reduced, decreasing the horsepower needed as well as the energy consumption. Additionally, increasing the capacity of the well may reduce the need for future rehabilitation and/or the number of future wells that will ultimately be needed.

Acidization was completed in one stage on April 11, 2014. The acidization procedure for BR-21B consisted of installing drop tubing to a depth of 165 feet BLS and pumping 1,010 gallons (three 300-gallon totes and two 55-gallon drums) of 32%, (20^{o} Baume) hydrochloric acid into the open interval at a rate of approximately 70 gpm, followed by enough water to displace the tubing. While pumping the acid, water was simultaneously pumped into a water injection line installed to a depth of 20-feet BLS, at a rate of approximately 60 gpm. During and after pumping, the wellhead was sealed and fitted with a pressure gauge to monitor pressure within the casing. A relief valve and gas

discharge hose was in place on the wellhead to vent off excess pressure in the well. After completing the procedure, SED continued to pump 470 gallons of fresh water into the well through the water injection line to push the acid out of the borehole and into the formation before sealing in the wellhead.

To determine the effectiveness of borehole acidization, a comparison was made between the specific capacity at the same flow rate before and after acid treatment. Prior to acid treatment the specific capacity of BR-21B was 5.0 gpm/ft at 500 gpm. Specific capacity following acid treatment was 17.0 gpm/ft at 600 gpm resulting in an increase of approximately 340%.

Following extensive post acidization development of well BR-21 sand measurements at the design rate were above water well standard of 5 ppm. JLA recommended the installation of 16-inch diameter, 0.090-inch slot sized well screen in the production interval to reduce sand production to within recommended standards.

2.2.5 22.5-Inch Borehole Drilling

Drilling operations resumed with the drilling of a nominal 22½-inch diameter borehole using the using the mud rotary method. A JLA hydrogeologist was on site during drilling of the completion interval to collect lithologic samples. Drilling continued to the total depth of each production well. Following completion of 22½-inch diameter borehole drilling, the borehole was circulated to facilitate installation of the final production well screen and riser casing. Drilling continued to the total depth as presented in Table 1 and Figure 2.

Table 1 (excerpt), Well Construction Details

	BR-21B
Borehole Interval (feet BLS) 22½-inch diameter	155 – 180

ft BLS – feet below land surface

2.2.6 16-Inch Well Screen and Riser Casing Installation

Final casing string consisted of 16-inch outside diameter CertainTeed, Certa-Lok, SDR17 PVC riser casing and Johnson Screens 16-inch diameter stainless steel, continuous slot 0.090-inch slot size screen attached by a PVC coupling was installed. The primary objective in selecting the screened interval was to enable the well, when completed, to efficiently produce the specified quantity of water at the design withdrawal rate while obtaining the best available water quality.

Table 1 (excerpt), Well Construction Details

	LW-16
Stainless Steel Screen Interval (feet BLS) *16-inch diameter, 0.090-inch slot*	155 – 180

ft BLS – feet below land surface

Stainless steel centralizers were strapped to the PVC casing and well screen at the top and bottom of the well screen and every 30 feet beginning above the well screen. Following installation of PVC riser casing and stainless steel screen, the annulus between the screen completion interval borehole was gravel packed via the tremie method from the base of the screen to a depth of approximately 120 feet BLS. A mud dispersant was installed with the gravel pack to reduce the amount of mud 'cake' buildup on the walls of the borehole in the completion interval. A grain size analysis summary and a grain size distribution graph of the Edgar Mineral (EM) 4x9 gravel are presented in Appendix D

Edgar Minerals 4 by 9 Grain Size Analyses

Sieve Size		Cumulative Percent Retained	Percent Passing
phi	mm		
4	4.76	0.1%	99.9%
6	3.36	15.9%	84.2%
8	2.38	87.8%	28.1%
10	2.00	95.2%	92.6%
12	1.68	97.0%	98.2%
16	1.19	98.2%	98.8%
20	0.84	98.8%	99.4%
30	0.59	99.3%	99.5%
40	0.42	99.5%	99.8%
50	0.29	99.7%	99.8%
Effective Size: 2.27		*Uniformity Coefficient*: 1.33	

2.3 Production Well Development

2.3.1 Airlift Development

Following completion of reverse air drilling and screen installation, the borehole was developed. The purpose of the development process is to remove the bulk of coarse sand and loose formation material from the borehole and adjacent formation. Removal of loose formation material acts to maximize overall well efficiency, increase well life, and minimize suspended solid content in the raw water. Initial development was performed using the compressed air lift method. Compressed air was forced into the well above the base of the casing to remove loose and coarse grained material that could damage the development pump. The compressed air flow rate was obtained with a 750 cubic feet per minute (CFM) compressor. The total depth of the well was continuously monitored to determine if any infilling had occurred. Formation discharge water generated during development was settled in a 4,000 gallon dumpster and drained into a swale adjacent to the well site and allowed to percolate.

2.3.2 Jetting Development

The borehole jetting phase of development was designed to deliver a high velocity of water directly into the screen with the use of a rotating jetting tool. The jetting tool consisting of four (4), 1-inch diameter, opposing jets spaced 90 degrees apart, was lowered to the screened interval of the well. Using a transfer pump, approximately 400 gpm of chlorinated raw water from the SUA raw water main was delivered through the four (4) jet development tool, imparting an exit velocity of approximately 50 feet per second. Formation water is discharged from the well during the jetting process to remove jet-dislodged sediment from the well bore.

As with airlift development, formation discharge water generated during jetting was discharged and settled in the swale adjacent to the well site. This process was continued as the jetting tool was slowly rotated and passed up and down through the screened interval from the base of 16-inch diameter riser casing to the well total depth. Specific capacity of the wells were measured daily during development to evaluate progress by improvement in well performance. Additionally, the discharge water was monitored for development solids and turbidity throughout jetting. Once the gravel pack, development solids and turbidity had stabilized to relatively low levels, jetting was discontinued.

2.3.3 Pump Development

The pump development protocol called for steady pumping of the well until the discharge water was visibly free of solids and turbidity. The maximum rate of pump

development was 500 gpm. Following the steady pumping period, the well was pumped intermittently with surge and rest periods every hour. Development progress was measured by performing Rossum sand testing, silt density index (SDI) testing, and specific capacity testing of the raw water. Development was considered complete when Rossum sand testing results consistently met criteria for membrane plants at the design maximum expected pumping rate for the well.

2.4 Step Drawdown Test

Following completion of well development, step drawdown testing was performed using the same pump and discharge setup used for the development. The step drawdown test was completed to assess well yield and anticipated drawdown. The flow rate during the test was measured with the use of an in-line flow meter that was calibrated just prior to the start of the project. Prior to starting the test, the static water level was measured with the use of an electronic water level tape and verified with the use of an electronic data logger. The test results were also used to measure specific capacity values for each well at increasing pumping rates.

Four (4) 120-minute duration steps were pumped at rates between 300 gpm and 450 gpm. Pumping water levels were measured in the well with an electronic water level data logger and verified with manual water level measurements. Field water quality samples were collected during each step to measure temperature, specific conductance, total dissolved solids, chloride, turbidity, SDI, sand concentration, hydrogen sulfide, and total iron and soluble iron.

Water level charts depicting water levels versus pumping rates are provided in Figure 3. Results of the step drawdown test, including specific capacity results, are provided in

Table 4. Charts depicting specific capacity with corresponding pumping rates are provided in Figure 4.

Table 4 (excerpt), Step Drawdown Test, Drawdown Data

Pumping Rate (gpm)	Pumping Duration (min)	Static Water Level (ft. BLS)	Water Level (ft. BLS)	Drawdown (feet)	Specific Capacity (gpm/ft)
300	120	2.24	61.8	59.6	5.0
350	120	2.24	75.2	73.0	4.8
400	120	2.24	87.4	85.2	4.7
450	130	2.24	100.0	97.8	4.6

ft BLS- feet below land surface
gpm - gallons per minute
gpm/ft - gallons per minute per foot of drawdown

Table 4 (excerpt), Step Drawdown Test, Water Quality Results

Pumping Rate (gpm)	Specific Conductivity (µS/cm)	Chloride (mg/L)	SDI#1	SDI#2	SDI#3	SDI#4	Sand Concentration (ppm)
300	925	149	2.8	2.2	1.8	1.7	<0.1
350	928	144	1.9	2.0	5.0	3.1	<0.1
400	944	148	2.7	2.1	0.9	1.7	<0.1
450	945	157	3.3	2.7	2.1	2.1	<0.1

µS/cm - microsiemens per cm
mg/L - milligrams per liter
ppm - parts per million

Figure 3, Step Drawdown Test Water Level Chart

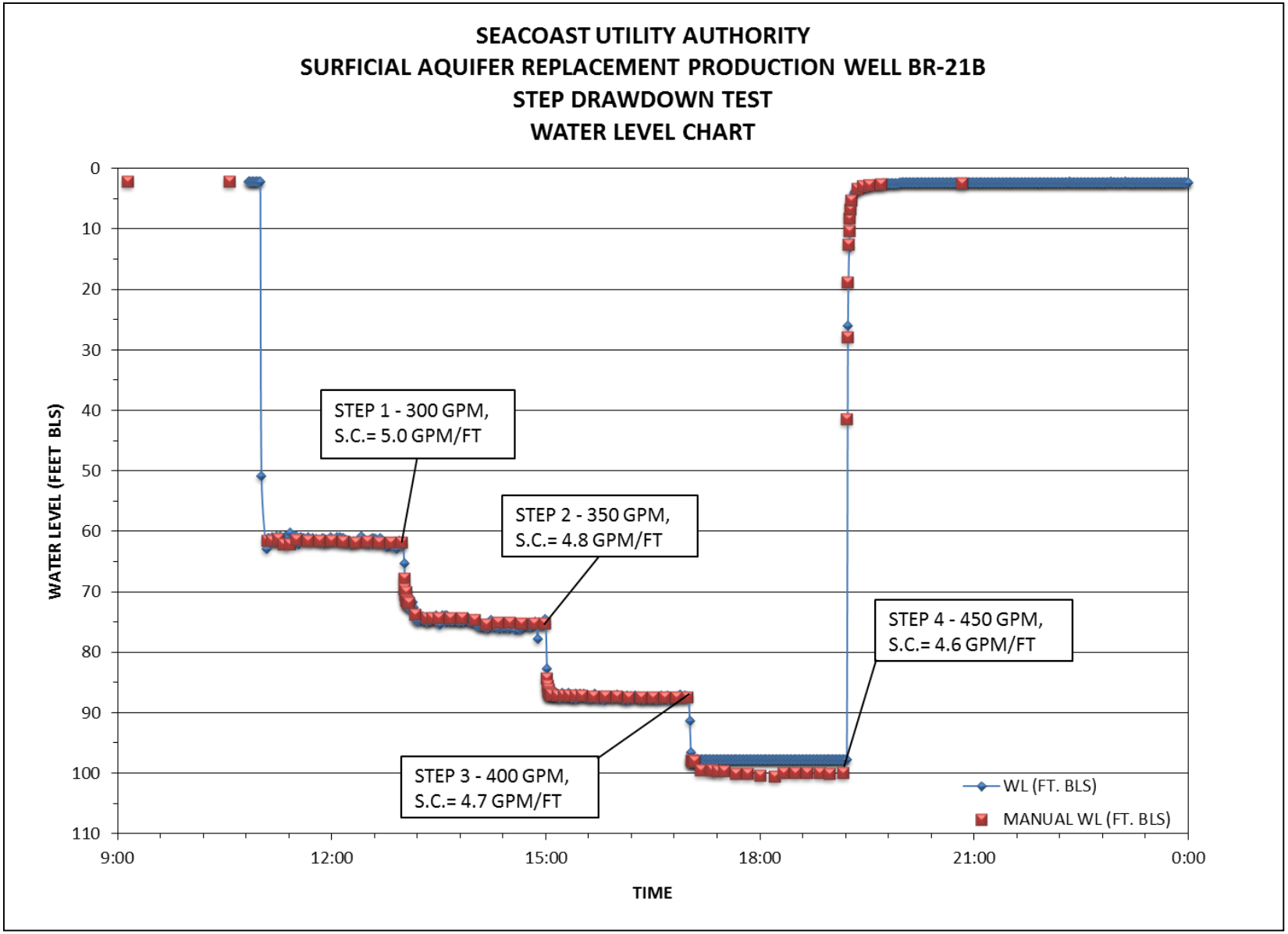
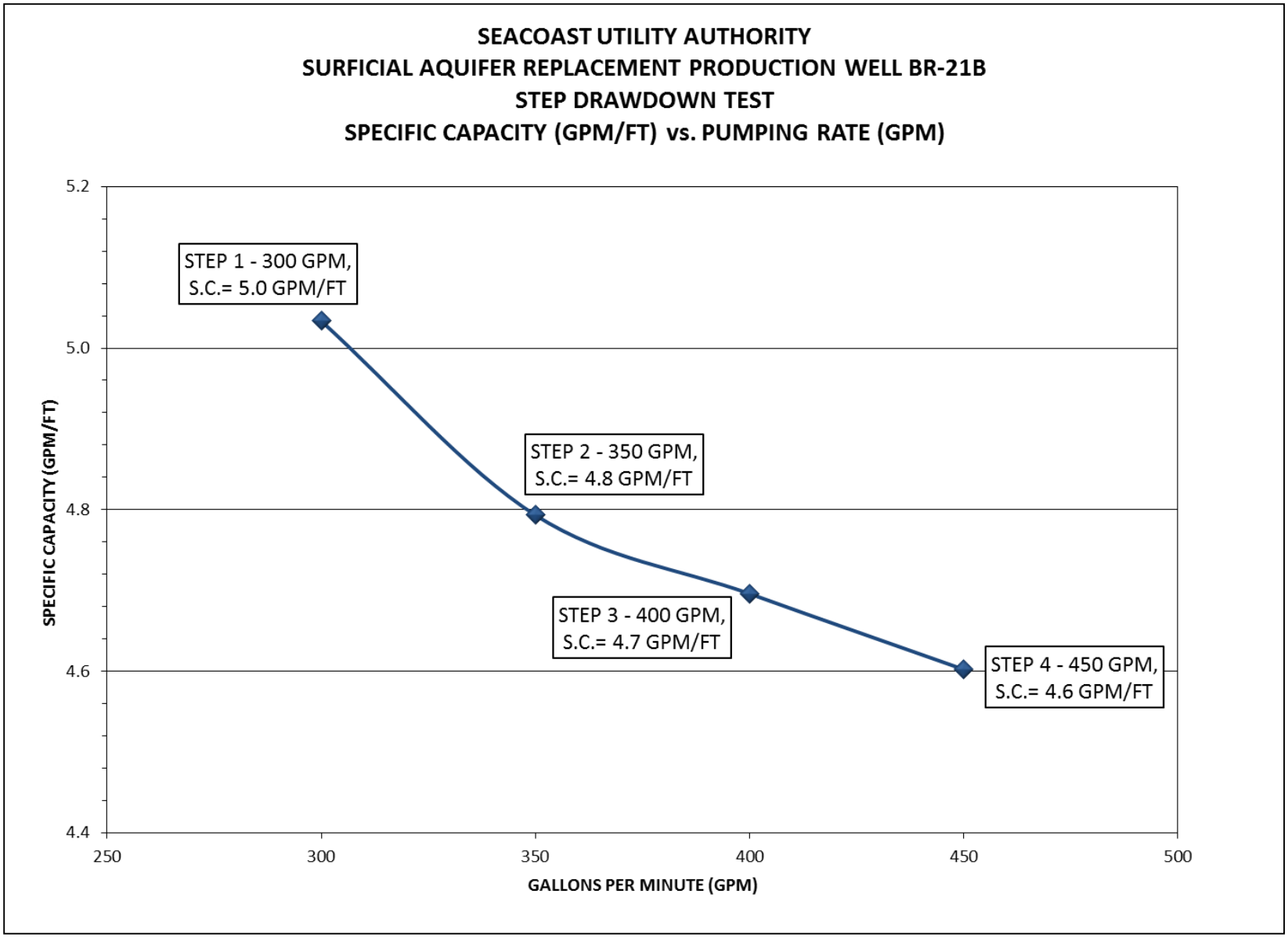


Figure 4, Step Drawdown Test Specific Capacity Chart



2.5 Video Logging

Following completion of well construction and testing, MVGS performed a down-hole video log. The well video was performed under static and dynamic (pumping) conditions. The 16-inch diameter PVC riser casing appeared to be in good condition with only minor abrasions due to drill pipe and pump insertion and removal. The 16-in diameter screen appeared to be in good condition with no visible voids in the gravel pack. An electronic copy of the well video is included in Appendix C.

During the video logging, laboratory sampling of the well was performed by SDS for primary and secondary drinking water standards in accordance with the project specifications. The results of this testing are presented in Table 5 and in Appendix E. Laboratory testing results of the water quality analysis indicated that the formation water meets Florida Department of Environmental Protection (FDEP) requirements for primary and secondary drinking water standards with the exception of color and odor. Surficial aquifer groundwater in South Florida typically exceeds regulatory standards for color and odor.

Table 5 (excerpt), Summary of Laboratory Water Quality Analyses

PARAMETER	UNIT	ANALYSIS RESULT	MCL*
Apparent Color	CU	**25**	15
Threshold Odor Number	T.O.N	**17**	3

**MCL – maximum contamination level*

3.0 HYDROGEOLOGY

Palm Beach County is underlain by two aquifer systems; the Surficial Aquifer System (SAS) and the Floridan Aquifer System (FAS). The drilling phase of the project penetrated the SAS to a maximum depth of 205 feet. A JLA geologist was present during key phases of the drilling to collect and log the lithologic samples as the formation materials were encountered. A lithologic log is provided in Appendix B. A

hydrostratigraphic section showing the site lithologies encountered during drilling at each site are provided as Figure 5.

The surficial aquifer is the only fresh groundwater resource in mainland southeast Florida. Descending from land surface, the surficial aquifer system formations include the Pamlico Sand, Anastasia, Fort Thompson, and Tamiami formations (Reese and Wacker, 2007).

The veneer of sand covering most of South Florida, known as the Pamlico Sand, is present beneath the site, consisting of fine to medium grained loose quartz sand grains, loose detrital clay, and shell. Sand extends to a depth of approximately 25 feet beneath the site where it becomes interbedded with sand and shell. The Anastasia Formation underlies the Pamlico and is commonly composed of coquina and mixtures of sand, shell, unconsolidated layers of shell hash, sandy limestone and quartz sandstone (Lovejoy, 1992). Underlying the Anastasia is the Fort Thompson Formation, which consists of marine limestone, minor gastropod-rich freshwater limestone, quartz sandstone, and sandy limestone.

Encountered beneath the Fort Thompson Formation is the Tamiami Formation. The Tamiami Formation is typically divided into two members: the Pinecrest Sand Member and Ochopee Limestone Member. The Tamiami Formation consists of quartz sand, carbonate sands and shell, calcareous quartz-rich sandstones, sandy limestone, pelecypod-rich quartz sandstone and floatstone, and locally abundant phosphate grains. The formations encountered while drilling at the SUA North Palm Beach (NPB) and Palm Beach Gardens (PBG) wellfields include the Pamlico Sand, Anastasia Formation and both the Pinecrest Member and Ochopee Member of the Tamiami Formation.

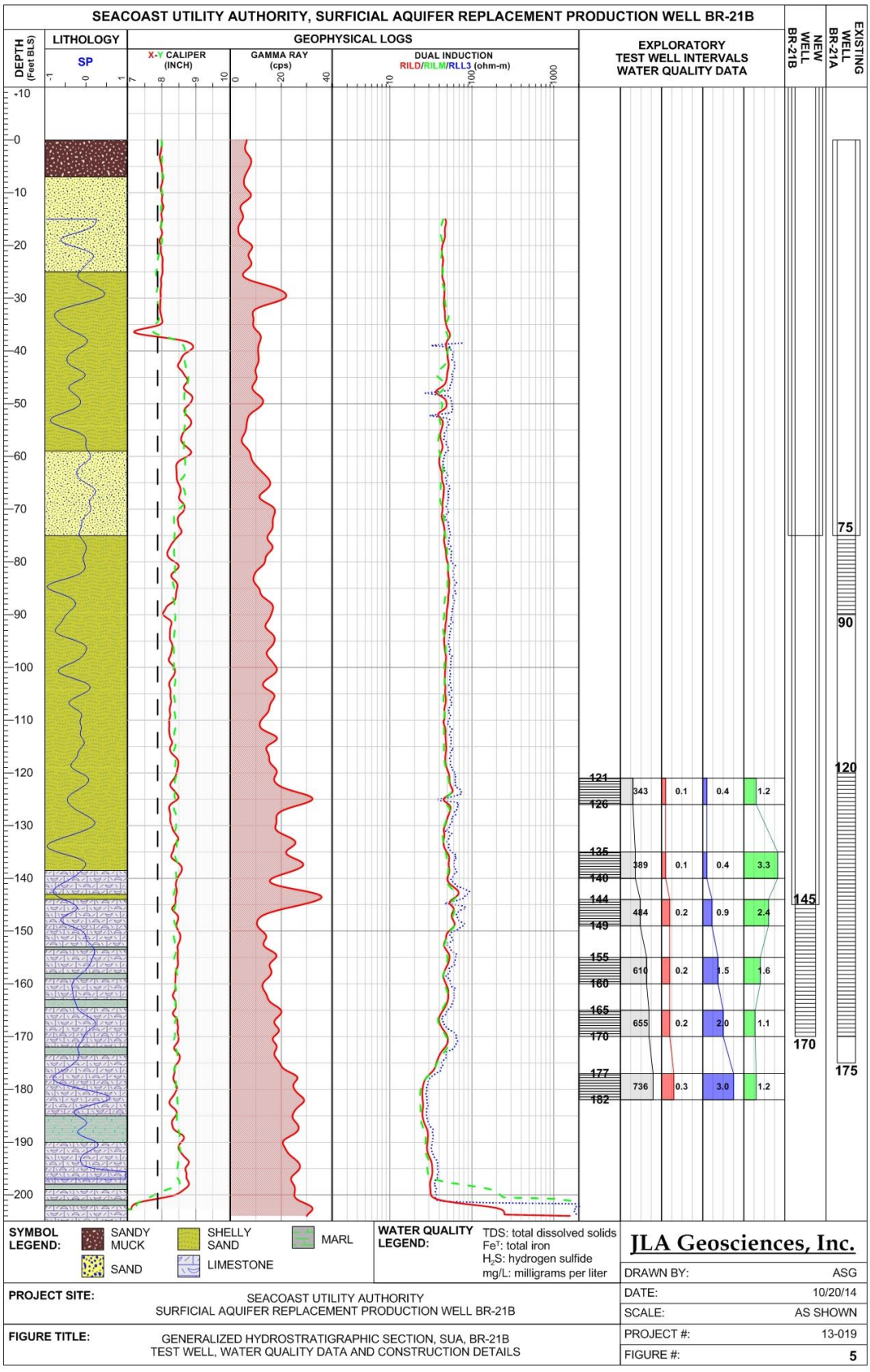
The lithostratigraphic units that contain the most productive parts of the surficial aquifer system in Palm Beach County are the sandstone and limestone units of the Anastasia, Fort Thompson, and Tamiami Formations (Reese and Wacker, 2007). The surficial aquifer can be subdivided into 3 primary zones of permeability, or subaquifers, and are

designated, from shallowest to deepest, as Zone 1, Zone 2, and Zone 3 (Reese and Wacker, 2007).

Zone 1 includes lithostratigraphic units above the Tamiami Formation, including the Anastasia and Fort Thompson Formations. Zone 1 comprises the water table aquifer and is found throughout Palm Beach County, except for inland eastern areas (Reese and Wacker, 2009). Presence of Zone 1 at the BR-21 site could not be confirmed; however, if present would likely begin at the top of the Anastasia Formation, between 25 feet BLS and 30 feet BLS.

Zone 2 is composed of shelly, highly permeable, well cemented limestone and quartz-rich sandstones, primarily of the Pinecrest Sand Member of the Tamiami Formation. Zone 2 is the most transmissive of the three zones, however, presence and thickness of this zone are variable and typically thickness decreases to 0 as it approaches the coast. Thickness and transmissivity of zone 2 is highest in inland eastern areas of Palm Beach County (Reese and Wacker, 2009). The production zone of the BR-21B replacement well is likely located in Zone 2 beginning at the top of the Pinecrest Member of the Tamiami Formation, located at approximately 140 feet BLS.

Zone 3 is composed of sandy lime rudstone or floatstone, quartz-rich sandstone and quartz or carbonate sands, primarily of the Ochopee Limestone member of the Tamiami Formation. Thickness of zone 3 is greatest in southeastern parts of the county. In areas where the semiconfining unit between zone 2 and zone 3 are indistinguishable, these zones can be mapped together as one productive zone (Reese and Wacker, 2009).


SEACOAST UTILITY AUTHORITY, SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL BR-21B
DEPTH (Feet BLS)
LITHOLOGY
SP
GEOPHYSICAL LOGS
X-Y CALIPER (INCH)
GAMMA RAY (cps)
DUAL INDUCTION RILD/RILM/RLL3 (ohm-m)
EXPLORATORY TEST WELL INTERVALS WATER QUALITY DATA
NEW WELL BR-21B
EXISTING WELL BR-21A
121
126
135
140
144
149
155
160
165
170
177
182
343
0.1
0.4
1.2
389
0.1
0.4
3.3
484
0.2
0.9
2.4
610
0.2
1.5
1.6
655
0.2
2.0
1.1
736
0.3
3.0
1.2
75
90
120
145
170
175
SYMBOL LEGEND:
SANDY MUCK
SHELLY SAND
MARL
SAND
LIMESTONE
WATER QUALITY LEGEND:
TDS: total dissolved solids
FeT: total iron
H2S: hydrogen sulfide
mg/L: milligrams per liter
JLA Geosciences, Inc.
DRAWN BY: ASG
DATE: 10/20/14
SCALE: AS SHOWN
PROJECT #: 13-019
FIGURE #: 5
PROJECT SITE:
SEACOAST UTILITY AUTHORITY
SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL BR-21B
FIGURE TITLE:
GENERALIZED HYDROSTRATIGRAPHIC SECTION, SUA, BR-21B
TEST WELL, WATER QUALITY DATA AND CONSTRUCTION DETAILS

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The following conclusions are made based on results of the drilling and testing conducted during well construction.

1. SAS Replacement Production Well BR-21B was constructed for Seacoast Utility Authority, Hood Road Water Treatment Plant between December, 2013 and September, 2014. Final completion intervals are as follows:

	BR-21B
Intermediate Well Casing Depth (feet BLS) 24-inch diameter Schedule 40 PVC	155
Well Screened Interval (feet BLS) 16-inch diameter, 316L Stainless Steel 0.090-inch slot size	155 – 180
Gravel Pack (feet BLS)	120

ft bls – feet below land surface

2. A step drawdown test was performed at each well following completion of well development. Step drawdown testing included four steps at two hours per step. Rates were between 300 gpm and 450 gpm. Specific capacity (gpm/ft) at the design pumping rate, 300 gpm, during the step drawdown test is 5.0 gpm/ft.

3. Water quality measured during step drawdown testing at the design rates is as follows:

Design Rate (gpm)	
Chloride* (mg/L)	89
Hydrogen Sulfide (ppm)**	2.0
Sand Concentration (ppm)**	<0.1
Silt Density Index**	1.7

**Laboratory Analysis during final well video*
***Field Analysis*

4. Recommended Silt Density Index (SDI) values for nanofiltration membrane facilities are 3.0 units with ideal values less than 1.0. SDI test results of raw water produced from the replacement production well met the SDI Nano criteria at SDI values less than 3.0 at design rate of 300 gpm.

5. Laboratory testing results of the water quality analysis indicated that the formation water meets Florida Department of Environmental Protection (FDEP) requirements for primary and secondary drinking water standards with the exception of the following parameters: apparent color and odor.

4.2 Recommendations

1. Water quality monitoring in the production wells should include, at a minimum the following parameters (frequency of measurement should be monthly):

    - Water Quality: specific conductance, chloride concentration and sand content.

    - Well Performance: static water levels, pumping water levels, pumping rates, and specific capacity calculation.

- Water level and water quality monitoring must include all applicable requirements as determined by the SUA, SFWMD Consumptive Use Permit (CUP) 50-00365-W (Permit).

	Monthly	Annually
Well Capacity		
Pumping Rate	X	X
Static Water Level	X	X
Pumping Water Level	X	X
Well Construction		
Depth to top of Gravel Pack	X	X
Water Quality*		
Specific Conductance	X	X
Total Dissolved Solids	X	X
Chloride	X	X
Sand Content	X	X
Silt Density Index	X	X

*Water level and water quality monitoring must include all applicable requirements as determined by the SFWMD permit.

2. Data should be recorded with dates, times of measurement, and personnel performing measurements. All data should be plotted electronically in time series format for periodic well performance evaluation. All data should be plotted electronically in time series format for periodic well performance evaluation.

3. Maintenance personnel should implement a program of continued water level monitoring. Monitoring should include monthly measurements of both static and pumping water levels in the production well. Consistently low water levels or a specific capacity loss of 20% or greater than reported herein may indicate the need for evaluation and potential rehabilitation.

5.0 REFERENCES

Freeze, R.A., and J.A. Cherry. 1979. Groundwater. Prentice-Hall, Inc., Englewood, N.J. 604 p.

Lovejoy, D., 1992, Classic exposures of the Anastasia Formation in Martin and Palm Beach Counties, Florida, 31 p.

Reese, R.S., and Wacker, M.A., 2007, Hydrostratigraphic Framework and Selection and Correlation of Geophysical Log Markers in the Surficial Aquifer System, Palm Beach County, Florida: U.S. Geological Survey Scientific Investigations Map 2971, 2 sheets.

Reese, R.S., and Wacker, M.A., 2009, Hydrogeologic and Hydraulic Characterization of the Surficial Aquifer System, and Origin of High Salinity Groundwater, Palm Beach County, Florida: U.S. Geologic Survey Scientific Investigations Report 2009-5113, 83 p (appendixes on CD).

FIGURES

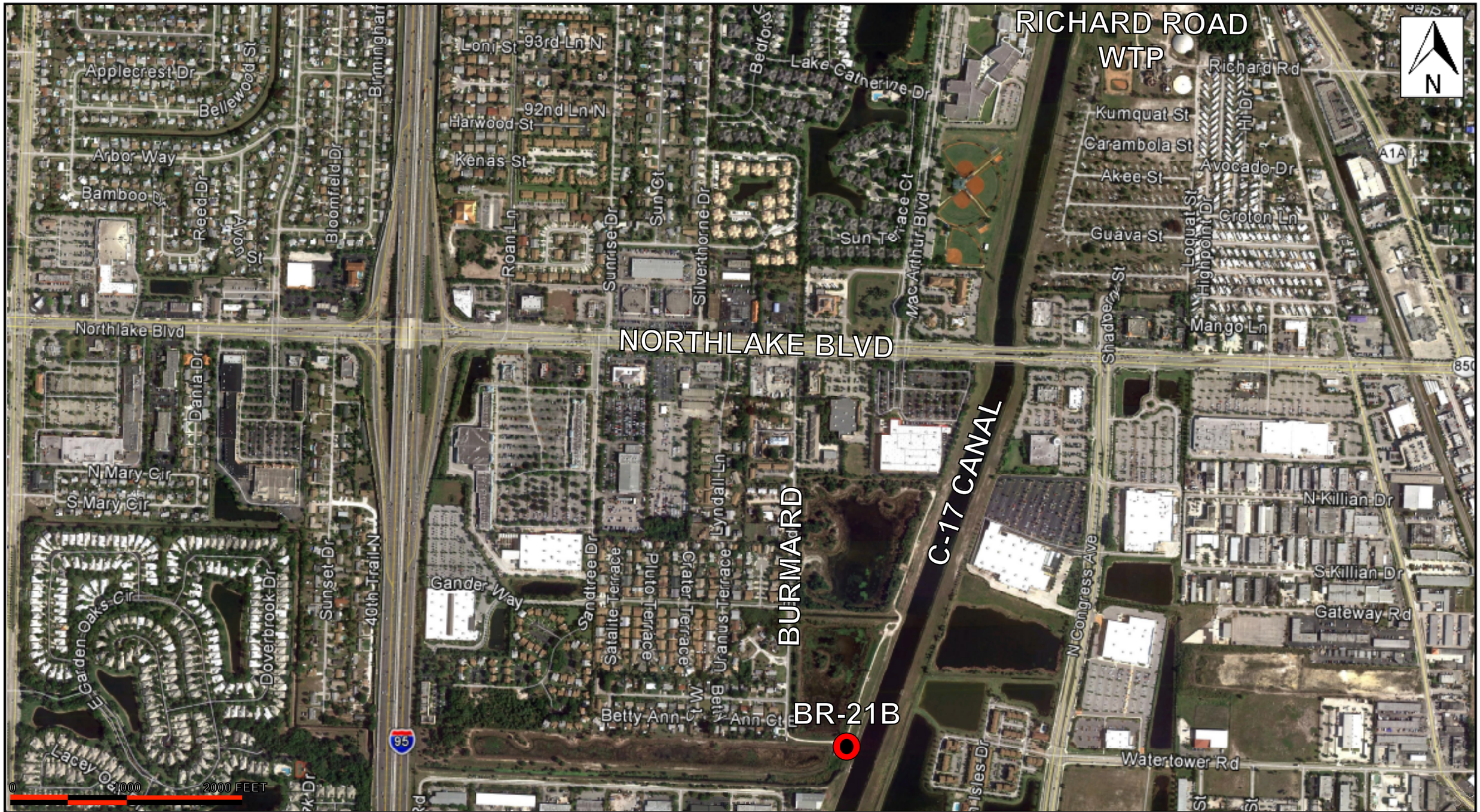


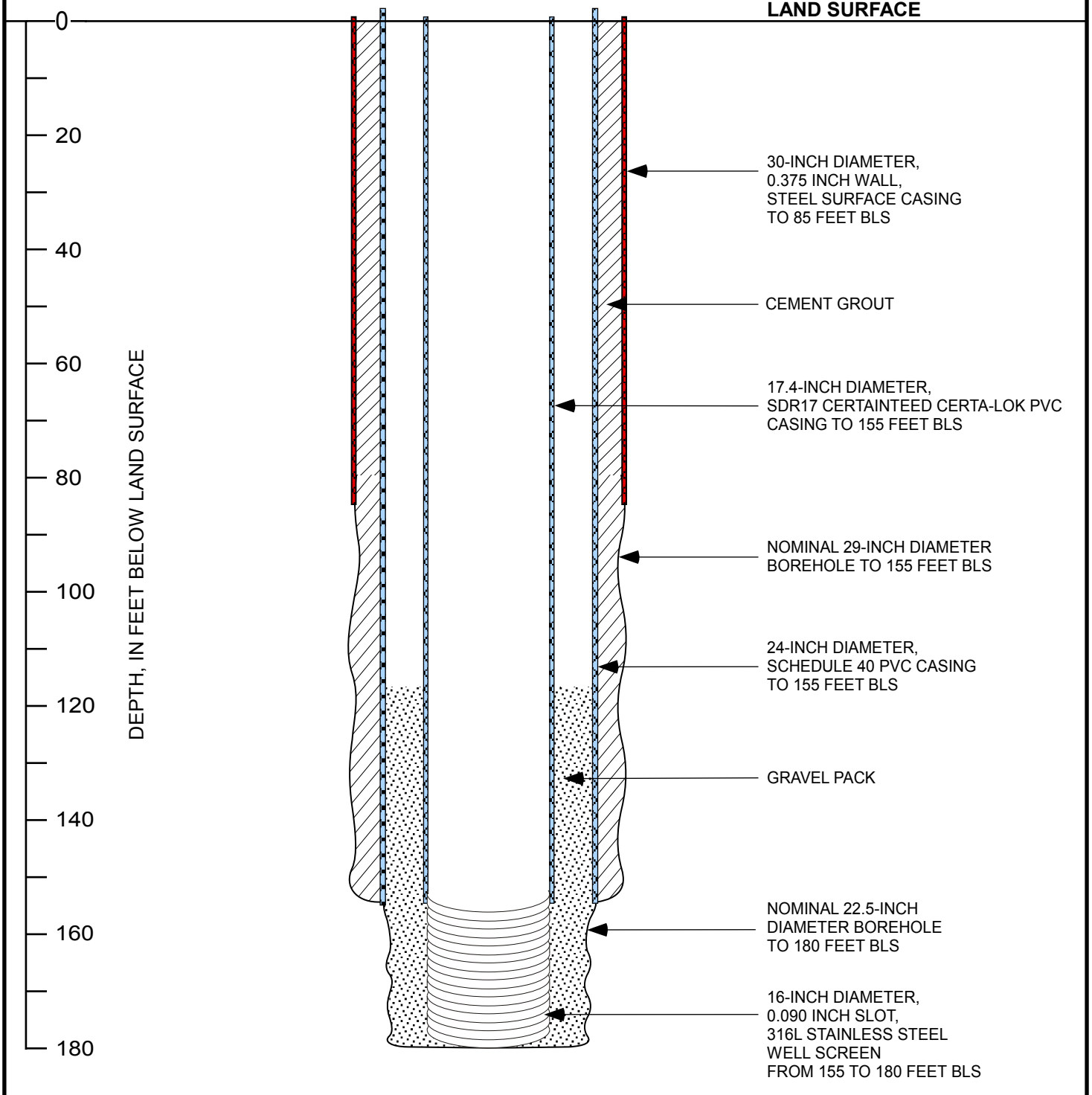
FIGURE TITLE:

SEACOAST UTILITY AUTHORITY
SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL BR-21B
PROJECT SITE LOCATION MAP

JLA Geosciences, Inc.

DATE:	4/2/14
DRAWN BY:	ASG
PROJECT NO:	13-019

FIGURE NO: 1



LEGEND:

CEMENT GROUT | STEEL WELL CASING | WELL SCREEN

GRAVEL PACK | PVC WELL CASING

PROJECT SITE:

SEACOAST UTILITY AUTHORITY
REPLACEMENT PRODUCTION WELL BR-21B

JLA Geosciences, Inc.

DATE: 10/20/14 | DRAWN BY: ASG

FIGURE TITLE:

AS BUILT DIAGRAM WITH CONSTRUCTION DETAILS

PROJECT NO: 13-019

FIGURE NO: 2

FIGURE 3

SEACOAST UTILITY AUTHORITY
SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL BR-21B
STEP DRAWDOWN TEST
WATER LEVEL CHART

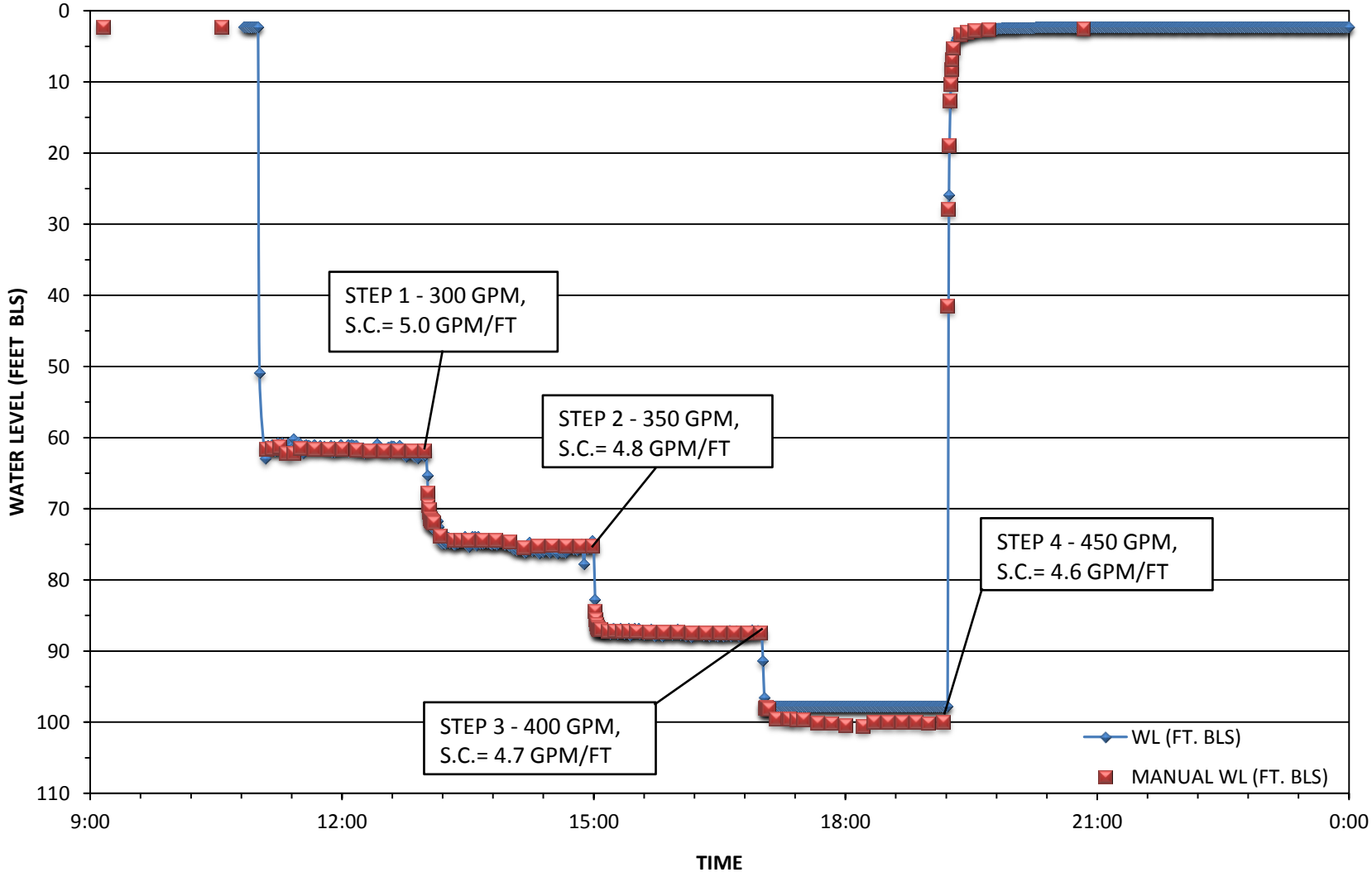
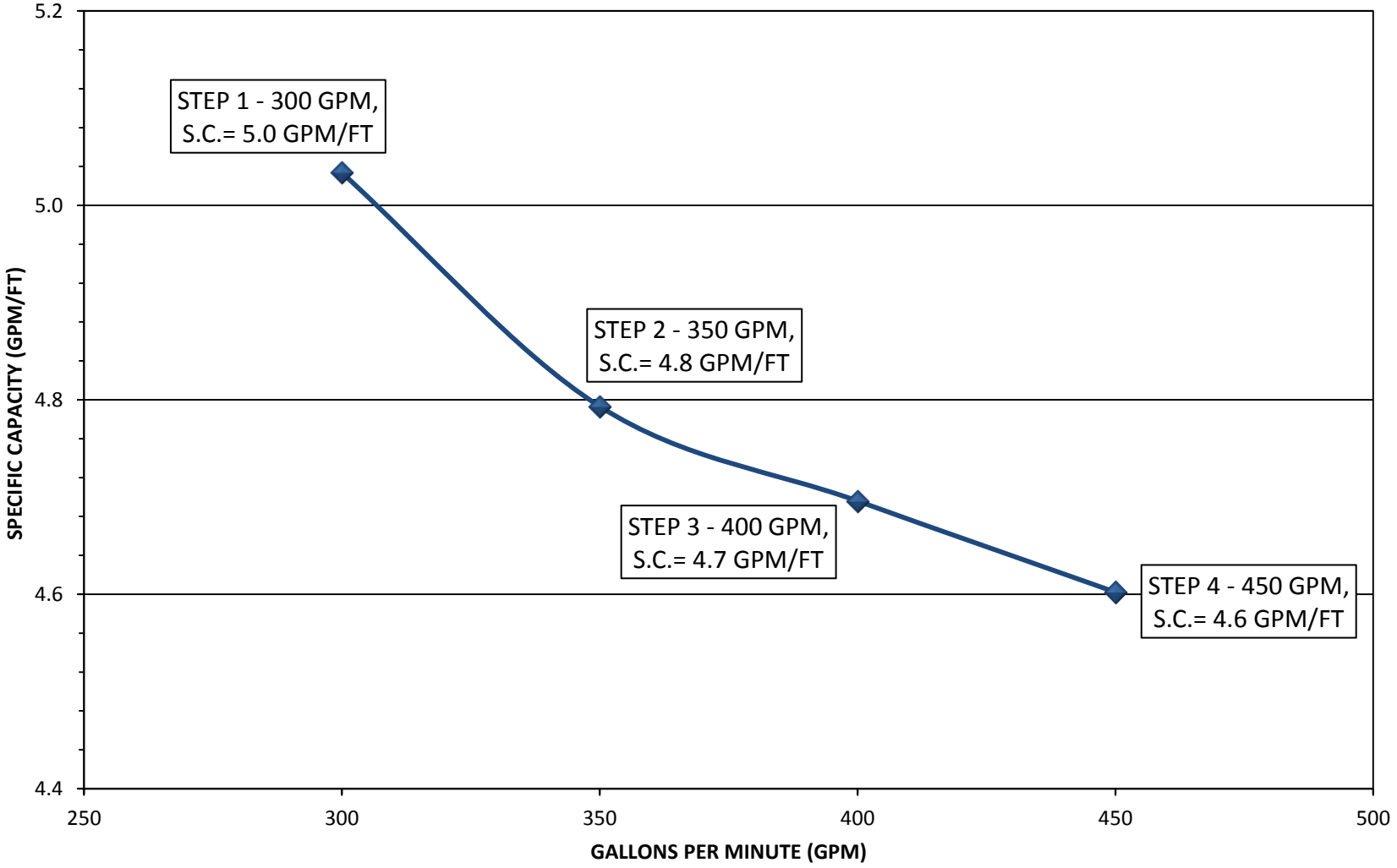
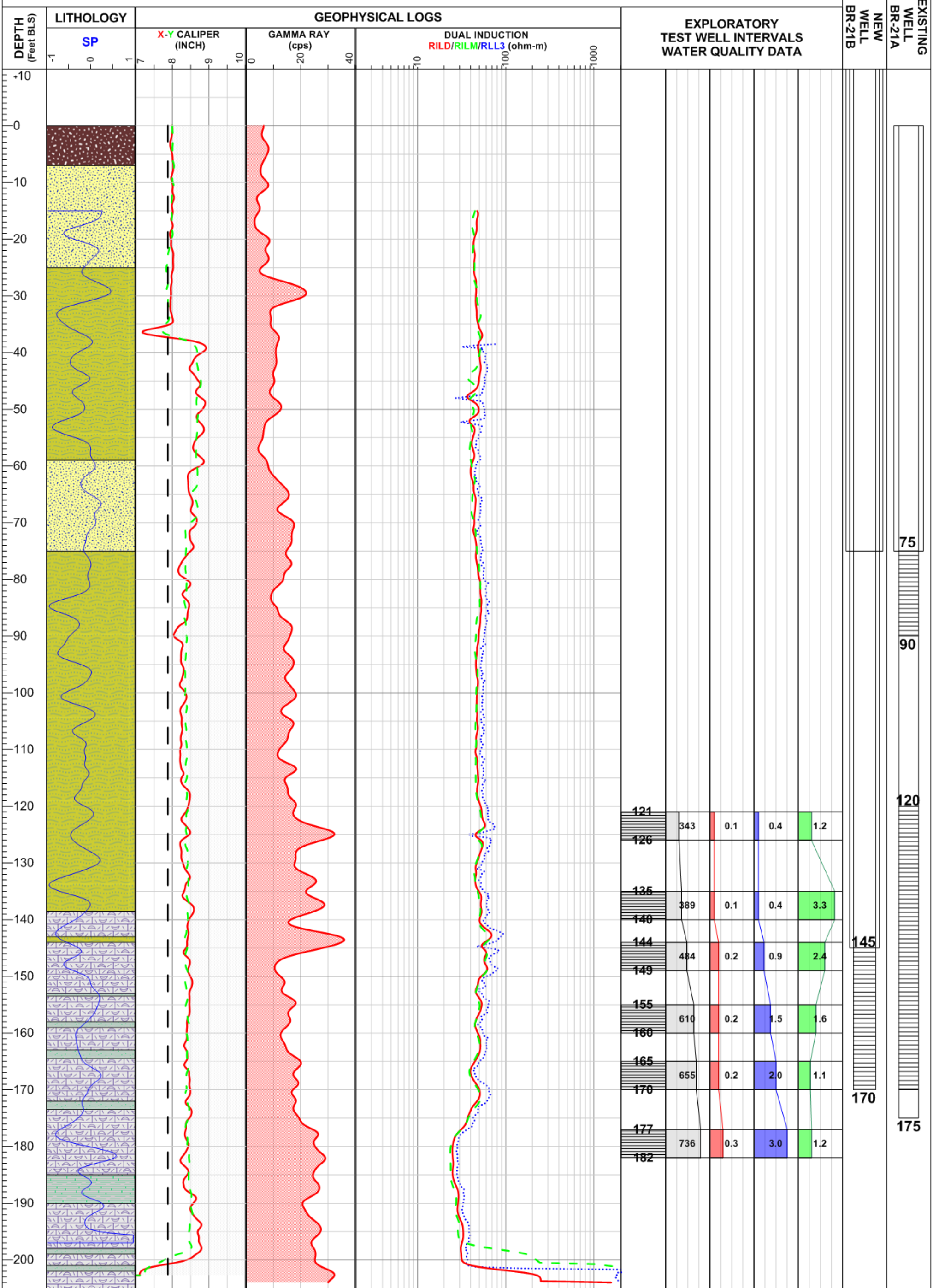


FIGURE 4

SEACOAST UTILITY AUTHORITY
SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL BR-21B
STEP DRAWDOWN TEST
SPECIFIC CAPACITY (GPM/FT) vs. PUMPING RATE (GPM)



SEACOAST UTILITY AUTHORITY, SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL BR-21B



SYMBOL LEGEND: SANDY MUCK; SHELLY SAND; MARL; SAND; LIMESTONE

WATER QUALITY LEGEND: TDS: total dissolved solids; Fe^T: total iron; H_2S: hydrogen sulfide; mg/L: milligrams per liter

JLA Geosciences, Inc.

DRAWN BY:	ASG
DATE:	10/20/14
SCALE:	AS SHOWN
PROJECT #:	13-019
FIGURE #:	5

PROJECT SITE: SEACOAST UTILITY AUTHORITY
SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL BR-21B

FIGURE TITLE: GENERALIZED HYDROSTRATIGRAPHIC SECTION, SUA, BR-21B
TEST WELL, WATER QUALITY DATA AND CONSTRUCTION DETAILS

TABLES

TABLE 1 SEACOAST UTILITY AUTHORITY SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL BR-21B Well Construction Details	
Pilot Hole Depth (feet BLS) *7⅞-inch diameter borehole*	205
Total Depth (feet BLS)	180
Surface Casing Depth (feet BLS) *30-inch diameter steel* *0.375-inch wall thickness*	85
Well Casing Depth (feet BLS) *24-inch diameter* *Schedule 40 PVC*	155
Riser Casing Interval (feet BLS) 17.4-inch diameter, SDR17 PVC CertainTeed Certa-Lok	0 – 155
Well Screened Interval (feet BLS) *16-inch diameter, 316L Stainless Steel* *0.090-inch slot size*	155 – 180
Well Screen Length (feet)	25
Gravel Pack Interval (feet BLS) *Lake Wales 4 by 9*	120

feet BLS - feet below land surface

TABLE 2
SEACOAST UTILITY AUTHORITY
SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL BR-21B
Test Well Water Quality And Performance Data

Test Well Depth (Feet BLS)	Interval #1 177-182	Interval #2 165-170	Interval #3 155-160	Interval #4 144-149	Interval #5 135-140	Interval #6 121-126
Drawdown Data						
Pumping Rate (gpm)	*9.84*	*9.38*	*8.84*	*9.25*	*9.94*	*8.26*
Static Water Level (feet below land surface)	*2.69*	*1.4*	*3.1*	*2.97*	*2.82*	*2.73*
Pumping Water Level (feet below land surface)	*10.85*	*9.98*	*8.61*	*6.73*	*5.75*	*9.36*
Maximum Drawdown (feet)	*8.16*	*8.58*	*5.51*	*3.76*	*2.93*	*6.63*
Specific Capacity (gpm/ft)	***1.2***	***1.1***	***1.6***	***2.4***	***3.3***	***1.2***
Water Quality Data						
Temperature (deg. C)	*25.4*	*25.5*	*25.5*	*25.6*	*25.6*	*25.9*
Specific Conductance (uS/cm)	*1133*	*1009*	*938*	*745*	*598*	*527*
Total Dissolved Solids (mg/L)	*736*	*655*	*610*	*484*	*389*	*343*
pH	*7.4*	*7.4*	*7.2*	*7.3*	*7.4*	*7.5*
Salinity (ppt)	*0.6*	*0.5*	*0.5*	*0.4*	*0.3*	*0.3*
Soluble Iron (ppm)	*0.3*	*0.2*	*0.2*	*0.2*	*0.1*	*0.1*
Total Iron (ppm)	*0.3*	*0.2*	*0.2*	*0.2*	*0.1*	*0.1*
Hydrogen Sulfide (ppm)	*3.0*	*2.0*	*1.5*	*0.9*	*0.4*	*0.4*
Turbidity	*-*	*7.31*	*9.94*	*6.67*	*5.77*	*7.81*
Chloride (mg/L)	*162*	*184*	*153*	*109*	*82*	*54*

gpm - gallons per minute
mg/l - milligrams per liter
mmhos/cm - millimhos per cm
b.l.s - below land surface
ppm - parts per million
ntu - nephelometric turbidity units

TABLE 3
SEACOAST UTILITY AUTHORITY
SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL BR-21B
Reverse Air Drilling Flow Test Summary

Depth (feet BLS)	Specific Conductivity (µS/cm)	Chloride (mg/L)	Static Water Level (feet BLS)	Pumping Water Level (feet BLS)	Pumping Rate (gpm)	Specific Capacity (gpm/ft)
165	589	67	18.35	31.05	73.5	5.78
170	633	66	-	-	-	-
175	636	66	6.06	24.65	68.9	3.70
180	700	73	10.53	22.93	94.6	7.63

feet BLS - Feet below land surface
µS/cm - microseimens per centimeter
mg/L – milligrams per liter
gpm - gallons per minute
gpm/ft - gallons per minute per foot of drawdown

TABLE 4
SEACOAST UTILITY AUTHORITY
SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL BR-21B
Step Drawdown Test Performance And Water Quality Results

WELL: BR-21B TEST DATE: 9/08/2014

STATIC WATER LEVEL: Referenced starting water level, 2.24 feet BLS.

DRAWDOWN DATA

Pumping Rate (gpm)	Pumping Duration (min)	Water Level (ft. BLS)	Drawdown (feet)	Specific Capacity (gpm/ft)
300	120	61.8	59.6	5.0
350	120	75.2	73.0	4.8
400	120	87.4	85.2	4.7
450	130	100.0	97.8	4.6

WATER QUALITY DATA

Pumping Rate (gpm)	Specific Cond. (µS/ cm)	Chloride (mg/L)	SDI#1	SDI#2	SDI#3	SDI#4	Sand Conc. (ppm)	Turbidity (NTU)	H_2S (ppm)	Fe^T (ppm)	Fe^S (ppm)
300	925	149.5	2.8	2.2	1.8	1.7	<0.1	0.58	2.0	<0.1	<0.1
350	928	144.5	1.9	2.0	5.0	3.1	<0.1	0.96	2.0	<0.1	<0.1
400	944	148	2.7	2.1	0.9	1.7	<0.1	3.67	2.0	<0.1	<0.1
450	945	157	3.3	2.7	2.1	2.1	<0.1	2.97	2.0	<0.1	<0.1

Notes:

- gpm - gallons per minute
- mg/L - milligrams per liter
- µS/cm - microseimens per cm
- ppm - parts per million
- BLS - below land surface
- NTU - nephelometric turbidity units
- H_2S - Hydrogen Sulfide Concentration
- Fe^T - Total Iron Concentration
- Fe^S - Soluble Iron Concentration

TABLE 5
SEACOAST UTILITY AUTHORITY
SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL BR-21B
Summary of Laboratory Water Quality Analyses

PARAMETER	UNITS	ANALYSIS RESULT	QUALIFIER	MCL
PRIMARY DRINKING WATER STANDARDS				
INORGANIC CONTAMINANTS				
Antimony	mg/L	0.0010	U	0.006
Asbestos	MFL	NA	U	7
Arsenic	mg/L	0.0014	I	0.010
Barium	mg/L	0.0065		2
Beryllium	mg/L	0.000096	U	0.004
Cadmium	mg/L	0.00027	U	0.005
Chromium	mg/L	0.010		0.1
Cyanide	mg/L	0.0061	I	0.2
Fluoride	mg/L	0.14		4
Lead	mg/L	0.00031	I	0.015
Mercury	mg/L	0.00010	U	0.002
Nickel	mg/L	0.0053		0.1
Nitrate as N	mg/L	0.01	U	10
Nitrite as N	mg/L	0.01	U, J5, J6	1
Selenium	mg/L	0.011		0.05
Sodium	mg/L	74		160
Thallium	mg/L	0.00024	U	0.002
Chlorite	µg/L	10	U	1000
Bromate	µg/L	5.0	U	10
Monochloroacetic Acid	µg/L	0.76	U	60
Dichloroacetic Acid	µg/L	0.68	U	60
Trichloroacetic Acid	µg/L	0.34	U	60
Monobromoacetic Acid	µg/L	0.33	U	60
Dibromoacetic Acid	µg/L	0.26	U	60
Haloacetic Acids (Total)	µg/L	0.26		60
Chloroform	µg/L	0.2	U	80
Bromoform	µg/L	0.2	U	80
Bromodichloromethane	µg/L	0.2	U	80
Dibromochloromethane	µg/L	0.1	U	80
Total Trihalomethanes (Calc.)	µg/L	0.1		80
VOLITILE ORGANICS				
1,1-Dichloroethene	µg/L	0.2	U	7
1,1,1-Trichloroethane	µg/L	0.2	U	200
1,1,2-Trichloroethane	µg/L	0.2	U	5
1,2-Dichloroethane	µg/L	0.1	U	3
1,2-Dichloropropane	µg/L	0.2	U	5
1,2,4-Trichlorobenzene	µg/L	0.3	U	70
Benzene	µg/L	0.1	U	1.0
Carbon tetrachloride	µg/L	0.2	U	3
cis-1,2-Dichloroethene	µg/L	0.09	U	70
Ethylbenzene	µg/L	0.08	U	700
Chlorobenzene	µg/L	0.1	U	100
1,2-Dichlorobenzene	µg/L	0.1	U	600
1,4-Dichlorobenzene	µg/L	0.2	U	75
Methylene Chloride	µg/L	0.2	U	5
Styrene	µg/L	0.05	U	100
Tetrachloroethene	µg/L	0.1	U	3
Toluene	µg/L	0.09	U	1,000
Trichloroethene	µg/L	0.2	U	3
Vinyl chloride	µg/L	0.3	U	1
Xylene (Total)	µg/L	0.1	U	10,000
trans-1,2-Dichloroethene	µg/L	0.2	U	100
SYNTHETIC ORGANICS				
bis(2-Ethylhexyl)adipate	µg/L	0.07	U	400
bis(2-Ethylhexyl)phthalate	µg/L	0.07	U	6
Alachlor	µg/L	0.03	U	2
Atrazine	µg/L	0.02	U	3

TABLE 5
SEACOAST UTILITY AUTHORITY
SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL BR-21B
Summary of Laboratory Water Quality Analyses

PARAMETER	UNITS	ANALYSIS RESULT	QUALIFIER	MCL
Chlordane (Technical)	µg/L	0.049	U	2
Endrin	µg/L	0.05	U	2
Heptachlor	µg/L	0.09	U	0.4
gamma-BHC (Lindane)	µg/L	0.02	U	0.2
Heptachlor epoxide	µg/L	0.08	U	0.2
Hexachlorobenzene	µg/L	0.04	U	1
Hexachlorocyclopentadiene	µg/L	0.06	U	50
Methoxychlor	µg/L	0.02	U	40
PCB, Total	µg/L	0.092	U	0.5
Simazine	µg/L	0.03	U	4
Toxaphene	µg/L	0.55	U	3
2,4,5-TP (Silvex)	µg/L	0.041	U	50
2,4-D	µg/L	0.099	U	70
Dalapon	µg/L	0.33	U	200
Dinoseb	µg/L	0.15	U	7
2,3,7,8- TCDD (Dioxin)	Ng/L	NA		0.03
Pentachlorophenol	µg/L	0.014	U	1
Picloram	µg/L	0.048	U	500
Carbofuran	µg/L	0.60	U	40
Oxamyl	µg/L	0.88	U	200
Glyphosate	µg/L	2.7	U	700
Endothall	µg/L	6.7	U	100
Diquat	µg/L	0.34	U	20
Benzo(a)pyrene	µg/L	0.02	U	0.2
1,2-Dibromo-3-chloropropane	µg/L	0.0055	U	0.2
Dibromoethane (EDB)	µg/L	0.0055	U	0.02
SECONDARY DRINKING WATER STANDARDS				
Aluminum	mg/L	0.050	U	0.2
Chloride	mg/L	89		250
Copper	mg/L	0.0027		1
Iron	mg/L	0.024	I	0.3
Manganese	mg/L	0.0095	I	0.05
Silver	mg/L	0.000069	U	0.1
Sulfate	mg/L	6.0		250
Zinc	mg/L	0.023		5
Apparent Color	Pt-Co	**25**		15
Threshold Odor Number	T.O.N	**17**		3
Foaming Agents (Surfactants)	mg/L	0.067	I	0.5
pH at 25 Degrees C	SU	NT		6.5-8.5
Total Dissolved Solids	mg/L	490		500
RADIONUCLEOTIDES				
Gross Alpha	pCi/L	2.9		15
Radium-226	pCi/L	0.4		5
Radium-228	pCi/L	0.6	U	5

NOTES:
BOLD: The sample exceeded the maximum contaminant level (MCL) for that parameter
C.U.= Color Units
MCL = Maximum Contaminant Level
MFL = million fibers per liter
mg/L = milligrams per liter
NA = Not Applicable
ND = Not Detected
NT= Not Tested
NTU = Nephelometric Turbidity Units
pCi/L = picocuries per liter
S.U. = Standard Units
T.O.N = Threshold Odor Number
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter

QUALIFIER:
J = Estimated value
U = reported value is below maximum detection limit
Q = Sample held beyond accepted holdtime
C = Sample confirmed by second analysis
I = reported value is between the laboratory method detection limit and the laboratory practical quantitation limit

APPENDIX A
DRILLER'S WELL COMPLETION REPORT

STATE OF FLORIDA WELL COMPLETION REPORT

Southwest
Northwest
St. Johns River
✓ South Florida
Suwannee River
DEP
Delegated Authority (If Applicable) ____________

PLEASE, FILL OUT ALL APPLICABLE FIELDS
(*Denotes Required Fields Where Applicable)

Date Stamp

Official Use Only

1.*Permit Number 3110-2013 *CUP/WUP Number ______ *DID Number ______ 62-524 Delineation No. BR-21A

2.*Number of permitted wells constructed, repaired, or abandoned 1 *Number of permitted wells not constructed, repaired, or abandoned 0

3.*Owner's Name Seacoast Utilities Authority 4.*Completion Date 11/23/14 5. Florida Unique ID ______

6. 8678 Burma Road, WPB, FL 33403
*Well Location - Address, Road Name or Number, City, ZIP

7.*County Palm Beach *Section 19 Land Grant ______ *Township 42 *Range 43

8. Latitude N897900 Longitude E953240

9. Data Obtained From: [✓] GPS [ ] Map [ ] Survey Datum: ___ NAD 27 X NAD 83 ___ WGS 84

10.*Type of Work: [✓] Construction [ ] Repair [ ] Modification [ ] Abandonment

11.*Specify Intended Use(s) of Well(s)

[ ] Domestic
[ ] Bottled Water Supply
[ ] Public Water Supply (Limited Use/DOH)
[✓] Public Water Supply (Community or Non-Community/DEP)
[ ] Class I Injection
[ ] Landscape Irrigation
[ ] Recreation Area Irrigation
[ ] Agricultural Irrigation
[ ] Livestock
[ ] Nursery Irrigation
[ ] Commercial/Industrial
[ ] Golf Course Irrigation
[ ] Site Investigations
[ ] Monitoring
[ ] Test
[ ] Earth-Coupled Geothermal
[ ] HVAC Supply
[ ] HVAC Return

Class V Injection: [ ] Recharge [ ] Commercial/Industrial Disposal [ ] Aquifer Storage and Recovery [ ] Drainage

Remediation: [ ] Recovery [ ] Air Sparge [ ] Other (Describe) ______

[ ] Other (Describe) ______

12. *Drill Method [ ] Auger [ ] Cable Tool [✓] Rotary [ ] Combination (Two or More Methods) [ ] Jetted [ ] Sonic
[ ] Horizontal Drilling [ ] Hydraulic Point (Direct Push) [ ] Other ______

13.*Measured Static Water Level 2.24 ft. Measured Pumping Water Level 61.8 ft. After 8 Hours at 300 GPM

14.*Measuring Point (Describe) TOC Which is 2 ft. x Above ___ Below Land Surface *Flowing: [ ] Yes [✓] No

15.*Casing Material: [ ] Black Steel [ ] Galvanized [✓] PVC [✓] Stainless Steel [ ] Not Cased [ ] Other ______

16.*Total Well Depth 182 ft. Cased Depth 152 ft. *Open Hole: From ___ To ___ ft. *Screen: From 152 To 182 ft. Slot Size 90

17.*Abandonment: [ ] Other (Explain) ______

From	To	No. of Bags	Seal Material (Check One)
NA ft.	ft.		[ ] Neat Cement [ ] Bentonite Other ___
ft.	ft.		[ ] Neat Cement [ ] Bentonite Other ___
ft.	ft.		[ ] Neat Cement [ ] Bentonite Other ___
ft.	ft.		[ ] Neat Cement [ ] Bentonite Other ___
ft.	ft.		[ ] Neat Cement [ ] Bentonite Other ___

18.*Surface Casing Diameter and Depth:

Dia (in.)	From (ft.)	To (ft.)	No. of Bags	Seal Material (Check One)
30	0	82		[ ] Neat Cement [ ] Bentonite [✓] Other
				[ ] Neat Cement [ ] Bentonite [ ] Other

19.*Primary Casing Diameter and Depth:

Dia (in.)	From (ft.)	To (ft.)	No. of Bags	Seal Material (Check One)
24	0	152	183	[✓] Neat Cement [ ] Bentonite [ ] Other
				[ ] Neat Cement [ ] Bentonite [ ] Other
				[ ] Neat Cement [ ] Bentonite [ ] Other
				[ ] Neat Cement [ ] Bentonite [ ] Other
				[ ] Neat Cement [ ] Bentonite [ ] Other

20.*Liner Casing Diameter and Depth:

Dia (in.)	From (ft.)	To (ft.)	No. of Bags	Seal Material (Check One)
16	0	152		[ ] Neat Cement [ ] Bentonite [ ] Other Gravel
				[ ] Neat Cement [ ] Bentonite [ ] Other
				[ ] Neat Cement [ ] Bentonite [ ] Other

21. *Telescope Casing Diameter and Depth:

Dia (in.)	From (ft.)	To (ft.)	No. of Bags	Seal Material (Check One)
				[ ] Neat Cement [ ] Bentonite [ ] Other
				[ ] Neat Cement [ ] Bentonite [ ] Other
				[ ] Neat Cement [ ] Bentonite [ ] Other

22. Pump Type (If Known):
[ ] Centrifugal [ ] Jet [✓] Submersible [ ] Turbine
Horsepower 25 Pump Capacity (GPM) 500
Pump Depth 100 ft. Intake Depth 100 ft.

23. Chemical Analysis (When Required):
Iron ___ ppm Sulfate ___ ppm Chloride ___ ppm
[✓] Laboratory Test [ ] Field Test Kit

24. Water Well Contractor:

*Contractor Name W. B. Ziegler *License Number 9078 E-mail Address wbz@southeastdrilling.net

*Contractor's Signature [signature] *Driller's Name (Print or Type) Barrett Garrison
(I certify that the information provided in this report is accurate and true.)

*Permit No. 3110-2013

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
2379 BROAD STREET, BROOKSVILLE, FL 34604-6899
PHONE: (352) 796-7211 or (800) 423-1476
WWW.SWFWMD.STATE.FL.US

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
4049 REID STREET, PALATKA, FL 32178-1429
PHONE: (386) 329-4500
WWW.SJRWMD.COM

NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT
152 WATER MANAGEMENT DR., HAVANA, FL 32333-4712
(U.S. Highway 90, 10 miles west of Tallahassee)
PHONE: (850) 539-5999
WWW.NWFWMD.STATE.FL.US

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
P.O. BOX 24680
3301 GUN CLUB ROAD
WEST PALM BEACH, FL 33416-4680
PHONE: (561) 686-8800
WWW.SFWMD.GOV

SUWANNEE RIVER WATER MANAGEMENT DISTRICT
9225 CR 49
LIVE OAK, FL 32060
PHONE: (386) 362-1001 or (800) 226-1066 (Florida only)
WWW.MYSUWANNEERIVER.COM

***DRILL CUTTINGS LOG** (Examine cuttings every 20 ft. or at formation changes. Note cavities and depth to producing zone. Grain Size: F=Fine, M=Medium, and C=Coarse)

From (ft.)	To (ft.)	Color	Grain Size (F, M, C)	Material
0	75	Grey	F	Grey Sand
75	182	Grey	F, M	Grey sand stone & shell

Comments: Static and pumping water levels noted were taken prior to rasing wellhead approximately 6 feet.

***Detailed Site Map of Well Location**

N

APPENDIX B
LITHOLOGIC LOG

Lithologic Log
Seacoast Utility Authority
Production Well BR-21B

Depth (feet bls)	Lithologic Description
0 – 7	SAND (60%), pale yellowish brown (10YR 6/2), unconsolidated, very fine sand to fine sand sized quartz, well rounded, well sorted; ORGANICS (40%), brownish black (5YR 2/1) dusky brown (5YR 2/2), decomposed organic material.
7 – 25	SAND (90%), grayish orange (10YR 7/4) to grayish yellow (5Y 8/4) to yellowish gray (5Y 8/1), unconsolidated, very fine sand grading into coarse sand sized quartz grains with depth, sub-angular to sub-rounded, well sorted sand to moderately well sorted. At approximately 20 feet BLS, sand becomes lighter in color and grades into coarse sand sized quartz grains.
25 – 59	SAND AND SHELL HASH (100%), pale orange (10YR 8/2) to light gray (N7), unconsolidated, fine sand to medium sand sized quartz grains, medium sand to very coarse sand sized undifferentiated shell fragments, sub-angular to rounded, well sorted sand. Overall, interbedded sand and shell with thin beds of poorly lithified shelly sandstone. Sand content decreased with depth.
59 – 75	SAND (100%), yellowish gray (5Y 8/1) unconsolidated, medium sand to coarse sand sized quartz grains, sub-angular to sub-rounded, well sorted. Overall, trace undifferentiated shell fragments with depth.
75 – 138.5	SAND AND SHELL HASH (100%), grayish yellow (5Y 8/4) to very pale orange (10YR 8/2) to pale yellowish brown (10YR 6/2), unconsolidated, very fine sand to fine sand sized quartz grains, medium sand to very coarse sand sized undifferentiated shell fragments, sub-angular to rounded, moderately sorted to well sorted sand. Overall, interbedded sand and shell with thin beds of poorly lithified coquina.
138.5 – 153	LIMESTONE (100%), medium light gray (N6) to light gray (N7), well lithified, hard, carbonate cemented fine sand sized carbonate, undifferentiated shell fragments and minor quartz grains, granular texture, moderate porosity. Overall, interbedded limestone and thin layers of marl. Sand and shell bed present at approximately 143 to 144 feet-BLS.
153 – 175	LIMESTONE (90%), yellowish gray (5Y 8/1) to grayish yellow (5Y 8/4) to very pale orange (10YR 8/2), moderately well lithified, moderately hard, carbonate cemented very fine sand to fine sand sized carbonate, granular texture, moderate porosity; MARL (10%), white (N9) to yellowish gray (5Y 8/1), unconsolidated, clay to fine grained calcareous mud, trace undifferentiated shell fragments. Overall, interbedded limestone and thin layers of marl.
175 – 205	LIMESTONE (100%), yellowish gray (5Y 8/1) to light gray (N7), moderately lithified, moderately hard, carbonate cemented very fine sand to fine sand sized carbonate and quartz grains, granular texture, moderate to moderately good porosity. Overall, interbedded limestone and thin layers of marl and calcite crystals present.

feet. bls - feet below land surface

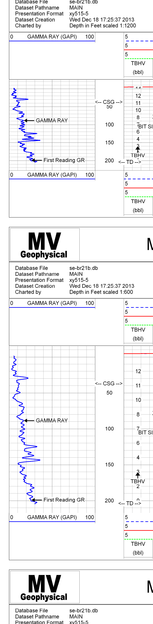
APPENDIX C
GEOPHYSICAL & WELL VIDEO LOG

Comments

MAXIMUM CALIPER ARM EXTENSION: 33"

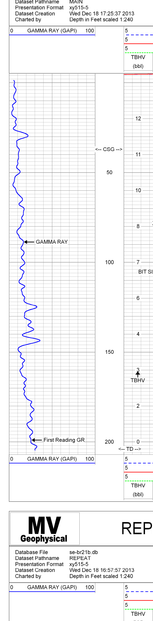
MAIN PASS

Database File: se-br21b.db
Dataset Pathname: MAIN
Presentation Format: xy515-5
Dataset Creation: Wed Dec 18 17:25:37 2013
Charted by: Depth in Feet scaled 1:1200



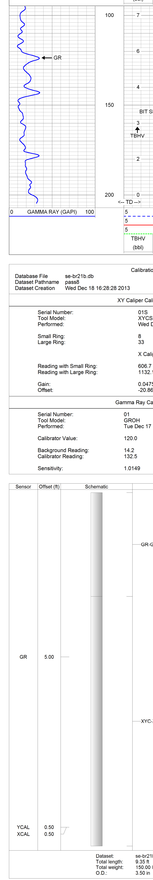
MAIN PASS

Database File: se-br21b.db
Dataset Pathname: MAIN
Presentation Format: xy515-5
Dataset Creation: Wed Dec 18 17:25:37 2013
Charted by: Depth in Feet scaled 1:600



MAIN PASS

Database File: se-br21b.db
Dataset Pathname: MAIN
Presentation Format: xy515-5
Dataset Creation: Wed Dec 18 17:25:37 2013
Charted by: Depth in Feet scaled 1:240



REPEAT SECTION

Database File: se-br21b.db
Dataset Pathname: REPEAT
Presentation Format: xy515-5
Dataset Creation: Wed Dec 18 16:57:57 2013
Charted by: Depth in Feet scaled 1:240

Calibration Report

Database File: se-br21b.db
Dataset Pathname: passB
Dataset Creation: Wed Dec 18 16:28:28 2013

XY Caliper Calibration Report

Serial Number: 013
Tool Model: XYCS
Performed: Wed Dec 18 16:33:44 2013

	X Caliper	Y Caliper	
Small Ring:	8	in	
Large Ring:	33	in	
Reading with Small Ring:	606.7	618	cps
Reading with Large Ring:	1132.1	1078.4	cps
Gain:	0.0475828	0.0543006	
Offset:	-20.8685	-25.5578	

Gamma Ray Calibration Report

Serial Number: 01
Tool Model: GRGH
Performed: Tue Dec 17 10:26:37 2013

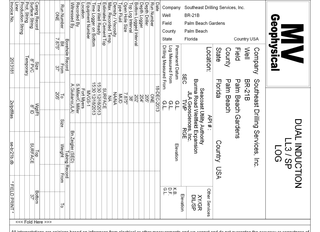
Calibrator Value: 120.0 GAPI

Background Reading: 14.2 cps
Calibrator Reading: 132.5 cps

Sensitivity: 1.0149 GAPI/cps

Sensor	Offset (ft)	Schematic	Description	Length (ft)	O.D. (in)	Weight (lb)
			GR-GRGH (01)	2.75	3.50	40.00
GR	5.00					
			XYC-XYCS (015)	6.60	3.50	110.00
YCAL	0.50					
XCAL	0.50					

Dataset: se-br21b.db: field\wellrun1\passB
Total length: 9.35 ft
Total weight: 150.00 lb
O.D.: 3.50 in

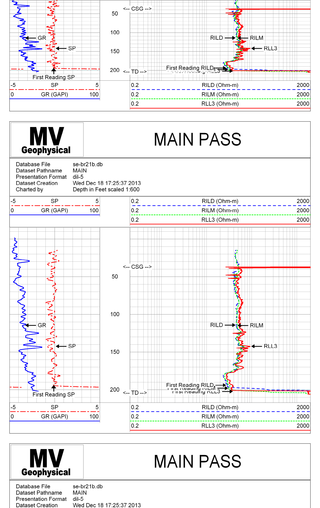


Comments

Rm=6.254 ohm-m @ 83.2 deg

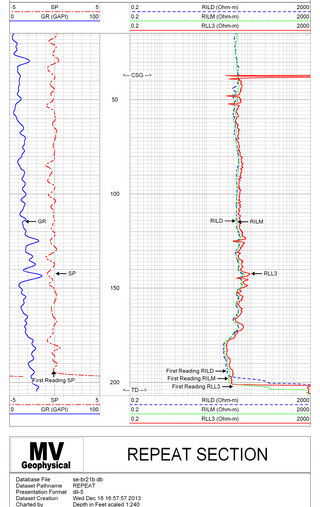
MAIN PASS

Database File: se-br21b.db
Dataset Pathname: MAIN
Presentation Format: dil-5
Dataset Creation: Wed Dec 18 17:25:37 2013
Charted by: Depth in Feet scaled 1:200



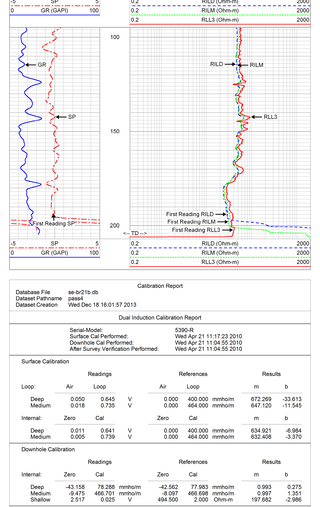
MAIN PASS

Database File: se-br21b.db
Dataset Pathname: MAIN
Presentation Format: dil-5
Dataset Creation: Wed Dec 18 17:25:37 2013
Charted by: Depth in Feet scaled 1:600



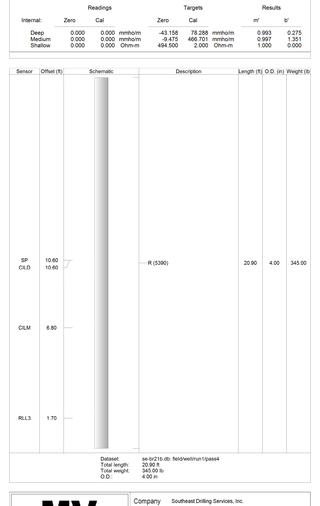
MAIN PASS

Database File: se-br21b.db
Dataset Pathname: MAIN
Presentation Format: dil-5
Dataset Creation: Wed Dec 18 17:25:37 2013
Charted by: Depth in Feet scaled 1:240



REPEAT SECTION

Database File: se-br21b.db
Dataset Pathname: REPEAT
Presentation Format: dil-5
Dataset Creation: Wed Dec 18 16:57:57 2013
Charted by: Depth in Feet scaled 1:240



Calibration Report

Database File: se-br21b.db
Dataset Pathname: pass4
Dataset Creation: Wed Dec 18 16:01:57 2013

Dual Induction Calibration Report

Serial-Model: 5390-R
Surface Cal Performed: Wed Apr 21 11:17:23 2010
Downhole Cal Performed: Wed Apr 21 11:04:55 2010
After Survey Verification Performed: Wed Apr 21 11:04:55 2010

Surface Calibration

Loop:	Air	Loop		Air	Loop		m	b
	Readings			References			Results	
Deep	0.050	0.645	V	0.000	400.000	mmho/m	672.269	-33.613
Medium	0.018	0.735	V	0.000	464.000	mmho/m	647.120	-11.545
Internal:	Zero	Cal		Zero	Cal		m	b
Deep	0.011	0.641	V	0.000	400.000	mmho/m	634.921	-6.984
Medium	0.005	0.739	V	0.000	464.000	mmho/m	632.408	-3.370

Downhole Calibration

Internal:	Zero	Cal		Zero	Cal		m	b
	Readings			References			Results	
Deep	-43.158	78.288	mmho/m	-42.562	77.983	mmho/m	0.993	0.275
Medium	-9.475	466.701	mmho/m	-8.097	466.698	mmho/m	0.997	1.351
Shallow	2.517	0.025	V	494.500	2.000	Ohm-m	197.682	-2.986

After Survey Verification

Internal:	Zero	Cal		Zero	Cal		m'	b'
	Readings			Targets			Results	
Deep	0.000	0.000	mmho/m	-43.158	78.288	mmho/m	0.993	0.275
Medium	0.000	0.000	mmho/m	-9.475	466.701	mmho/m	0.997	1.351
Shallow	0.000	0.000	Ohm-m	494.500	2.000	Ohm-m	1.000	0.000

MV Geophysical

Company	Southeast Drilling Services, Inc.
Well	BR-21B
Field	Palm Beach Gardens
County	Palm Beach
State	Florida
Country	USA

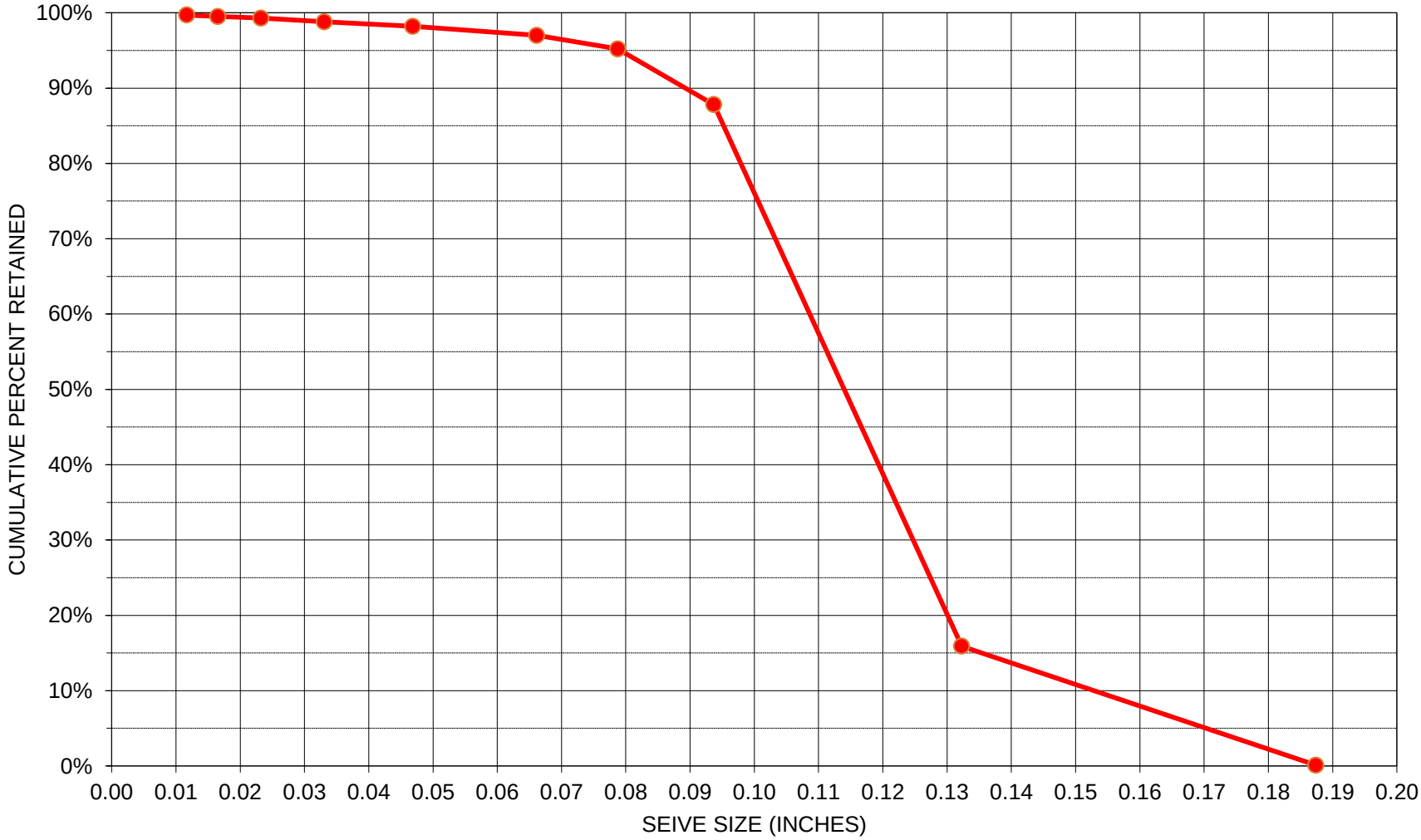
APPENDIX D
GRAVEL PACK DATA

APPENDIX D
SEACOAST UTILITY AUTHORITY
SURFICIAL AQUIFER REPLACEMENT PRODUCTION WELL BR-21B
EDGAR MINERALS 4x9 GRAIN SIZE ANALYSIS

Sieve Size		Cumulative Percent Retained	Percent Passing
phi	mm		
4	4.76	0.1%	99.9%
6	3.36	15.9%	84.2%
8	2.38	87.8%	28.1%
10	2.00	95.2%	92.6%
12	1.68	97.0%	98.2%
16	1.19	98.2%	98.8%
20	0.84	98.8%	99.4%
30	0.59	99.3%	99.5%
40	0.42	99.5%	99.8%
50	0.29	99.7%	99.8%
Effective Size: 2.27		Uniformity Coefficient: 1.33	

APPENDIX D

SEACOAST UTILITY AUTHORITY
SURFICIAL AQUIFER REPLACEMENT WELL BR-21B
EDGAR MINERALS 4X9 GRAVEL PACK



APPENDIX E
LABORATORY WATER QUALITY REPORT

Southeast Drilling Services, Inc. CLWT
119 Lucina Drive, Hypoluxo, FL 33462
(561) 493-9832 Fax (561) 493-5140
P.O. Box 2764, Lutz,FL 33548
(813) 968-7277 Fax (813) 948-1406

Shop Drawing

To	Mr. Brent Weidenhamer, P.E. Holtz Engineering 50 S US Hwy 1, Suite 206 Jupiter, FL 33477 561/575-2005	**From**	Bart Ziegler, P.E. 119 Lucina Dr Hypoluxo, FL 33642
Attn		**Date**	9/29/2014
RE	Burma Road Well 21A	**Project Number**	13-545-W

WE ARE SENDING YOU

- [■] ATTACHED
- [ ] **UNDER SEPARATE COVER** _____
- [ ] SHOP DRAWINGS
- [ ] DOCUMENTS
- [ ] TRACINGS
- [ ] PRINTS
- [ ] SPECIFICATIONS
- [ ] CATALOGS
- [ ] COPY OF LETTER
- [ ] _____

QUANTITY	DESCRIPTION
	SED Submittal No. 19
1	Primary & Secondary

IF MATERIAL RECEIVED IS NOT AS LISTED, PLEASE NOTIFY US AT ONCE

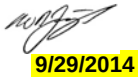
REMARKS _____

COPY TO _____

Southeast Drilling Services, Inc.

Job Name: **Burma Road 21A**
Section: **4200**
Description: **Primary & Secondary**
Submittal No.: **19**

[x] Reviewed and Approved by Contractor
[x] Submitted for Approval
[ ] Per Specifications
[ ] Alternate

By: 

Date: **9/29/2014**

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 FAX 813-855-2218

Florida Department of Environmental Protection
Safe Drinking Water Program Laboratory Reporting Format

Southeast Drilling Service Inc.
Full Chem Group Code - chlorinated

PUBLIC WATER SYSTEM INFORMATION (to be completed by sampler - please type or print legibly)

System Name: _____ PWS I.D. #: ☐☐☐☐☐☐☐

System Type (check one): ☐ Community ☐ Nontransient Noncommunity ☐ Transient Noncommunity

Address: _____

City: _____ Zip Code: _____

Phone: _____ Fax: _____ E-Mail Address: _____

SAMPLE INFORMATION (to be completed by sampler)

Sample Number: 1409818-01 Sample Date: 9/9/14 Sample Time: 5:03 pm AM PM (Circle One)

Sample Location (be specific): SUA #21 Location Code: _____

Disinfection Residual (Required when reporting results for trihalomethanes and haloacetic acids): _____ mg/L Field pH: _____

Sample Type (Check Only One)

- ☐ Distribution
- ☐ Entry Point (to Distribution)
- ☐ Plant Tap (not for compliance with 62-550)
- ☐ Raw (at well or intake)
- ☐ Max. Residence Time
- ☐ Ave. Residence Time
- ☐ Near First Customer

Reason (s) for Sample (Check all that apply)

- ☐ Routine Compliance with 62-550
- ☐ Confirmation of MCL Exceedance*
- ☐ Composite of Multiple Sites **
- ☐ Other: _____
- ☐ Replacement (of Invalidated Sample)
- ☐ Special (not for compliance with 62-550)
- ☐ Clearance (permitting)

Sampling Procedure Used or Other Comments: _____

* See 62-550.500(6) for requirements and restrictions. And 62-550.5.12(3) for nitrate or nitrite exceedances.

** See 62-550.500(4) for requirements and attach a results page for each site

SAMPLER CERTIFICATION

I, Barret Garrison (Print Name), _____ (Print Title) do HEREBY CERTIFY that the above public water system and sample collection information is complete and correct.

Signature: _____ Date: _____

Certified Operator #: _____ Phone #: _____ Sampler's Fax #: _____

Sampler's E-Mail: _____

Reporting Format 62-550-730
Effective January 1995. Revised February 2010

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 FAX 813-855-2218

Florida Department of Environmental Protection
Safe Drinking Water Program Laboratory Reporting Format

Southeast Drilling Service Inc.
Full Chem Group Code - chlorinated

LABORATORY CERTIFICATION INFORMATION (to be completed by lab - please type or print legibly)

Lab Name: Southern Analytical Laboratories, Inc. Florida DOH Certification #: E84129 Certification Expiration Date: 06/30/2015

ATTACH CURRENT DOH ANALYTE SHEET*

Address: 110 Bayview Blvd Oldsmar,FL 34677 Phone: (813) 855-1844

Were any analyses subcontracted? [ ] Yes [X] No If yes, please provide DOH certification number(s):

ATTACH CURRENT DOH ANALYTE SHEET FOR EACH SUBCONTRACTED LAB*

ANALYSIS INFORMATION (to be completed by lab) Date Sample(s) Received: 09/10/2014

PWS ID (From Page 1): Sample Number (From Page 1): 1409818-01 Lab Assigned Report # or Job ID: 1409818-01

Group(s) Analyzed & Results attached for compliance with Chapter 62-550, F.A.C. (Check all that apply):

Inorganics	Synthetic Organics	Volatile Organics	Disinfection Byproducts	Radionuclides	Secondaries
[X] All Except for Asbestos	[ ] All 30	[X] All 21	[X] Trihalomethanes	[X] Single Sample	[ ] All 14
[ ] Partial	[X] All Except Dioxin	[ ] Partial	[X] Haloacetic Acids	[ ] Qtrly Composite	[X] Partial
[X] Nitrate	[ ] Partial		[X] Chlorite		
[X] Nitrite	[ ] Dioxin Only		[X] Bromate		
[ ] Asbestos					

LAB CERTIFICATION

I, Francis I. Daniels (Print Name), Laboratory Director (Print Title) do HEREBY CERTIFY

that all attached analytical data are correct and unless noted meet all requirements of the National Environmental Laboratory Acceditation Conference (NELAC).

Signature:  Date: 09/29/2014

* Failure to provide a valid and current Florida DOH lab certification number and a current Analyte Sheet for the attached analysis results will result in rejection of the report, possible enforcement against the public water system for failure to sample, and may result in notification of the DOH Bureau of Laboratory Services.

** Please provide radiological sample dates & locations for each quarter.

CONFIRMATION & NOTIFICATION IS REQUIRED WITHIN 24 HOURS FOR NITRATE AND NITRITE MCL EXCEEDANCES

NON-DETECTS ARE TO BE REPORTED AS THE MDL WITH A "U" QUALIFIER (Non-detects reported as "BDL" or with a "<" are not acceptable.)

COMPLIANCE DETERMINATION (to be completed by DEP or DOH - attach notes as necessary)

Sample Collection & Analysis Satisfactory: [ ] Yes [ ] No Replacement Sample or Report Requested (circle or highlight group(s) above)

Person Notified: Date Notified: DEP/DOH Reviewing Official:

Reporting Format 62-550-730
Effective January 1995. Revised February 2010

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 FAX 813-855-2218

Florida Department of Environmental Protection
Safe Drinking Water Program Laboratory Reporting Format

INORGANIC CONTAMINANTS
62-550.310(1)

Report Number / Job ID: 1409818-01
PWS ID (From Page 1):

Contam ID	Contam Name	MCL	Units	Analysis Result	Qualifier*	Analytical Method	Lab MDL	Analysis Date	Analysis Time	DOH Lab Certification #
1040	Nitrate (as N)	10	mg/L	0.01	U	EPA 300.0	0.01	9/10/14	20:15	E84129
1041	Nitrite (as N)	1	mg/L	0.01	U,J5,J6	EPA 300.0	0.01	9/10/14	20:15	E84129
1005	Arsenic	0.010	mg/L	0.0014	I	EPA 200.8	0.00093	9/22/14	16:45	E84129
1010	Barium	2	mg/L	0.0065		EPA 200.8	0.00018	9/22/14	16:45	E84129
1015	Cadmium	0.005	mg/L	0.00027	U	EPA 200.8	0.00027	9/22/14	16:45	E84129
1020	Chromium	0.1	mg/L	0.010		EPA 200.8	0.00035	9/22/14	16:45	E84129
1024	Cyanide	0.2	mg/L	0.0061	I	SM 4500CN-E	0.0050	9/15/14	11:42	E84129
1025	Fluoride	4.0	mg/L	0.14		EPA 300.0	0.010	9/10/14	20:15	E84129
1030	Lead	0.015	mg/L	0.00031	I	EPA 200.8	0.00025	9/22/14	16:45	E84129
1035	Mercury	0.002	mg/L	0.00010	U	EPA 245.1	0.00010	9/11/14	14:20	E84129
1036	Nickel	0.1	mg/L	0.0053		EPA 200.8	0.00046	9/22/14	16:45	E84129
1045	Selenium	0.05	mg/L	0.011		EPA 200.8	0.00093	9/23/14	12:47	E84129
1052	Sodium	160	mg/L	74		EPA 200.7	0.13	9/24/14	11:27	E84129
1074	Antimony	0.006	mg/L	0.0010	U	EPA 200.8	0.0010	9/23/14	12:47	E84129
1075	Beryllium	0.004	mg/L	0.000096	U	EPA 200.7	0.000096	9/24/14	11:27	E84129
1085	Thallium	0.002	mg/L	0.00024	U	EPA 200.8	0.00024	9/22/14	16:45	E84129

*Qualifiers:

U=Analyte was undetected. Indicated concentration is method detection limit.
I=The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
J5=Matrix spike of this sample was outside typical range. All other QC criteria were acceptable.
J6=The sample matrix interfered with the ability to make any accurate determination.

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 FAX 813-855-2218

ACCREDITED IN ACCORDANCE WITH nelac

Florida Department of Environmental Protection
Safe Drinking Water Program Laboratory Reporting Format

SECONDARY CONTAMINANTS
62-550.320

Report Number / Job ID: 1409818-01
PWS ID (From Page 1):

Contam ID	Contam Name	MCL	Units	Analysis Result	Qualifier*	Analytical Method	Lab MDL	Analysis Date	Analysis Time	DOH Lab Certification #
1002	Aluminum	0.2	mg/L	0.050	U	EPA 200.7	0.050	9/24/14	11:27	E84129
1017	Chloride	250	mg/L	89		EPA 300.0	0.050	9/10/14	20:15	E84129
1022	Copper	1	mg/L	0.0027		EPA 200.8	0.00013	9/22/14	16:45	E84129
1025	Fluoride	2.0	mg/L	0.14		EPA 300.0	0.010	9/10/14	20:15	E84129
1028	Iron	0.3	mg/L	0.024	I	EPA 200.7	0.020	9/24/14	11:27	E84129
1032	Manganese	0.05	mg/L	0.0095	I	EPA 200.7	0.0010	9/24/14	11:27	E84129
1050	Silver	0.1	mg/L	0.000069	U	EPA 200.8	0.000069	9/22/14	16:45	E84129
1055	Sulfate	250	mg/L	6.0		EPA 300.0	0.20	9/10/14	20:15	E84129
1095	Zinc	5	mg/L	0.023		EPA 200.8	0.00088	9/22/14	16:45	E84129
1905	Color	15	CU	25		SM 2120B	5	9/10/14	15:54	E84129
1920	Odor @ 25C	3	TON	17		SM 2150B	1	9/10/14	16:59	E84129
1930	Total Dissolved Solids	500	mg/L	490		SM 2540C	10	9/12/14	15:51	E84129
2905	Foaming Agents	0.5	mg/L	0.067	I	SM 5540C	0.048	9/10/14	16:46	E84129

*Qualifiers:

U=Analyte was undetected. Indicated concentration is method detection limit.
I=The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 FAX 813-855-2218

Florida Department of Environmental Protection
Safe Drinking Water Program Laboratory Reporting Format

DISINFECTION BYPRODUCTS
62-550.310(3)

Report Number / Job ID: 1409818-01
Disinfectant Residual (mg/L) (From Page 1):
PWS ID (From Page 1):

Contam ID	Contam Name	MCL	Units	Analysis Result	Qualifier*	Analytical Method	Lab MDL	Reg MRL**	Analysis Date	Analysis Time	DOH Lab Certification #
1009	Chlorite	1000	ug/L	10	U	EPA 300.1	10	20	9/11/14	10:18	E84129
1011	Bromate	10	ug/L	5.0	U	EPA 300.1	5.0	5.0	9/11/14	10:18	E84129
Contam ID	Contam Name	MCL	Units	Analysis Result	Qualifier*	Analytical Method	Lab MDL	Reg MRL**	Analysis Date	Analysis Time	DOH Lab Certification #
2450	Monochloroacetic Acid	N/A	ug/L	0.76	U	EPA 552.2	0.76	2.0	9/17/14	13:36	E84129
2451	Dichloroacetic Acid	N/A	ug/L	0.68	U	EPA 552.2	0.68	1.0	9/17/14	13:36	E84129
2452	Trichloroacetic Acid	N/A	ug/L	0.34	U	EPA 552.2	0.34	1.0	9/17/14	13:36	E84129
2453	Monobromoacetic Acid	N/A	ug/L	0.33	U	EPA 552.2	0.33	1.0	9/17/14	13:36	E84129
2454	Dibromoacetic Acid	N/A	ug/L	0.26	U	EPA 552.2	0.26	1.0	9/17/14	13:36	E84129
2456	Total Haloacetic Acids (HAA5)	60	ug/L	0.26	U	EPA 552.2	0.26	---	9/17/14	13:36	E84129
Contam ID	Contam Name	MCL	Units	Analysis Result	Qualifier*	Analytical Method	Lab MDL	Reg MRL**	Analysis Date	Analysis Time	DOH Lab Certification #
2941	Chloroform	N/A	ug/L	0.2	U	EPA 524.2	0.2	1.0	9/11/14	21:23	E84129
2942	Bromoform	N/A	ug/L	0.2	U	EPA 524.2	0.2	1.0	9/11/14	21:23	E84129
2943	Bromodichloromethane	N/A	ug/L	0.2	U	EPA 524.2	0.2	1.0	9/11/14	21:23	E84129
2944	Dibromochloromethane	N/A	ug/L	0.1	U	EPA 524.2	0.1	1.0	9/11/14	21:23	E84129
2950	Total Trihalomethanes (TTHM)	80	ug/L	0.1	U	EPA 524.2	0.1	---	9/11/14	21:23	E84129

** Laboratories are required to adhere to minimum reporting level (MRL) requirements of 40 CFR 141.131(b)(2)(iv). Chlorite regulatory MRL is applicable to monitoring as prescribed in 40 CFR 141.132(b)(2)(i)(B) and (b)(2)(ii). Laboratories that use EPA Methods 317.0 Revision 2.0, 326.0 or 321.8 must meet a 1.0 ug/L MRL for bromate.

*Qualifiers:

U=Analyte was undetected. Indicated concentration is method detection limit.

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 FAX 813-855-2218

Florida Department of Environmental Protection
Safe Drinking Water Program Laboratory Reporting Format

RADIONUCLIDES
62-550.310(6)

Report Number / Job ID: 1409818-01
PWS ID (From Page 1):

Contam ID	Contam Name	MCL	Units	Analysis Result	Qualifier*	Analytical Method	Lab MDL	RDL	Analysis Error	Analysis Date	Analysis Time	DOH Lab Certification
4002	Gross Alpha (Incl Uranium)	***	pCi/L	2.9		SM 7110B	2.5	3	2.3	9/15/14	9:40	E84129
4006	Combined Uranium (mass)	30	ug/L	0.096	I	EPA 200.8	0.054	1		9/22/14	16:45	E84129
4020	Radium-226	5	pCi/L	0.4		EPA 903.1	0.1	1	0.16	9/17/14	16:09	E84129
4030	Radium-228	5	pCi/L	0.6	U	EPA Ra-05	0.6	1	0.4	9/15/14	17:22	E84129

** If the result for Gross Alpha (Excl Uranium) exceed 5 pCi/L, a measurement for radium-226 is required. Uranium is reported separately under Contam ID 4006.

*** If the result for Gross Alpha (Incl Uranium) exceeds 5 pCi/L, a measurement for Radium-226 is required. If the results exceed 15 pCi/L, a measurement for Combined Uranium must be reported separately. DEP/DOH will subtract the Uranium value from the Gross Alpha (ID 4002) to determine compliance with MCL for Gross Alpha (Excl. Uranium) of 15 pCi/L. If the result of ID 4002 Gross Alpha (Including Uranium) does not exceed 15 pCi/L, Combined Uranium need not be measured nor reported.

If using Uranium testing methods ASTM D5174 or EPA 200.8 only, then Analysis Error need not be reported.

*Qualifiers:

U=Analyte was undetected. Indicated concentration is method detection limit.
I=The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 FAX 813-855-2218

ACCREDITED IN ACCORDANCE WITH nelac

Florida Department of Environmental Protection
Safe Drinking Water Program Laboratory Reporting Format

VOLATILE ORGANICS
62-550.310(4)(a)

Report Number / Job ID: 1409818-01
PWS ID (From Page 1):

Contam ID	Contam Name	MCL	Units	Analysis Result	Qualifier*	Analytical Method	Lab MDL	RDL	Analysis Date	Analysis Time	DOH Lab Certification #
2378	1,2,4-Trichlorobenzene	70	ug/L	0.3	U	EPA 524.2	0.3	0.5	9/11/14	21:23	E84129
2380	cis-1,2-Dichloroethylene	70	ug/L	0.09	U	EPA 524.2	0.09	0.5	9/11/14	21:23	E84129
2955	Xylenes (total)	10,000	ug/L	0.1	U	EPA 524.2	0.1	0.5	9/11/14	21:23	E84129
2964	Dichloromethane	5	ug/L	0.2	U	EPA 524.2	0.2	0.5	9/11/14	21:23	E84129
2968	o-Dichlorobenzene	600	ug/L	0.1	U	EPA 524.2	0.1	0.5	9/11/14	21:23	E84129
2969	para-Dichlorobenzene	75	ug/L	0.2	U	EPA 524.2	0.2	0.5	9/11/14	21:23	E84129
2976	Vinyl chloride	1	ug/L	0.3	U	EPA 524.2	0.3	0.5	9/11/14	21:23	E84129
2977	1,1-Dichloroethylene	7	ug/L	0.2	U	EPA 524.2	0.2	0.5	9/11/14	21:23	E84129
2979	trans-1,2-Dichloroethylene	100	ug/L	0.2	U	EPA 524.2	0.2	0.5	9/11/14	21:23	E84129
2980	1,2-Dichloroethane	3	ug/L	0.1	U	EPA 524.2	0.1	0.5	9/11/14	21:23	E84129
2981	1,1,1-Trichloroethane	200	ug/L	0.2	U	EPA 524.2	0.2	0.5	9/11/14	21:23	E84129
2982	Carbon tetrachloride	3	ug/L	0.2	U	EPA 524.2	0.2	0.5	9/11/14	21:23	E84129
2983	1,2-Dichloropropane	5	ug/L	0.2	U	EPA 524.2	0.2	0.5	9/11/14	21:23	E84129
2984	Trichloroethylene	3	ug/L	0.2	U	EPA 524.2	0.2	0.5	9/11/14	21:23	E84129
2985	1,1,2-Trichloroethane	5	ug/L	0.2	U	EPA 524.2	0.2	0.5	9/11/14	21:23	E84129
2987	Tetrachloroethylene	3	ug/L	0.1	U	EPA 524.2	0.1	0.5	9/11/14	21:23	E84129
2989	Monochlorobenzene	100	ug/L	0.1	U	EPA 524.2	0.1	0.5	9/11/14	21:23	E84129
2990	Benzene	1	ug/L	0.1	U	EPA 524.2	0.1	0.5	9/11/14	21:23	E84129
2991	Toluene	1000	ug/L	0.09	U	EPA 524.2	0.09	0.5	9/11/14	21:23	E84129
2992	Ethylbenzene	700	ug/L	0.08	U	EPA 524.2	0.08	0.5	9/11/14	21:23	E84129
2996	Styrene	100	ug/L	0.05	U	EPA 524.2	0.05	0.5	9/11/14	21:23	E84129

NOTE: Results indicating non-detection with a reported lab MDL > .5 µg/L will not be accepted for compliance.

*Qualifiers:

U=Analyte was undetected. Indicated concentration is method detection limit.

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 FAX 813-855-2218

ACCREDITED IN ACCORDANCE WITH nelac

Florida Department of Environmental Protection
Safe Drinking Water Program Laboratory Reporting Format

SYNTHETIC ORGANICS
62-550.310(4)(b)

Report Number / Job ID: 1409818-01
PWS ID (From Page 1):

Contam ID	Contam Name	MCL	Units	Analysis Result	Qualifier*	Analytical Method	Lab MDL	RDL	Extraction Date	Analysis Date	Analysis Time	DOH Lab Certification #
2005	Endrin	2	ug/L	0.05	U	EPA 525.2	0.05	0.01	9/15/14	9/15/14	20:10	E84129
2010	Lindane	0.2	ug/L	0.02	U	EPA 525.2	0.02	0.02	9/15/14	9/15/14	20:10	E84129
2015	Methoxychlor	40	ug/L	0.02	U	EPA 525.2	0.02	0.1	9/15/14	9/15/14	20:10	E84129
2020	Toxaphene	3	ug/L	0.55	U	EPA 508.1	0.55	1	9/15/14	9/19/14	5:26	E84129
2031	Dalapon	200	ug/L	0.33	U	EPA 515.3	0.33	1	9/16/14	9/18/14	5:05	E84129
2032	Diquat	20	ug/L	0.34	U	EPA 549.2	0.34	0.4	9/11/14	9/12/14	20:04	E84129
2033	Endothall	100	ug/L	6.7	U	EPA 548.1	6.7	9	9/11/14	9/23/14	18:34	E84129
2034	Glyphosate	700	ug/L	2.7	U	EPA 547	2.7	6	9/11/14	9/11/14	16:10	E84129
2035	Di(2-ethylhexyl)adipate	400	ug/L	0.07	U	EPA 525.2	0.07	0.6	9/15/14	9/15/14	20:10	E84129
2036	Oxamyl (Vydate)	200	ug/L	0.88	U	EPA 531.1	0.88	2	9/22/14	9/22/14	20:53	E84129
2037	Simazine	4	ug/L	0.03	U	EPA 525.2	0.03	0.07	9/15/14	9/15/14	20:10	E84129
2039	Di(2-ethylhexyl)phthalate	6	ug/L	0.7	U	EPA 525.2	0.7	0.6	9/15/14	9/15/14	20:10	E84129
2040	Picloram	500	ug/L	0.048	U	EPA 515.3	0.048	0.1	9/16/14	9/18/14	5:05	E84129
2041	Dinoseb	7	ug/L	0.15	U	EPA 515.3	0.15	0.2	9/16/14	9/18/14	5:05	E84129
2042	Hexachlorocyclopentadiene	50	ug/L	0.06	U	EPA 525.2	0.06	0.1	9/15/14	9/15/14	20:10	E84129
2046	Carbofuran	40	ug/L	0.60	U	EPA 531.1	0.60	0.9	9/22/14	9/22/14	20:53	E84129
2050	Atrazine	3	ug/L	0.02	U	EPA 525.2	0.02	0.1	9/15/14	9/15/14	20:10	E84129
2051	Alachlor	2	ug/L	0.03	U	EPA 525.2	0.03	0.2	9/15/14	9/15/14	20:10	E84129
2065	Heptachlor	0.4	ug/L	0.09	U	EPA 525.2	0.09	0.04	9/15/14	9/15/14	20:10	E84129
2067	Heptachlor epoxide	0.2	ug/L	0.08	U	EPA 525.2	0.08	0.02	9/15/14	9/15/14	20:10	E84129
2105	2,4-D	70	ug/L	0.099	U	EPA 515.3	0.099	0.1	9/16/14	9/18/14	5:05	E84129
2110	2,4,5-TP (Silvex)	50	ug/L	0.041	U	EPA 515.3	0.041	0.2	9/16/14	9/18/14	5:05	E84129
2274	Hexachlorobenzene	1	ug/L	0.04	U	EPA 525.2	0.04	0.1	9/15/14	9/15/14	20:10	E84129
2306	Benzo(a)pyrene	0.2	ug/L	0.02	U	EPA 525.2	0.02	0.02	9/15/14	9/15/14	20:10	E84129
2326	Pentachlorophenol	1	ug/L	0.014	U	EPA 515.3	0.014	0.04	9/16/14	9/18/14	5:05	E84129
2383	Polychlorinated biphenyls (PCBs)	0.5	ug/L	0.092	U	EPA 508.1	0.092	0.1	9/15/14	9/19/14	5:26	E84129
2931	Dibromochloropropane	0.2	ug/L	0.0055	U	EPA 504.1	0.0055	0.01	9/15/14	9/15/14	23:59	E84129
2946	Ethylene dibromide (EDB)	0.02	ug/L	0.0055	U	EPA 504.1	0.0055	0.02	9/15/14	9/15/14	23:59	E84129
2959	Chlordane	2	ug/L	0.049	U	EPA 508.1	0.049	0.2	9/15/14	9/19/14	5:26	E84129

*Qualifiers: ** Non-detects with a reported lab MDL <50% of the MCL are acceptable for compliance with 62-550.310(4)(b)

U=Analyte was undetected. Indicated concentration is method detection limit.

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No. 1409818

Client Name: Southeast Drilling	Contact / Phone: Bart Ziegler
Project Name / Location: Stoutamire Burns Rd 21 — 62550 F.A.C DW Analyses	wbz@southeastdrilling.net
Samplers: (Signature) Bart D Ziegler / Brent G Garrison	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

PARAMETER / CONTAINER DESCRIPTION

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	1LP, Cool 4°C Misc. Inorganics, Bromate	250ml P, H_2SO_4 Nutrients	250ml P, HNO_3 Metals	250ml P, Ascorbic Acid * Cyanide	1LG, Cool 4°C Odor	40ml V, $Na_2S_2O_3$ 524.2, TTHM	1LG, Na_2SO_3 525.2,508.1	1LaP, $Na_2S_2O_3$ 549.2	40ml V, $Na_2S_2O_3$ 504.1, 547	40ml aV, EDA Chlorite	40ml V, MCAA|$Na_2S_2O_3$ 531.1	40ml Amber V, $Na_2S_2O_3$ 515.3	40ml aV, NH_4Cl 548.1	100ml P, $Na_2S_2O_3$ T. Coliforms	1/2 gal, HNO_3 GA, Ra226, Ra228, U	40ml AV, NH_4Cl Haloacetic Acids
01	SUA #21	9-9-14	1703	DW		X	1	1	1	1	1	2	4	1	4	2	1	3	1	2	2	3
02	Trip Blank			R		X						1										

Containers Prepared/ Relinquished: [signature]	Date/Time: 1130 9/8/14	Received:	Date/Time:
Relinquished: [signature]	Date/Time: 1800 9/8/14	Received: fedex	Date/Time:
Relinquished: fedex	Date/Time:	Received: [signature]	Date/Time: 9-10-14 1000
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact?	(Y) N N/A
Samples intact upon arrival?	(Y) N N/A
Received on ice? Temp 4.4	(Y) N N/A
Proper preservatives indicated?	(Y) N N/A
Rec'd within holding time?	(Y) N N/A
Volatiles rec'd w/out headspace?	Ø N N/A
Proper containers used?	(Y) N N/A

Instructions / Remarks:

* Add NaOH once sample has been received

Chain of Custody.xls
Rev.Date 11/19/01

Chain of Custody

APPENDIX F
PROJECT PHOTOGRAPHS & ELECTRONIC COPY OF WELL COMPLETION REPORT