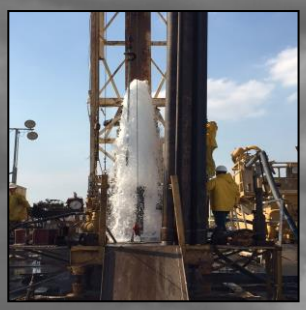

WELL CONSTRUCTION & TESTING REPORT

FOR UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT WATER TREATMENT PLANT NO. 11 BELLE GLADE, FLORIDA

Prepared for:

Palm Beach County Water Utilities Department

and

Mathews Consulting, Inc.
1475 Centrepark Blvd., Suite 250
West Palm Beach, Florida 33401

August 2015

JLA Geosciences, Inc.

WELL CONSTRUCTION AND TESTING REPORT

FOR

PALM BEACH COUNTY WATER UTILITIES DEPARTMENT
WATER TREATMENT PLANT 11
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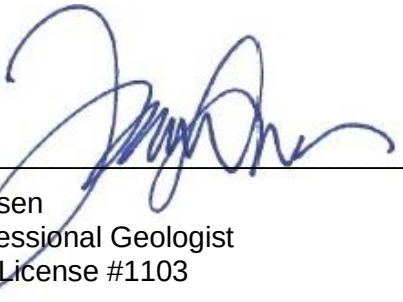
Jupiter, Florida 33458



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

August 13, 2015

Rene L. Mathews, P.E.
Mathews Consulting, Inc.
477 S. Rosemary Avenue, Suite 330
West Palm Beach, Florida 33401

RE: ***Palm Beach County Water Utilities Department, WTP 11, Floridan Aquifer Production Wells PW-9 and PW-10 Well Completion Report***

Dear Rene,

We are pleased to submit five (5) copies of the Well Completion Report for Palm Beach County Water Utilities Department, Upper Floridan Aquifer Production Wells PW-9 and PW-10. This report summarizes construction, development, acidization and testing of two (2) 14-inch diameter and 17.4-inch diameter production wells constructed for Water Treatment Plant 11 in Belle Glade, Florida.

If we can do anything further, please call us.

Sincerely,
JLA Geosciences, Inc.

James L. Andersen, P.G.
Principal Hydrogeologist

JLA/jla
Encls.

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EXECUTIVE SUMMARY

Between June 2014 and May 2015, JLA Geosciences, Inc. (JLA) provided hydrogeologic consulting services for the construction of Upper Floridan Aquifer (UFA) Production wells PW-9 and PW-10 for Palm Beach County Water Utilities Department (PBCWUD) and Mathews Consulting (MC). UFA production wells PW-9 and PW-10 will serve to supplement the existing reverse osmosis raw water supply for the PBCWUD Water Treatment Plant No.11 (WTP11), located at 39800 Hooker Highway in Belle Glade, Florida. All Webbs Enterprises (AWE) of Jupiter, Florida was contracted by PBCWUD to construct production wells PW-9 and PW-10.

Based on PW-9 site lithology, the Surficial Aquifer System (SAS) extends to a depth of approximately 160 feet below land surface (BLS). Below the SAS, the Intermediate Confining Unit (ICU) continues to the top of the Upper Floridan Aquifer (UFA) to a depth of approximately 823 feet BLS. Site lithology of PW-10, located 1,800 feet east of PW-9, reveals a potential unconformity separating the contact between the ICU and UFA by approximately 200 feet deeper at approximately 955 feet BLS. Based on the lithologic logs, geophysical logs, well video, and wellhead flow data, significant flow in PW-9 occurs at 1,270 feet BLS with thin flow zones occurring from 1,075 to 1,350 feet BLS; in PW-10, significant flow occurs at 1,010 to 1,040 feet BLS and thin flow zones occur from 1,050 to 1,350 feet BLS.

The final completion interval of each production well varied depending on site specific conditions and well performance. Each well was completed as follows:

Table 1 (excerpt), Well Construction Details

	PW-9	PW-10
Open Borehole Interval (feet BLS) *19-inch diameter**	1,052 – 1,363	1,004 – 1,113

feet BLS: feet below land surface

A step drawdown (SDD) test was performed at each well following completion of well development. SDD testing included at least five (5) steps at approximately two (2) hours per step. PW-10 SDD testing included six (6) steps with step 5 at approximately 80 minutes and step 6 at 40 minutes. Rates varied from well to well, but ranged between 600 gallons per minute (GPM) and 2,500 GPM. Specific capacities at the design pumping rate during the step drawdown tests are summarized below:

Table 8 & 9 (excerpt), Step Drawdown Test, Specific Capacity at Design Rate

900 gpm Design Rate	PW-9 965 gpm	PW-10 970 gpm
Specific Capacity (gpm/ft)	33.2	776

gpm: gallons per minute
gpm/ft: gallons per minute per foot of drawdown

In constructing PW-9 and PW-10, a shallower completion interval was targeted based on increases in conductivity of produced water from existing deeper UFA wells. The total dissolved solids (TDS) of new production wells PW-9 and PW-10 are approximately 3,500 mg/L and 8,500 mg/L, respectively. Additional water quality parameters, as measured during the step drawdown test at approximately 900 gpm, are as follows:

Table 8 and 9 (excerpt), Step Drawdown Test, Field Water Quality Results

Well	Rate (gpm)	Chloride (mg/L)	Specific Cond. (mS/cm)	TDS (ppt)	Hydrogen Sulfide (ppm)	Total Iron (ppm)	Sand (ppm)	SDI
PW-9	965	1,565	5,520	3.58	2.0	<0.1	<0.1	0.2
PW-10	970	2,850	10,080	8.56	6.0	0.1	0.1	2.4

gpm: gallons per minute
mg/L: milligrams per liter
mS/cm: microsiemens per centimeter
ppt: parts per thousand
ppm: parts per million

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: Sodium (PW-9: 930 mg/L, PW-10: 1690 mg/L), Bromate (PW-9: 50 ug/L), Chloride (PW-9: 1580 mg/L, PW-10: 2710 mg/L), Sulfate (PW-9: 488 mg/L, PW-10: 558 mg/L) Threshold Odor Number (PW-9: 67 T.O.N, PW-10: 100 T.O,N), Total Dissolved Solids (PW-9: 3210 mg/L, PW-10: 5660 mg/L), Gross Alpha (PW-10: 60.3±5.90) and Radium 226 (PW-9: 7.23±1.68 pCi/L, PW-10: 40.5±4.35 pCi/L).

Based on the results of drilling and testing of PW-9 and PW-10, JLA recommends the following:

1. As outlined in *GUA UFA Groundwater Modeling Results* (JLA Geosciences Inc., 2011), a pumpage rate of 900 gpm is recommended for both PW-9 and PW-10, with reductions in future withdrawals from existing wells when one (1) additional new UFA well, PW-11 is completed.

2. Prior to placing wells PW-9 and PW-10 in service, any residual kill water and associated debris should be purged from the wells until silt density index (SDI) and sand concentration reach that of values measured during the step drawdown test as outlined in this report. Well service performed for the production wells should be performed without “killing” the well where possible.

3. Water quality monitoring of PW-9 and PW-10 should include laboratory analysis of chloride concentration and specific conductance collected weekly for the first 6 months of operation. After 6 months and review of the data, sampling of chloride and specific conductance may be reduced to monthly. In addition, water quality sampling should also include, at a minimum, the parameters tested during construction, which include: TDS, pH, SDI, and hydrogen sulfide. Frequency of these additional parameters should be monthly at a minimum. Results of all sampling should be plotted and analyzed for trends or changes in water quality

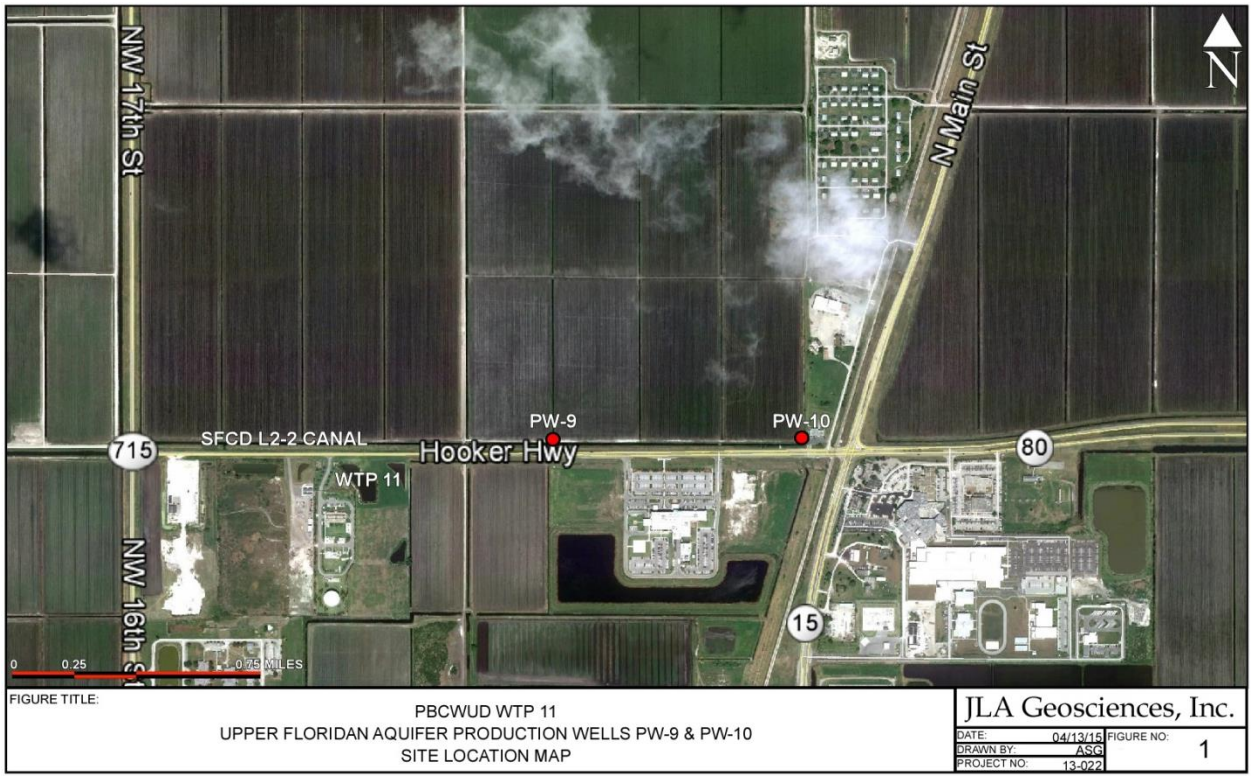
over time. Laboratory analysis should be performed by the Palm Beach County Central Laboratory or a state of Florida NELAC certified analytical laboratory.

4. 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. 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 water levels or a specific capacity loss of 20% or greater than reported herein may indicate the need for evaluation and potential rehabilitation.

5. A three (3) day Aquifer Performance Test (APT) including existing UFA wells (TP-1, TP-2, PW-3, PW-4, PW-5, PW-6, PW-7 and PW-8) and new production wells PW-9 and PW-10 should be performed to evaluate aquifer characteristics. The APT should include background measurement of water levels in PW-9 and PW-10 with wells PW-3, PW-4, PW-6 and PW-7 pumping. To evaluate well field changes during the APT, test production wells PW-9 and PW-10, should be pumped for as long as possible; then wells TP-1, TP-2, PW-5, and PW-8 added into service to meet water plant demand. A formal APT plan should be developed to address testing requirements and water plant operational requirements.

1.0 INTRODUCTION

JLA was contracted by PBCWUD to provide hydrogeologic consulting services associated with the construction of two (2) UFA production wells, identified in South Florida Water Management District (SFWMD) permit 50-06857-W as PW-9 and PW-10, to provide public water supply for the PBCWUD Water Treatment Plant No. 11 located at 39800 Hooker Highway, Belle Glade, Florida. The site and well locations are shown in Figure 1.



JLA Geosciences would like to recognize Mr. Tom Uram, P.G. with Palm Beach County Water Utilities Department, whose outstanding efforts and significant contributions benefitted the project.

JLA and PBCWUD personnel jointly provided the following services during construction of the WTP11 production wells: observation of pilot hole drilling, testing and sampling; geophysical and video logging; production well construction, measurement and testing services; interpretation of hydrogeologic, water quality and geophysical data; and

provision of recommendations as to the depths of boreholes, well casings and final production intervals.

All Webbs Enterprises (AWE) of Jupiter, Florida was contracted by PBCWUD to construct the production wells. AWE complied with the standards of the American Water Works Association for Deep Wells (AWWA A100-06), as referenced in the specifications. Copies of the Driller's Well Completion Report and Contractor Submittals are included in Appendix A.

Well construction for PW-9 began in June 2014 and was completed in November 2014. PW-10 well construction began in November 2014 and was completed in May 2015. Well PW-9 and PW-10 were completed with a nominal 19-inch diameter open hole production interval from 1,052 to 1,363 feet BLS and 1,004 to 1,113 feet BLS, respectively. The final casing string of 120 feet, constructed of 17.4-inch and 14-inch outside diameter Poly Vinyl Chloride (PVC) Certainteed Certalok SDR 17, was installed to a depth of 1,052 feet BLS at PW-9 and 1,004 feet BLS at PW-10.

2.0 WELL CONSTRUCTION AND TESTING

By contract, AWE was responsible for all aspects of production well construction and performed all of the construction elements. JLA performed onsite hydrogeologic observation during rotary drilling of pilot holes, geophysical logging, casing installations, casing grouting, reverse air drilling of completion intervals, development and pump testing. Pilot hole drilling, geophysical logging, well construction phases and testing were completed as follows:

Well Construction Sequence

Construction Dates	PW-9	PW-10
36-in. Steel Pit Casing Installation	6/12/2014	6/13/2014
34.5-in. Surface Casing Borehole Drilling	7/18/2014 – 7/22/2014	11/5/2014 – 11/6/2014
Geophysical Logging* (Caliper)	7/23/2014	11/6/2014
30-in. Surface Casing Installation and Grouting	7/23/2014	11/7/2014
12.25-in. Pilot Hole Drilling to 950 feet BLS	7/25/2014 – 8/1/2014	11/12/2014 – 12/12/2014
Geophysical Logging* (Full Suite)	8/1/2014	11/25/2014
20-in. Intermediate Casing Installation and Grouting	8/20/2014 – 8/23/2014	12/15/2014 – 12/18/2014
12.25-in. Pilot Hole Reverse Air Drilling and Flow Tests	9/2/2014 – 9/5/2014	1/6/2015 – 1/17/2015
Geophysical Logging* (Full Suite)	9/6/2014	1/20/2015; 2/3/2015
Backfill and Plug Production Interval	NA	2/11/2015 – 3/10/2015
17.4-in. and 14-in. Production Casing Installation and Grouting	9/25/2014 – 10/6/2014	3/16/2015 – 3/25/2015
Plumbness and Alignment Test	10/3/2014	3/26/2015
Acidization	10/30/2014 – 10/31/2014	NA
Jetting and Pump Development	11/1/2014	3/30/2015 – 5/4/2015
Step Drawdown Test	11/19/2014	5/6/2015
Well Completion Video	11/20/2014	5/7/2015

*Refer to Summary of Geophysical Logging for details

2.1 Mud Rotary Pilot Hole Drilling

JLA personnel provided oversight during the vibrating, drilling, installation and grouting of each production well casing. A 34.5-inch diameter borehole to 160 feet BLS and a 12.5-inch diameter pilot hole to 950 feet BLS were drilled using the mud rotary method to obtain lithologic data at both wells. Lithologic samples were collected every five feet during pilot hole drilling in order to evaluate geologic character of the aquifer with depth and to select an appropriate casing setting depth. A copy of the lithologic logs compiled from the geologic formations encountered during drilling is provided in Appendix B.

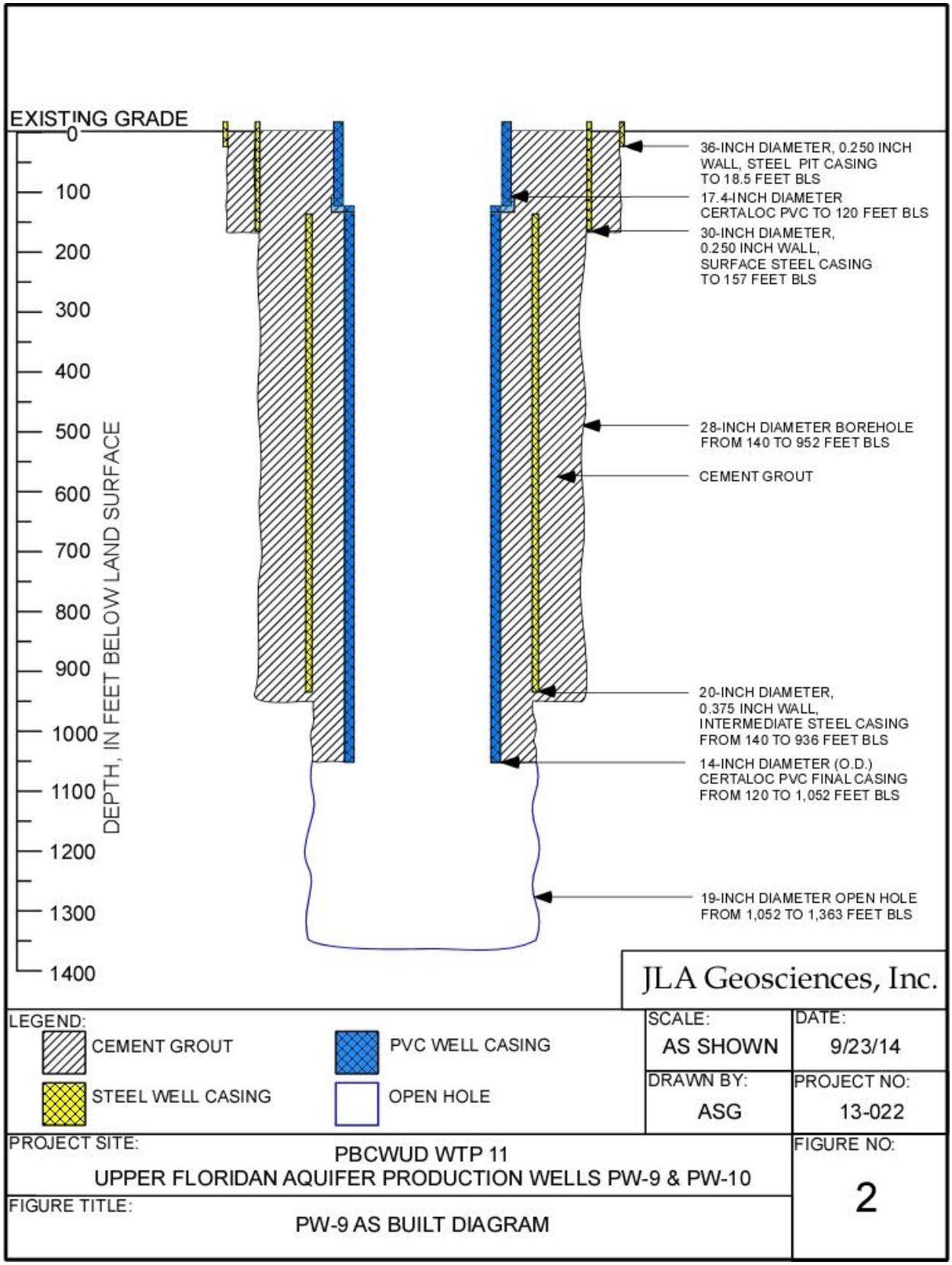
Upon completion of borehole and pilot hole drilling the drilling fluid was circulated to clear the hole of cuttings in preparation for geophysical logging. Geophysical logging was performed in the pilot hole and/or reamed hole at various stages of well construction. Electronic copies of the geophysical logs for the production wells are included in Appendix C.

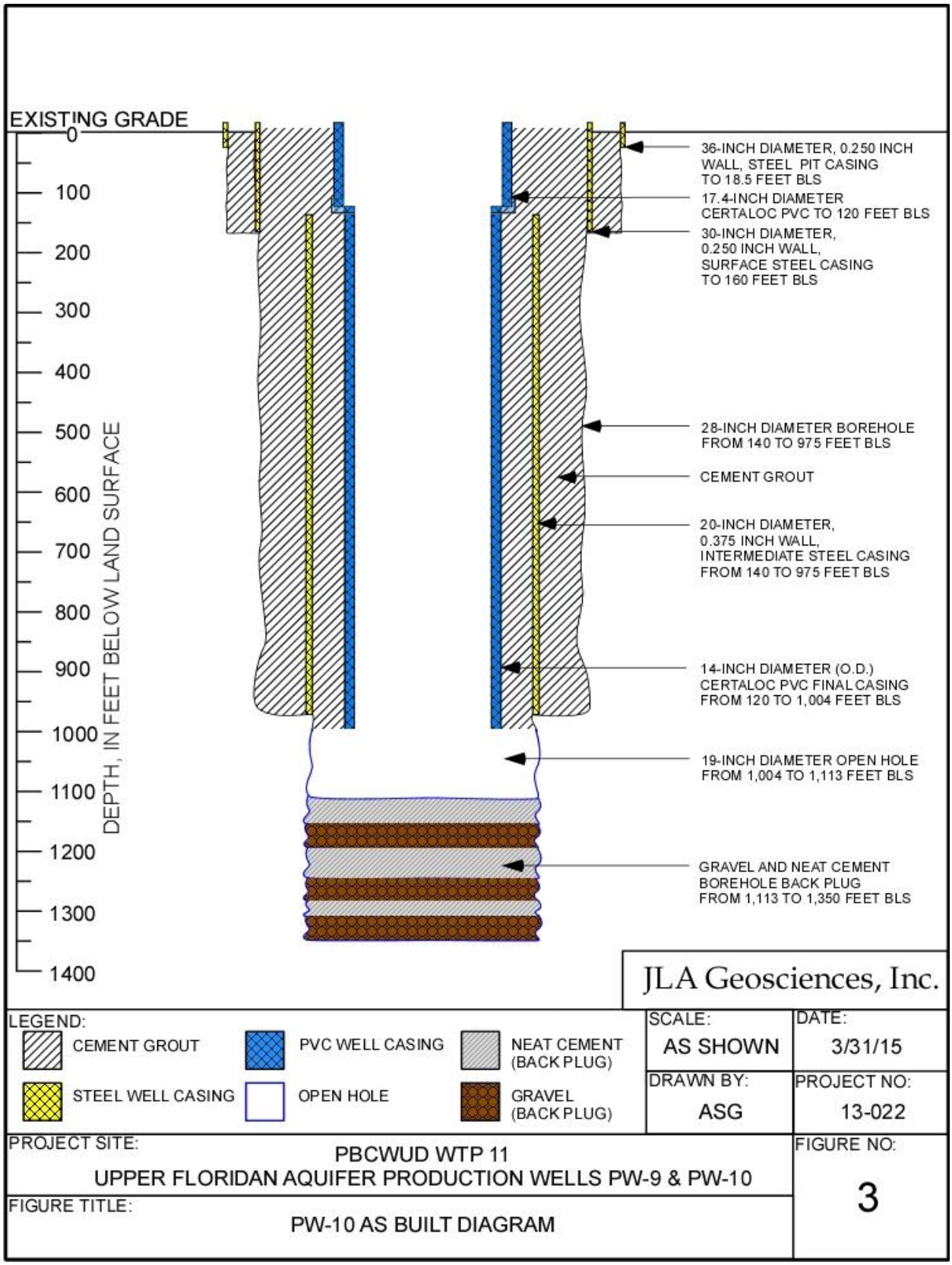
The well construction details for the production wells are provided in Table 1. As-built diagrams of Production wells PW-9 and PW-10 are provided as Figure 2 and Figure 3.

Table 1, Well Construction Details

	PW-9	PW-10
Total Depth (feet BLS)	**1,363**	**1,113**
Pit Casing Depth (feet BLS) *36-in diameter, steel 0.250-inch wall thickness*	18.5	18.5
Surface Casing Depth (feet BLS) *30-in diameter, steel 0.250-inch wall thickness*	157	160
Intermediate Casing Depth Interval (feet BLS) *20-in diameter, steel* 0.375-inch wall thickness	140 – 936	140 – 975
Final Casing Depth Interval (feet BLS) *Certainteed Certalok SDR17 17.4-in Outside Diameter*	0 – 120	0 – 120
Certainteed Certalok SDR17 14-in Outside Diameter	120 – 1,052	120 – 1,004
Open Hole Production Depth Interval (feet BLS) *19-in diameter*	1,052 – 1,363	1,004 – 1,113
Borehole Back Plug Depth Interval (feet BLS) *Gravel & Neat Cement*	NA	1,113 – 1,350

feet BLS – feet below land surface


EXISTING GRADE
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
DEPTH, IN FEET BELOW LAND SURFACE
36-INCH DIAMETER, 0.250 INCH WALL, STEEL PIT CASING TO 18.5 FEET BLS
17.4-INCH DIAMETER CERTALOC PVC TO 120 FEET BLS
30-INCH DIAMETER, 0.250 INCH WALL, SURFACE STEEL CASING TO 157 FEET BLS
28-INCH DIAMETER BOREHOLE FROM 140 TO 952 FEET BLS
CEMENT GROUT
20-INCH DIAMETER, 0.375 INCH WALL, INTERMEDIATE STEEL CASING FROM 140 TO 936 FEET BLS
14-INCH DIAMETER (O.D.) CERTALOC PVC FINAL CASING FROM 120 TO 1,052 FEET BLS
19-INCH DIAMETER OPEN HOLE FROM 1,052 TO 1,363 FEET BLS
JLA Geosciences, Inc.
LEGEND:
CEMENT GROUT
PVC WELL CASING
STEEL WELL CASING
OPEN HOLE
SCALE: AS SHOWN
DATE: 9/23/14
DRAWN BY: ASG
PROJECT NO: 13-022
PROJECT SITE:
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
FIGURE NO: 2
FIGURE TITLE:
PW-9 AS BUILT DIAGRAM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DEPTH, IN FEET BELOW LAND SURFACE
36-INCH DIAMETER, 0.250 INCH WALL, STEEL PIT CASING TO 18.5 FEET BLS
17.4-INCH DIAMETER CERTALOC PVC TO 120 FEET BLS
30-INCH DIAMETER, 0.250 INCH WALL, SURFACE STEEL CASING TO 160 FEET BLS
28-INCH DIAMETER BOREHOLE FROM 140 TO 975 FEET BLS
CEMENT GROUT
20-INCH DIAMETER, 0.375 INCH WALL, INTERMEDIATE STEEL CASING FROM 140 TO 975 FEET BLS
14-INCH DIAMETER (O.D.) CERTALOC PVC FINAL CASING FROM 120 TO 1,004 FEET BLS
19-INCH DIAMETER OPEN HOLE FROM 1,004 TO 1,113 FEET BLS
GRAVEL AND NEAT CEMENT BOREHOLE BACK PLUG FROM 1,113 TO 1,350 FEET BLS
JLA Geosciences, Inc.
LEGEND:
CEMENT GROUT
PVC WELL CASING
NEAT CEMENT (BACK PLUG)
STEEL WELL CASING
OPEN HOLE
GRAVEL (BACK PLUG)
SCALE: AS SHOWN
DATE: 3/31/15
DRAWN BY: ASG
PROJECT NO: 13-022
PROJECT SITE: PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
FIGURE NO: 3
FIGURE TITLE: PW-10 AS BUILT DIAGRAM

2.1.1 36-inch Pit Casing Installation

Construction began with the installation of 36-inch diameter, 0.250-inch wall, steel pit casing to 18.5 feet BLS by the vibration method. Vibrating of the surface casing was performed using a hydraulically powered, American Piledriving Equipment, Inc. (APE) vibratory hammer.

2.1.2 30-inch Surface Casing Installation

A 34.5-inch diameter borehole was drilled using the mud rotary method to obtain lithologic data used to select an appropriate casing setting depth. Upon completion of geophysical logging, the surface casing, consisting of a continuous string of 30-inch diameter, 0.250-inch thick carbon steel pipe with factory-beveled, butt-welded joints, was installed to a total depth of 157 feet BLS at PW-9 and 160 feet BLS at PW-10. Steel centering guides were welded to the outside of the casing at the base of the casing, five (5) feet above the casing base, and at subsequent 40-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 pressure grouted to land surface using API Class B Portland neat cement. The cement was allowed 48 hours to cure before drilling was resumed.

2.1.3 20-inch Intermediate Casing Installation

Following installation and cementing of the surface casing, a 12.25-inch diameter pilot hole was drilled using the mud rotary method. Pilot hole drilling continued until a suitable competent limestone was encountered within the Upper Floridan Aquifer. Upon completion of pilot hole drilling to a depth of 950 feet BLS at PW-9 and 984 feet BLS at PW-10, drilling fluid was circulated to clear the hole of cuttings. Geophysical logging was then conducted by AWE and included dual induction, single point resistivity, SP, caliper, and gamma ray. Based on the analysis of the lithologic samples (drill cuttings) from the pilot hole, drilling penetration, and geophysical logs, JLA recommended a casing setting depth of 936 feet BLS at PW-9 and 975 feet BLS at PW-10 for the intermediate 20-inch diameter steel casing string. At this depth the base of the 20-inch diameter casing at PW-9 and PW-10 is approximately 3 feet and 2 feet into competent, harder limestone.

Following pilot hole drilling and geophysical logging, the borehole was reamed to the recommended casing setting depth using a 28-inch diameter reaming bit assembly. A caliper log of the 28-inch borehole was performed by AWE prior to casing installation to ensure no obstructions will be encountered. The caliper logs are in included Appendix C.

Upon completion of reaming the borehole, a 20-inch diameter, 0.375-inch wall, steel intermediate casing was lowered into the borehole using a fabricated backoff tool to set the casing from 140 feet BLS to 936 feet BLS at PW-9, and 140 feet BLS to 975 feet BLS at PW-10. Steel centering guides were welded to the outside of the casing approximately five feet above the casing base and at subsequent 40-foot intervals.

Cementing of the 20-inch diameter casing was performed in three stages at PW-9 and four stages at PW-10. At both production wells,

Stage 1 consisted of the annular space pressure grouted to land surface using 285 sacks (94 lbs/sack) of API Class B Portland neat. The remaining stages consisted of 6-percent bentonite cement. A total of 889 sacks were used at PW-9 and a total of 1,294 sacks were used at PW-10 during the installation of the 20-inch diameter intermediate casing. A grout summary for the 20-inch diameter casing is provided as Table 2.

Table 2, Grout Summary of 20-inch Intermediate Casing

PW-9								
Grout Stage	**Date**	**Method**	**Max Pressure (psi)**	**% Bentonite Added**	**Barrels Pumped**	**No. Sacks Portland Cement**	**Tagged Depth (feet BLS)**	**Vertical Lift (feet)**
1	8/22/14	Pressure	97	0%	60	285	615	325
2	8/22/14	Tremie	--	6%	87	414	320	295
3	8/23/14	Tremie	--	6%	40	190	0	320
TOTAL SACKS						**889**		

PW-10								
1	12/16/14	Pressure	50	0%	60	285	778	197
2	12/14/14	Tremie	--	0%	84	273	572.75	205.25
3	12/18/14	Tremie	--	0%	88	286	362.75	210
4	12/19/15	Tremie	--	0%	40	190	5	357.75
TOTAL SACKS						**1,294**		

ft BLS – feet below land surface

2.2 Reverse Air Pilot Hole Drilling

Following the completion of grouting the 20-inch steel intermediate casing string, 12.25-inch diameter pilot hole drilling operations resumed using the reverse air drilling method. Reverse air drilling is accomplished by installing an airline supplying compressed air down the center of the drill string to approximately 300 feet. 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 for drilling in the Floridan aquifer production zones because it does not introduce drilling mud to the production zone and allows for flow and water quality testing of the interval with depth.

Before reverse air drilling of the open hole section, the cement plug at the base of the 20-inch casing was drilled out using a nominal 19-inch diameter reaming bit assembly. Drilling continued through the limestone of the UFA to the total depth of the well at 1,350 feet BLS. A JLA hydrogeologist was on site during drilling of the open hole interval to collect lithologic and water quality samples; conduct field water quality analyses; and perform flow tests.

AWE performed geophysical logging of the reverse air 12.25-inch diameter pilot hole which included dual induction, single point resistivity, borehole compensated sonic, SP, temperature, caliper, gamma ray, fluid resistivity, and flow logs in both static (non-flowing) and dynamic (flowing) conditions. Electronic copies of the geophysical logs are included in Appendix C.

2.2.1 Water Quality Testing

During reverse air drilling (PW-9, 936' to 1,363 feet BLS; PW-10, 975 to 1350 feet BLS) in the Floridan aquifer, specific conductance and chloride concentration of the formation water were measured at regular intervals in order to evaluate variability in water quality in the intended production zone with depth. At approximately 10-foot intervals during drilling, specific conductance and chloride concentration of the formation water were measured and recorded. At every drill rod change, approximately 30 feet, additional water quality analyses were conducted on the water from the artesian well head flow.

Water quality analyses of well head flow included temperature, specific conductance, pH, chloride, hydrogen sulfide, and total iron. Chloride analysis was performed using a Hach titrator and silver nitrate titrant. A summary of water quality and flow testing is described in Table 3 and Table 4. Graphs depicting specific conductance and chloride concentration versus depth are included as Figure 4 and Figure 5.

Table 3, PW-9 Reverse Air Drilling Chloride, Specific Conductance vs. Depth

		Water Quality Results		Flow Test Results			
Drilled Depth	Sample From	Chloride (mg/L)	Spec. Conductivity (uS/cm)	Static WL (ft als)	Flowing WL (ft als)	Flow Rate Average (gpm)	Specific Capacity (gpm/ft)
950	BOTTOM	1440	5750				
950	FLOW	1502.5	5460			37.5	
960	BOTTOM	1680	5750				
970	BOTTOM	1475	5640				
980.56	FLOW	1485	5420	10.38	0	27.5	2.6
990	BOTTOM	1327.5	5110				
1000	BOTTOM	1420	5630				
1010	BOTTOM	1392.5	5650				
1012.33	BOTTOM	1427.5	5690				
1012.33	FLOW	1530	5430	15.55	0	39	2.5
1020	BOTTOM	1510	4960				
1030	BOTTOM	1475	5210				
1040	BOTTOM	1557.5	5080				
1043.76	FLOW	1530	5560	26	0.125	90.9	3.5
1050	BOTTOM	1490	5390				
1060	BOTTOM	1597.5	5570				
1070	BOTTOM	1750	5590				
1075.78	BOTTOM	1550	5720				
1075.78	FLOW	1422.5	5280	26.7	0.23	197.75	7.5
1080	BOTTOM	1625	5820				
1090	BOTTOM	1662.5	5640				
1100	BOTTOM	1805	5700				
1107.78	BOTTOM	1662.5	5900				
1107.78	FLOW	1770	5990	28	1	249	9.2
1110	BOTTOM	1845	5720				
1120	BOTTOM	1737.5	5840				
1130	BOTTOM	1837.5	5850				
1139.78	BOTTOM	1795	5900				
1139.78	FLOW	1745	5900	35.25	1.79	333	10.0
1150	BOTTOM	1887.5	6080				
1160	BOTTOM	1702.5	6000				
1170	BOTTOM	1677.5	6040				
1171.72	BOTTOM	1680	6020				
1171.72	FLOW	1667.5	5930	30.95	1.87	350	12.0
1180	BOTTOM	1717.5	6220				
1190	BOTTOM	1660	6040				
1200	BOTTOM	1670	5840				
1203.72	BOTTOM	1600	5830				
1203.72	FLOW	1712.5	6100	31.05	2.57	470	16.5
1210	BOTTOM	1555	5520				
1220	BOTTOM	1467.5	5380				
1230	BOTTOM	1680	5830				
1235.62	BOTTOM	1590	5820				
1235.62	FLOW	1802.5	6150	24.1	3	605	28.7
1240	BOTTOM	1647	5380				
1250	BOTTOM	1475	5260				
1260	BOTTOM	1990	6440				
1267.44	BOTTOM	1815	6330				
1267.44	FLOW	1782.5	5980	25.2	4.2	736	35.0
1270	BOTTOM	1742.5	6090				
1280	BOTTOM	1945	6320				
1290	BOTTOM	1955	6770				
1299.37	BOTTOM	1880	6980				
1299.37	FLOW	1857.5	6180	28.22	5.36	855	37.4
1310	BOTTOM	1946.25	6500				
1320	BOTTOM	2020	6620				
1330	BOTTOM	1852.5	6210				
1331.18	FLOW	1741.25	6130	33.95	5.5	915	32.2
1340	BOTTOM	1332.5	4804				
1350	BOTTOM	1600	5260				
1353	FLOW	1681	5830	34.2	6.06	970	34.5
1360	BOTTOM	1385	5030				
1363.18	BOTTOM	1460	5320				
1363.18	FLOW	1677.5	5780	34.2	6.12	945	33.7

Not Representative - Added makeup water during drilling
Flow test water quality not representative- added makeup water during drilling

ft als – feet above land surface
gpm – gallons per minute

mg/l – milligrams per liter
µS/cm – microsiemens Per centimeter

Table 4, PW-10 Reverse Air Drilling Chloride, Specific Conductance vs. Depth

		Water Quality Results		Flow Test Results			
Drilled Depth	Sample From	Chloride (mg/L)	Spec. Conductivity (uS/cm)	Static WL (ft als)	Flowing WL (ft als)	Flow Rate Average (gpm)	Specific Capacity (gpm/ft)
1003	FLOW	1950	6730	40	23	300	17.6
1010	BOTTOM	2230	6500				
1014.82	BOTTOM	2325	7040				
1014.82	FLOW	2125	6680	39.7	5.1	1775	51.3
1020	BOTTOM	1970	6180				
1030	BOTTOM	2085	6340				
1040	BOTTOM	2170	6450				
1046.82	BOTTOM	1930	6520				
1046.82	FLOW	2055	6620	40	8.3	2765	87.2
1050	BOTTOM	2090	6420				
1060	BOTTOM	2040	6610				
1070	BOTTOM	2130	6590				
1078.72	BOTTOM	2275	6720				
1078.72	FLOW	2270	7070	39.4	12.8	2819	110.5
1080	BOTTOM	1970	7030				
1090	BOTTOM	2270	7230				
1100	BOTTOM	1730	7030				
1109.92	BOTTOM	2380	7100				
1109.92	FLOW	2270	7270	37.65	12.83	2866	115.5
1120	BOTTOM	1730	8110				
1130	BOTTOM	1780	7980				
1140	BOTTOM	1750	8270				
1142.16	BOTTOM	1840	7990				
1142.16	FLOW	1840	7400	38.2	13.4	3330	134.3
1150	BOTTOM	1810	7600				
1160	BOTTOM	2160	7770				
1170	BOTTOM	2120	7580				
1174.76	BOTTOM	2180	7560				
1174.76	FLOW	2640	7650	37.6	15.1	3061	136.0
1180	BOTTOM	2120	7640				
1190	BOTTOM	2210	7980				
1194	BOTTOM	2420	8000				
1200	BOTTOM	2260	8140				
1206.65	BOTTOM	2250	7970				
1206.65	FLOW	2410	7660	37.4	14.9	3292	146.3
1210	BOTTOM	2470	7700				
1220	BOTTOM	2480	7560				
1230	BOTTOM	2570	7620				
1238.59	BOTTOM	2470	7920				
1238.59	FLOW	2231	7680	37.5	20.2	3644	210.6
1240	BOTTOM	2550	7160				
1250	BOTTOM	2440	8220				
1260	BOTTOM	2560	8240				
1270.79	BOTTOM	2430	8280				
1270.79	FLOW	2712	8000	37	22.6	3747	260.2
1280	BOTTOM	2490	7940				
1290	BOTTOM	2290	7560				
1300	BOTTOM	2880	9080				
1302.21	BOTTOM	3190	9330				
1302.21	FLOW	2735	8000	37	23	3785	270.4
1310	BOTTOM	2620	8950				
1320	BOTTOM	2710	8880				
1330	BOTTOM	2700	8740				
1334.24	BOTTOM	2640	8930				
1334.24	FLOW	2520	8270	36.9	23	3775	271.6
1340	BOTTOM	2830	9110				
1345	BOTTOM	3080	10008				
1350	BOTTOM	3460	10500				
1350	FLOW	2845	8350	36.7	21.7	3896	259.7

ft als – feet above land surface
gpm – gallons per minute
mg/l – milligrams per liter
µS/cm – microsiemens per centimeter

Figure 4, PW-9 Reverse Air Drilling Chloride, Specific Conductance vs Depth

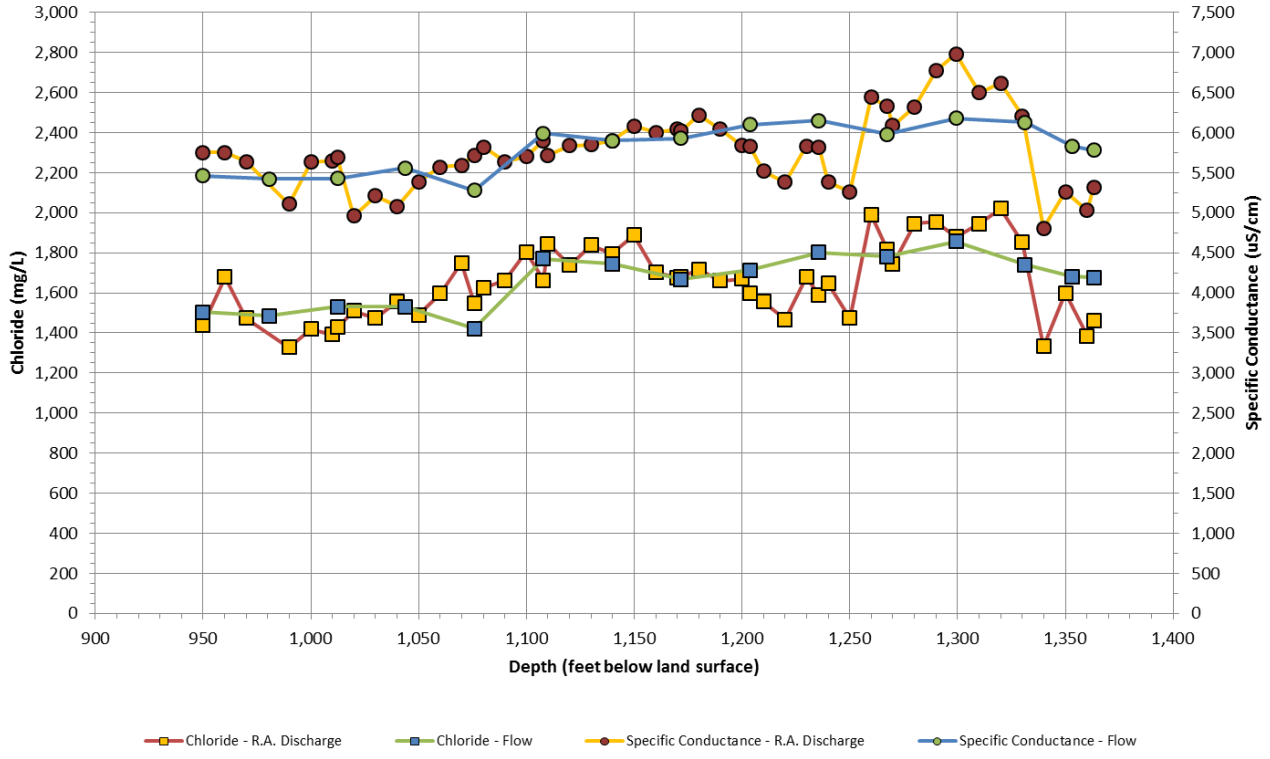
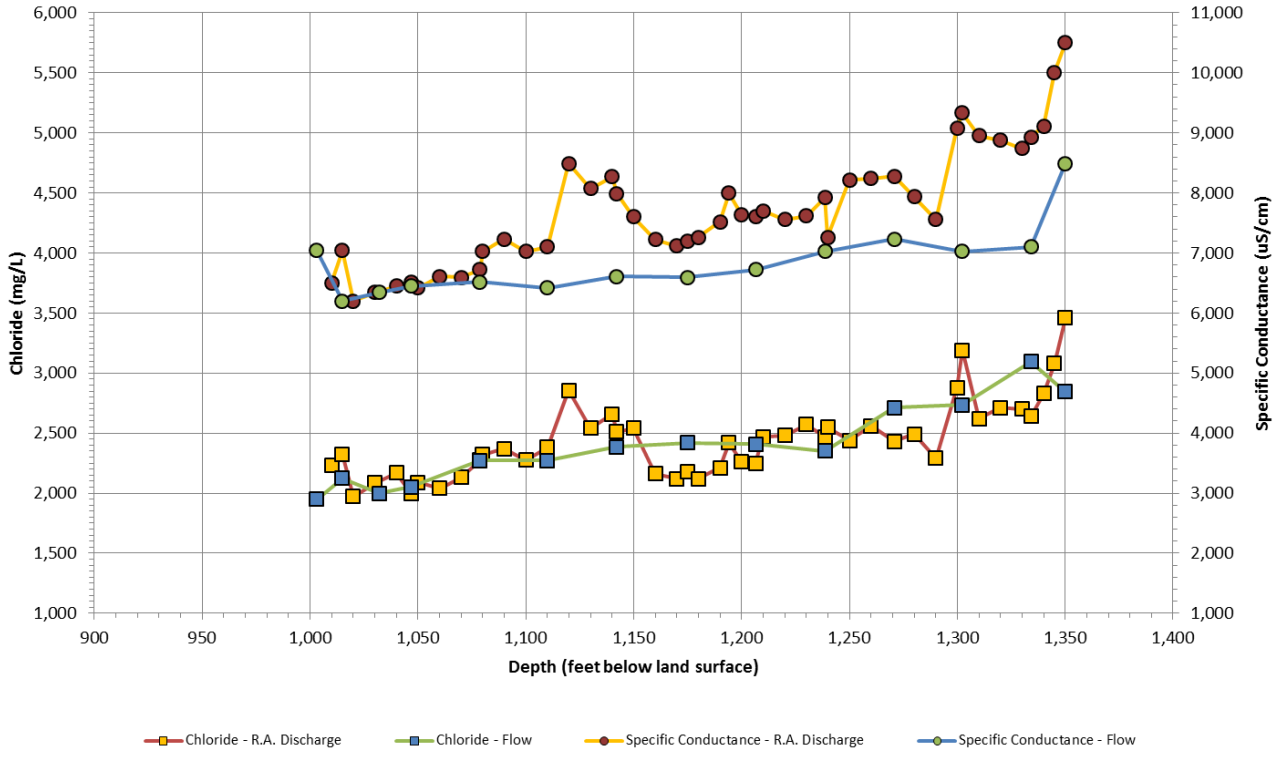


Figure 5, PW-10 Reverse Air Drilling Chloride, Specific Conductance vs Depth



2.2.2 Flow Testing

During reverse air drilling through the UFA, flow tests were performed to evaluate the specific capacity of the borehole with depth. The tests were performed after every drill rod change (approximately every 30 feet). To perform the test, a construction header was fitted to the flanged 30-inch diameter surface casing and sealed to the drilling tools with a rubber stripping header. The construction well head effectively sealed the well so that drilling could be accomplished under artesian conditions. The construction header was equipped with a butterfly valved flow port; a 2-inch port for adding "kill" water to prevent the well from flowing; and a 0.75-inch manometer fitting. A manometer tube was fitted to the construction header to measure the potentiometric (static) and flowing water levels.

During low flow conditions, the flow rate was measured using 6-inch diameter and 10-inch diameter orifice weirs on the end of the 12-inch diameter discharge pipe. For flows above 1,800 gpm, an in-line flow meter was installed in the discharge pipe to measure flow rates. Formation discharge water was discharged directly to the adjacent SFCD L2-2 Canal. In addition to the orifice weir and in-line flow meter, physical (volumetric) measurements were conducted to verify flow rates. Water levels in the well were measured during the flow test and compared to static, no-flow conditions measured at the beginning of each day and after each test. Measurement of flow rate (Q) and drawdown in the well (dh), allowed for the specific capacity (Cs) of the well to be approximated using the formula Cs=Q/dh (Freeze and Cherry, 1979).

Table 3 and Table 4 provide a summary of water quality data and calculated values for specific capacity from flow tests conducted during reverse air drilling. Figure 6 and Figure 7 depict specific capacity encountered with depth during reverse air drilling.

Figure 6, PW-9 Reverse Air Drilling Specific Capacity vs. Depth

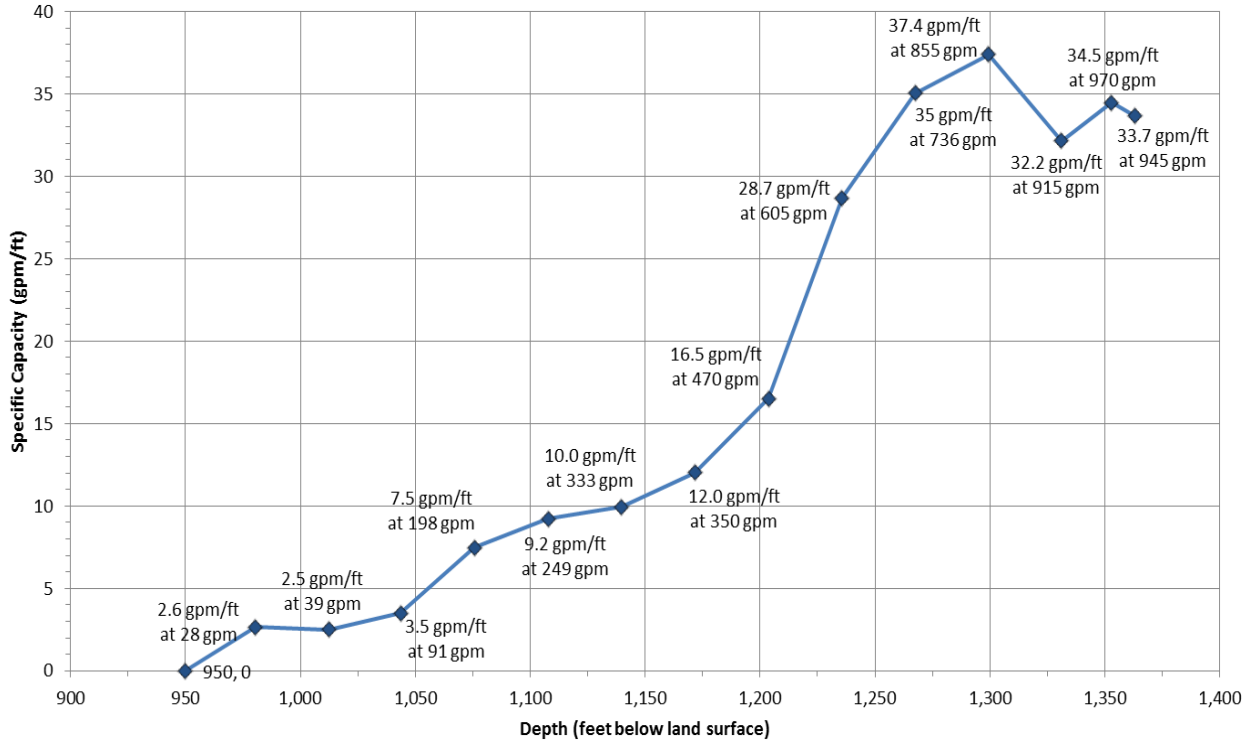
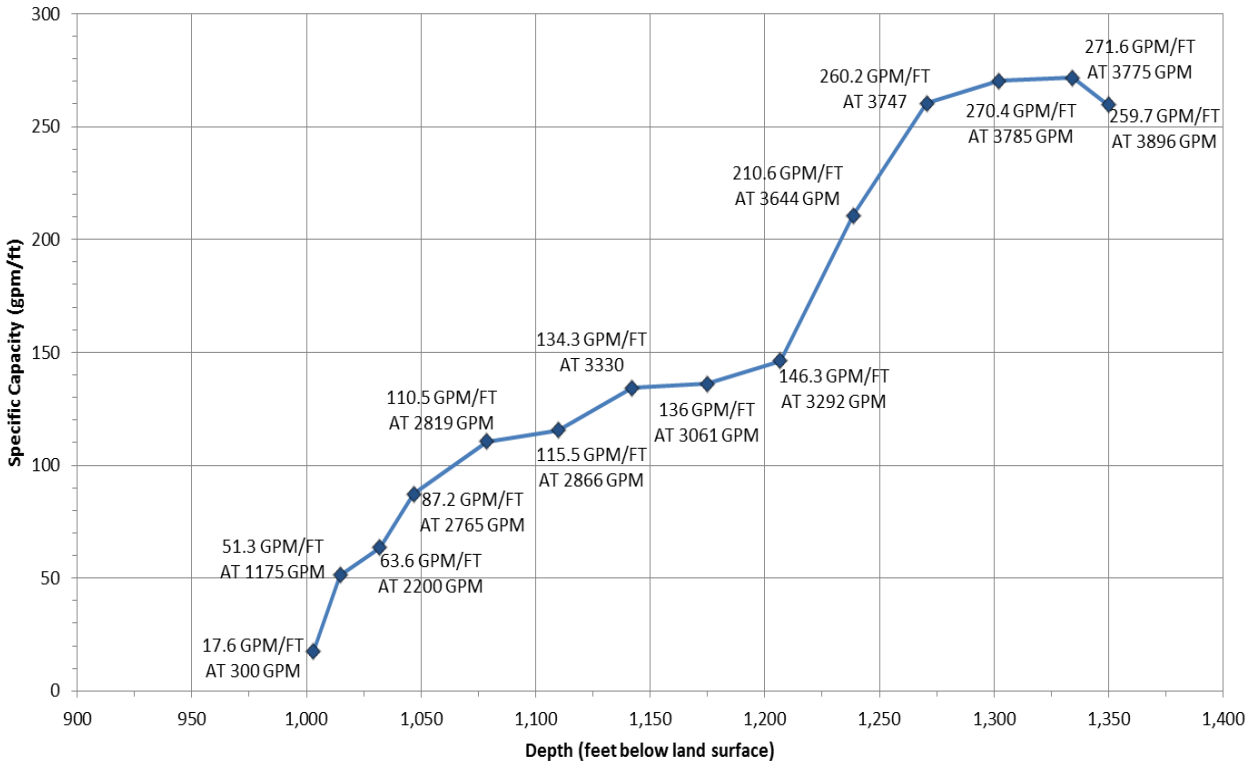


Figure 7, PW-10 Reverse Air Drilling Specific Capacity vs. Depth



2.2.3 17.4-inch and 14-inch Final Casing Installation

After completion of pilot hole reverse air drilling and testing to the total depth, a suite of geophysical logs were performed by AWE which included: Dual induction, single point resistivity, SP, caliper, borehole compensated sonic, and gamma ray. The following geophysical logs were performed under both static (non-flowing) and dynamic (flowing) conditions: temperature, fluid resistivity, and flow log.

The primary objective in selecting the 17.4-inch and 14-inch diameter SDR17 Certalok casing setting depth was to enable the well, when completed, to efficiently produce the specified quantity of water at the design withdrawal rate while meeting appropriate water quality for the PBCWUD WTP 11.

Based on lithologic and drilling penetration observations, the first occurrence of significantly firmer and better consolidated limestone began at approximately 1,040 feet BLS at PW-9 and 1,000 feet BLS at PW-10. At PW-9, flow testing and geophysical logging indicate a flow of approximately 90 gpm at 3.5 gpm/ft of drawdown specific capacity at a depth of 1,043 feet BLS and 197 gpm at 7.5 gpm/ft of drawdown specific capacity at a depth of 1,075 feet BLS. At PW-10, flow testing and geophysical logging indicate a flow of approximately 300 gpm at 17.6 gpm/ft of drawdown specific capacity at a depth of 1,003 feet BLS and 1,775 gpm at 51.3 gpm/ft of drawdown specific capacity at a depth of 1,014 feet BLS. JLA recommended setting of the base of the 14-inch diameter SDR17 Certalok casing to a depth of 1,052 feet BLS at PW-9 and 1,004 feet BLS at PW-10. Setting the final 14-inch production casing at the depth of 1,052 feet BLS and 1,004 ft BLS at PW-9 and PW-10, places the base of casing approximately 12 feet and 4 feet into relatively harder, competent formation, while still capturing potential upper flow zones for the final production interval.

2.2.3.1 Borehole Back Plug and Production Interval Backfill

Well design of production well PW-9 and PW-10 included back plugging the 12.25-inch pilot hole to 1,310 feet BLS due to the gradual decrease in water quality observed in the nearby existing production wells at similar depths. Evaluation of both water quality and specific capacity in well PW-9 indicated back plugging of the borehole, would likely result in a loss of specific capacity without significantly changing near term water quality. JLA recommended no back plugging of the 12.25-inch diameter pilot hole and reaming of the 19-inch borehole to the total depth of 1,363 feet BLS at PW-9.

Evaluation of pilot hole water quality and specific capacity data of Production Well PW-10 indicated that backplugging of the borehole may help enable targeting of better water quality and lower chloride concentrations. Based on flow data and geophysical logging, a depth of 1,113 feet BLS was recommended for well total depth. Back plugging of the pilot hole was completed in multiple states of alternating lists of gravel and cement, as outlined in Table 5.

Following completion of geophysical logging of the 12.25-inch diameter pilot hole, PW-9 borehole was reamed to 19-inch diameter to a total depth of 1,363 feet BLS. A caliper log of the 19-inch borehole was performed by AWE prior to final casing installation. The borehole at PW-10 continuously dredged during the pilot hole drilling, therefore reaming of the borehole was not required. A caliper log of the borehole, performed on February 3, 2015, measured borehole diameter in exceedance of 40-inches at several depths. Copies of the reamed borehole caliper logs are included in Appendix C.

Table 5, PW-10 Back Plug Gravel and Grout Summary

Lift Stage	Date	Method	% Bentonite Added	Barrels	No. Sacks Portland Cement	Pea Gravel (YDS^3)	Pre-Lift Tagged Depth (feet BLS)	Post-Lift Tagged Depth (feet BLS)	Vertical Lift (feet)
1	2/11/2015	GROUT	0%	52	**247**		1312	1310	2
2	2/11/2015	GROUT	0%	82	**390**		1310	1309.5	0.5
3	2/12/2015	GROUT	0%	43	**205**		1309.5	1288	21.5
4	2/12/2015	GRAVEL		76.5		**15.9**	1288	1284	4
5	2/13/2015	GRAVEL		28		**5.8**	1284	--	
6	2/16/2015	GRAVEL		23		**4.78**	--	1246	38
7	2/23/2015	GROUT	6%	51	**166**		1246	1214.9	31.15
8	2/23/2015	GROUT	6%	51.4	**167**		1214.9	1191	23.9
9	2/24/2015	GROUT	6%	45	**146**		1191	1178	13
10	2/27/2015	GRAVEL		71		**14.8**	1178	1153	25
11	3/2/2015	GROUT	0%	40	**130**		1153	1142	11
12	3/3/2015	GROUT	6%	13	**42**		1142	1126	16
13	3/3/2015	GRAVEL		17		**3.5**	1126	1125.6	1.6
14	3/4/2015	GROUT	6%	15	**49**		1125.6	1124	0.4
15	3/5/2015	GRAVEL		13		**2.7**	1125.6	1120	5.6
16	3/5/2015	GROUT	0%	14	**67**		1120	1113	7
17	3/5/2015	GROUT	0%	14	**67**		1113	1113	0
18	3/6/2015	GROUT	0%	7	**33**		1113	1113	0
TOTAL					**1708**	**47.5**			

Prior to casing installation, AWE backfilled the nominal 19-inch diameter open borehole with chlorine treated 0.375-inch limestone 'pea' gravel via the tremie method, from the total depth of the well to the suggested casing setting depth to facilitate cementing of the casing in place. Production well PW-9 was backfilled from 1,363 feet BLS to 1,052 feet BLS with 46 cubic yards of 'pea' gravel. PW-10 production interval was backfilled with 48 cubic yards of 'pea' gravel from 1,350 feet BLS to 1,004 feet BLS.

2.2.3.2 Final Casing Installation

The final casing string consisted of 17.4-inch and 14-inch outside diameter CertainTeed Certalok, SDR-17 lock coupling PVC casing. The casing string consisted of 120 feet of 20-foot sections of 17.4-inch PVC casing locked together using CertainTeed Certalok couplings and spline. A 14-inch by 17.4-inch adapter was installed to connect 20-foot sections of 14-inch PVC casing locked together using CertainTeed Certalok couplings and spline to a total depth of 1,052 feet BLS at PW-9 and to 1,004 feet BLS at PW-10.

2.2.3.3 Grouting

Cementing of the final PVC casing string in place was performed in stages to minimize grouting stress caused by the heat of hydration and potential differential pressures. The initial grouting stage was performed by the “tremie method” which consisted of pumping API Class B Portland cement under pressure through the tremie pipe to fill the annular space between the casing and borehole. After each lift of cement had hardened, the cement fill depth was measured. Grouting continued until the annular space was completely filled to surface.

The initial four (PW-9) and three (PW-10) grouting stages (pressure grouting stage and first tremie stage) consisted of neat cement in order to obtain maximum strength around the base of the casing. The remaining grouting stages used a grout slurry mixture consisting of API Class B Portland cement mixed with 6-percent bentonite clay. The addition of bentonite serves to reduce the heat of hydration during the

cooling process. Grouting of the final casing string at PW-9 was accomplished in 8 cementing stages and utilized 940 sacks (94 lbs/sack) of cement. Grouting of the final casing string at PW-10 was accomplished in 7 cementing stages and utilized 905 sacks (94 lbs/sack) of cement. Table 6 and Table 7 provide the cementing details of the 17.4-inch and 14-inch PVC final casing string at PW-9 and PW-10.

2.2.3.4 Plumbness and Alignment Test

Prior to the completion of cementing of the upper 190 feet at PW-9 and the upper 370 feet at PW-10, AWE performed a plumbness and alignment test (P&A) of the final 17.4-inch diameter casing. P&A testing was conducted to ensure that the inner casing plumbness and alignment complied with AWWA requirements. The P&A test setup consisted of a 1.8-foot tall cylindrical spool/plumb suspended and centered from an apex located 10 feet above the 17.4-inch PVC final casing top. As the plumb was lowered into the inner casing, measurements of its deviation from the top of casing center were recorded with depth. Results of the P&A tests indicate the PVC casing is compliant with applicable AWWA well construction standards. The P&A test results are included in Appendix D.

In addition to the P&A test, a “dummy” test was also performed on the final 17.4-inch diameter casing. The “dummy” test consisted of lowering a “dummy” pipe, 22 foot length with a diameter of 11.5-inches into the final casing. This procedure ensured that the well was plumb and aligned sufficiently to allow for passing and installation of permanent pumps. The dummy pipe passed with no impediments to approximately 120 feet BLS at both wells.

2.3 Well Development and Testing

2.3.1 Borehole Jetting Development

The borehole jetting phase of development was designed to deliver a high velocity of water directly into the borehole with the use of a rotating jetting tool. Following construction completion of the well, a jetting tool consisting of four, 1-inch diameter, opposing jets spaced 90 degrees apart and one additional jet facing directly downward, was lowered to the open hole interval of the well. Using the mud system pumps and drilling tools, approximately 500 gpm of clean water was delivered through the five jet development tool, imparting an exit velocity of approximately 45 feet per second. Formation water is discharged from the well during the jetting process to remove jet-dislodged sediment from the well bore. Formation discharge water generated during jetting was pumped to the adjacent canal. This process was continued as the jetting tool was slowly rotated and passed up and down the borehole from the base of the 14-inch diameter casing to the total depth of 1,363 feet BLS at PW-9 and 1,113 feet BLS at PW-10. The discharge water was monitored for turbidity throughout jetting. Once turbidity had stabilized to relatively low levels, jetting was discontinued. A total of 24 hours of jetting was performed on each production well.

2.3.2 Acidization

Acid treatment was included in the specification to maximize the specific capacity of each well prior to placing the wells into service. The treatment procedure called for 3,500 gallons of 32 percent hydrochloric acid 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 and the energy consumption. Additionally, higher capacity wells may reduce the need for future rehabilitation and/or the number of future wells that will ultimately be needed.

Production well PW-9 was acidized to maximize flow and increase the specific capacity. PW-9 was acidized on October 31, 2014 with one stage of 3,500 gallons. Well PW-10 had a sufficiently high specific capacity and did not require acid treatment. The detailed procedure and results are summarized below.

The acidization procedure for well PW-9 consisted of installing 1,350 feet of drop tubing into the well and pumping 3,500 gallons of 32%, (22° Baume) hydrochloric acid into the open interval at a rate of approximately 120 to 140 gpm, followed by 3,000 gallons of water to displace the tubing. While pumping the acid, water was simultaneously pumped into the 200 feet of installed water injection line at a rate of 5 gpm. Once 500 gallons of acid was pumped, backside flow was ceased and the wellhead was flowed at approximately 100 to 120 gpm. Simultaneous pumping of acid and flowing the wellhead allowed the acid to target the open borehole interval by rising from the terminus to the base of casing. Once the volume of the well was flowed the wellhead was shut in. During and after pumping, the wellhead was sealed and fitted with a pressure gage 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 but it was not needed. The pressure at the wellhead rose to a maximum of 44 psi. After completing the procedure, AWE continued to pump water into the well to reduce the wellhead pressure. The well remained shut in for approximately 18 hours until development of the well began.

To determine the effectiveness of the acid treatment at PW-9 a comparison is made between the flow rate and specific capacity at the same flow rate before and after acid treatment. Prior to acid treatment the Artesian flow rate was 930 gpm. The Artesian flow rate following acid treatment increased to 1040 gpm, yielding an improvement of approximately 12%.

Specific capacity, prior to acid treatment, was 30.4 gpm/ft at 950 gpm. The specific capacity following acid treatment can be determined from the step drawdown test results. At 965 gpm the specific capacity is extrapolated to be approximately 33.2 gpm/ft, yielding an improvement of about 8%. The results of the effectiveness of the acid treatment are summarized below:

PW-9 Acid Treatment Effectiveness Summary

Performance	Pre-Acid		Post-Acid		Step Drawdown Test
	9/5/14*	9/6/14	11/3/14	11/4/14	11/16/14
Static Water Level (feet ALS)	34.20	37.57	38.40	40.20	40.16
Flowing Water Level (feet ALS)	6.12	6.28	4.95	4.60	11.08
Drawdown (feet)	28.08	31.29	33.45	35.60	29.08
Flow Rate (gpm)	945	950	995	1040	965
Specific Capacity (gpm/ft)	33.6	30.4	29.7	29.2	33.2

ft ALS- feet above land surface
*9/5/14- Reverse Air Drilling results

2.3.3 Pump Development

The pump development protocol called for steady pumping at the maximum rate of 2,400 gpm until the discharge water was visibly free of solids and turbidity. An 8-inch diameter pump was installed to 100 feet BLS. Following the steady flow period, the well was pumped intermittently with surge and rest periods. Development progress was measured by performing Rossum sand testing and silt density index (SDI) testing of the raw water. Additionally, the specific capacity of the well was measured periodically during development to evaluate progress by improvement in well performance. Development was considered complete when Rossum sand testing results were consistently at or below 0.1 part per million (ppm) and SDI values were consistently at or below 1 at the design flow rate of 900 gpm. A total of 40 hours of pump development was performed on each production well.

2.3.4 Step Drawdown Testing

Following well development, a step drawdown test (SDD) was performed on each production well using the same pump and discharge setup used for the development. The step test was completed to assess well yield, anticipated drawdown and measure specific capacity values at increasing pump rates.

Five (5) 120-minute duration steps were pumped at approximately 600 gpm, 900 gpm, 1,200 gpm, 1,500 gpm, and 1,700 gpm. At PW-10, step 5 was pumped at approximately 1,700 gpm for 80 minutes and an additional step (6) was added lasting 40 minutes at approximately 2,400 gpm. 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 elevated manometer tube and verified with an electronic water level data logger. Wellhead pressure (psi) was measured in the well with the electronic water level data logger at 10-second intervals to calculated pumping water levels. Water levels were verified manually at each pumping rate using the elevated manometer tube until drawdown fell below the top of casing; therefore an electronic water level tape was used. Manual water levels were collected at 1-minute, 5-minute, and 10-minute intervals.

Field water quality samples were collected every thirty minutes to measure temperature, specific conductance, TDS, salinity, chloride, turbidity, pH, dissolved oxygen, hydrogen sulfide, total iron, SDIs, and sand concentration.

Water quality and performance results of the step drawdown test for PW-9 and PW-10 are provided below and in Table 8 and Table 9, respectively. A water level chart depicting water levels versus pumping rates is provided below and as Figure 8 and Figure 9. Erroneous data points due to adjustment of the flow rates at the beginning of each step were removed from the water level chart. This adjustment took place in the first 5 minutes of each step and is not relevant to analysis of the step drawdown test. However, for reference, all data points from the step drawdown test are included in Appendix E. A summary of specific capacity with corresponding pumping rates is included as Figure 10 and Figure 11.

During the step drawdown test, laboratory sampling of the well was performed by AWE for primary and secondary drinking water standards in accordance with the project specifications. 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: sodium (PW-9: 930 mg/L; PW-10: 1,690 mg/L), Bromate (PW-9: 50 ug/L), chloride (PW-9: 1,580 mg/L; PW-10: 2,710), sulfate (PW-9: 488 mg/L; PW-10: 558 mg/L), threshold odor number (PW-9: 67 T.O.N; PW-10: 100 T.O.N), total dissolved solids (PW-9: 3,210 mg/L; PW-10: 5,660 mg/L), gross alpha (PW-10: 60.3±5.90

pCi/L) and radium 226 (PW-9: 7.23±1.68 pCiL; PW-10: 40.5±4.35 pCiL). The results of this testing are presented in Table 10 and in Appendix F.

Table 8, PW-9 Step Drawdown Summary

Performed on 11/19/2014	Step 1 520 gpm		Step 2 965 gpm		Step 3 1,200 gpm		Step 4 1,505 gpm		Step 5 1,675 gpm	
Drawdown Data	*Hour 1*	*Hour 2*	*Hour 1*	*Hour 2*	*Hour 1*	*Hour 2*	*Hour 1*	*Hour 2*	*Hour 1*	*Hour 2*
Cumulative Pumping Duration (min)	60	120	180	240	300	360	420	490	540	600
Static Water Level (ft als)	+40.16		+40.16		+40.16		+40.16		+40.16	
Pumping Water Level (ft als/BLS)	+24.83		+11.08		+3.83		-6.55		-12.28	
Max Drawdown (ft)	15.33		29.08		36.33		46.71		52.44	
Specific Capacity (gpm/ft)	33.9		33.2		33.0		32.2		31.9	
Water Quality Data										
Temperature (deg. C)	26.7	26.7	26.6	26.6	26.2	26.1	26.2	26.1	26.5	26.5
Specific Conductance (µmhos/cm)	5630	5300	5290	5520	5570	5550	5670	5670	5850	5850
Total Dissolved Solids (ppt)	3.65	3.44	3.43	3.58	3.62	3.60	3.68	3.68	3.80	3.80
pH	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Salinity (ppt)	2.9	2.8	2.8	3.0	3.0	3.0	3.1	3.1	3.2	3.2
Dissolved Oxygen (mg/L)	0.13	0.08	0.04	0.03	0.03	0.03	0.04	0.04	0.03	0.03
Hydrogen Sulfide (ppm)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.0	2.5
Total Iron (ppm)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Soluble Iron (ppm)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Turbidity (NTU)	0.63	0.97	1.47	1.70	0.07	0.10	0.18	0.28	0.18	0.20
Chloride (mg/L)	1,508		1,565		1,560		1,585		1,585	
SDI#1	--	0.4	--	0.4	--	0.5	--	0.4	--	0.7
SDI#2	0.3	0.3	0.2	0.2	0.4	0.3	0.5	0.4	0.6	0.3
Sand Content (ppm)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

gpm - gallons per minute
als - above land surface
gpm/ft - gallons per minute per foot of drawdown
µmhos/cm - micromhos per cm
ppt - parts per thousand
mg/L - milligrams per liter
ppm - parts per million
ntu - nephelometric turbidity units

Performed on 5/6/2015	Step 1 580 gpm		Step 2 970 gpm		Step 3 1,220 gpm		Step 4 1,385 gpm		Step 5 1,684 gpm		Step 6 2,485 gpm	
Drawdown Data	*Hour1*	*Hour2*	*Hour1*	*Hour2*	*Hour1*	*Hour2*	*Hour1*	*Hour2*	*Hour1*	*Hour2*	*Hour1*	*Hour2*
Cumulative Pumping Duration (min)	60	120	180	240	300	360	420	480	540	560	600	--
Static Water Level (ft als)	+37.20		+37.20		+37.20		+37.20		+37.20		+37.20	
Pumping Water Level (ft als)	+36.50		+35.95		+34.80		+34.20		+32.20		+26.85	
Max Drawdown (ft)	0.70		2.25		2.40		3.00		5.00		10.35	
Specific Capacity (gpm/ft)	828.6		776.0		508.3		461.6		336.8		240.1	
Water Quality Data												
Temperature (deg. C)	26.6	26.6	26.5	26.6	26.7	26.6	26.6	26.9	26.6	26.9	26.7	26.8
Specific Conductance (µmhos /cm)	10040	10020	10230	10800	10200	9980	10130	10150	10420	10150	10380	10360
Total Dissolved Solids (ppt)	8.43	8.70	8.43	8.56	8.20	8.49	8.33	8.55	8.28	8.40	8.71	8.65
pH	6.73	6.67	6.48	6.40	7.00	6.57	6.97	6.96	7.00	6.82	6.62	6.85
Salinity (ppt)	5.4	5.6	5.8	5.7	5.7	5.6	5.7	5.7	5.9	5.7	5.8	5.8
Dissolved Oxygen (mg/L)	0.17	0.06	0.04	0.03	0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00
Hydrogen Sulfide (ppm)	6.0	6.5	7.0	6.0	7.0	7.0	7.0	7.0	8.0	--	9.0	9.0
Total Iron (ppm)	0.1	0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	--	<0.1	<0.1
Soluble Iron (ppm)	0.1	0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	--	<0.1	<0.1
Turbidity (NTU)	0.14	0.15	0.01	0.07	0.04	0.01	0.01	0.01	0.02	0.01	0.02	0.01
Chloride (mg/L)	2,690		2,850		2,880		2,890		2,950		2,950	
SDI#1	2.3	2.3	2.5		2.4	2.4	2.4	2.4	2.3	2.4	2.2	
SDI#2	2.1	2.1	2.4		2.4	2.4	2.4	2.5	2.4	2.5	2.3	
Sand Content (ppm)	<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	

Table 9, PW-10 Step Drawdown Summary

gpm - gallons per minute
als - above land surface
gpm/ft - gallons per minute per foot of drawdown
µmhos/cm - micromhos per cm
ppt - parts per thousand
mg/L - milligrams per liter
ppm - parts per million
ntu - nephelometric turbidity units

Figure 8, Step Drawdown Test, Water Level and Specific Conductivity

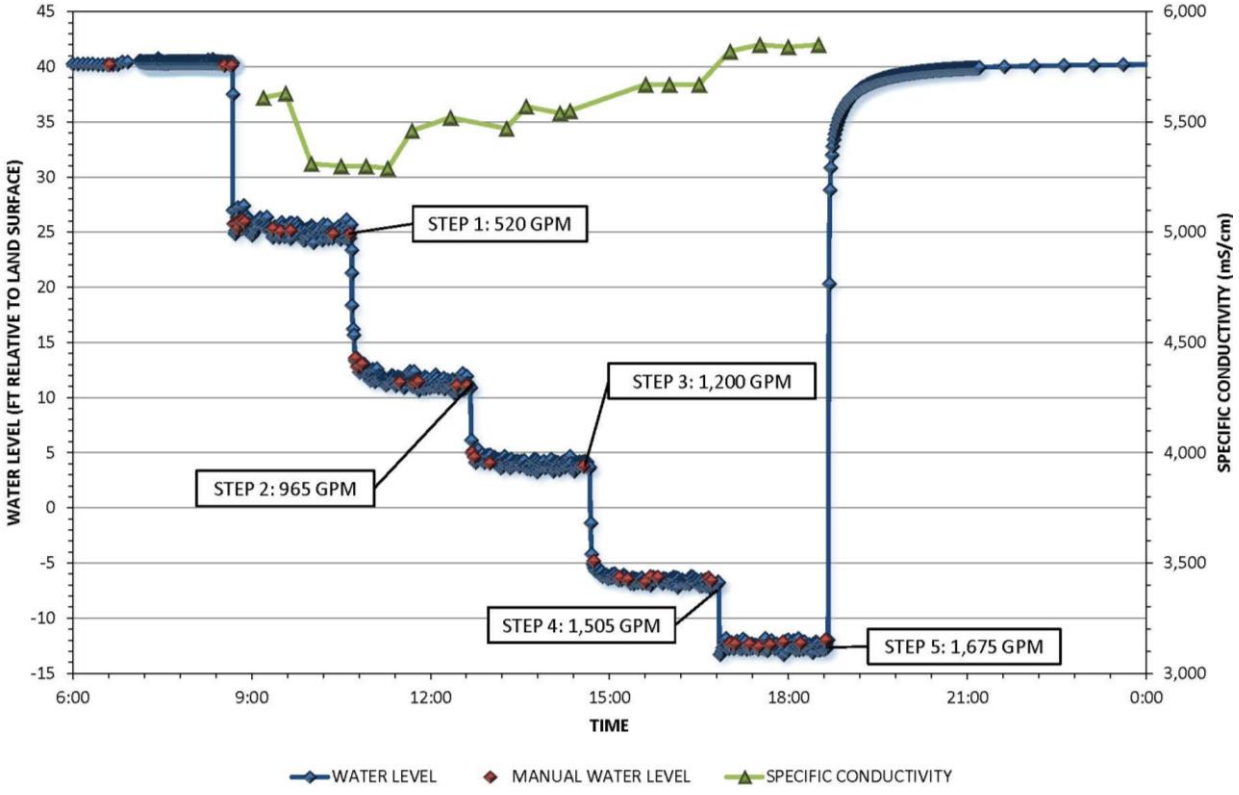


Figure 9, Step Drawdown Test, Water Level and Specific Conductivity

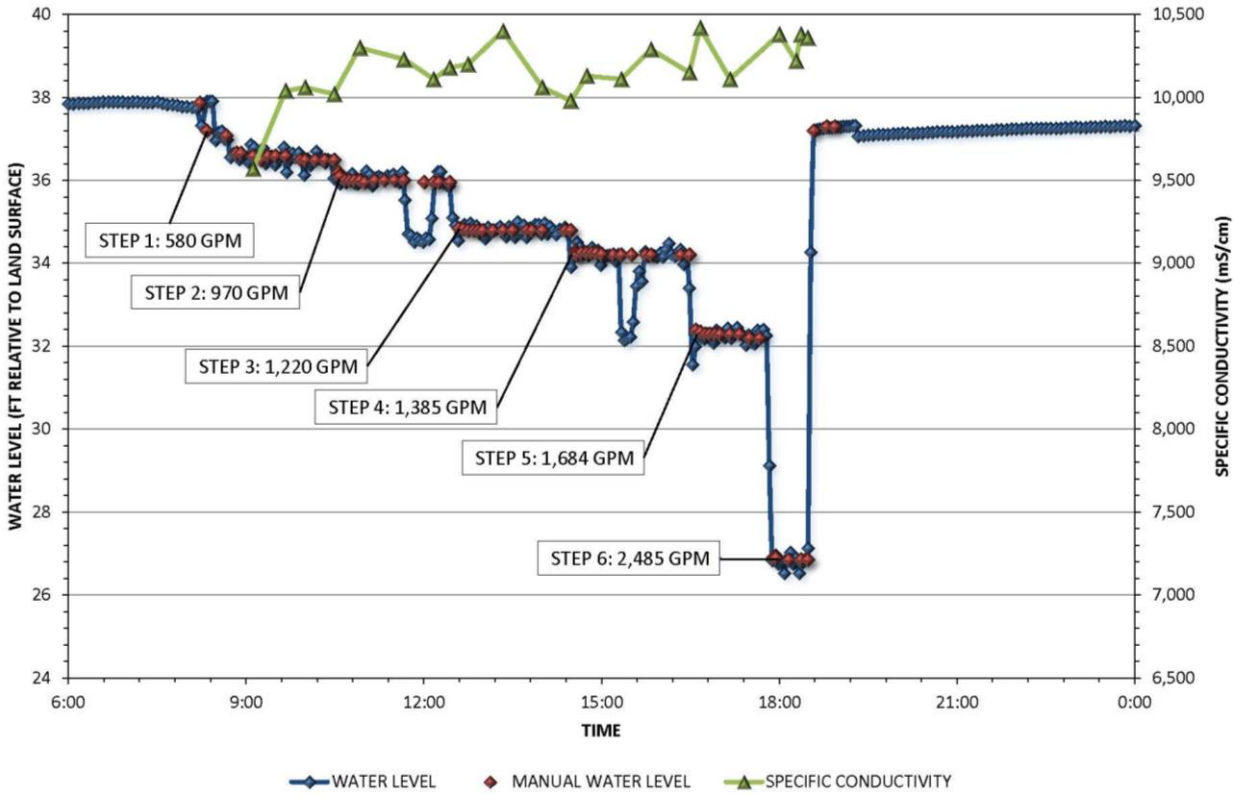


Figure 10, PW-9 Step Drawdown Test, Specific Capacity vs. Pumping Rate

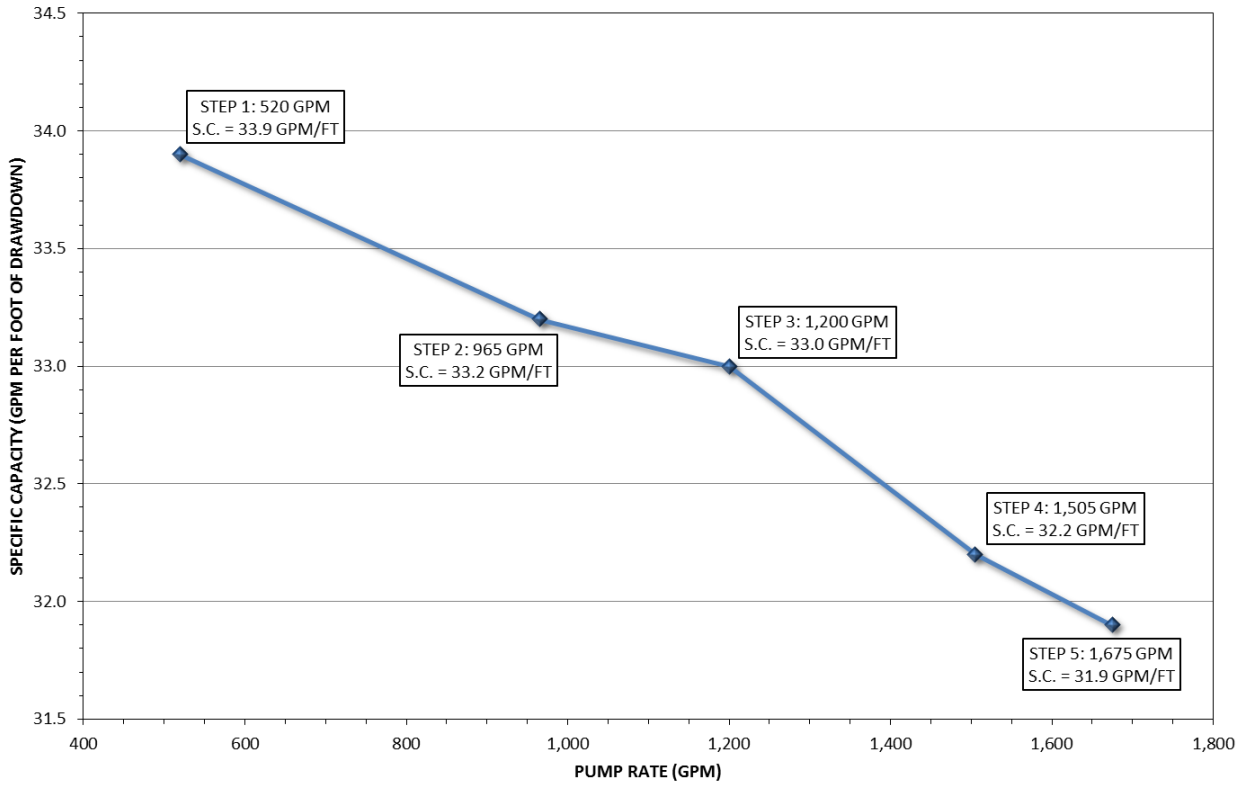
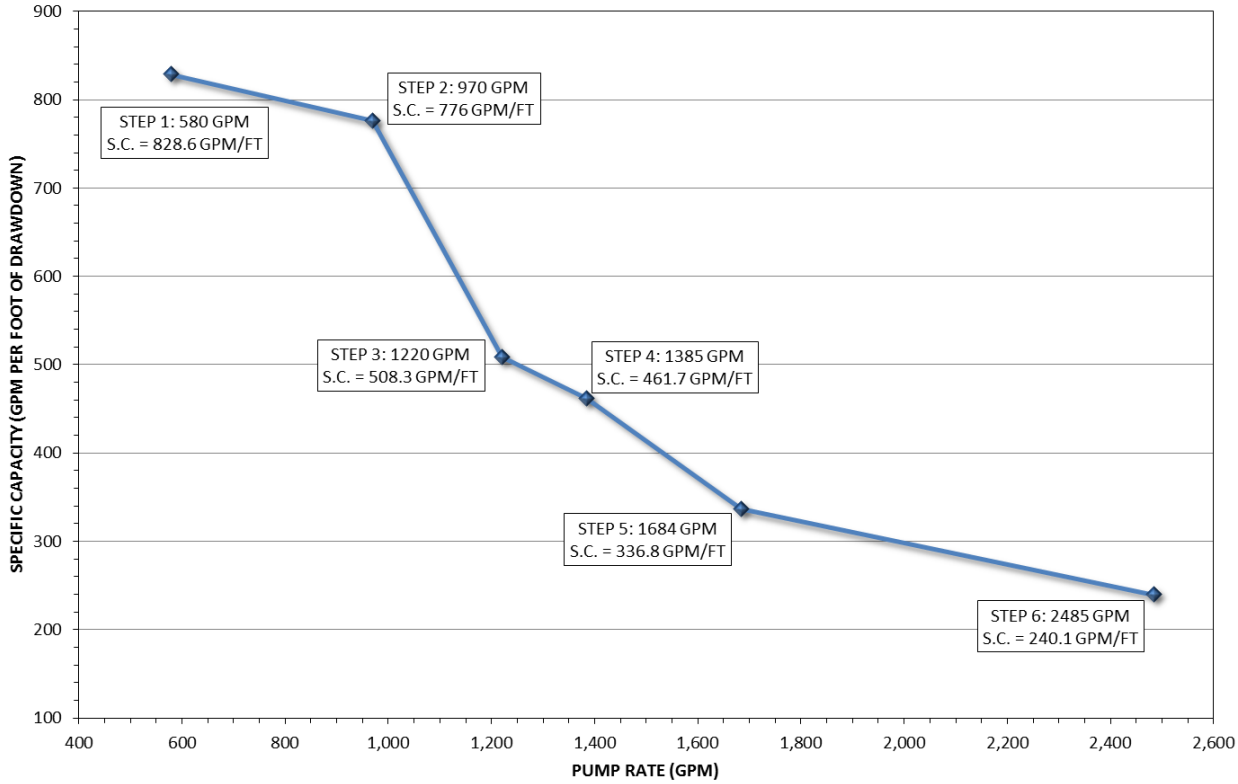


Figure 11, PW-10 Step Drawdown Test, Specific Capacity vs. Pumping Rate



2.4 Geophysical Logging

Geophysical logging was performed during various stages of PW-9 and PW-10 well construction. The logs were used to aid in the decision-making and data gathering process to evaluate hole dimensions, casing setting depths, geologic formation characteristics, water quality, flow zone and aquifer characteristics.

After completion of pilot hole drilling to the total depth, a suite of geophysical logs were performed by AWE which included: Dual induction, single point resistivity, SP, temperature, caliper, gamma ray, borehole compensated sonic, fluid resistivity, and flow log. Geophysical logs in the open hole portion of the borehole were performed under both static (non-flowing) and dynamic (flowing) conditions. A caliper log was performed after the pilot hole had been reamed before intermediate and final casing installation. A JLA hydrogeologist was on site to observe all logging activities and interpret the results. A summary of geophysical and video logs performed is outlined below.

Summary of Geophysical Logging

Construction Phase	Logs Performed
34-inch reamed hole for 30-inch diameter surface casing installation	Caliper
12-inch Pilot Hole	Dual induction, single point resistivity, SP, caliper, gamma ray
28-inch reamed hole for 20-inch steel intermediate casing installation	Caliper
12-inch Pilot Hole (20” casing depth to TD)	Dual induction, single point resistivity, SP, temperature, caliper, gamma ray, fluid resistivity, flow
19-inch reamed hole for 17.4-inch & 14-inch PVC casing installation	Caliper
Well Completion	Well Video with rotating lens (Static and Dynamic Condition)

A generalized hydrostratigraphic cross section of both production wells depicting generalized geology, well construction, gamma ray, dual induction and flow rates is included as Figure 12. Pilot hole flow test results of the production zone at PW-9 and PW-10 are included as a generalized hydrostratigraphic cross section from 800 feet BLS to 1,400 feet BLS in Figure 13 and Figure 14. Electronic copies of the geophysical logs for the production wells are included in Appendix C.

2.5 Video Logging

Following completion of the step drawdown test, AWE performed a down-hole video log of the production wells. Evidence of cement grout was present at the base of 14-inch PVC casing, approximately 1058 feet BLS at PW-9 and 995 feet BLS at PW-10, based on the video log camera tool measurement. A mixture of cement grout and gravel used to temporarily backfill the production zone during cementing, was present to a depth of 1,063 feet BLS at PW-9 and 1,006 feet BLS at PW-10.

As evident in the casing and joint inspection during the PW-9 and PW-10 video log, the 14-inch PVC casing appeared to be in good condition with only minor abrasions due to drill pipe and pump insertion and removal, and discoloration of the casing. Upon inspection, the total depth of PW-9 is 1,363 feet and 1,090 feet at PW-10. There appears to be no borehole fill at well PW-9 and approximately 23 feet of borehole fill was measured at the base of PW-10.

Several flow zones were observed during video logging. The most visibly predominate flow zone in PW-9 was located at approximately 1,303 feet BLS. Based on lithologic cuttings, this zone is composed of fine grained to microcrystalline limestone, well cemented with abundant foraminifera, and good permeability. Additional shallower thin flow zones were present from 1,100 to 1,260 feet BLS. In PW-10 the most visible predominant flow was at approximately 1,044 feet BLS. This zone is along a transition of lithologies comprised of soft fine grained to micritic limestone with abundant foraminifera

and sandy dolomitic limestone. An electronic copy of the video log is included in Appendix C.

3.0 HYDROGEOLOGY

Palm Beach County is underlain by two aquifer systems: the Surficial aquifer (SAS) and the Floridan aquifer system (FAS). The drilling phase of the project penetrated these two aquifer systems to a total depth of 1,363 feet BLS at PW-9 and 1,350 feet BLS at PW-10. A JLA Geosciences geologist was present during key phases of the drilling to collect and log the lithologic samples as the formation materials were encountered. Lithologic logs of the production wells are provided in Appendix B.

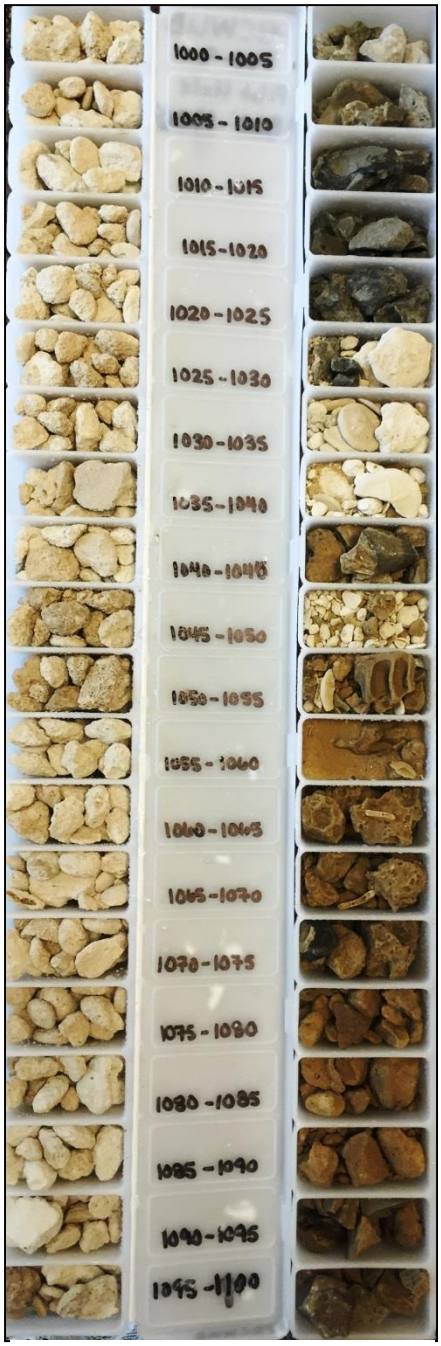
3.1 Surficial Aquifer System

The surficial aquifer beneath the site occurs in the Pleistocene and Pliocene aged lithostratigraphic units consisting of predominately sand and shell, shell beds, sandstone, and sandy limestone. Regionally, in descending order, these units are: Pamlico Sand, Miami Limestone, Anastasia, Fort Thompson, Caloosahatchee Marl, and the Tamiami Formations (Reese, 2009). Depths and presences of these geologic units vary based on location. The basal confining unit of the SAS occurs at approximately 160 feet beneath the PW-9 site and approximately 180 feet beneath the PW-10 site.

3.2 Intermediate Confining Unit

The intermediate confining unit (ICU) consists of the relatively impermeable calcareous clays and silts of the Hawthorn Group. The Miocene to Late Oligocene aged Hawthorn sediments consist of silty, sandy, dense, green clay, interbedded with sand, shell, lime mud and limestone. The depth to the top of the intermediate confining unit is approximately 170 feet to 180 feet beneath the project area with a thickness of

approximately 700 to 800 feet. The predominantly clayey upper section of the unit is known as the Peace River Formation. The lime muds, shell and limestone that underlie the Peace River comprise the Arcadia Formation.



PW-9 (left) and PW-10 (right) lithologic chip trays, 1,000-1,100 feet BLS

3.3 Floridan Aquifer System

The Floridan Aquifer System (FAS), a confined aquifer, underlies the intermediate confining unit. The brackish upper portion, having TDS concentrations less than 10,000 mg/l, is called the Upper Floridan Aquifer (UFA) (Reese & Richardson, 2008). The UFA is predominantly composed of interbedded limestone and dolomite of Miocene/Early Oligocene to middle Eocene age, represented by four primary rock units. In descending order, regionally these units are: Arcadia Formation of the Basal Hawthorn Unit (Miocene); Suwannee Limestone (Early Oligocene) the Ocala Limestone (Eocene age); and the Avon Park Formation (Eocene age) (Reese & Richardson, 2008). However, depths and presences of these geologic units vary based on location.

The top of the UFA at the PW-9 site is approximately 823 feet BLS, however at PW-10, the top of the UFA is approximately 955 feet BLS. Locally, based on lithologic cuttings, the following formations of the UFA were encountered at PW-9: Basal Hawthorn Unit (740 feet to 823 feet), Ocala Limestone (823 feet to 940 feet) and the Avon Park Formation (940 feet to total depth). Based on the lithologic cuttings, distinguishing the

presence of UFA formations at PW-10 proved difficult. The formations underlying PW-10 are potentially offset by a geologic unconformity created by a Paleolithic sinkhole.

The maximum depth penetrated at PW-9 during drilling was 1,363 feet BLS. The lithology approaching the terminus of the well consisted of interbedded calcarenitic limestone, hard microcrystalline limestone and dolomitic limestone of the Avon Park Formation. Production well PW-10 was penetrated to a maximum depth was 1,350 feet BLS. The lithology consisted of predominantly dolomitic limestone and sandy dolomitic limestone interbedded with thin layers of calcarenitic limestone.

The producing zones within the Floridan aquifer can generally be referred to as "flow zones". A flow zone is typically a thin sequence of highly solutioned rock, where water flowing within the aquifer is concentrated. Numerous thin flow zones may contribute water to the open interval of a well; often times, however, a high percentage of the water produced by the well comes from one or two thin flow zones.

A generalized hydrostratigraphic section depicting formations and lithology encountered from land surface to total depth at PW-9 and PW-10 is presented as Figure 12. A generalized hydrostratigraphic section of the production zone is presented as Figure 13 (PW-9) and Figure 14 (PW-10).

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. UFA Production Wells PW-9 and PW-10 were constructed for Palm Beach County Water Utilities Department Water Treatment Plant No.11 between June 2014 and May 2015. Well PW-9 was completed to a total depth of 1,363 feet BLS with an open hole production interval from 1,052 to 1,363 feet BLS. Well PW-10 was completed to a total depth of 1,350 feet BLS, backfilled to 1,113 feet with an open hole production interval from 1,004 to 1,113 feet BLS.

	PW-9	PW-10
Open Borehole Interval (feet BLS) *19-inch diameter*	1,052 – 1,363	1,004 – 1,113

2. Based on site lithology, the SAS extends to a depth of approximately 170 to 180 feet BLS. Below the SAS, the ICU continues to the top of the UFA to a depth of approximately 820 feet BLS at PW-9 and approximately 980 feet BLS at PW-10. Based on the lithologic logs, geophysical logs, well video, and wellhead flow data, the most visibly predominate flow zone was located at approximately 1,348 feet BLS, with additional shallower production zones from 1,160 to 1,290 feet BLS also contributing to flow.

3. A step drawdown test was performed on November 19, 2014 at PW-9, for two hours per step at approximate rates of 600 gpm, 900 gpm, 1,210 gpm, 1,530 gpm, and 1,730 gpm. Prior to the step drawdown pumping test, the static head measured +40.16 feet ALS. On May 6, 2015, a step test was performed at PW-

10, at the approximate rates of 600 gpm, 900 gpm, 1,200 gpm, 1,500 gpm, 1,700 gpm and 2,400 gpm. Prior to the step drawdown pumping test, the static head measured +37.2 feet ALS. Specific capacities at the approximate design rate of 900 GPM during the step drawdown test were as follows:

900 GPM Design Rate	PW-9 965 gpm*	PW-10 970 gpm*
Static Water Level (ft ALS)	+40.16	+37.20
Pumping Water Level (ft ALS)	+11.08	+35.95
Drawdown (ft)	29.08	2.25
Specific Capacity (gpm/ft**)	33.2	776.0

4. Water quality measured during the step drawdown test at the design rate of approximately 900 gpm is as follows:

Well	Rate (gpm)	Chloride (mg/L)	Specific Cond. (S/cm)	TDS (ppt)	Hydrogen Sulfide (ppm)	Total Iron (ppm)	Sand (ppm)	SDI
PW-9	965	1,565	5,520	3.58	2.0	<0.1	<0.1	0.2
PW-10	970	2,850	10,080	8.56	6.0	0.1	0.1	2.4

5. Recommended SDI values for RO facilities are 3.0 units with ideal values less than 1.0. SDI test results of raw water produced from PW-9 were between 0.7 and 0.2, results from PW-10 were between 2.5 and 2.1, indicating raw water from both production wells is suitable for RO supply.

6. Laboratory testing results of the water quality analysis indicated that the formation water meets FDEP requirements for primary and secondary drinking water standards with the exception of the following parameters: sodium (PW-9: 930 mg/L; PW-10: 1,690 mg/L), Bromate (PW-9: 50 ug/L), chloride (PW-9: 1,580 mg/L; PW-10: 2,710), sulfate (PW-9: 488 mg/L; PW-10: 558 mg/L), threshold odor number (PW-9: 67 T.O.N; PW-10: 100 T.O.N), total dissolved solids (PW-9: 3,210 mg/L; PW-10: 5,660 mg/L), gross alpha (PW-10: 60.3±5.90 pCi/L) and radium 226 (PW-9: 7.23±1.68 pCiL; PW-10: 40.5±4.35 pCiL).

4.2 Recommendations

1. As outlined in *GUA UFA Groundwater Modeling Results* (JLA Geosciences Inc., 2011), a pumpage rate of 900 gpm is recommended for both PW-9 and PW-10, with reductions in future withdrawals from existing wells when one (1) additional new UFA well, PW-11 is completed.

2. Prior to placing wells PW-9 and PW-10 in service, any residual kill water and associated debris should be purged from the wells until silt density index (SDI) and sand concentration reach that of values measured during the step drawdown test as outlined in this report. Well service performed for the production wells should be performed without “killing” the well where possible.

3. Water quality monitoring of PW-9 and PW-10 should include laboratory analysis of chloride concentration and specific conductance collected weekly for the first 6 months of operation. After 6 months and review of the data, sampling of chloride and specific conductance may be reduced to monthly. In addition, water quality sampling should also include, at a minimum, the parameters tested during construction, which include: TDS, pH, SDI, and hydrogen sulfide. Frequency of these additional parameters should be monthly at a minimum. Results of all sampling should be plotted and analyzed for trends or changes in water quality

over time. Laboratory analysis should be performed by the Palm Beach County Central Laboratory or a state of Florida NELAC certified analytical laboratory.

4. 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. 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 water levels or a specific capacity loss of 20% or greater than reported herein may indicate the need for evaluation and potential rehabilitation.

5. A three (3) day Aquifer Performance Test (APT) including existing UFA wells (TP-1, TP-2, PW-3, PW-4, PW-5, PW-6, PW-7 and PW-8) and new production wells PW-9 and PW-10 should be performed to evaluate aquifer characteristics. The APT should include background measurement of water levels in PW-9 and PW-10 with wells PW-3, PW-4, PW-6 and PW-7 pumping. To evaluate well field changes during the APT, test production wells PW-9 and PW-10, should be pumped for as long as possible; then wells TP-1, TP-2, PW-5, and PW-8 added into service to meet water plant demand. A formal APT plan should be developed to address testing requirements and water plant operational requirements.

5.0 REFERENCES

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

JLA Geosciences, Inc., 2011, GUA UFA Groundwater Modeling Results Technical Memorandum, JLA Geosciences, Inc., 18 p.

Reese, R.S. and Richardson, Emily, 2008, Synthesis of the Hydrogeologic Framework of the Floridan Aquifer System and Delineation of a Major Avon Park Permeable Zone in Central and Southern Florida: U.S. Geological Survey Scientific Investigations Report 2007-5207, 60 p., 4 pls., plus apps. (on CD).

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

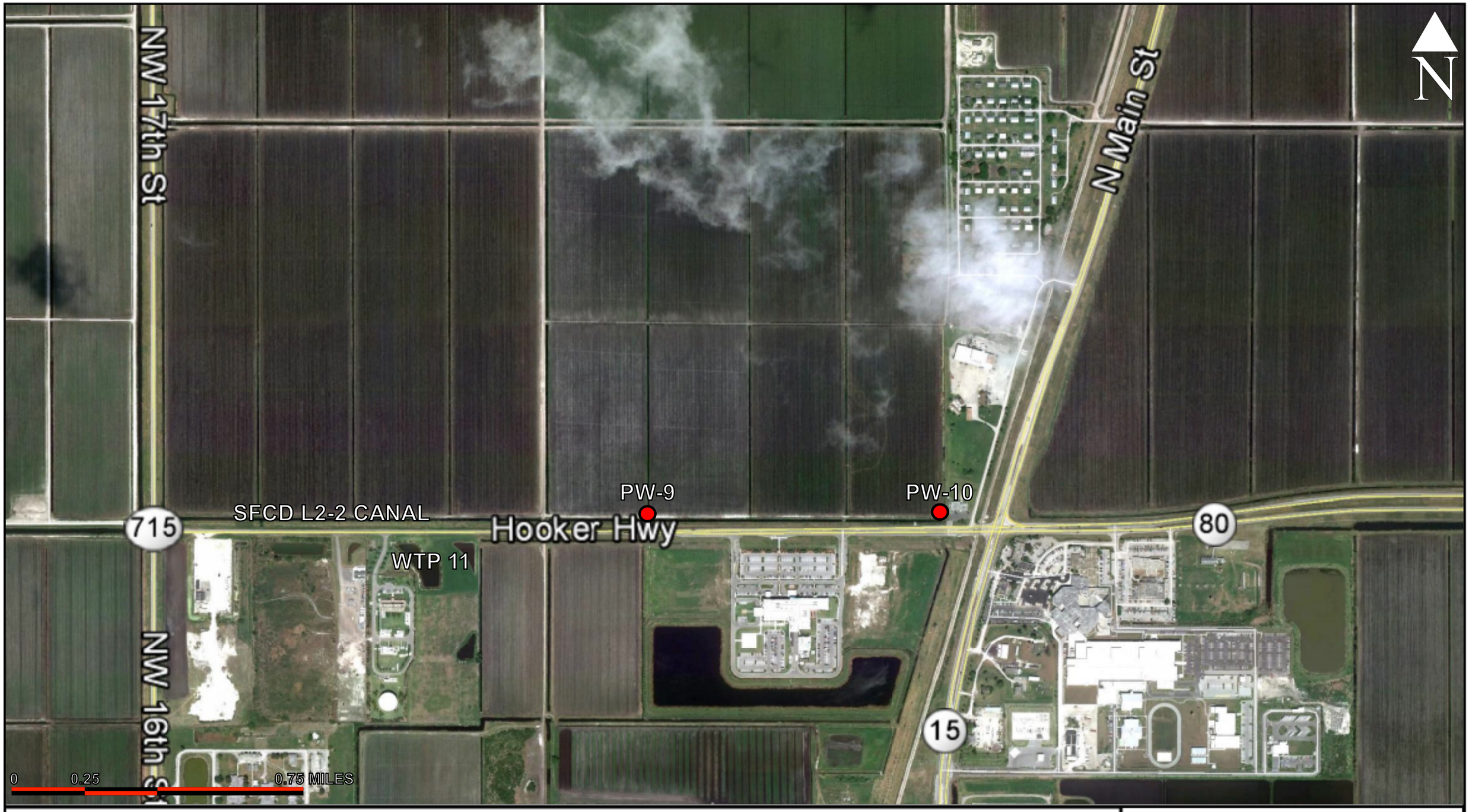


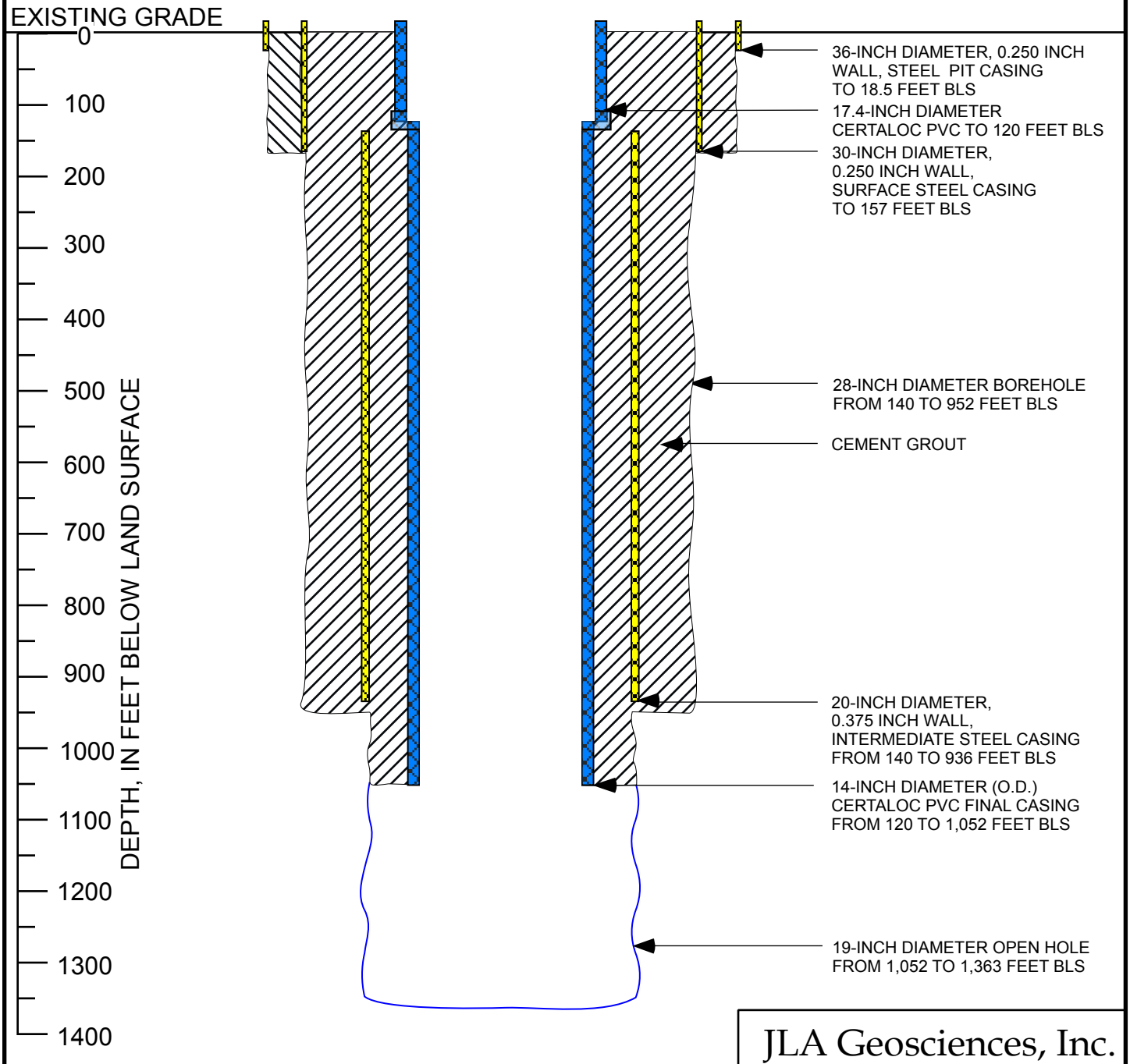
FIGURE TITLE:

PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
SITE LOCATION MAP

JLA Geosciences, Inc.

DATE:	04/13/15
DRAWN BY:	ASG
PROJECT NO:	13-022

FIGURE NO: 1



JLA Geosciences, Inc.

LEGEND:

CEMENT GROUT

PVC WELL CASING

STEEL WELL CASING

OPEN HOLE

SCALE:	DATE:
AS SHOWN	9/23/14
DRAWN BY:	PROJECT NO:
ASG	13-022

PROJECT SITE:

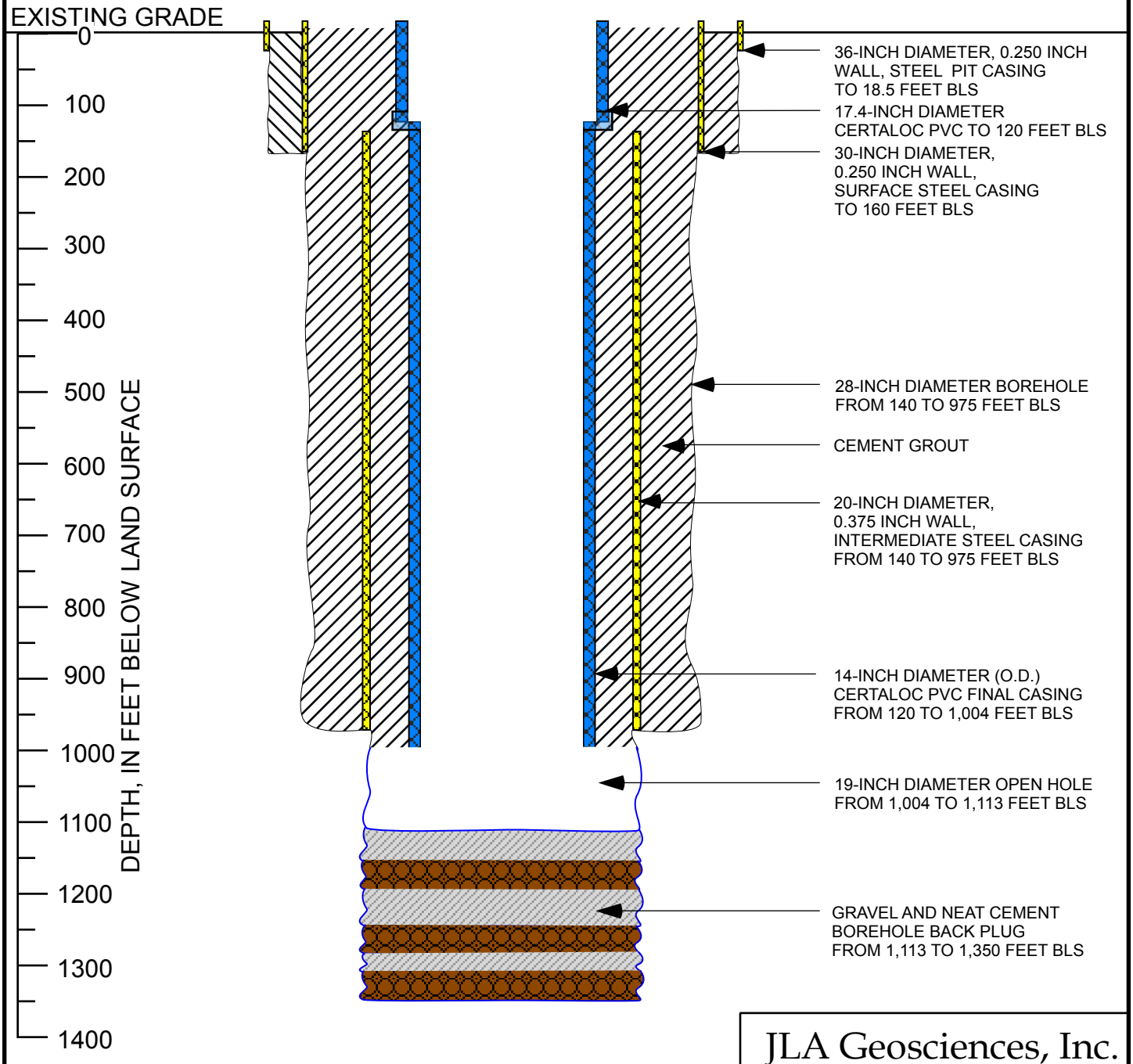
PBCWUD WTP 11

UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10

FIGURE NO: 2

FIGURE TITLE:

PW-9 AS BUILT DIAGRAM



JLA Geosciences, Inc.

LEGEND:

CEMENT GROUT | PVC WELL CASING | NEAT CEMENT (BACK PLUG)

STEEL WELL CASING | OPEN HOLE | GRAVEL (BACK PLUG)

SCALE:	DATE:
AS SHOWN	3/31/15
DRAWN BY:	PROJECT NO:
ASG	13-022

PROJECT SITE:

PBCWUD WTP 11

UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10

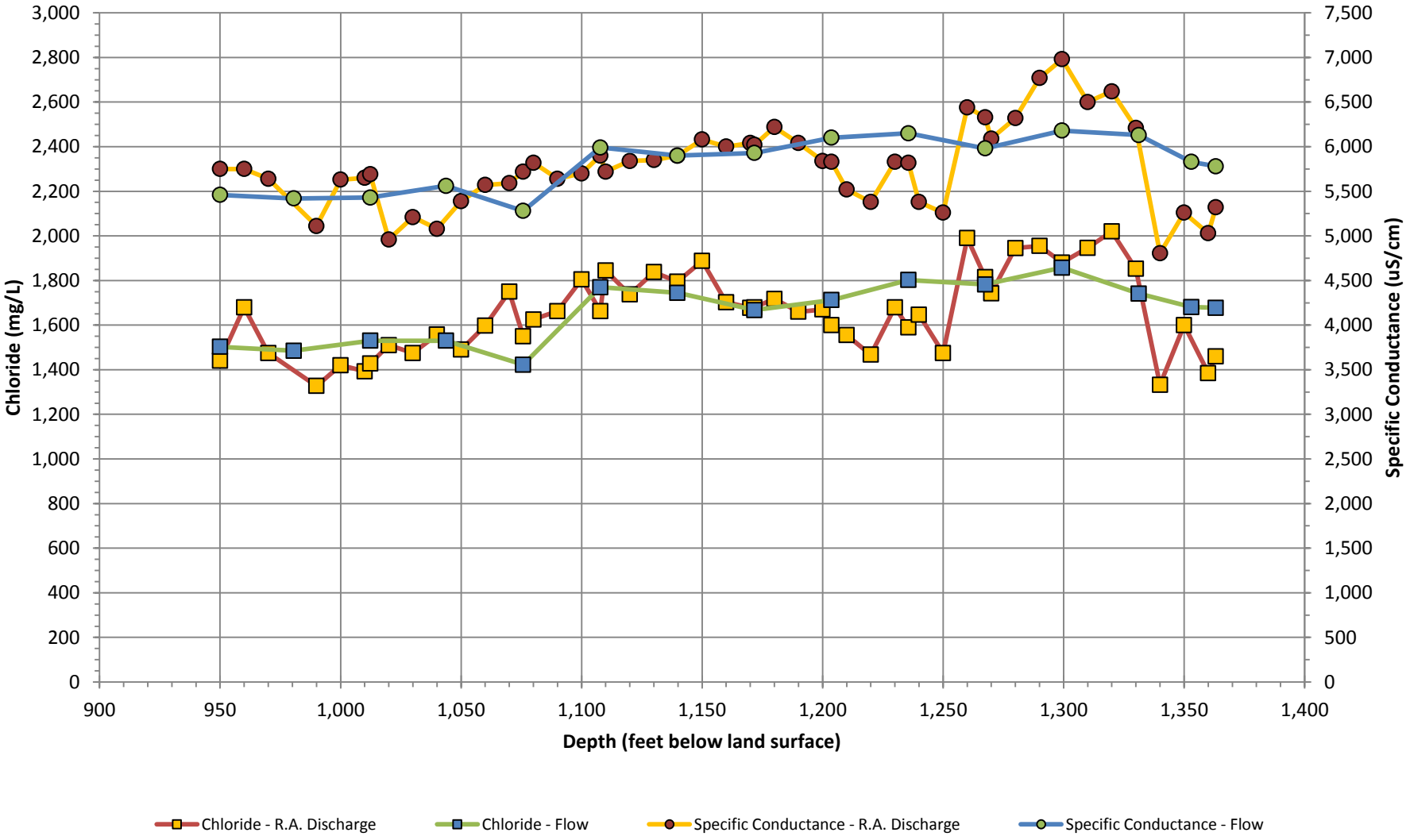
FIGURE NO: 3

FIGURE TITLE:

PW-10 AS BUILT DIAGRAM

FIGURE 4

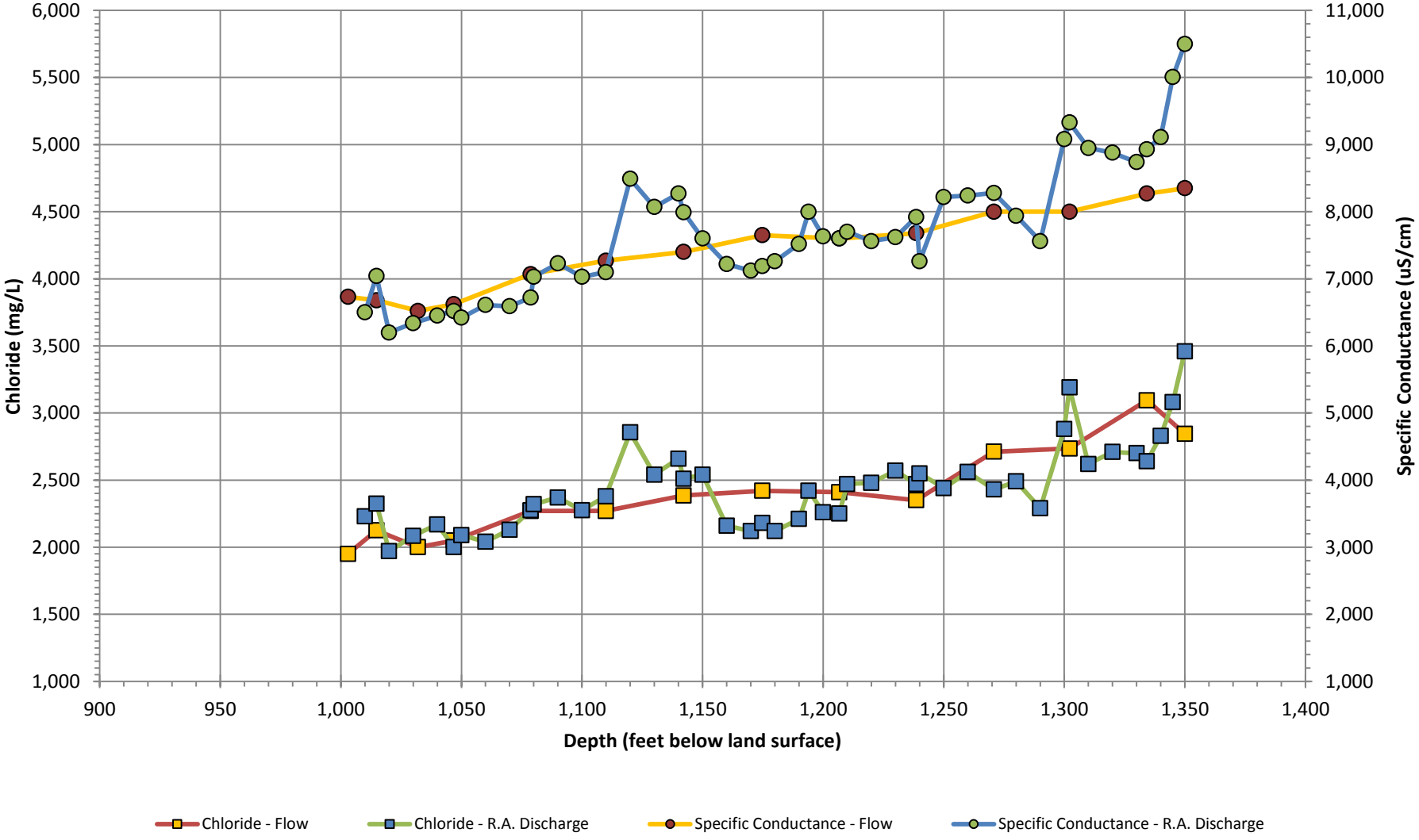
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-9 Reverse Air Drilling Chloride, Specific Conductance vs Depth



JLA Geosciences, Inc.

FIGURE 5

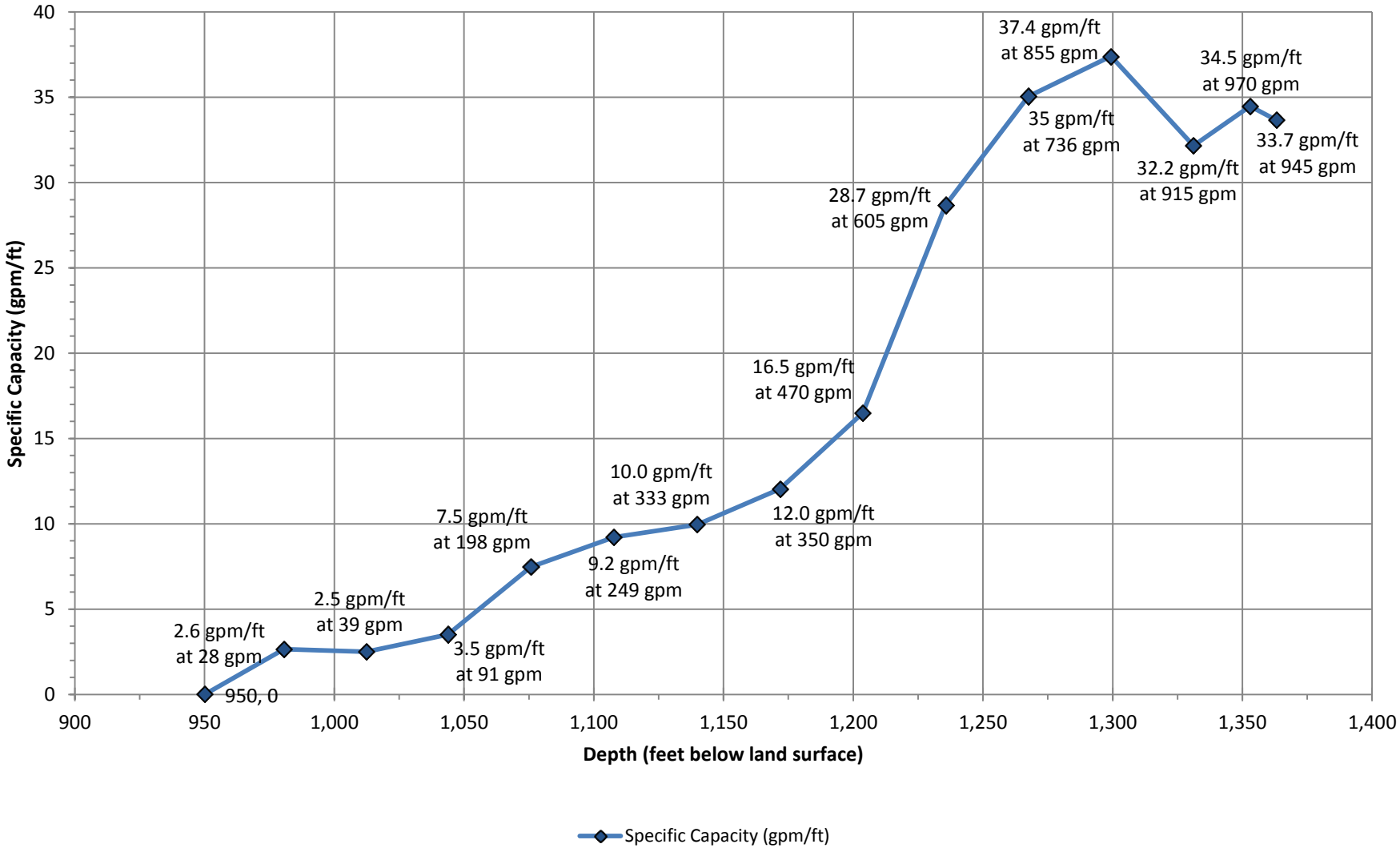
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-10 Reverse Air Drilling Chloride, Specific Conductance vs Depth



JLA Geosciences, Inc.

FIGURE 6

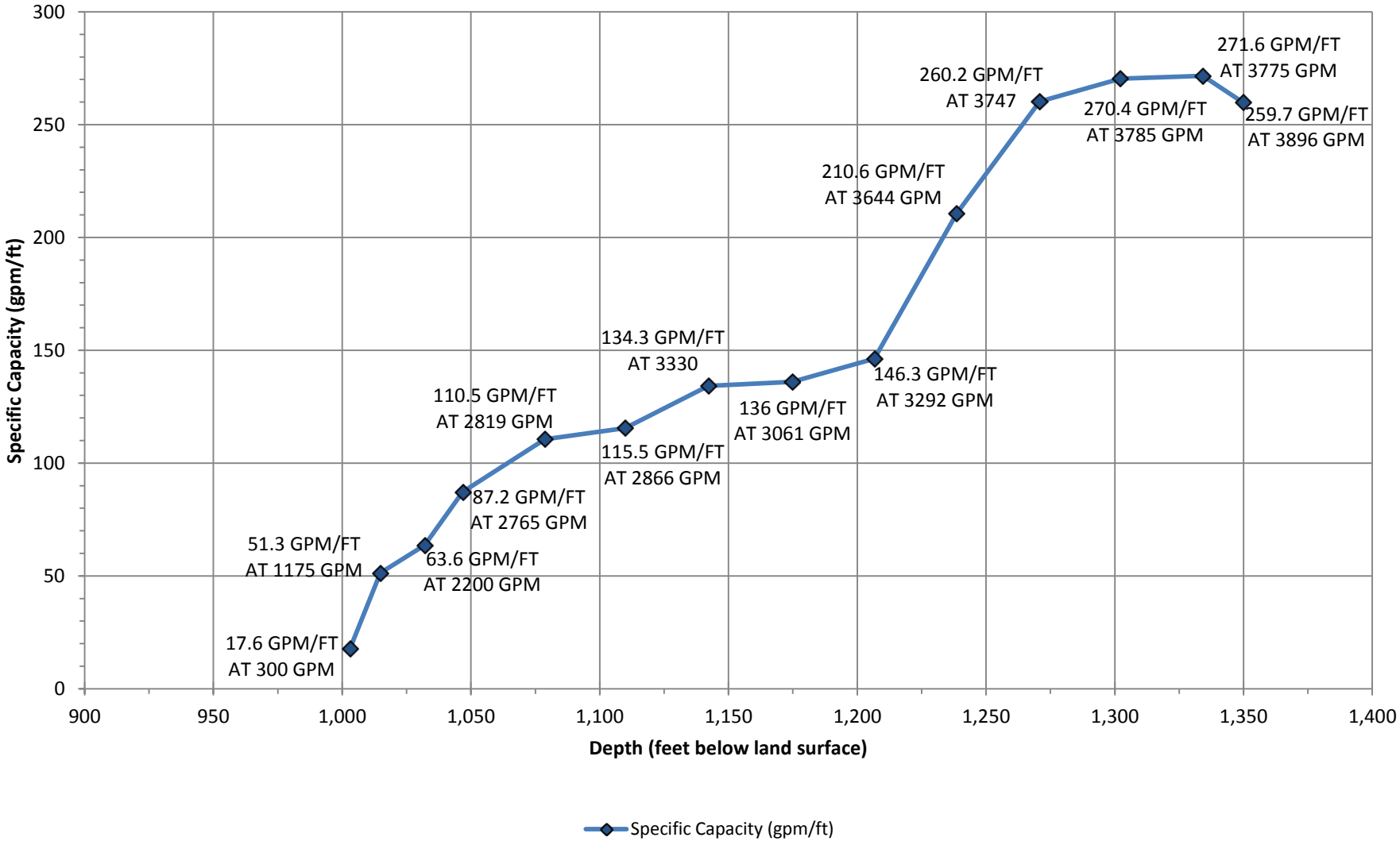
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-9 Reverse Air Drilling Specific Capacity vs Depth



JLA Geosciences, Inc.

FIGURE 7

PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-10 Reverse Air Drilling Specific Capacity vs Depth



JLA Geosciences, Inc.

FIGURE 8

PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-9 Step Drawdown Test, Water Level and Specific Conductivity Plot

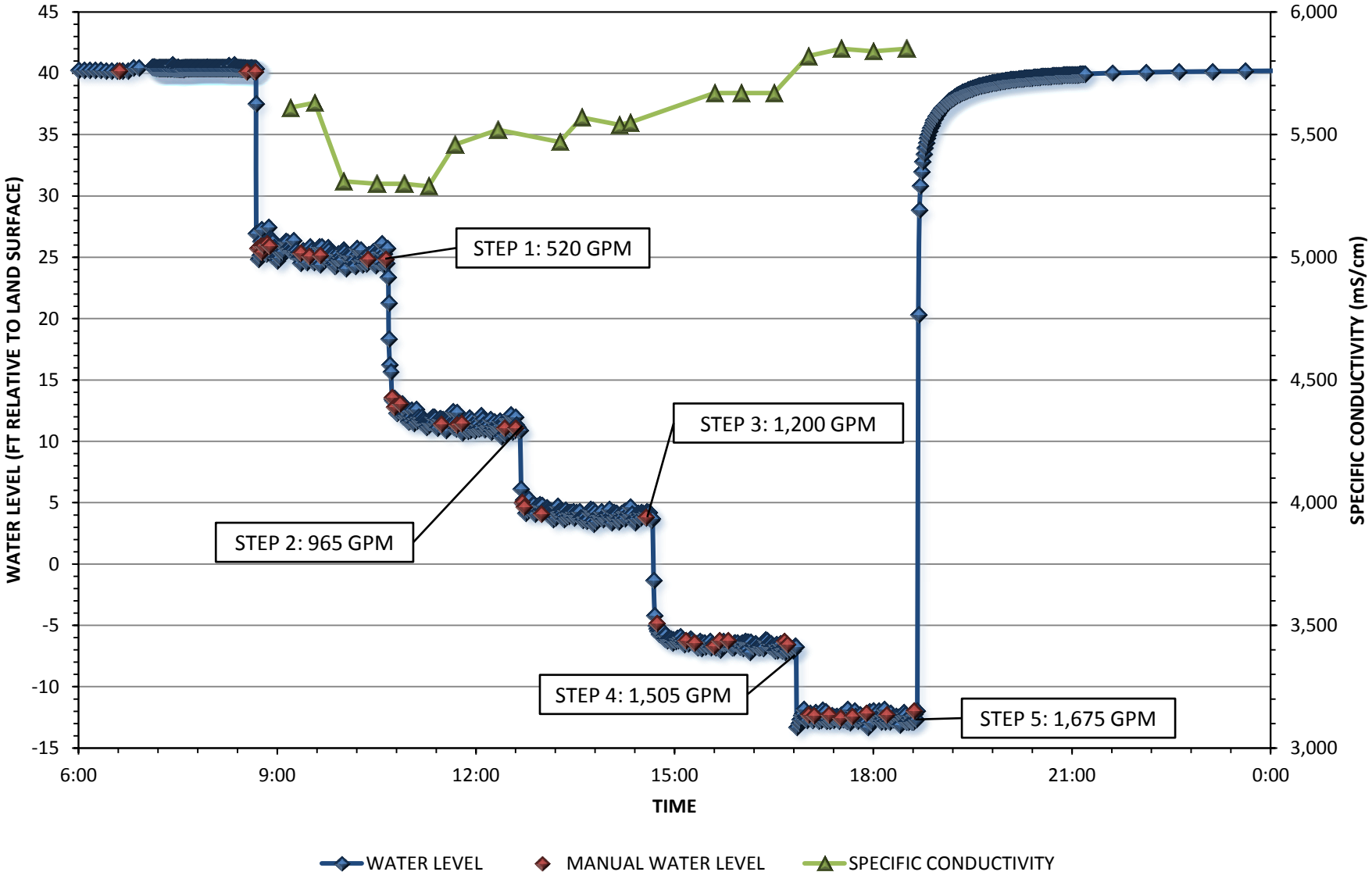


FIGURE 9

PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-10 Step Drawdown Test, Water Level and Specific Conductivity Plot

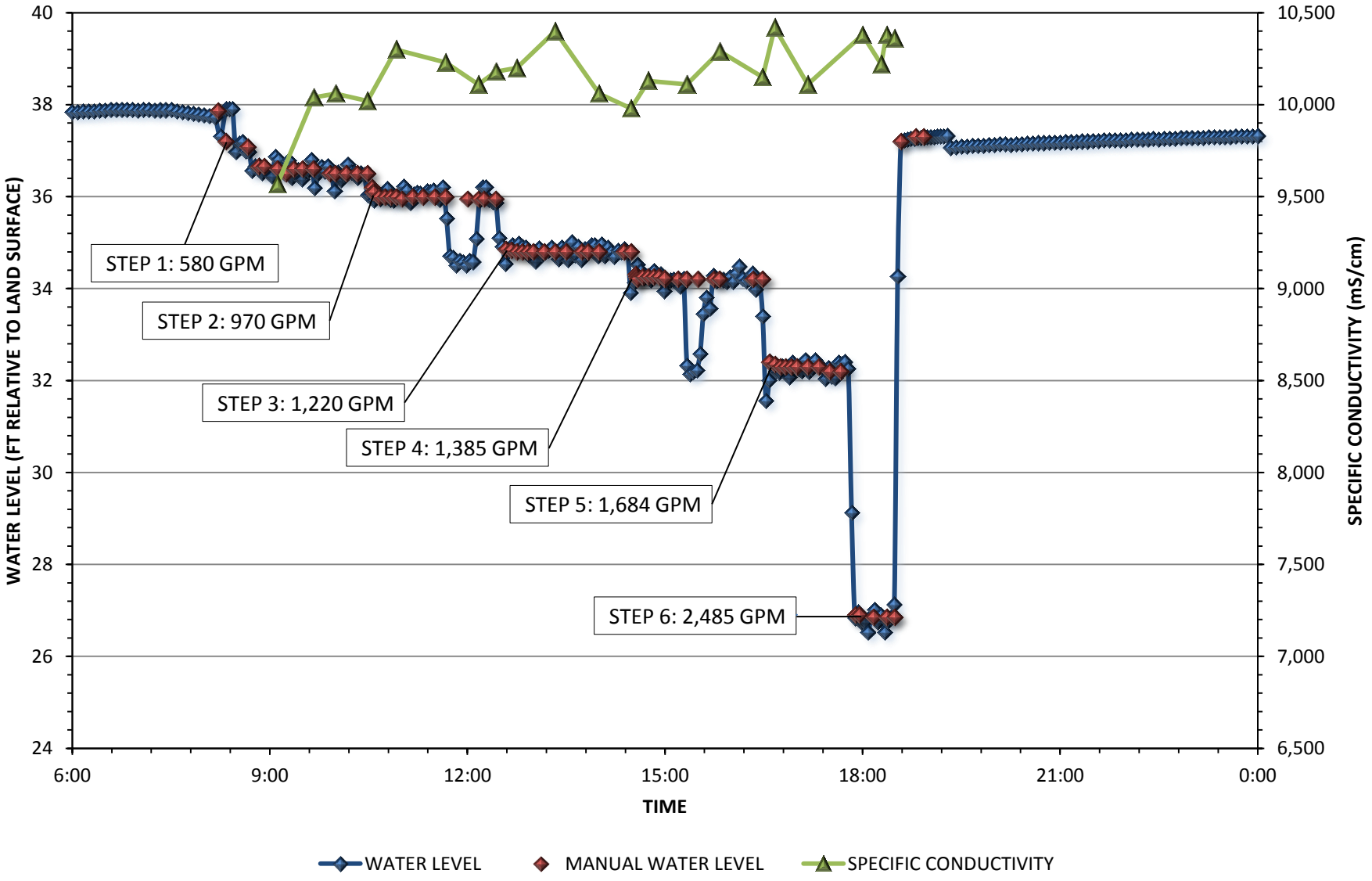


FIGURE 10

PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-9 Step Drawdown Test, Specific Capacity vs. Pumping Rate

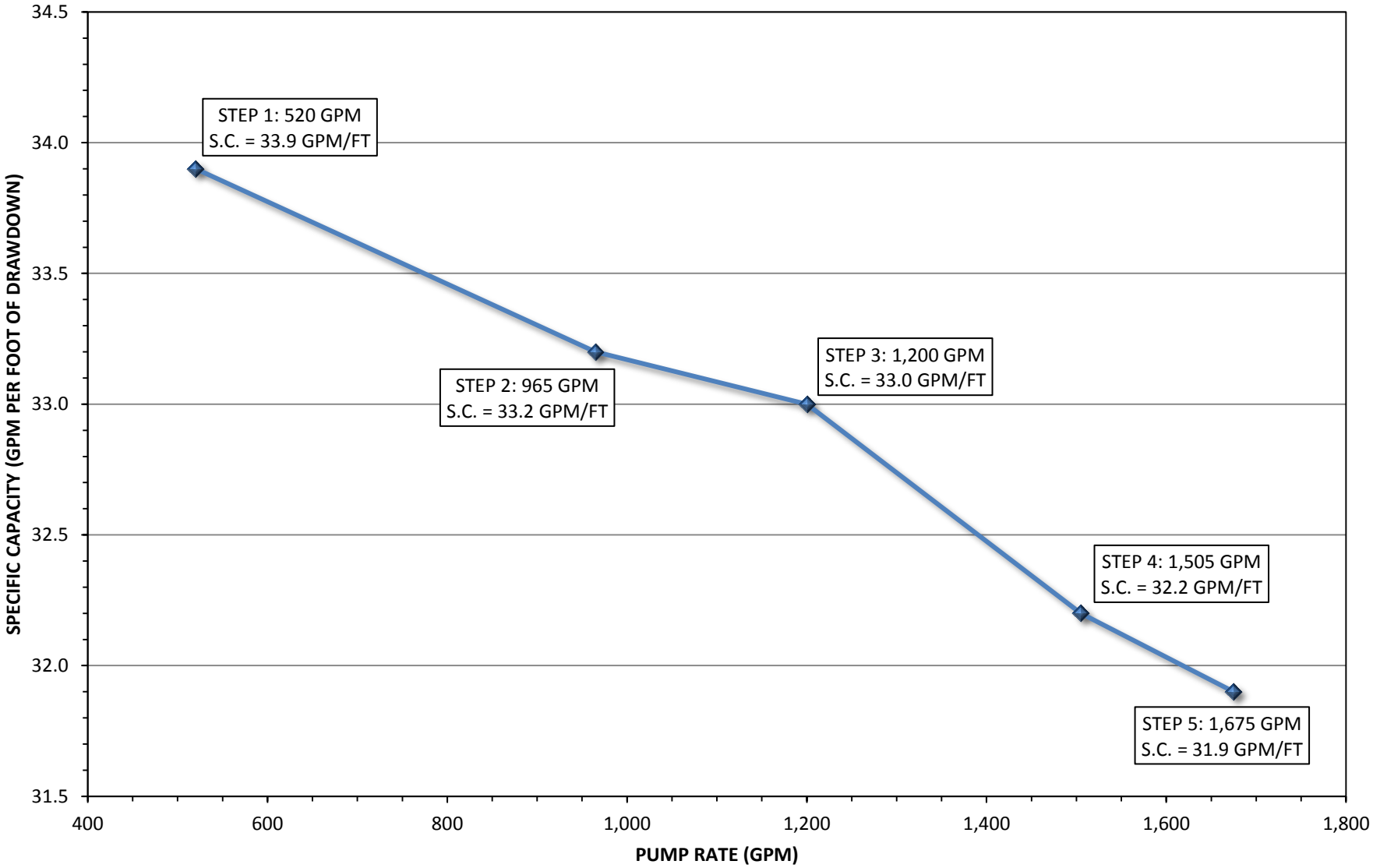
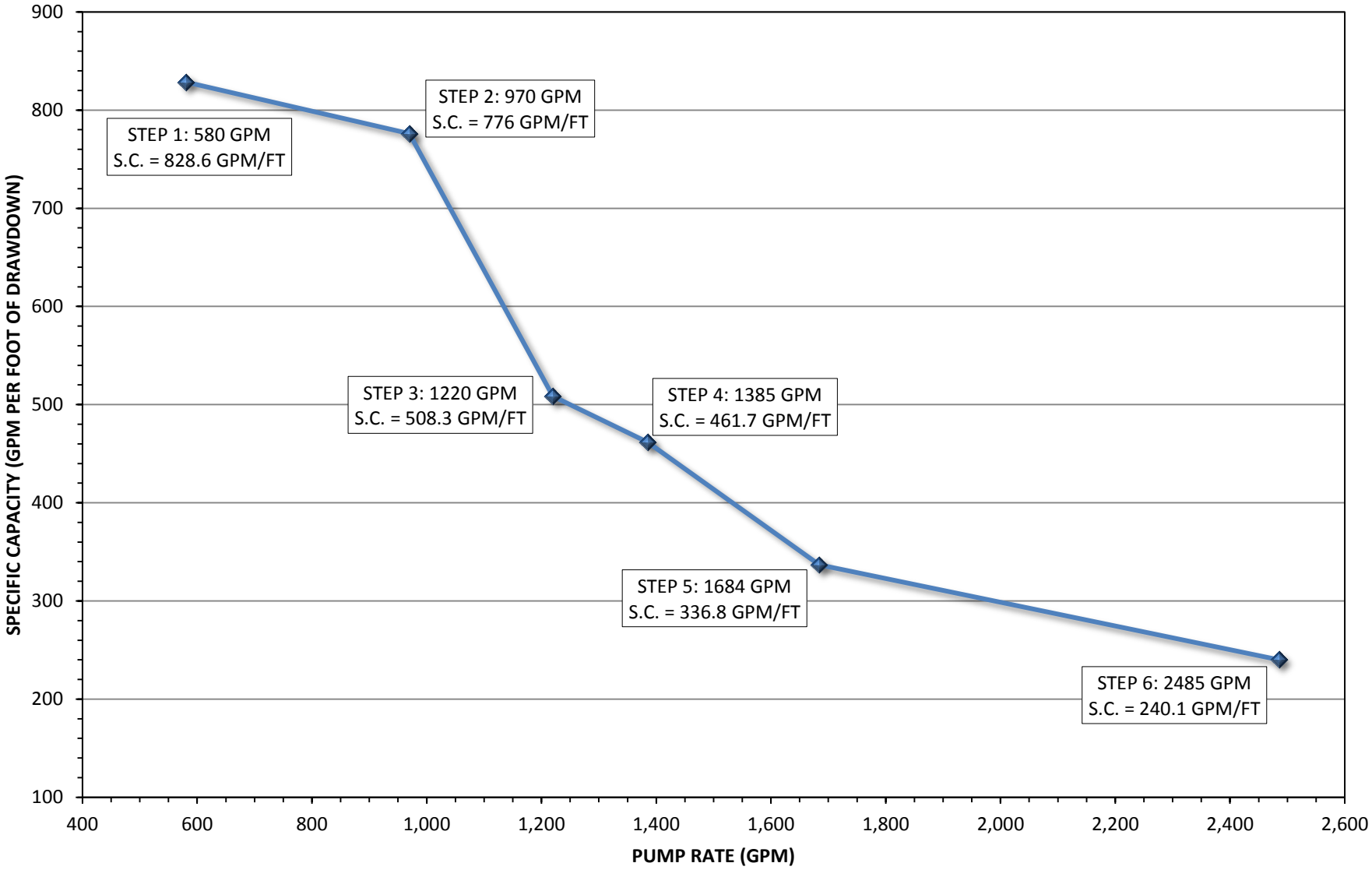
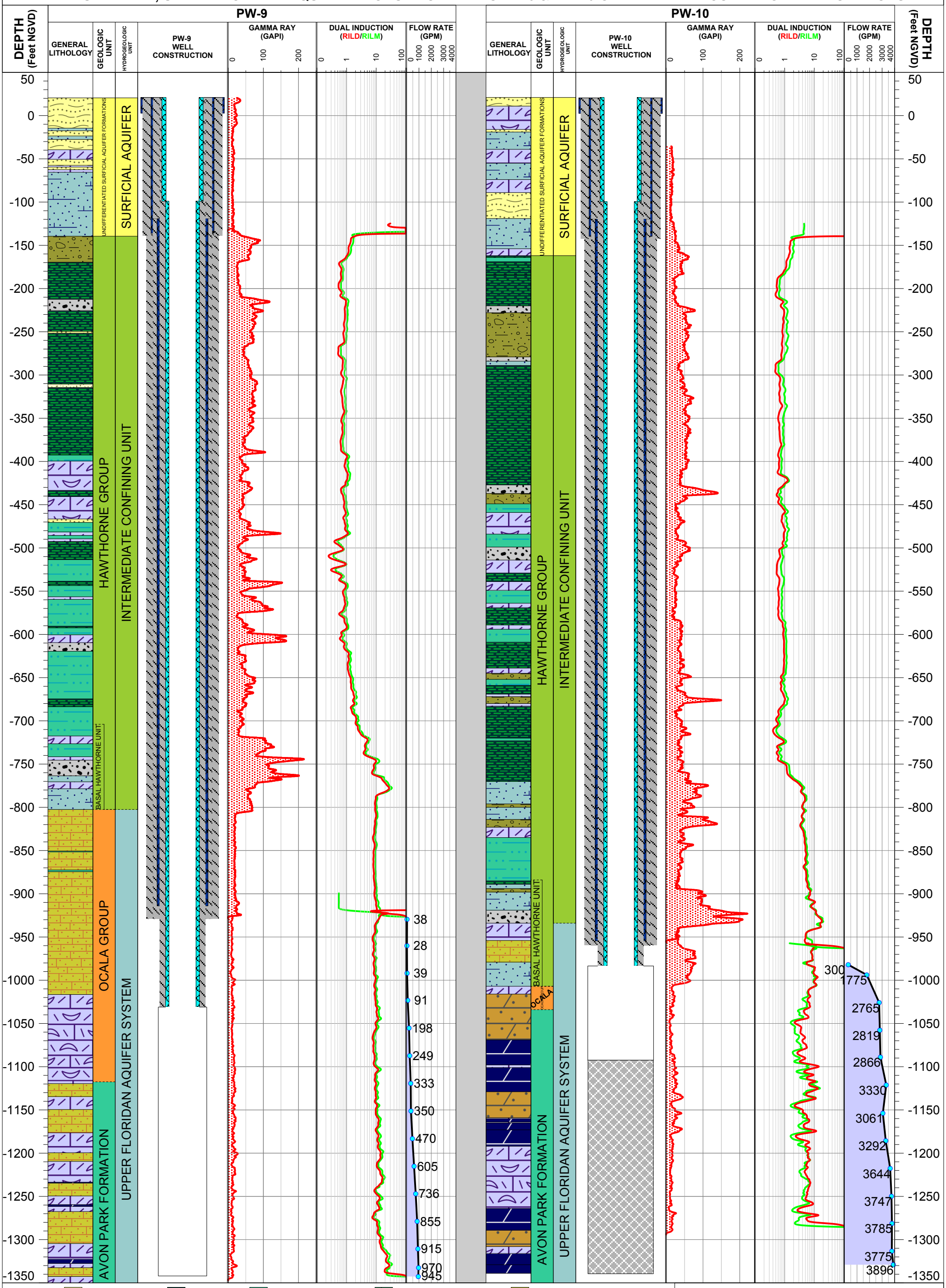


FIGURE 11

PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-10 Step Drawdown Test, Specific Capacity vs. Pumping Rate



PBCWUD WTP 11, UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10 GENERAL HYDROSTRATIGRAPHIC SECTIONS



NOTE: SAND; CLAY; LIMEMUD; PHOSPHATIC SANDY CLAY; SANDY LIMESTONE; SAND AND SHELL; LIMESTONE; DOLOMITIC LIMESTONE; PHOSPHATIC SAND; SANDY DOLOMITIC LIMESTONE; SANDSTONE; CEMENT GROUT; STEEL; PVC; PRODUCTION INTERVAL; BACKFILL

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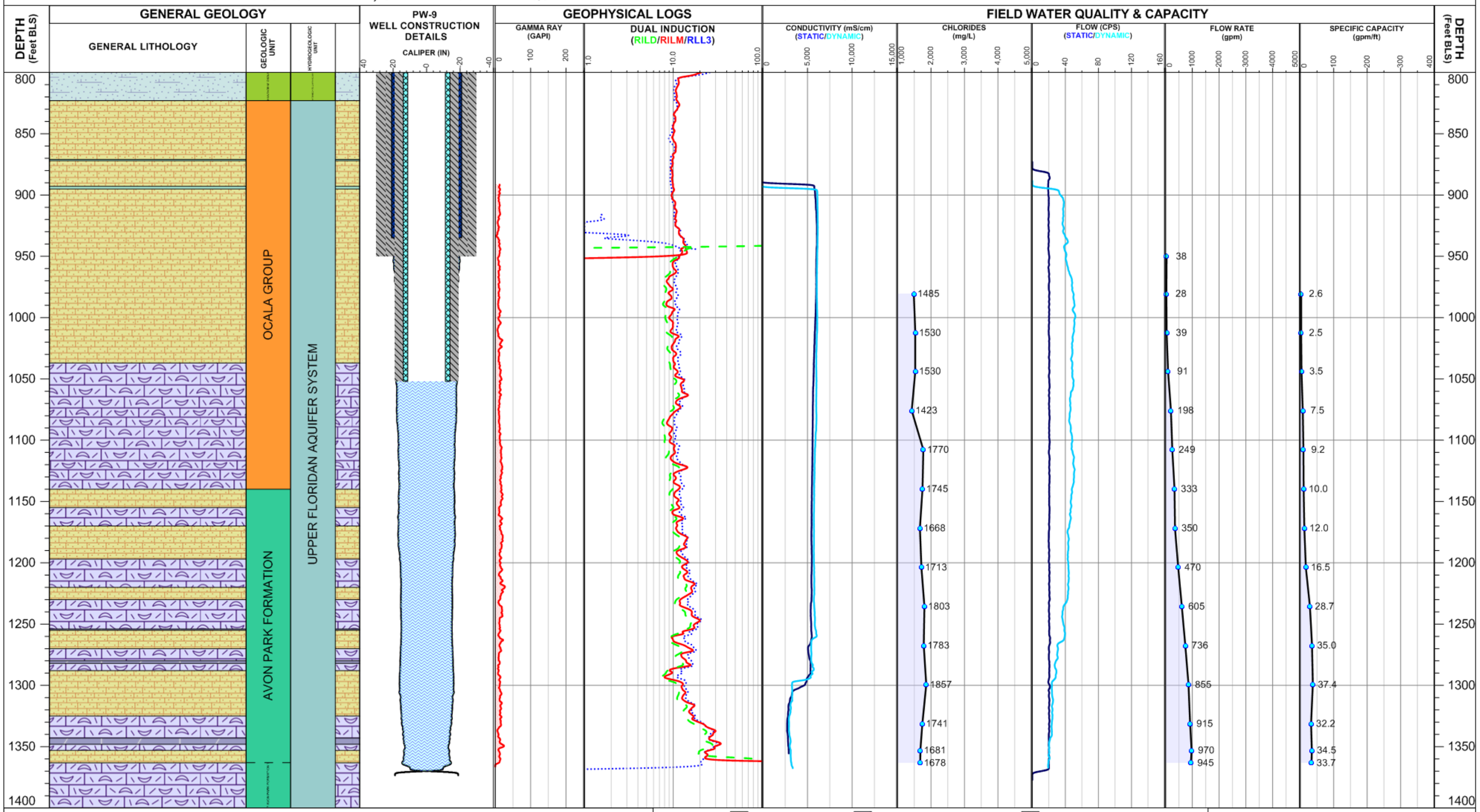
DRAWN BY:	ASG
DATE:	4/13/15
SCALE:	AS SHOWN
PROJECT #:	13-022
FIGURE #:	**12**

PROJECT SITE: PBCWUD WTP 11
UPPER FLORIDAN PRODUCTION WELLS PW-9 & PW-10

FIGURE TITLE: PW-9 & PW-10 GENERAL HYDROSTRATIGRAPHIC SECTION,
WELL CONSTRUCTION, GEOPHYSICAL LOGS AND FLOW RATE WITH DEPTH

PBCWUD WTP 11, UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 PILOT HOLE GENERALIZED HYDROSTRATIGRAPHIC SECTION



PROJECT SITE: PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10

FIGURE TITLE: PW-9 PILOT HOLE (800' - 1363')
GENERALIZED LITHOLOGY, CONSTRUCTION DETAILS,
GEOPHYSICAL DATA AND FLOW TEST RESULTS

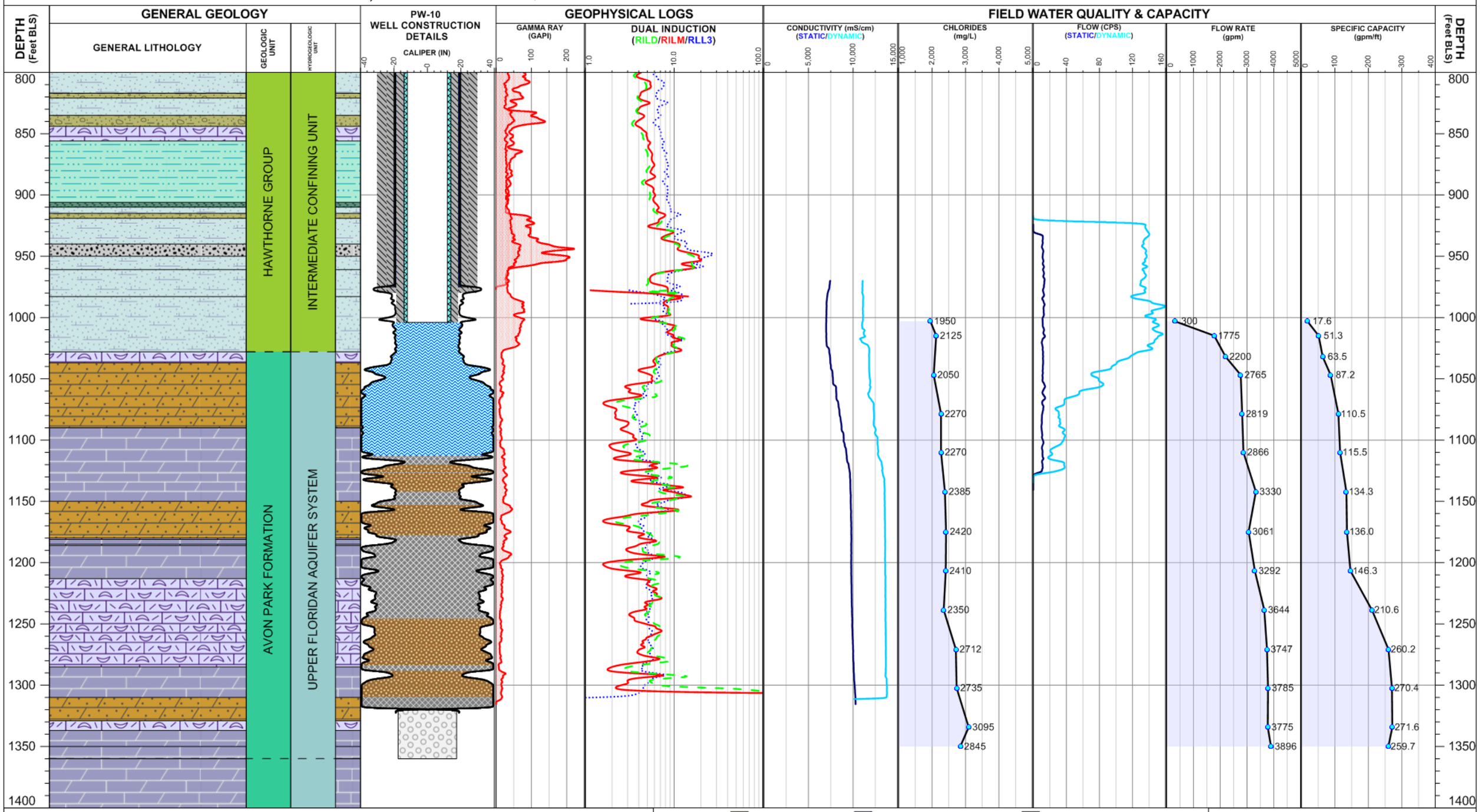
LEGEND:

- SAND
- SAND AND SHELL
- SANDSTONE
- CLAY
- LIMESTONE
- LIMEMUD
- DOLOMITIC LIMESTONE
- PHOSPHATIC SANDY CLAY
- PHOSPHATIC SAND
- SANDY LIMESTONE
- SANDY DOLOMITIC LIMESTONE

JLA Geosciences, Inc.

PROJECT #:	13-022	FIGURE #:	13
DATE:	2/4/15		

PBCWUD WTP 11, UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-10 PILOT HOLE GENERALIZED HYDROSTRATIGRAPHIC SECTION



PROJECT SITE: PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10

FIGURE TITLE: PW-10 PILOT HOLE (975' - 1350')
GENERALIZED LITHOLOGY, CONSTRUCTION DETAILS,
GEOPHYSICAL DATA AND FLOW TEST RESULTS

LEGEND:

- SAND
- SAND AND SHELL
- SANDSTONE
- CLAY
- LIMESTONE
- LIMEMUD
- DOLOMITIC LIMESTONE
- PHOSPHATIC SANDY CLAY
- PHOSPHATIC SAND
- SANDY LIMESTONE
- SANDY DOLOMITIC LIMESTONE

JLA Geosciences, Inc.

PROJECT #: 13-022
DATE: 2/4/15
FIGURE #: 14

TABLES

TABLE 1
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
Well Construction Details

	PW-9	PW-10
Total Depth (feet bls)	**1,363**	**1,113**
Pit Casing **Depth (feet bls)** *36-in diameter, steel* *0.250-inch wall thickness*	18.5	18.5
Surface Casing **Depth (feet bls)** *30-in diameter, steel* *0.250-inch wall thickness*	157	160
Intermediate Casing **Depth Interval (feet bls)** *20-in diameter, steel* 0.375-inch wall thickness	140 – 936	140 – 975
Final Casing **Depth Interval (feet bls)**		
Certainteed Certalok SDR17 *17.4-in Outside Diameter*	0 – 120	0 – 120
Certainteed Certalok SDR17 *14-in Outside Diameter*	120 – 1,052	120 – 1,004
Open Hole Production **Depth Interval (feet bls)** *19-in diameter*	1,052 – 1,363	1,004 – 1,113
Borehole Back Plug **Depth Interval (feet bls)** *Gravel & Neat Cement*	NA	1,113 – 1,350

feet bls - feet below land surface

TABLE 2
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
Grout Summary for 20-inch Intermediate Casing

PW-9								
Grout Stage	**Date**	**Method**	**Maximum Pressure (psi)**	**% Bentonite Added**	**Barrels Pumped**	**No. Sacks Portland Cement**	**Tagged Depth (feet BLS)**	**Vertical Lift (feet)**
1	8/22/14	Pressure	97	0%	60	285	615	325
2	8/22/14	Tremie	--	6%	87	414	320	295
3	8/23/14	Tremie	--	6%	40	190	0	320
TOTAL SACKS						**889**		

PW-10								
1	12/16/14	Pressure	50	0%	60	285	778	197
2	12/14/14	Tremie	--	0%	84	273	572.75	205.25
3	12/18/14	Tremie	--	0%	88	286	362.75	210
4	12/19/15	Tremie	--	0%	40	190	5	357.75
TOTAL SACKS						**1,294**		

ft BLS – feet below land surface

TABLE 3
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-9 Reverse Air Drilling Water Quality and Flow Test Summary

		Water Quality Results		Flow Test Results			
Drilled Depth (ft bls)	Sample From	Chloride (mg/L)	Spec. Conductivity (uS/cm)	Static WL (ft als)	Flowing WL (ft als)	Flow Rate Average (gpm)	Specific Capacity (gpm/ft)
950	BOTTOM	1440	5750				
950	FLOW	1502.5	5460	0	0	37.5	0.0
960	BOTTOM	1680	5750				
970	BOTTOM	1475	5640				
980.56	FLOW	1485	5420	10.38	0	27.5	2.6
990	BOTTOM	1327.5	5110				
1000	BOTTOM	1420	5630				
1010	BOTTOM	1392.5	5650				
1012.33	BOTTOM	1427.5	5690				
1012.33	FLOW	1530	5430	15.55	0	39	2.5
1020	BOTTOM	1510	4960				
1030	BOTTOM	1475	5210				
1040	BOTTOM	1557.5	5080				
1043.76	FLOW	1530	5560	26	0.125	90.9	3.5
1050	BOTTOM	1490	5390				
1060	BOTTOM	1597.5	5570				
1070	BOTTOM	1750	5590				
1075.78	BOTTOM	1550	5720				
1075.78	FLOW	1422.5	5280	26.7	0.23	197.75	7.5
1080	BOTTOM	1625	5820				
1090	BOTTOM	1662.5	5640				
1100	BOTTOM	1805	5700				
1107.78	BOTTOM	1662.5	5900				
1107.78	FLOW	1770	5990	28	1	249	9.2
1110	BOTTOM	1845	5720				
1120	BOTTOM	1737.5	5840				
1130	BOTTOM	1837.5	5850				
1139.78	BOTTOM	1795	5900				
1139.78	FLOW	1745	5900	35.25	1.79	333	10.0
1150	BOTTOM	1887.5	6080				
1160	BOTTOM	1702.5	6000				
1170	BOTTOM	1677.5	6040				
1171.72	BOTTOM	1680	6020				
1171.72	FLOW	1667.5	5930	30.95	1.87	350	12.0
1180	BOTTOM	1717.5	6220				
1190	BOTTOM	1660	6040				
1200	BOTTOM	1670	5840				
1203.72	BOTTOM	1600	5830				
1203.72	FLOW	1712.5	6100	31.05	2.57	470	16.5
1210	BOTTOM	1555	5520				
1220	BOTTOM	1467.5	5380				
1230	BOTTOM	1680	5830				
1235.62	BOTTOM	1590	5820				
1235.62	FLOW	1802.5	6150	24.1	3	605	28.7
1240	BOTTOM	1647	5380				
1250	BOTTOM	1475	5260				
1260	BOTTOM	1990	6440				
1267.44	BOTTOM	1815	6330				
1267.44	FLOW	1782.5	5980	25.2	4.2	736	35.0
1270	BOTTOM	1742.5	6090				
1280	BOTTOM	1945	6320				
1290	BOTTOM	1955	6770				
1299.37	BOTTOM	1880	6980				
1299.37	FLOW	1857.5	6180	28.22	5.36	855	37.4
1310	BOTTOM	1946.25	6500				
1320	BOTTOM	2020	6620				
1330	BOTTOM	1852.5	6210				
1331.18	FLOW	1741.25	6130	33.95	5.5	915	32.2
1340	BOTTOM	1332.5	4804				
1350	BOTTOM	1600	5260				
1353	FLOW	1681	5830	34.2	6.06	970	34.5
1360	BOTTOM	1385	5030				
1363.18	BOTTOM	1460	5320				
1363.18	FLOW	1677.5	5780	34.2	6.12	945	33.7

Not Representative - Added makeup water during drilling
Flow test water quality not representative- added makeup water during drilling

ft als – feet above land surface
gpm – gallons per minute

mg/l – milligrams per liter
µS/cm – microsiemens Per centimeter

TABLE 4
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-10 Reverse Air Drilling Water Quality and Flow Test Summary

		Water Quality Results		Flow Test Results			
Drilled Depth (ft bls)	Sample From	Chloride (mg/L)	Spec. Conductivity (uS/cm)	Static WL (ft als)	Flowing WL (ft als)	Flow Rate Average (gpm)	Specific Capacity (gpm/ft)
1003	FLOW	1950	6730	40.0	23	300	17.6
1010	BOTTOM	2230	6500				
1014.82	BOTTOM	2325	7040				
1014.82	FLOW	2125	6680	39.7	5.1	1775	51.3
1020	BOTTOM	1970	6180				
1030	BOTTOM	2085	6340				
1032	FLOW	--	6520	40.3	5.7	2200	63.5
1040	BOTTOM	2170	6450				
1046.82	BOTTOM	2000	6520				
1046.82	FLOW	2050	6620	40.0	8.3	2765	87.2
1050	BOTTOM	2090	6420				
1060	BOTTOM	2040	6610				
1070	BOTTOM	2130	6590				
1078.72	BOTTOM	2275	6720				
1078.72	FLOW	2270	7070	39.4	12.8	2819	110.5
1080	BOTTOM	2320	7030				
1090	BOTTOM	2370	7230				
1100	BOTTOM	2275	7030				
1109.92	BOTTOM	2380	7100				
1109.92	FLOW	2270	7270	37.65	12.83	2866	115.5
1120	BOTTOM	2855	8110				
1130	BOTTOM	2540	7980				
1140	BOTTOM	2660	8270				
1142.16	BOTTOM	2510	7990				
1142.16	FLOW	2385	7400	38.2	13.4	3330	134.3
1150	BOTTOM	2540	7600				
1160	BOTTOM	2160	7770				
1170	BOTTOM	2120	7580				
1174.76	BOTTOM	2180	7560				
1174.76	FLOW	2420	7650	37.6	15.1	3061	136.0
1180	BOTTOM	2120	7640				
1190	BOTTOM	2210	7980				
1194	BOTTOM	2420	8000				
1200	BOTTOM	2260	8140				
1206.65	BOTTOM	2250	7970				
1206.65	FLOW	2410	7660	37.4	14.9	3292	146.3
1210	BOTTOM	2470	7700				
1220	BOTTOM	2480	7560				
1230	BOTTOM	2570	7620				
1238.59	BOTTOM	2470	7920				
1238.59	FLOW	2350	7680	37.5	20.2	3644	210.6
1240	BOTTOM	2550	7160				
1250	BOTTOM	2440	8220				
1260	BOTTOM	2560	8240				
1270.79	BOTTOM	2430	8280				
1270.79	FLOW	2712	8000	37	22.6	3747	260.2
1280	BOTTOM	2490	7940				
1290	BOTTOM	2290	7560				
1300	BOTTOM	2880	9080				
1302.21	BOTTOM	3190	9330				
1302.21	FLOW	2735	8000	37	23	3785	270.4
1310	BOTTOM	2620	8950				
1320	BOTTOM	2710	8880				
1330	BOTTOM	2700	8740				
1334.24	BOTTOM	2640	8930				
1334.24	FLOW	3095	8270	36.9	23	3775	271.6
1340	BOTTOM	2830	9110				
1345	BOTTOM	3080	10008				
1350	BOTTOM	3460	10500				
1350	FLOW	2845	8350	36.7	21.7	3896	259.7
1350*	FLOW	--	9650	35.75	28.8	6.95	710

gpm – gallons per minute
ft als – feet above land surface
*POST BOREHOLE REAMING TO 17.5”

mg/L – milligrams per liter
µS/cm – microsiemens Per centimeter

TABLE 5
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-9 Grout Summary for 17.4-inch & 14-inch Final Casing

Grout Stage	Date	Method	% Bentonite Added	Barrels Pumped	No. Sacks Portland Cement	Tagged Depth - before (feet BLS)	Tagged Depth - after (feet BLS)	Vertical Lift (feet)
1	9/27/14	Pressure	0%	3	14	1052	1049.5	2.5
2	9/29/14	Tremmie	0%	5	24	1049.5	1032	17.5
3	9/29/14	Tremmie	0%	19	90	1032	986	46
4	9/30/14	Tremmie	0%	17	81	986	938	48
5	10/1/14	Tremmie	6%	51	166	938	671	267
6	10/2/14	Tremmie	6%	54	175	671	371	300
7	10/3/14	Tremmie	6%	72	234	371	91	280
8	10/4/14	Tremmie	6%	48	156	91	4	87
TOTAL SACKS					**940**			

ft BLS – feet below land surface

TABLE 6
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-10 Grout Summary for 17.4-inch & 14-inch Final Casing

Grout Stage	Date	Method	% Bentonite Added	Barrels Pumped	No. Sacks Portland Cement	Tagged Depth - before (feet BLS)	Tagged Depth - after (feet BLS)	Vertical Lift (feet)
1	3/19/15	Pressure	0%	3	14	1005	1005	0
2	3/20/15	Tremmie	0%	23	109	1005	972.6	32.4
3	3/21/15	Tremmie	0%	12	57	972.6	911.3	61.3
4	3/23/15	Tremmie	6%	41	133	911.3	699.3	189.4
5	3/24/15	Tremmie	6%	40	130	699.3	491.2	208.1
6	3/25/15	Tremmie	6%	55	179	491.2	189.9	212
7	3/26/15	Tremmie	6%	87	282	189.9	0.5	301.3
TOTAL SACKS					**905**			

ft BLS – feet below land surface

TABLE 7
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-10 Gravel and Grout Summary for Borehole Back Plug

Lift Stage	Date	Method	% Bentonite Added	Barrels	No. Sacks Portland Cement	Pea Gravel (YDS^3)	Pre-Lift Tagged Depth (feet BLS)	Post-Lift Tagged Depth (feet BLS)	Vertical Lift (feet)
1	2/11/2015	GROUT	0%	52	**247**		1312	1310	2
2	2/11/2015	GROUT	0%	82	**390**		1310	1309.5	0.5
3	2/12/2015	GROUT	0%	43	**205**		1309.5	1288	21.5
4	2/12/2015	GRAVEL		76.5		**15.9**	1288	1284	4
5	2/13/2015	GRAVEL		28		**5.8**	1284	--	
6	2/16/2015	GRAVEL		23		**4.78**	--	1246	38
7	2/23/2015	GROUT	6%	51	**166**		1246	1214.9	31.2
8	2/23/2015	GROUT	6%	51.4	**167**		1214.9	1191	23.9
9	2/24/2015	GROUT	6%	45	**146**		1191	1178	13
10	2/27/2015	GRAVEL		71		**14.8**	1178	1153	25
11	3/2/2015	GROUT	0%	40	**130**		1153	1142	11
12	3/3/2015	GROUT	6%	13	**42**		1142	1126	16
13	3/3/2015	GRAVEL		17		**3.5**	1126	1125.6	1.6
14	3/4/2015	GROUT	6%	15	**49**		1125.6	1124	0.4
15	3/5/2015	GRAVEL		13		**2.7**	1125.6	1120	5.6
16	3/5/2015	GROUT	0%	14	**67**		1120	1113	7
17	3/5/2015	GROUT	0%	14	**67**		1113	1113	0
18	3/6/2015	GROUT	0%	7	**33**		1113	1113	0
TOTAL					**1708**	**47.5**			

feet BLS – feet below land surface

TABLE 8
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLSPW-9 & PW-10
PW-9 Step Drawdown Test Summary

Performed on 11/19/2014	Step 1 520 gpm		Step 2 965 gpm		Step 3 1,200 gpm		Step 4 1,505 gpm		Step 5 1,675 gpm	
Drawdown Data	*Hour 1*	*Hour 2*	*Hour 1*	*Hour 2*	*Hour 1*	*Hour 2*	*Hour 1*	*Hour 2*	*Hour 1*	*Hour 2*
Cumulative Pumping Duration (min)	60	120	180	240	300	360	420	490	540	600
Static Water Level (feet relative to land surface)	40.16		40.16		40.16		40.16		40.16	
Pumping Water Level (feet relative to land surface)	+24.83		+11.08		+3.83		-6.55		-12.28	
Maximum Drawdown (feet)	15.33		29.08		36.33		46.71		52.44	
Specific Capacity (gpm/ft)	33.9		33.2		33.0		32.2		31.9	
Water Quality Data										
Temperature (deg. C)	26.7	26.7	26.6	26.6	26.2	26.1	26.2	26.1	26.5	26.5
Specific Conductance (mS/cm)	5.63	5.30	5.29	5.52	5.57	5.55	5.67	5.67	5.85	5.85
Total Dissolved Solids (ppt)	3.65	3.44	3.43	3.58	3.62	3.60	3.68	3.68	3.80	3.80
pH	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Salinity (ppt)	2.9	2.8	2.8	3.0	3.0	3.0	3.1	3.1	3.2	3.2
Dissolved Oxygen (mg/L)	0.13	0.08	0.04	0.03	0.03	0.03	0.04	0.04	0.03	0.03
Hydrogen Sulfide (ppm)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.0	2.5
Total Iron (ppm)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Soluble Iron (ppm)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Turbidity (NTU)	0.63	0.97	1.47	1.70	0.07	0.10	0.18	0.28	0.18	0.20
Chloride (mg/L)	1,507.5		1,565		1,560		1,585		1,585	
SDI#1	--	0.4	--	0.4	--	0.5	--	0.4	--	0.7
SDI#2	0.3	0.3	0.2	0.2	0.4	0.3	0.5	0.4	0.6	0.3
Sand Content (ppm)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

gpm - gallons per minute
als - above land surface
gpm/ft - gallons per minute per foot of drawdown

µS/cm - microsiemens per cm
ppt - parts per thousand
mg/L - milligrams per liter

ppm - parts per million
ntu - nephelometric turbidity unit

TABLE 9
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-10 Step Drawdown Test Summary

Performed on 5/6/2015	Step 1 580 gpm		Step 2 970 gpm		Step 3 1,220 gpm		Step 4 1,385 gpm		Step 5 1,684 gpm		Step 6 2,485 gpm	
Drawdown Data	*Hour 1*	*Hour 2*	*Hour 1*	*Hour 2*	*Hour 1*	*Hour 2*	*Hour 1*	*Hour 2*	*Hour 1*	*Hour 2*	*Hour 1*	*Hour 2*
Cumulative Pumping Duration (min)	60	120	180	240	300	360	420	480	540	560	600	--
Static Water Level (feet relative to land surface)	37.20		37.20		37.20		37.20		37.20		37.20	
Pumping Water Level (feet relative to land surface)	36.50		35.95		34.80		34.20		32.20		26.85	
Maximum Drawdown (feet)	0.70		2.25		2.40		3.00		5.00		10.35	
Specific Capacity (gpm/ft)	**828.6**		**776.0**		**508.3**		**461.6**		**336.8**		**240.1**	
Water Quality Data												
Temperature (deg. C)	26.6	26.6	26.5	26.6	26.7	26.6	26.6	26.9	26.6	26.9	26.7	26.8
Specific Conductance (mS/cm)	10.04	10.02	10.23	10.80	10.20	9.98	10.13	10.15	10.42	10.15	10.38	10.36
Total Dissolved Solids (mg/L)	8.43	8.70	8.43	8.56	8.20	8.49	8.33	8.55	8.28	8.40	8.71	8.65
pH	6.73	6.67	6.48	6.40	7.00	6.57	6.97	6.96	7.00	6.82	6.62	6.85
Salinity (ppt)	5.4	5.6	5.8	5.7	5.7	5.6	5.7	5.7	5.9	5.7	5.8	5.8
Dissolved Oxygen (mg/L)	0.17	0.06	0.04	0.03	0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00
Hydrogen Sulfide (ppm)	6.0	6.5	7.0	6.0	7.0	7.0	7.0	7.0	8.0	--	9.0	9.0
Total Iron (ppm)	0.1	0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	--	<0.1	<0.1
Soluble Iron (ppm)	0.1	0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	--	<0.1	<0.1
Turbidity (NTU)	0.14	0.15	0.01	0.07	0.04	0.01	0.01	0.01	0.02	0.01	0.02	0.01
Chloride (mg/L)	2,690		2,850		2,880		2,890		2,950		2,950	
SDI#1	2.34	2.3	2.5	2.4	2.4	2.4	2.4	2.3	2.4		2.2	
SDI#2	2.1	2.1	2.4	2.4	2.4	2.4	2.5	2.4	2.5		2.3	
Sand Content (ppm)	<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	

gpm - gallons per minute
als - above land surface
gpm/ft - gallons per minute per foot of drawdown
µS/cm - microsiemens per cm
ppt - parts per thousand
mg/L - milligrams per liter
ppm - parts per million
ntu - nephelometric turbidity units

TABLE 10
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
Summary of Laboratory Water Quality Analyses

PARAMETER	UNITS	PW-9	PW-10	MCL
PRIMARY DRINKING WATER STANDARDS				
INORGANIC CONTAMINANTS				
Antimony	mg/L	0.0005U	0.00050	0.006
Asbestos	MFL	ND	ND	7
Arsenic	mg/L	0.0005U	0.0010	0.010
Barium	mg/L	0.037	0.068	2
Beryllium	mg/L	0.00050U	0.00050	0.004
Cadmium	mg/L	0.00050U	0.00050	0.005
Chromium	mg/L	0.0025U	0.0025	0.1
Cyanide	mg/L	0.0050U	0.0050	0.2
Fluoride	mg/L	2.4U	0.56	4
Lead	mg/L	0.0005U	0.00050U	0.015
Mercury	ug/L	0.10U	0.10U	2.0
Nickel	mg/L	0.0025U	0.0025U	0.1
Nitrate as N	mg/L	0.025U	0.025U	10
Nitrite as N	mg/L	0.025U	0.025U	1
Selenium	mg/L	0.0005U	0.00050U	0.05
Sodium	mg/L	**930**	**1690**	160
Thallium	mg/L	0.0005U	0.00050U	0.002
Chlorite	ug/L	100	28.4U	1000
Bromate	ug/L	**50**	8.0U	10
Monochloroacetic Acid	ug/L	0.61U	0.61U	60
Dichloroacetic Acid	ug/L	0.61U	0.61U	60
Trichloroacetic Acid	ug/L	0.61U	0.61U	60
Monobromoacetic Acid	ug/L	0.61U	0.61U	60
Dibromoacetic Acid	ug/L	0.61U	0.61U	60
Haloacetic Acids (Total)	ug/L	0.61U	0.61U	60
Chloroform	ug/L	0.25U	0.25U	80
Bromoform	ug/L	0.25U	0.25U	80
Bromodichloromethane	ug/L	0.25U	0.25U	80
Dibromochloromethane	ug/L	0.25U	0.25U	80
Total Trihalomethanes (Calc.)	ug/L	0.25U	0.25U	80
VOLATILE ORGANICS				
1,1-Dichloroethene	ug/L	0.25U	0.25U	7
1,1,1-Trichloroethane	ug/L	0.25U	0.25U	200
1,1,2-Trichloroethane	ug/L	0.25U	0.25U	5
1,2-Dichloroethane	ug/L	0.25U	0.25U	3
1,2-Dichloropropane	ug/L	0.25U	0.25U	5
1,2,4-Trichlorobenzene	ug/L	0.25U	0.25U	70
Benzene	ug/L	0.25U	0.25U	1.0
Carbon tetrachloride	ug/L	0.25U	0.25U	3
cis-1,2-Dichloroethene	ug/L	0.25U	0.25U	70
Ethylbenzene	ug/L	0.25U	0.25U	700
Chlorobenzene	ug/L	0.25U	0.25U	100
1,2-Dichlorobenzene	ug/L	0.25U	0.25U	600
1,4-Dichlorobenzene	ug/L	0.25U	0.25U	75
Methylene Chloride	ug/L	0.25U	0.44U	5
Styrene	ug/L	0.25U	0.25U	100
Tetrachloroethene	ug/L	0.25U	0.25U	3
Toluene	ug/L	0.25U	0.25U	1,000
Trichloroethene	ug/L	0.25U	0.25U	3
Vinyl chloride	ug/L	0.25U	0.25U	1
Xylene (Total)	ug/L	0.25U	0.25U	10,000
trans-1,2-Dichloroethene	ug/L	0.25U	0.25U	100
SYNTHETIC ORGANICS				
bis(2-Ethylhexyl)adipate	ug/L	0.36U	0.37U	400
bis(2-Ethylhexyl)phthalate	ug/L	0.47U	0.48U	6
Alachlor	ug/L	0.032U	0.033U	2

TABLE 10
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
Summary of Laboratory Water Quality Analyses

PARAMETER	UNITS	PW-9	PW-10	MCL
Atrazine	ug/L	0.020U	0.020U	3
Chlordane (Technical)	ug/L	0.044U	0.045U	2
Endrin	ug/L	0.0019U	0.0019U	2
Heptachlor	ug/L	0.0057U	0.0058U	0.4
gamma-BHC (Lindane)	ug/L	0.0028U	0.0029U	0.2
Heptachlor epoxide	ug/L	0.0028U	0.0029U	0.2
Hexachlorobenzene	ug/L	0.010U	0.011U	1
Hexachlorocyclopentadiene	ug/L	0.030U	0.031U	50
Methoxychlor	ug/L	0.013U	0.013U	40
PCB, Total	ug/L	0.075U	0.077U	0.5
Simazine	ug/L	0.042U	0.042U	4
Toxaphene	ug/L	0.57U	0.58U	3
2,4,5-TP (Silvex)	ug/L	0.16U	0.16U	50
2,4-D	ug/L	0.081U	0.081U	70
Dalapon	ug/L	0.89U	0.89U	200
Dinoseb	ug/L	0.16U	0.16U	7
Pentachlorophenol	ug/L	0.030U	0.030U	1
Picloram	ug/L	0.094U	0.094U	500
Carbofuran	ug/L	0.75U	0.75U	40
Oxamyl	ug/L	0.47U	0.47U	200
Glyphosate	ug/L	5.4U	5.4U	700
Endothall	ug/L	4.1U	4.1U	100
Diquat	ug/L	0.15U	0.15U	20
Benzo(a)pyrene	ug/L	0.018U	0.018U	0.2
1,2-Dibromo-3-chloropropane	ug/L	0.0052U	0.0051U	0.2
Dibromoethane (EDB)	ug/L	0.0066U	0.0065U	0.02
SECONDARY DRINKING WATER STANDARDS				
Aluminum	mg/L	0.050U	0.050U	0.2
Chloride	mg/L	**1580**	**2710**	250
Copper	mg/L	0.0005U	0.00050U	1
Iron	mg/L	0.025 I	0.020U	0.3
Manganese	mg/L	0.0025U	0.025U	0.05
Silver	mg/L	0.0025U	0.0025 U	0.1
Sulfate	mg/L	**488**	**558**	250
Zinc	mg/L	0.010U	0.010U	5
Apparent Color	U	5.0U	-	15
Threshold Odor Number	T.O.N	**67**	**100**	3
Foaming Agents (Surfactants)	mg/L	0.059U	0.059U	0.5
pH at 25 Degrees C	SU	-	6.8	6.5-8.5
Total Dissolved Solids	mg/L	**3210**	**5660**	500
RADIONUCLIDES				
Gross Alpha	pCi/L	9.62 ± 0.971	**60.3 ± 5.90**	15
Radium-226	pCi/L	**7.23 ± 1.68**	**40.5 ± 4.35**	5
Radium-228	pCi/L	1.10 ± 0.434	0.648U ± 0.326	5

NOTES:
MCL = Maximum Contaminant Level
ND = Not Detected
ug/L = micrograms per liter
mg/L = milligrams per liter
S.U. = standard units
C.U.= Color Units
T.O.N = Threshold Odor Number
pCi/L = picocuries per liter
J = Estimated value
U = reported value is below maximum detection limit
I = reported value is between the laboratory method detection limit and the laboratory practical quantitation limit
Q = Sample held beyond accepted hold time
C = Sample confirmed by second analysis
BOLD: The sample exceeded the maximum contaminant level for that parameter

APPENDIX A
DRILLER'S WELL COMPLETION REPORT
&
CONTRACTOR SUBMITTALS

PBCWUD WTP II Well PW-9

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 3492-2014 *CUP/WUP Number 50-06857w *DID Number _____ 62-524 Delineation No. _____

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

3.*Owner's Name Palm Beach County Water Utilities Department 4.*Completion Date March 2015 5. Florida Unique ID _____

6. 39363 Hooker Highway, Belle Glade Fl 33430
*Well Location - Address, Road Name or Number, City, ZIP

7.*County Palm Beach *Section 18 Land Grant _____ *Township 43S *Range 37E

8. Latitude N 869.743.526 Longitude E 762.657.015

9. Data Obtained From: ☐ GPS ☐ Map ☑ Survey Datum: ____ NAD 27 ____ 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 +39 ft. Measured Pumping Water Level _____ ft. After _____ Hours at _____ GPM

14.*Measuring Point (Describe) Land surface Which is ____ ft. ____ Above ____ Below Land Surface *Flowing: ☐ Yes ☐ No

15.*Casing Material: ☑ Black Steel ☐ Galvanized ☑ PVC ☐ Stainless Steel ☐ Not Cased ☐ Other _____

16.*Total Well Depth 1350 ft. Cased Depth ____ ft. *Open Hole: From ____ To ____ ft. *Screen: From ____ To ____ ft. Slot Size ____

17.*Abandonment: ☐ Other (Explain) _____

From ____ ft. To ____ ft. No. of Bags ____ Seal Material (Check One): ☐ Neat Cement ☐ Bentonite Other _____
From ____ ft. To ____ ft. No. of Bags ____ Seal Material (Check One): ☐ Neat Cement ☐ Bentonite Other _____
From ____ ft. To ____ ft. No. of Bags ____ Seal Material (Check One): ☐ Neat Cement ☐ Bentonite Other _____
From ____ ft. To ____ ft. No. of Bags ____ Seal Material (Check One): ☐ Neat Cement ☐ Bentonite Other _____
From ____ ft. To ____ ft. No. of Bags ____ Seal Material (Check One): ☐ Neat Cement ☐ Bentonite Other _____

18.*Surface Casing Diameter and Depth:

Dia 36 in. From 0 ft. To 20 ft. No. of Bags ____ Seal Material (Check One): ☐ Neat Cement ☐ Bentonite ☐ Other ____
Dia ____ in. From ____ ft. To ____ ft. No. of Bags ____ Seal Material (Check One): ☐ Neat Cement ☐ Bentonite ☐ Other ____

19.*Primary Casing Diameter and Depth:

Dia 17.4 in. From 0 ft. To 120 ft. No. of Bags 237 Seal Material (Check One): ☑ Neat Cement ☐ Bentonite ☐ Other 6%
Dia 14 in. From 120 ft. To 1052 ft. No. of Bags 713 Seal Material (Check One): ☑ Neat Cement ☐ Bentonite ☐ Other 6%
Dia ____ in. From ____ ft. To ____ ft. No. of Bags ____ Seal Material (Check One): ☐ Neat Cement ☐ Bentonite ☐ Other ____
Dia ____ in. From ____ ft. To ____ ft. No. of Bags ____ Seal Material (Check One): ☐ Neat Cement ☐ Bentonite ☐ Other ____
Dia ____ in. From ____ ft. To ____ ft. No. of Bags ____ Seal Material (Check One): ☐ Neat Cement ☐ Bentonite ☐ Other ____

20.*Liner Casing Diameter and Depth:

Dia ____ in. From ____ ft. To ____ ft. No. of Bags ____ Seal Material (Check One): ☐ Neat Cement ☐ Bentonite ☐ Other ____
Dia ____ in. From ____ ft. To ____ ft. No. of Bags ____ Seal Material (Check One): ☐ Neat Cement ☐ Bentonite ☐ Other ____
Dia ____ in. From ____ ft. To ____ ft. No. of Bags ____ Seal Material (Check One): ☐ Neat Cement ☐ Bentonite ☐ Other ____

21. *Telescope Casing Diameter and Depth:

Dia 30 in. From 0 ft. To 157 ft. No. of Bags 295 Seal Material (Check One): ☑ Neat Cement ☐ Bentonite ☐ Other ____
Dia 20 in. From 140 ft. To 936 ft. No. of Bags 911 Seal Material (Check One): ☑ Neat Cement ☐ Bentonite ☐ Other ____
Dia ____ in. From ____ ft. To ____ ft. No. of Bags ____ Seal Material (Check One): ☐ Neat Cement ☐ Bentonite ☐ Other ____

22. Pump Type (If Known):
☐ Centrifugal ☐ Jet ☑ Submersible ☐ Turbine
Horsepower 60 Pump Capacity (GPM) 950
Pump Depth 80 ft. Intake Depth 84 ft.

23. Chemical Analysis (When Required):
Iron ____ ppm Sulfate ____ ppm Chloride ____ ppm
☐ Laboratory Test ☐ Field Test Kit

24. Water Well Contractor:

*Contractor Name David Webb *License Number 2040 E-mail Address allwebbs@allwebbs.com

*Contractor's Signature _____ *Driller's Name (Print or Type) David Robbers
(I certify that the information provided in this report is accurate and true.)

*Permit No. 3492-2014

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
				see attached lithology.

Comments:

***Detailed Site Map of Well Location**

N

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 3493-2014 *CUP/WUP Number 50-06857w *DID Number ______ 62-524 Delineation No. ______

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

3.*Owner's Name Palm Beach County Water Utilities 4.*Completion Date ______ 5. Florida Unique ID ______

6. 39015 Hooker Highway Belle glade FL 33430
*Well Location - Address, Road Name or Number, City, ZIP

7.*County Palm Beach *Section 18 Land Grant 43S *Township 37E *Range ______

8. Latitude N869.744.661 Longitude E 762.459.357

9. Data Obtained From: [ ] GPS [ ] Map [✓] Survey Datum: ______ NAD 27 ______ 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 +39 ft. Measured Pumping Water Level ______ ft. After ______ Hours at ______ GPM

14.*Measuring Point (Describe) Land surface Which is ______ ft. ______ Above ______ Below Land Surface *Flowing: [ ] Yes [ ] No

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

16.*Total Well Depth 1105 ft. Cased Depth 1002 ft. *Open Hole: From 1002 To 1105 ft. *Screen: From ______ To ______ ft. Slot Size ______

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

From	To	No. of Bags	Seal Material (Check One):			
___ 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):		
36	0	20		[ ] 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):		
17.4	0	120	237	[✓] Neat Cement	[ ] Bentonite	[ ] Other 6%
14	120	1002	668	[ ] Neat Cement	[ ] Bentonite	[ ] Other 6%
				[ ] 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):		
				[ ] Neat Cement	[ ] Bentonite	[ ] Other
				[ ] 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):		
30	0	160	300	[✓] Neat Cement	[ ] Bentonite	[ ] Other
20	140	975	1291	[✓] Neat Cement	[ ] Bentonite	[ ] Other
				[ ] Neat Cement	[ ] Bentonite	[ ] Other

22. Pump Type (If Known):
[ ] Centrifugal [ ] Jet [✓] Submersible [ ] Turbine
Horsepower 60 Pump Capacity (GPM) 950
Pump Depth 80 ft. Intake Depth 84 ft.

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

24. Water Well Contractor:
*Contractor Name David Webb *License Number 2040 E-mail Address allwebbs@allwebbs.com

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

*Permit No._____

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

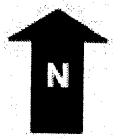
***DRILL CUTTINGS LOG** (Examine cuttings every 20 ft. or at formation changes. Note cavities and depth to producing zone. Grain Size: F=Fine, M=Medium, and C=Coarse) See attached

From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material
From	ft.	To	ft.	Color		Grain Size (F, M, C)		Material

Comments: _____

***Detailed Site Map of Well Location**

See attached.



APPENDIX B
LITHOLOGIC LOG

PBCWUD WTP 11 UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 & PW-10 PW-9 Lithologic Log	
Depth (feet bls)	Lithologic Description
0 – 10	SAND AND SHELL (50%), yellowish gray (5Y 8/1), unconsolidated, fine sand to medium sand sized quartz and shell grains, sub-angular to angular; LIMEMUD (50%), soft, moderate to poorly cohesive, minor shell fragments, low permeability.
10 – 30	SAND AND SHELL (60%), yellowish gray (5Y 8/1), unconsolidated, fine sand to medium sand sized quartz; COQUINA (40%), yellowish gray (5Y 8/1), moderately soft, poorly cemented, abundant shell fragments, moderate permeability.
30 – 50	SAND AND SHELL (70%), yellowish gray (5Y 8/1), unconsolidated, fine sand to medium sand sized quartz and phosphate grains, undifferentiated shell; SANDSTONE (30%), medium light gray (N6) to very light gray (N8), moderately hard, moderately well cemented, very fine sand to fine sand sized quartz and carbonate grains.
50 – 60	SAND AND SHELL (>90%), yellowish gray (5Y 8/1), unconsolidated, fine sand to medium sand sized quartz grains and undifferentiated shell fragments; SANDSTONE (<10%), same as above.
60 – 86	COQUINA (70%), light gray (N7) to medium gray (N5), medium sand to coarse sand shell fragments, moderately hard, moderate to moderately well cemented, minor phosphate grains, minor moldic porosity; SAND AND SHELL (30%), white (N9) to very light gray (N8) to very pale orange (10YR 8/2), unconsolidated, fine sand sized quartz grains and undifferentiated shell fragments.
86 – 95	SANDSTONE (100%), white (N9) to very light gray (N8), poorly consolidated, fine sand to medium sand sized quartz, moderate fine sand sized phosphate grains, trace undifferentiated shell fragments.
95 – 106	SANDSTONE (90%), white (N9) to very light gray (N8), poor to moderately consolidated, moderately soft, fine sand to medium sand sized quartz, moderate fine sand sized phosphate grains, trace undifferentiated shell fragments; SHELL (10%), very light gray (N8) to medium light gray (N6) to medium bluish gray (5B 5/1), unconsolidated, undifferentiated shell fragments.
106 – 125	SANDSTONE (70%), white (N9) to very light gray (N8), poor to moderately consolidated, moderately hard, fine sand to medium sand sized quartz, moderate fine sand sized phosphate grains, trace undifferentiated shell fragments; SHELL (30%), same as above. Overall, shell content increases with depth.
125 – 147	SANDSTONE (>65%), light olive gray (5Y 5/2) to olive gray (5Y 4/1), moderately hard, moderate to poor cementation, very fine sand to fine sand sized quartz grains, minor phosphate grains; SANDSTONE (30%), white (N9) to very light gray (N8), moderately hard, moderately well cemented, fine sand to medium sand sized quartz, moderate fine sand sized phosphate grains; SHELL (<5%), same as above.
147 – 160	SANDSTONE (85%), light olive gray (5Y 5/2) to olive gray (5Y 4/1), moderate hardness, moderate to poor cementation, very fine sand to fine sand sized quartz grains, minor phosphate grains; SANDSTONE (15%), very light gray (N8) to medium light gray (N6), moderate hardness, moderate cementation, carbonate cementing, fine sand to medium sand sized quartz and phosphate grains, minor shell fragments cemented.
160 – 190	PHOSPHATIC SAND (70%), light gray (N7) to medium light gray (N6), unconsolidated, silt to very fine sand sized phosphate and quartz grains; CLAY (30%), light olive gray (5Y 6/1), moderately poor cohesiveness, moderately low porosity.
190 – 233	CLAY (100%), olive gray (5Y 3/2) to grayish olive (10Y 4/2), unconsolidated, cohesive

PBCWUD WTP 11 UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 & PW-10 PW-9 Lithologic Log	
Depth (feet bls)	Lithologic Description
	to very cohesive, minor silt sized phosphate grains, low porosity.
233 – 246	PHOSPHATIC SAND (100%), medium light gray (N6), unconsolidated, very fine to silt sized phosphate and quartz grains.
246 – 280	CLAY (85%), olive gray (5Y 3/2), unconsolidated, cohesive, minor silt sized phosphate grains, low porosity; PHOSPHATIC SAND (10%), medium light gray (N6), unconsolidated, silt to very fine sand sized phosphate and quartz grains; SHELL (5%), very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments.
280 – 303	CLAY (100%), olive gray (5Y 3/2) to grayish olive green (5GY 3/2), semiconsolidated, cohesive to very cohesive, minor silt sized phosphate grains, low porosity.
303 – 331	CLAY (70%), light olive gray (5Y 6/1) to olive gray (5Y 3/2), semiconsolidated, cohesive, moderate silt sized phosphate grains, low porosity; PHOSPHATIC SAND (30%) medium light gray (N6), unconsolidated, very fine to silt sized phosphate and quartz grains, trace undifferentiated shell fragments.
331 – 335	SAND (80%), very light gray (N8) to medium light gray (N5), unconsolidated, medium sand to coarse sand sized quartz grains, minor phosphate grains and trace undifferentiated shell fragments, moderately well sorted; CLAY (20%), same as above.
335 – 413	CLAY (80%), light olive gray (5Y 5/2) to olive gray (5Y 3/2), semiconsolidated, very cohesive to cohesive, minor silt sized phosphate grains, low porosity; PHOSPHATIC SAND (20%) medium light gray (N6), unconsolidated, very fine to silt sized phosphate and quartz grains.
413 – 420	LIMEMUD (50%), white (N9) to yellowish gray (5Y 7/2), poorly cohesive, moderate silt sized phosphate grains; LIMESTONE (50%), yellowish gray (5Y 8/1), soft hardness, poor cementation, silt to very fine sand sized phosphate, quartz grains and undifferentiated shell fragments.
420 – 454	LIMESTONE (40%), yellowish gray (5Y 8/1) to light olive gray (5Y 6/1), soft to moderate hardness, poor to moderate cementation, silt to very fine sand sized carbonate, phosphate and quartz grains, abundant shell fragments; SHELL (40%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated; LIMEMUD (20%), white (N9), to light olive gray (5Y 6/1), poorly cohesive, minor silt sized phosphate grains.
454 – 461	CLAY (100%), olive gray (5Y 3/2) to dark greenish gray (5GY 4/1), consolidated, very cohesive, low porosity, trace phosphate grains.
461 – 487	LIMESTONE (40%), yellowish gray (5Y 8/1) to light olive gray (5Y 6/1), soft to moderate hardness, poor to moderate cementation, silt to very fine sand sized carbonate, phosphate and quartz grains, abundant shell fragments; SHELL (40%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments; LIMEMUD (20%), white (N9), to light olive gray (5Y 6/1), poorly cohesive; PHOSPHATIC SAND (5%), black (N1), unconsolidated, silt to coarse sand sized grains, sub-rounded to rounded.
487 – 502	LIMEMUD (60%), white (N9), poorly cohesive, minor silt sized phosphate grains; SHELL (40%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments.
502 – 513	LIMESTONE (60%), yellowish gray (5Y 8/1), soft to moderate hardness, poor to moderate cementation, silt to very fine sized phosphate and quartz grains, abundant undifferentiated shell fragments; LIMEMUD (20%), white (N9) to yellowish gray (5Y

PBCWUD WTP 11 UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 & PW-10 PW-9 Lithologic Log	
Depth (feet bls)	Lithologic Description
	8/1), poorly cohesive, minor silt sized phosphate grain; CLAY (20%), olive gray (5Y 3/2), very cohesive, low porosity.
513 – 534	CLAY (50%), olive gray (5Y 3/2), consolidated, very cohesive, low porosity; SHELL (30%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments; LIMESTONE (10%), yellowish gray (5Y 8/1), soft to moderate hardness, poor to moderate cementation, very fine to silt sized phosphate and quartz grains, abundant shell fragments; LIMEMUD (10%), white (N9) to yellowish gray (5Y 8/1), poorly cohesive, minor silt sized phosphate grains.
534 – 564	CLAY (30%), olive gray (5Y 3/2) to dark greenish gray (5GY 4/1), consolidated, very cohesive very low porosity; LIMEMUD (30%), white (N9) to yellowish gray (5Y 8/1), poorly cohesive, silt sized phosphate grains; LIMESTONE (20%), yellowish gray (5Y 8/1), soft to moderate hardness, poor to moderate cementation, silt to very fine sand sized phosphate grains, abundant undifferentiated shell fragments; PHOSPHATIC SAND (15%), black (N1), unconsolidated, silt to coarse sand sized grains, sub-rounded to rounded; SHELL (5%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments.
564 – 600	LIMEMUD (60%), white (N9) to yellowish gray (5Y 8/1), moderately cohesive, minor silt to very fine sand sized phosphate grains; LIMESTONE (20%), yellowish gray (5Y 8/1), moderate hardness, poor to moderate cementation, silt to very fine sand sized carbonate and phosphate grains, moderate shell fragments; PHOSPHATIC SAND (20%), black (N1), silt to coarse sand sized phosphate grains, sub-rounded to rounded.
600 – 630	LIMEMUD (60%), white (N9) to yellowish gray (5Y 8/1), moderately cohesive, moderate fine sand sized phosphate grains; SHELL (20%), yellowish gray (5Y 8/1), unconsolidated, undifferentiated shell fragments; LIMESTONE (10%), yellowish gray (5Y 8/1), moderate hardness, poor to moderate cementation, silt to very fine sand sized carbonate and phosphate grains; PHOSPHATIC SAND (10%), black (N1), unconsolidated, coarse sand sized phosphate grains, well rounded.
630 – 640	PHOSPHATIC SAND (80%), medium light gray (N6) to black (N1), unconsolidated, silt to very fine sand sized phosphate and quartz grains; LIMEMUD (20%), white (N9) to yellowish gray (5Y 8/1), cohesive, abundant very fine to silt sized phosphate grains.
640 – 648	LIMEMUD (80%), white (N9) to yellowish gray (5Y 8/1), moderate to poorly cohesive, abundant very fine to silt sized phosphate grains; SHELL (20%), yellowish gray (5Y 8/1), unconsolidated, undifferentiated shell fragments.
648 – 695	LIMEMUD (60%), white (N9) to yellowish gray (5Y 8/1), moderate to poorly cohesive, abundant silt to very fine sized phosphate grains; SHELL (20%), yellowish gray (5Y 8/1), unconsolidated, undifferentiated shell fragments; LIMESTONE (20%), white (N9) to yellowish gray (5Y 8/1), poorly lithified, soft hardness, poor cementation, silt to very fine sand sized carbonate and shell fragments.
695 – 704	CLAY (50%), olive gray (5Y 3/2) to dark greenish gray (5GY 4/1), consolidated, moderately cohesive to very cohesive; LIMEMUD (50%), white (N9) to yellowish gray (5Y 8/1), moderately cohesive, silt sized phosphate grains.
704 – 738	LIMEMUD (95%), white (N9) to yellowish gray (5Y 8/1), moderately cohesive; PHOSPHAT SAND (5%), black (N1), unconsolidated, coarse sand sized phosphate grains, well rounded.
738 – 747	LIMEMUD (70%), white (N9) to yellowish gray (5Y 8/1), moderate to poorly cohesive,

PBCWUD WTP 11 UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 & PW-10 PW-9 Lithologic Log	
Depth (feet bls)	Lithologic Description
	abundant silt to very fine sized phosphate grains; LIMESTONE (20%), white (N9) to yellowish gray (5Y 8/1), soft hardness, poor cementation, silt to very fine sand sized carbonate and shell fragments; SHELL (10%), yellowish gray (5Y 8/1), unconsolidated, undifferentiated shell fragments.
747 – 762	LIMEMUD (95%), white (N9) to yellowish gray (5Y 8/1), moderately cohesive; PHOSPHATE GRAINS (5%), black (N1), unconsolidated, coarse sand sized phosphate grains, well rounded.
762 – 784	PHOSPHATIC SAND (60%), medium light gray (N6) to black (N1), unconsolidated, silt to very fine sand sized phosphate and quartz grains; PHOSPHATE GRAINS (20%), black (N1), unconsolidated, coarse sand sized, well rounded; LIMEMUD (20%), white (N9) to yellowish gray (5Y 8/1), cohesive, abundant very fine to silt sized phosphate grains.
784 – 823	SANDSTONE (40%), medium dark gray (N4), poor to moderate hardness, poor to moderate cementation, very fine sand to fine sand sized quartz grains and moderate phosphate grains; LIMESTONE (20%), white (N9) to very light gray (N8), moderately soft, moderately cemented, fine sand to medium sand sized carbonate grains and undifferentiated shell fragments; LIMEMUD (20%), white (N9) to yellowish gray (5Y 8/1), moderate silt to medium sand sized phosphate grains, moderately cohesive; CLAY (20%), olive gray (5Y 3/2), consolidated, moderately cohesive to very cohesive.
823 – 857	LIMESTONE (100%), very pale orange (10YR 8/2), soft hardness, friable, granular texture, calcarenitic, poor cementation, minor very fine sand sized quartz grains, shell fragments cemented, some moldic porosity.
857 – 934	LIMESTONE (50%), very pale orange (10YR 8/2), soft hardness, friable, granular texture, calcarenitic, poor cementation, minor very fine sand sized quartz grains, shell fragments cemented, some moldic porosity. LIMESTONE (50%), very pale orange (10YR 8/2), moderate hardness, granular texture, moderate cementation, some shell fragments cemented, moldic porosity. Overall, limestone interbedded with thin beds of phosphatic limemud.
934 – 950	LIMESTONE (80%), very pale orange (10YR 8/2), moderate hardness, granular texture, moderate cementation, some shell fragments cemented, moldic porosity; LIMESTONE (20%), very pale orange (10YR 8/2), soft hardness, friable, granular texture, poor cementation, minor very fine sand sized quartz grains, shell fragments cemented, some moldic porosity. Overall, calcite replacement present in fossils; Dictyconus foraminifera abundant beginning at 934.
950 – 993	LIMESTONE (70%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), moderate to soft hardness, friable, granular texture, very fine sand to medium sand sized carbonate grains, poor cementation, calcarenitic, intergranular porosity; LIMESTONE (30%), very pale orange (10YR 8/2), moderate hardness, micritic to granular texture, very fine sand sized carbonate grains, moderate cementation, some moldic porosity.
993 – 1012	LIMESTONE (90%), very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), soft hardness, moderately friable, granular texture, calcarenitic, poor to moderate cementation, very fine sand to medium sand sized carbonate grains, undifferentiated fossil/shell fragments, moderate to good intergranular porosity; LIMESTONE (10%), very pale orange (10YR 8/2), moderate hardness, granular to very fine grained texture, moderate to good cementation, minor secondary porosity. Overall, abundant Dictyconus foraminifera.

PBCWUD WTP 11 UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 & PW-10 PW-9 Lithologic Log	
Depth (feet bls)	Lithologic Description
1012 – 1044	LIMESTONE (75%), very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), soft hardness, moderately friable, granular texture, calcarenitic, poor to moderate cementation, very fine sand to medium sand sized carbonate grains, undifferentiated fossil/shell fragments, moderate to good intergranular porosity; LIMESTONE (25%), yellowish gray (5Y 8/1), moderate hardness, granular texture, moderate cementation, very fine sand to fine sand sized carbonate grains and undifferentiated shell fragments, moderate to high intergranular porosity, some moldic porosity.
1044 – 1055	LIMESTONE (100%), very pale orange (10YR 8/2) to grayish orange (10YR 7/4), moderate hardness, granular texture, moderate to good cementation, medium sand to coarse sand sized carbonate grains and undifferentiated shell fragments, minor secondary porosity. Overall, abundant fossil/ shell fragments and Dictyconus foraminifera.
1055 – 1104	LIMESTONE (90%), very pale orange (10YR 8/2), soft hardness, friable, granular texture, calcarenitic, poor to moderate cementation, medium sand to coarse sand sized carbonate grains and undifferentiated shell fragments, intergranular porosity; LIMESTONE (10%), very pale orange (10YR 8/2), moderate hardness, micritic to granular texture, moderate to good cementation, minor secondary porosity.
1104 – 1138	LIMESTONE (100%), yellowish gray (5Y 8/1), soft hardness, friable, granular texture, moderate to poor cementation, fine sand to medium sand sized carbonate grains and abundant undifferentiated fossil/shell fragments, moderate to high intergranular porosity.
1138 – 1140	LIMESTONE (90%), very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), moderate hardness, micritic texture, moderate to good cementation, low porosity. LIMESTONE (10%), yellowish gray (5Y 8/1), soft to moderate hardness, granular texture abundant fossil/shell fragments cemented, intergranular porosity; dictyconus formanifera.
1140 – 1165	LIMESTONE (100%), very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), moderate hardness, moderate cementation, granular texture, calcarenitic, abundant fossil/shell fragments cemented, moderate intergranular porosity.
1165 – 1170	LIMESTONE (100%), very pale orange (10YR 8/2), moderate hardness, moderate to good cementation, fine grained texture, granular texture, fossil/shell fragments cemented, poor porosity, minor secondary porosity.
1170 – 1185	LIMESTONE (100%), yellowish gray (5Y 8/1), moderate hardness, micritic texture, moderately to well cemented, moderate to low porosity, minor moldic porosity.
1185 – 1195	LIMESTONE (100%), yellowish gray (5Y 8/1), moderate to soft hardness, granular texture, moderate to poor cementation, slightly friable, some fossils, moderate permeability.
1195 – 1210	LIMESTONE (100%), very pale orange (10YR 8/2), moderate hardness, granular texture, calcarenitic, moderate cementation, moderate to poor intergranular porosity.
1210 – 1235	LIMESTONE (70%), very pale orange (10YR 8/2), moderate to hard hardness, very fine grained texture, moderate to good cementation, moldic porosity and some secondary dissolution features; LIMESTONE (30%), very pale orange (10YR 8/2), soft hardness, friable, granular texture, calcarenitic, poor cementation, abundant fossil/shell fragments cemented, intergranular porosity; overall high permeability.
1235 – 1250	LIMESTONE (70%), very pale orange (10YR 8/2), moderate to hard hardness, very fine

PBCWUD WTP 11 UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 & PW-10 PW-9 Lithologic Log	
Depth (feet bls)	Lithologic Description
	grained to micritic texture, moderate to good cementation, some secondary dissolution features; LIMESTONE (30%), very pale orange (10YR 8/2) to pale yellowish brown (10YR 6/2), soft hardness, granular texture, poor cementation, fossil/shell fragments cemented, intergranular porosity; overall moderate permeability.
1250 – 1290	LIMESTONE (70%), very pale orange (10YR 8/2), very soft hardness, friable, granular texture, calcarenitic, poor cementation; DOLOMITIC LIMESTONE (30%), very pale orange (10YR 8/2) to medium gray (N5), moderate to hard hardness, very fine grained to microcrystalline texture, good cementation, some secondary dissolution features.
1290 – 1305	LIMESTONE (100%), very pale orange (10YR 8/2), moderate to soft hardness, slightly friable, granular texture, calcarenitic, moderate to poor cementation, dissolution features visible, some secondary porosity.
1305 – 1340	LIMESTONE (90%), very pale orange (10YR 8/2) to pale yellowish brown (10 YR 6/2), moderate hardness, granular texture, calcarenitic, moderate cementation, fossil/shell fragments cemented, intergranular porosity, secondary dissolution features; DOLOMITIC LIMESTONE (10%) very pale orange (10YR 8/2) to medium gray (N5), moderate hardness, micritic texture, moderate to well cementation, low porosity.
1340 – 1350	LIMESTONE (100%), light gray (N7), moderate hardness, very fine grained to micritic texture, well cemented, low permeability. Overall, interbedded with thin layers of marl.
1350 – 1363	LIMESTONE (100%), very pale orange (10YR 8/2) to grayish orange (10YR 7/4), moderate to soft hardness, granular texture, calcarenitic, moderate cementation, fossil/shell fragments cemented, moderate intergranular porosity.

feet. bls - feet below land surface

PBCWUD WTP 11 UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 & PW-10 PW-10 Lithologic Log	
Depth (feet bls)	Lithologic Description
0 – 10	SAND AND SHELL (50%), yellowish gray (5Y 8/1), unconsolidated, fine sand to medium sand sized quartz and shell grains, sub-angular to angular; LIMEMUD (50%), semiconsolidated, soft, moderate to poorly cohesive, minor shell fragments, low permeability. Overall, shell content increases at 5 feet bls; material is local fill.
10 – 26	SAND AND SHELL (70%), yellowish gray (5Y 8/1), unconsolidated to semiconsolidated, fine sand to medium sand sized quartz, undifferentiated shell fragments; LIMESTONE (30%), pale yellowish brown (10YR 6/2), moderately soft, moderate to poorly cemented, abundant shell fragments.
26 – 60	SANDSTONE (80%), medium light gray (N6) to medium dark gray (N4) to medium bluish gray (5B 5/1), moderately hard, well cemented, carbonate cement, very fine sand to fine sand sized quartz, phosphate and moderate carbonate grains; SAND AND SHELL (20%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, fine sand to medium sand sized quartz, phosphate and carbonate grains, undifferentiated shell.
60 – 76	SAND AND SHELL (60%), yellowish gray (5Y 8/1), unconsolidated to semiconsolidated, fine sand to medium sand sized quartz grains and undifferentiated shell fragments; SANDSTONE (40%), pale yellowish brown (10YR 6/2), moderately soft, moderately cemented, very fine sand sized quartz, phosphates and carbonate grains, undifferentiated shell fragments.
76 – 85	SANDSTONE (70%), light olive gray (5Y 6/1) to pale yellowish brown (10YR 6/2), very fine sand to medium sand sized quartz and phosphate grains, undifferentiated shell fragments, moderately hard, moderate to moderately well cemented, minor moldic porosity; SAND AND SHELL (30%), white (N9) to very light gray (N8) to very pale orange (10YR 8/2), unconsolidated to semiconsolidated, fine sand sized quartz grains, phosphate and undifferentiated shell fragments.
85 – 95	SANDSTONE (100%), light olive gray (5Y 6/1) to pale yellowish brown (10YR 6/2), moderately hard to moderately soft, fine sand to medium sand sized quartz and phosphate grains, undifferentiated shell fragments, moderate moldic porosity.
95 – 110	LIMESTONE (50%), white (N9) to very light gray (N8), moderately hard, moderately well carbonate cemented, fine sand to medium sand sized quartz, phosphate grains and undifferentiated shell fragments; SANDSTONE (40%), light olive gray (5Y 5/2) to olive gray (5Y 4/1) to pale yellowish brown (10YR 6/2), moderately hard, moderate to poor cementation, very fine sand to fine sand sized quartz grains and phosphate grains; SHELL (10%), very light gray (N8) to medium light gray (N6) to medium bluish gray (5B 5/1), unconsolidated, undifferentiated shell fragments. Overall, interbedded limestone, sandstone and shell beds.
110 – 140	SHELL (40%), very light gray (N8) to medium light gray (N6) to medium bluish gray (5B 5/1), unconsolidated, undifferentiated shell fragments; SANDSTONE (40%), white (N9) to very light gray (N8), semiconsolidated to moderately consolidated, moderately soft, fine sand to medium sand sized quartz and phosphate grains, undifferentiated shell fragments; SANDSTONE (20%), light olive gray (5Y 5/2) to olive gray (5Y 4/1) to pale yellowish brown (10YR 6/2), moderately hard, moderate to poor cementation, very fine sand to fine sand sized quartz grains and phosphate grains. Overall, interbedded sandstone and shell beds.

PBCWUD WTP 11 UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 & PW-10 PW-10 Lithologic Log	
Depth (feet bls)	Lithologic Description
140 – 160	SANDSTONE (50%), olive gray (5Y 4/1), moderate hardness, moderately well cemented, very fine sand to fine sand sized quartz, minor phosphate grains; SANDSTONE (40%), light olive gray (5Y 5/2) to olive gray (5Y 4/1), friable to semiconsolidated, poor cementation, very fine sand to fine sand sized quartz, abundant phosphate grains; CLAY (10%), olive gray (5Y 4/1), unconsolidated, moderately cohesive, minor silt sized phosphate grains, low porosity.
160 – 183	SANDSTONE (65%), light olive gray (5Y 5/2) to olive gray (5Y 4/1), moderately hard, moderately well cemented, very fine sand to fine sand sized quartz and phosphate grains, abundant gypsum crystals; LIMESTONE (20%), brownish gray (5YR 4/1), moderately hard, well cemented, micritic texture, minor undifferentiated shell fragments; LIMEMUD (15%), brownish gray (5YR 4/1), to yellowish gray (5Y 8/1), unconsolidated to semiconsolidated, very cohesive, low porosity, trace undifferentiated shell fragments. Overall, abundance of Selenite (form of gypsum) present in sandstone.
183 – 190	LIMEMUD (75%), brownish gray (5YR 4/1), to yellowish gray (5Y 8/1), unconsolidated to semiconsolidated, very cohesive, low porosity, trace undifferentiated shell fragments; CLAY (15%), olive gray (5Y 4/1), semiconsolidated, cohesive, minor silt sized phosphate grains, low porosity; LIMESTONE (10%), brownish gray (5YR 4/1), moderately hard, well cemented, micritic texture, minor undifferentiated shell fragments. Overall, interbedded limemud and clay.
190 – 205	CLAY (30%), light olive gray (5Y 6/1) to olive gray (5Y 4/1), unconsolidated, moderate to moderately poor cohesiveness, moderate silt to very fine sand sized quartz, minor silt sized phosphate grains, moderately low porosity.
205 – 243	CLAY (100%), olive gray (5Y 3/2) to grayish olive (10Y 4/2), consolidated, cohesive to very cohesive, minor silt sized phosphate grains, low porosity.
243 – 300	CLAY (70%), olive gray (5Y 3/2) to grayish olive (10Y 4/2), consolidated, cohesive to very cohesive, moderate silt sized phosphate grains, low porosity; PHOSPHATIC SAND (30%), medium light gray (N6), unconsolidated, very fine to silt sized phosphate and quartz grains. Overall, at approximately 270 feet BLS gypsum crystals present as Selenite in clay.
300 – 310	CLAY (85%), olive gray (5Y 3/2) to light olive gray (5Y 6/1), unconsolidated, cohesive, minor silt sized phosphate grains, low porosity; PHOSPHATIC SAND (10%), medium light gray (N6), semiconsolidated, silt to very fine sand sized phosphate and quartz grains; SHELL (5%), very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments.
310 – 343	CLAY (100%), same as above.
343 – 375	CLAY (70%), light olive gray (5Y 6/1) to olive gray (5Y 3/2), unconsolidated, moderately poor cohesiveness, moderate silt sized phosphate grains, low porosity; SAND (30%) medium light gray (N6), unconsolidated, fine sand to coarse sand sized quartz grains, very fine to silt sized phosphate, trace undifferentiated shell fragments. Overall, thin beds of sand interbedded with clay.
375 – 448	CLAY (100%), light olive gray (5Y 6/1) to olive gray (5Y 3/2), semiconsolidated to consolidated, moderately poor to moderate cohesiveness, moderate silt sized phosphate grains, low porosity, trace undifferentiated shell fragments.

PBCWUD WTP 11 UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 & PW-10 PW-10 Lithologic Log	
Depth (feet bls)	Lithologic Description
448 – 458	CLAY (80%), light olive gray (5Y 5/2) to olive gray (5Y 3/2), semiconsolidated, very cohesive to cohesive, minor silt sized phosphate grains, low porosity; PHOSPHATIC SAND (20%) medium light gray (N6), unconsolidated, very fine to silt sized phosphate and quartz grains.
458 – 470	LIMEMUD (>70%), white (N9) to yellowish gray (5Y 7/2), poorly cohesive, moderate silt sized phosphate grains; CLAY (30%), light olive gray (5Y 5/2), semiconsolidated, cohesive, minor silt sized phosphate grains, low porosity; LIMESTONE (<5%), yellowish gray (5Y 8/1), soft hardness, poor cementation, silt to very fine sand sized phosphate, quartz grains and undifferentiated shell fragments.
470 – 480	LIMEMUD (40%), white (N9), to light olive gray (5Y 6/1), poorly cohesive, minor silt sized phosphate grains; SHELL (40%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated; LIMESTONE (20%), yellowish gray (5Y 8/1) to light olive gray (5Y 6/1), soft to moderate hardness, poor to moderate cementation, silt to very fine sand sized carbonate, phosphate and quartz grains, abundant shell fragments.
480 - 505	LIMESTONE (40%), yellowish gray (5Y 8/1) to light olive gray (5Y 6/1), soft to moderate hardness, poor to moderate cementation, silt to very fine sand sized carbonate, phosphate and quartz grains, abundant shell fragments; SHELL (40%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments; LIMEMUD (20%), white (N9), to light olive gray (5Y 6/1), poorly cohesive.
505 – 520	LIMEMUD (80%), white (N9), poorly cohesive to moderately cohesive, abundant silt to very fine sand sized phosphate and quartz grains; SHELL (20%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments.
502 – 520	LIMESTONE (60%), yellowish gray (5Y 8/1), soft to moderate hardness, poor to moderate cementation, silt to very fine sized phosphate and quartz grains, abundant undifferentiated shell fragments; LIMEMUD (20%), white (N9) to yellowish gray (5Y 8/1), poorly cohesive, minor silt sized phosphate grain; CLAY (20%), olive gray (5Y 3/2), consolidated, very cohesive, low porosity.
520 – 550	PHOSPHATIC SAND (30%), black (N1), unconsolidated, silt to coarse sand sized grains, sub-rounded to rounded; LIMESTONE (25%), yellowish gray (5Y 8/1) to medium gray (N5), soft to moderate hardness, poor to moderate cementation, very fine to silt sized phosphate, carbonates, and minor quartz grains; LIMEMUD (20%), pale olive (10Y 6/2) to yellowish gray (5Y 8/1), poorly cohesive, minor silt sized phosphate grains; SHELL (15%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments; CLAY (10%), olive gray (5Y 3/2), consolidated, very cohesive, low porosity.
550 – 560	CLAY (85%), pale olive (10Y 6/2) to yellowish gray (5Y 8/1), semiconsolidated to consolidated, moderately cohesive, carbonate rich, minor silt sized phosphate grains; SHELL (15%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments.
560 – 570	LIMESTONE (60%), yellowish gray (5Y 8/1) to pale yellowish brown (10YR 6/2), friable to very soft, poor cementation, granular to micritic texture, clay to silt sized carbonate grains, moderate phosphate grains, moderate permeability; CLAY (40%), pale olive (10Y 6/2) to yellowish gray (5Y 8/1), moderately cohesive, carbonate rich,

PBCWUD WTP 11 UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 & PW-10 PW-10 Lithologic Log	
Depth (feet bls)	Lithologic Description
	trace silt sized phosphate grains, minor silt size carbonate grains.
570 - 585	LIMEMUD (60%), yellowish gray (5Y 8/1) to light olive gray (5Y 4/1), poorly cohesive, minor silt to very fine sand sized phosphate grains; CLAY (40%), yellowish gray (5Y 8/1) to dusky yellow (5Y 6/4) to light olive brown (5Y 5/6), semiconsolidated to consolidated, moderately cohesive, trace silt sized phosphate grains, minor silt size carbonate grains.
585 – 590	LIMESTONE (50%), yellowish gray (5Y 8/1) very pale orange (10YR 8/2), soft, poor cementation, micritic texture, clay to silt sized carbonate grains, moderate phosphate grains; LIMEMUD (30%), yellowish gray (5Y 8/1) to light olive gray (5Y 4/1), poorly cohesive, minor silt to very fine sand sized phosphate grains; CLAY (20%), yellowish gray (5Y 8/1) to dusky yellow (5Y 6/4) to light olive brown (5Y 5/6), semiconsolidated to consolidated, moderately cohesive, trace silt sized phosphate grains, minor silt size carbonate grains.
590 – 610	CLAY (60%), yellowish gray (5Y 8/1) to dusky yellow (5Y 6/4) to light olive brown (5Y 5/6), semiconsolidated to consolidated, moderately cohesive, trace silt sized phosphate grains, minor silt size carbonate grains; LIMEMUD (40%), yellowish gray (5Y 8/1) to light olive gray (5Y 4/1), poorly cohesive, minor silt to very fine sand sized phosphate grains. Overall, interbedded clay and limemud beds.
610 – 615	LIMESTONE (50%), yellowish gray (5Y 8/1) very pale orange (10YR 8/2), soft, poor cementation, micritic texture, clay to silt sized carbonate grains, moderate phosphate grains; LIMEMUD (30%), yellowish gray (5Y 8/1) to light olive gray (5Y 4/1), poorly cohesive, minor silt to very fine sand sized phosphate grains; CLAY (20%), yellowish gray (5Y 8/1) to dusky yellow (5Y 6/4) to light olive brown (5Y 5/6), semiconsolidated to consolidated, moderately cohesive, trace silt sized phosphate grains, minor silt size carbonate grains. Overall, limestone occurs as thin beds interbedded with limemud and clay.
615 – 660	LIMEMUD (50%), yellowish gray (5Y 8/1) to light olive gray (5Y 4/1), poorly cohesive, minor silt to very fine sand sized phosphate grains; CLAY (50%), yellowish gray (5Y 8/1) to dusky yellow (5Y 6/4) to light olive brown (5Y 5/6), semiconsolidated to consolidated, moderately cohesive, trace silt sized phosphate grains, minor silt size carbonate grains. Overall, interbedded limemud and clay beds.
660 – 673	CLAY (40%), yellowish gray (5Y 8/1) to dusky yellow (5Y 6/4) to light olive brown (5Y 5/6), semiconsolidated to consolidated, moderately cohesive, abundant silt to fine sand sized phosphate grains; LIMESTONE (30%), yellowish gray (5Y 8/1) very pale orange (10YR 8/2), soft, poor cementation, micritic texture, clay to silt sized carbonate grains, moderate phosphate grains; SHELL (30%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments.
673 – 690	CLAY (50%), olive gray (5Y 4/1) to dark greenish gray (5GY 4/1) to medium dark gray (N4), semiconsolidated to consolidated, moderately cohesive, trace silt sized phosphate grains, minor silt size carbonate grains; LIMESTONE (20%), yellowish gray (5Y 8/1) very pale orange (10YR 8/2), soft, poor cementation, micritic texture, clay to silt sized carbonate grains, moderate undifferentiated shell fragments, trace phosphate grains; SHELL (20%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments; LIMEMUD (10%), yellowish gray (5Y 8/1), poorly cohesive, abundant silt to very fine sand sized phosphate grains.

PBCWUD WTP 11 UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 & PW-10 PW-10 Lithologic Log	
Depth (feet bls)	Lithologic Description
690 – 704	LIMESTONE (50%), yellowish gray (5Y 8/1) very pale orange (10YR 8/2), soft, poor cementation, micritic texture, clay to silt sized carbonate grains, moderate undifferentiated shell fragments, trace phosphate grains; SHELL (30%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments; LIMEMUD (20%), yellowish gray (5Y 8/1), poorly cohesive, moderate silt to coarse sand sized phosphate grains.
704 – 741	CLAY (100%), olive gray (5Y 4/1) to dark greenish gray (5GY 4/1) to medium dark gray (N4), consolidated, very cohesive, moderate silt to medium sand sized phosphate grains. Overall, phosphatic sand thinly interbedded with clay.
741 – 755	CLAY (80%), olive gray (5Y 4/1) to dark greenish gray (5GY 4/1), semi consolidated to consolidated, moderately cohesive to cohesive, moderate silt to medium sand sized phosphate grains; LIMEMUD (20%), yellowish gray (5Y 8/1), moderately poor cohesiveness, moderate silt to coarse sand sized phosphate grains.
755 – 765	CLAY (50%), olive gray (5Y 4/1) to dark greenish gray (5GY 4/1) to medium dark gray (N4), consolidated, very cohesive, moderate silt to medium sand sized phosphate grains; LIMEMUD (50%), yellowish gray (5Y 8/1), very cohesive, moderate silt to medium sand sized phosphate grains.
765 – 791	CLAY (70%), olive gray (5Y 4/1) to dark greenish gray (5GY 4/1), consolidated, very cohesive, moderate silt to medium sand sized phosphate grains; LIMEMUD (30%), yellowish gray (5Y 8/1), moderately cohesive, moderate silt to coarse sand sized phosphate grains.
791 – 805	LIMEMUD (60%), yellowish gray (5Y 8/1), moderately cohesive, abundant silt to coarse sand sized phosphate grains; CLAY (30%), olive gray (5Y 4/1) to dark greenish gray (5GY 4/1), consolidated, very cohesive, moderate silt to medium sand sized phosphate grains; SHELL (10%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments.
805 – 833	SANDSTONE (40%), yellowish gray (5Y 8/1) to light olive gray (5Y 5/2) to brownish gray (5YR 4/1), soft, poorly cemented, silt to very fine sand sized quartz grains, medium to coarse phosphate grains; SANDSTONE (40%), olive gray (5Y 4/1) to brownish gray (5YR 4/1), moderately hard, moderately cemented, silt to very fine sand sized quartz, very fine sand to coarse sand sized phosphate grains; PHOSPHATE GRAINS (10%), brownish black (5YR 2/1) to brownish gray (5YR 4/1), unconsolidated, medium sand to pebble sized grains, sub-angular to sub-rounded; LIMEMUD (10%), light olive gray (5Y 5/2) to brownish gray (5YR 4/1), moderately cohesive, abundant very fine to silt sized phosphate grains.
833 – 844	SANDSTONE (75%), olive gray (5Y 4/1) to brownish gray (5YR 4/1), moderately hard, moderately cemented, silt to very fine sand sized quartz, very fine sand to coarse sand sized phosphate grains; PHOSPHATE GRAINS (15%), brownish black (5YR 2/1) to brownish gray (5YR 4/1), unconsolidated, medium sand to pebble sized grains, sub-angular to sub-rounded; CLAY (10%), light olive gray (5Y 5/2) to brownish gray (5YR 4/1), semiconsolidated, moderately cohesive, abundant very fine to silt sized phosphate grains.
844 – 856	LIMESTONE (50%), yellowish gray (5Y 8/1) very pale orange (10YR 8/2), soft, poor cementation, micritic texture, clay to silt sized carbonate grains, moderate undifferentiated shell fragments, trace phosphate grains; SHELL (30%), yellowish gray

PBCWUD WTP 11 UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 & PW-10 PW-10 Lithologic Log	
Depth (feet bls)	Lithologic Description
	(5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments; LIMEMUD (20%), yellowish gray (5Y 8/1), poorly cohesive, moderate silt to coarse sand sized phosphate grains.
856 – 906	SHELL (40%), yellowish gray (5Y 8/1) to very pale orange (10YR 8/2), unconsolidated, undifferentiated shell fragments; LIMEMUD (40%), white (N9) to yellowish gray (5Y 8/1), poorly cohesive, moderate silt to coarse sand sized phosphate grains; SANDSTONE (>15%), olive gray (5Y 4/1) to brownish gray (5YR 4/1), moderately hard, moderately cemented, silt to very fine sand sized quartz, very fine sand to coarse sand sized phosphate grains; CLAY (<5%), light olive gray (5Y 5/2) to brownish gray (5YR 4/1), semiconsolidated, moderately cohesive, abundant very fine to silt sized phosphate grains.
906 – 910	CLAY (70%), olive gray (5Y 4/1) to brownish gray (5YR 4/1), consolidated, very cohesive, abundant very fine to silt sized phosphate grains; LIMEMUD (30%), white (N9) to yellowish gray (5Y 8/1), poorly cohesive, moderate silt to coarse sand sized phosphate grains, abundant undifferentiated shell fragments.
910 – 919	SANDSTONE (75%), olive gray (5Y 4/1) to brownish gray (5YR 4/1), moderately hard, moderately cemented, silt to very fine sand sized quartz, very fine sand to coarse sand sized phosphate grains; CLAY (25%), light olive gray (5Y 5/2) to brownish gray (5YR 4/1), semiconsolidated, moderately cohesive, abundant very fine to silt sized phosphate grains. Overall, thin layers of clay interbedded with sandstone.
919 – 940	Lost circulation, no samples obtained.
940 – 955	SANDSTONE (100%), olive gray (5Y 4/1) to light olive gray (5Y 5/2) to brownish gray (5YR 4/1), soft, poorly cemented, silt to very fine sand sized quartz and phosphate grains, moderate undifferentiated shell fragments, abundant silt to very fine sand sized phosphate grains. Overall, abundant Selenite crystals in sandstone; samples may not be representative due to loss of circulation.
955 – 983	Lost circulation, no samples obtained.
983 – 1000	SANDSTONE (50%), olive gray (5Y 4/1) to light olive gray (5Y 5/2) to brownish gray (5YR 4/1), soft, poorly cemented, carbonate cement, silt to very fine sand sized quartz and phosphate grains, moderate undifferentiated shell fragments, abundant silt to very fine sand sized phosphate grains; SANDSTONE (50%), medium dark gray (N4), moderately hard, well cemented, micritic to microcrystalline, fine sand to medium sand sized phosphate grains.
1000 – 1028	LIMESTONE (60%), olive gray (5Y 4/1) to medium light gray (N6) to grayish black (N2), hard, well cemented, micritic texture, moderately poor porosity; SANDSTONE (40%), medium dark gray (N4) to dark gray (N3), moderately soft, moderately poorly cemented, carbonate cementation, very fine sand to fine sand sized quartz grains
1028 – 1037	LIMESTONE (100%), very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), soft, moderately friable, calcarenitic, poor to moderate cementation, very fine sand sized carbonate grains, undifferentiated fossil/shell fragments and molds, moderate to good intergranular porosity. Overall, abundant in Periarchus foraminifera.
1037 – 1055	DOLOMITIC LIMESTONE (50%), pale yellowish brown (10YR 6/2) to dusky yellow (5Y 6/4), very hard, well cemented, micritic to fossiliferous texture, moderate to poor porosity; LIMESTONE (50%), same as above. Overall, abundant in Periarchus

PBCWUD WTP 11 UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 & PW-10 PW-10 Lithologic Log	
Depth (feet bls)	Lithologic Description
	foraminifera.
1055 – 1090	DOLOMITIC LIMESTONE (100%), pale yellowish brown (10YR 6/2) to yellowish gray (5Y 7/2), moderately hard, well cemented, sandy to fossiliferous texture, very fine sand to fine sand sized quartz grains, moderate porosity. Overall, abundant in Periarchus foraminifera to 1065 feet BLS.
1090 – 1103	DOLOMITIC LIMESTONE (75%), pale yellowish brown (10YR 6/2) to dusky yellow (5Y 6/4) to dark greenish gray (5GY 4/1) to brownish black (5YR 2/1), very hard, well cemented, micritic texture, poor porosity, laminar bedding; DOLOMITIC LIMESTONE (25%), pale yellowish brown (10YR 6/2) to yellowish gray (5Y 7/2), moderately hard, well cemented, sandy to fossiliferous texture, very fine sand to fine sand sized quartz grains, moderate porosity.
1103 – 1190	DOLOMITIC LIMESTONE (90%), pale yellowish brown (10YR 6/2) to yellowish gray (5Y 7/2), moderately hard, well cemented, sandy to fossiliferous texture, very fine sand to fine sand sized quartz grains, moderate porosity; DOLOMITIC LIMESTONE (10%), pale yellowish brown (10YR 6/2) to dusky yellow (5Y 6/4) to dark greenish gray (5GY 4/1) to brownish black (5YR 2/1), very hard, well cemented, micritic texture, poor porosity, laminar bedding. Overall, very abundant in Periarchus foraminifera.
1190 – 1212	DOLOMITIC LIMESTONE (40%), pale yellowish brown (10YR 6/2) to yellowish gray (5Y 7/2), moderately hard, well cemented, sandy to fossiliferous texture, very fine sand to fine sand sized quartz grains, moderate porosity; DOLOMITIC LIMESTONE (30%), greenish black (5G 2/1) to black (N1), soft to friable, poorly cemented, very fine sand to fine sand sized quartz grains, moderate porosity; DOLOMITIC LIMESTONE (20%), pale yellowish brown (10YR 6/2) to dusky yellow (5Y 6/4) to dark greenish gray (5GY 4/1) to brownish black (5YR 2/1), very hard, well cemented, micritic texture, poor porosity, laminar bedding; LIMESTONE (10%), grayish yellow (5Y 8/4), soft, moderately friable, calcarenitic, poor to moderate cementation, very fine sand sized carbonate grains, undifferentiated fossil/shell fragments and molds, moderate to good intergranular porosity. Overall, interbedded tan and black dolomitic limestone and soft calcareous limestone.
1212 – 1288	LIMESTONE (60%), very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), soft, moderately friable, calcarenitic, poor to moderate cementation, very fine sand sized carbonate grains, undifferentiated fossil/shell fragments and molds, moderate intergranular porosity; DOLOMITIC LIMESTONE (40%), pale yellowish brown (10YR 6/2) to yellowish gray (5Y 7/2), moderately soft, moderately cemented, sandy to fossiliferous texture, very fine sand to fine sand sized quartz grains, moderate porosity. Overall, abundant in Periarchus foraminifera and undifferentiated fossil fragments.
1288 – 1309	DOLOMITIC LIMESTONE (100%), pale yellowish brown (10YR 6/2) to dark yellowish brown (10YR 2/2), moderately soft, moderately well cemented, sandy to fossiliferous texture, very fine sand to fine sand sized quartz grains, moderate porosity; DOLOMITIC LIMESTONE (20%), light olive brown (5Y 5/6), moderately hard, well cemented, micritic texture, poor porosity.
1309 – 1329	DOLOMITIC LIMESTONE (100%), dark yellowish brown (10YR 2/2) to dark yellowish brown (10YR 2/2), soft to friable, poorly cemented, very fine sand to fine sand sized quartz grains carbonate cemented, moderately good porosity.

PBCWUD WTP 11 UPPER FLORIDAN AQUIFER PRODUCTION WELL PW-9 & PW-10 PW-10 Lithologic Log	
Depth (feet bls)	Lithologic Description
1329 – 1340	LIMESTONE (50%), very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), soft, moderately friable, calcarenitic, poor to moderate cementation, very fine sand sized carbonate grains, undifferentiated fossil/shell fragments and molds, moderate intergranular porosity; DOLOMITIC LIMESTONE (50%), pale yellowish brown (10YR 6/2) to yellowish gray (5Y 7/2), moderately soft, moderately cemented, sandy to fossiliferous texture, very fine sand to fine sand sized quartz grains, moderate porosity. Overall, abundant in Periarchus foraminifera and undifferentiated fossil fragments.
1340 – 1350	DOLOMITIC LIMESTONE (20%), pale yellowish brown (10YR 6/2) to dusky yellow (5Y 6/4) to dark greenish gray (5GY 4/1) to brownish black (5YR 2/1), very hard, well cemented, micritic to fossiliferous texture, poor porosity. Overall, abundant in Periarchus foraminifera and minor laminar bedding.

feet. bls - feet below land surface

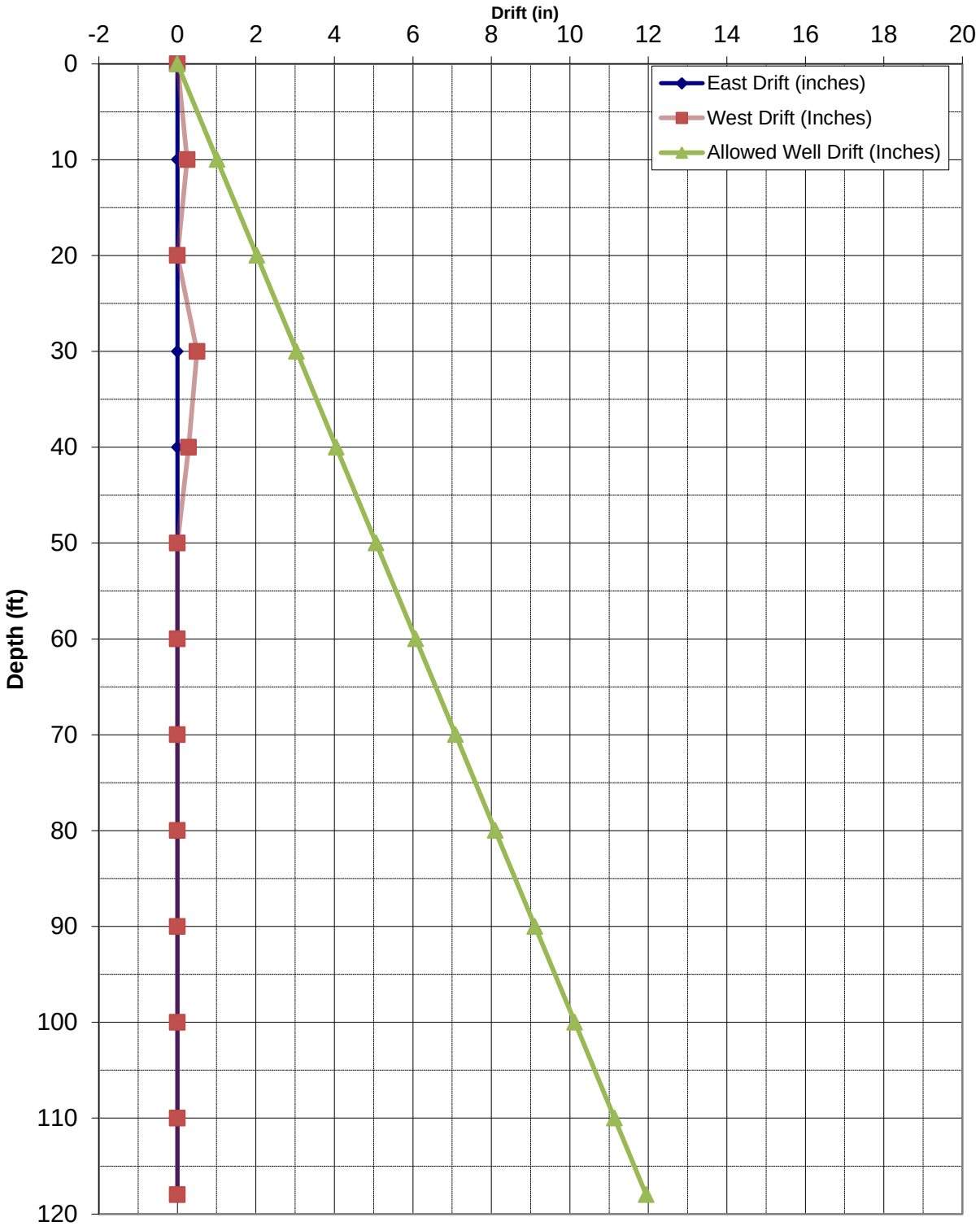
APPENDIX C
GEOPHYSICAL & WELL VIDEO LOG

APPENDIX C
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
Summary of Geophysical Logging

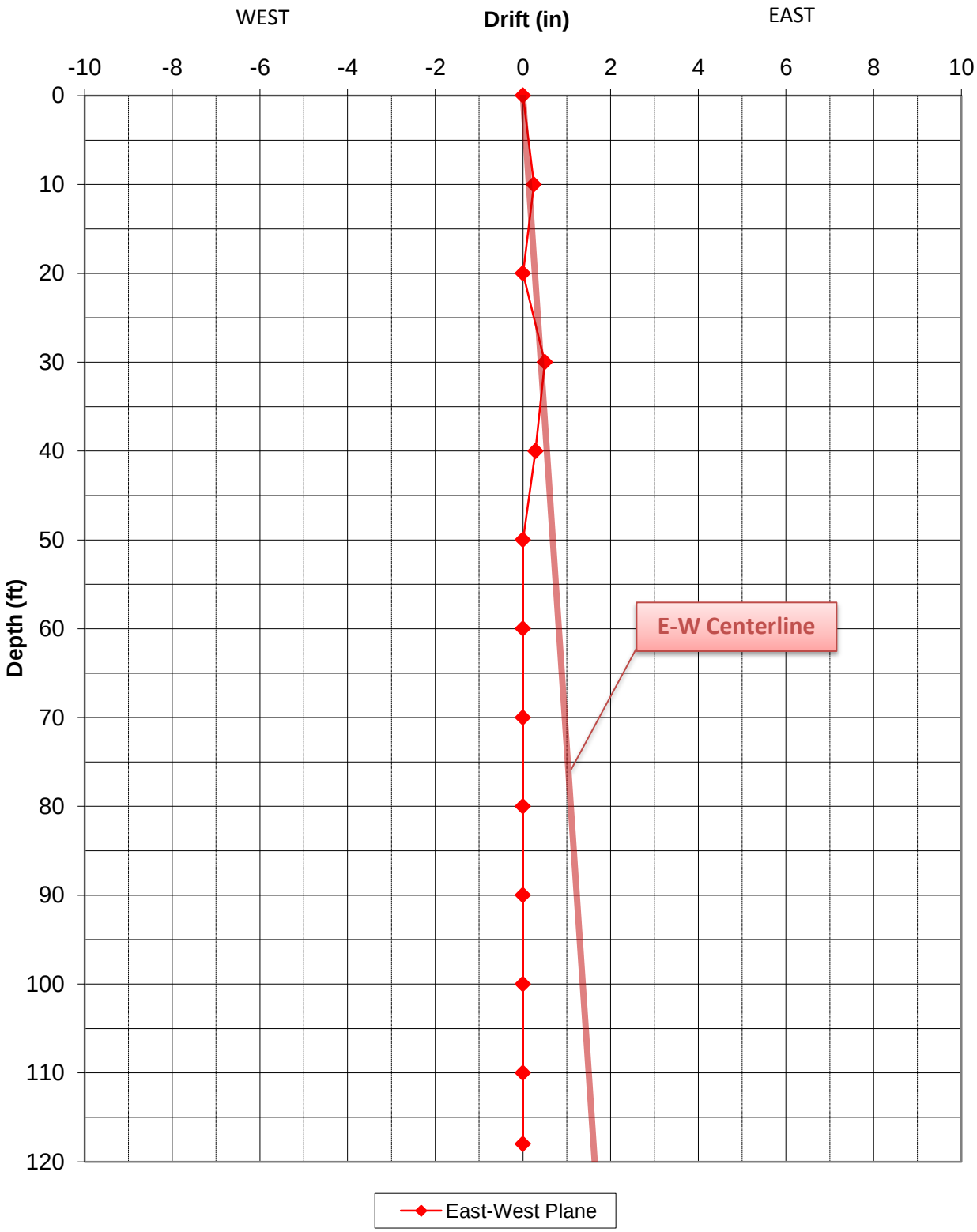
Construction Phase	Logs Performed
34-inch reamed hole for 30-inch diameter surface casing installation	Caliper
12-inch Pilot Hole (160 feet to 950 feet)	Dual induction, single point resistivity, SP, caliper, gamma ray
28-inch reamed hole for 20-inch steel intermediate casing installation	Caliper
12-inch Pilot Hole (950 feet to 1,363 feet/1350 feet)	Dual induction, single point resistivity, SP, temperature, caliper, gamma ray, compensated borehole sonic, fluid resistivity, flow
19-inch reamed hole for 17.4-inch & 14-inch PVC casing installation	Caliper
Well Completion	Well Video with rotating lens (Static and Dynamic Condition)

APPENDIX D
PLUMBNESS & ALIGNMENT TEST

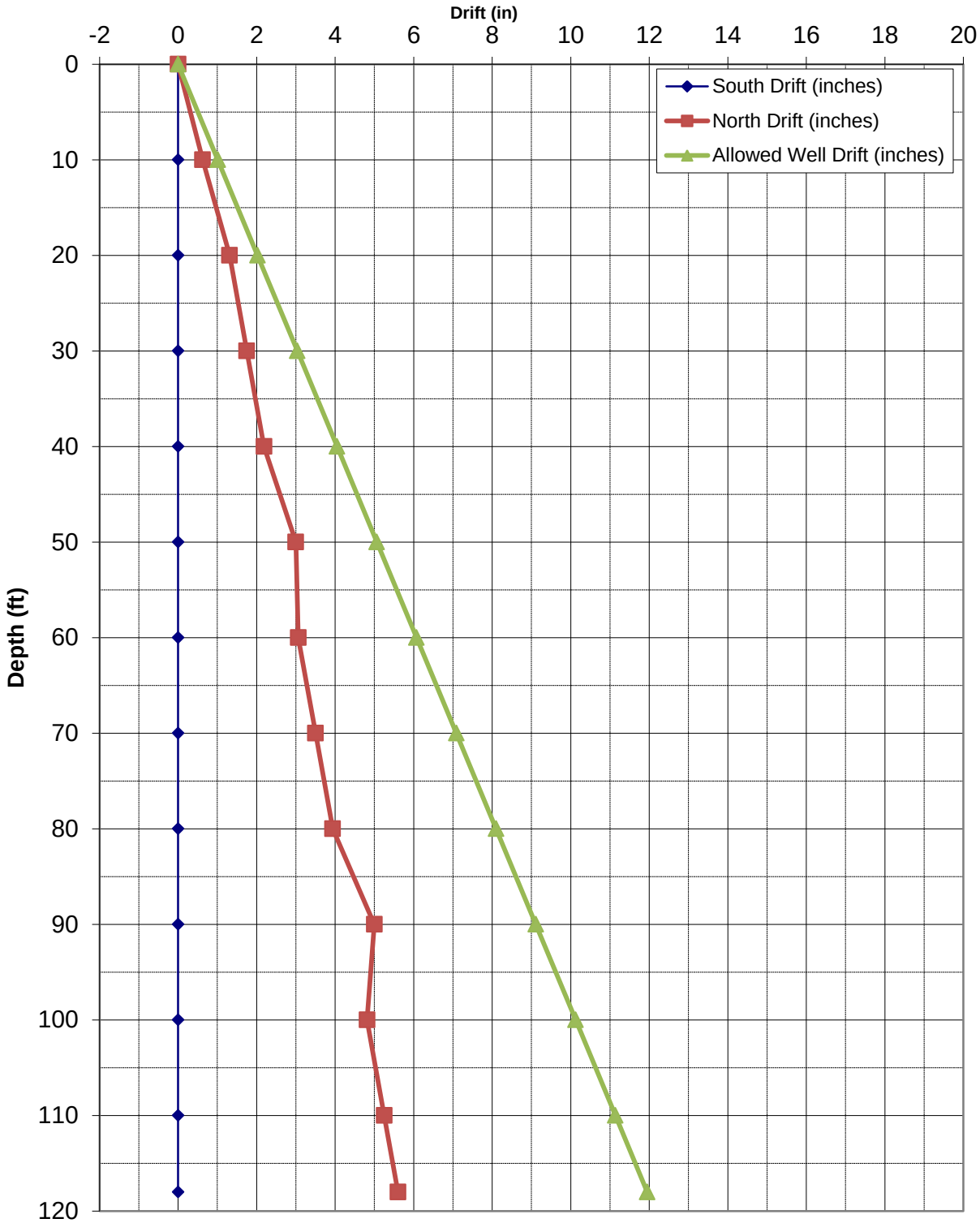
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-9 PLUMBNESS AND ALIGNMENT TEST
East-West Drift



PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-9 PLUMBNESS AND ALIGNMENT TEST
East -West Plane



PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-9 PLUMBNESS AND ALIGNMENT TEST
North-South Drift



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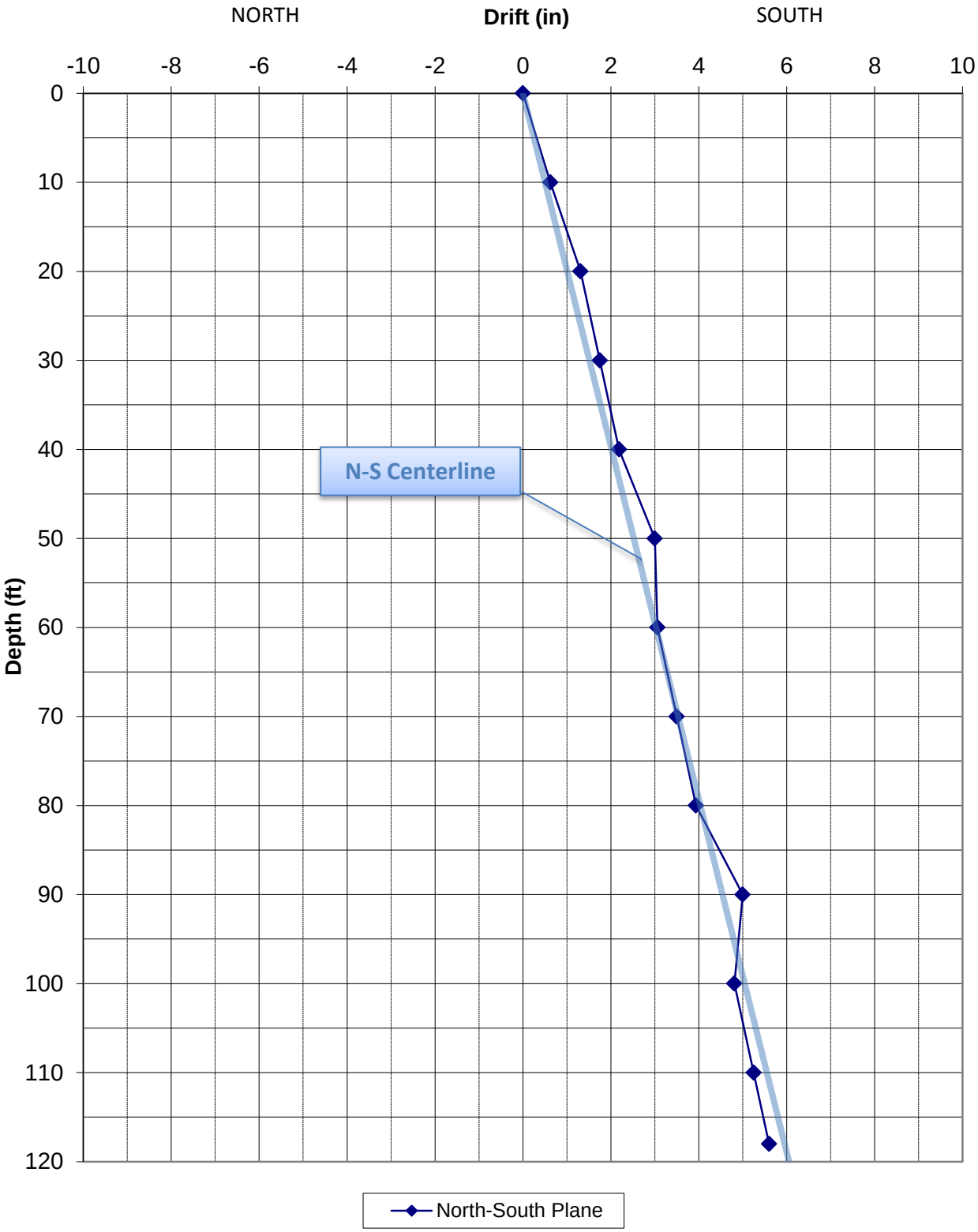
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-9 PLUMBNESS AND ALIGNMENT TEST
North-South Plane



APPENDIX D

PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10

PW-9 PLUMBNESS AND ALIGNMENT TEST RESULTS

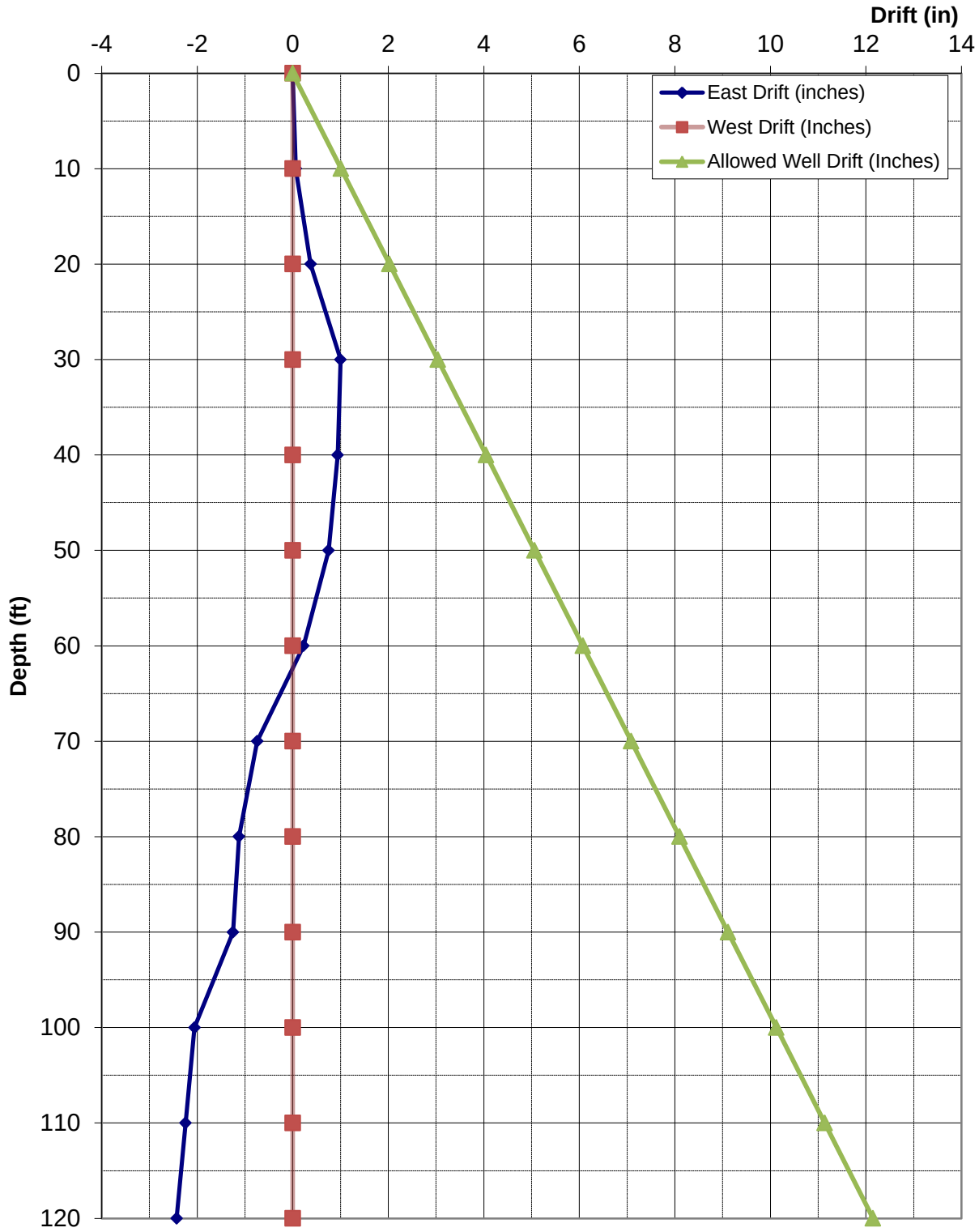
10/3/2014	INCHES	FEET
CASING OD:	17.40	1.45
CASING ID:	15.19	1.27
2/3 CASING ID:	10.13	0.84
APEX:	120.00	10.00
PLUMMET DIAMETER:	14.50	1.21
PLUMMET HEIGHT:	24.00	2.00

Drift = ((Deflection*(Apex+Depth))/Apex)

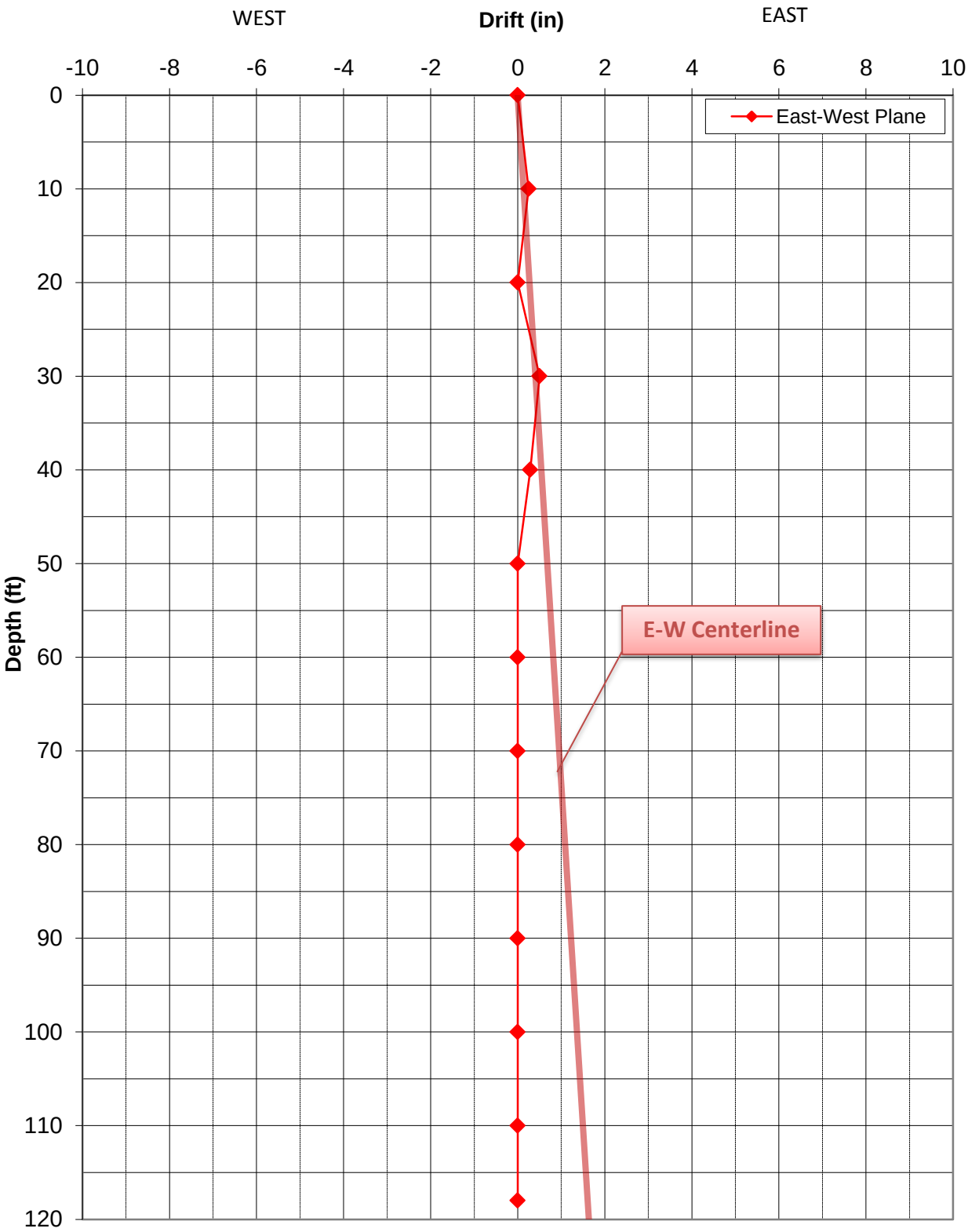
Allowed Drift = 2/3 of ID per 100 ft.

Depth of Plummet Below Top of Casing (ft)	Measured Horizontal Deflection of Plumb Line in 1/32nds of an Inch				Measured Horizontal Deflection of Plumb Line (in)				Calculated Drift (Inches)				Allowed Drift (in)	Difference (in)			
	N	S	E	W	N	S	E	W	N	S	E	W		N	S	E	W
0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	10	0	0	4	0.31	0.00	0.00	0.13	0.63	0.00	0.00	0.25	1.01	0.39	1.01	1.01	0.76
20	14	0	0	0	0.44	0.00	0.00	0.00	1.31	0.00	0.00	0.00	2.03	0.71	2.03	2.03	2.03
30	14	0	0	4	0.44	0.00	0.00	0.13	1.75	0.00	0.00	0.50	3.04	1.29	3.04	3.04	2.54
40	14	0	0	2	0.44	0.00	0.00	0.06	2.19	0.00	0.00	0.29	4.05	1.86	4.05	4.05	3.76
50	16	0	0	0	0.50	0.00	0.00	0.00	3.00	0.00	0.00	0.00	5.06	2.06	5.06	5.06	5.06
60	14	0	0	0	0.44	0.00	0.00	0.00	3.06	0.00	0.00	0.00	6.08	3.01	6.08	6.08	6.08
70	14	0	0	0	0.44	0.00	0.00	0.00	3.50	0.00	0.00	0.00	7.09	3.59	7.09	7.09	7.09
80	14	0	0	0	0.44	0.00	0.00	0.00	3.94	0.00	0.00	0.00	8.10	4.16	8.10	8.10	8.10
90	16	0	0	0	0.50	0.00	0.00	0.00	5.00	0.00	0.00	0.00	9.11	4.11	9.11	9.11	9.11
100	14	0	0	0	0.44	0.00	0.00	0.00	4.81	0.00	0.00	0.00	10.13	5.31	10.13	10.13	10.13
110	14	0	0	0	0.44	0.00	0.00	0.00	5.25	0.00	0.00	0.00	11.14	5.89	11.14	11.14	11.14
118	14	0	0	0	0.44	0.00	0.00	0.00	5.60	0.00	0.00	0.00	11.95	6.35	11.95	11.95	11.95

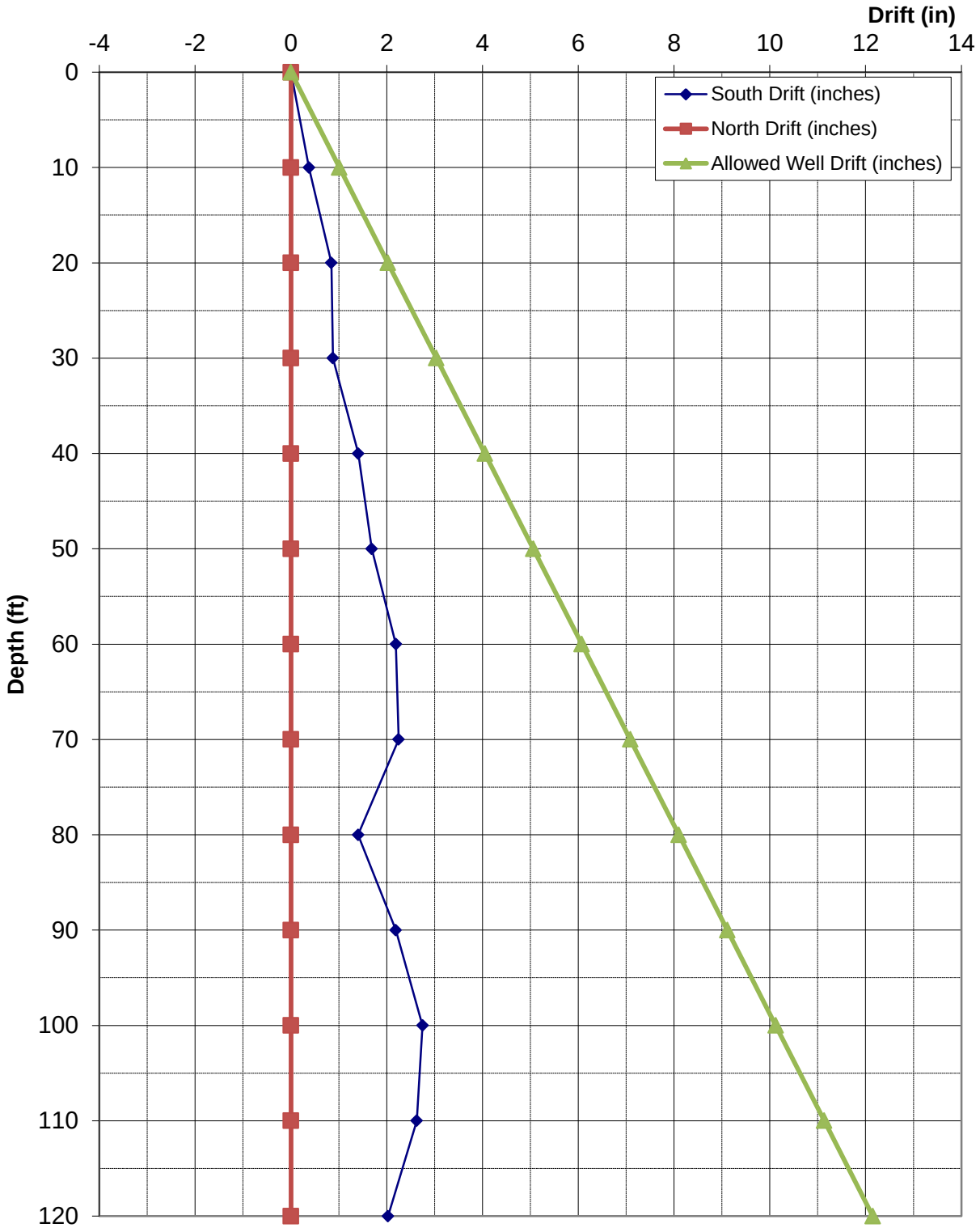
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-10 PLUMBNESS AND ALIGNMENT TEST
East-West Drift



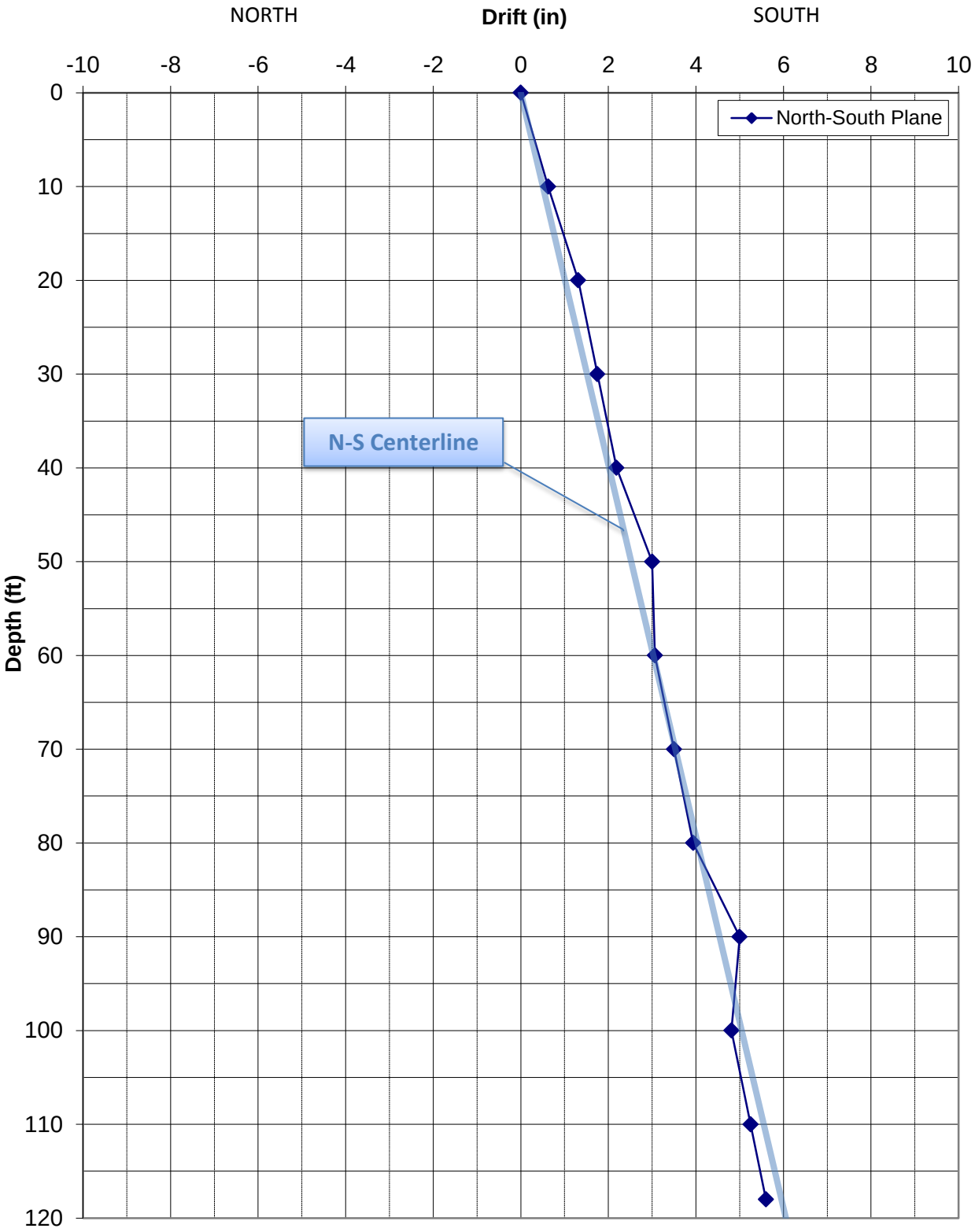
PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-10 PLUMBNESS AND ALIGNMENT TEST
East-West Plane



PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-10 PLUMBNESS AND ALIGNMENT TEST
North-South Drift



PBCWUD WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10
PW-10 PLUMBNESS AND ALIGNMENT TEST
North-South Plane



APPENDIX D

PBCWUD LAKE REGION WTP 11
UPPER FLORIDAN AQUIFER PRODUCTION WELLS PW-9 & PW-10

PW-10 PLUMBNESS AND ALIGNMENT TEST RESULTS

3/26/2015	INCHES	FEET
CASING OD:	17.40	1.45
CASING ID:	15.19	1.27
2/3 CASING ID:	10.13	0.84
APEX:	10.00	10.00
PLUMMET DIAMETER:	14.50	1.21
PLUMMET HEIGHT:	24.00	2.00

Drift = ((Deflection*(Apex+Depth))/Apex)

Allowed Drift = 2/3 of ID per 100 ft.

Depth of Plummet Below Top of Casing (ft)	Measured Horizontal Deflection of Plumb Line in 1/32nds of an Inch				Measured Horizontal Deflection of Plumb Line (in)				Calculated Drift (Inches)				Allowed Drift (in)	Difference (in)			
	N	S	E	W	N	S	E	W	N	S	E	W		N	S	E	W
0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0	6	1	0	0.00	0.19	0.03	0.00	0.00	0.38	0.06	0.00	1.01	1.01	0.64	0.95	1.01
20	0	9	4	0	0.00	0.28	0.13	0.00	0.00	0.84	0.38	0.00	2.03	2.03	1.18	1.65	2.03
30	0	7	8	0	0.00	0.22	0.25	0.00	0.00	0.88	1.00	0.00	3.04	3.04	2.16	2.04	3.04
40	0	9	6	0	0.00	0.28	0.19	0.00	0.00	1.41	0.94	0.00	4.05	4.05	2.65	3.11	4.05
50	0	9	4	0	0.00	0.28	0.13	0.00	0.00	1.69	0.75	0.00	5.06	5.06	3.38	4.31	5.06
60	0	10	1	0	0.00	0.31	0.03	0.00	0.00	2.19	0.22	0.00	6.08	6.08	3.88	5.85	6.08
70	0	9	-3	0	0.00	0.28	-0.09	0.00	0.00	2.25	-0.74	0.00	7.09	7.09	4.84	7.83	7.09
80	0	5	-4	0	0.00	0.16	-0.13	0.00	0.00	1.40	-1.13	0.00	8.10	8.10	6.70	9.23	8.10
90	0	7	-4	0	0.00	0.22	-0.13	0.00	0.00	2.19	-1.25	0.00	9.11	9.11	6.92	10.36	9.11
100	0	8	-6	0	0.00	0.25	-0.19	0.00	0.00	2.75	-2.06	0.00	10.13	10.13	7.38	12.18	10.13
110	0	7	-6	0	0.00	0.22	-0.19	0.00	0.00	2.63	-2.24	0.00	11.14	11.14	8.51	13.38	11.14
120	0	5	-6	0	0.00	0.16	-0.19	0.00	0.00	2.03	-2.43	0.00	12.15	12.15	10.12	14.58	12.15

APPENDIX E
STEP DRAWDOWN TEST
WATER LEVEL DATA

APPENDIX F
LABORATORY WATER QUALITY REPORT

ALL WEBBS
ENTERPRISES, INC.

CONTRACTOR'S SUBMITTAL

Date:	January 7, 2015	**Submittal No:**	**WUD11-101-035**
Contractor:	All Webbs Enterprises, Inc. 309 Commerce Way Jupiter, FL 33458 561-746-2079 allwebbs@allwebbs.com	**New Submittal**	**X**
		Previous Submittal No. :	
		Project:	Water Treatment Plant 11, Floridan Aquifer Production Wells PW-09 and PW-10
Hydrogeologist:	JLA Geosciences, Inc.		
Supplier:	**NA**		
Manufacturer:	**Various (see below)**		
Subcontractor:			

The following items are submitted:

Copies	Description	Section No.
Electronic	Pace Analytical Laboratory Report dated December 30, 2014	13215

NO EXCEPTIONS NOTED [X]
MAKE CORRECTIONS NOTED [ ]
REVISE AND RESUBMIT [ ]
NOT APPROVED [ ]

The approval of this submittal is limited to specifications which are contained in the Contract Documents.

All Webb's Enterprises, Inc.

1/7/2015
Date

R.A. Thomson
Name
for David Webb Jr.

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www.pacelabs.com

Pace Analytical Services, Inc.
8 East Tower Circle
Ormond Beach, FL 32174
(386)672-5668

December 30, 2014

David Webb Jr.
All Webbs Enterprises, Inc.
309 Commerce Way
Jupiter, FL 33458

RE: Project: PW 9
Pace Project No.: 35164623

Dear David Jr.:
Enclosed are the analytical results for sample(s) received by the laboratory on November 20, 2014. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Some analyses have been subcontracted outside of the Pace Network. The subcontracted laboratory report has been attached.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Bo Garcia
bo.garcia@pacelabs.com
Project Manager

Enclosures

cc: Leigh, All Webbs Enterprises, Inc.

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Ormond Beach, FL 32174
(386)672-5668

CERTIFICATIONS

Project: PW 9
Pace Project No.: 35164623

Pennsylvania Certification IDs
1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ACLASS DOD-ELAP Accreditation #: ADE-1544
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California/TNI Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Guam/PADEP Certification
Hawaii/PADEP Certification
Idaho Certification
Illinois/PADEP Certification
Indiana/PADEP Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188
Utah/TNI Certification #: PA014572014-4
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin/PADEP Certification
Wyoming Certification #: 8TMS-Q

Ormond Beach Certification IDs
8 East Tower Circle, Ormond Beach, FL 32174
Alabama Certification #: 41320
Arizona Certification #: AZ0735
Connecticut Certification #: PH-0216
Delaware Certification: FL NELAC Reciprocity
Florida Certification #: E83079
Georgia Certification #: 955
Guam Certification: FL NELAC Reciprocity
Hawaii Certification: FL NELAC Reciprocity
Illinois Certification #: 200068
Indiana Certification: FL NELAC Reciprocity
Kansas Certification #: E-10383
Kentucky Certification #: 90050
Louisiana Certification #: FL NELAC Reciprocity
Louisiana Environmental Certificate #: 05007
Maryland Certification: #346
Massachusetts Certification #: M-FL1264
Michigan Certification #: 9911
Mississippi Certification: FL NELAC Reciprocity
Missouri Certification #: 236
Montana Certification #: Cert 0074
Nebraska Certification: NE-OS-28-14
Nevada Certification: FL NELAC Reciprocity
New Hampshire Certification #: 2958
New Jersey Certification #: FL765
New York Certification #: 11608
North Carolina Environmental Certificate #: 667
North Carolina Certification #: 12710
Pennsylvania Certification #: 68-00547
Puerto Rico Certification #: FL01264
South Carolina Certification: #96042001
Tennessee Certification #: TN02974
Texas Certification: FL NELAC Reciprocity
US Virgin Islands Certification: FL NELAC Reciprocity
Virginia Environmental Certification #: 460165
Washington Certification #: C955
West Virginia Certification #: 9962C
Wisconsin Certification #: 399079670
Wyoming (EPA Region 8): FL NELAC Reciprocity

South Florida Certification IDs
3610 Park Central Blvd N, Pompano Beach, FL 33064
Pace Analytical Services - Pompano certification number E96080
Florida Certification #: E86240

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
8 East Tower Circle
Ormond Beach, FL 32174
(386)672-5668

SAMPLE SUMMARY

Project: PW 9
Pace Project No.: 35164623

Lab ID	Sample ID	Matrix	Date Collected	Date Received
35164623001	PW 9	Drinking Water	11/19/14 16:30	11/20/14 00:00

Pace Analytical Services, Inc.
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SAMPLE ANALYTE COUNT

Project: PW 9
Pace Project No.: 35164623

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
35164623001	PW 9	EPA 504.1	AYF	2	PASI-O
		EPA 508.1	JTJ	21	PASI-O
		EPA 515.3	LJM	7	PASI-O
		EPA 531.1	LAJ	3	PASI-O
		EPA 547	LAJ	1	PASI-O
		EPA 549.2	LAJ	1	PASI-O
		EPA 552.2	AYF	7	PASI-O
		EPA 200.7	CRT	11	PASI-O
		EPA 200.8	CRT	6	PASI-O
		EPA 245.1	CKJ	1	PASI-O
		EPA 525.2	TWB	6	PASI-O
		EPA 548.1	EAO	1	PASI-O
		EPA 524.2	JLR	31	PASI-O
		SM 7110C	FCC	1	PASI-PA
		EPA 903.1	JC2	1	PASI-PA
		EPA 904.0	JAL	1	PASI-PA
		SM 2150B	TAN	2	PASI-SF
		SM 2540C	LCM	1	PASI-SF
		SM 9223B	JJJ	2	PASI-SF
		SM 2120B	KEK	1	PASI-O
		SM 4500-Cl D	KHC	1	PASI-O
		SM 5540C	GPW	2	PASI-O
		EPA 300.0	AIS	3	PASI-O
		EPA 335.4	BIP	1	PASI-O
		EPA 353.2	AIS	3	PASI-O

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ANALYTICAL RESULTS

Project: PW 9
Pace Project No.: 35164623

Sample: PW 9 **Lab ID: 35164623001** Collected: 11/19/14 16:30 Received: 11/20/14 00:00 Matrix: Drinking Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
504.1 GCS EDB and DBCP	Analytical Method: EPA 504.1 Preparation Method: EPA 504.1								
1,2-Dibromo-3-chloropropane	**0.0052U**	ug/L	0.021	0.0052	1	11/24/14 14:40	11/25/14 00:51	96-12-8	
1,2-Dibromoethane (EDB)	**0.0066U**	ug/L	0.011	0.0066	1	11/24/14 14:40	11/25/14 00:51	106-93-4	
508.1 GCS Pesticides	Analytical Method: EPA 508.1 Preparation Method: EPA 508.1								
Alachlor	**0.032U**	ug/L	0.19	0.032	1	11/24/14 12:00	11/26/14 02:28	15972-60-8	
Atrazine	**0.020U**	ug/L	0.094	0.020	1	11/24/14 12:00	11/26/14 02:28	1912-24-9	
gamma-BHC (Lindane)	**0.0028U**	ug/L	0.019	0.0028	1	11/24/14 12:00	11/26/14 02:28	58-89-9	
Chlordane (Technical)	**0.044U**	ug/L	0.19	0.044	1	11/24/14 12:00	11/26/14 02:28	57-74-9	
Endrin	**0.0019U**	ug/L	0.0094	0.0019	1	11/24/14 12:00	11/26/14 02:28	72-20-8	
Heptachlor	**0.0057U**	ug/L	0.038	0.0057	1	11/24/14 12:00	11/26/14 02:28	76-44-8	
Heptachlor epoxide	**0.0028U**	ug/L	0.019	0.0028	1	11/24/14 12:00	11/26/14 02:28	1024-57-3	
Hexachlorobenzene	**0.010U**	ug/L	0.094	0.010	1	11/24/14 12:00	11/26/14 02:28	118-74-1	
Hexachlorocyclopentadiene	**0.030U**	ug/L	0.094	0.030	1	11/24/14 12:00	11/26/14 02:28	77-47-4	
Methoxychlor	**0.013U**	ug/L	0.094	0.013	1	11/24/14 12:00	11/26/14 02:28	72-43-5	
PCB-1016 (Aroclor 1016)	**0.075U**	ug/L	0.094	0.075	1	11/24/14 12:00	11/26/14 02:28	12674-11-2	
PCB-1221 (Aroclor 1221)	**0.027U**	ug/L	0.094	0.027	1	11/24/14 12:00	11/26/14 02:28	11104-28-2	
PCB-1232 (Aroclor 1232)	**0.027U**	ug/L	0.094	0.027	1	11/24/14 12:00	11/26/14 02:28	11141-16-5	
PCB-1242 (Aroclor 1242)	**0.048U**	ug/L	0.094	0.048	1	11/24/14 12:00	11/26/14 02:28	53469-21-9	
PCB-1248 (Aroclor 1248)	**0.058U**	ug/L	0.094	0.058	1	11/24/14 12:00	11/26/14 02:28	12672-29-6	
PCB-1254 (Aroclor 1254)	**0.022U**	ug/L	0.094	0.022	1	11/24/14 12:00	11/26/14 02:28	11097-69-1	
PCB-1260 (Aroclor 1260)	**0.062U**	ug/L	0.094	0.062	1	11/24/14 12:00	11/26/14 02:28	11096-82-5	
PCB, Total	**0.075U**	ug/L	0.094	0.075	1	11/24/14 12:00	11/26/14 02:28	1336-36-3	
Simazine	**0.042U**	ug/L	0.066	0.042	1	11/24/14 12:00	11/26/14 02:28	122-34-9	
Toxaphene	**0.57U**	ug/L	0.94	0.57	1	11/24/14 12:00	11/26/14 02:28	8001-35-2	
Surrogates									
Decachlorobiphenyl (S)	105	%	70-130		1	11/24/14 12:00	11/26/14 02:28	2051-24-3	
515.3 Chlorinated Herbicides	Analytical Method: EPA 515.3 Preparation Method: EPA 515.3								
2,4-D	**0.081U**	ug/L	0.10	0.081	1	11/24/14 08:45	11/25/14 17:55	94-75-7	
Dalapon	**0.89U**	ug/L	1.0	0.89	1	11/24/14 08:45	11/25/14 17:55	75-99-0	
Dinoseb	**0.16U**	ug/L	0.20	0.16	1	11/24/14 08:45	11/25/14 17:55	88-85-7	
Pentachlorophenol	**0.030U**	ug/L	0.040	0.030	1	11/24/14 08:45	11/25/14 17:55	87-86-5	
Picloram	**0.094U**	ug/L	0.10	0.094	1	11/24/14 08:45	11/25/14 17:55	1918-02-1	
2,4,5-TP (Silvex)	**0.16U**	ug/L	0.20	0.16	1	11/24/14 08:45	11/25/14 17:55	93-72-1	
Surrogates									
2,4-DCAA (S)	88	%	70-130		1	11/24/14 08:45	11/25/14 17:55	19719-28-9	
531.1 HPLC Carbamates	Analytical Method: EPA 531.1								
Carbofuran	**0.75U**	ug/L	2.0	0.75	1		11/26/14 03:20	1563-66-2	
Oxamyl	**0.47U**	ug/L	2.0	0.47	1		11/26/14 03:20	23135-22-0	
Surrogates									
Propoxur (S)	100	%	80-120		1		11/26/14 03:20	114-26-1	
547 HPLC Glyphosate	Analytical Method: EPA 547								
Glyphosate	**5.4U**	ug/L	6.0	5.4	1		11/21/14 14:15		

REPORT OF LABORATORY ANALYSIS

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8 East Tower Circle
Ormond Beach, FL 32174
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ANALYTICAL RESULTS

Project: PW 9
Pace Project No.: 35164623

Sample: PW 9 **Lab ID: 35164623001** Collected: 11/19/14 16:30 Received: 11/20/14 00:00 Matrix: Drinking Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
549.2 HPLC Paraquat Diquat	Analytical Method: EPA 549.2 Preparation Method: EPA 549.2								
Diquat	**0.15U**	ug/L	0.40	0.15	1	11/21/14 17:30	11/25/14 14:13	85-00-7	
552.2 Haloacetic Acids	Analytical Method: EPA 552.2 Preparation Method: EPA 552.2								
Dibromoacetic Acid	**0.61U**	ug/L	1.0	0.61	1	11/21/14 12:00	11/27/14 23:07	631-64-1	
Dichloroacetic Acid	**0.61U**	ug/L	1.0	0.61	1	11/21/14 12:00	11/27/14 23:07	79-43-6	
Haloacetic Acids (Total)	**0.61U**	ug/L	1.0	0.61	1	11/21/14 12:00	11/27/14 23:07		
Monobromoacetic Acid	**0.61U**	ug/L	1.0	0.61	1	11/21/14 12:00	11/27/14 23:07	79-08-3	
Monochloroacetic Acid	**0.61U**	ug/L	1.0	0.61	1	11/21/14 12:00	11/27/14 23:07	79-11-8	
Trichloroacetic Acid	**0.61U**	ug/L	1.0	0.61	1	11/21/14 12:00	11/27/14 23:07	76-03-9	
Surrogates									
2,3-Dibromopropanoic Acid (S)	80	%	70-130		1	11/21/14 12:00	11/27/14 23:07	600-05-5	
200.7 MET ICP, Drinking Water	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Aluminum	**0.050U**	mg/L	0.10	0.050	1	12/03/14 19:31	12/04/14 14:27	7429-90-5	
Barium	**0.037**	mg/L	0.010	0.0050	1	12/03/14 19:31	12/04/14 14:27	7440-39-3	
Beryllium	**0.00050U**	mg/L	0.0010	0.00050	1	12/03/14 19:31	12/04/14 14:27	7440-41-7	
Cadmium	**0.00050U**	mg/L	0.0010	0.00050	1	12/03/14 19:31	12/04/14 14:27	7440-43-9	
Chromium	**0.0025U**	mg/L	0.0050	0.0025	1	12/03/14 19:31	12/04/14 14:27	7440-47-3	
Iron	**0.025 I**	mg/L	0.040	0.020	1	12/03/14 19:31	12/04/14 14:27	7439-89-6	
Manganese	**0.0025U**	mg/L	0.0050	0.0025	1	12/03/14 19:31	12/04/14 14:27	7439-96-5	
Nickel	**0.0025U**	mg/L	0.0050	0.0025	1	12/03/14 19:31	12/04/14 14:27	7440-02-0	
Silver	**0.0025U**	mg/L	0.0050	0.0025	1	12/03/14 19:31	12/04/14 14:27	7440-22-4	
Sodium	**930**	mg/L	20.0	10.0	20	12/03/14 19:31	12/04/14 14:48	7440-23-5	D4
Zinc	**0.010U**	mg/L	0.020	0.010	1	12/03/14 19:31	12/04/14 14:27	7440-66-6	
200.8 MET ICPMS Drinking Water	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8								
Antimony	**0.00050U**	mg/L	0.0010	0.00050	1	12/03/14 19:31	12/04/14 11:38	7440-36-0	
Arsenic	**0.00050U**	mg/L	0.0010	0.00050	1	12/03/14 19:31	12/04/14 11:38	7440-38-2	
Copper	**0.00050U**	mg/L	0.0010	0.00050	1	12/03/14 19:31	12/04/14 11:38	7440-50-8	
Lead	**0.00050U**	mg/L	0.0010	0.00050	1	12/03/14 19:31	12/04/14 11:38	7439-92-1	
Selenium	**0.00050U**	mg/L	0.0010	0.00050	1	12/03/14 19:31	12/04/14 11:38	7782-49-2	CU
Thallium	**0.00050U**	mg/L	0.0010	0.00050	1	12/03/14 19:31	12/04/14 11:38	7440-28-0	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1								
Mercury	**0.10U**	ug/L	0.20	0.10	1	12/05/14 14:02	12/08/14 11:36	7439-97-6	
525.2 Base Neutral Extractable	Analytical Method: EPA 525.2 Preparation Method: EPA 525.2								
Benzo(a)pyrene	**0.018U**	ug/L	0.094	0.018	1	11/24/14 12:00	11/25/14 16:35	50-32-8	
bis(2-Ethylhexyl)adipate	**0.36U**	ug/L	1.5	0.36	1	11/24/14 12:00	11/25/14 16:35	103-23-1	
bis(2-Ethylhexyl)phthalate	**0.47U**	ug/L	1.9	0.47	1	11/24/14 12:00	11/25/14 16:35	117-81-7	
Surrogates									
1,3-Dimethyl-2-nitrobenzene(S)	100	%	70-130		1	11/24/14 12:00	11/25/14 16:35	81209	
Perylene-d12 (S)	97	%	70-130		1	11/24/14 12:00	11/25/14 16:35	1520963	
Triphenylphosphate (S)	102	%	70-130		1	11/24/14 12:00	11/25/14 16:35	115-86-6	

REPORT OF LABORATORY ANALYSIS

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Ormond Beach, FL 32174
(386)672-5668

ANALYTICAL RESULTS

Project: PW 9
Pace Project No.: 35164623

Sample: PW 9 **Lab ID: 35164623001** Collected: 11/19/14 16:30 Received: 11/20/14 00:00 Matrix: Drinking Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
548.1 GCS Endothall	Analytical Method: EPA 548.1 Preparation Method: EPA 548.1								
Endothall	**4.1U**	ug/L	9.0	4.1	1	11/20/14 16:30	11/21/14 11:37		
524.2 MSV	Analytical Method: EPA 524.2								
Benzene	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	71-43-2	
Bromodichloromethane	**0.25U**	ug/L	1.0	0.25	1		12/02/14 17:25	75-27-4	
Bromoform	**0.25U**	ug/L	1.0	0.25	1		12/02/14 17:25	75-25-2	
Carbon tetrachloride	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	56-23-5	
Chlorobenzene	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	108-90-7	
Chloroform	**0.25U**	ug/L	1.0	0.25	1		12/02/14 17:25	67-66-3	
Dibromochloromethane	**0.25U**	ug/L	1.0	0.25	1		12/02/14 17:25	124-48-1	
1,2-Dichlorobenzene	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	95-50-1	
1,4-Dichlorobenzene	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	106-46-7	
1,2-Dichloroethane	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	107-06-2	
1,1-Dichloroethene	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	75-35-4	
cis-1,2-Dichloroethene	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	156-59-2	
trans-1,2-Dichloroethene	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	156-60-5	
1,2-Dichloropropane	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	78-87-5	
Ethylbenzene	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	100-41-4	
Methylene Chloride	**0.44U**	ug/L	0.50	0.44	1		12/02/14 17:25	75-09-2	
Methyl-tert-butyl ether	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	1634-04-4	
Naphthalene	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	91-20-3	
Styrene	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	100-42-5	
Tetrachloroethene	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	127-18-4	
Toluene	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	108-88-3	
Total Trihalomethanes (Calc.)	**0.25U**	ug/L	1.0	0.25	1		12/02/14 17:25		
1,2,4-Trichlorobenzene	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	120-82-1	
1,1,1-Trichloroethane	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	71-55-6	
1,1,2-Trichloroethane	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	79-00-5	
Trichloroethene	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	79-01-6	
Vinyl chloride	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	75-01-4	
Xylene (Total)	**0.25U**	ug/L	0.50	0.25	1		12/02/14 17:25	1330-20-7	
Surrogates									
4-Bromofluorobenzene (S)	97	%	70-130		1		12/02/14 17:25	460-00-4	
Toluene-d8 (S)	104	%	70-130		1		12/02/14 17:25	2037-26-5	
1,2-Dichloroethane-d4 (S)	104	%	70-130		1		12/02/14 17:25	17060-07-0	
2150B Threshold Odor Number	Analytical Method: SM 2150B								
Temperature, Water (C)	**39.8**	deg C			1		11/20/14 11:15		
Threshold Odor Number	**67.0**	TON	1.0	1.0	1		11/20/14 11:15		
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**3210**	mg/L	50.0	50.0	1		11/25/14 17:21		
Total Coli/e. Coli (9223)	Analytical Method: SM 9223B Preparation Method: SM 9223B								
Total Coliforms	**Absent**				1	11/20/14 19:00	11/21/14 15:39		

REPORT OF LABORATORY ANALYSIS

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, Inc.
8 East Tower Circle
Ormond Beach, FL 32174
(386)672-5668

ANALYTICAL RESULTS

Project: PW 9
Pace Project No.: 35164623

Sample: PW 9 **Lab ID: 35164623001** Collected: 11/19/14 16:30 Received: 11/20/14 00:00 Matrix: Drinking Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Coli/e. Coli (9223)	Analytical Method: SM 9223B Preparation Method: SM 9223B								
E.coli	**Absent**				1	11/20/14 19:00	11/21/14 15:39		
2120B Apparent Color	Analytical Method: SM 2120B								
Apparent Color	**5.0U**	units	5.0	5.0	1		11/21/14 11:40		
Chlorine, Residual,Total,Free	Analytical Method: SM 4500-Cl D								
Chlorine, Total	**0.10U**	mg/L	0.10	0.10	1		11/24/14 13:50	7782-50-5	Q
5540C MBAS Surfactants	Analytical Method: SM 5540C								
LAS Molecular Weight, g/mol	**320**				1		11/20/14 16:13		
MBAS, Calculated as LAS	**0.059U**	mg/L	0.20	0.059	1		11/20/14 16:13		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Chloride	**1580**	mg/L	250	125	50		12/01/14 20:01	16887-00-6	
Fluoride	**2.4U**	mg/L	2.5	2.4	50		12/01/14 20:01	16984-48-8	
Sulfate	**488**	mg/L	250	125	50		12/01/14 20:01	14808-79-8	
335.4 Cyanide, Total	Analytical Method: EPA 335.4 Preparation Method: EPA 335.4								
Cyanide	**0.0050U**	mg/L	0.010	0.0050	1	12/03/14 13:00	12/03/14 16:57	57-12-5	
353.2 Nitrogen, NO2/NO3 unpres	Analytical Method: EPA 353.2								
Nitrogen, Nitrate	**0.025U**	mg/L	0.050	0.025	1		11/20/14 13:39		
Nitrogen, Nitrite	**0.025U**	mg/L	0.050	0.025	1		11/20/14 13:39		
Nitrogen, NO2 plus NO3	**0.025U**	mg/L	0.050	0.025	1		11/20/14 13:39		

REPORT OF LABORATORY ANALYSIS

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
Phone: (561)575-0030
Fax: (561)575-4118
www.jupiterlabs.com
clientservices@jupiterlabs.com

March 2, 2015

Tami Wells
All Webb's Enterprises, Inc.
309 Commerce Way
Jupiter, FL 33458

RE: LOG# 1540882
Project ID: Belle Glade
COC# 540882

Dear Tami Wells:

Enclosed are the analytical results for sample(s) received by the laboratory on Wednesday, February 25, 2015. Results reported herein conform to the most current NELAC standards, where applicable, unless indicated by * in the body of the report. The enclosed Chain of Custody is a component of this package and should be retained with the package and incorporated therein.

Results for all solid matrices are reported in dry weight unless otherwise noted. Results for all liquid matrices are reported as received in the laboratory unless otherwise noted. Results relate only to the samples received. Should insufficient sample be provided to the laboratory to meet the method and NELAC Matrix Duplicate and Matrix Spike requirements, then the data will be analyzed, evaluated and reported using all other available quality control measures.

Samples are disposed of after 30 days of their receipt by the laboratory unless extended storage is requested in writing. The laboratory maintains the right to charge storage fees for archived samples. This report will be archived for 5 years after which time it will be destroyed without further notice, unless prior arrangements have been made.

Certain analyses are subcontracted to outside NELAC certified laboratories, please see the Project Summary section of this report for NELAC certification numbers of laboratories used. A Statement of Qualifiers is available upon request.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Melissa Mills for
Kacia Baldwin
V.P. of Operations

FDOH# E86546

CERTIFICATE OF ANALYSIS

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
Phone: (561)575-0030
Fax: (561)575-4118

SAMPLE SUMMARY

Workorder: 1540882

Project ID: Belle Glade

Lab ID	Sample ID	Matrix	Date Collected	Date Received
1540882001	Well	Aqueous Liquid	2/24/2015 12:00	2/25/2015 12:05

FDOH# E86546

CERTIFICATE OF ANALYSIS

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

Jupiter Environmental Labs
1540882

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: 1502000-01 Sample Date: 2/24/15 Sample Time: 12:00 pm AM PM (Circle One)

Sample Location (be specific): 1540882001 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, _____ (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

Jupiter Environmental Labs
1540882

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 ☒ 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: 02/26/2015

PWS ID (From Page 1): Sample Number (From Page 1): 1502000-01 Lab Assigned Report # or Job ID: 1502000-01

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
☐ All Except for Asbestos	☐ All 30	☐ All 21	☐ Trihalomethanes	☐ Single Sample	☐ All 14
☐ Partial	☐ All Except Dioxin	☐ Partial	☐ Haloacetic Acids	☐ Qtrly Composite	☐ Partial
☐ Nitrate	☐ Partial		☒ Chlorite		
☐ Nitrite	☐ Dioxin Only		☒ 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: 03/02/2015

* 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

DISINFECTION BYPRODUCTS
62-550.310(3)

Report Number / Job ID: 1502000-01
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	100	U	EPA 300.1	100	20	2/28/15	7:14	E84129
1011	Bromate	10	ug/L	50	U	EPA 300.1	50	5.0	2/28/15	7:14	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.

Jupiter
Environmental Laboratories, Inc.

www.jupiterlabs.com
150 S. Old Dixie Highway, Jupiter, FL 33458
(561) 575-0030 • FAX (561) 575-4118 • clientservices@jupiterlabs.com

J.E.L. Log # 1540882
P.O. # _____
Quote # _____

Company Name All Webbs
Address
City State Zip
Sampling Site Address
Attn: Email
Project Name Belle Glade Project #
Sampler Name/Signature

#	Sample Label (Client ID)	Collected Date	Collected Time	Matrix Code*	# of Cont	Pres Codes	Parameters: Bromate	Parameters: Chlorite	Field Filtered (Y/N)
1	Well	2-24 2-25 KMT	1200		3		X	X	
2									
3									
4									
5									
6									
7									
8									
9									
0									

LAB ANALYSIS

Requested Turnaround Time

Note: Rush requests subject to acceptance by the laboratory

X Standard
___ Expedited
Due ___/___/___

Comments

Matrix Codes*

S	Soil/Solid Sediment	SW	Surface Water
GW	Ground Water	SL	Sludge
WW	Waste Water	O	Other (Please Specify)
DW	Drinking Water		

Pres Codes

A-	none	I-	Ice
B-	HNO_3	O-	Other
C-	H_2SO_4	M-	MeOH
D-	NaOH	N-	$Na_2S_2O_3$
E-	HCl	Z-	ZnAc

Relinquished by	Date	Time	Received by	Date	Time
	2-25-15 1205	1205		2-25-15	1205

QA/QC level with report
None ___1___2___3___ See price guide for applicable fees

FDEP Dry Cleaning ❑ FDEP UST Pre-Approval ❑
SFWMD ❑ ADaPT ❑ DOT ❑

Temp Control: 4.0 °C

KMT 2-25-15

Login Checklist

Cooler Unpacked/Checked by: KMT Date: 2-25-15

JEL LOG#: 1540882

Cooler Check

Cooler ID	Cooler Temp (C)	# of Samples in Cooler	Evidence Tape				Method of Receipt		
			Present?		Intact?				
			Yes	No	Yes	No	Drop Off	Comm. Carrier	Pick Up
	4.0	1		X			X		

Note: if the temperature of a cooler is above 6C or an evidence seal is damaged then identify the bottles in the affected cooler(s) on the sample discrepancy form.
*Write tracking number only if waybill copy cannot be placed in the folder

Condition of Containers:

Loose Caps: Yes_____ No X
If yes, fill out sample discrepancy form.

Broken Containers: Yes_____ No X
If yes, fill out sample discrepancy form.

Acid Preserved Samples: Are their pHs </=2 ?Yes_____ No_____ N/A X
If yes, pH strip lot #:HC412469
If no: Fill out sample discrepancy form
Check unpreserved containers with same Field ID
If acid is added: HCL Lot #: , HNO3 Lot #: , H2SO4 Lot #:

Base Preserved Samples: Are their pHs >/=12 or 9 ?Yes_____ No_____ N/A X
(Cyanide >/= 12; Sulfide >/=9)
If yes, pH strip lot #: HC412469
If no: Fill out sample discrepancy form
Check unpreserved containers with same Field ID
If base is added: NaOH Lot #:

Are all samples in cooler on COC?: Yes X No_____
If no, fill out sample discrepancy form.

Are all samples on COC in cooler?: Yes X No_____
If no, fill out sample discrepancy form.

N/A = not Applicable Temperature Gun ID #: TEMP-GUN-1

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

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

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

System Type (check one): ☐ Community ☐ Non-transient Non-community ☐ Transient Non-community

Address: _____

City: _____ ZIP Code: _____

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

SAMPLE INFORMATION (to be completed by sampler)

Sample Number: Well PW-11 Sample Date: 5/6/2015 Sample Time: 9:15 (AM) PM (Circle One)

Sample Location (be specific): SP1 Location Code: _____

Disinfectant 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*
- ☐ Confirmation 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 62-550.512(3) for nitrate or nitrite exceedances.

**See 62-550.550(4) for requirements and attach a results page for each site.

SAMPLER CERTIFICATION

I, _____ (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: _____

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

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

Lab Name: Pace Analytical Services, Inc. Florida DOH Certification #: E83079 Certification Expiration Date: 06/31/2015

ATTACH CURRENT DOH ANALYTE SHEET*

Address: 8 East Tower Circle, Ormond Beach, FL 32174 Phone # 386 672-5668

Were any analyses subcontracted? [X] Yes [ ] No If yes, please provide DOH certification numbers(s): E87605,E87863

ATTACH DOH ANALYTE SHEET FOR EACH SUBCONTRACTED LAB*

ANALYSIS INFORMATION (to be completed by lab) Date Sample(s) Received: 5/6/2015

PWS ID (From Page1): PBCWUD WTP11 Sample Number (From Page1): Well PW-11 Lab Assigned Report # or Job ID: 35187024001

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 Asbestos	[X] All 30	[X] All 21	[X] Trihalomethanes	[X] Single Sample	[ ] All 14
[ ] Partial	[ ] All Except Dioxin	[ ] Partial	[X] Haloacetic Acids	[ ] Qtrly Composite**	[X] Partial
[ ] Nitrate	[ ] Partial		[X] Chlorite		
[ ] Nitrite	[ ] Dioxin Only		[X] Bromate		
[X] Asbestos					

LAB CERTIFICATION

I, Bo Garcia (Print Name), Project Manager (Print Title), do HEREBY CERTIFY

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

Signature:  Date: 06/02/2015

* 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 failture 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 HRS FOR NITRATE OR 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: _____

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

INORGANIC CONTAMINANTS
62-550.310(1)

Report Number / Job ID: 35187024001

PWS ID (From Page 1): PBCWUD WTP11

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	0.025	U	EPA 353.2	0.025	05/07/2015	14:09	E83079
1041	Nitrite as N	1	mg/L	0.025	U	EPA 353.2	0.025	05/07/2015	14:09	E83079
1005	Arsenic	0.010	mg/L	0.0010		EPA 200.8	0.00050	05/15/2015	21:18	E83079
1010	Barium	2	mg/L	0.068		EPA 200.7	0.0050	05/16/2015	18:42	E83079
1015	Cadmium	0.005	mg/L	0.00050	U	EPA 200.7	0.00050	05/16/2015	18:42	E83079
1020	Chromium	0.1	mg/L	0.0025	U	EPA 200.7	0.0025	05/16/2015	18:42	E83079
1024	Cyanide	0.2	mg/L	0.0050	U	EPA 335.4	0.0050	05/19/2015	13:35	E83079
1025	Fluoride	4.0	mg/L	0.56		EPA 300.0	0.068	05/09/2015	09:59	E83079
1030	Lead	0.015	mg/L	0.00050	U	EPA 200.8	0.00050	05/15/2015	21:18	E83079
1035	Mercury	0.002	mg/L	0.00010	U	EPA 245.1	0.00010	05/28/2015	15:47	E83079
1036	Nickel	0.1	mg/L	0.0025	U	EPA 200.7	0.0025	05/16/2015	18:42	E83079
1045	Selenium	0.05	mg/L	0.00050	U	EPA 200.8	0.00050	05/15/2015	21:18	E83079
1052	Sodium	160	mg/L	**1690**		EPA 200.7	5.0	05/17/2015	11:14	E83079
1074	Antimony	0.006	mg/L	0.00050	U	EPA 200.8	0.00050	05/15/2015	21:18	E83079
1075	Beryllium	0.004	mg/L	0.00050	U	EPA 200.7	0.00050	05/16/2015	18:42	E83079
1085	Thallium	0.002	mg/L	0.00050	U	EPA 200.8	0.00050	05/15/2015	21:18	E83079
1094	Asbestos	7 MFL	MFL	0.18	U	EPA 100.2	0.18	05/07/2015	03:45	E86795

*Results must be reported with appropriate qualifiers in accordance with Florida Administrative Code Rule 62-160, Table 1. Results qualified with A, F, H, N, O, T, Z, ?, *, are unacceptable for compliance with 62-550. Results qualified with a J, Q, R, or Y must be accompanied by written justification and will be evaluated on a case by case basis. To avoid a monitoring violation, unacceptable results must be replaced with acceptable results from samples collected during the same monitoring period.

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

SECONDARY CONTAMINANTS
62-550.320

Report Number / Job ID: 35187024001

PWS ID (From Page 1): PBCWUD WTP11

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	05/16/2015	18:42	E83079
1017	Chloride	250	mg/L	2710		EPA 300.0	125	05/08/2015	00:03	E83079
1022	Copper	1	mg/L	0.00050	U	EPA 200.8	0.00050	05/15/2015	21:18	E83079
1025	Fluoride	2.0	mg/L	0.56		EPA 300.0	0.068	05/09/2015	09:59	E83079
1028	Iron	0.3	mg/L	0.020	U	EPA 200.7	0.020	05/16/2015	18:42	E83079
1032	Manganese	0.05	mg/L	0.025	U	EPA 200.7	0.025	05/17/2015	11:14	E83079
1050	Silver	0.1	mg/L	0.0025	U	EPA 200.7	0.0025	05/16/2015	18:42	E83079
1055	Sulfate	250	mg/L	558		EPA 300.0	125	05/08/2015	00:03	E83079
1095	Zinc	5	mg/L	0.010	U	EPA 200.7	0.010	05/16/2015	18:42	E83079
1905	Color	15	CU							
1920	Odor	3	TON	100		SM 2150B	1.0	05/06/2015	18:30	E86240
1925	pH	6.5 - 8.5	Std. Units	6.8	Q	SM 4500-H+B	0.10	05/07/2015	12:20	E83079
1930	Total Dissolved Solids	500	mg/L	5660		SM 2540C	100	05/13/2015	15:56	E83079
2905	Foaming Agents	0.5	mg/L	0.059	U	SM 5540C	0.059	05/07/2015	08:54	E83079

Q - Sample held beyond the accepted holding time.

*Results must be reported with appropriate qualifiers in accordance with Florida Administrative Code Rule 62-160, Table 1. Results qualified with A, F, H, N, O, T, Z, ?, *, are unacceptable for compliance with 62-550. Results qualified with a J, Q, R, or Y must be accompanied by written justification and will be evaluated on a case by case basis. To avoid a monitoring violation, unacceptable results must be replaced with acceptable results from samples collected during the same monitoring period.

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

DISINFECTION BYPRODUCTS
62-550.310(3)

Report Number / Job ID: 35187024001
Disinfect Residual (mg/L):
PWS ID (From Page 1): PBCWUD WTP11

Contam ID	Contam Name	MCL	Units	Analysis Result	Qualifier*	Analytical Method	Lab MDL	Regulatory MRL**	Analysis Date	Analysis Time	DOH Lab Certification #
1009	Chlorite	1000	ug/L	28.4	U	EPA 300.1	28.4	20***	05/14/2015	17:34	E83079
1011	Bromate	10	ug/L	8.0	U	EPA 300.1	8.0	5.0 or 1.0****	05/14/2015	00:00	E83079

Contam ID	Contam Name	MCL	Units	Analysis Result	Qualifier*	Analytical Method	Lab MDL	Regulatory MRL**	Analysis Date	Analysis Time	DOH Lab Certification #
2450	Monochloroacetic Acid	N/A	ug/L	0.61	U	EPA 552.2	0.61	2.0	05/20/2015	01:52	E83079
2451	Dichloroacetic Acid	N/A	ug/L	0.61	U	EPA 552.2	0.61	1.0	05/20/2015	01:52	E83079
2452	Trichloroacetic Acid	N/A	ug/L	0.61	U	EPA 552.2	0.61	1.0	05/20/2015	01:52	E83079
2453	Monobromoacetic Acid	N/A	ug/L	0.61	U	EPA 552.2	0.61	1.0	05/20/2015	01:52	E83079
2454	Dibromoacetic Acid	N/A	ug/L	0.61	U	EPA 552.2	0.61	1.0	05/20/2015	01:52	E83079
2456	Total Haloacetic Acids (HAA5)	60	ug/L	0.61	U	EPA 552.2	0.61	---	05/20/2015	01:52	E83079

Contam ID	Contam Name	MCL	Units	Analysis Result	Qualifier*	Analytical Method	Lab MDL	Regulatory MRL**	Analysis Date	Analysis Time	DOH Lab Certification #
2941	Chloroform	N/A	ug/L	0.25	U	EPA 524.2	0.25	1.0	05/15/2015	16:41	E83079
2942	Bromoform	N/A	ug/L	0.25	U	EPA 524.2	0.25	1.0	05/15/2015	16:41	E83079
2943	Bromodichloromethane	N/A	ug/L	0.25	U	EPA 524.2	0.25	1.0	05/15/2015	16:41	E83079
2944	Dibromochloromethane	N/A	ug/L	0.25	U	EPA 524.2	0.25	1.0	05/15/2015	16:41	E83079
2950	Total Trihalomethanes (TTHM)	80	ug/L	0.25	U	EPA 524.2	0.25	---	05/15/2015	16:41	E83079

** Laboratories are required to adhere to the minimum reporting level (MRL) requirements of 40 CFR 141.131(b)(2)(iv).

*** 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 µg/L MRL for bromate.

NOTE: Do not round values. Report results to the accuracy, precision, and sensitivity of the analytical method used.

*Results must be reported with appropriate qualifiers in accordance with Florida Administrative Code Rule 62-160, Table 1. Results qualified with A, F, H, N, O, T, Z, ?, *, are unacceptable for compliance with 62-550. Results qualified with a J, Q, R, or Y must be accompanied by written justification and will be evaluated on a case by case basis. To avoid a monitoring violation, unacceptable results must be replaced with acceptable results from samples collected during the same monitoring period.

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

RADIONUCLIDES
62-550.310(6)

Report Number / Job ID: 35187024001

PWS ID (From Page 1) PBCWUD WTP11:

Contam ID	Contam Name	MCL	Units	Analysis Result	Qualifier*	Analytical Method	Lab MDL	RDL	Analysis Error	Analysis Date	Analysis Time	DOH Lab Certification #
4000	Gross Alpha (Excl Uranium)	15	pCi/L	**				3				
4002	Gross Alpha (Incl Uranium)	***	pCi/L	**60.3**		SM 7110C	2.17	3	5.90	05/15/2015	06:34	E87683
4006	Combined Uranium**** (U-234, U-235, & U-238)	20	pCi/L	0.322	U	EPA 908.0	0.322	0.67	0.189	06/19/2015	20:56	E87683
		30	ug/L					1				
4020	Radium-226	5	pCi/L	**40.5**		EPA 903.1	0.989	1	4.35	05/18/2015	13:18	E87683
4030	Radium-228			0.648	U	EPA 904.0	0.648	1	0.326	05/18/2015	17:10	E87683

** If the result exceeds 5 pCi/L, a measurement for radium-226 is required. Uranium is reported separately under Contam ID 4006.

*** If the results exceed 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. The DEP/DOH will subtract the U value from the Gross Alpha (ID 4002) to determine compliance with MCL for Gross Alpha (Excl. U) of 15pCi/L. If the result for ID 4002 Gross Alpha (Including Uranium) does not exceed 15pCi/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.

*Results must be reported with appropriate qualifiers in accordance with Florida Administrative Code Rule 62-160, Table 1. Results qualified with A, F, H, N, O, T, Z, ?, *, are unacceptable for compliance with 62-550. Results qualified with a J, Q, R, or Y must be accompanied by written justification and will be evaluated on a case by case basis. To avoid a monitoring violation, unacceptable results must be replaced with acceptable results from samples collected during the same monitoring period.

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

VOLATILE ORGANICS
62-550.310(4)(a)

Report Number / Job ID: 35187024001

PWS ID (From Page 1): PBCWUD WTP11

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	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2380	cis-1,2-Dichloroethylene	70	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2955	Xylenes (total)	10,000	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2964	Dichloromethane	5	ug/L	0.44	U	EPA 524.2	0.44	0.5	05/15/2015	16:41	E83079
2968	o-Dichlorobenzene	600	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2969	para-Dichlorobenzene	75	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2976	Vinyl chloride	1	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2977	1,1-Dichloroethylene	7	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2979	trans-1,2-Dichloroethylene	100	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2980	1,2-Dichloroethane	3	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2981	1,1,1-Trichloroethane	200	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2982	Carbon tetrachloride	3	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2983	1,2-Dichloropropane	5	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2984	Trichloroethylene	3	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2985	1,1,2-Trichloroethane	5	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2987	Tetrachloroethylene	3	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2989	Monochlorobenzene	100	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2990	Benzene	1	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2991	Toluene	1,000	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2992	Ethylbenzene	700	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079
2996	Styrene	100	ug/L	0.25	U	EPA 524.2	0.25	0.5	05/15/2015	16:41	E83079

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

*Results must be reported with appropriate qualifiers in accordance with Florida Administrative Code Rule 62-160, Table 1. Results qualified with A, F, H, N, O, T, Z, ?, *, are unacceptable for compliance with 62-550. Results qualified with a J, Q, R, or Y must be accompanied by written justification and will be evaluated on a case by case basis. To avoid a monitoring violation, unacceptable results must be replaced with acceptable results from samples collected during the same monitoring period.

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

SYNTHETIC ORGANICS
62-550.310(4)(b)

Report Number / Job ID: 35187024001 PWS ID (From Page 1): PBCWUD WTP11

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	0.0019	U	EPA 508.1	0.0019	0.01	05/07/2015	05/09/2015	05:27	E83079
2010	Lindane	0.2	ug/L	0.0029	U	EPA 508.1	0.0029	0.02	05/07/2015	05/09/2015	05:27	E83079
2015	Methoxychlor	40	ug/L	0.013	U	EPA 508.1	0.013	0.1	05/07/2015	05/09/2015	05:27	E83079
2020	Toxaphene	3	ug/L	0.58	U	EPA 508.1	0.58	1	05/07/2015	05/09/2015	05:27	E83079
2031	Dalapon	200	ug/L	0.89	U	EPA 515.3	0.89	1	05/08/2015	05/10/2015	04:58	E83079
2032	Diquat	20	ug/L	0.15	U	EPA 549.2	0.15	0.4	05/08/2015	05/08/2015	18:22	E83079
2033	Endothall	100	ug/L	4.1	U	EPA 548.1	4.1	9	05/12/2015	05/13/2015	14:13	E83079
2034	Glyphosate	700	ug/L	5.4	U	EPA 547	5.4	6	05/12/2015	05/12/2015	17:10	E83079
2035	Di(2-ethylhexyl)adipate	400	ug/L	0.37	U	EPA 525.2	0.37	0.6	05/07/2015	05/08/2015	01:45	E83079
2036	Oxamyl (Vydate)	200	ug/L	0.47	U	EPA 531.1	0.47	2	05/08/2015	05/08/2015	12:05	E83079
2037	Simazine	4	ug/L	0.042	U	EPA 508.1	0.042	0.07	05/07/2015	05/09/2015	05:27	E83079
2039	Di(2-ethylhexyl)phthalate	6	ug/L	0.48	U	EPA 525.2	0.48	0.6	05/07/2015	05/08/2015	01:45	E83079
2040	Picloram	500	ug/L	0.094	U	EPA 515.3	0.094	0.1	05/08/2015	05/10/2015	04:58	E83079
2041	Dinoseb	7	ug/L	0.16	U	EPA 515.3	0.16	0.2	05/08/2015	05/10/2015	04:58	E83079
2042	Hexachlorocyclopentadinene	50	ug/L	0.031	U	EPA 508.1	0.031	0.1	05/07/2015	05/09/2015	05:27	E83079
2046	Carbofuran	40	ug/L	0.75	U	EPA 531.1	0.75	0.9	05/08/2015	05/08/2015	12:05	E83079
2050	Atrazine	3	ug/L	0.020	U	EPA 508.1	0.020	0.1	05/07/2015	05/09/2015	05:27	E83079
2051	Alachlor	2	ug/L	0.033	U	EPA 508.1	0.033	0.2	05/07/2015	05/09/2015	05:27	E83079
2063	2,3,7,8-TCDD (Dioxin)	0.03	ng/L	0.0012	U	EPA 1613	0.0012	0.005	05/13/2015	05/14/2015	18:38	E87605
2065	Heptachlor	0.4	ug/L	0.0058	U	EPA 508.1	0.0058	0.04	05/07/2015	05/09/2015	05:27	E83079
2067	Heptachlor epoxide	0.2	ug/L	0.0029	U	EPA 508.1	0.0029	0.02	05/07/2015	05/09/2015	05:27	E83079
2105	2,4-D	70	ug/L	0.081	U	EPA 515.3	0.081	0.1	05/08/2015	05/10/2015	04:58	E83079
2110	2,4,5-TP (Silvex)	50	ug/L	0.16	U	EPA 515.3	0.16	0.2	05/08/2015	05/10/2015	04:58	E83079
2274	Hexachlorobenzene	1	ug/L	0.011	U	EPA 508.1	0.011	0.1	05/07/2015	05/09/2015	05:27	E83079
2306	Benzo(a)pyrene	0.2	ug/L	0.018	U	EPA 525.2	0.018	0.02	05/07/2015	05/08/2015	01:45	E83079
2326	Pentachlorophenol	1	ug/L	0.030	U	EPA 515.3	0.030	0.04	05/08/2015	05/10/2015	04:58	E83079
2383	Polychlorinated biphenyls (PCBs)	0.5	ug/L	0.077	U	EPA 508.1	0.077	0.1	05/07/2015	05/09/2015	05:27	E83079
2931	Dibromochloropropane	0.2	ug/L	0.0051	U	EPA 504.1	0.0051	0.02	05/12/2015	05/13/2015	06:41	E83079
2946	Ethylene Dibromide (EDB)	0.02	ug/L	0.0065	U	EPA 504.1	0.0065	0.01	05/12/2015	05/13/2015	06:41	E83079
2959	Chlordane	2	ug/L	0.045	U	EPA 508.1	0.045	0.2	05/07/2015	05/09/2015	05:27	E83079

NOTE: Results indicating non-detection with a reported lab MDL >50% of the MCL will not be accepted for compliance.

*Results must be reported with appropriate qualifiers in accordance with Florida Administrative Code Rule 62-160, Table 1. Results qualified with A, F, H, N, O, T, Z, ?, *, are unacceptable for compliance with 62-550. Results qualified with a J, Q, R, or Y must be accompanied by written justification and will be evaluated on a case by case basis. To avoid a monitoring violation, unacceptable results must be replaced with acceptable results from samples collected during the same monitoring period.

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

OTHER CONTAMINANTS

Report Number / Job ID: 35187024001

PWS ID (From Page 1): PBCWUD WTP11

Contam ID	Contam Name	MCL	Units	Analysis Result	Qualifier*	Analytical Method	Lab MDL	Analysis Date	Analysis Time	DOH Lab Certification #
	Nitrogen, NO2 plus NO3	10	mg/L	0.025	U	EPA 353.2	0.025	05/07/2015	14:09	E83079
	PCB-1016 (Aroclor 1016)		ug/L	0.077	U	EPA 508.1	0.077	05/09/2015	05:27	E83079
	PCB-1221 (Aroclor 1221)		ug/L	0.028	U	EPA 508.1	0.028	05/09/2015	05:27	E83079
	PCB-1232 (Aroclor 1232)		ug/L	0.028	U	EPA 508.1	0.028	05/09/2015	05:27	E83079
	PCB-1242 (Aroclor 1242)		ug/L	0.049	U	EPA 508.1	0.049	05/09/2015	05:27	E83079
	PCB-1248 (Aroclor 1248)		ug/L	0.059	U	EPA 508.1	0.059	05/09/2015	05:27	E83079
	PCB-1254 (Aroclor 1254)		ug/L	0.022	U	EPA 508.1	0.022	05/09/2015	05:27	E83079
	PCB-1260 (Aroclor 1260)		ug/L	0.063	U	EPA 508.1	0.063	05/09/2015	05:27	E83079
	Methyl-tert-butyl ether		ug/L	0.25	U	EPA 524.2	0.25	05/15/2015	16:41	E83079
	Naphthalene		ug/L	0.25	U	EPA 524.2	0.25	05/15/2015	16:41	E83079
	E.coli			Absent		SM 9223B		05/07/2015	15:44	E86240
	Total Coliforms			Absent		SM 9223B		05/07/2015	15:44	E86240

*Results must be reported with appropriate qualifiers in accordance with Florida Administrative Code Rule 62-160, Table 1. Results qualified with A, F, H, N, O, T, Z, ?, *, are unacceptable for compliance with 62-550. Results qualified with a J, Q, R, or Y must be accompanied by written justification and will be evaluated on a case by case basis. To avoid a monitoring violation, unacceptable results must be replaced with acceptable results from samples collected during the same monitoring period.

APPENDIX G
PROJECT PHOTOGRAPHS & ELECTRONIC COPY OF WELL COMPLETION REPORT