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Construction and Testing Report

Southeast Monitoring Wells

November 2013

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Southeast Monitoring Wells

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1 Introduction

In May 2004, Orlando Utilities Commission (OUC) retained ARCADIS G&M, Inc., (ARCADIS) to provide hydrogeologic consulting services for the design of a multi-zone monitor well or well cluster located southeast of the Southeast Water Plant Wellfield, and to prepare technical specifications for construction. St. Johns River Water Management District (SJRWMD) requires OUC to monitor three zones in the Floridan Aquifer as a condition of its consumptive water use permit. The condition requires OUC to identify the depth of the 5,000-milligram per liter isochlor for chloride, and to undertake periodic water-level and water-quality monitoring of the Upper Floridan aquifer production zone, the upper production zone of the Lower Floridan (also called Mid-Floridan) aquifer and the 250 mg/L isochlor.

A single monitor well, to monitor the Upper Floridan aquifer production zone was designed, along with a test well drilled to 2,200 feet below land surface to investigate the 5,000-milligram per liter isochlor (chloride). The design then required conversion of the deep test well to a dual zone monitor well, to monitor the two lower zones.

This report summarizes the results from the construction of the wells, including the comprehensive testing program that was completed. Well construction and testing procedures were performed in accordance with the July 2006 contract and specifications entitled “Orlando Utilities Commission Southeast Monitor Wells”, prepared with the assistance of ARCADIS. The Contractor selected for the construction and testing was Florida Design Drilling Corp., a Florida state licensed water well contractor. A site map showing the general location of the monitor well cluster is presented as **Figure 1**, with a more detailed site plan provided in **Figure 2**.

2 Test Objectives

The prime objective of the monitor well cluster is to satisfy SJRWMD permit condition "Other Conditions No. 26, I, B, Monitor Location 1" as described in the Technical staff Report.

Several secondary objectives associated with the drilling and testing were also added and included;

- Improve the characterization of the middle semi-confining / confining unit located between the upper and lower Floridan aquifers;
- Identify possible anhydrite layers within the Avon Park Formation that may explain the source of high sulfate concentrations that are encountered in the OUC Southeast well field;
- Identify possible injection or aquifer recharge zones.

Experience elsewhere in Florida has shown that the Floridan aquifer is a complex aquifer system, with discrete flow zones that vary in depth and quality regionally. Therefore in order to properly characterize the aquifer and determine suitable monitor zone depths, a carefully designed testing program consisting of pilot-hole drilling, drill-stem water quality sampling, flow measurements, geophysical logging and packer testing was completed, prior to installation of the monitor tubes in the dual zone monitor well.

3 Regional Hydrogeological Setting

The regional stratigraphy and hydrogeological setting of the area surrounding the test well site is summarized in **Figure 3**: Generalized Regional Geology and Hydrogeology. This figure, sourced from O'Reily et al (2002), summarizes the stratigraphic units, lithologic descriptions and corresponding hydrogeologic units. Two distinctly different aquifer units are present at this location; the Surficial aquifer and the Floridan aquifer, separated by a sequence of clays and other sediments belonging to the Hawthorn Group.

The Surficial aquifer is the uppermost water-bearing unit and generally consists of unconsolidated quartz sands with varying amounts of shell and clay. This aquifer contains the water table, and water within it is under mainly unconfined conditions and in the low lying wetland areas is very close to, or at the surface. These sediments, which were deposited during the Pliocene to Holocene periods, lie between land surface and a depth of approximately 40 feet.

The lower limit of the Surficial aquifer coincides with the top of laterally extensive and vertically persistent beds of lower permeability. These beds, which belong to the Hawthorn Group, consist of interbedded, locally highly phosphatic clays, silt, sand limestone and dolomite. These sediments are collectively referred to as the "Intermediate Confining Unit" and restrict vertical movement of groundwater between the surficial aquifer and the underlying Floridan aquifer. Total thickness of these sediments in the vicinity of the southeast monitor well site is approximately 180 feet. At the base the intermediate confining units there are more permeable zones of sandy limestone and dolomite which are generally attributed to the Arcadia Formation (basal Hawthorn Group).

The Floridan aquifer system, the primary source of groundwater in Central Florida, underlies all of Florida and southern Georgia. The aquifer consists primarily of Eocene-age Ocala Limestone, Avon Park Formation and Oldsmar Formation and approaches a total thickness of approximately 2,300 feet. The aquifer system has been mapped with two permeable zones; the Upper and Lower Floridan aquifers. The Upper Floridan aquifer lies within the Ocala Limestone and the upper portion of the Avon Park Formation. The Lower Floridan aquifer generally lies within the lower part of the Avon Park Formation and the Oldsmar Formation. Between these two permeable zones is an interval of softer less permeable limestone and dolomite within the Avon Park Formation that is collectively referred to as the "middle semi confining unit".

4 Construction and Testing of UFMW-1

Construction of the Upper Floridan Monitor Well (UFMW-1) was undertaken in three stages;

- Installation of outer casing strings comprising of 16-inch outside diameter (OD) pit casing to 40 feet below land surface (feet bls) and 8-inch OD surface casing set into the top of the intermediate confining unit (Hawthorn Group) to 100 feet bls;
- Pilot-hole drilling and testing down to 290 feet bls to determine the water quality and flow characteristics within the Upper Floridan aquifer so that the monitor interval could be determined;
- Final construction, including installation of final casing to 230 ft bls, well development, test pumping, completion of headworks and final water quality sampling.

A summary of the daily construction activities is provided in **Table 1**. Final well construction and a summary of the testing completed during pilot-hole drilling of UFM-1 are shown graphically in **Figure 4**. Detailed results from the drilling and testing are contained in the Appendices.

4.1 Outer Casing Strings

On August 16, 2010, 16-inch OD steel pit casing was installed and cemented in place to a depth of 40 feet bls. On August 17, 2010, the Contractor drilled a nominal 16-inch diameter hole using a 15.00-inch diameter tri-cone (roller) bit from the base of the 16-inch diameter pit casing to a depth of approximately 104 feet bls using the mud-rotary drilling method. The borehole was advanced into the top of the Hawthorn Group. X-Y Caliper and Gamma-Ray logging was performed by MV Geophysical Services prior to installation of 8-inch inside diameter (ID), 0.375-inch wall thickness steel surface casing. Copies of the log plots are included in **Appendix C**. The 8-inch casing was installed to 100 feet bls on August 18, 2010 and cemented in place.

4.2 Pilot Hole Drilling:

On August 19, 2010, the Contractor began to drill a nominal 8-inch diameter pilot-hole using a 7.75-inch diameter tri-cone (roller) bit from the base of the 8-inch diameter steel surface casing (100 feet bls) to a depth of approximately 290 feet bls using the

mud-rotary drilling method. This drilling was completed the same day. Geologic descriptions of the drill cuttings were prepared and these descriptions, along with those taken during drilling for the outer casing strings, are included in **Appendix B**.

Following completion of the pilot hole, X Y Caliper and gamma-ray logging were performed to determine the appropriate depth for the final casing. Logging was completed by MV Geophysical Services and observed by ARCADIS personnel. Copies of the log plots are included in **Appendix C**. The base of the Hawthorn Group was noted at a depth of approximately 218 feet bls. A depth of approximately 230 feet below grade was selected as most suitable for the Final Casing setting.

4.3 Final Construction

On August 20, 2010 4-inch ID, 0.375-inch wall thickness steel final casing was installed to a depth of 230 feet bls with a cement basket attached. The final casing was cemented in place with 2 stages of cementing. The first stage, following an initial 1 cubic foot spot placement of neat cement at the base of casing, was placed via cement tremie. The first stage was tagged at 105 feet bls, and on August 23, 2010 a second stage of neat cement was pumped via tremie until detected at the surface. A summary of all cementing completed is provided in **Table 7.**

UFM-1 was initially developed using air on August 23, 2010. However during construction of the Dual Zone Monitor Well (DZMW-1), UFM-1 was periodically used for make-up water, which meant that prior to final development and sampling, the well was already well developed. Final development was completed on February 10, 2011 using a submersible pump set with a total of 1,860 gallons pumped. A specific capacity test was performed with a calculated specific capacity 1.2 gpm/ft, and a final water quality sample was taken. A copy of the final water quality results are contained in **Appendix F**.

5 Construction and Testing of DZMW-1

Construction of the Dual Zone Monitor Well (DZMW-1) was undertaken in four stages;

- Installation of outer casing strings comprising 42-inch OD pit casing to 40 feet bls and 30-inch OD surface casing to 110 feet bls set into the top of the Hawthorn Group;

- Installation of 20-inch OD intermediate casing to 307 feet bls in order to isolate the Hawthorn Group and the interval selected for the Upper Floridan aquifer monitor zone;

- Pilot-hole drilling and testing to 2,075 feet bls to determine the water quality and flow characteristics within the Floridan aquifer, including the depths of the 250 and 5,000-milligram per liter isochlors for chloride;

- Final construction, including installation of dual zone monitor intervals following reaming, well development, test pumping, completion of headworks and final water quality sampling.

A summary of the daily construction activities is provided in **Table 1**. Final well construction and a summary of the testing completed during pilot-hole drilling of DZMW-1 are shown graphically in **Figure 4**. Detailed results from the drilling and testing are contained in the Appendices, with a summary of test results provided in **Section 6**.

5.1 Construction of Outer casing Strings

On August 25, 2010, 42-inch OD steel pit casing was installed and cemented in place to a depth of 40 feet bls. On August 27, 2010, the Contractor drilled a nominal 40-inch diameter hole using a 39.00-inch diameter tri-cone (roller) bit from the base of the 42-inch diameter pit casing (40 feet bls) to a depth of approximately 112 feet bls using the mud-rotary drilling method. The borehole was advanced into the top of the Hawthorn Group. On August 30, 2010, X Y caliper and gamma-ray logging was performed by MV Geophysical Services following a “wiper pass”. Copies of the log plots are included in **Appendix C.**

On August 31, 2010, 30-inch outside diameter, 0.375-inch wall thickness steel surface casing was installed to 110 feet bls, and the first of two cement stages completed. The

second cement stage was completed on September 1, 2010, following tagging of the first stage at 64.5 feet bls.

5.2 Construction of Intermediate Casing String

On September 2, 2010, the Contractor began to drill a nominal 30-inch diameter borehole using a 29-inch diameter tri-cone (roller) bit from the base of the 30-inch diameter steel surface casing (110 feet bls). During the period September 2 to September 9, 2010, drilling was advanced to a total depth of approximately 311 feet bls using the mud-rotary drilling method. Geologic descriptions of the drill cuttings were prepared and these descriptions are included in **Appendix B**.

Following "wiper trips" of the open hole, geophysical logging (X Y caliper and gamma-ray) were performed on September 14, 2011 to determine the appropriate depth for the intermediate casing. Logging was completed by MV Geophysical Services and observed by ARCADIS personnel. Copies of the log plots are included in **Appendix C**. The base of the Hawthorn Group clays was noted at a depth of approximately 216 feet bls. These logs were correlated with logs completed for UFM-1 and it was determined that the vertical offset between the two boreholes is approximately 2 feet, with strata in UFM-1 deeper. A depth of approximately 307 feet bls was selected as most suitable for the Intermediate Casing setting to ensure the monitor interval in UFM-1 was protected during drilling of DZMW-1.

Immediately following geophysical logging, the 20-inch OD, 0.375-inch wall thickness steel intermediate casing was installed to 307 feet bls. The intermediate casing was cemented in place during 3 stages of cementing. A summary of the cementing completed is provided in **Table 7**. Upon completion, the Contractor switched drilling rigs and rigged up for testing and for drilling the remainder of the borehole using the reverse-air method of drilling. Prior to commencement of pilot hole drilling, the intermediate casing was checked for plumbness and alignment using the "sure-shot" method and all drift results were found to be within acceptable range. The results from this testing is provided in **Table 2**.

5.3 Pilot-Hole Drilling

The Contractor drilled a nominal 12-inch diameter pilot-hole by the reverse-air method using a 9.75-inch diameter drilling bit from the base of the 20-inch diameter intermediate casing set at 307 feet bls to a total depth of 2,075 feet bls. Geologic

descriptions of the drilled cuttings were prepared by ARCADIS personnel and are included in **Appendix B**.

Pilot hole drilling was completed in two sections. The reason for this was to ensure reliable determination of the 250 mg/L isochlor for chloride prior to encountering more saline groundwaters at greater depth. The first section of drilling was completed to a depth of 1,602 feet bls between October 5 and November 11, 2010. Following testing of this section, the pilot hole was then extended to a total depth of 2,075 feet bls between December 8 and December 14, 2010.

5.3.1 Drill-Stem Water Quality Tests

During drilling, an ARCADIS hydrogeologist collected water samples for field measurements of chloride, specific conductance, temperature, and sulfide. Water samples were collected from the reverse-air discharge at the completion of each drill rod change (approximately every 30 feet). The prime objective of this sampling was to determine the approximate depth of the 250 and 5,000-milligram per liter isochlors for chloride. From these provisional water quality results, and the results from the geophysical logging, depths for completing packer tests to more accurately determine the water quality was then identified. Results from the drill stem water quality samples are presented in **Table 3**.

5.3.2 Inclination Surveys

Inclination surveys were completed every 90 feet to ensure good verticality. Verticality was checked using the “sure-shot” method and all drift results were within acceptable range. The results from this testing is provided in **Table 6**.

5.3.3 Core Runs

Three core runs were completed for select intervals during drilling of the upper section of the pilot hole. The intervals for these core runs are summarized in **Table 5**. Core log summaries including lithologic descriptions are provided in **Appendix B**. The prime objective of the core runs was to allow determination of the confining properties of the middle semi-confining unit. Core was delivered to SJRWMD for further analysis.

5.3.4 Geophysical Logging

Geophysical surveys were performed on the nominal 12-inch diameter pilot hole by MV Geophysical Services. Two logging runs were performed – one for each of the two sections of pilot hole. The first section of pilot hole from the base of the intermediate casing to 1,602 feet bls was logged in entirety. For the second section of pilot hole, which was extended from 1,602 feet to 2,075 feet bls, fluid logs were completed in entirety, but the formation logs were completed from 1,500 feet to 2,077 feet bls, i.e. only the lowermost 100 feet of the upper section was re-logged to ensure correlation of the two sections.

For both logging runs, logging was initially conducted under static conditions. Static logs included formation and fluid logging. The formation logging suite comprised of X-Y Caliper, Gamma-Ray, spontaneous potential, single-point resistance and dual-induction. Fluid logging included temperature, fluid resistivity and flowmeter. Static fluid logs were then repeated under dynamic pumping conditions to better differentiate potential flow zones. Video surveys using side scan were completed following the dynamic fluid logging as this ensured greatest down hole borehole clarity. Dynamic flow logging was achieved using a submersible pump set installed at approximately 60 feet bls. For the first logged interval (245 to 1,602 feet bls), dynamic logging was undertaken at approximately 460 gpm. For the second logged interval (245 to 2,077 feet bls) logging was undertaken at approximately 450 gpm. A summary of the logging is presented in **Table 4**. Copies of the log plots are included in **Appendix C**

5.3.5 Packer Testing

Based on results from the geophysical logging (formation, fluid and video surveys); drill stem water-quality data; and lithologic descriptions, sections of the open pilot hole were targeted for completion of inflatable packer tests to determine water quality and hydraulics of the water-bearing formation. Centerline depths for the packer elements were carefully selected using the caliper logs and side view video to ensure over inflation of the packers did not occur, and to avoid setting packers directly onto any secondary porosity features in the pilot hole side wall that may allow the packers to leak.

A total of six packer tests were performed using a combination of single and straddle packers. All tests followed the same protocol, which following packer inflation, consisted of a development phase to ensure stable water quality, a recovery phase to allow water levels to return to static conditions, a constant rate pumping phase at test

rates between approximately 37 and 72 gpm and durations of up to 468 minutes, followed by deflation and removal or relocation of the packers. Pressure heads for the packer interval and for the heads above the upper packer were instrumented during the tests. Flow rates from the test zone were recorded via an inline flow meter.

Packer tests 1, 2 and 3 were conducted between November 17, and December 7, 2010 using straddle packers. These tests were undertaken following completion of the first section of pilot hole. Packer test spans (the distance between the upper and lower packer elements), were set to try and replicate the likely final monitor interval for the 250 mg/L isochlor for chloride. Packer tests 4, 5 and 6 were conducted between December 27, 2010 and January 13, 2011 following completion of the lower section of the pilot hole and used both single and straddle packers.

Packer tests 4 and 5 were undertaken using a single packer, with the bottom of the test interval being the bottom of the pilot hole. Results for packer test 4 (PT#4) confirmed the presence of groundwater with chlorides greater than 5,000 mg/L, however the borehole geometry at the base of the pilot hole meant that conducting a straddle packer test at a slightly higher interval to determine the location of groundwater with chlorides less than 5,000 mg/L was risky. Therefore prior to conducting PT#5, the pilot hole was back plugged from 2,075 feet to 1,956 feet bls. Back plugging was undertaken in multiple stages on January 3, 4 and 5, 2011, after an almost complete cement loss during the first lift, (actual versus theoretical lift was only1.2 percent), necessitated careful placement of alternating lifts of gravel and neat Type I/II cement coinciding with cavities and more competent formation. A summary of this back plugging is provided in **Table 8**. Packer Test 6 (PT#6), located within a higher interval, was completed on January 13, 2011 using straddle packers. The aim of this packer test was to confirm the hydraulic parameters for an upper monitor zone.

A summary of the selected test intervals is provided in **Table 10**, and are shown graphically on **Figure 4**. **Table 10** also summarizes the laboratory analysis for the final water quality samples taken at the end of each test. **Table 11** summarizes the calculated hydraulic parameters for each of the tested intervals. Packer test results are described more fully in Section 6 and the measurements taken during testing are contained in **Appendix E**.

5.4 Final Construction

After completing all pilot hole drilling, testing, and data analysis, the intervals for the upper and lower monitor zones in DZMW-1 were confirmed, with input from SJRWMD

staff. The lower monitor zone was selected with an interval 1,423 to 1,453 feet bls, and is designed to monitor the 250 mg/L isochlor for chloride. The upper monitor zone was selected with an interval 475 to 507 feet bls, and is designed primarily to monitor water level changes at the very base of the upper Floridan aquifer. A summary of the data used to select these monitor intervals is provided in **Section 7**.

The dual zone monitor well consists of two monitor tubes with identical design components. In summary, the uppermost 150 feet of tubing for each monitor zone consists of nominal 4-inch ID Fiberglass Reinforced Pipe (FRP) tubing designed to allow installation of 3-inch OD sample pumps. This tubing is connected via reducer to nominal 2.5-inch ID FRP tubing, which in turn is connected to a 35-foot screen assembly located within the monitor interval. The screen assembly, from the base up, consists of a capped 5-foot blank end sump pipe and a 30-foot, 2.5 inch FRP well screen. This assembly is encapsulated within a gravel pack comprising of 40 linear feet of pea gravel with an overlying 5 linear feet of fine sand and a "cement shot" to allow placement of cement in the remaining annulus. The small diameter of the monitor tubes is designed to reduce the purge volumes required to withdraw samples from greater depths. The monitor well construction is summarized in **Figure 4,** while more detailed drawings of the monitor zone assembly and monitor wellhead completions are provided in **Appendix A**.

5.4.1 Monitor Tube Installation

Prior to installation of the monitor tube array, the pilot hole was back-plugged further from 1,956 feet to a total depth of 1,462 feet bls, to match the base of the proposed lower monitor interval. Back plugging was completed with multiple lifts during the period January 14 to January 24, 2011. With the exception of the second stage of back plugging, the pilot hole was back plugged with Type I/II neat cement. Excessive cement losses during the first stage of cementing (3.8 percent actual fill versus theoretical), necessitated emplacement of gravel for a 22-foot interval between 1,928 and 1,950 feet bls. A summary of the back plugging is provided in **Table 9**.

The monitor tube array was installed in multiple steps. The first step involved installation of the lower monitor zone tubing and gravel pack on January 25, 2011. Star® Series 1250-ACT tubing with an ID of 3.91-inch and wall thickness of 0.24-inch was installed to 150 feet bls as designed. This was connected to Star® Series 1750-ACT tubing with an ID of 2.43-inch and wall thickness of 0.21-inch, installed to a total depth of 1,453 feet bls. The higher pipe rating for the 2.5-inch FRP was used as greater stiffness is needed for installing small diameter tubing to greater depths. The

screen interval was set between 1,423 and 1,453 feet bls. The installed well screen was hand slotted 2.5inch FRP tubing with 0.038-inch slot and a minimum open area of 3 percent. Kwik-Zip casing centralizers at the specified intervals were installed on the monitor tubing. Gravel was emplaced from 1,462 to 1,418 feet bls and topped off with fine sand to approximately 1,415 feet bls.

The second step involved placement of neat cement in the annulus (ASTM Type I/II) to a depth of 515 feet bls. Cementing was undertaken in 9 cementing stages and was completed during the period January 26 to February 3, 2011. A summary of cementing is provided in **Table 7**. Despite careful placement of cement and review of cementing calculations, the top of cement feet was placed to a depth of 512 feet bls, 3 feet above the target depth of 515 feet bls.

The third step involved installation of the upper monitor zone tubing and gravel pack on February 1, 2011. The screen interval was set between 507 and 475 feet bls. Due to the top of cement exceeding the target depth of 515 feet bls, two additional feet of screen was installed by hand slotting the top two feet of the 5-foot blank sump pipe installed below the 30-foot screen assembly, therefore in the UMZ there is a 3 foot blank sump pipe installed – which is still considered sufficient. Gravel was emplaced from 470 to 512 feet bls and topped off with fine sand to approximately 468 feet bls.

The fourth step involved placement of neat cement in the annulus (ASTM Type I/II) to the surface. Cementing was undertaken in 4 cementing stages and was completed during the period February 4 to February 9, 2011. A summary of cementing is provided in **Table 7**.

5.4.2 Well Development, Water Quality Sampling and Specific Capacity Testing

On February 10, 2011, the UMZ and LMZ were separately developed using a 3-inch submersible pump set at approximately 130 feet bls. The UMZ was developed for a period of 100 minutes at an average rate of 62.2 gpm. During this period of pumping approximately 19.4 well volumes were removed. The LMZ was developed for a period of 95 minutes at an average rate of 54 gpm with approximately 12.8 well volumes removed.

During development initial hydraulic parameters were measured. At the end of development, water quality field parameters (temperature, conductivity, chlorides and pH) were measured, and a final water quality sample was taken. A summary of the monitor zone development, field water quality measurements and specific capacity

testing is provided in **Table 12**. The final water quality results are contained in **Appendix F**.

5.4.3 Wellhead Completion, Survey and Site Restoration

Wellheads were completed as per plan, and a final wellhead and site survey completed. In summary, UFMW-1 was completed with the 4-inch monitor well casing protected by outer 12-inch stainless steel casing and a custom made locking well cap. The protective casing was cemented in place with a 3-foot square reinforced concrete well pad, and 4-inch concrete filled steel bollards were installed at each corner of the well pad. DZMW-1 was completed in a similar fashion, with the two 4-inch monitor casings (UMZ and LMZ) protected by 16-inch diameter stainless steel casing.

A final site survey was completed to confirm the well locations, the well pad and well top elevations, and to provide horizontal control for the driveway access. The survey revealed that the driveway in the vicinity of the monitor wells was incorrectly located, therefore it was realigned. Modifications were also made to the driveway turning access so that a small dry retention pond could be accommodated. The pond, with approximate dimensions 60 feet by 25 feet and a total depth below grade of approximately 2 feet, was constructed so that purge water from the monitor wells could be directed to this pond without risk of flooding the site.

Final survey, including photographs of the wellheads, is included in **Appendix A**. Key survey information is as follows:

Well UFMW-1

Coordinates	N =1465285.8
	E = 576300.2
Pad Elevation	84.843 ft NAVD (benchmark)
Top of 12“ casing	87.14 ft NAVD

Well DZMW-1

Coordinates	N =1465198.4
	E = 576303.3
Pad Elevation	85.046 ft NAVD (benchmark)
Top of 16“ casing	87.12 ft NAVD

6 Summary Results

6.1 Hydrogeological Profile

Surficial

From land surface to a depth of 40 feet, the sediments consist primarily of unconsolidated fine grained quartz sand, (very fine to fine-grained) with phosphatic sandy clay below 30 feet.

Intermediate Confining Unit (Hawthorn Group)

Between 40 feet and approximately 90 feet bls the sediments are more competent with alternating layers of limestone, sandstone, shell and clayey sand. It is difficult to interpret whether these sediments are post Hawthorn Group sediments or part of the Upper Hawthorn Group. The Gamma Ray log in the UFMW-1 15-inch pilot hole (RUN 1) show minor gamma peaks (over 30 GAPI) between approximately 40 feet and 70 feet bls that could be reworked Hawthorn sediments, but equally could be undisturbed phosphatic layers within the Hawthorn Group.

From 90 feet bls a mix of interbedded poor to well cemented sandstone, limestone, shell, and sand extends to approximately 220 feet bls. At the base of this interval are phosphatic sands and minor shale inter-beds. The gamma ray log (UFMW-1 RUN 2) show peaks and a signature characteristic of the Arcadia Formation (basal Hawthorn Group) with a drop in counts to less than 10 GAPI at 218 feet bls.

Total thickness of the Hawthorn Group is estimated to be at least 130 feet and possibly 180 feet, with sediments below 90 feet bls attributed as belonging to the Arcadia Formation. As stated above, the sandstones logged between 40 and 90 feet bls may or may not be part of the Hawthorn Group, but are tentatively identified as belonging to the Peace River Formation.

Upper Floridan Aquifer (Ocala Limestone)

Below 220 feet bls a change to white (N9) soft chalky limestone is noted. Minor interbeds of Dolostone (or dolomitic limestone), marl, yellowish grey (5Y 7/2) limestone (mainly packstone with mollusk intraclasts) are present. It is interpreted that this sequence is the upper section of the Ocala Limestone; although it cannot be

completely ruled out that the interval from 220 to approximately 302 feet bls is in fact the Suwannee Limestone.

Below 302 feet bls the dolomite content increases. Light grey (N6) and yellowish grey (5Y 7/2) poorly cemented oolitic grainstones alternate with fine crystalline hard dolostones. The log descriptions between 302 and 440 feet bls generally match the sequence associated with the lower Ocala Limestone.

The interval from approximately 440 to 525 feet bls is significantly dolomitized, and includes darker brown (10YR 4/2) dolomite. The top of this interval is likely the top of the Avon Park Formation. The base of this interval is correlated as being the base of the Upper Floridan Aquifer. This sequence contains several significant fracture zones and in the Orlando area this is a significant aquifer zone referred to as "Zone B" of the Upper Floridan aquifer (O'Reilly et el (2002)). Elsewhere this is referred to as the Avon Park Permeable Zone (APPZ) (Reese and Richardson (2007)).

Middle Confining Unit

At 525 feet bls there is a distinct formation change from Dolostone to a sequence dominated by soft oolitic packstone and grainstone. This is interpreted to be the top of the middle semi-confining or confining unit, and is also part of the Avon Park Formation. The top of this unit is clearly identified by the sharp decrease in formation resistivity (see DZMW-1, RUN 3, DIL3). This sequence continues to a depth of 1,145 feet bls.

Lower Floridan Aquifer

Below 1,145 feet bls there are very hard crystalline dolostones, predominantly pale yellowish brown (10YR 6/2) in color. It is interpreted that this transition lithologically is into layers assigned to the top of the Lower Floridan aquifer. However static and dynamic flow logging (see section 6.3.2) did not identify zones of any measurable permeability until below approximately 1,450 feet bls. The interval between 1,145 feet bls and approximately 1,450 feet bls therefore may be better described as a partially confining unit with minor horizontal fracture zone layers.

A transition to an alternating sequence of white (N9) chalky limestone, yellowish grey (5Y 8/1) micritic limestone with occasional fossiliferous layers and dolostone occurs below 1,530 feet bls. This sequence is typical for the Oldsmar Formation. This

sequence continues to a depth of 1,926 feet bls. Glauconitic marker beds commonly associated with the top of the Oldsmar Formation were not positively identified.

Below 1,926 feet bls the sequence is dominated by microcrystalline, massive, hard to very hard, pale yellowish brown (10YR 6/2) and grey (N5) dolomite. This sequence continues to the total depth of the pilot hole (2,075 feet bls), and is interpreted as belonging to the Cedar Keys Formation. Slow drilling progress through this sequence, the absence of positively identified anhydrite layers, and the confirmation of very brackish groundwater below 2,043 feet bls (see section 6.2 below), meant pilot hole drilling was terminated.

6.2 Drill Stem Water Quality Profile

During pilot-hole drilling of DZMW-1, water samples were collected from the reverse air discharge at each drill rod change (approximate 32-foot intervals), and analyzed in the field for basic parameters; temperature, specific conductivity and chloride concentration. Samples were also analyzed for sulfide starting with a sample taken at 565 feet bls.

Prior to taking each water sample, the circulation water was briefly discharged directly to above ground tanks and not re-circulated. This sampling technique was undertaken to improve the likelihood that the majority of the groundwater sampled comes from the depth of the drill bit. However, care must still be taken with interpreting the results because these samples still generally reflect muted changes in pilot-hole water quality with depth because there is still the possibility that the sample includes a mixture of re-circulated drilling fluids containing formation water from overlying depths. Therefore only general water quality trends can be interpreted, and the most reliable water quality samples are those obtained from the packer test intervals.

The reverse-air discharge water-quality data for DZMW-1 is included in **Table 3**. Associated chloride and conductivity plots are presented in **Figure 5**. The results from the pilot-hole drill stem water quality sampling indicate the following:

- Between 348 and 442 feet bls: Water quality remains stable with chloride concentrations of 40 milligrams per liter (mg/L) and conductivity between 511 and 672 micro Siemens per centimeter (µS/cm).

- Between 442 and 1,131 feet bls: A small increase in chloride and conductivity is noted between the samples taken at 442 feet and 503 feet bls. Chlorides

increase from 40 mg/L to 100 mg/L and conductivity from 672 μS/cm to 1,001 μS/cm. This change in water quality coincides with the top of a major flow zone located between approximately 440 and 520 feet bls observed on the down hole flow logs, and identified as the APPZ. Below 503 feet to 1,131 feet bls there is very little change in water quality and it is interpreted that the majority of the circulation water sampled below 503 feet is derived from the APPZ.

- Between 1,131 and 1,413 feet bls: A further small, but notable step wise increase in chloride and conductivity is observed between the samples taken at 1,131 feet and 1,154 feet bls. Chlorides increase from 80 mg/L to 120 mg/L and conductivity from 1,005 μS/cm to 1,259 μS/cm. Between 1,154 feet and 1,4134 feet bls there is a continued small but measurable increasing trend with chlorides increasing from 120 mg/L to 200 mg/L and conductivity from 1,259 μS/cm to 1,739 μS/cm. This interval coincides with a zone interpreted to have partially confining properties.

- Between 1,445 and 1,602 feet bls: Salinities are much higher, with chlorides in the range 400 mg/L to 500 mg/L and conductivity 2,640 μS/cm to 3,000 μS/cm. Based on the drill stem water quality samples, the depth of the 250 mg/L isochlor for chloride is interpreted to lie between 1,413 feet and 1,445 feet bls.

- Between 1,635 and 1,917 feet bls: An unexpected drop in salinity from the overlying interval is measured, with chlorides in the range 100 mg/L to 360 mg/L and conductivity 936 μS/cm to 1,620 μS/cm. The freshest groundwater is sampled at a depth of 1,824 feet bls. It is possible that there is fresher groundwater's circulating at this depth, but it is most probable that water samples taken from this interval are not representative. The pilot hole was drilled in two stages below the intermediate casing, with the upper section completed and tested down to 1,602 feet bls before the pilot hole was then deepened. It is interpreted that the interval below 1,602 feet bls was invaded by overlying fresher groundwater with higher static heads during the second phase of pilot hole drilling, i.e. overlying fresher groundwater flowed down the pilot hole when the two intervals were connected.

- Between 1,917 and 2,075 feet bls: Between 1,917 and 1,948 feet bls a significant increase in salinity is observed, with chlorides increasing from 360 mg/L to 1,500 mg/L and conductivity from 2,200 μS/cm to 5,350 μS/cm. A

further even more pronounced transition to very brackish groundwater is observed in the interval 2,011 feet to 2,043 feet bls with chlorides increasing from 1,500 mg/L to 15,500 mg/L and conductivity from 6,490 μS/cm to 31,900 μS/cm. Based on the drill stem water quality samples, the depth of the 5,000 mg/L isochlor for chloride is interpreted to lie between 2,011 feet and 2,043 feet bls.

6.3 Geophysical Logging

6.3.1 Upper Floridan Monitor Well (UFMW-1)

The following geophysical logs were conducted during construction of UFMW-1;

1. Log Run 1: X-Y Caliper and Gamma-Ray logs of the nominal 14-inch diameter open hole from surface to 104 feet bls, prior to installation of the surface casing.

2. Log Run 2: X-Y Caliper and Gamma-Ray logs of the nominal 8-inch diameter open hole from surface to 290 feet bls, prior to installation of the final casing.

The prime objective of Log Run 1 was to confirm the depth of the top of the upper confining unit (Hawthorn Group) and borehole geometry in preparation for the installation of the surface casing string. Limited lithological interpretation was possible from these logs.

The prime objective of Log Run 2 was to confirm the depth of the top of the upper Floridan aquifer and to confirm borehole geometry in preparation for installation of the final casing string. Increased gamma-ray counts from approximately 20 GAPI up to 62 GAPI in the interval 184 feet to 218 feet bls clearly identifies phosphatic sands within the base of the Hawthorn Group. Below 218 feet bls a distinct drop in gamma ray counts to approximately 10 GAPI identifies a formation change, interpreted to be the top of the upper Floridan aquifer.

6.3.2 Dual Zone Monitor Well (UFMW-1)

The following geophysical logs were conducted during construction and testing of UFMW-1:

1. Log Run 1: X-Y Caliper and Gamma-Ray logs of the nominal 42-inch diameter open hole from surface to 112 feet bls, prior to installation of the surface casing.

2. Log Run 2: X-Y Caliper and Gamma-Ray logs of the nominal 30-inch diameter open hole from surface to 315 feet bls, prior to installation of the Intermediate casing.

3. Log Run 3: X-Y Caliper, Gamma-Ray and video (TV) survey in the Intermediate casing and pilot hole from the surface to 1,602 feet bls. Spontaneous potential, single-point resistance and dual-induction logs as well as static and dynamic fluid conductivity, temperature and fluid velocity logs in the pilot hole from just above the base of the intermediate casing to 1,602 feet bls.

4. Log Run 4: X-Y Caliper, Gamma-Ray, spontaneous potential, single-point resistance dual-induction logs and video (TV) survey in the pilot hole from 1,500 feet to 2,077 feet bls. Static and dynamic fluid conductivity, temperature and fluid velocity logs in the pilot hole from 250 feet (above the base of the intermediate casing) to 2,075 feet bls.

Upper Casing objectives

Log Run 1 confirmed the borehole geometry in preparation for installation of the surface casing string. Limited lithological interpretation was possible from these logs

Log Run 2 confirmed the depth of the top of the upper Floridan aquifer and borehole geometry in preparation for installation of the intermediate casing string. Larger borehole diameters meant attenuation of the gamma rays counts occurred, although good correlation with the gamma ray log for UFM-1 was still obtained. For example, several clear gamma ray peaks associated within phosphatic sands in the base of the Hawthorn Group can be correlated with an approximate vertical offset of 2 feet, and the distinct drop in gamma ray counts at the top of the upper Floridan aquifer is identified at 216 feet bls in DZMW-1 compared with 218 feet bls in UFM-1.

Formation Logging

X-Y Caliper, gamma-ray, spontaneous potential, single-point resistance, and dual-induction logs obtained during Log Runs 3 and 4 were used to identify major formation changes below 300 feet bls.

Limited interpretation was possible from the gamma-ray logs alone. Gamma-ray peaks associated with phosphatic sands were clearly identified for the basal Hawthorn Formation (down to 220 feet bls), but variations in gamma-ray counts for the underlying

Formations are more difficult to interpret and correlate with other geophysical logs in the area due to significant variation in the signatures associated with different Formations. Nevertheless the following general observations are made:

- Between 300 feet and approximately 1,200 feet bls gamma-ray counts show limited variation, with counts generally between 10 and 20 GAPI.
- Below 1,200 feet bls a reduction in gamma-ray counts is observed, Counts remain below 10 GAPI with the exception of several layers around 1,225 to 1,255 feet bls and a minor signature with a peak centered at 1,346 feet bls.
- At 1,538 feet bls a small increase in gamma-ray counts occurs (to approximately 10 GAPI).
- A notable gamma-ray signature with peaks up to approximately 42 GAPI is observed between 1,594 and 1,644 feet bls
- Between 1,644 and 1,925, some variation is noted, but gamma-ray counts are generally in the approximate range 7 to 20 GAPI
- Below 1,925 feet bls much greater variation in counts is observed (generally between 10 and 25 GAPI) with two notable peaks centered at 1,931 feet bls (40 GAPI) and 2,061 feet bls (61 GAPI)

The Dual Induction Logs provide more useful signatures to identify the different Formations, and are more co-relatable. For example dolostones or dolomitic limestones have characteristic high resistivities. The following general observations are made:

- Between 300 feet and 440 feet bls resistivities are relatively uniform, with resistivities averaging approximately 65 Ohm-m.
- Between 440 feet and 516 feet bls much greater variability is observed, with several dominant resistivity spikes or peaks greater than 300 Ohm-m associated with dolostones that were logged during pilot hole drilling.
- Below 516 feet bls resistivities are again uniform until 650 feet bls.
- Between 650 feet and 1,100 feet bls resistivities generally vary between 100 and approximately 200 Ohm-m and indicate an alternating sequence dominated by limestone. A drop in resistivities with most of the sequence in the range approximately 40 to 100 Ohm-m is observed between 1,100 and 1,140 feet bls. This is interpreted to be due to organic material, with the exception of a peak centered on 1,125 which correlates with a hard dolostone logged during pilot hole drilling.
- Between 1,140 feet and 1,495 feet bls there is a transition to a sequence increasingly dominated by dolomite.

- A distinct drop in resistivities is observed directly below 1,495 feet bls to approximately 35 Ohm-m. A small separation between the deep, medium and shallow resistivity plots is also observed, suggesting a possible transition to slightly more saline groundwater. The prime reason for the drop in resistivities however is interpreted to be due to the greater presence of limestone, and some marl horizons. This sequence continues until approximately 1,594 feet bls. Resistivity peaks characteristic of dolomitic layers are still observed between approximately 1,520 feet and 1,548 feet bls, with individual thicker dolomitic horizons also observed centered on 1,579 feet and 1,582 feet bls.
- Between 1,594 feet and 1,874 feet bls resistivities are much more variable, with resistivities generally in the range 40 to 300 Ohm-m, indicating an alternating sequence of limestone and dolomite. A transition with less variability is observed below approximately 1,790 feet bls, with an associated declining trend in resitivities.
- Lower resistivities are observed in the interval between 1,875 feet and 1,926 feet bls, with resistivities generally in the range 20 to 40 Ohm-m. The signature is typical of a limestone sequence.
- Below 1,926 feet bls resistance is highly variable, indicating a sequence dominated by dolomite. However resistance values in the general approximate range 6 to 90 Ohm-m are also less than the overlying sequences indicating that the resistivities are also likely impacted by groundwaters with much higher salinities.
- A distinct drop to even lower resistance with values predominantly below 10 ohm/m is observed at 2,014 feet bls with some very low resistance less than 3 ohm/m indicating very saline groundwater in the intervals 2,014 feet to 2,026 ft bls and 2,052 feet to 2,056 feet bls.

Fluid Logging Results

Comparison of the static and dynamic fluid logs obtained during Log Runs 3 and 4 provided useful information on the major flow zones within the Floridan aquifer. Key features of the flow profile are summarized below. A dominant flow horizon between 480 and 510 feet bls was clearly identified during both log runs. However positive identification of the secondary flow zones was problematic, primarily because the major flow zones mask the less permeable flow horizons, i.e. when the pilot hole was pumped at approximately 450 gpm, the majority of the flow was produced from the more permeable flow horizons. Nevertheless repeating the static and dynamic fluid logs for the interval 250 to 1602 feet bls during Log Run 4 provided additional useful data.

Interval	Flow Contribution
Base of casing to 450 feet bls	Limited or no flow. Increases in flow velocities attributed primarily to corresponding reductions in borehole diameter with depth.
450 to 480 feet bls	Limited or no flow
480 to 510 feet bls	Significant flow accretion via several notable fractures centered on 483, 502 and 506 feet bls.
510 to 550 feet bls	Limited flow
550 to 730 feet bls	No flow
730 to 865 feet bls	Very minor flow (flow loss), possibly associated with cavity / fracture zones centered on 786 and 823 feet bls
865 to 1,060 feet bls	No flow
1,060 to 1,350 feet bls	Limited Flow
1,350 to 1,480 feet bls	Limited Flow, possibly associated with a cavity centered on 1,424 ft bls
1,480 to base of pilot-hole, 2,075 feet bls	Limited or No Flow

The Fluid Conductivity profiles obtained during Log Runs 3 and 4 were also used to assist with identifying the likely depth of the 250 mg/L and 5,000 mg/L isochlors for chloride. Packer test intervals to confirm the water quality profile were selected using this data in combination with the drill stem water quality results.

To identify the likely depth of the 250mg/L isochlor, an approximate ratio of 0.16 was used to convert fluid conductivity to chloride, i.e. groundwater with an approximate conductivity of 1,560 μS/cm was estimated to contain chlorides in the order of 250 mg/L. Using the Run 3 fluid conductivity profile, the depth with these conductivities was located at 1,490 feet bls. However the decision was made to packer test a slightly higher interval based on the fluid conductivity profile which also indicates a stepwise increase in fluid conductivity at 1,450 feet bls, and the drill stem water quality samples taken at 1,413 and 1,445 ft bls which show an increase in chloride concentrations from 200 mg/L to 400 mg/L.

To identify the depth of the 5,000mg/L isochlor for chloride, an approximate ratio of 0.4 was used to convert fluid conductivity to chloride, i.e. groundwater with an approximate conductivity of 20,000 μS/cm will likely contain chlorides in the order of 5,000 mg/L. Using the Run 4 fluid conductivity profile, the depth with this conductivity was located at 1,943 feet bls. Very distinct increases in groundwater salinity, as measured by the fluid conductivity log, are observed below 1,930 feet bls, with very saline groundwaters having conductivities greater than 35,000 logged at depths below 2,030 feet bls. The depth of the very saline groundwater is broadly consistent with the water quality obtained from the drill stem samples.

It is worth noting that on Run 3 and Run 4 fluid conductivity logs, a distinct increase in fluid conductivities are also observed at approximately 1,530 feet and 1,500 feet bls respectively. This depth coincides approximately with a change in lithology from the Avon Park to Oldsmar Formations. The conductivities for each log run are however slightly different. For example on Log Run 3, stable fluid conductivities less than 1,300 μS/cm are logged above 1,510 feet bls. Below 1,550 feet bls conductivities are approximately 3,000 μS/cm. For Log Run 4, conductivities above approximately 1,500 feet bls are 1,293 μS/cm, while below this depth increase to over 5,000 μS/cm. The reason for the increased fluid conductivities and small changes in the depths between log runs are unclear, but illustrate the complexities involved with interpreting test data from pilot holes that interconnect multiple aquifer zones.

6.4 Packer Testing

Packer tests 1, 2 and 3 were undertaken following completion of the first section of pilot hole to 1,602 feet bls. These packer tests were completed to identify the depth of the 250 mg/L isochlor for chloride and to try and replicate the likely final monitor interval for monitoring this zone.

Packer Test No. 1 (PT#1), was completed in the interval 1,414 to 1,459 feet bls, and confirmed the approximate location of the 250 mg/L isochlor for chloride (laboratory analysis for chloride was 248 mg/L). This interval was selected based primarily on the increase in salinity at 1,445 feet bls noted from the drill stem water quality results, and from the static and dynamic fluid conductivity profiles (RUN 3) which indicated distinct increases in conductivity at approximately 1,450 and 1,530 feet bls. Development pumping for over 18 hours at approximately 65 gpm was required to purge fresher drill circulation water from this interval before more stable water quality was obtained. Static water level prior to pumping was measured at 42.47 feet bls, with an equilibrium pumping level of 45.76 feet bls. The measured drawdown of 3.29 feet (calculated

specific capacity 19.3 gpm/ft), confirmed the interval likely has sufficient permeability for use as a monitor zone.

Packer Test No. 2 (PT#2) was completed in the interval 1,514 to 1,544 feet bls, to confirm the presence of more saline groundwater below the 250 mg/L isochlor for chloride. Stable chloride concentrations of approximately 560 mg/L were measured in the field with Hach kits, which were later confirmed to be in the correct range by the final sample laboratory measurement of 505 mg/L. Field conductivity measurements obtained during pumping (approximately 3,250 µmhos/cm) and the laboratory sample (2,720 µmhos/cm) were consistent with the fluid conductivities measured from the static fluid log profile (RUN 3) for depths greater than 1,540 feet, but not above this depth as fresher groundwater is indicated. Correlation of geophysical log profiles with packer test results can often be problematic as drilling and testing can disturb the prior equilibrium groundwater salinity profile. However one plausible explanation is that the more saline groundwater measured during packer testing was derived from the lower portion of the test interval.

Packer Test No.3 (PT#3) was completed in the interval 1,143 to 1,173 feet bls, following consultation with SJRWMD. The objective of the test was to confirm that the salinity of the groundwater was less than 250 mg/L chloride, and to test the permeability of the zone. The original dual zone monitor well design called for an upper monitor zone located in the approximate interval 1,100 to 1,140 feet bls within the base of the Upper Floridan aquifer. However drilling confirmed the presence of a thicker than anticipated middle confining unit, with the deepest significant flow zones located at much shallower depths (approximately 450 to 550 feet bls). A minor permeable interval was suggested from the static and dynamic flow logs (RUN 3) within the approximate interval 1,060 to 1,200 feet bls. Therefore after close inspection of the video log, a suitable test interval was selected. Stable chloride concentrations of approximately 100 mg/L were measured in the field, which were later confirmed to be in the correct range with a laboratory measurement of 69 mg/L. Pumping rates of 61.6 gpm were achieved with a drawdown of 2.90 feet. Static water level prior to pumping was measured at 48.11 feet bls, with an equilibrium pumping level of 51.01 feet bls. Specific capacity was calculated at 21.2 gpm/ft.

Packer tests 4 and 5 were undertaken after the pilot hole was extended to 2,075 feet bls. These tests were completed to determine the depth for the 5,000 mg/L isochlor for chloride.

Packer Test No. 4 (PT#4) was completed in the interval 2,005 to 2,075 feet bls, and confirmed the presence of saline groundwater with a chloride concentration greater than 5,000 mg/L. Stable water quality was achieved after 5 hours of development pumping at approximately 38 gpm, but to be certain development pumping was continued for a total of 627 minutes. Field measured chloride concentrations of 13,000 mg/L were taken during test pumping, with a laboratory measurement of 17,000 mg/L clearly indicating salinities significantly higher than 5,000 mg/L. Static water level prior to pumping was measured at 76.14 feet bls, with an equilibrium pumping level of 77.02 feet bls when pumping at 37.0 gpm. The lower static water levels compared with the other packer tests are partly due to the greater density of the more saline groundwater which is suppressing the aquifer heads.

Packer Test No. 5 (PT#5), completed in the interval from 1,925 feet to 1,965 feet bls, was undertaken to try and more accurately define the depth to the 5,000 mg/L isochlor for chloride. Laboratory results for chloride of 2,451 mg/L and stable field measured chloride concentrations of 2,500 mg/L were obtained. When compared with the results from PT#4, this indicates that at the time of testing, the 5,000 mg/L isochlor for chloride lies between the two packer test intervals, i.e. between 1,965 feet and 2,005 feet bls. However interpretation of the results is not straight forward as each packer test represents either an average of the water quality within the tested interval, or, the water quality of a more permeable zone or fracture within the tested interval that preferentially produces water when the interval is pumped.

Closer inspection of the geophysical fluid conductivity logs (RUN 4) show very similar water quality depth profiles for both the static and dynamic logs. In summary, abrupt increases in salinity are observed within the interval 1,924 feet to 1,955 feet bls, and also within the interval 2,020 feet to approximately 2,070 feet bls. Comparison of the laboratory derived conductivity results obtained from PT#4 and PT#5 with both the static and dynamic fluid conductivity profiles suggests that groundwater pumped from each packer test were derived from the top of each test interval. Therefore it is interpreted that the 5,000 mg/L isochlor for chloride lies at a depth of approximately 1,950 feet bls.

Packer test 6 (PT#6) was performed higher up in the sequence to confirm the hydraulic parameters for an upper monitor interval, and was completed in the interval 461 to 523 feet bls. Water level drawdown during test pumping at 71.7 gpm was only 0.25 feet, and confirmed the results from both dynamic flow profiles (RUN 3 and RUN 4) that this interval with fractures centered on 493, 502 and 506 feet bls is a significant flow zone.

Static water level prior to packer test pumping was measured at 52.18 feet bls, with an equilibrium pumping level of 52.43 feet bls. It should be noted that these heads are significantly lower (depressed) compared with the heads measured in the completed upper monitor zone (DZMW-1/UMZ). The completed interval for DZMW-1/UMZ is 475 to 507 feet bls and static water levels following development were measured at 37.02 feet bls. It is interpreted that when the pilot hole was open to total depth, groundwater higher in the sequence was able to flow down the pilot hole and invade the lower sequences with lower static heads. However this may have resulted in lowered (or depleted) groundwater heads in the upper test sequence and reinforces the importance of testing pilot holes with less open interval.

7 Monitor Zone Selection

Monitor zone selection was made with full consultation using SJRWMD staff. Selection of the monitor interval for the Upper Floridan aquifer production zone in the single monitor well (UFMW-1) was relatively straightforward. Once the top of the Floridan aquifer was identified, a sixty foot interval was selected to ensure sufficient flow zones were intercepted.

For the Dual Zone monitor well (DZMW-1), upper and lower monitor zone intervals were initially recommended by ARCADIS, and then agreed with by SJRWMD. The monitor zone objectives, key hydrogeological features including relevant packer test results, and the proposed monitor zone construction details presented at the time of construction are summarized below:

DZMW-1 Upper Monitor Zone:

Objective:	Monitor Water Levels and Water Quality at the base of the Upper Floridan aquifer
Hydrogeological Features:	Significant cavities are centered on 483, 502, and 506 feet bls which coincide with zones containing significant flow. These cavities are likely to be vertically interconnected, therefore there is likely to be limited benefit in separately monitoring these discrete flow zones. A formation change from dolomite to limestone occurs below approximately 525 feet bls, which below approximately 550 feet bls does not appear to be contributing any flow. It is interpreted that below 525 feet bls the formation is either a minor aquifer or has semi-confining properties and is therefore part of the middle confining unit.
Packer Test:	PT#6 463-523 feet bls demonstrated that this is a very permeable interval. Laboratory Water Quality results not yet available, but Water Quality is “fresh”.
Proposed UMZ Construction	
Screen Interval:	480 - 510 feet bls
Gravel Interval:	475 - 515 feet bls
Sand (top of gravel):	470 - 475 feet bls
Cement Bottom:	Target 515-520 feet bls
Cement Top:	Target 470 feet bls

DZMW-1 Lower Monitor Zone:

Objective:	Monitor Water Levels and Water Quality in the Lower Floridan aquifer at the 250mg/L isochlor for Chloride
Hydrogeological Features:	Semi-confining and confining layers (The Middle Confining Unit between the Upper and Lower Floridan aquifers) are identified between 525 and approximately 1,424 feet bls, with much greater thickness and depth than anticipated. A monitor zone located in the top of the Lower Floridan aquifer therefore needs to be much deeper than the originally anticipated depth of approximately 1,100 feet bls. At this location the 250 mg/L isochlor for Chloride, previously assumed to be located at approximately 1,800 feet bls, is also located closer to 1,450 feet bls and lies within the top of the Lower Floridan aquifer. A minor cavity is centered on 1,424 feet bls within vuggy dolostone and other minor solution cavities are identified in the interval 1,418-1,449 feet bls. Flow zones are not clear. Only minor flow contribution is identified on the fluid flow log, while the fluid Temperature Conductivity profile suggests increased salinity and a change in thermal gradient below 1,450 feet bls. Correlation of the laboratory packer test water quality result with the geophysical fluid conductivity profile suggests the 250 mg/L isochlor for chloride is located at the bottom of the PT#1 interval.
Packer Test:	PT#1 1,414-1,459 feet bls demonstrated sufficiently permeability in this interval (65gpm, 3.3 foot drawdown), Laboratory Chloride =248 mg/L
Proposed LMZ Construction:	
Screen Interval:	1,423 – 1,453 feet bls
Gravel Interval:	1,418 – 1,458 feet bls
Sand (top of gravel):	1,415 – 1,418 feet bls
Cement Bottom:	Target 1,458-60 feet bls
Cement Top:	Target 1,415 feet bls

8 Summary

A single monitor well (UFMW-1) and a dual zone monitor well (DZMW-1), have been successfully designed and constructed at a site located off Narcoossee Rd, Lake Nona, southeast of OUC's Southeast Water Plant Wellfield. These monitor wells satisfy St. Johns River Water Management District (SJRWMD) requirement for OUC to monitor three zones in the Floridan Aquifer as a condition of its consumptive water use permit.

UFMW-1 was constructed to a total depth of 290 feet, and 4-inch inside diameter (ID) steel casing was installed to a total depth of 230 feet below land surface (bls). This well monitors water-level and water-quality in the top of the Upper Floridan aquifer production zone.

DZMW-1 was initially constructed as a test well to fully characterize the Floridan aquifer. This included identification of the depths for the 250 and 5,000-milligram per liter (mg/L) isochlors for chloride. Pilot hole was drilled to a total depth of 2,075 feet bls. The 250 and 5,000 mg/L isochlors for chloride were identified at the approximate depths of 1,445 feet and 1,950 feet bls respectively, although an exact determination was not obtained.

Following extensive testing, the test well pilot hole was back-plugged to 1,462 feet bls and two 2.43-inch ID Fiberglass Reinforced Pipe (FRP) monitor tubes were installed and cemented in place with slotted screen and gravel packs at the designated monitor zone intervals. The uppermost 150 feet of each monitor tube was increased in diameter to 3.91-inch ID FRP tubing to allow installation of 3-inch sample pumps.

The upper monitor zone (UMZ), with a screen installed between 475 feet and 507 feet bls, monitors water-level and water-quality in the lowermost section of the Upper Floridan aquifer production zone (the Avon Park Permeable Zone). The lower monitor zone (LMZ), with a screen installed between 1,423 feet and 1,453 feet bls, monitors water-level and water-quality in the upper section of the Lower Floridan aquifer and straddles the approximate depth of the 250 mg/L isochlor for chloride.

The following table summarizes basic monitor zone completion information; with static water levels, well performance, and monitor zone final laboratory chloride concentrations measured during final construction:

Monitor Zone	Description	Monitor Interval (ft NAVD)	Static Water Level (ft NAVD)	Specific Capacity (gpm/ft)	Chloride (mg/L)
UFMW-1	Upper Floridan	-145.2 to -205.2	53.5	1.2	16.8
DZMW-1 UMZ	Base of Upper Floridan	-387.9 to -419.9	50.3	2.9	68.8
DZMW-1 LMZ	Top of Lower Floridan, 250 mg/L isochlor for Chloride	-1,335.9 to -1,365.9	50.1	1.5	149.0

Note: monitor interval and water level elevations have been converted to feet NAVD using surveyed pad elevation data; UFMW-1 84.84 feet NAVD, DZMW-1 87.12 feet NAVD

Interpreted depths for the base of the various stratigraphic and hydrogeological units intersected during drilling are summarized in the table below. It should be noted that these interpretations are preliminary. For example they are not based on any detailed fossil or foraminifera analysis; therefore further evaluation may be beneficial. Several of the formation changes were also observed to be transitional; therefore the exact boundary between formations is subject to individual interpretation. Nevertheless it is believed that much useful data has been obtained from the drilling of these wells. Several of the key features of the Floridan aquifer at this location are as follows:

- The most permeable zone is located in the Upper Flordan aquifer in the interval 440 feet to 510 feet bls. This zone lies in the top of the Avon Park Formation within fractured dolomite, and contains fresh groundwater with chlorides less than 100 mg/L.

- A significant thickness of semi-confining or confining strata was encountered from approximately 525 feet to 1,450 feet bls. At depths below 1,145 feet bls there is a transition lithologically into layers assigned elsewhere in the region to the top of the Lower Florida aquifer. Several discrete flow zones were tested with straddle packers, however static and dynamic flow logging was unable to delineate any zones of measurable permeability.

- Below 1,450 feet bls, zones of significant permeability were not identified in the Lower Floridan aquifer.

- Below 1,926 feet bls the sequence is dominated by microcrystalline, massive, hard to very hard, dolomites belonging to the Cedar Keys Formation. It is interpreted that this strata has semi-confining properties. Distinct increases in salinity are observed within this sequence, and very saline groundwater having chlorides greater than an estimated 10,000 mg/L were encountered below approximately 2,020 feet bls.

- Anhydrites were not positively identified within the middle confining units, or, the lower section of the Lower Floridan aquifer. Therefore the source of high sulfate water encountered in the OUC southeast well field is still not well understood.

<table>
<tr><th>Stratigraphic Unit</th><th>Depth to base (ft NAVD)</th><th>Hydrogeologic Unit</th><th>Depth to base (ft NAVD)</th></tr>
<tr><td>Undifferentiated deposits</td><td>47</td><td>Surficial aquifer</td><td>47</td></tr>
<tr><td>Hawthorn Group</td><td>-131</td><td>Intermediate confining unit</td><td>-131</td></tr>
<tr><td>Ocala Limestone</td><td>-353</td><td rowspan="2">Upper Floridan aquifer</td><td rowspan="2">-438</td></tr>
<tr><td rowspan="3">Avon Park Formation</td><td rowspan="3">-1,443</td></tr>
<tr><td>Middle Semi-Confining Unit</td><td>-1,058</td></tr>
<tr><td>Middle Confining Unit</td><td>-1,363</td></tr>
<tr><td>Oldsmar Formation</td><td>-1,839</td><td rowspan="2">Lower Floridan Aquifer</td><td rowspan="2">-1,839</td></tr>
<tr><td>Cedar Keys Formation</td><td>Not encountered, depth below -1,988</td><td>???</td><td>???</td></tr>
</table>

Note: Depths have been converted to feet NAVD using surveyed pad elevation data for DZMW-1 of 87.12 feet NAVD, and rounded to the nearest foot

9 Selected References

Arthur, J.D., Fischler, C., Kromhout, C., et al, 2008, Hydrogeologic Framework of the Southwest Florida Water Management District: Florida Geological Survey Bulletin No. 68

O'Reilly, A.M., Spechler, R.M., and McGurk, B.E., 2002, Hydrogeology and Water Characteristics of the Lower Floridan Aquifer in East-Central Florida: U.S. Geological Survey Water-Resources Investigations Report 02-4193

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FIGURES

TABLES

ARCADIS

Appendix A

SJRWMD Construction Permit and Well Completion Reports

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Appendix B

Geologic Logs and Core Log Summary

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Appendix C

Geophysical Logs

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Appendix D

Video Surveys

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Appendix E

Packer Test Water Quality Summary and Laboratory Data

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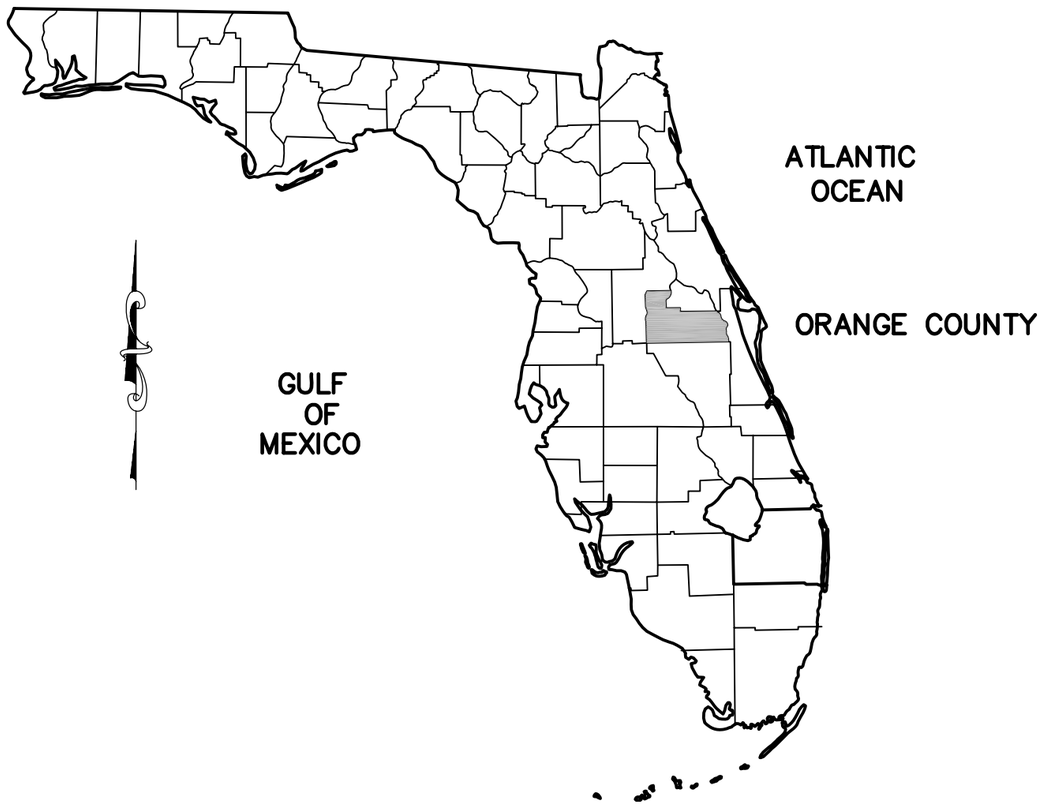
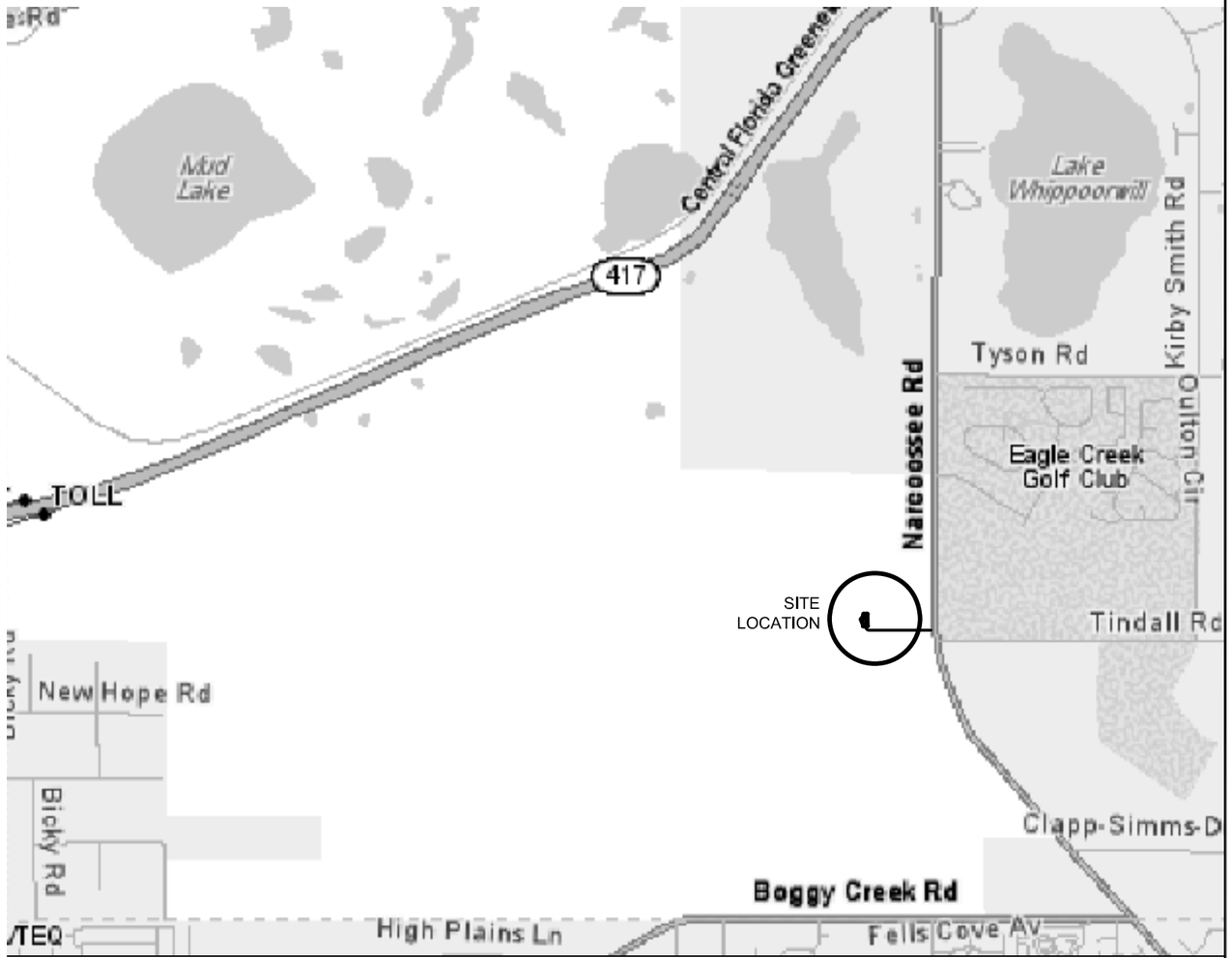
Appendix F

Final Water Quality Data

FIGURES



LOCATION MAP



AREA MAP

0 3000'

SCALE IN FEET

Area Manager	W.LYNCH
Project Director	T.TESSIER
Task Manager	D. SMITH
Technical Review	T.TESSIER

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ORLANDO UTILITIES COMMISSION
SOUTHEAST MONITOR WELLS

LOCATION MAP

ORANGE COUNTY, FLORIDA

Project Number	PF000705.0009
Drawing Date	03AUG05
Figure	1

Current Plotstyle : ByColor
Layout Tab: Fx_Well Cover(1)
Acad Version : R16.2s (LMS Tech) Date\Time : Mon, 20 Aug 2007 – 11:09am
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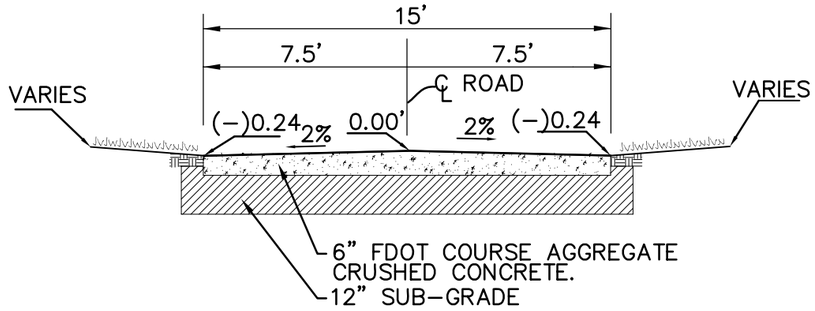
NOTES:

1. EXACT LOCATIONS OF EASEMENTS AND WELL SITE SHALL BE SURVEYED BY PROFESSIONAL SURVEYOR ACCORDING TO LEGAL DESCRIPTIONS PROVIDED IN APPENDIX.

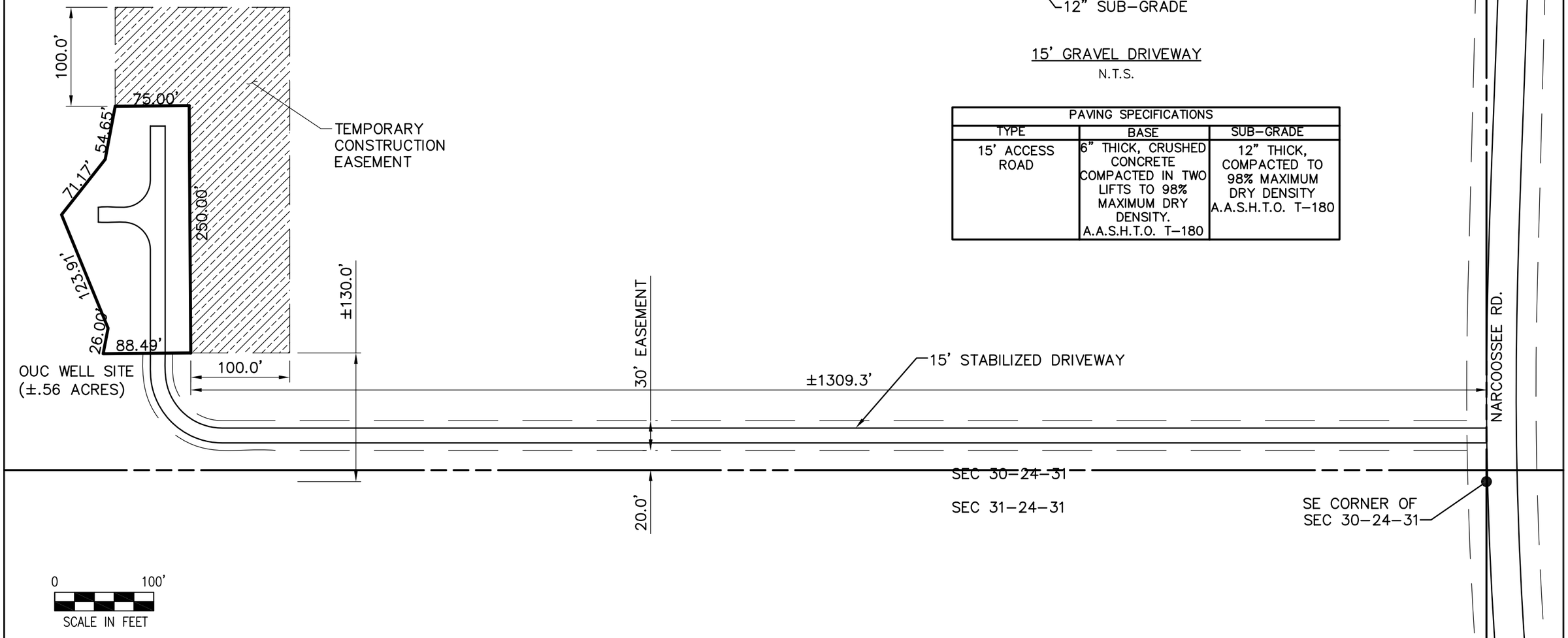
1. BOTH WELL LOCATIONS TO BE PROPOSED BY CONTRACTOR AND APROVED BY OWNER.



15' GRAVEL DRIVEWAY

N.T.S.

PAVING SPECIFICATIONS		
TYPE	BASE	SUB–GRADE
15' ACCESS ROAD	6" THICK, CRUSHED CONCRETE COMPACTED IN TWO LIFTS TO 98% MAXIMUM DRY DENSITY. A.A.S.H.T.O. T–180	12" THICK, COMPACTED TO 98% MAXIMUM DRY DENSITY A.A.S.H.T.O. T–180



Area Manager	W.LYNCH
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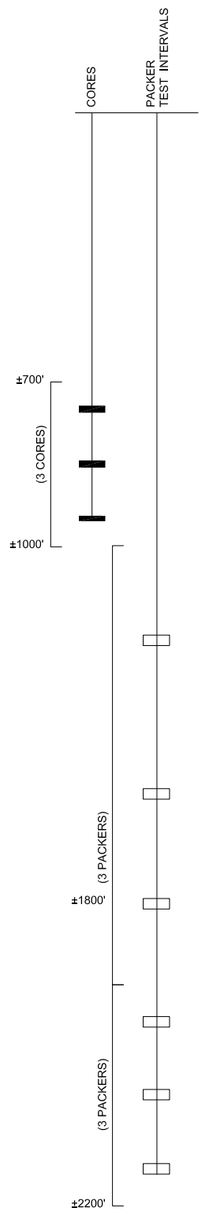
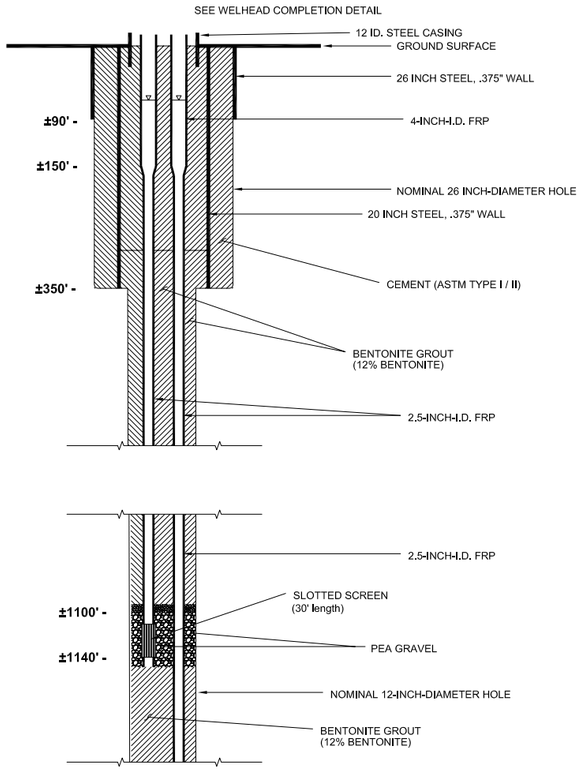
ORLANDO UTILITIES COMMISSION

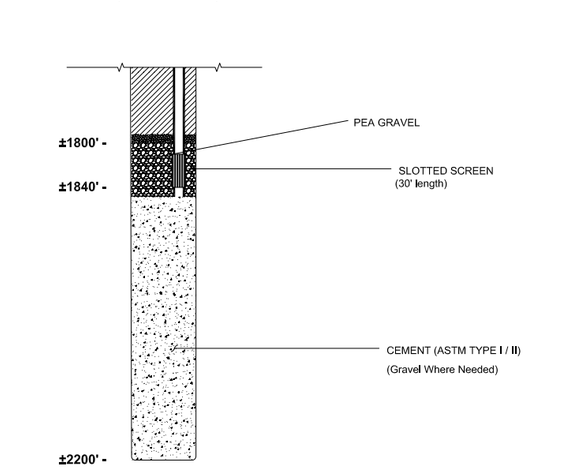
SOUTHEAST MONITOR WELL SITE PLAN

ORANGE COUNTY, FLORIDA

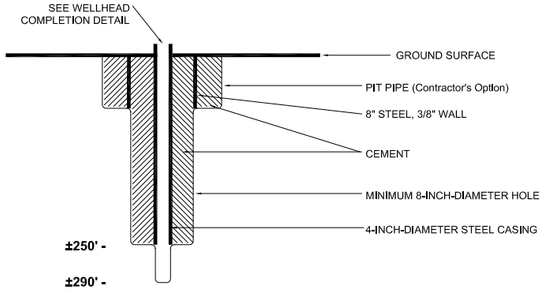
Project Number	PF000705.0009
Drawing Date	03AUG05
Figure	2



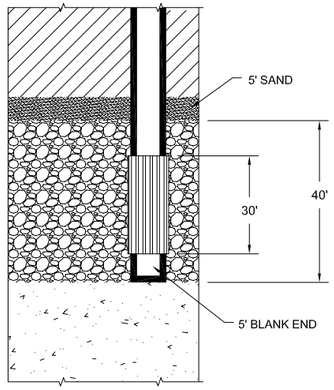


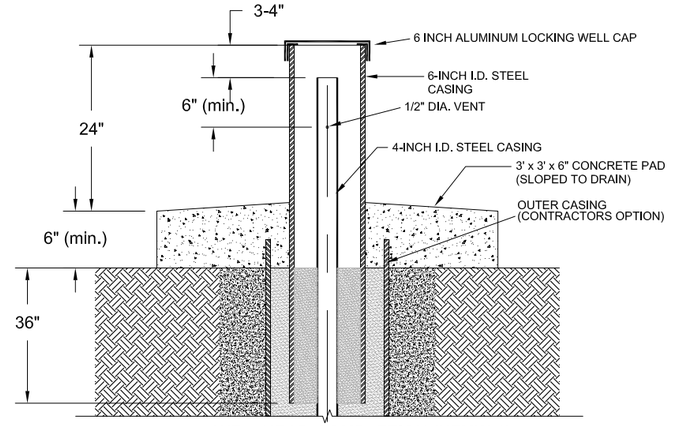


LOWER FLORIDAN MONITOR WELL (DZMW-1)

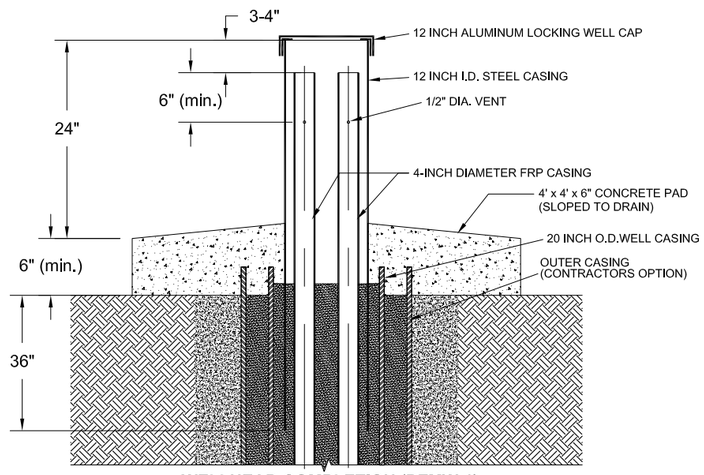


UPPER FLORIDAN AQUIFER MONITOR WELL (UFMW-1)





WELLHEAD COMPLETION (UFMW-1)



WELLHEAD COMPLETION (DZMW-1)

Notes:

1.) Core and Packer intervals are approximate and will be established in the field by the Engineer with input from the Contractor.
2.) All concrete shall contain a minimum of 5-1/2 sacks of cement per cubic yard.
3.) All concrete not specifically designated shall be proportioned for a strength of 4,000 lbs. per square inch at 28 days of age.
4.) Water-Cement ratio: All concrete shall have a maximum water-cement ratio of 0.45.

Area Manager	W.LYNCH
Project Director	T.TESSIER
Task Manager	D. SMITH
Technical Review	T.TESSIER

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ORLANDO UTILITIES COMMISSION

SOUTHEAST MONITOR WELL DESIGNS

ORANGE COUNTY, FLORIDA

Project Number	PF000705.0009
Drawing Date	03AUG05
Figure	3

Acad Version : R16.2s (LMS Tech) Date\Time : Mon, 20 Aug 2007 – 11:11am
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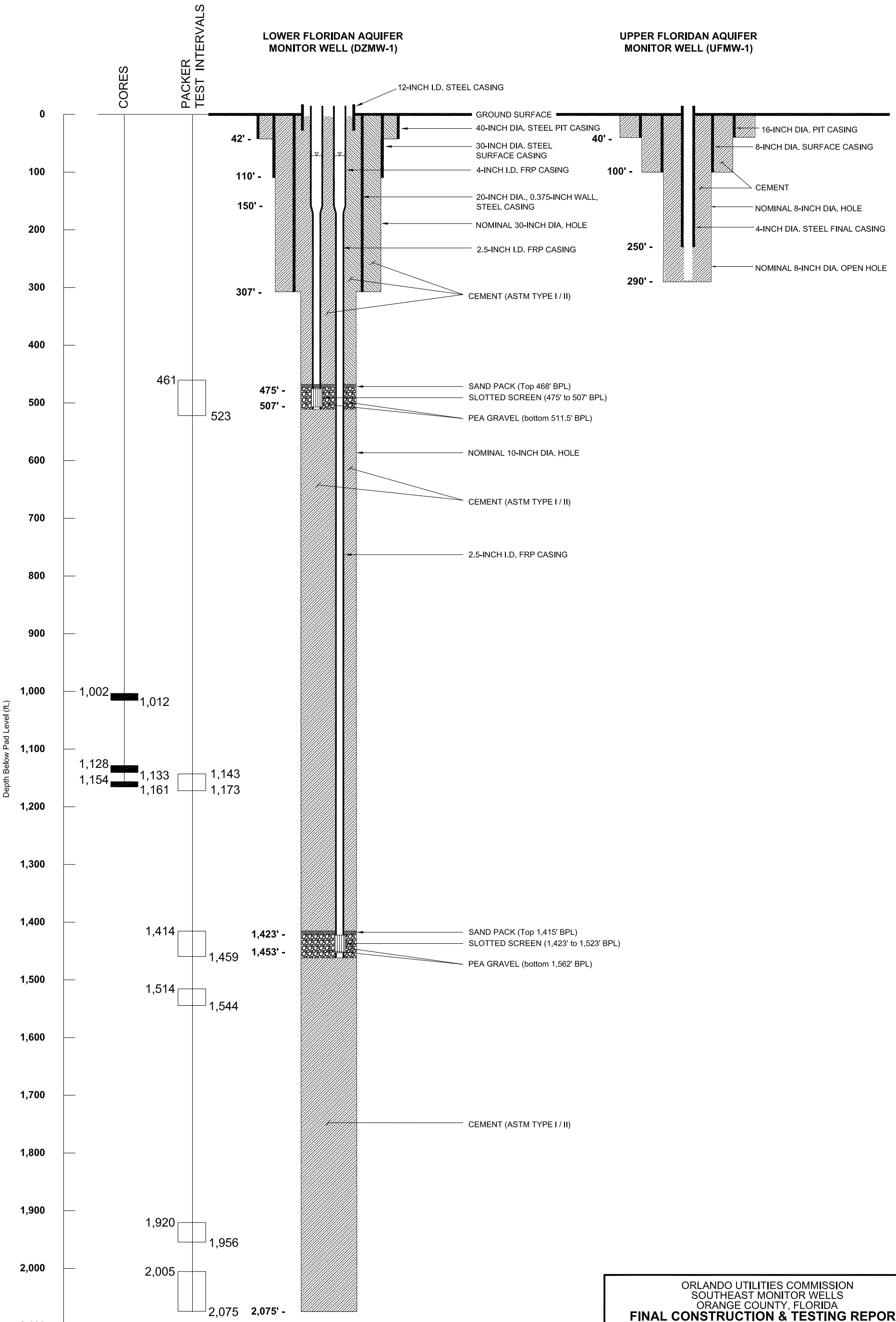
Current Plotstyle : ByColor
Layout Tab: Fx_Well Design(3)

Figure 3: Generalized Regional Geology and Hydrogeology

<table>
<tr><th colspan="2">SERIES</th><th>STRATIGRAPHIC UNIT</th><th>LITHOLOGY</th><th colspan="3">HYDROGEOLOGIC UNIT</th></tr>
<tr><td colspan="2">Holocene</td><td rowspan="3">Undifferentiated deposits</td><td>Alluvium, freshwater marl, peats and muds in stream and lake bottoms. Also, some dunes and other windblown sand.</td><td colspan="3" rowspan="2">Surficial aquifer system</td></tr>
<tr><td colspan="2">Pleistocene</td><td>Mostly quartz sand. Locally may contain deposits of shell and thin beds of clay.</td></tr>
<tr><td colspan="2">Pliocene</td><td>Interbedded deposits of sand, shell fragments, and sandy clay;base may contain phosphatic clay.</td><td colspan="3" rowspan="2">Intermediate confining unit</td></tr>
<tr><td colspan="2">Miocene</td><td>Hawthorn Group</td><td>Interbedded quartz, sand, silt and clay, often phosphatic; phosphatic limestone often found at base of formation.</td></tr>
<tr><td rowspan="3">Eocene</td><td>Upper</td><td>Ocala Limestone</td><td>Cream to tan, soft to hard, granular, porous, foraminiferal limestone.</td><td rowspan="3">Floridan aquifer system</td><td colspan="2">Upper Floridan aquifer</td></tr>
<tr><td>Middle</td><td>Avon Park Formation</td><td>Light brown to brown, soft to hard, porous to dense, granular to chalky, fossiliferous limestone and brown, crystalline dolomite; intergranular gypsum and anhydrite.</td><td>Middle semi-confining unit</td><td>Middle Confining unit</td></tr>
<tr><td>Lower</td><td>Oldsmar Formation</td><td>Alternating beds of light brown to white, chalky, porous, fossiliferous limestone and porous crystalline dolomite.</td><td colspan="2">Lower Floridan aquifer</td></tr>
<tr><td colspan="2">Paleocene</td><td>Cedar Keys Formation</td><td>Dolomite, with considerable anhydrite and gypsum, some limestone.</td><td colspan="3">Sub-Floridan confining unit</td></tr>
</table>

(source: USGS Hydrogeology and Water Quality Characteristics of the Lower Floridan Aquifer in East-Central Florida)



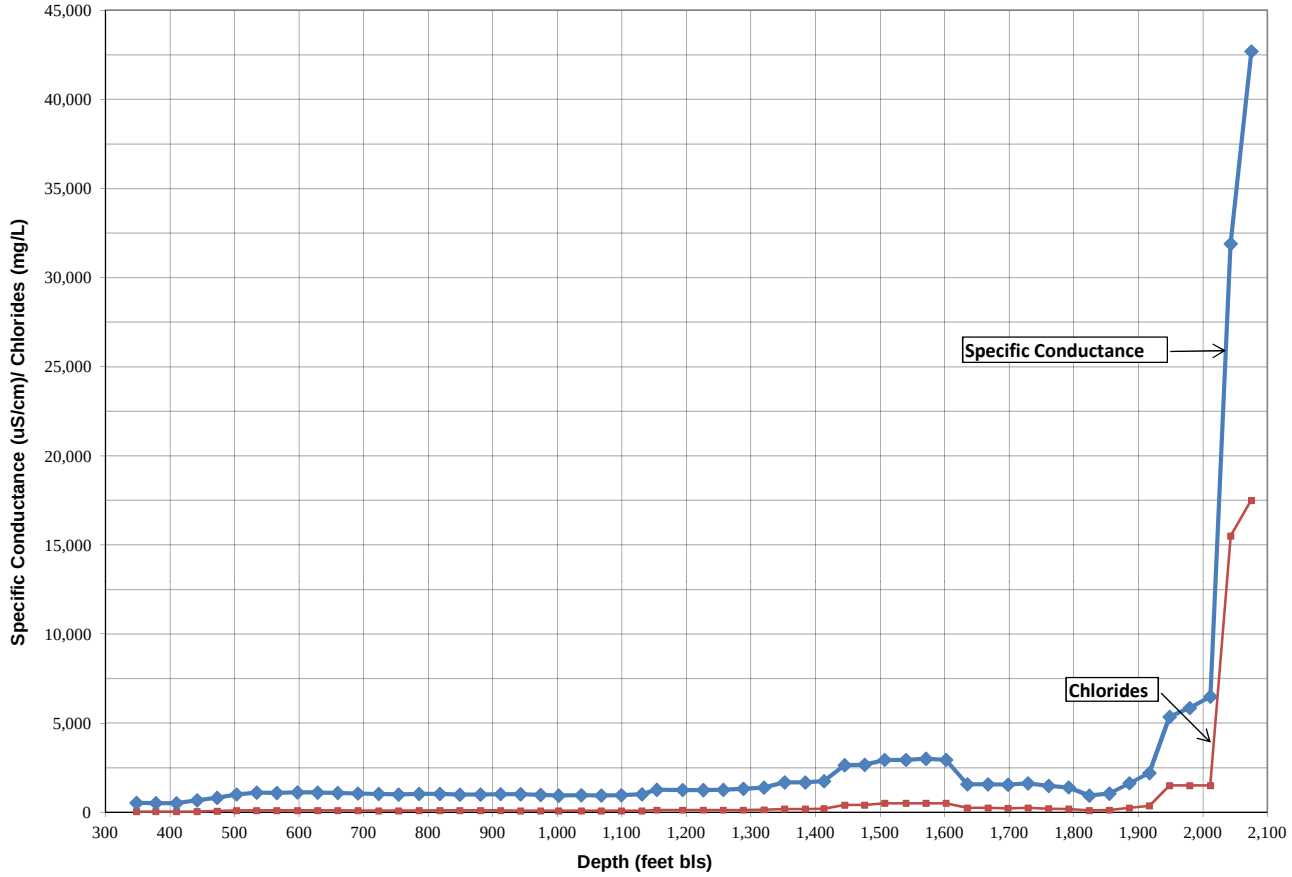
ORLANDO UTILITIES COMMISSION
SOUTHEAST MONITOR WELLS
ORANGE COUNTY, FLORIDA
FINAL CONSTRUCTION & TESTING REPORT

SOUTHEAST MONITOR WELLS TESTING AND CONSTRUCTION DETAILS

ARCADIS

FIGURE
X

Figure 5: DZMW-1 Water Quality Chart



TABLES

Table 1: Summary of Construction and Testing Activities

Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

Upper Floridan Monitor Well (UFMW-1)		
Week	**Date**	**Description**
8/16/10-8/20/10	8/16/10	Install 16-inch O.D. Pit Casing to 40 ft bls.
	8/17/10	Drill nom. 16-inch borehole to 102 ft bls.Perform geophysical logging (caliper and gamma ray).
	8/18/10	Install 8-inch O.D. surface casing to 100 ft bls. Pump 113 cubic feet of neat cement to surface.
	8/19/10	Drill nom. 8-inch diameter borehole to 290 ft bls.
	8/20/10	Conduct geophysical logging and set 4-inch O.D. final casing with cement basket to 230 ft bls. Pump spotting stage of neat cement (1 C.F.). Tag top of cement plug at 220 ft bls. Pump 27 cubic feet of neat cement during 1-st stage.
Dual Zone Monitor Well (DZMW-1)		
Week	**Date**	**Description**
8/23/10-8/27/10	8/23/10	Tag top of cement in UFMW-1 after stage No. 1 at 105 ft bls. Pump 28 cubic feet of neat cement during stage No. 2 until detected on surface.
	8/24/10	Relocate rig to DZMW-1 location, set-up to drill.
	8/25/10	Drill and install 40-inch O.D. pit casing to 42 ft bls. Cement to surface.
	8/26/10	Rig-up to drill nominal 40-inch diameter borehole.
	8/27/10	Drill borehole with 39-inch diameter bit to 112 ft bls.
8/30/10-9/3/10	8/30/10	Perform "wiper trip" and conduct geophysical logging of the nominal 40-inch diameter borehole.
	8/31/10	Install 30-inch O.D. surface casing to 110 ft bls, pump 191.5 sacks (226 C.F.) of neat cement for stage No. 1.
	9/1/10	Tag top of cement after stage No. 1 at 64.5 ft bls. Pump 223 sacks (263 C.F.) of neat cement to surface during stage No. 2.
	9/2/10	Begin to drill nominal 30-inch diameter borehole from 110 feet bls (seat of the surface casing). Extend borehole to 151 ft bls.
9/6/10-9/10/10	9/7/10	Resume drilling and extend 30-inch borehole depth to 192 ft bls.
	9/8/10	Drill borehole with 29-inch diameter bit from 192 ft bls to 260 ft bls.
	9/9/10	Complete drilling of the 30-inch diameter borehole to 311 ft bls (including 4 feet of a "rat hole") for 20-inch casing setting depth of 307 ft bls. (to be confirmed by geophysical logging).
9/13/10-9/17/10	9/13/10	Driller performs "wiper trips" of the open hole.
	9/14/10	Conduct geophysical logging of the borehole (caliper and gamma-ray). Tag bottom with a tool at 311 feet bls. Install 20-inch outside diameter (O.D.) steel intermediate casing to 307 feet bls. Pump 226 cubic feet (C.F.) of neat cement during stage No.1.
	9/15/17	Tag top of cement after stage No.1 at 216 feet bls; pump 295 C.F. of cement (74 C.F. of neat and 221 C. F. of 6% bentonite mix) during stage No. 2. Tag TOC after stage No. 2 at 80 feet bls and pump 207 C.F. of 6% bentonite mix during stage No. 3 (until cement was detected on surface).
9/20/10-9/24/10		Drilling rigs switch, rig-up for reverse-air drilling.
9/27/10-10/01/10	9/28/10	Rig-up for 20-inch casing Plumbness and alignment test. Postpone test due to inclement weather.
	9/29/10	Perform Plumbness and alignment test on 20-inch casing by "sure shot" method. All drift results within acceptable range (not exceeding 1 degree total and 0.5 degree between subsequent survey depths). Evacuate drilling mud. Work on well (pilot hole drilling below 20-inch casing seat) suspended until Monday 10/04/10.
10/04/10-10/08/10	10/4/10	Drill-out cement plug and borehole to 310 ft bls.
	10/5/10	Begin to drill pilot hole with 9.8-inch diameter bit. Extend borehole to 348 feet bls.
	10/6/10	Drill pilot hole to 435 feet bls.
	10/7/10	Extend pilot hole depth to 504 feet bls.
	10/8/10	Extend pilot hole depth to 533 feet bls. Secure well for the weekend.
10/11/10-10/15/10	10/11/10	Resume pilot drilling. Extend pilot hole to 629 feet bls.
	10/12/10	Extend pilot hole depth to 786 feet bls.
	10/13/10	Extend pilot hole depth to 881 feet bls.
	10/14/10	Extend pilot hole depth to 970 feet bls.
	10/15/10	Extend pilot hole depth to 980 feet bls. Secure well for the weekend.
10/18/10-10/22/10	10/18/10	Resume pilot drilling. Extend pilot hole to 1002 feet bls. Stop drilling; prepare for core # 1 collection.
	10/19/10	Collect core #1 from interval 1102-1112 feet bls. Retrieve 6 feet of core.
	10/20/10	Resume pilot hole drilling. Extend depth of pilot hole to 1050 feet bls.
	10/21/10	Extend pilot hole depth to 1128 feet bls. Stop drilling. TIH with bit in preparation for core # 2 collection.
	10/22/10	TIH with core barrel. Secure well for the weekend.
10/25/10-10/29/10	10/25/10	Core interval from 1128 feet bls to 1133.5 feet bls. 4.8 feet of cored material recovered (approx. 3 feet unusable).
	10/26/10	Resume pilot hole drilling. Extend depth of pilot hole to 1154 feet bls; select this depth for top of the core # 3.
	10/27/10	Begin core # 3 collection from T.D. of 1154 feet bls. Core to approx. 1160 feet bls. Stop for the night.
	10/28/10	Resume coring from 1160 feet bls. Due to lack of progress stop coring at 1160.8 feet bls. Retrieve core. Approximately 3 feet of cored material recovered. TIH with bit.
	10/29/10	Resume pilot hole drilling: re-drill cored interval. Secure well for the weekend.
11/05/10	11/1/10	Resume pilot hole drilling from 1161 feet bls. Extend borehole to 1195 feet bls.
	11/2/10	Extend pilot hole depth to 1257 feet bls.

Week	Date	Description
11/01/10-11	11/3/10	Extend pilot hole depth to 1345 feet bls.
	11/4/10	Extend pilot hole depth to 1410 feet bls.
	11/5/10	Extend pilot hole depth to 1420 feet bls. Secure well for the weekend.
11/08/10-11/12/10	11/8/10	Resume pilot hole drilling from 1420 feet bls. Extend borehole to 1459 feet bls.
	11/9/10	Extend pilot hole depth to 1507 feet bls.
	11/10/10	Extend pilot hole depth to 1571 feet bls.
	11/11/10	Extend pilot hole depth to 1602 feet bls.
	11/12/10	Perform borehole cleaning. TOH with bit. Purge water to remove sediments. Secure well for the weekend.
11/15/10-11/19/10	11/15/10	Perform geophysical logging under static conditions.
	11/16/10	Perform geophysical logging under pumping (460 gpm) conditions. Conduct video survey.
	11/17/10	Set packers for PT#1 from 1414 to1459 feet bls. Develop zone (overnight) with submersible pump at a rate of 65 gpm (max.)
	11/18/10	Complete development. Wait on recovery. Perform pump test for PT#1. Collect recovery data.
	11/19/10	Drillers unable to deflate packers.
11/22/10-11/26/10	11/22/10	Deflate packers.
	11/23/10	TOH with packers to inspect packers and pressure line.
	11/24/10	No work onsite.
	11/25/10	No work onsite (Holiday).
	11/26/10	No work onsite (Holiday).
11/29/10-12/03/10	11/29/10	Set packers in PT#2 selected interval: 1514-1543 feet bls.
	11/30/10	Develop zone with submersible pump at a rate of 61-62 gpm (max.). Overnight recovery.
	12/1/10	Perform pump test and collect recovery data.
	12/2/10	Drillers attempt to move packers up, but again unable to deflate.
	12/3/10	The Contractor installed packers in the interval 1143-1173 ft bls for PT#3 and secured well for the weekend.
12/06/10-12/10/10	12/6/10	Develop zone with submersible pump at a rate of 63 gpm (max.). Overnight recovery.
	12/7/10	Perform pump test and collect recovery data.
	12/8/10	TIH with a bit, resume pilot hole drilling. Extend pilot hole to1655 ft bls.
	12/9/10	Extend pilot hole depth to 1840 feet bls.
	12/10/10	Extend pilot hole depth 1935 feet bls. Secure well for the weekend.
12/13/10-12/17/10	12/13/10	Resume pilot hole drilling. Extend borehole to 1970 feet bls.
	12/14/10	Terminate pilot hole drilling due to worsening water quality at 2075 feet bls. Clean borehole.
	12/15/10	TOH with bit.
	12/16/10	Purge water from well in preparation for video survey. Diluting discharge water fresh water from SFMW-1.
	12/17/10	Secure well for the weekend.
12/20/10-12/24/10	12/20/10	Perform geophysical logging under static and pumping conditions. Conduct video survey.
	12/21/10	Select packer test #4 interval. No construction work on the well is scheduled until Monday 12/27/10 (driller's time-off).
	12/22/10	No work onsite.
	12/23/10	No work onsite.
	12/24/10	No work onsite (Holiday).
12/27/10-12/31/10	12/27/10	Set single packer for PT#4 at 2005 feet bls.
	12/28/10	Develop zone with submersible pump at a rate of 38 gpm (max.). Overnight recovery.
	12/29/10	Perform pump test and collect recovery data.
	12/30/10	Drillers TOH with packer.
	12/31/10	No work onsite (Holiday).
1/03/11-1/07/11	1/3/11	Begin pilot hole cementing back from 2075 feet bls. Pump 108 cubic feet of neat cement during stage #1.
	1/4/11	Tag TOC (top of cement) after stage #1 at 2073 feet bls. Tag top of gravel at 2050 feet bls. Pump 96 c.f. of neat cement during stage #2.
	1/5/11	Tag TOC (top of cement) after stage #2 at 2031 feet bls. Emplace 8 c.f. of gravel. Tag top of gravel at 2010 feet bls. Pump 41 c.f. of neat cement during stage #3. Tag TOC after stage #3 at 1971 feet bls. Emplace 2 c.f. of gravel. Tag top of gravel at 1970 feet bls. Pump 2 c.f. of neat cement.
	1/6/11	Tag TOC at 1956 feet bls. Set single packer at 1920 feet bls.
	1/7/11	Begin development. Check water quality, and suspend development until all development water could be containerized due to high chloride content.

Week	Date	Description
1/10/11-1/14/11	1/10/11	Resume PT# 5 development. Purge approx. 41,000 gals at 53 gpm until parameters stabilized. Let recover overnight.
	1/11/11	Perform pump test and collect recovery data.
	1/12/11	TOH with packer. Assembly packers for test #6. TIH with packers. Set packers in the interval 461-523 feet bls.
	1/13/11	Perform PT# 6 interval development, conduct pump test and collect data on recovery. This concludes testing DZMW-1.
	1/14/11	Drillers TOH with packers. TIH with tremie pipe. Pump 108 c.f. of neat cement during stage #1 of back plugging.
1/17/11-1/21/11	1/17/11	Tag TOC after stage #1 at 1950 feet bls. Emplace 22 c.f. of gravel; tag top of gravel at 1928 c.f.
	1/18/11	Pump 108 c.f. of neat cement during stage #2.
	1/19/11	Tag TOC after stage #2 at 1879 feet bls. Pump 135 c.f. of neat cement during stage #3. Tag TOC after stage #3 at 1776 feet bpl, pump 135 c.f. during stage #4.
	1/20/11	Tag TOC after stage #4 at 1703 feet bls. Pump 135 c.f. of neat cement during stage #5.
	1/21/11	Tag TOC after stage #5 at 1525 feet bls. Pump 28 c.f. of neat cement during stage #6.
1/24/11-1/28/11	1/24/11	Tag TOC after stage #6 at 1500 feet bls. Pump 10 c.f. of neat cement during stage #7.
	1/25/11	Tag TOC after stage #7 at 1462 feet bls. Install LMZ FRP 2.5-inch I.D. screen between 1423 and 1453 feet bls. Emplace gravel to 1418 feet bls and top-off with fine sand.
	1/26/11	Tag top of sand seal at 1415 feet bls and pump approx. 7 C.F. as "spotting" stage.
	1/27/11	Tag cement "spot" at 1400 feet bls, pump 135 C.F. of neat cement during stage #1. Tag TOC after stage#1 at 1379 feet bls and pump 135 C.F. of neat cement during stage #2.
	1/28/11	Tag TOC after stage #2 at 1379 feet bls. Pump 135 c.f. of neat cement during stage #3.
1/31/11-2/04/11	1/31/11	Tag TOC after stage #3 at 1231 feet bls. Pump 135 c.f. of neat cement during stage #4.
	2/1/11	Tag TOC after stage #4 at 1148 feet bls. Pump 135 c.f. of neat cement during stage #5. Tag TOC after stage #5 at 1049 feet bls. Pump 270 c.f. of neat cement during stage #6.
	2/2/11	Tag TOC after stage #6 at 860 feet bls. Pump 216 c.f. of neat cement during stage #7. Tag TOC after stage #7 at 652 feet bls. Pump 81 c.f. of neat cement during stage #8
	2/3/11	Tag TOC after stage #8 at 586 feet bls. Pump 37 c.f. of neat cement during stage #9.
	2/4/11	Tag TOC after stage #9 at 512 feet bls (3 feet above the target). Install UMZ FRP 2.5-inch I.D. screen between 507 and 475 feet bls. Emplace gravel to 470 feet bls and top-off with 2 feet of fine sand. Tag top of sand seal at 468 feet bls and pump approx. 10 C.F. as "spotting" stage #1.
2/07/11-2/11/11	2/7/11	Tag cement "spot" at 464 feet bls, pump another 10 C.F. of neat cement during "spotting" stage #2. Tag TOC after "spotting" stage#2 at 454 feet bls and pump 135 C.F. of neat cement during stage #1.
	2/8/11	Tag TOC after stage #1 at 422 feet bls. Pump 270 c.f. of neat cement during stage #2.Tag TOC after stage #2 at 330 feet bls. Pump 270 c.f. of neat cement during stage #3.
	2/9/11	Tag TOC after stage #3 at 142 feet bls. Pump 216 c.f. of neat cement during stage #4. Bring cement to surface.
	2/10/11	Develop LMZ, UMZ and UFMW-1, collect lab samples, perform specific capacity tests. Wells construction and testing completed.
	2/11/11	No work on site.

Table 2: Summary of Inclination Survey Results for DZMW-1 20-inch Casing

Orlando Utilities Commission (OUC)

Southeast Monitoring Wells

Date:	**09/29/10**
Driller:	**Florida Design Drilling**
Well Designation:	**DZMW-1**
Casing OD:	**20-inches**
Casing ID:	**19.25-inches**
Method:	**"Sure Shot"**
Bit Diameter (inches):	**18.5**

Depth of a Survey Below Top of Casing (feet)	Drift (Degrees)	Change (Degrees)
0	0.50	0.50
30	1.00	0.50
60	0.50	0.50
90	0.90	0.40
120	0.40	0.50
150	0.50	0.10
180	0.50	0.00
210	0.50	0.00
240	0.50	0.00
270	1.00	0.50
300	0.50	0.50

Note: 20-inch casing was installed to 307 feet below land surface

Top of 20-inch casing at the time of survey was 1 foot above land surface

Table 3: Water-Quality Sampling Results from DZMW-1 Pilot-Hole Reverse-Air Discharge

Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

Date	Depth (feet bls)	Field Analysis			
		Chlorides (mg/L)	Specific Conductance (µS/cm)	Temperature (°C)	Sulfide (mg/l)
10/06/10	348	40	525	22.6 (ambient)	
10/06/10	378	40	516	24.3	
10/06/10	410	40	511	24.4	
10/07/10	442	40	672	23.1	
10/07/10	473	60	810	24.3	
10/07/10	503	100	1,001	25.0	
10/08/10	534	100	1,108	25.6	
10/11/10	565	100	1,090	26.7	0.02
10/11/10	597	100	1,113	26.9	0.04
10/11/10	629	100	1,106	26.2	0.05
10/12/10	660	100	1,089	24.8	0.01
10/12/10	691	100	1,055	25.5	0.02
10/12/10	723	80	1,031	26.8	0.01
10/12/10	754	80	994	26.1	0.01
10/12/10	786	100	1,035	25.1	0.07
10/13/10	818	100	1,031	25.4	0.04
10/13/10	849	100	988	26.1	0.09
10/13/10	881	100	998	25.9	0.06
10/14/10	912	100	1,019	24.8	0.09
10/14/10	943	80	1,017	24.8	0.06
10/14/10	974	80	975	24.8	0.12
10/18/10	1,002	80	931	24.7	0.14
10/20/10	1,037	80	959	25.4	0.06
10/21/10	1,068	80	944	24.7	0.05
10/21/10	1,099	80	962	25.3	0.04
10/21/10	1,131	80	1,005	26.1	0.16
10/26/10	1,154	120	1,259	26.4	0.03
11/01/10	1,194	120	1,252	25.6	0.14
11/02/10	1,226	120	1,248	26.1	0.09
11/02/10	1,257	120	1,256	26.3	0.13
11/03/10	1,288	120	1,320	26.1	0.06
11/03/10	1,320	140	1,385	26.4	0.05
11/04/10	1,352	180	1,680	26.1	0.09
11/04/10	1,384	180	1,670	25.7	0.09
11/05/10	1,413	200	1,739	22.7	n/a
11/08/10	1,445	400	2,640	25.7	0.06
11/09/10	1,476	400	2,670	26.3	0.06
11/09/10	1,507	500	2,940	26.6	0.07
11/10/10	1,540	500	2,940	26.8	0.06
11/10/10	1,571	500	3,000	26.1	0.08
11/11/10	1,602	500	2,940	26.4	0.08
12/08/10	1,635	240	1,573	24.9	n/a
12/09/10	1,667	240	1,570	n/a	n/a
12/09/10	1,698	220	1,543	n/a	n/a
12/09/10	1,729	240	1,620	25.5	0.06
12/09/10	1,761	200	1,480	25.6	0.05
12/09/10	1,792	180	1,396	25.3	0.05
12/09/10	1,824	100	936	n/a	n/a
12/10/10	1,855	120	1,051	n/a	n/a
12/10/10	1,886	240	1,629	n/a	n/a
12/10/10	1,917	360	2,200	26.1	0.03
12/13/10	1,948	1,500	5,350	n/a	n/a
12/13/10	1,980	1,500	5,850	n/a	n/a
12/14/10	2,011	1,500	6,490	25.1	0.02
12/14/10	2,043	15,500	31,900	25.2	0.00
12/14/10	2,075	17,500	42,700	22.7	0.00

"bls" denotes below land surface
"mg/L" denotes milligrams per liter
"µS/cm" denotes microSiemens per centimeter
"°C" denotes degrees Celsius

Table 4: Summary of Geophysical Logs Performed

Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

Well	Date	Geophysical Survey Performed	Casing Depth (feet bls)	Open Hole Depth (feet bls)	Drilled Hole Diameter (inches)
UFMW-1	08/17/10	X-Y Caliper, Gamma Ray	40	102	15.0
	08/20/10	X-Y Caliper, Gamma Ray	100	290	7.8
DZMW-1	08/30/10	X-Y Caliper, Gamma Ray	40	112	41.0
	09/14/11	X-Y Caliper, Gamma Ray	110	311	29.25
	11/15/11	X-Y Caliper, Gamma Ray	307	1602	9.8
	11/15/11	Dual Induction LL3 with SP	307	1602	9.8
	11/16/11	Fluid Conductivity, Temperature	307	1602	9.8
	11/16/11	Flowmeter	307	1602	9.8
	11/16/11	Video Survey	307	1602	9.8
	12/20/11	X-Y Caliper, Gamma Ray	307	2075	9.8
	12/20/11	Fluid Conductivity, Temperature	307	2075	9.8
	12/20/11	Flowmeter	307	2075	9.8
	12/20/11	Dual Induction LL3 with SP	307	2075	9.8
	12/20/11	Video Survey	307	2075	9.8

"bls" denotes below land surface.
"LL3" denotes lateral resistivity
"SP" denotes spontaneous potential

Table 5: DZMW-1 Coring Summary

Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

Core Number	Cored Interval (from-to feet bls)	Cored Interval Length (feet)	Length of Core Sample Retrieved (feet)	Core Sample Retrieved (%)	General Description
1	1002 -1012	10	6.0	60	Dolomitic Limestone
2	1128 -1133.5	5.5	4.80	87	Dolomitic Limestone
3	1154 -1160.8	6.8	2.90	43	Dolostone

"bls" denotes below land surface

Table 6: Summary of Inclination Survey Results
for DZMW-1 10-inch Pilot Hole (9.8-inch Bit)

Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

Date	Inclination Survey Depth (ft)	Survey Result (degrees) Deviation Total	Deviation Change
10/7/2010	400	0.50	0.50
10/7/2010	490	0.40	0.10
10/11/2010	580	0.40	0.00
10/12/2010	670	0.20	0.20
10/13/2010	760	0.50	0.30
10/13/2010	850	0.50	0.00
10/14/2010	940	0.40	0.10
10/20/2010	1030	0.80	0.40
10/21/2010	1120	0.40	0.40
11/2/2010	1210	0.30	0.10
11/4/2010	1300	0.50	0.20
11/5/2010	1390	0.30	0.20
11/9/2010	1480	0.60	0.30
11/10/2010	1570	0.40	0.20
12/9/2010	1690	0.50	0.10
12/9/2010	1780	0.60	0.10
12/10/2010	1870	0.60	0.00
12/14/2010	1960	0.50	0.10

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

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

"bpl" denotes below pad level

Table 7: Cementing Summary for UFMW-1 and DZMW-1 Casing Strings

Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

Outside Diameter (inches)	Inside Diameter (inches)	Casing Depth (feet bls)	Date	Cement Stage	Type of Cement	Cement Quantity (cubic feet)	Remarks
UFMW-1							
8.00	7.25	100	8/18/2010	1	Neat	113	Tagged bottom at 104 feet bls. Pressure grout.
4.5	4	223	8/20/2010	Spot	Neat	1	Tagged bottom at 230 feet bls. Tremied in place.
				1	Neat	27	Tagged cement top at 220 feet bls. Tremied in place.
			8/23/2010	2	Neat	28	Tagged cement top at 105 feet bls. Tremied in place to surface.
DZMW-1							
30.00	29.25	110	8/31/2010	1	Neat	227	Tagged bottom at 112 feet bls. Pressure grout.
			9/1/2010	2	Neat	263	Tagged cement top at 65 feet bls. Tremied in place to surface.
20.00	19.25	307	9/14/2010	1	Neat	226	Tagged bottom at 311 feet bls. Pressure grout.
			9/15/2010	2	Neat	74	Tagged cement top at 216 feet bls. Tremied in place.
					6% bentonite	221	
			9/15/2010	3	6% bentonite	207	Tagged cement top at 80 feet bls. Tremied in place to surface.
UMZ 2.5-inch diameter FRP Tubing	2.5/4.5	1,453	1/26/2011	Spot	Neat	7	Tagged top of sand at 1,415 feet bls. Tremied in place.
			1/27/2011	1	Neat	135	Tagged cement top at 1,400 feet bls. Tremied in place.
			1/27/2011	2	Neat	135	Tagged cement top at 1,375 feet bls. Tremied in place.
			1/28/2011	3	Neat	135	Tagged cement top at 1,364 feet bls. Tremied in place.
			1/31/2011	4	Neat	135	Tagged cement top at 1,231 feet bls. Tremied in place.
			2/1/2011	5	Neat	135	Tagged cement top at 1,148 feet bls. Tremied in place.
			2/1/2011	6	Neat	270	Tagged cement top at 1,049 feet bls. Tremied in place.
			2/2/2011	7	Neat	216	Tagged cement top at 860 feet bls. Tremied in place.
			2/2/2011	8	Neat	81	Tagged cement top at 652 feet bls. Tremied in place.
			2/3/2011	9	Neat	37	Tagged cement top at 586 feet bls. Tremied in place.
LMZ 2.5- inch diameter FRP Tubing	2.5/4.5	507	2/4/2011	Spot #1	Neat	10	Tagged top of sand at 468 feet bls. Tremied in place.
			2/7/2011	Spot #2	Neat	10	Tagged cement top at 464 feet bls. Tremied in place.
			2/7/2011	1	Neat	135	Tagged cement top at 454 feet bls. Tremied in place.
			2/8/2011	2	Neat	270	Tagged cement top at 422 feet bls. Tremied in place.
			2/8/2011	3	Neat	270	Tagged cement top at 330 feet bls. Tremied in place.
			2/9/2011	4	Neat	216	Tagged cement top at 142 feet bls. Cement to surface.
					Total (cubic feet):	**3,585**	

"bls" denotes below land surface.
"LMZ" denotes Lower Monitoring Zone
"UMZ" denotes Upper Monitoring Zone

Table 8: DZMW-1 Open Hole (2,075 and 1,956 feet bls) Backplugging Summary

Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

Backplugging Stage	Date	Tagged Bottom (feet bls)	Volume Emplaced (cubic feet)	Theoretical Interval Filled (feet)	Actual Interval Filled (feet)	Actual / Theoretical Filled Interval (percent)	Type of Fill (including additives)
1	1/3/2011	2075	108	169	2	1.2	Neat Cement
2	1/4/2011	2073	27	43	23	53.5	Gravel
3	1/4/2011	2050	54	96	29	30.2	Neat Cement
4	1/5/2010	2031	8	17	21	123.5	Gravel
5	1/5/2010	2010	41	69	39	57	Neat Cement
6	1/5/2010	1971	2	2	1	50	Gravel
7	1/5/2010	1970	2	2.5	14	560	Neat Cement
	Final tag:	1956					

Cement Total: 241.5 Cubic Feet

Note: Drilling Bit diameter was 9.8 inches

Tagged Bottom refers to the top of cement that was tagged by the Contractor prior to the cementing stage.

Theoretical Interval Cemented is the theoretical linear feet of cement fill based on the volume of cement pumped for that stage (calculated using XY caliper log).

Actual Interval Cemented refers to the difference between "Tagged Bottom" depths.

Actual/Theoretical Filled Interval refers to the Actual Interval Cemented divided by the Theoretical Interval Cemented as a percentage.

"bls" denotes below land surface.

Table 9: DZMW-1 Open Hole (1,956 and 1,462 feet bls) Backplugging Summary

Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

Backplugging Stage	Date	Tagged Bottom (feet bls)	Volume Emplaced (cubic feet)	Theoretical Interval Filled (feet)	Actual Interval Filled (feet)	Actual / Theoretical Filled Interval (percent)	Type of Fill (including additives)
1	1/14/2011	1956	135	156	6	3.8	Type I/II Neat Cement
2	1/17/2011	1950	22	22	22	100.0	Gravel
3	1/18/2011	1928	108	96	49	51.0	Type I/II Neat Cement
4	1/19/2011	1879	135	196	103	52.6	Type I/II Neat Cement
5	1/19/2011	1776	135	188	73	39	Type I/II Neat Cement
6	1/20/2011	1703	135	202	178	88	Type I/II Neat Cement
7	1/21/2011	1525	14	45	25	56	Type I/II Neat Cement
8	1/24/2011	1500	10	20	17	85	Type I/II Neat Cement
9	1/24/2011	1483	10	20	21	105	Type I/II Neat Cement
	Final tag:	1462					

Cement Total: 704 Cubic Feet

Note: Drilling Bit diameter was 9.8 inches

Tagged Bottom refers to the top of cement that was tagged by the Contractor prior to the cementing stage.

Theoretical Interval Cemented is the theoretical linear feet of cement fill based on the volume of cement pumped for that stage (calculated using XY caliper log).

Actual Interval Cemented refers to the difference between "Tagged Bottom" depths.

Actual/Theoretical Filled Interval refers to the Actual Interval Cemented divided by the Theoretical Interval Cemented as a percentage.

"bls" denotes below land surface.

Table 10: Summary of DZMW-1 and UFMW-1 Packer Tests and Final Water Sample Analytical Results

Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

Well	Test Interval (feet bls)	Test No.	Sample Date	Specific Conductance (μmhos/cm)	Chloride (mg/L)	Total Hardness (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Lab pH (s.u)	Alk. (mg/L)	Alk. BiCarb (mg/L)	Alk. Carbonate (mg/L)	K (mg/L)	Ca (mg/L)	Na (mg/L)	Mg (mg/L)
DZMW-1	1143-1173	3	12/7/10	1,030	69	546	437	845	7.43	133.5	133.15	0.33	2.31	162.00	43.5	35.1
	1414-1459	1	11/18/10	1,528	248	793	655	1,427	7.39	119	118.71	0.27	5.60	219.00	133	219
	1514-1544	2	12/1/10	2,720	505	1235	1057	2,324	7.30	110	109.78	0.20	10.6	314	299	92.6
	461-526	6	1/13/11	1,189	75	540	403	821	7.54	136.0	315	1.02	2.45	159	41.6	34.7
	1925-1964	5	1/11/11	11,240	2,451	1849	1,349	5,930	7.78	104.8	104.2	0.60	43.5	424	1295	192
	2005-2075	4	12/29/10	79,000	17,000	4801	3,000	25,916	7.09	104.8	104.7	0.12	253	710	7466	738
UMZ	475-507	n/a	02/10/11	973	68.8	n/a	354	800	7.45	136.8	136.42	0.36	3.02	152.00	41.5	30.7
LMZ	1423-1453	n/a	02/10/11	1,558	149.0	n/a	459	1,038	7.93	283.6	281.31	2.25	5.55	171.00	83.3	40.3
UFMW-1	230-290	n/a	02/10/11	601	16.8	n/a	<0.25	376	7.19	126.9	126.71	0.18	1.87	99.20	24.6	3.21

"bls" denotes below land surface
"TDS" denotes Total Dissolved Solids
"Alk." denotes Alkalinity
"K" denotes Potassium
"Ca" denotes Calcium
"Na" denotes Sodium
"Mg" denotes Magnesium
"mg/L" denotes concentration in units of milligrams per liter.
"μmhos/cm" denotes specific conductance in units of microohms per centimeter.
"n/a" denotes not analyzed

Table 11: Summary of Packer Test Data and Horizontal Hydraulic Conductivity Estimates

Orlando Utilities Commission (OUC)

Southeast Monitoring Wells

Well	Depth Interval (feet bls)	Packer Test Number		Tested Aquifer Thickness (feet)	Pumping Rate (gpm)	Specific Capacity (gpm/ft)	Estimated Transmissivity (gpd/ft)	Estimated Horizontal Hydraulic Conductivity (gpd/sq ft)	Estimated Horizontal Hydraulic Conductivity (cm/sec)	Method of Interpretation
DZMW-1	1143-1173	3	12/7/10	30	62	21.20	31,500	1050	4.95E-02	Turcan (1963)
	1414-1459	1	11/18/10	45	65	19.30	33,775	751	3.54E-02	Turcan (1963)
	1514-1544	2	12/1/10	30	62	7.60	13,300	443	2.09E-02	Turcan (1963)
	461-523	6	1/13/11	62	71.7	67.00	117,250	1891	8.92E-02	Turcan (1963)
	1920-1956	5	1/11/11	36	53.8	27.00	47,250	1312	6.19E-02	Turcan (1963)
	2005-2075	4	12/29/10	70	37.0	37.00	64,750	925	4.36E-02	Turcan (1963)

"bls" denotes below land surface.

"gpm" denotes gallons per minute.

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

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

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

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

"E" denotes scientific notation (ex. 6.79E-04 means 6.79×10^{-4}).

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

Table 12: Monitor Zone and Well Development Summary

Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

Well/Zone Developed	Open Hole/ Screen Depth (feet bls)	Length of screen/open hole (feet)	Diameter of screen/open hole (inches)	Length of Development (minutes)	Static Water-Level (feet bls)	Pumping Rate (gpm)	Maximum Drawdown (feet)	Specific Capacity (gpm/ft of drawdown)	Water Quality Field Parameters			
									Temperature (Degr. C)	Conductivity (uS/cm)	Chlorides (mg/L)	pH
UFMW-1 (Open Hole)	230-290	60	8	N/A	31.30	31.0	26.35	1.2	22.8	605	35	7.02
DZMW-1/UMZ	475-507	32	2.5	100	36.81	62.2	21.41	2.9	24.6	1154	80	7.23
DZMW-1/LMZ	1423-1453	30	2.5	95	37.02	54.0	36.72	1.5	25.5	1549	180	7.98

Note: The following well volumes (tubing and screened interval) were purged prior to water sample collection for laboratory analysis:

UFMW-1: 3.8 (1,860 gals) on 2/10/11 only. Well was originaly developed on 8/24/10 (well completion date) and since that date was utilized as water supply well

Upper Monitoring Zone (UMZ): 19.4 (6,220 gals)

Lower Monitoring Zone (LMZ): 12.8 (6,080 gals)

"bls" denotes below land surface

"gpm" denotes gallons per minute.

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

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

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

ARCADIS

Appendix A

SJRWMD Construction Permit and Well Completion Reports

St. Johns River
Water Management District
Kirby B. Green III, Director • David W. Fisk, Assistant Executive Director

4049 Reid Street • P.O. Box 1429 • Palatka, FL 32178-1429 • (386) 329-4500
On the Internet at floridaswater.com.

August 16, 2010

Orlando Utilities Commission
5971 Pershing Ave
Orlando, FL 32822

SUBJECT: Water Well Construction Permit 125213 located in Orange County
Zone: C-MW-NXC

Dear Sirs/Madam:

Please find enclosed the permit for the above referenced project. Permit issuance does not relieve you from the responsibility of obtaining permits from any federal, state, and/or local agencies asserting concurrent jurisdiction for this work.

In the event you sell your property, the permit will be transferred to the new owner if we are notified by you within thirty (30) days of the recording of the sale. Please assist us in this matter so as to maintain a valid permit for the new property owner.

The permit enclosed is a legal document. Please read the permit carefully since you are responsible for compliance with any conditions which is a part of this permit. Compliance is a legal requirement and your assistance in this matter will be greatly appreciated.

If you have any questions concerning your permit, please do not hesitate to contact this office at (386) 329-4401.

Thank you for your interest in our water resources.

Sincerely,

Janet Stein

Janet Stein
Regulatory Information Management Specialist II
Division of Regulatory Information Management

Cc: District Permit File
Contractor
Jim Frazee

STATE OF FLORIDA PERMIT APPLICATION TO CONSTRUCT, REPAIR, MODIFY, OR ABANDON A WELL

☐ Southwest
☐ Northwest
☒ St. Johns River
☐ South Florida
☐ Suwannee River

CHECK BOX FOR APPROPRIATE DISTRICT ADDRESS ON BACK OF PERMIT FORM

THIS FORM MUST BE FILLED OUT COMPLETELY.

The water well contractor is responsible for completing this form and forwarding the permit to the appropriate delegated county where applicable.

Permit No. 125213-1
Florida Unique I.D. AAL 6132
Permit Stipulations Required (See attached)
62-524 Quad # 3510 Delineation # 48000000
CUP/WUP Application No. 3159

ABOVE THIS LINE FOR OFFICIAL USE ONLY

Fold at this line in order that address is visible through envelope window

1. Orlando Utilities Commission | 5971 Pershing Ave. | Orlando, FL 32822 | 407-423-9100
Owner, Legal Name of Entity if Corporation | Address | City | Zip | Telephone Number

2. 13990 Narcoossee Road, Orlando, FL (LAKE NONA LAND CO LLC)
Well Location _ Address, Road Name or number, City
Parcel # (Pin) 36-24-30-0000-00-004

3. Florida Desing Drilling Corp. Daniel Ringdahl - 11148 | 561-324-3885 fax: 561-844-2967
Well Drilling Contractor | dan@FloridaDesignDrilling.com License No. | Telephone No.

1405 North Killian Drive
Address

Lake Park, FL 33403
City | State | Zip

4. SW (smallest) 1/4 of SE (biggest) 1/4 of Section 30

5. Township 24 Range 31

(Indicate Well on Chart)

NW NE
30
SW SE X

6. Orange | 36-24-30-0000-00-004 (Lake Nona Land Co. LLC)
County | Subdivision Name | Lot | Block | Unit

7. Number of proposed wells 1 Check the use of well: (See back of permit for additional choices) _____ Domestic Monitor (type) X Upper Floridan UFMW-1
_____ Irrigation (Type) (See Back) Public Water Supply (type) _____ (See Back) List Other _____
Distance from septic system 50' minimum ft. Description of facility Well field monitoring Estimated start of construction date August 9,2010

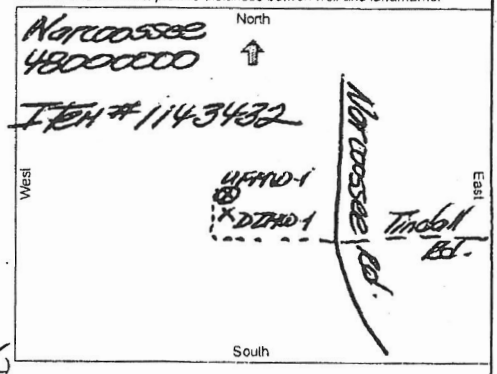
8. Application for: X New Construction _____ Repair/Modify _____ Abandonment _____ (Reason for Abandonment)

Date Stamp: RECEIVED 125213-1 JUL 29 2010 ALTAMONTE

9. Estimated: Well Depth 290' Casing Depth 250' Screen Interval from — to —
Casing Material: Blk-Steel / Gal / PVC Casing Diameter 4" (smallest) Seal Material neat cement

10. If applicable: Proposed From 0 to 100 Seal Material neat cement 8"
Grouting Interval From 0 to 250 Seal Material neat cement 4"
From _____ to _____ Seal Material _____

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



11. Telescope Casing ___ or Liner ___ (check one) Diameter _____
Blk-Steel / Galvanized / PVC Other (specify:) 8" surface casing to 100' (steel)

12. Method of Construction: X Rotary _____ Cable Tool _____ Combination
_____ Auger _____ Other (specify:) _____

13. Indicate total No. of wells on site 2 List number of unused wells on site 0

14. Is this well or any other well or water withdrawal on the owner's contiguous property covered under a Consumptive/Water Use Permit (CUP/WUP) or CUP/WUP Application? ___ No X Yes
(IF YES, COMPLETE THE FOLLOWING) CUP/WUP No. ~~48-00195-5~~ 3159
District well I.D. No. 243077
Latitude 28°21'51.8" Longitude 81°14'53.7"
Data obtained from GPS X or map ___ or survey ___ *(map datum NAD 27 __ NAD 83 ✓)*

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

Signature of Contractor | 11148 License No.

I certify that I am the owner of the property, that the information provided is accurate, and that I am aware of my responsibilities under Chapter 373, Florida Statutes, to maintain or properly abandon this well; or, I certify that I am the agent for the owner, that the information provided is accurate, and that I have informed the owner of his responsibilities as stated above. Owner consents to personnel of the WMD or a representative access to the well site.

Owner's or Agent's Signature | 7/27/10 Date

DO NOT WRITE BELOW THIS LINE - FOR OFFICIAL USE ONLY

Approval Granted By: Cathi Andrew Issue Date: 8/16/10 Hydrologist Approval 49885 Initials

Owner Number: MLMW SE-UFA SOUTHEAST Fee Received: $ 120.00 Receipt No.: A035330 Check No.: 1274

THIS PERMIT NOT VALID UNTIL PROPERLY SIGNED BY AN AUTHORIZED OFFICER OR REPRESENTATIVE OF THE WMD. IT SHALL BE AVAILABLE AT THE WELL SITE DURING ALL DRILLING OPERATIONS. ***This permit is valid for 90 days from the date of issue.***

FORM LEG-R.040.00 (4/09) RULE 40D-3.101(1), F.A.C.

WHITE: ORIGINAL FILE
YELLOW: DRILLING CONTRACTOR
PINK: OWNER

"EXHIBIT A"
CONDITIONS FOR ISSUANCE OF PERMIT NUMBER 125213
Orlando Utilities Commission
DATED AUGUST 16, 2010

1. The well contractor shall notify the District no less than 24 hours prior to any construction or grouting operations. The well contractor shall schedule a final inspection within 60 days of completion. District representative: Jim Frazee/Charles Shirley Office: Altamonte Springs Service Center Telephone (fax): 407-947-3896/407-659-4866(4805) jfrazee@sjrwmd.com / cshirley@sjrwmd.com

2. The well contractor shall submit a completion report to the District within 30 days of completion of this well.

3. The well contractor shall construct the well as described in the application specifications submitted on 29-jul-2010. The well contractor shall seal all marker beds. Any changes to the construction plan shall be approved in advance by the District.

4. The well contractor shall disinfect and pump this well clean using the permanent pump in accordance with Chapters 40C-3 and 62-532, F.A.C., until the discharge water is clear and free of particulate material.

5. The well contractor shall finish the upper well terminus a minimum of 12 inches above land surface as required in Chapter 62-532, F.A.C., and protect the upper well terminus in a secured enclosure.

6. The well contractor shall add the latitude and longitude coordinates of this well (282151.8 / 811453.7) to the list of information required to be inscribed, stamped or printed on the metallic well tag.

7. The well contractor shall post a copy of this permit on site during all phases of well construction.

8. The well contractor shall collect drill cutting samples to identify the casing seat geology during construction.
   The samples shall be maintained on site for inspection by the District.

9. The well owner shall provide to the District all geophysical logs run during or post construction of this well in hard copy and .LAS electronic format within seven days of the completion of the logs. Video logs shall be submitted in a format compatible with Windows Media Player. The well owner shall contact District staff to obtain a Station Attribute Data Form to submit with each log. At a minimum, the owner shall provide the following information for each log:

   Latitude/ Longitude
   GPS Determination Method
   Control Datum
   Station ID (243077)
   Station Name (MZMW SE-UFA SOUTHEAST)
   CUP Permit Number (3159)

WWC Permit Number (125213-1)
Well Use
Well Status
Logging Company
Logging Date
Well Conditions During Log
Flow Rate if Pumped or Flowing

10. The well contractor shall provide access into the well for geophysical logging by the District to check construction and formation information if the well does not produce water that passes the Imhoff cone test.

St. Johns River
Water Management District
Kirby B. Green III, Director • David W. Fisk, Assistant Executive Director

4049 Reid Street • P.O. Box 1429 • Palatka, FL 32178-1429 • (386) 329-4500
On the Internet at floridaswater.com.

August 16, 2010

Orlando Utilities Commission
5971 Pershing Ave
Orlando, FL 32822

SUBJECT: Water Well Construction Permit 125207 located in Orange County
Zone: C-MW-NXC

Dear Sirs/Madam:

Please find enclosed the permit for the above referenced project. Permit issuance does not relieve you from the responsibility of obtaining permits from any federal, state, and/or local agencies asserting concurrent jurisdiction for this work.

In the event you sell your property, the permit will be transferred to the new owner if we are notified by you within thirty (30) days of the recording of the sale. Please assist us in this matter so as to maintain a valid permit for the new property owner.

The permit enclosed is a legal document. Please read the permit carefully since you are responsible for compliance with any conditions which is a part of this permit. Compliance is a legal requirement and your assistance in this matter will be greatly appreciated.

If you have any questions concerning your permit, please do not hesitate to contact this office at (386) 329-4401.

Thank you for your interest in our water resources.

Sincerely,

Janet Stein

Janet Stein
Regulatory Information Management Specialist II
Division of Regulatory Information Management

Cc: District Permit File
Contractor
Jim Frazee

SCANNED

STATE OF FLORIDA PERMIT APPLICATION TO CONSTRUCT, REPAIR, MODIFY, OR ABANDON A WELL

☐ Southwest
☐ Northwest
☒ St. Johns River
☐ South Florida
☐ Suwannee River

CHECK BOX FOR APPROPRIATE DISTRICT ADDRESS ON BACK OF PERMIT FORM

THIS FORM MUST BE FILLED OUT COMPLETELY.

The water well contractor is responsible for completing this form and forwarding the permit to the appropriate delegated county where applicable.

Permit No. 125207-1 AUG 03 2010
Florida Unique I.D. AAL 6123
Permit Stipulations Required (See attached) ALTAMONTE SPRING
62-524 Quad # 3510 Delineation # 4800000
CUP/WUP Application No. 3159

ABOVE THIS LINE FOR OFFICIAL USE ONLY

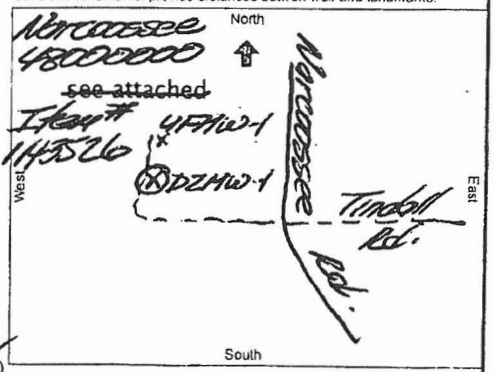
Fold at this line in order that address is visible through envelope window

1. Orlando Utilities Commission | 5971 Pershing Ave. | Orlando, FL 32822 | 407-423-9100
   Owner, Legal Name of Entity if Corporation | Address | City | Zip | Telephone Number
2. 13990 Narcoossee Road, Orlando, FL (LAKE NONA LAND CO LLC)
   Well Location _ Address, Road Name or number, City
   Parcel # (Pin) 36-24-30-0000-00-004
3. Florida Desing Drilling Corp. Daniel Ringdahl - 11148 | 561-324-3885 fax: 561-844-2967
   Well Drilling Contractor dan@FloridaDesignDrilling.com License No. | Telephone No.
   1405 North Killian Drive
   Address
   Lake Park, FL 33403
   City | State | Zip
4. SW (smallest) 1/4 of SE (biggest) 1/4 of Section 30
   (Indicate Well on Chart)
5. Township 24 Range 31
6. Orange | 36-24-30-0000-00-004 (Lake Nona Land Co. LLC) | | | |
   County | Subdivision Name | Lot | Block | Unit

NW NE SW SE

7. Number of proposed wells 1 Check the use of well: (See back of permit for additional choices) _____ Domestic Monitor (type) x Dual Zone DZMW-1
   _____ (See Back) Irrigation (Type) Public Water Supply (type) _____ (See Back) List Other _____
   Distance from septic system ~~na~~ 50+minimum ft. Description of facility ~~na~~ well. Field monitoring Estimated start of construction date August 9,2010
8. Application for: ✓ New Construction ✗ Repair/Modify _____ Abandonment _____ (Reason for Abandonment)
9. Estimated: Well Depth 2,200' Casing Depth 1140; 1840 Screen Interval from 1805 to 1835 1105-1135
   Casing Material: Blk-Steel / Gal / PVC Casing Diameter 2.5" FRP (smallest) Seal Material neat cement 12% bent
10. If applicable: Proposed Grouting Interval From 0 to 350 Seal Material neat cement & 12% bentonite
    From 0 to 1840 Seal Material neat cement & 12% bentonite
    From 1840 to 2200 Seal Material 12% bent.
11. Telescope Casing X or Liner _____ (check one) Diameter 20" to 350'
    Blk-Steel / Galvanized / PVC Other (specify:) 26" steel pit casing to 90'
12. Method of Construction: X Rotary _____ Cable Tool _____ Combination
    _____ Auger _____ Other (specify:) _____
13. Indicate total No. of wells on site 2 List number of unused wells on site 0
14. Is this well or any other well or water withdrawal on the owner's contiguous property covered under a Consumptive/Water Use Permit (CUP/WUP) or CUP/WUP Application? ___ No X Yes
    (IF YES, COMPLETE THE FOLLOWING) CUP/WUP No. ~~48-00195-S~~ 3159
    District well I.D. No. 243078 (3-095-3159-12)
    Latitude 28°21'51.1" Longitude 81°14'54.1"
    Data obtained from GPS X or map ___ or survey ___ (map datum NAD 27 ___ NAD 83 ✓)

Draw a map of well location and indicate well site with an "X" identify known roads and landmarks: provide distances betwen well and landmarks.



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

Signature of Contractor | 11148 License No.

I certify that I am the owner of the property, that the information provided is accurate, and that I am aware of my responsibilities under Chapter 373, Florida Statutes, to maintain or properly abandon this well; or, I certify that I am the agent for the owner, that the information provided is accurate, and that I have informed the owner of his responsibilities as stated above. Owner consents to personnel of the WMD or a representative access to the well site.

Owner's or Agent's Signature | Date 7/27/10

RECEIVED
125207-1
JUL 29 2010
ALTAMONTE

DO NOT WRITE BELOW THIS LINE - FOR OFFICIAL USE ONLY

Approval Granted By: Catrin Ewer Issue Date: 8/16/10 Hydrologist Approval Initials

Owner Number: MZMW SE-LFA Fee Received: $ 120.00 Receipt No. 4988530 Check No.: 1274
SOUTHEAST ABB corps

THIS PERMIT NOT VALID UNTIL PROPERLY SIGNED BY AN AUTHORIZED OFFICER OR REPRESENTATIVE OF THE WMD. IT SHALL BE AVAILABLE AT THE WELL SITE DURING ALL DRILLING OPERATIONS. ***This permit is valid for 90 days from the date of issue.***

FORM LEG-R.040.00 (4/09) RULE 40D-3.101(1), F.A.C.

WHITE: ORIGINAL FILE
YELLOW: DRILLING CONTRACTOR
PINK: OWNER

"EXHIBIT A"
CONDITIONS FOR ISSUANCE OF PERMIT NUMBER 125207
Orlando Utilities Commission
DATED AUGUST 16, 2010

1. The well contractor shall notify the District no less than 24 hours prior to any construction or grouting operations. The well contractor shall schedule a final inspection within 60 days of completion. The following staff will be available to assist: James M. Frazee, Jr. 407-947-3896 (jfrazee@sjrwmd.com) or Charles Shirley 407-659-4866/ 407-466-5465 cell (cshirley@sjrwmd.com)

2. The well contractor shall submit a completion report to the District within 30 days of completion of this well.

3. The well contractor shall construct the well as described in the application specifications submitted on 29-jul-2010. The well contractor shall seal all marker beds with grouted casing prior to penetrating the next lower stratum, including the top of the Avon Park limestone. The use of non-standard grout mixes, such as 12% bentonite, and changes to the construction plan shall be approved in advance by the District.

4. The well contractor shall disinfect and pump this well clean using the rig or alternate pumping system in accordance with Chapters 40C-3 and 62-532, F.A.C., until the discharge water is clear and free of particulate material.

5. The well contractor shall finish the upper well terminus a minimum of 12 inches above land surface as required in Chapter 62-532, F.A.C., and protect the upper well terminus in a secured enclosure.

6. The well contractor shall add the latitude and longitude coordinates of this well (282151.1 / 811454.1) to the list of information required to be inscribed, stamped or printed on the metallic well tag.

7. The well contractor shall post a copy of this permit on site during all phases of well construction.

8. The well contractor shall collect full-bag drill cutting samples from land surface to approximately 2200 feet at 10-feet intervals or at formation changes, and leave the samples on site for inspection by District staff.

9. The well owner shall provide to the District all geophysical logs run during or post construction of this well in hard copy and .LAS electronic format within seven days of the completion of the logs. Video logs shall be submitted in a format compatible with Windows Media Player. The well owner shall contact District staff to obtain a Station Attribute Data Form to submit with each log. At a minimum, the owner shall provide the following information for each log:

   Latitude/ Longitude
   GPS Determination Method
   Control Datum

Station ID (243078)
Station Name (MZMW SE-LFA/LFB SOUTHEAST)
CUP Permit Number (3159)
WWC Permit Number (125207-1)
Well Use
Well Status
Logging Company
Logging Date
Well Conditions During Log
Flow Rate if Pumped or Flowing

10. The well contractor shall provide access into the well for geophysical logging by the District to check construction and formation information if the well does not produce water that passes the Imhoff cone test.

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 125207-1 *CUP/WUP Number 3-095-3159-12 *DID Number 243078 62-524 Delineation No. _____

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

3.*Owner's Name Orlando Utilities Commission (OUC) 4.*Completion Date 2-9-11 5. Florida Unique ID _____

6. 13990 Narcoossee Road, Orlando, FL (Lake Nona Land Co. LLC) 36-24-30-0000-00-004
*Well Location - Address, Road Name or Number, City, ZIP

7.*County Orange *Section 30 Land Grant _____ *Township 24 *Range 31

8. Latitude 28-24'51.1" Longitude 81-14'54.1"

9. Data Obtained From: X GPS ____Map ____Survey Datum: ____NAD 27 X NAD 83 ____WGS 84

10.*Type of Work: X 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 Investigation
X 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 X Rotary ____Combination (Two or More Methods) ____Jetted ____Sonic
____Horizontal Drilling ____Hydraulic Point (Direct Push) ____Other _____

13.*Measured Static Water Level 35 ft. Measured Pumping Water Level _____ ft. After _____ Hours at _____ GPM

14.*Measuring Point (Describe) TOC Which is _____ ft. ____Above ____Below Land Surface *Flowing: ____Yes X No

15.*Casing Material: ____Black Steel ____Galvanized ____PVC ____Stainless Steel ____Not Cased Other FRP

16.*Total Well Depth ~~2048~~ 2075 *Cased Depth _____ ft. *Open Hole: From none To _____ ft. *Screen: From 1423 To 1453 ft. Slot Size .038"
Dual 480-510 425-507

17.*Abandonment: X Other (Explain) Backplugged from ~~2048~~ to 1450 to 2075
From ~~2048~~ ft. To 1450 ft. No. of Bags 750 Seal Material (Check One): X Neat Cement ____Bentonite ____Other _____
From _____ ft. To _____ ft. No. of Bags _____ Seal Material (Check One): ____Neat Cement ____Bentonite ____Other _____
From 2075 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: steel casing .375" wall
Dia 30 in. From 0 ft. To 110 ft. No. of Bags 415 Seal Material (Check One): X 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: steel casing .375" wall
Dia 20 in. From 0 ft. To 307 ft. No. of Bags 617 Seal Material (Check One): X 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 _____
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: 425 FRP total cement from 1420 to surface
Dia 2-7/8" From 150 ft. To ~~480~~ ft. No. of Bags 1890 Seal Material (Check One): X Neat Cement ____Bentonite ____Other _____
Dia 2-7/8" From 150 ft. To 1423 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: FRP - attached to top of 2-7/8" FRP casings Dual zone configuration
Dia 4 in. From 0 ft. To 150 ft. No. of Bags _____ Seal Material (Check One): ____Neat Cement ____Bentonite ____Other _____
Dia 4 in. From 0 ft. To 150 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 _____

22. Pump Type (If Known):
____Centrifugal ____Jet ____Submersible ____Turbine
Horsepower _____ Pump Capacity (GPM) _____
Pump Depth _____ ft. Intake Depth _____ ft.

23. Chemical Analysis (When Required):
Iron _____ ppm Sulfate _____ ppm Chloride _____ ppm
____Laboratory Test ____Field Test Kit

24. Water Well Contractor:

*Contractor Name Daniel Ringdahl *License Number 11148 E-mail Address dan@FloridaDesignDrilling.com

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

*Permit No. 125207-1

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

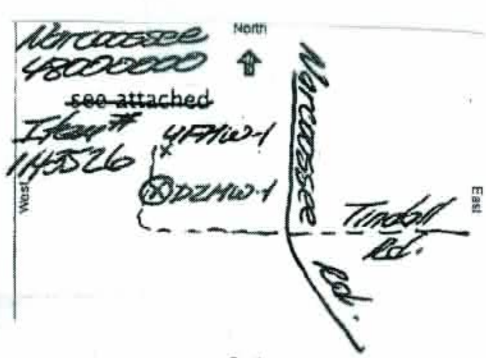
***DRILL CUTTINGS LOG** (Examine cuttings every 20 ft. or at formation changes. Note cavities and depth to producing zone. Grain Size: F=Fine, M=Medium, and C=Coarse)

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

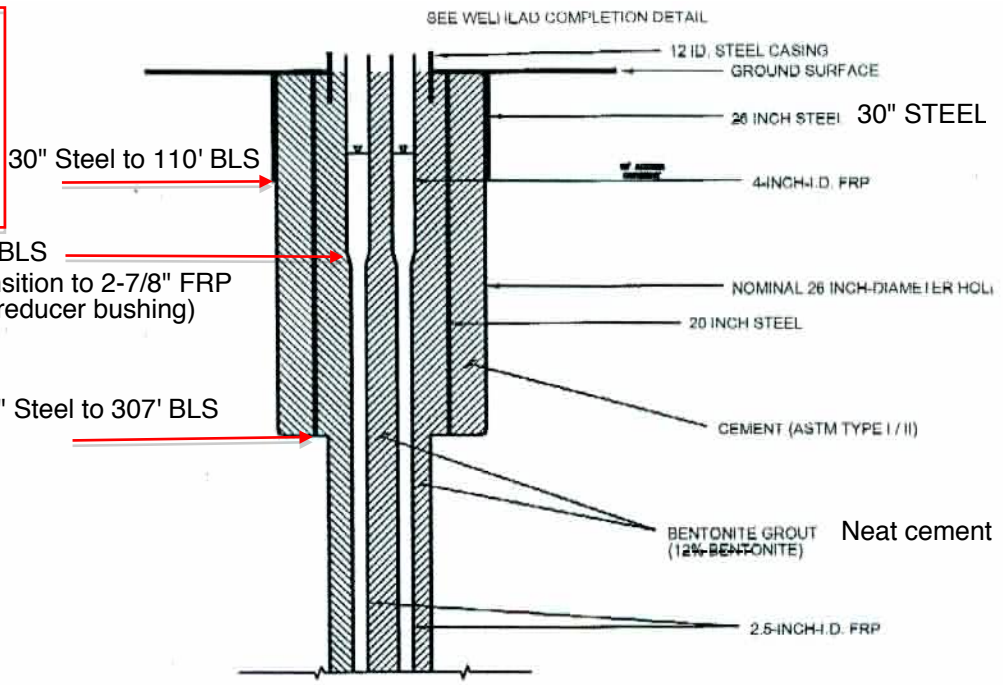
Comments: Drill cuttings log to be provided by ARCADIS, Inc. in seperate report.

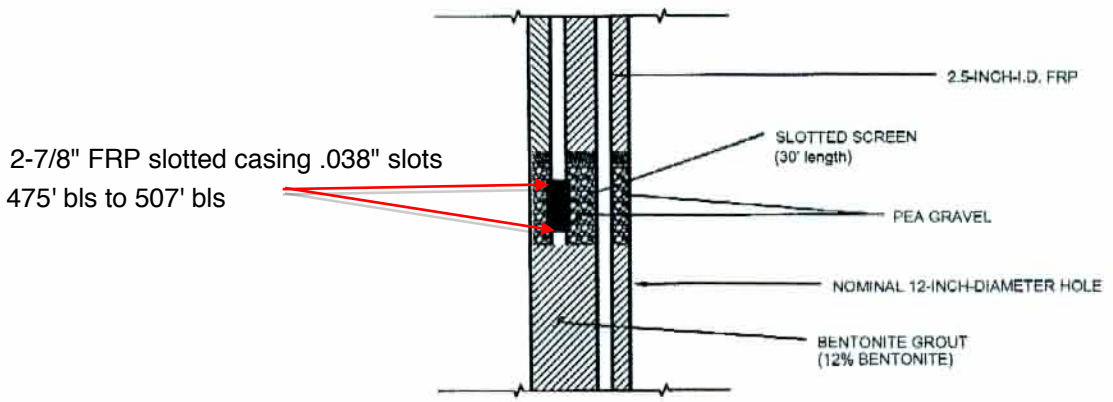
***Detailed Site Map of Well Location**

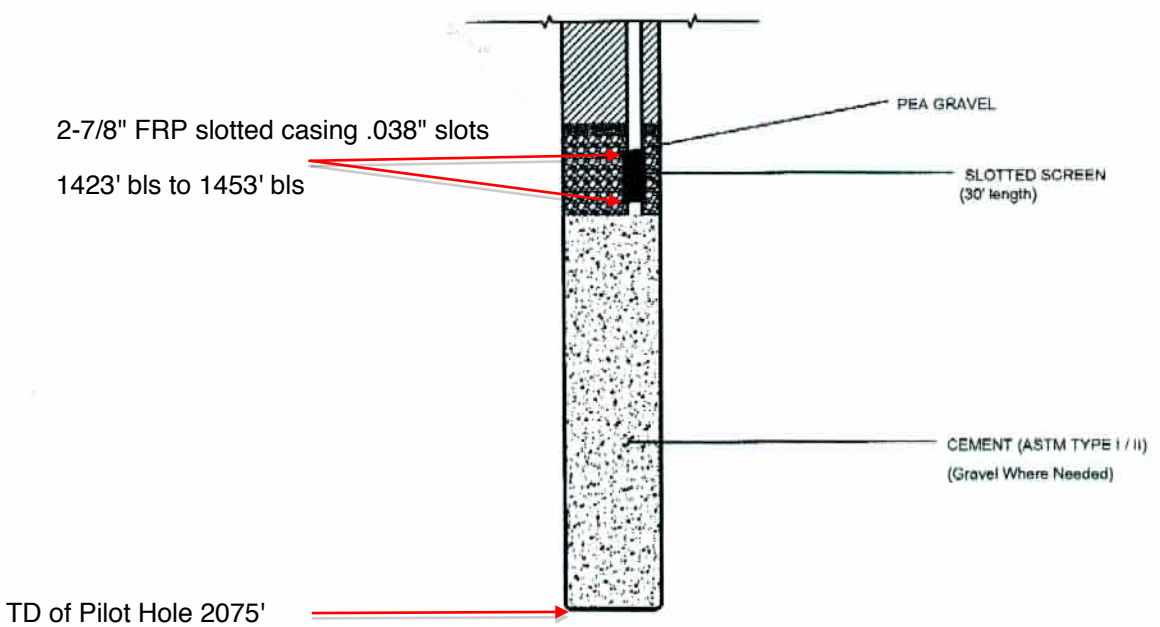
N



"As Built" Drawing
Florida Design Drilling Corp.
OUC Southeast Monitor Well Project
DZMW-1
St. Johns Permit #125207-1
DID # 243078
Completion Date: 2-10-2011







LOWER FLORIDAN MONITOR WELL (DZMW-1)

WELL COMPLETION REPORT (Please complete in black ink or type.)

PERMIT #: 125213-1 CUP/WUP#: 3159 DID#: AAL6122
Indicate the number of wells drilled/abandoned for this report: 1
Indicate the number of wells permitted but not drilled/abandoned that are being cancelled: 0

WATER WELL CONTRACTOR'S SIGNATURE _____ License # 11148
I certify that the information provided in this report is accurate and true.

Grout	No. of Bags	From (ft.)	To (ft.)
Neat Cement: pit csg	64	0	40
Neat - 8" csg	96	0	100
Neat - 4" csg	60	0	230

WELL LOCATION: County Orange
____ 1/4 of ____ 1/4 of Section 36, Township 24, Range 30
Latitude: 28°21'57.8", Longitude: 81°14'53.7"

DATE STAMP

Official Use Only

Sketch of well location on property

Give distances from septic tank and house, or other reference points

CHEMICAL ANALYSIS WHEN REQUIRED
Iron: ____ppm Sulfate: ____ppm
Chlorides: ____ ppm TDS ____ mg/l
Conductivity ____ umhos/cm
[ ] Lab Test [ ] Field Test Kit

Pump Type
[ ] Centrifugal [ ] Jet [ ] Submersible [ ] Turbine
Horsepower: _____ Capacity: _____ GPM: _____
Pump Depth: _____ft. Intake Depth: _____ft.

FORM LEG-R.005.00(10/05)

OWNER'S NAME: Orlando Utilities Commission
COMPLETION DATE: 10-26-10 Florida Unique I.D.: AAL6122
Parcel # (Pin): 36-24-30-0000-00-004
WELL USE:
[ ] Public Supply [ ] Irrigation [ ] Domestic [X] Monitor
[ ] Injection [ ] Other
DRILL METHOD:
[X] Rotary [ ] Cable Tool [ ] Combination
[ ] Jet [ ] Auger [ ] Other _____

Measured Static Water Level: _____ Measured Pumping Water Level: _____
After ____Hours at _____GPM. Measuring Pt. (Describe): _____
Which is _____ft. [ ] above [ ] below land surface
Casing: [x] Black Steel [ ] Galvanized [ ] PVC [ ] Other: _____

[x] Open Hole [ ] Screen	Depth (feet) From	Depth (feet) To	DRILL CUTTINGS LOG Examine cuttings every 20 ft. or at formation changes. Note cavities, depth to producing zones. Color | Grain Size | Type of Material
Casing Diameter and Depth (ft.)			
Diameter: 16" From: 0 To: 40©			0-10 sand 10-20 sand clay - tan 20-25 brown sand
Diameter: 8" From: 0 To: 100©			25-40 sandy green clay 40-80 sand gray clay 80-140 geen clay, shell
Liner [ ] or Casing [x] Diameter: 4" From: 0 To: 230©			140-227 clay shell sand intermixed 227-290 hard limestone TD at 290' bls

Driller's Name (print or type): Bruce Balmer

ASBUILTS BY:

gai consultants
301 East Pine Street
Suite 500
Orlando, Florida 32801
407-423-8398
LB 3604

Legend of Symbols & Abbreviations

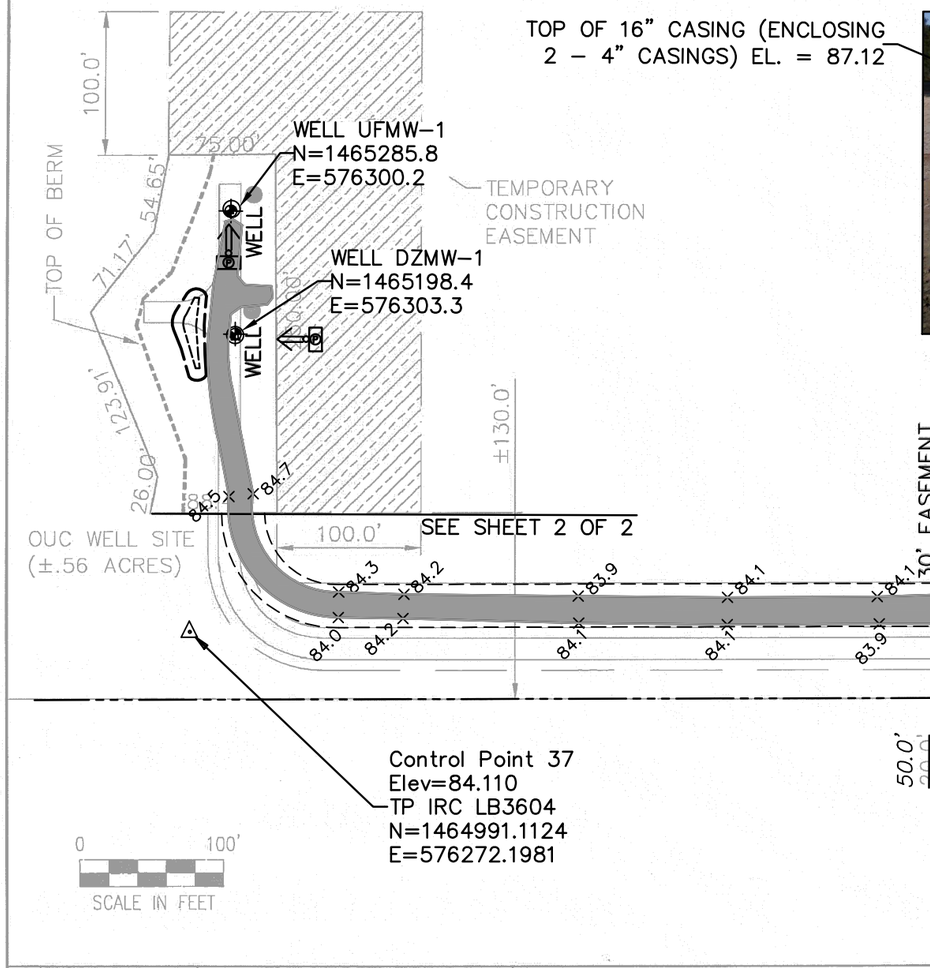
CM	CONCRETE MONUMENT LB68	TP	TRAVERSE POINT
CONC.	CONCRETE		APPROXIMATE CENTER OF WELL
ELEV	ELEVATION	+XXX.XX	ASBUILT ELEVATION
IRC	IRON ROD & CAP		DIRECTION PHOTOGRAPH WAS TAKEN
OUC	ORLANDO UTILITIES COMMISSION		
T.O.B.	TOP OF BANK		
T.O.S.	TOE OF SLOPE		

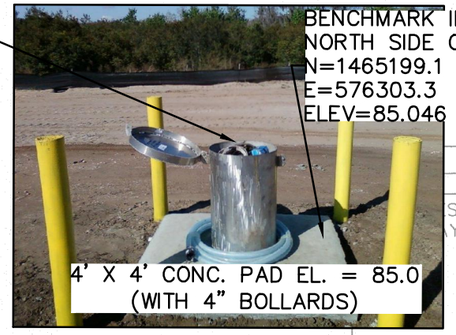
NOTES:

1. EXACT LOCATIONS OF EASEMENTS AND WELL SITE SHALL BE SURVEYED BY PROFESSIONAL SURVEYOR ACCORDING TO LEGAL DESCRIPTIONS PROVIDED IN APPENDIX.
2. BOTH WELL LOCATIONS TO BE PROPOSED BY CONTRACTOR AND APPROVED BY OWNER.

The BOLD AS-BUILT INFORMATION shown hereon is based on actual measurements taken at the site on October 6, 2010 thru March 31, 2011 by GAI Consultants, Inc. 301 E. Pine Street, Orlando, Florida 32801 Tel. 407-423-8398. This work was done under my direction and is believed to be accurate.

Linda J. Griffin PLS #4543 Florida Professional Land Surveyor Not valid without the Surveyors signature & original raised seal. GAI Consultants, Inc. LB #3604





WELL DZWM-1
NOT TO SCALE

WELL UFWM-1
NOT TO SCALE

30' PROPOSED ACCESS EASEMENT IN UNRECORDED OUC TEMPORARY CONSTRUCTION EASEMENT AGREEMENT, SHOWN PER SKETCH OF DESCRIPTION BY DONALD McINTOSH ASSOCIATES, INC., DATED 7/18/05

Control Point 38
Elev=83.900
TP IRC LB3604
N=1464981.5947
E=577420.2300

BENCHMARK IN CONC. AT SOUTH SIDE OF WELL UFWM-1
N=1465285.0
E=576300.0
ELEV=84.843

Surveyor's Notes

1) Vertically this project was controlled by Site Benchmark #2, elevation 82.11, as shown on LAKE NONA AREA MIDDLE SCHOOL BOUNDARY AND TOPOGRAPHIC SURVEY, prepared by Leading Edge Land Services, Incorporated, dated 06/08 and Nail and Disc LB 6846 elevation 83.033 which are based on the National Geodetic Vertical Datum of 1929. Elevations shown hereon were converted to North American Vertical Datum of 1988 using CORPSCON, version 6.0.1, having a vertical adjustment of (–)1.01 feet.

2) The coordinates and the North Arrow shown hereon are based on State Plane Coordinates NAD83 Florida East Zone, US-foot (FL83-EF), as derived from GPS Control Survey Measurements as performed on August 5, 2010. Coordinates are in State Plane Zone 901 Florida East and were derived by Fast-Static method. These points were post-processed thru the Online Positioning User Service (O.P.U.S.-http://www.ngs.noaa.gov/OPUS/) as provided by the National Geodetic Survey web-site.

3) The well locations shown hereon are to the approximate center of well.

4) Photographs were taken on February 28, 2011, are shown for graphic presentation and are not to scale.

Department Manager	T. JENSEN
Project Director	T.TESSIER
Task Manager	D. SMITH
Technical Review	T.TESSIER

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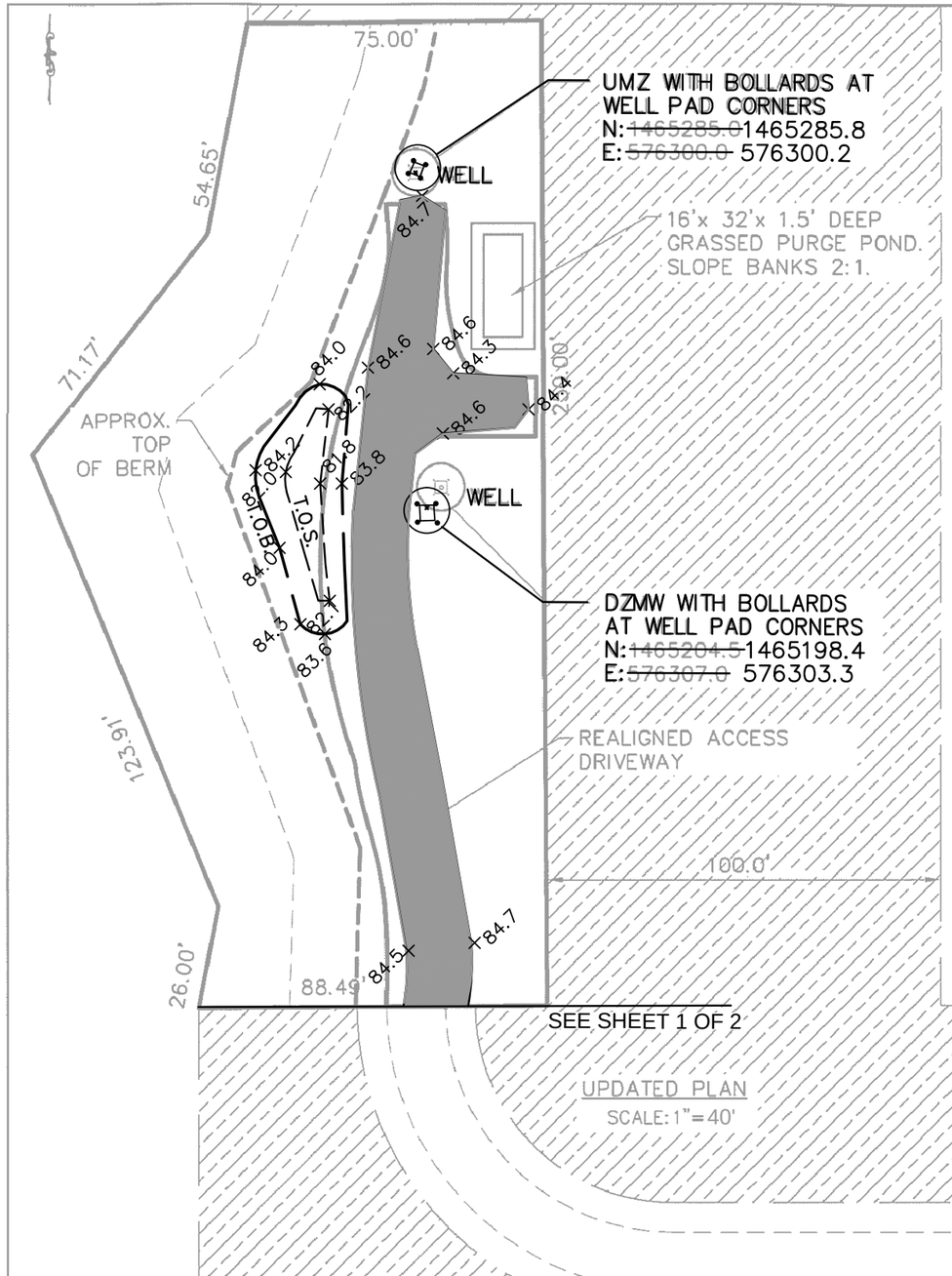
ORLANDO UTILITIES COMMISSION

SOUTHEAST MONITORING WELL SITE PLAN

ORANGE COUNTY, FLORIDA

Project Number	PF000705.0009
Drawing Date	13 MAY 10
Figure	2

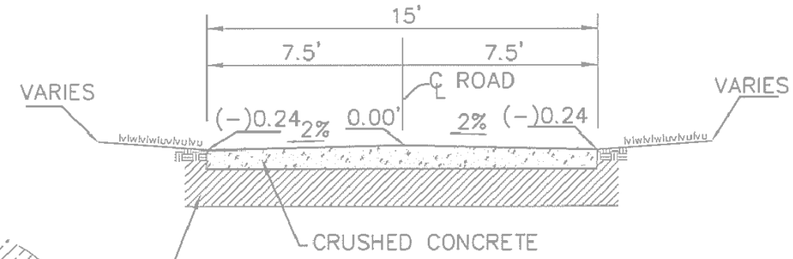
ASBUILT SHEET 1 OF 2



ASBUILTS BY:

gai consultants
301 East Pine Street
Suite 500
Orlando, Florida 32801
407-423-8398
LB 3604

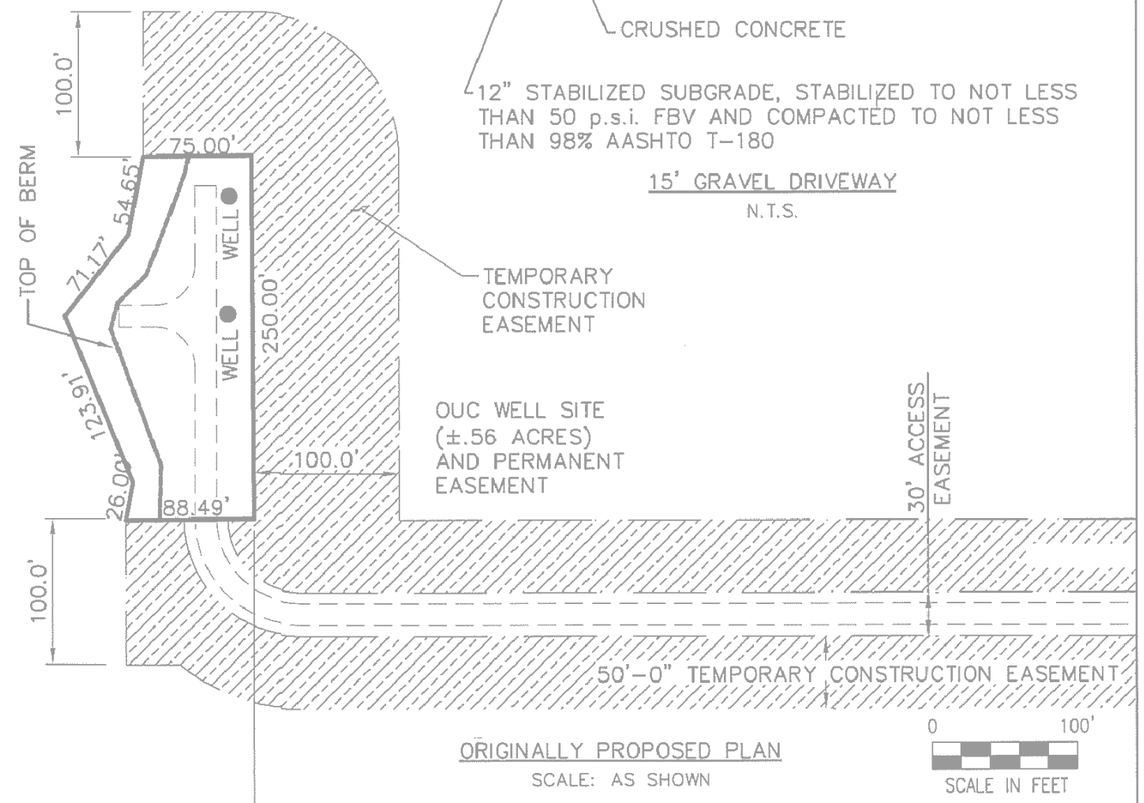
PAVING SPECIFICATIONS		
TYPE	BASE	SUB-GRADE
15' ACCESS DRIVEWAY	6" THICK, CRUSHED CONCRETE COMPACTED IN TWO LIFTS TO 98% MAXIMUM DRY DENSITY. A.A.S.H.T.O. T-180 CRUSHED CONCRETE GRADATION: MIN. 97% PASSING 3 1/2" SEIVE MAX. 50% PASSING No. 4 SEIVE MAX. 7.5% PASSING No. 200 SEIVE	12" THICK, COMPACTED TO 98% MAXIMUM DRY DENSITY A.A.S.H.T.O. T-180



12" STABILIZED SUBGRADE, STABILIZED TO NOT LESS THAN 50 p.s.i. FBV AND COMPACTED TO NOT LESS THAN 98% AASHTO T-180

15' GRAVEL DRIVEWAY

N.T.S.



ORIGINALLY PROPOSED PLAN

SCALE: AS SHOWN

SEE SHEET 1 OF 2 FOR NOTES, CONTROL, CERTIFICATION AND LEGEND.

ORLANDO UTILITIES COMMISSION

SOUTHEAST MONITORING WELL SITE PLAN

ORANGE COUNTY, FLORIDA

ASBUILT SHEET 2 OF 2

Department Manager	T. JENSEN
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Figure	2

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Appendix B

Geologic Logs and Core Log Summary

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GEOLOGIC LOG
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells
UFMW-1

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
SAND AND LITTLE ORGANIC MATTER: Sand, 90%, clear to pale yellowish brown (10YR 6/2), quartz, very fine- to fine-grained, sub-rounded to rounded, well sorted; Organic Matter, 10%, roots and decomposed, black (N1), dry and moist to 5 feet below land surface (bls), wet and saturated below.	N/A	0-10	10
SAND: Sand, 100%, clear to dark yellowish brown (10YR 4/2), quartz, silty, trace of organic matter, very fine- to fine-grained, sub-rounded to rounded, well sorted.	N/A	10-20	10
CLAY: Clay, 100%, light bluish gray (5B 7/1), silty with trace of quartz sand, very soft, cohesive, non-plastic.	N/A	20-50	30
SANDY CLAY: Clay, 70%, medium bluish gray (5B 5/1), silty, phosphatic, soft, cohesive, low plasticity; Sand, 30%, clear, quartz, very fine grained.	N/A	50-70	20
CLAY AND SHELL: Clay, 60%, medium bluish gray (5B 5/1), sandy, very soft, cohesive, non-plastic; Shell, 40%, bivalves, white to yellowish gray (5Y 8/1), mostly tests, few whole shells up to 4 mm.	N/A	70-80	10
CLAY AND SOME SHELL: Clay, 80%, medium bluish gray (5B 5/1), slightly sandy, soft, cohesive, low- to medium-plasticity; Shell, 20%, white (N9) to yellowish gray (5Y 7/2), mollusks, bivalves, tests to 12 mm, few whole shells.	N/A	80-90	10
SANDSTONE, SOME LIMESTONE, SHELL AND LITTLE CLAY: Sandstone, 50%, light olive gray, (5Y 6/1) quartz with calcareous matrix, fossiliferous with frequent shell intraclasts, poorly- to moderately well- cemented, soft to moderately hard; Limestone, 20%, yellowish gray (5 7/2), bioclastic (numerous tests poorly cemented by carbonate matrix), soft; Shell, 20%, white (N9) to very light gray (N8), mostly tests, few whole shells (mollusks, bivalves) to 12 mm; Clay, 10%, grayish olive (10Y 4/2), very soft, cohesive, non-plastic.	N/A	90-100	10
SANDSTONE, SOME CLAY, LITTLE SHELL AND LIMESTONE: Sandstone, 60%, pale olive (10Y 6/2) to medium gray (N5), quartz, fine grained, poorly- to moderately well- cemented, soft to moderately hard; Clay, 20%, light olive gray (5Y 5/2), sandy, very soft, non-plastic; Shell, 10%, very light gray (N8), tests to 3 mm; Limestone, 10%, very light gray (N8), bioclastic with numerous shell intraclasts, poorly cemented, soft.	N/A	100-110	10

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
SANDSTONE, SOME SHELL, LITTLE CLAY AND LIMESTONE: Sandstone, 50%, pale olive (10Y 6/2) to medium gray (N5), quartz, fine grained, poorly- to moderately well- cemented, soft to moderately hard; Shell, 30%, very light gray (N8), large tests, few whole up to 12 mm; Clay, 10%, light olive gray (5Y 5/2), sandy, very soft, non-plastic; Limestone, 10%, very light gray (N8), bioclastic with numerous shell intraclasts, poorly cemented, soft.	N/A	110-120	10
SANDY CLAY WITH SOME SHELL AND LITTLE SANDSTONE: Clay, 60%,dark greenish gray (5GY 4/1), very sandy, very soft, cohesive, non-plastic; Shell, 30%, very light gray (N8) to very pale orange ((10YR 8/2), large tests, few whole up to 12 mm; Sandstone, 10%, pale olive (10Y 6/2) to medium gray (N5), quartz, fossiliferous with few shell intraclasts, fine grained, poorly- to moderately well- cemented, soft to moderately hard	N/A	120-140	20
SANDSTONE, SOME SHELL AND LIMESTONE: Sandstone, 60%, light olive gray (5Y 6/1) to medium gray (N5), quartz, fossiliferous with few shell intraclasts, fine grained, poorly- to moderately well- cemented, soft to moderately hard; Shell, 20%, very light gray (N8) to medium light gray (N6), large tests, few whole up to 15 mm; Limestone, 20%, very light gray (N8), bioclastic with numerous shell intraclasts, poorly cemented, soft.	N/A	140-150	10
SHELL, SOME SAND AND LITTLE SANDSTONE: Shell, 70%, yellowish gray (5Y 7/2) to grayish orange (10YR 8/2), very large tests to 1,5-inch, few whole shells, mollusks; Sand, 20%, clear, quartz, phosphatic, fine- to medium- grained, sub-rounded; Sandstone, 10%, light olive gray (5Y 6/1) to medium gray (N5), quartz, fossiliferous with few shell intraclasts, fine grained, poorly- to moderately well- cemented, soft to moderately hard	N/A	150-170	20
SHELL, SOME LIMESTONE, LITTLE SAND AND SANDSTONE: Shell, 60%, yellowish gray (5Y 7/2) to white (N9), large tests, few whole to 1-inch, mollusks; Limestone, 20%, very light gray (N8), bioclastic with numerous shell intraclasts, little quartz, moderately well cemented, moderately hard, vuggy; Sand, 10%, clear, quartz, little carbonate, phosphatic, fine- to medium- grained, sub-rounded; Sandstone, 10%, light olive gray (5Y 6/1) to medium gray (N5), quartz, fine grained, poorly- to moderately well-cemented, soft to moderately hard	N/A	170-180	10

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GEOLOGIC LOG
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells
UFMW-1

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
SHELL AND SOME SAND: Shell, 70%, pale yellowish brown (10YR 6/2) to grayish orange (10YR 7/4), large tests to 1-inch; Sand, 30%, clear, quartz, little calcareous, fine- to medium- grained, sub-rounded; Limestone, trace, pale yellowish brown (10YR 6/2), very fossiliferous with abundant shell intraclasts.	N/A	180-190	10
SAND AND SOME SHELL: Sand, 70%, clear, quartz, fine- to medium- grained, sub-rounded, very phosphatic; Shell, 30%, pale yellowish brown (10YR 6/2) to grayish orange (10YR 7/4), large tests to 1-inch; Clay, trace, light olive gray (5Y 5/2), very soft, non-plastic.	N/A	190-200	10
PHOSPHATIC SAND AND LITTLE SHALE: Sand, 90%, quartz, fine- to medium- grained, sub-rounded; Shale, 10%, black (N1), grainy fragments to 2 mm; Clay, trace, dark greenish gray (5GY 4/1).	N/A	200-210	10
LIMESTONE AND VERY LITTLE CLAY: Limestone, 95%, light olive gray (5Y 6/1) to yellowish gray (5Y 7/2), fossiliferous mudstone, numerous shell intraclasts (mollusks), very fine grained, moderately well cemented, moderately hard, slightly vuggy; Clay,5%, light olive gray (5Y 6/1), very soft, non-plastic; Shell, trace, yellowish gray (5Y 7/2), small tests to 3 mm.	N/A	210-220	10
LIMESTONE: Limestone, 100%, white (N9) to yellowish gray (5Y 8/1), mudstone with few shell intraclasts (mollusks), very fine grained, moderately well cemented, moderately hard, vuggy; Clay, trace, white (N9), calcareous, very soft, chalky.	N/A	220-240	20
LIMESTONE AND LITTLE DOLOSTONE: Limestone, 90%, white (N9) to yellowish gray (5Y 8/1), mudstone with few shell intraclasts (mollusks), very fine grained, moderately well cemented, moderately hard, vuggy; Dolostone, 10%, pale yellowish brown (10YR 6/2), fine crystalline, well indurated, hard; Clay, trace, white (N9), calcareous, very soft, chalky.	N/A	240-250	10
LIMESTONE: Limestone, 100%, white (N9) to yellowish gray (5Y 8/1), mudstone with few shall intraclasts (mollusks), very fine grained, moderately well cemented, moderately hard, vuggy; Clay, trace, white (N9), calcareous, very soft, chalky.	N/A	250-260	10
LIMESTONE AND SOME MARL: Limestone, 70%, yellowish gray (5Y 7/2), grainstone, mostly oolitic, fine grained, poorly cemented, very soft, up to 90% in a form of calcareous, sand; Marl, 30%, moderate yellowish brown (10YR 5/4), very soft, non-plastic.	N/A	260-270	10

ARCADIS

GEOLOGIC LOG
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells
UFMW-1

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
LIMESTONE: Limestone, 100%, white (N9) to yellowish gray (5Y 8/1), mudstone, very fine grained, moderately well cemented, moderately hard; Clay, trace, white (N9), calcareous, very soft, chalky.	N/A	270-280	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), little white (N9), mudstone with very few shell intraclasts, slightly phosphatic, very fine grained, poorly- to moderately well-cemented, soft to moderately hard, vuggy; Clay, trace, white (N9), calcareous, very soft, chalky.	N/A	280-290	10

ARCADIS

GEOLOGIC LOG
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells
DZMW-1

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
SAND AND ORGANIC MATTER: Sand, 60%, clear to dark yellowish brown (10YR 4/2), quartz, very fine grained, sub-rounded to rounded, silty, well sorted; Organic Matter, 40%, dusky brown (5YR 2/2), decomposed, dry and moist to 6 feet below land surface (bls), wet and saturated below.		0-10	10
Sand, 100%, clear to moderate yellowish brown (10YR 5/2), quartz, silty, very fine- to fine- grained, sub-rounded to rounded, well sorted.		10-20	10
CLAYEY SAND: Sand, 70%, clear to light brown (5Y 5/6), slightly silty, quartz, fine grained, sub-rounded; Clay, 30%, grayish orange (10YR 7/4), very soft, cohesive, non-plastic.		20-30	10
SANDY CLAY: Clay, 60%, light olive gray (5Y 6/1) to olive gray (5Y 4/1), silty, slightly phosphatic, soft, cohesive, low plasticity; Sand, 40%, clear, quartz, very fine- to fine- grained.		30-40	10
LIMESTONE WITH LITTLE CLAY AND SAND: Limestone, 80%, yellowish gray (5Y 7/2) to light gray (N7), mudstone, very fine grained, moderately well cemented, moderately hard, slightly vuggy; Clay,10%, yellowish gray (5Y 7/2), soft, non-plastic; Sand, 10%, clear, quartz, fine grained, sub-rounded.		40-50	10
CLAYEY, SILTY SAND: Sand, 100%, light olive gray (5Y 5/2), quartz, clayey (up to 10% of clay) and silty, very fine- to fine-grained, sub-rounded.		50-60	10
CLAYEY SAND, SOME SANDSTONE, LITTLE SHELL AND LIMESTONE: Sand, 75%, clear to moderate yellowish brown (10YR 5/4), quartz, very fine- to coarse- grained, sub-rounded to sub- angular, with up to 10% of moderate yellowish gray (10YR 5/4) clay, silty; Sandstone, 15%, moderate yellowish gray (10YR 5/4), quartz, fine grained, poorly cemented, soft; Limestone, 5%, yellowish gray (5Y 7/2), mudstone, very fine grained, moderately well cemented, moderately hard; Shell, 5%, white (N9), small tests to 3 mm.		60-70	10
SHELL: Shell, 100% (“shell hash”), mollusks, bivalves, white (N9), little yellowish gray (5Y 8/1), mostly tests, few whole shells up to 12 mm. Clay, trace, light olive gray (5Y 6/1), very soft, non plastic.		70-80	10

ARCADIS

GEOLOGIC LOG
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells
DZMW-1

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
CLAYEY SHELL AND LITTLE LIMESTONE: Shell, 60%, white (N9) to yellowish gray (5Y 7/2), mollusks (bivalves), tests to 12 mm, few whole shells; Clay, 30%, brownish gray (5YR 4/1) to black (N1), sandy, soft, non-plastic; low to medium plasticity; Limestone, 10%, light gray (N7), mudstone with shell intraclasts, moderately well cemented, moderately hard.		80-90	10
SHELL, SOME LIMESTONE AND SANDSTONE: Shell, 50%, white (N9), yellowish gray (5Y 7/2) and very light gray (N9), mostly tests, few whole shells (bivalves) to 12 mm; Limestone, 30%, yellowish gray (5 7/2), bioclastic (numerous tests cemented by carbonate matrix), poorly- to moderately well- cemented, soft to moderately hard; Sandstone, 20%, light olive gray (5Y 6/1), quartz with calcareous matrix, poorly cemented, soft; Clay, trace, grayish olive (10Y 4/2), very soft, cohesive, non-plastic.		90-110	20
SHELL, LIMESTONE AND LITTLE SANDSTONE: Shell, 50%, yellowish gray (5Y 7/2, few white (N9) and very light gray (N9), mostly tests, few whole shells (bivalves) to 12 mm; Limestone, 40%, yellowish gray (5Y 7/2), fossiliferous mudstone with numerous shell intraclasts, moderately well cemented, moderately hard; Sandstone,10%, light olive gray (5Y 6/1), quartz with calcareous matrix, moderately well cemented, moderately hard.		110-140	30
SHELL, LITTLE LIMESTONE AND SANDSTONE: Shell, 80%, yellowish gray (5Y 7/2), few white (N9), mostly large tests (bivalves) to 20 mm; Limestone, 10%, medium light gray (N6), bioclastic (numerous tests cemented by carbonate matrix), poorly- to moderately well- cemented, soft to moderately hard; Sandstone, 10%, light olive gray (5Y 6/1), quartz with calcareous matrix, poorly cemented, soft.		140-150	10
SHELL AND SOME SAND: Shell, 70%, yellowish gray (5Y 7/2) to grayish orange (10YR 8/2), very large tests to 1,5-inch, few whole shells, bivalves; Sand, 30%, clear, quartz, phosphatic, fine- to coarse- grained, sub-rounded to sub-angular, poorly sorted; Sandstone, trace, light olive gray (5Y 6/1) to medium gray (N5), quartz, fine- to medium- grained, poorly cemented, soft.		150-170	20
SHELL: Shell, 100% (“shell hash”), yellowish gray (5Y 7/2) to grayish orange (10YR 7/4), bivalves, tests to 15 mm.		170-190	20

ARCADIS

GEOLOGIC LOG
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells
DZMW-1

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
CLAYEY SAND: Sand, 100%, clear to medium dark gray (N4), quartz, slightly phosphatic, clayey (up to 10% of very soft, dark greenish gray clay), fine- to coarse- grained, sub-rounded to sub-angular; Shale, trace, black (N1), grainy fragments to 2 mm.		190-200	10
LIMESTONE AND SOME SAND: Limestone, 80%, yellowish gray (5Y 7/2), little light gray (N7), fossiliferous mudstone, numerous shell intraclasts (mollusks), very fine grained, moderately well cemented, moderately hard, slightly vuggy; Sand, 20%, clear to very light gray (N8), quartz, medium- to coarse- grained, sub-rounded; Shell, trace, yellowish gray (5Y 8/1), fragments to 4 mm.		200-210	10
LIMESTONE, SOME SAND AND VERY LITTLE SHELL: Limestone, 80%, grayish orange (10YR 7/4), little medium light gray (N6), grainstone (some oolitic) and packstone (fossiliferous with shell intraclasts), locally phosphatic, very fine grained to microcrystalline, poorly cemented, soft, easily disintegrating into calcareous sand; Sand, 15%, clear, quartz and yellowish gray (5Y 7/2), calcareous, fine- to medium-grained, sub-rounded; Shell, 5%, yellowish gray (5Y 7/2), small tests to 2 mm		210-230	20
LIMESTONE AND LITTLE DOLOSTONE: Limestone, 90%, yellowish gray (5Y 7/2), little white (N9), packstone with few shell intraclasts (mollusks), locally with traces of phosphate, very fine grained, moderately well cemented, moderately hard; Dolostone, 10%, pale yellowish brown (10YR 6/2), little light gray (N7), fine crystalline, well indurated, hard.		230-250	20
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to grayish orange (10YR 7/4), mostly packstone, some mudstone, fossiliferous, locally bioclastic with numerous shell intraclasts (mollusks), very fine grained; little light gray (N7), microcrystalline, dolomitic, moderately well cemented, moderately hard.		250-280	30
LIMESTONE: Limestone, 100%, white (N9) to yellowish gray (5Y 8/1), packstone and mudstone, dolomitic, very fine grained, some very fine crystalline, moderately well- to well-cemented, moderately hard to hard, slightly vuggy; Dolostone, trace, yellowish gray (5Y 7/2), micritic, well indurated; Clay, trace, white (N9), calcareous, very soft, non-plastic, chalky.		280-302	22

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GEOLOGIC LOG
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells
DZMW-1

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
DOLOSTONE AND SOME LIMESTONE: Dolostone, 70%, moderate yellowish brown (10YR 5/4), little medium light gray (N6), with trace of fossils (few shell intraclasts), fine- to micro-crystalline, vuggy, well indurated, hard to very hard; Limestone, 30%, yellowish gray (5Y 7/2), micro-crystalline, dolomitic, well indurated, massive, hard; Shell, trace, very pale orange (10YR 8/2), rare larger tests to 4 mm.	Drilling data not available	302-320	18
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to grayish orange (10YR 7/4), grainstone, mostly oolitic, some bioclastic with fossils intraclasts, fine- to medium-grained, poorly cemented, very soft to soft, easily disintegrating into calcareous sand (up to 70%), vuggy.	WOB:28K RPM:26	320-340	20
LIMESTONE AND SOME DOLOSTONE: Limestone, 85%, yellowish gray (5Y 7/2) to grayish orange (10YR 7/4), oolitic grainstone, with rare fossils intraclasts, fine- to medium-grained, poorly cemented, very soft to soft, easily disintegrating into calcareous sand (up to 70%), vuggy; Dolostone, 15%, yellowish gray (5Y 8/1) to very light gray (N8), fine crystalline, with trace of fossils, well cemented, hard, vuggy.	WOB:28K RPM:26	340-360	20
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to grayish orange (10YR 7/4), mostly (up to 60%) oolitic grainstone, fine- to medium-grained, poorly cemented, very soft to soft, easily disintegrating into calcareous sand, some fine crystalline, dolomitic, with trace of fossils (intraclasts), moderately hard, vuggy.	WOB:22 RPM:35	360-390	30
LIMESTONE AND SOME DOLOSTONE: Limestone, 70%, yellowish gray (5Y 7/2) to grayish orange (10YR 7/4), oolitic grainstone, with rare fossils intraclasts, fine- to medium-grained, poorly cemented, very soft to soft, easily disintegrating into calcareous sand (up to 70%), vuggy; Dolostone, 30%, yellowish gray (5Y 8/1) to very light gray (N8), fine crystalline, with trace of fossils, well cemented, hard, vuggy.	WOB:28K RPM:26	390-400	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to grayish orange (10YR 7/4), oolitic grainstone, mostly oolitic, fine- to medium-grained, poorly cemented, very soft to soft, chalky, easily disintegrating into calcareous sand (up to 90%): Marl, trace, yellowish gray (5Y 7/2), calcareous, very soft, non-plastic.	WOB:28K RPM:26	400-410	10

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GEOLOGIC LOG
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells
DZMW-1

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to grayish orange (10YR 7/4), mostly (up to 90%) oolitic grainstone, little packstone, fine- to medium-grained, poorly cemented, very soft to soft, easily disintegrating into calcareous sand, trace bioclastic with abundant shell intraclasts and trace of light gray (N7) microcrystalline, dolomitic, hard; Marl, trace (at approx. 446 ft bls), yellowish gray (5Y 7/2), calcareous, very soft, non-plastic.	WOB:28K RPM:26	410-440	30
LIMESTONE AND DOLOSTONE: Limestone, 60%, yellowish gray (5Y 7/2) to very pale orange (10YR 8/2), packstone, slightly dolomitic, little grainstone, trace of fossils (small tests to 2mm), moderately well cemented, moderately hard; Dolostone, 40%, predominantly pale yellowish brown (10YR 6/2), some dark yellowish brown (10YR 4/2), fine- to micro-crystalline, very hard, slightly vuggy; Marl, trace, yellowish gray (5Y 7/2), calcareous, very soft, non-plastic.	WOB:12K RPM:26	440-449	9
DOLOSTONE AND SOME LIMESTONE: Dolostone, 80%, pale yellowish brown (10YR 6/2) to light olive gray (5Y 5/2), fine- to microcrystalline with white carbonate inclusions, very hard, partly vuggy; Limestone, 20%, very pale orange (10YR 8/2), packstone, fine crystalline, moderately hard.	WOB:12K RPM:24 Occasional bit chatter,	449-460	11
DOLOSTONE, 100%, pale yellowish brown (10YR 6/2), some dark yellowish brown (10YR 4/2), micro-crystalline, very hard, mostly massive with rare small vugs; Limestone, trace (at the top of layer), very pale orange (10YR 8/2), packstone, fine crystalline, moderately hard.	WOB:12K RPM:26 Loud bit chatter	460-500	40
DOLOSTONE: Dolostone, 100%, mostly variable shades of brown from pale yellowish brown (10YR 6/2) to brownish black (5YR 2/1), fine- to micro-crystalline, very hard, sharp angular fragments, little (up to 10%) moderate yellowish brown (10YR 5/4), saccharoidal, moderately well indurated, moderately hard, slightly vuggy; Limestone, trace , very pale orange (10YR 8/2), small (1-2 mm) nodules.	WOB:24K RPM:28	500-510	10
DOLOSTONE, 100%, moderate yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/2), fine- to micro-crystalline, very hard, small vugs, some saccharoidal, fine grained, moderately well cemented, moderately hard.	WOB:28K RPM:26	510-525	15

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
LIMESTONE AND SOME DOLOSTONE: Limestone, 80%, yellowish gray (5Y 7/2) to pale yellowish brown (10YR 6/2), bioclastic packstone with fossils (shells, trace forams), vuggy to porous, moderately well cemented, moderately hard, little grainstone, fine- to medium-grained, poorly cemented, soft; Dolostone, 20%, pale yellowish brown (10YR 6/2) to dark yellowish brown (10YR 4/2), fine- to micro-crystalline, very hard, small vugs, little saccharoidal, fine grained, moderately well cemented, moderately hard.	WOB:24K RPM:32	525-540	15
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to grayish orange (10YR 7/4), mostly (up to 80%) oolitic grainstone, little bioclastic packstone, with shell intraclasts and forams, fine- to medium-grained, poorly cemented, very soft to soft, easily disintegrating into calcareous sand; Dolostone, trace, moderate yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/2), fine- to micro-crystalline, very hard, small vugs, hard.	WOB:12K RPM:28	540-630	90
LIMESTONE: Limestone, 100%, pale yellowish brown (10YR 6/2), packstone, fine crystalline, dolomitic, locally fossiliferous with shell intraclasts, little grainstone, fine- to medium-grained, vuggy, moderately well- to poorly- cemented, moderately hard to soft.	WOB:24-28K RPM:28	630-640	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to pale yellowish brown (10YR 6/2), predominantly grainstone (trace oolitic), fine grained, some dolomitic packstone, fine crystalline, trace of fossils, moderately well- to poorly-cemented, moderately hard to soft, vuggy.	WOB:24-28K RPM:28	640-650	10
LIMESTONE AND SOME DOLOSTONE: Limestone, 70%, pale yellowish brown (10YR 6/2), predominantly packstone, fine crystalline, dolomitic, locally fossiliferous with shell intraclasts, little grainstone, fine- to medium-grained, vuggy, moderately well- to poorly- cemented, moderately hard to soft; Dolostone, 30%, moderate yellowish brown (10YR 5/4), little dark yellowish brown (10YR 4/2), fine- to micro-crystalline, locally saccharoidal, well indurated, moderately hard, small vugs.	WOB:24-28K RPM:	650-660	10
LIMESTONE: Limestone, 100%, pale yellowish brown (10YR 6/2), mostly packstone, fine crystalline, dolomitic, locally fossiliferous with shell intraclasts, some grainstone, fine- to medium-grained, vuggy, poorly- cemented, soft; Dolostone, trace, moderate yellowish brown (10YR 5/4), micro-crystalline, locally saccharoidal, well indurated, moderately hard, vuggy.	WOB: 8K RPM:26	660-670	10

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LIMESTONE AND SOME DOLOSTONE: Limestone, 80%, pale yellowish brown (10YR 6/2), packstone, fine crystalline, dolomitic, trace of fossils (rare intraclasts), little grainstone, fine- to medium-grained, vuggy, poorly- cemented, soft; Dolostone, 20%, moderate yellowish brown (10YR 5/4), micritic, partly saccharoidal, moderately hard, vuggy.	WOB: 8K RPM:26	670-690	20
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to moderate yellowish brown (10YR 5/4), mostly (up to 80%) oolitic grainstone, fine- to medium-grained, poorly cemented, very soft to soft, easily disintegrating into calcareous sand, little fine crystalline, dolomitic, hard, vuggy; Dolostone, trace, moderate yellowish brown (10YR 5/4), microcrystalline, locally saccharoidal, well indurated, moderately hard, small vugs.	WOB: 8K RPM:26	690-720	30
LIMESTONE AND SOME DOLOSTONE: Limestone, 80%, pale yellowish brown (10YR 6/2), packstone, fine crystalline, dolomitic, locally fossiliferous with shell intraclasts, little grainstone, fine- to medium-grained, vuggy, poorly cemented, soft; Dolostone, 20%, moderate yellowish brown (10YR 5/4), little dark yellowish brown (10YR 4/2), fine- to micro-crystalline, locally saccharoidal, well indurated, moderately hard, small vugs.	WOB: 8K RPM:26	720-730	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to moderate yellowish brown (10YR 5/4), mostly (up to 80%) oolitic grainstone, fine- to medium-grained, poorly cemented, very soft to soft, easily disintegrating into calcareous sand, little fine crystalline, dolomitic, hard, vuggy; Dolostone, trace, moderate yellowish brown (10YR 5/4), fine- to micro-crystalline, locally saccharoidal, well indurated, moderately hard, small vugs.	WOB: 8K RPM:26	730-760	30
LIMESTONE AND SOME DOLOSTONE: Limestone, 80%, pale yellowish brown (10YR 6/2), packstone, fine crystalline, dolomitic, locally fossiliferous with shell intraclasts, some, grainstone, fine- to medium-grained, poorly cemented, soft; Dolostone, 20%, moderate yellowish brown (10YR 5/4), fine- to micro-crystalline, locally saccharoidal, well indurated, moderately hard, small vugs.	WOB: 8K RPM:26	760-770	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to pale yellowish brown (10YR 6/2), mostly (up to 80%) oolitic grainstone, fine- to medium-grained, poorly cemented, very soft to soft, easily disintegrating into calcareous sand, little fine crystalline, dolomitic, hard, vuggy.	WOB: 8K RPM:26	770-785	15

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
LIMESTONE AND LITTLE DOLOSTONE: Limestone, 90%, yellowish gray (5Y 7/2) to pale yellowish brown (10YR 6/2), mostly (up to 80%) oolitic grainstone, fine- to medium-grained, poorly cemented, very soft to soft, easily disintegrating into calcareous sand, some packstone, locally bioclastic with shell intraclasts, better indurated, vuggy; Dolostone, 10%, pale yellowish brown (10YR 6/2) to moderate yellowish brown (10YR 5/4), with brighter calcareous inserts, micritic, locally saccharoidal, moderately hard, small vugs.	WOB: 8K RPM:26	785-810	25
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), 60% micritic, dolomitic, slightly fossiliferous (shell intraclasts), moderately well cemented, moderately hard, vuggy; 40% grainstone, poorly cemented, soft.	WOB: 8K RPM:26	810-820	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to moderate yellowish brown (10YR 5/4), mostly (up to 80%) oolitic grainstone, fine- to medium-grained, poorly cemented, very soft to soft, easily disintegrating into calcareous sand; little fine crystalline, dolomitic, moderately hard, vuggy.	WOB: 8K RPM:26	820-830	10
DOLOSTONE AND LITTLE LIMESTONE: Dolostone, 90%, pale yellowish brown (10YR 6/2), fine crystalline, massive, hard; Limestone, 10%, yellowish gray (5Y 7/2), grainstone, slightly dolomitic, fine- to medium-grained, poorly cemented, soft.	WOB: 30K RPM:24	830-835	5
LIMESTONE AND LITTLE DOLOSTONE: Limestone, 90%, yellowish gray (5Y 7/2) to pale yellowish brown (10YR 6/2), packstone, fine crystalline, dolomitic and grainstone, fine- to medium-grained, poorly cemented, soft, vuggy; Dolostone, 10%, pale yellowish brown (10YR 6/2), fine crystalline, massive, hard.	WOB: 8K RPM:26	835-860	25
LIMESTONE: Limestone, 100%, moderate yellowish brown (10YR 5/4), oolitic grainstone, poorly cemented, very soft, easily disintegrating into calcareous sand, some packstone, partly bioclastic with trace of fossils, little micritic, moderately well cemented, moderately soft, vuggy, rare thin darker smudges; Lignite, trace, brownish black (5YR 2/1), moderately hard to soft, small specks to 3mm.	WOB: 8K RPM:26	860-870	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), packstone, bioclastic with trace of fossils and micritic, dolomitic, moderately well indurated, moderately hard, vuggy; some grainstone, partly oolitic, poorly cemented, soft.	WOB: 8K RPM:26	870-900	30

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LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to pale yellowish brown (10YR 6/2), mostly (up to 60%) oolitic grainstone, fine- to medium-grained, poorly cemented, very soft to soft, easily disintegrating into calcareous sand; some fine crystalline, dolomitic, little packstone, moderately hard, vuggy.	WOB: 8K RPM:26	900-920	20
DOLOMITIC LIMESTONE:Limestone,100%, predominantly very pale orange (10YR 8/2), highly dolomitized, micro crystalline, moderately hard, sharp edged fragments, slightly vuggy; up to 40% pale yellowish brown (10YR 6/2), packstone and grainstone, poorly cemented, soft.	WOB: 8K RPM:26	920-930	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to pale yellowish brown (10YR 6/2), oolitic grainstone and bioclastic packstone, fine- to medium-grained, poorly cemented, very soft to soft, easily disintegrating into calcareous sand; some fine crystalline, dolomitic, moderately hard, vuggy.	WOB: 8K RPM:26	930-950	20
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), 50% packstone, micritic, dolomitic, moderately well indurated, moderately hard, vuggy; 50% grainstone, partly oolitic, poorly cemented, soft.	WOB: 8K RPM:26	950-960	10
LIMESTONE: Limestone, 100%, pale yellowish brown (10YR 6/2), oolitic grainstone, some packstone, fine- to medium-grained, poorly cemented, very soft, mostly in a form of calcareous sand, little micritic, dolomitic, moderately hard.	WOB: 8K RPM:26 Heavy dredging	960-994	34
LIMESTONE, LIGNITE AND LITTLE CLAY: Limestone, 50%, mostly yellowish gray (5Y 7/2), packstone, moderately well cemented, moderately hard, some very pale orange (10YR 8/2), micritic, hard; Lignite, 40%, black (N1), moderately hard, slightly clayey; Clay, 10%, grayish brown (5YR 3/2), organic, soft, low plasticity.	WOB: 8K RPM:26	994-997	3

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DOLOMITIC LIMESTONE:Limestone,100%; 40% very pale orange (10YR 8/2), highly dolomitized, micritic, frequent deep solution cavities, scattered light bluish gray (5B 7/1) elongated spots 2-5 mm, well indurated, moderately hard to hard; 30% pale yellowish brown (10YR 6/2), packstone, dolomitic, very fine crystalline, predominantly well indurated, moderately hard to hard; 30%, yellowish gray (5Y 7/2), grainstone, slightly dolomitic, fossiliferous with infrequent shell intraclasts, trace phosphatic, numerous solution cavities and vugs to porous, poorly cemented, soft, soft to very soft, easily disintegrating; Dolostone, trace, pale yellowish brown (10YR 6/2), microcrystalline, very hard, trace of vugs.	CORE 1: (1002-1012 feet.bls)	997-1030	33
LIMESTONE: Limestone, 100%, pale yellowish brown (10YR 6/2), oolitic grainstone, fine- to medium-grained, poorly cemented, very soft, mostly in a form of calcareous sand; some (up to 20%), very pale orange (10YR 8/2) packstone, micritic, dolomitic, moderately hard.	WOB: 8K RPM:24	1030-1040	10
DOLOMITIC LIMESTONE:Limestone,100%, predominantly very pale orange (10YR 8/2), highly dolomitized, micro crystalline, moderately hard, sharp edged fragments, slightly vuggy; up to 20% of yellowish gray (5Y 7/2), packstone, fine crystalline, trace of phosphate, slightly dolomitic, moderately well cemented, soft.	WOB: 24K RPM:28	1040-1070	30
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2) to moderate yellowish brown (10YR 6/2), packstone and grainstone, slightly dolomitic, trace of phosphate, micritic to fine grained, poorly cemented, very soft to soft, mostly in a form of calcareous sand; Dolostone, trace, pale brown (5YR 5/2), microcrystalline, moderately hard.	WOB: 10K RPM:28	1070-1110	40
LIMESTONE AND SOME DOLOSTONE: Limestone, pale yellowish brown (10YR 6/2), predominantly dolomitic packstone, micritic, little bioclastic, vuggy, some grainstone, fine grained, poorly cemented, soft; Dolostone, 30%, yellowish gray (5Y 8/2), micro-crystalline, well indurated, moderately hard, small vugs.	WOB: 24K RPM:26	1110-1120	10
DOLOSTONE, LIMESTONE AND LIGNITE: Dolostone, 40%, yellowish gray (5Y 8/2), microcrystalline, hard; Limestone, 30%, pale yellowish brown (10YR 6/2), packstone, dolomitic, hard, vuggy; Lignite, 30%, black (N1), thin layers within limestone, micritic, moderately hard, brittle.	WOB: 24K RPM:26	1120-1123	3

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DOLOSTONE AND SOME LIMESTONE: Dolostone, 80%, pale yellowish brown (10YR 6/2), microcrystalline, thin, sharp fragments, very hard; Limestone, 20%, yellowish gray (5Y 7/2), packstone and grainstone, dolomitic, very fine crystalline, well indurated, hard to moderately hard.	WOB: 40K RPM:26	1123-1128	5
DOLOMITIC LIMESTONE AND LITTLE DOLOSTONE: Limestone, 90%; 50% yellowish gray (5Y 7/2), highly dolomitized, micritic, frequent light bluish gray (5B 7/1) irregular spots 2-10 mm, well indurated, moderately hard to hard; 40% pale yellowish brown (10YR 6/2), packstone, dolomitic, micritic, predominantly well indurated, moderately hard to hard, some grainstone, slightly dolomitic, with thin laminas of dark brown to black lignite, numerous solution cavities and vugs to porous, poorly cemented, soft to very soft, easily disintegrating, some in a form of calcareous sand; Dolostone, 10%, on top of cored interval, pale olive (10Y 6/2), microcrystalline, massive, very hard.	Core #2 (1128-1133.5 feet bls)	1128-1133	5
LIMESTONE AND SOME DOLOSTONE: Limestone, 80%, yellowish gray (5Y 7/2), packstone and grainstone, slightly dolomitic, micritic to fine grained, poorly cemented, very soft to soft, mostly in a form of calcareous sand, vuggy to porous; Dolostone, 20%, pale yellowish brown (10YR 6/2), microcrystalline, moderately hard to very hard, slightly vuggy.	WOB: 10K RPM:26	1133-1145	12
DOLOSTONE AND VERY LITTLE LIMESTONE: Dolostone, 95%, multicolored; mostly pale yellowish brown, some yellowish gray (5Y 7/2), light olive gray (5Y 5/2), light gray (N7) to medium dark gray (N4), very fine- to micro- crystalline, hard to very hard; Limestone, 5%, yellowish gray (5Y 8/1), with thin darker smudges, packstone, dolomitic, fine crystalline, moderately hard, vuggy .	WOB: 30K RPM:26	1145-1154	9
DOLOSTONE: Dolostone, 100%, multicolored; pale yellowish brown(10YR 6/2), yellowish gray (5Y 7/2), light olive gray (5Y 5/2) and little light gray (N7) to medium light gray (N6), trace of black lignite (intraclasts), micro- crystalline, scattered brighter carbonate inclusions and thin black laminas, frequent solution cavities, occasional diagonal fractures, very hard.	WOB: 40K RPM:22 Core #3 (1154-1160.8 feet bls)	1154-1170	16
DOLOSTONE: Dolostone, 100%, predominantly pale yellowish brown, microcrystalline, hard, little moderate yellowish brown (10YR 5/4), saccharoidal, moderately hard, vuggy to porous; Limestone, trace, yellowish gray (5Y 8/1), with thin darker smudges, packstone, dolomitic, fine crystalline, moderately hard, vuggy .	WOB: 40K RPM:22	1170-1190	20

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DOLOSTONE: Dolostone, 100%, grayish black (N2), brownish black (5YR 2/1) and brownish gray (5YR 4/1), microcrystalline, little saccharoidal, pale yellowish brown (10YR 6/2), some in a form of dolomitic sand, moderately hard, vuggy to porous; Lignite, trace, black (N1) inclusions, soft to moderately hard.	WOB: 40K RPM:22	1190-1200	10
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR 6/2) micro-crystalline, well indurated, hard to very hard, sharp edged fragments, some moderate yellowish brown (10YR 5/4), saccharoidal, moderately hard, some disintegrating into dolomitic sand, vuggy; Limestone, trace, white (N9), small (1-2 mm), chalky, very soft.	WOB: 40K RPM:22 Loud bit chatter	1200-1245	45
DOLOSTONE: Dolostone, 100%, predominantly pale yellowish brown (10YR 6/2) to grayish orange (10YR 7/4), saccharoidal, mostly in a form of fine- to medium- grained dolomitic sand, partially vuggy, inter-bedded with well indurated, moderate yellowish brown (10YR 5/4), microcrystalline, hard to very hard, trace of vugs.	WOB: 10K RPM:26	1245-1305	60
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR 6/2) to dark yellowish brown (10YR 4/2), microcrystalline, very hard, trace of vugs, frequent fragments to 1-inch, little (up to 10%) saccharoidal, moderate brown (5YR 4/4), fine–to medium–grained, well cemented, hard, vuggy.	WOB: 40K RPM:22 Loud bit chatter	1305-1330	25
DOLOSTONE: Dolostone, 100%, (up to 60%) grayish orange (10YR 7/4), saccharoidal, some in a form of fine- to medium-grained dolomitic sand, partially vuggy, inter-bedded with well indurated, moderate yellowish brown (10YR 5/4), microcrystalline, hard to very hard, trace of vugs.	WOB: 40K RPM:22 Intermittent bit chatter	1330-1340	10
DOLOSTONE: Dolostone, 100%, dark yellowish brown (10YR 4/2), microcrystalline, very hard, trace of vugs, frequent sharp edged fragments to 1-inch, trace saccharoidal, moderate brown (5YR 4/4), fine–to medium–grained, well cemented, hard, vuggy.	WOB: 40K RPM:22 Loud bit chatter	1340-1365	25
LIMESTONE: Limestone, 100%, yellowish gray (5Y 8/1), slightly dolomitic, calcitic , fossiliferous (numerous shell intraclasts) packstone, little oolitic grainstone, fine- to medium- grained, poorly- to moderately well- cemented, soft to moderately hard, slightly chalky.	WOB: 5K RPM:26	1365-1370	5

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
DOLOSTONE AND LIMESTONE: Dolostone, 60%, pale yellowish brown (10YR 6/2) to pale brown (5YR 5/2), fine crystalline, little saccharoidal, moderately hard to hard, vuggy; Limestone, 100%, yellowish gray (5Y 8/1), slightly dolomitic, fossiliferous (numerous shell intraclasts) packstone, little oolitic grainstone, same as above.	WOB: 5K RPM:26	1370-1380	10
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR 6/2), saccharoidal, poorly integrated, very soft to soft, up to 90% in a form of dolomitic sand, little fine crystalline, moderately hard; Limestone, trace, yellowish brown (5Y 8/1), chalky, very soft.	WOB: 5K RPM:26	1380-1410	30
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR 6/2), little light olive gray (5Y 5/2), microcrystalline, well indurated, massive, thin sharp edged fragments, hard to very hard, slightly vuggy.	WOB: 40K RPM:22 Loud bit chatter	1410-1445	35
DOLOSTONE AND LITTLE CALCAREOUS SILT: Dolostone, 90%, pale yellowish brown (10YR 6/2), saccharoidal, very fine grained, poorly cemented, very soft, easily disintegrating into dolomitic sand, vuggy, little light olive gray (5Y 6/2), microcrystalline, moderately well indurated, hard; Calcareous silt, 10%, very pale orange (10YR 8/2).	WOB: 10K RPM:26	1445-1455	10
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR 6/2) to light olive gray (5Y 5/2), saccharoidal, better indurated than above, little (up to 10%) in a form of fine- to medium-grained dolomitic sand, soft to moderately hard, inter-bedded with well indurated, microcrystalline dolostone, hard.	WOB: 15K RPM:24	1455-1480	25
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR 6/2 to light olive gray (5Y 5/2), microcrystalline, well indurated, hard to very hard, locally vuggy.	WOB: 40K RPM:21 Loud bit chatter	1480-1490	10
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR 6/2), saccharoidal, very fine grained, poorly cemented, very soft, easily disintegrating into dolomitic sand (up to 60% in a form of dolomitic sand), vuggy; little microcrystalline, moderately well indurated, hard; Limestone, trace, yellowish gray (5Y 8/1) to white (N9), chalky, very soft.	WOB: 15K RPM:24	1490-1500	10

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
DOLOSTONE: Dolostone, 100%, grayish orange (10YR 7/4) to pale yellowish brown (10YR 6/2), saccharoidal, slightly better indurated than above (up to 40% in a form of fine- to medium- grained dolomitic sand), soft, inter-bedded with well indurated, pale brown (5YR 5/2), microcrystalline dolostone, hard; Limestone, trace, yellowish gray (5Y 8/1) to white (N9), chalky, very soft.	WOB: 15K RPM:24	1500-1510	10
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR 6/2 to light olive gray (5Y 5/2), microcrystalline, well indurated, hard to very hard, locally vuggy, some grayish orange (10YR 7/4), saccharoidal, poorly indurated, easily disintegrating (up to 60% in a form of fine- to medium- grained dolomitic sand), soft to moderately hard.	WOB: 30K RPM:22 Occasional loud bit chatter	1510-1530	20
DOLOSTONE AND LIMESTONE: Dolostone, 50%, pale yellowish brown (10YR 6/2) to light olive gray (5Y 5/2), microcrystalline, well indurated, hard to very hard, little saccharoidal, soft, locally vuggy; Limestone, 50%, yellowish gray (5Y 8/1), micritic, dolomitic, slightly phosphatic, moderately hard, little bioclastic packstone with shell intraclasts, poorly cemented, soft, vuggy.	WOB: 30K RPM:22 Occasional loud bit chatter	1530-1540	10
LIMESTONE, SOME DOLOSTONE AND CHERT: Limestone, 50%, very pale orange (10YR 8/2), little white (N9) and chalky, packstone, dolomitic, moderately hard; Dolostone, 30%, moderate yellowish brown (10YR 5/4), microcrystalline, well indurated, hard; Chert, 20%, dusky yellowish brown, waxy lustered, conchoidal fractures, very hard.	WOB: 30K RPM:22 Occasional loud bit chatter	1540-1550	10
DOLOSTONE AND LIMESTONE: Dolostone, 60%, moderate yellowish brown (10YR 5/4), microcrystalline, sharp edged fragments, hard to very hard; Limestone, 40%, yellowish gray (5Y 8/1), micritic, dolomitic, moderately well cemented, moderately hard.	WOB: 30K RPM:22	1550-1560	10
DOLOSTONE, SOME MARL AND LIMESTONE: Dolostone, 50%, pale yellowish brown (10YR 6/2), microcrystalline, well indurated, hard; Marl (calcareous clay), 30%, white (N9), chalky, slightly phosphatic, very soft, non- plastic; Limestone, 20%, yellowish gray (5Y 8/1), micritic, slightly dolomitic, moderately well cemented, soft to moderately hard.	WOB: 30K RPM:26	1560-1570	10

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DOLOSTONE, SOME LIMESTONE AND LITTLE MARL: Dolostone, 70%, pale yellowish brown (10YR 6/2), predominantly saccharoidal, poorly indurated, soft, easily disintegrating, some microcrystalline, well indurated, hard; Limestone, 20%, yellowish gray (5Y 8/1), micritic, slightly dolomitic, moderately well- to poorly- cemented, soft; Marl (calcareous clay), 10%, white (N9), chalky, slightly phosphatic, very soft, non- plastic	WOB: 30K RPM:26	1570-1580	10
DOLOSTONE AND LITTLE LIMESTONE: Dolostone, 90%, pale yellowish brown (10YR 6/2), predominantly saccharoidal, poorly indurated, soft, easily disintegrating, some microcrystalline, well indurated, hard; Limestone, 10%, yellowish gray (5Y 8/1), micritic, slightly dolomitic, moderately well- to poorly- cemented, soft; Marl (calcareous clay), trace, white (N9), chalky, slightly phosphatic, very soft, non- plastic	WOB: 30K RPM:26 Occasional loud bit chatter	1580-1590	10
LIMESTONE, SOME DOLOSTONE AND MARL: Limestone, 60%, yellowish gray (5Y 8/1) to white (N9), micritic, dolomitic, slightly phosphatic, moderately well- to poorly- cemented, soft; Dolostone, 20%, pale yellowish brown (10YR 6/2), fine- to micro-crystalline, trace of phosphate, some round shaped nodules, well indurated, moderately hard to very hard; Marl (calcareous clay), 20%, white (N9), chalky, slightly phosphatic, very soft, non- plastic.	WOB: 30K RPM:26 Occasional loud bit chatter	1590-1602	12
DOLOSTONE AND SOME LIMESTONE: Dolostone, 70%, yellowish gray (5Y 7/2) to pale yellowish brown (10YR 6/2), trace light gray (N7), micro- to fine- crystalline, well indurated, hard; Limestone, 30%, yellowish gray (5Y 8/1), dolomitic, trace of phosphate and trace of fossils (rare shell intraclasts), moderately well cemented, moderately hard.	WOB: 15-20K RPM:26 Occasional loud bit chatter	1602-1610	8
DOLOSTONE AND LIMESTONE: Dolostone, 60%, multicolored: yellowish gray (5Y 7/2), moderate yellowish brown (10YR 4/2), medium light gray (N5) and dusky yellowish brown (10YR 2/2), micro- to fine- crystalline, trace saccharoidal, well indurated, hard; Limestone, 40%, yellowish gray (5Y 8/1-7/2), dolomitic, trace of phosphate and trace of bioclastic with fossil intraclasts, moderately well cemented, moderately hard.	WOB: 15-20K RPM:26 Occasional loud bit chatter	1610-1620	10
DOLOSTONE: Dolostone, 100%, medium dark gray (N4), little yellowish gray (5Y 7/2), microcrystalline, well indurated, hard; Limestone, trace, yellowish gray (5Y 8/1), dolomitic, fine crystalline, moderately hard.	WOB: 15-20K RPM:26 Occasional loud bit chatter	1620-1625	5

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), little white (N9), packstone, some grainstone, slightly dolomitic, trace of glauconite (few green <1mm specks), partly oolitic, poorly- to moderately well- cemented, soft.	WOB: 10K RPM:26	1625-1640	15
LIMESTONE AND SOME DOLOSTONE: Limestone, 80%, yellowish gray (5Y 7/2), little white (N9), packstone, some grainstone, slightly dolomitic, trace of glauconite (few green <1mm specks), partly oolitic, poorly- to moderately well-cemented, soft to very soft, up to 20% in a form of calcareous sand; Dolostone, 20%, medium gray (N5), little yellowish gray (5Y 7/2), microcrystalline, well indurated, hard.	WOB: 10-15K RPM:24	1640-1650	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), little white (N9), predominantly grainstone, little packstone, very fine grained to micritic, trace of phosphate, locally slightly dolomitic, partly oolitic, mostly poorly cemented and very soft, up to 60% in a form of calcareous sand; Dolostone, trace, medium gray (N5) to light gray (N7), microcrystalline, well indurated, hard.	WOB: 10K RPM:26	1650-1700	50
DOLOSTONE AND LIMESTONE: Dolostone, 60%, multicolored: yellowish gray (5Y 7/2), moderate yellowish brown (10YR 4/2), medium light gray (N5) and dusky yellowish brown (10YR 2/2), micro- to fine- crystalline, trace saccharoidal, well indurated, hard; Limestone, 40%, yellowish gray (5Y 8/1-7/2), mudstone, dolomitic, trace of phosphate, very fine grained, moderately well cemented, moderately hard.	WOB: 15-20K RPM:26 Occasional loud bit chatter	1700-1720	20
LIMESTONE AND SOME DOLOSTONE: Limestone, 80%, yellowish gray (5Y 7/2), grainstone (some oolitic and easily disintegrating into calcareous sand) and packstone, very fine grained, slightly dolomitic, mostly poorly cemented and very soft, up to 40% in a form of calcareous sand; Dolostone, 20%, medium gray (N5) to light gray (N7), microcrystalline, well indurated, hard.	WOB: 10K RPM:26	1720-1740	20
DOLOSTONE AND VERY LITTLE LIMESTONE: Dolostone, 95%, dark yellowish brown (10YR 4/2) to moderate yellowish brown (10YR 5/4), microcrystalline, well indurated, hard; Limestone, 5%, yellowish gray (5Y 8/1), mudstone, dolomitic, very fine grained, moderately well cemented, moderately hard.	WOB: 15-20K RPM:26 Occasional loud bit chatter	1740-1760	20

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
DOLOSTONE AND SOME LIMESTONE: Dolostone, 80%, pale yellowish brown (10YR 6/2) to moderate yellowish brown (10YR 5/4), microcrystalline, massive, trace saccharoidal and vuggy, well indurated, hard; Limestone, 20%, yellowish gray (5Y 8/1), mudstone, dolomitic, very fine grained, moderately well cemented, moderately hard.	WOB: 15-20K RPM:26 Occasional loud bit chatter	1760-1790	30
DOLOSTONE AND LITTLE LIMESTONE: Dolostone, 90%, dark yellowish brown (10YR 4/2), moderate yellowish brown (10YR 5/4) and little dark gray (N3), microcrystalline, little saccharoidal, well indurated, hard, trace of vugs; Limestone, 10%, yellowish gray (5Y 8/1), packstone and grainstone, slightly dolomitic, very fine grained, poorly- to moderately well -cemented, moderately hard to soft, mostly in a form of calcareous sand.	WOB: 15-20K RPM:26 Occasional loud bit chatter	1790-1810	20
DOLOSTONE AND VERY LITTLE LIMESTONE: Dolostone, 95%, dark yellowish brown (10YR 4/2 to moderate yellowish brown (10YR 5/4), microcrystalline, partly saccharoidal, well indurated, hard; Limestone, 5%, yellowish gray (5Y 8/1), mudstone, dolomitic, very fine grained, moderately well cemented, moderately hard.	WOB: 15-20K RPM:26 Occasional loud bit chatter	1810-1820	10
LIMESTONE AND SOME DOLOSTONE: Limestone, 80%, yellowish gray (5Y 7/2), grainstone (some oolitic and easily disintegrating into calcareous sand) and packstone, very fine grained, slightly dolomitic, mostly poorly cemented and very soft, up to 60% in a form of calcareous sand; Dolostone, 20%, medium gray (N5) to light gray (N7), microcrystalline, little saccharoidal, well indurated, hard, trace of vugs.	WOB: 10K RPM:26	1820-1840	20
DOLOSTONE AND LITTLE LIMESTONE: Dolostone, 90%, dark yellowish brown (10YR 4/2), moderate yellowish brown (10YR 5/4) and little dark gray (N3), microcrystalline, little saccharoidal, well indurated, hard, trace of vugs; Limestone, 10%, yellowish gray (5Y 8/1), packstone and grainstone, slightly dolomitic, very fine grained, poorly- to moderately well -cemented, moderately hard to soft, mostly in a form of calcareous sand.	WOB: 15-20K RPM:26 Occasional loud bit chatter	1840-1850	10
LIMESTONE AND LITTLE DOLOSTONE: Limestone, 90%, yellowish gray (5Y 7/2), grainstone (some oolitic and easily disintegrating into calcareous sand) and packstone, very fine grained, slightly dolomitic, poorly cemented and very soft; Dolostone, 10%, moderate yellowish brown (10YR 5/4), medium gray (N5) to light gray (N7), microcrystalline, well indurated, hard.	WOB: 10K RPM:26	1850-1870	20

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
DOLOSTONE AND VERY LITTLE LIMESTONE: Dolostone, 95%, dark yellowish brown (10YR 4/2) to moderate yellowish brown (10YR 5/4), microcrystalline, partly saccharoidal, well indurated, hard; Limestone, 5%, yellowish gray (5Y 8/1), mudstone, dolomitic, very fine grained, moderately well cemented, moderately hard.	WOB: 15-20K RPM:26 Occasional loud bit chatter	1870-1880	10
LIMESTONE: Limestone, 100%, yellowish gray (5Y 8/1), very pale orange (10YR 8/2) and very light gray (N8), packstone, some grainstone (partly oolitic), trace of phosphate, locally slightly dolomitic, poorly- to moderately well- cemented, soft to very soft, up to 40% in a form of calcareous sand, commonly vuggy.	WOB: 10K RPM:26	1880-1910	30
LIMESTONE AND LITTLE DOLOSTONE: Limestone, 90%, yellowish gray (5Y 7/2), grainstone (some oolitic and easily disintegrating into calcareous sand) and packstone, very fine grained, slightly dolomitic, mostly poorly cemented and very soft; Dolostone, 10%, moderate yellowish brown (10YR 5/4), medium gray (N5) to light gray (N7), microcrystalline, well indurated, hard.	WOB: 10K RPM:26	1910-1920	10
DOLOSTONE: Dolostone, 100%, moderate yellowish brown (10YR 5/4), dark yellowish brown (10YR 4/2) and medium dark gray (N4), microcrystalline, massive, hard to very hard.	WOB: 15-20K RPM:26 Occasional loud bit chatter	1920-1930	10
DOLOMITIC SAND: Sand, 100%, grayish orange (10YR 7/4), very fine- to medium- grained, product of disintegrated saccharoidal dolostone; Limestone, trace, yellowish gray (5Y 8/1), mudstone, slightly dolomitic, very fine grained, moderately well cemented, moderately hard.	WOB: 5K RPM:26 Heavy dredging.	1930-1935	5
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR 6/2) to moderate yellowish brown (10YR 5/4) and medium gray (N5), microcrystalline, massive, hard to very hard, sharp edged fragments; trace of yellowish gray (5Y 8/1) calcareous sand.	WOB: 15-20K RPM:26 Occasional loud bit chatter	1935-1950	15
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR 6/2) to moderate yellowish brown (10YR 5/4), microcrystalline, well indurated, hard to very hard, little saccharoidal (some disintegrating into dolomitic sand), trace of yellowish gray (5Y 8/1) calcareous sand.	WOB: 15-20K RPM:26 Occasional loud bit chatter	1950-1990	40

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GEOLOGIC LOG
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells
DZMW-1

LITHOLOGICAL DESCRIPTION	DRILLING COMMENTS	DEPTH INTERVAL	THICKNESS
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR 6/2) to light brownish gray (5YR 6/1), microcrystalline, well indurated, hard, trace saccharoidal (mostly in a form of dolomitic sand).	WOB: 15-20K RPM:26 Occasional loud bit chatter	1990-2015	25
DOLOSTONE: Dolostone, 100%, pale yellowish brown (10YR 6/2) to light olive gray (5Y 6/1), microcrystalline, sharp edged fragments, trace of vugs, well indurated, hard to very hard, trace saccharoidal (mostly in a form of dolomitic sand).	WOB: 15-20K RPM:26 Occasional loud bit chatter	2015-2030	15
DOLOSTONE: Dolostone, 100%, multicolored: pale yellowish brown (10YR 6/2) to dark yellowish brown (10YR 4/2) and olive gray (5Y 4/1) to light gray (N7), predominantly micro- to fine- crystalline, trace saccharoidal, well indurated, hard to very hard, mostly sharp edged fragments.	WOB: 15-20K RPM:32 Occasional loud bit chatter	2030-2050	20
DOLOSTONE: Dolostone, 100%, medium gray (N5) to medium dark gray (N4), microcrystalline, sharp edged fragments, massive, hard to very hard, trace saccharoidal, trace of vugs.	WOB: 15-20K RPM:32 Occasional loud bit chatter	2050-2070	20
DOLOSTONE: Dolostone, 100%, predominantly light olive gray (5Y 6/1), some medium gray (N5) to medium dark gray (N4), microcrystalline, trace vuggy to porous, mostly well-indurated, with some softer spots, hard to moderately hard.	WOB: 15-20K RPM:32 Occasional loud bit chatter	2070-2075	5

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CORE LOG SUMMARY

Orlando Utilities Commission (OUC)

Southeast Monitoring Wells

DZMW-1

Core Sample No. 1

Total Depth Drilled (feet):	**10**	**Date:**	**10/19/2010**
Core Barrel Length (feet):	**20 feet**	**Sampling Interval (feet bls):**	**1002-1012**
Core Barrel ID (inches):	**4**	**Hole Diameter (inches):**	**6**
Drilling Fluid Used:	**water**	**Recovery (%):**	**60**

Depth (feet bls) From	Depth (feet bls) To	Interval Length (feet)	WOB x 1000 lbs	RPM	Pressure (PSI)	ROP (min/ft)	Core Description
1,002.0	1,003.0	1	1	20	0	11	1002-1003.1: LIMESTONE: Limestone, very pale orange (10YR 8/2), micritic, highly dolomitic, with deep solution cavities, vertically fractured, with light bluish gray (5B 7/1) elongated scattered spots 2-5 mm, well indurated, hard, with 3x4-inch dolostone sharp-edged fragment on top (pale yellowish brown (10YR 6/2), microcrystalline, very hard, trace of vugs.
1,003.0	1,004.0	1	5	20	0	7	
1,004.0	1,005.0	1	5	20	24	13	
1,005.0	1,006.0	1	3	20	18	5	1003.1-1006.8: LIMESTONE: Limestone, 100%, pale yellowish brown (10YR 6/2), packstone, dolomitic, very fine crystalline, predominantly well indurated, moderately hard to hard, frequent fractures (vertical and diagonal), locally (1005.0-1005.3 ft bls) poorly cemented grainstone, easily disintegrating, soft, gradually becoming better indurated, very pale orange (10YR 8/2), micritic, highly dolomitic with solution cavities.
1,006.0	1,007.0	1	3	20	16	9	
1,007.0	1,008.0	1	3	20	7	14	
1,008.0	1,009.0	1	3	20	2	24	
1,009.0	1,010.0	1	3	20	3	10	1006.8-1008.0: LIMESTONE: Limestone, 100%, yellowish gray (5Y 7/2), packstone and grainstone, slightly dolomitic, fossiliferous with infrequent shell intraclasts, trace phosphatic, numerous solution cavities and vugs to porous, poorly cemented, soft, easily disintegrating, mostly 1-3-inch size fragments, soft.
1,010.0	1,011.0	1	3	20	3	10	
1,011.0	1,012.0	1	3	20	3	13	
Total Cored (feet):		**10.0**					

"bls" denotes below land surface

"RPM" denotes rate per minute of coring barrel

"WOB" denotes weight on coring barrel

"lbs" denotes pounds

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CORE LOG SUMMARY

Orlando Utilities Commission (OUC)

Southeast Monitoring Wells

DZMW-1

Core Sample No. 2

Total Depth Drilled (feet):	**5.5**
Core Barrel Length (feet):	**20 feet**
Core Barrel ID (inches):	**4**
Drilling Fluid Used:	**water**

Date:	**10/25/2010**
Sampling Interval (feet bls):	**1128-1133.5**
Hole Diameter (inches):	**6**
Recovery (%):	**87 (50% usable)**

Depth (feet bls) From	Depth (feet bls) To	Interval Length (feet)	WOB x 1000 lbs	RPM	Pressure (PSI)	ROP (min/ft)	Core Description
1,128.0	1,128.5	0.5	4	20	3	40	1128-1128.3: DOLOSTONE: Dolostone, 100%, light olive gray (5Y 5/2), microcrystalline, massive, very hard.
1,128.5	1,129.0	0.5	5	20	3	50	1128.3-1130.7: LIMESTONE: Limestone, 100%, yellowish gray (5Y/7/2), highly dolomitic, micritic, with solution cavities, vugs, even porous, with dark brown or black inserts and laminas of lignite and light bluish gray (5B 7/1) elongated scattered spots up to 3-inches, mostly massive, hard, with few diagonal fractures, broken into 1-4-inch sections.
1,129.0	1,130.0	1	5	20	3	32	
1,130.0	1,131.0	1	5	20	3	43	
1,131.0	1,132.0	1	5	20	3	23	130.7-1132.8: LIMESTONE: Limestone, 100%, pale yellowish brown (10YR 6/2) to yellowish gray (5Y 7/2), mostly grainstone, little micritic, locally with medium gray (N5) intraclasts, slightly dolomitic, with dark brown or black inserts and laminas of lignite, few solution cavities and vugs, poorly cemented, soft to very soft, easily disintegrating, crumbling, mostly 0.2-1-inch size fragments, 3 larger fragments up to 4 inches.
1,132.0	1,133.0	1	5	20	3	24	
1,133.0	1,133.5	0.5	5.5	20	3	43	
Total Cored (feet):		**5.5**					

"bls" denotes below land surface
"RPM" denotes rate per minute of coring barrel
"WOB" denotes weight on coring barrel
"lbs" denotes pounds

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CORE INVENTORY

Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

DZMW-1
Core Sample No. 3

Total Depth Drilled (feet):	**6.8**
Core Barrel Length (feet):	**20 feet**
Core Barrel ID (inches):	**4**
Drilling Fluid Used:	**water**

Date:	**10/28/2010**
Sampling Interval (feet bls):	**1154-1160.8**
Hole Diameter (inches):	**6**
Recovery (%):	**43**

Depth (feet bls) From	Depth (feet bls) To	Interval Length feet	Core Description
1,154.0	1,154.2	0.20	Dolostone, fragments 1-2-inch
1,154.2	1,154.5	0.30	Dolostone, very hard, with vugs and solution cavities
1,154.5	1,154.9	0.40	Dolostone, very hard, with vugs and deep solution cavities
1,154.9	1,155.1	0.20	Dolostone, vertically cut in half
1,155.1	1,156.1	1.00	Dolostone, irregular shape fragments 2-4-inch
1,156.1	1,156.4	0.30	Dolostone, very hard, very vuggy with solution cavities, lignite inclusions
1,156.4	1,156.6	0.20	Dolostone, irregular shape fragments 2-3-inch
1,156.6	1,156.9	0.30	Dolostone, massive, very hard, diagonal fracture
Total Core Length (feet):		**2.90**	

"bls" denotes below land surface

"RPM" denotes rate per minute of coring barrel

"WOB" denotes weight on coring barrel

"lbs" denotes pounds

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Appendix C

Geophysical Logs

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Appendix D

Video Surveys

OUC Southeast Monitoring Wells
Summary of TV Survey of DZMW-1 (from land surface to 1,602 feet below land surface)

Performed: November 16, 2010

Depth (feet below land surface)		Description of Features
From	To	
	+1	Top of 20-inch casing
	39	Water level, poor to zero visibility.
	62	Pump intake
	95.5	Casing connection, improving visiblity
	137.5	Casing connection
	179.5	Casing connection
	221.5	Casing connection
	263.5	Casing connection
	305.5	Casing seat, topof an open hole. Side view of a casing seat.
305.5	370	Massive formation with protruding rock at 322 and 350 feet bls and slightly vuggy at 355 feet bls
370	404	Massive but with trace of vugs. Stop at 404 feet bls due to rapidly deteriorating visibility. End of first video section. Pump-on.
404	429	Massive with trace of vugs.
429	445	Vugs, mostly shallow becoming more common.
445	480	Numerous vugs and washouts, frequent shallow solution cavities, locally vertically fractured, diagonally to a lesser degree. From 472 feet bls becoming more fractured horizontally.
480	518	Increasing number of larger cavities, irregular, poorly defined borehole, from 501 to 503.5 feet bls large cavity.
518	611	Numerous shallow vugs, but well gauged, locally massive with only few vuggs
611	630	Frequent fractures and solution cavities.
630	652	Frequent larger, deeper vugs.
652	655	Cavity.
655	681	Vuggy and fractured with locally poorly defined borehole walls (668 feet bls)
681	697	Massive but with vugs and few solution cavities.
697	750	Fractured with frequent cavitis seperated by few massive section.
750	780	Mostly massive with few vuggy sections
780	809	Darker walls, frequent fractures and cavities (large cavity 786-788 feet bls)
809	820	Mostly massive but vuggy
820	836	Numerous solution cavities and vugs.
836	875	Mostly massive but vuggy
875	930	Massive with fewer vugs and small cavities
930	966	Frequent vugs and shallow solution cavities (larger 954-955 feet bls)

Summary of TV Survey of DZMW-1 (from land surface to 1,602 feet below land surface)

Performed: November 16, 2010

Depth (feet below land surface)		Description of Features
From	To	
966	1040	Borehole widening, becoming cavernous, multiple vugs and cavities filled with some loose material
1040	1060	Vertical fractures common, some vugs
1060	1090	Mostly massive with occasional vugs and shallow cavities
1090	1115	Intermittent massive and vuggy sections within darker material
1115	1158	Massive formation with trace of vugs (with exception for cavity from 1140 to 1142 feet bls)
1158	1175	Intermittent massive and vuggy sections within darker material
1175	1190	Common vugs and solution cavities
1190	1370	Predominantly vuggy with multiple solution cavities, some fractures, locally poorly gauged with sharp-edged walls, separated by short sections of massive rock
1370	1418	Brighter, massive formation with only some shallow vugs
1418	1433	Increasingly vuggy with some solution cavities (cavity from 1425 to 1427 feet bls)
1433	1445	Massive, slightly vuggy
1445	1449	Frequent solution cavities
1449	1470	Massive, slightly vuggy
1470	1498	Generally vuggy with solution cavities, separated by more massive, short intervals
1498	1518	Massive formation, slightly vuggy
1518	1540	Vuggy with some solution cavities
1540	1602	Predominantly massive, slightly vuggy; picture quality deteriorating from 1550 feet bls, becoming poor quality from 1570 feet bls with no upward flow visible. Continue video with intermittent front and side view.
	1602	Unable to detect borehole bottom due to zero visibility.
1581	1100	**SIDE VIEW FOR REMAINDER OF SURVEY**

OUC Southeast Monitoring Wells
Summary of TV Survey of DZMW-1 (from 1,492 to 2,075 feet below land surface).

Performed December 20, 2010

Depth (feet below land surface)		Description of Features
From	To	
1492	1503	Massive formation, slightly vuggy
1503	1528	Mostly massive with some vugs and rare, small cavities.
1528	1531	Cavity.
1531	1539	Numerous vugs and cavities.
1539	1544	Solid, massive with some vuggy intervals.
1544	1549	Numerous cavities.
1549	1606	Solid, massive with some vugs.
1606	1610	Numerous vugs and cavities, some deep.
1610	1612	Large cavity.
1612	1629	Solid, massive with some vugs.
1629	1644	Washouts and numerous vugs.
1644	1692	Massive with rare washouts and vugs.
1692	1703	Numerous vugs.
1703	1749	Massive with more frequent vugs in the 1725-1726 feet bls interval.
1749	1752	Large cavities.
1752	1830	Massive with few vugs and isolated washout cavity at 1760 feet bls.
1830	1836	Numerous vugs and small cavities.
1836	1870	Massive with few vugs and small cavities
1870	1874	Large cavity.
1874	1886	Numerous solution cavities and vugs.
1886	1920	Massive but with vugs and few solution cavities.
1920	1960	Frequent fractures and solution cavities (large cavity 1931-1932 feet bls), some horizontal washouts.
1960	1969	Mostly massive with few vugs.
1969	1979	Frequent vertical fractures and solution cavities (large cavity 1931-1932 feet bls), some horizontal washouts.
1979	1990	Mostly massive but vuggy
1990	2000	Frequent vugs, some solution cavities.
2000	2012	Mostly massive with few vugs.
2012	2026	Vertical fractures common, very vuggy with solution cavities. Large cavity 2016-2018 and 2024-2026 feet bls with boulder blocking 3/4 of the borehole at the bottom.
2026	2055	Numerous solution cavities and vugs, few vertical fractures.
2055	2057	Cavity.
2057	2070	Numerous solution cavities and vugs.
2070	2075	Massive with some vugs and small cavities.
	2075	Bottom of the borehole.
2075	1495	**SIDE VIEW FOR REMAINDER OF SURVEY**

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Appendix E

Packer Test Water Quality Summary and Laboratory Data

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PACKER TEST WATER QUALITY SUMMARY
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

DZMW-1
Packer Test No. 1 (Straddle Packer)

Start date: 10/18/2010 **End date: 10/18/2010**

Flowmeter Total-Start (gal) :	**378,326**	**Open Hole Total Depth (feet bls) :**	**1,602**
Flowmeter Total- End (gal) :	**408,820**	**Packer Depth Interval (feet bls):**	**1414-1459**
Stabilized Test Pumping Rate (gpm) :	**64.9**	**Pump Setting Depth (feet bls):**	**185.0**
Development Duration (hrs):	**19.1**	**Transducer Depth (feet bls):**	**171.5**
Pump Test Duration (min):	**462**	**Pipe and open hole volume:**	**694 + 195 = 889 gallons**
Static DTW Before Test (feet bls):	**42.51**	**Maximum Drawdown (feet):**	**3.37**

Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bls)	Temp. (^{O}C)	Cond. (µS/cm)	Chlorides (mg/L)	Comments
Development									
11/17/10	12:25	0			42.51				Begin development with sub. pump. Ann. 4.020 ft Tot: 303190
11/17/10	12:32	7	65.0	350	45.79				Packer press. 138 psi
11/17/10	13:45	20	65.2	1,195		25.0	1,086	80	
11/17/10	13:05	40	65.2	2,495		24.8	1,097	80	Ann. 40.038
11/17/10	13:50	85	65.2	5,395	45.61	25.2	1,105	80	Ann. 40.057
11/17/10	14:50	145	65.3	9,330		25.3	1,127	100	Total: 312500; sulfide: 0.35 mg/L
11/17/10	15:40	195	65.3	12,550	45.74	25.4	1,151	120	Ann. 40.059, DD: 3.23 ft
11/17/10	16:59	274	65.5	17,715		24.5	1,170	120	
11/17/10	18:00	335	65.6	21,710		24.5	1,204	120	
11/17/10	18:56	391	65.6	25,380		24.6	1,240	140	
11/17/10	20:00	455	65.7	29,680	45.73	24.5	1,288	140	
11/17/10	22:00	575	65.7	37,560		24.6	1,340	140	
11/18/10	0:00	695	65.7	45,440		24.7	1,427	160	
11/18/10	2:00	815	65.7	53,320		24.9	1,499	160	
11/18/10	4:00	935	65.7	61,200		24.7	1,571	180	
11/18/10	6:00	1055	65.8	69,080		25.0	1,658	200	
11/18/10	7:00	1115	65.8	73,025	45.70	25.3	1,708	220	
11/18/10	7:32	1147	65.8	75,130	45.69				Pump-off, begin recovery., Tot: 378326 gals. Av. Rate: 65.5 gpm, packers press.: 145 psi, ann. 4.04
Pump Test									
11/18/10	9:44	0		0	42.47				Stop pre-test recovery. Pump-on. Packer press.: 142 psi.
11/18/10	10:48	64.0	64.3	4,100	45.70	25.7	1,762	220	Ann.:4.00
11/18/10	11:54	130	64.5	8,370		25.9	1,794	220	
11/18/10	12:51	187	64.9	12,690		25.9	1,824	240	
11/18/10	14:04	260	64.7	17,410	45.76	25.7	1,854	260	Ann.:4.10
11/18/10	16:01	377	64.9	24,990		25.5	1,909	280	
11/18/10	17:05	441	64.9	29,140		25.0	1,959	280	Collect lab sample
11/18/10	17:17	453	64.9	29,910	45.76				Ann.:4.07
11/18/10	17:26	462	64.9	30,494					Pump-off, begin recovery., Tot: 408820 gals. Av. Rate: 64.9 gpm, packers press: 140 psi, ann. 4.08

"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"feet apl" denotes feet above pad level.
"^{o}C" denotes degrees celcius.
"µS/cm" denotes milliSiemans per cenitmeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.

ARCADIS

PACKER TEST WATER QUALITY SUMMARY
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

DZMW-1
Packer Test No. 2 (Straddle Packer)

Start date: 12/1/2010 **End date: 12/1/2010**

Flowmeter Total-Start (gal) :	**444,274**	**Open Hole Total Depth (feet bls) :**	**1,602**
Flowmeter Total- End (gal) :	**471,945**	**Packer Depth Interval (feet bls):**	**1514-1544**
Stabilized Test Pumping Rate (gpm) :	**61.5**	**Pump Setting Depth (feet bls):**	**184.0**
Development Duration (hrs):	**9.8**	**Transducer Depth (feet bls):**	**76.0**
Pump Test Duration (min):	**450**	**Pipe and open hole volume:**	**689 + 120 = 809 gallons**
Static DTW Before Test (feet bls):	**43.02**	**Maximum Drawdown (feet):**	**8.13**

Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bls)	Temp. (^{O}C)	Cond. (µS/cm)	Chlorides (mg/L)	Comments
Development									
11/30/10	9:18	0			41.86				Pump-on; begin development with sub. pump. Ann. 5.13 ft Tot: 407950, packer press: 148 psi
11/30/10	9:36	18	61.6	1,080	50.38	24.6	1,151	120	
11/30/10	10:20	62	61.6	3,590		24.6	1,409	140	
11/30/10	10:50	92	61.6	5,440		24.7	1,585	200	
11/30/10	11:20	122	61.6	7,290	50.00	25.1	1,761	240	Ann. 5.21
11/30/10	11:50	152	61.6	9,140		25.2	1,860	280	
11/30/10	12:20	182	61.6	10,990		25.3	1,972	300	
11/30/10	12:50	212	61.7	12,860		25.5	2,005	300	
11/30/10	13:20	242	61.6	14,710		25.6	2,110	320	
11/30/10	13:50	272	61.6	16,560		25.8	2,150	320	
11/30/10	14:20	302	61.6	18,410	50.51	25.8	2,240	340	Ann. 5.40
11/30/10	14:50	332	61.6	20,260	50.46	25.7	2,320	360	
11/30/10	15:20	362	61.5	22,080		25.8	2,380	380	
11/30/10	15:50	392	61.5	23,930		26	2,420	400	
11/30/10	16:20	422	61.5	25,770		26.1	2,520	420	
11/30/10	16:50	452	61.5	27,610		26.1	2,560	420	
11/30/10	17:20	482	61.5	29,460		25.9	2,640	460	Sulfide: 0.15 mg/L
11/30/10	17:50	512	61.5	31,310		26.0	2,750	480	
11/30/10	18:20	542	61.5	33,160		25.9	2,780	480	
11/30/10	18:50	572	61.5	35,010		26	2,800	480	
11/30/10	19:07	589	61.5	36,060	50.87				Pump-off, begin pre-test recovery., packers press.: 143 psi, ann. 5.46
Pump Test									
12/1/10	7:40	0	61.3	0	43.02				Stop pre-test recovery. Pump-on. Packer press.: 142 psi. Ann.: 5.36
12/1/10	8:10	30	61.3	1,830		25.2	2,820	480	
12/1/10	9:10	90	61.4	5,520	51.00	25.3	2,920	500	Ann.:5.38
12/1/10	10:20	160	61.5	9,920		25.5	3,020	520	
12/1/10	11:20	220	61.5	13,660		25.8	3,090	520	
12/1/10	12:20	280	61.5	17,200		25.9	3,160	540	
12/1/10	13:20	340	61.5	20,880	51.02	26.0	3,210	560	
12/1/10	14:20	400	61.5	24,580		26.0	3,250	560	
12/1/10	15:00	440	61.5			26.0	3,270	560	Collect lab sample. Sulfide: 0.19 mg/L
12/1/10	15:08	448	61.5		51.11				Ann.:5.53
12/1/10	15:10	450	61.2	27,670					Pump-off, begin recovery, packers press:143 psi

"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"feet apl" denotes feet above pad level.
"^{O}C" denotes degrees celcius.
"µS/cm" denotes milliSiemans per cenitmeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.

ARCADIS

PACKER TEST WATER QUALITY SUMMARY
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

DZMW-1
Packer Test No. 3 (Straddle Packer)

Start date: 12/7/2010 **End date: 12/7/2010**

Flowmeter Total-Start (gal) :	**507,073**	**Open Hole Total Depth (feet bls) :**	**1,602**
Flowmeter Total- End (gal) :	**535,891**	**Packer Depth Interval (feet bls):**	**1143-1173**
Stabilized Test Pumping Rate (gpm) :	**61.6**	**Pump Setting Depth (feet bls):**	**184.0**
Development Duration (hrs):	**9.2**	**Transducer Depth (feet bls):**	**174.8**
Pump Test Duration (min):	**468**	**Pipe and open hole volume:**	**554 + 113 = 667 gallons**
Static DTW Before Test (feet bls):	**48.11**	**Maximum Drawdown (feet):**	**3.43**

Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bls)	Temp. (^{O}C)	Cond. (µS/cm)	Chlorides (mg/L)	Comments Ann. Transd. 45.9 ft bls
Development									
12/6/10	8:45	0	63.0		50.10				Pump-on; begin development with sub. pump. Tot: 471945, packer press: 130 psi
12/6/10	9:45	60	63.1	3,790		17.2	1,101	80	
12/6/10	10:45	120	63.1	7,580		21.1	1,098	80	
12/6/10	12:05	200	63.1	12,620		24.1	1,123	100	
12/6/10	12:45	240	63.1	15,160		24.4	1,121	100	
12/6/10	13:45	300	63.3	18,980	53.40	24.5	1,140	100	Ann. 3.24
12/6/10	14:45	360	63.3	22,805		24.5	1,148	100	
12/6/10	15:45	420	63.3	26,600		24.6	1,157	100	
12/6/10	16:45	480	63.3	30,430		24.6	1,169	100	
12/6/10	17:45	540	63.3	34,190		24.4	1,173	100	Sulfide:0.19 mg
12/6/10	18:00	555	63.3	35,138	51.06				Pump-off, begin pre-test recovery., packers press.: 132 psi, ann. 3.25
Pump Test									
12/7/10	8:17	0	61.2	0	48.11				Stop pre-test recovery. Pump-on. Packer press.: 142 psi. Ann.: 3.12
12/7/10	9:10	53	61.6	3,280	51.02	23.4	1,159	100	
12/7/10	10:10	113	61.6	7,000		24.6	1,165	100	
12/7/10	11:17	180	61.6	11,160		24.5	1,170	100	
12/7/10	12:17	240	61.6	14,820		24.7	1,172	100	
12/7/10	13:17	300	61.6	18,550		24.9	1,173	100	
12/7/10	14:17	360	61.6	22,270	51.01	25.0	1,178	100	Ann. 3.18
12/7/10	15:17	420	61.6	25,990		24.9	1,179	100	Sufide:0.25 mg
12/7/10	15:45	448	61.7			24.8	1,180	100	Collect lab sample
12/7/10	16:05	468		28,820	50.89				Pump-off, begin recovery. Ann.: 3.23, Packer press.: 144 psi

"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"feet apl" denotes feet above pad level.
"^{o}C" denotes degrees celcius.
"µS/cm" denotes milliSiemans per cenitmeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.

ARCADIS

PACKER TEST WATER QUALITY SUMMARY
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

DZMW-1
Packer Test No. 4 (Single Packer)

Start date: 12/29/2010 **End date: 12/29/2010**

Flowmeter Total-Start (gal) :	**562,310**	**Open Hole Total Depth (feet bls) :**	**2,075**
Flowmeter Total- End (gal) :	**576,110**	**Packer Depth (feet bls):**	**2,005**
Stabilized Test Pumping Rate (gpm) :	**37.0**	**Pump Setting Depth (feet bls):**	**149.0**
Development Duration (hrs):	**10.5**	**Transducer Depth (feet bls):**	**141.0**
Pump Test Duration (min):	**373**	**Pipe and open hole volume:**	**959 + 337 = 1296 gallons**
Static DTW Before Test (feet bls):	**76.14**	**Maximum Drawdown (feet):**	**0.88**

Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bls)	Temp. (^{O}C)	Cond. (µS/cm)	Chlorides (mg/L)	Comments Ann. Transd. 45.9 ft bls
Development									
12/28/10	7:00	0	38.0		n/a				Pump-on; begin development with sub. pump. Tot: 537258 gals, valves fully open
12/28/10	8:55	115	38.4	4,416		21.9	33,400	12,000	packer press: 152 psi. Ann: 9.27
12/28/10	9:55	175	38.5	6,727		22.3	34,800	12,500	
12/28/10	11:00	240	38.4	9,222	77.46	23.8	35,400	12,500	
12/28/10	12:00	300	38.4	11,495		24.7	35,800	13,000	
12/28/10	13:00	360	38.5	13,832	77.65	25.1	36,200	13,500	Flowmeter power failed. Resumed. Total volume calculated.
12/28/10	14:00	420	38.5	16,140		25.4	36,100	13,500	
12/28/10	15:00	480	38.5	18,450		25.3	36,300	13,500	Flowmeter power failed. Resumed. Total volume calculated.
12/28/10	16:00	540	38.4	20,750		25.4	36,100	13,500	Pulled ann. Transducer 5 ft up
12/28/10	17:00	600	38.4	23,050		25.4	36,000	13,500	Sulfide:0.0 mg
12/28/10	17:27	627	38.4	24,900	77.19				Pump-off, begin pre-test recovery., packers press.: 142 psi, ann. 4.39
Pump Test									
12/29/10	7:55	0	36.0	0	76.14				Stop pre-test recovery. Pump-on. Packer press.: 150 psi. Ann.: 4.20
12/29/10	8:25	25	37.4	1,120		23.3	36,000	13,500	
12/29/10	9:25	90	37.2	3,360	76.84	24.2	35,800	13,000	Ann. 4.26
12/29/10	10:25	150	37.1	5,590		25.3	35,600	13,000	
12/29/10	11:25	210	37.0	7,810		25.7	35,800	13,000	
12/29/10	12:25	270	37.0	10,030	77.02	26.1	35,900	13,000	
12/29/10	13:25	330	37.0	12,250		26.2	35,700	13,000	
12/29/10	13:55	360	37.0	13,360	76.91	26.3	35,600	13,000	Ann. 4.41(ft above transducer)
12/29/10	14:00	365	37.0						Collect lab. sample.
12/29/10	14:08	373		13,800					Pump-off, begin recovery. Packer press: 145 psi

"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"feet apl" denotes feet above pad level.
"^{o}C" denotes degrees celcius.
"µS/cm" denotes milliSiemans per cenitmeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.

ARCADIS

PACKER TEST WATER QUALITY SUMMARY
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

DZMW-1
Packer Test No. 5 (Single Packer)

Start date: 1/11/2011 **End date: 1/11/2011**

Flowmeter Total-Start (gal) :	**1,429,300**	**Open Hole Total Depth (feet bls) :**	**1,956**
Flowmeter Total- End (gal) :	**1,448,170**	**Packer Depth (feet bls):**	**1,920**
Stabilized Test Pumping Rate (gpm) :	**53.8**	**Pump Setting Depth (feet bls):**	**173.0**
Development Duration (hrs):	**7.4**	**Transducer Depth (feet bls):**	**100.0**
Pump Test Duration (min):	**351**	**Pipe and open hole volume:**	**870 + 150 = 1020 gallons**
Static DTW Before Test (feet bls):	**58.94**	**Maximum Drawdown (feet):**	**1.99**

Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bls)	Temp. (^{O}C)	Cond. (µS/cm)	Chlorides (mg/L)	Comments Ann. Transd. 45.9 ft bls
Development									
1/7/11	6:20	0	58.0		57.65				Pump-on; begin development with sub. pump. Tot: 537258 gals, valves fully open
1/7/11	8:03	103		5,800	61.50	23.9	9,100	3,000	Stop development due to lack of large volume containment to collect development water.
1/10/11	8:30	0	53.0	0	59.55				Resume development. Packer press.: 144psi, Ann.: 4.49 ft of water above transd.
1/10/11	8:50	20	53.5	1,070	62.19	23.2	9,120	3,000	
1/10/11	9:55	85	53.8	4,300		24.5	8,730	3,000	
1/10/11	10:40	130	53.9	6,990		25.2	8,780	3,000	
1/10/11	11:30	180	54.0	9,680		26.1	8,750	3,000	
1/10/11	12:30	240	54.1	12,920		26.3	8,710	3,000	
1/10/11	13:30	300	54.2	16,170		26.3	8,640	3,000	
1/10/11	14:30	360	54.3	19,420		26.6	8,590	2,500	Flowmeter down-total calculated manually
1/10/11	15:30	420	54.3	22,670		26.6	8,570	2,500	
1/10/11	15:52	442		23,350	61.18				Pump-off, begin pre-test recovery., packers press.: 145 psi, ann. 4.86
Pump Test									
1/11/11	7:55	0	54.0	0	58.94				Stop pre-test recovery. Pump-on. Packer press.: 150 psi. Ann.: 4.62
1/11/11	8:25	30	53.7	1,620		24.4	8,480	2,500	
1/11/11	9:25	90	53.6	4,750	61.35	25.5	8,400	2,500	Sulfide: 0.07 mg/L
1/11/11	10:25	150	53.7	8,070		26.1	8,350	2,500	
1/11/11	11:25	210	53.7	11,310		26.3	8,320	2,500	
1/11/11	12:25	270	53.8	14,500		26.5	8,310	2,500	
1/11/11	13:25	330	53.8	17,760		26.6	8,290	2,500	Sulfide: 0.12 mg/L
1/11/11	13:35	340	53.8		60.71				Collect lab. sample. Ann.: 4.85
1/11/11	13:46	351		18,870					Pump-off, begin recovery. Packer press: 142 psi

"gal" denotes gallons.
"gpm" denotes gallons per minute.
"min" denotes minutes.
"feet bpl" denotes feet below pad level.
"feet apl" denotes feet above pad level.
"^{o}C" denotes degrees Celsius.
"µS/cm" denotes milliSiemans per centimeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.

PACKER TEST WATER QUALITY SUMMARY
Orlando Utilities Commission (OUC)
Southeast Monitoring Wells

DZMW-1
Packer Test No. 6 (Straddle Packer)

Start date: 1/13/2011 **End date: 1/13/2011**

Flowmeter Total-Start (gal) :	**1,466,860**	**Open Hole Total Depth (feet bls) :**	**1,956**
Flowmeter Total- End (gal) :	**1,480,050**	**Packers Depth (feet bls):**	**461-523**
Stabilized Test Pumping Rate (gpm) :	**71.7**	**Pump Setting Depth (feet bls):**	**173.0**
Development Duration (hrs):	**4.25**	**Transducer Depth (feet bls):**	**100.0**
Pump Test Duration (min):	**184**	**Pipe and open hole volume:**	**294+ 330 = 624 gallons**
Static DTW Before Test (feet bls):	**52.18**	**Maximum Drawdown (feet):**	**1.07**

Date	Time	Elapsed Time (min)	Pumping Rate (gpm)	Total Volume (gal)	Water Level (feet bls)	Temp. (^{O}C)	Cond. (µS/cm)	Chlorides (mg/L)	Comments Ann. Transd. 45.9 ft bls
Development									
1/13/11	7:30	0	72.0		52.00				Pump-on; begin development with sub. pump. Tot: 1448400 gals, valves fully open. Packers press.: 143 psi
1/13/11	8:22	52	72.0	3,740	53.20	22.1	986	120	Ann. Transd. 4.54 ft
1/13/11	9:00	90	72.0	6,630		22.8	980	100	
1/13/11	10:00	150	72.0	10,800		23.3	975	100	
1/13/11	11:00	210	71.7	15,250		23.8	969	80	
1/13/11	11:30	240	71.5		53.22	23.9	962	80	Sulfide: 030 mg/L
1/13/11	11:45	255	71.5	18,460					Pump-off, begin pre-test recovery., packers press.: 140 psi, ann. 4.55
Pump Test									
1/13/11	13:19	0	71.5	0	52.18				Stop pre-test recovery. Pump-on. Packer press.: 150 psi. Ann.: 4.62
1/13/11	13:49	30	71.3	2,140		23.8	971	80	
1/13/11	14:49	90	71.7	6,440		23.9	967	80	
1/13/11	15:49	150	71.8	10,750		23.8	966	80	
1/13/11	16:10	171	71.7			23.70	968	80	Collect lab. sample.
1/13/11	16:23	184		13,190	52.43				Pump-off, begin recovery. Packer press: 140 psi

"gal" denotes gallons.
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"min" denotes minutes.
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"feet apl" denotes feet above pad level.
"^{o}C" denotes degrees Celsius.
"µS/cm" denotes milliSiemans per centimeter.
"mg/L" denotes milligrams per liter.
"psi" denotes pressure in pounds per square inch.
"n/a" denotes data not available.

December 17, 2010

OUC The Reliable One®

WATER QUALITY LABORATORY

Technical Report for:

Steve Lockington

WQLAB Job Number:

101119001

Report to:

Steve Lockington
3800 Gardenia Ave
Orlando, FL 32839

Total Number of Pages **9** **(Including Cover Page)**

Estimates of uncertainty of analysis are available on request.
These results relate only to the samples tested.

Test results contained in this data package meet the requirements of the National Environmental Laboratory Accreditation Conference and/or state specific certification programs, as applicable.

John N. Gray
Laboratory Manager

Certification: FLDOH Certification Number E53566

3800 Gardenia Avenue, Orlando, FL 32839 - Phone 407-244-8779 - Fax 407-244-8780

December 17, 2010

Steve Lockington
3800 Gardenia Ave
Orlando, FL 32839

Re WQLAB Project Number: **101119001**
Client Project Description: **SE Monitoring Wells**

Enclosed is the report of laboratory analysis for the following samples:

Sample Number	Sample Description	Date Collected
AC05147	DZMW-1/PT#1	11/18/2010
AC05287	DZMW-1 / PT#2	12/1/2010
AC05488	DZMW-1/PF/#3	12/7/2010

Footnotes are given at the end of the report, when applicable.

If you have any questions or comments concerning this report, please do not hesitate to contact us.

Sincerely,

John N. Gray
Laboratory Manager

Enclosures

Batch No: 1,866

Associated Samples: AC05147

QA Sample ID: AC05147

		Method Blanks	LCS (%)
Chloride	11/22/2010	1.0U	102

Batch No: 1,867

Associated Samples: AC05147

QA Sample ID: AC05147

		Method Blanks	LCS (%)
Sulfate	11/22/2010	0.25U	103

Batch No: 1,870

Associated Samples: AC05147 AC05287

QA Sample ID: AC05287

		Method Blanks	LCS (%)	MS (%)	DUPL (RPD)
Alkalinity	12/3/2010	1.0U	107	104	0.905

Batch No: 1,875

Associated Samples

AC05147 AC05287 AC05488

QA Sample ID: AC05147

		Method Blanks	LCS (%)	DUPL (RPD)
Specific Conductance - Lab	12/10/2010	0.43	89.3	0.26

Batch No: 1,876

Associated Samples

AC05147 AC05287 AC05488

QA Sample ID: AC05488

		Method Blanks	LCS (%)	MS (%)	DUPL (RPD)
Calcium	12/10/2010	0.06U	104	102	6.57

Batch No: 1,877

Associated Samples

AC05147 AC05287 AC05488

QA Sample ID: AC05488

		Method Blanks	LCS (%)	MS (%)	DUPL (RPD)
Magnesium	12/10/2010	0.037U	104	101	6.61

Batch No: 1,878

Associated Samples

AC05147 AC05287 AC05488

QA Sample ID: AC05488

		Method Blanks	LCS (%)	MS (%)	DUPL (RPD)
Potassium	12/10/2010	0.18U	104	99	1.75

Batch No: 1,879

Associated Samples

AC05147 AC05287 AC05488

QA Sample ID: AC05488

		Method Blanks	LCS (%)	MS (%)	DUPL (RPD)
Sodium	12/10/2010	0.30U	106	104	7.71

Batch No: 1,880

Associated Samples

AC05287 AC05488

QA Sample ID: AC05287

		Method Blanks	LCS (%)	DUPL (RPD)
Total Dissolved Solids	12/7/2010	5.0U	85.5	0.0861

Batch No: 1,881

Associated Samples

AC05147 AC05287 AC05488

QA Sample ID: AC05488

		Method Blanks	LCS (%)	MS (%)	DUPL (RPD)
Total Hardness	12/14/2010	1.00U	93.4	96	0.730

December 17, 2010
Project No: 101119001

Steve Lockington
3800 Gardenia Ave
Orlando, FL 32839

Laboratory Report

Project Name	**SE Monitoring Wells**	
Sample Designation	**DZMW-1/PT#1**	
Matrix	**DW**	
WQLAB Sample Number	**AC05147**	
Date/Time Collected	**11/18/10**	**17:05**
Date/Time Logged-In	**11/19/10**	**09:10**

Parameters	Results	Units	Method	MDL	PQL	Date/Time Analyzed	Analyst
Chloride	248	mg/L	EPA300.0	10.0	10	11/22/10 21:50	JLK
Sulfate	655	mg/L	EPA300.0	2.50	2.5	11/22/10 21:50	JLK
Calcium	219	mg/L	EPA200.7	0.06	0.06	12/10/10 14:43	JNG
Potassium	5.60	mg/L	EPA200.7	0.20	0.20	12/10/10 14:15	JNG
Magnesium	219	mg/L	EPA200.7	0.05	0.05	12/10/10 14:43	JNG
Sodium	133	mg/L	EPA200.7	0.3	0.30	12/10/10 14:43	JNG
Alkalinity	119	mg/L	SM2320B	1	1	12/03/10 14:00	JFP
Alkalinity, Bicarbonate (CaCO3)	118.71	mg/L	SM2320B		0	12/03/10 14:00	JFP
Alkalinity, Carbonate (CaCO3)	0.27	mg/L	SM2320B		0	12/03/10 14:00	JFP
Specific Conductance - Lab	1528	uS/cm	SM2510B	1	1	12/10/10 11:21	JFP
Total Hardness	793	mg/L	SM2340C	1	1	12/14/10 13:33	JFP
pH	7.39	pH	SM4500HB			12/10/10 14:50	JFP
Total Dissolved Solids	1427	mg/L	SM2540C	5	5	11/19/10 14:00	JFP

Project Name		
Sample Designation	**DZMW-1 / PT#2**	
Matrix	**GW**	
WQLAB Sample Number	**AC05287**	
Date/Time Collected	**12/01/10**	**15:00**
Date/Time Logged-In	**12/01/10**	**16:00**

Parameters	Results	Units	Method	MDL	PQL	Date/Time Analyzed	Analyst
Field Temperature	26.0	C	SM2550B			10/01/10 15:00	
Chloride	505	mg/L	EPA300.0	20.0	10	12/09/10 02:07	JLK
Sulfate	1057	mg/L	EPA300.0	5.00	2.5	12/09/10 02:07	JLK
Calcium	314	mg/L	EPA200.7	0.06	0.06	12/10/10 14:45	JNG
Potassium	10.6	mg/L	EPA200.7	0.20	0.20	12/10/10 14:17	JNG
Magnesium	92.6	mg/L	EPA200.7	0.05	0.05	12/10/10 14:45	JNG
Sodium	299	mg/L	EPA200.7	0.3	0.30	12/10/10 14:45	JNG
Alkalinity	110	mg/L	SM2320B	1	1	12/03/10 14:00	JFP
Alkalinity, Bicarbonate (CaCO3)	109.78	mg/L	SM2320B		0	12/14/10 13:08	JFP
Alkalinity, Carbonate (CaCO3)	0.20	mg/L	SM2320B		0	12/03/10 14:00	JFP
Specific Conductance - Lab	2720	uS/cm	SM2510B	1	1	12/10/10 11:21	JFP
Total Hardness	1235	mg/L	SM2340C	1	1	12/14/10 13:33	JFP

Steve Lockington
3800 Gardenia Ave
Orlando, FL 32839

December 17, 2010
Project No: 101119001

Laboratory Report

Project Name		
Sample Designation	**DZMW-1 / PT#2**	
Matrix	**GW**	
WQLAB Sample Number	**AC05287**	
Date/Time Collected	**12/01/10**	**15:00**
Date/Time Logged-In	**12/01/10**	**16:00**

Parameters	Results	Units	Method	MDL	PQL	Date/Time Analyzed	Analyst
pH	7.30	pH	SM4500HB			12/02/10 14:00	DWM
Total Dissolved Solids	2324	mg/L	SM2540C	5	5	12/07/10 16:00	JFP

Project Name	**SE Monitoring Wells**	
Sample Designation	**DZMW-1/PF/#3**	
Matrix	**DW**	
WQLAB Sample Number	**AC05488**	
Date/Time Collected	**12/07/10**	**15:45**
Date/Time Logged-In	**12/08/10**	**14:30**

Parameters	Results	Units	Method	MDL	PQL	Date/Time Analyzed	Analyst
Chloride	69.4	mg/L	EPA300.0	1.0	10	12/09/10 02:25	JLK
Sulfate	437	mg/L	EPA300.0	5.00	2.5	12/09/10 02:25	JLK
Calcium	162	mg/L	EPA200.7	0.06	0.06	12/10/10 14:47	JNG
Potassium	2.31	mg/L	EPA200.7	0.20	0.20	12/10/10 14:19	JNG
Magnesium	35.1	mg/L	EPA200.7	0.05	0.05	12/10/10 14:47	JNG
Sodium	43.5	mg/L	EPA200.7	0.3	0.30	12/10/10 14:47	JNG
Alkalinity	133.5	mg/L	SM2320B	20.0	1	12/10/10 14:50	JFP
Alkalinity, Bicarbonate (CaCO3)	133.15	mg/L	SM2320B		0	12/10/10 14:50	JFP
Alkalinity, Carbonate (CaCO3)	0.33	mg/L	SM2320B		0	12/10/10 14:50	JFP
Specific Conductance - Lab	1030	uS/cm	SM2510B	1	1	12/10/10 11:21	JFP
Total Hardness	546	mg/L	SM2340C	1	1	12/14/10 13:33	JFP
pH	7.43	pH	SM4500HB			12/10/10 14:50	JFP
Total Dissolved Solids	845	mg/L	SM2540C	5	5	12/07/10 16:00	JFP

Steve Lockington
3800 Gardenia Ave
Orlando, FL 32839

December 17, 2010
Project No: 101119001

Laboratory Report

Project Name: SE Monitoring Wells

Footnotes

A	*Absent of Bacteria*
I	*The reported value is between the laboratory method detection limit and the practical quantitation limit.*
J	*Estimated value; value may not be accurate*
J1	*Surrogate recovery limits have been exceeded*
J3	*The reported value failed to meet the established quality control criteria for either precision or accuracy.*
J4	*The sample matrix interfered with the ability to make an accurate determination.*
J5	*The data are questionable because of improper laboratory or field protocols.*
K	*Off-scale low. Actual value is known to be less than the value given.*
L	*Off-scale high. Actual value is known to be greater than the value given.*
LCS	*Laboratory Control Sample*
LCSD	*Laboratory Control Sample Duplicate*
MS	*Matrix Spike*
MSD	*Matrix Spike Duplicate*
NC	*Laboratory lacks NELAC certification for this analyte.*
NS	*Not Screened*
P	*Presence of Bacteria*
Q	*Sample held beyond the accepted holding time.*
RPD	*Relative Percent Difference*
T	*Value reported is less than the method detection limit.*
U	*The compound was analyzed for but not detected.*
V	*The analyte was detected in both the sample and the associated blank.*
PQL	*The lowest result that can be routinely quantified and reported.*
MDL	*Method detection limit.*
Y	*The laboratory analysis was from an improperly preseved sample.*

Approved by:

John N. Gray
Laboratory Manager

Sample ID	Sample Description	Date Collected	Time Collected	Analyte	Result
AC05616	DZMW-1 / PT #4	12/29/2010	14:00	Alkalinity	104.8
AC05616	DZMW-1 / PT #4	12/29/2010	14:00	Alkalinity, Bicarbonate (CaCO3)	104.7
AC05616	DZMW-1 / PT #4	12/29/2010	14:00	Alkalinity, Carbonate (CaCO3)	0.12
AC05616	DZMW-1 / PT #4	12/29/2010	14:00	Chloride	17000
AC05616	DZMW-1 / PT #4	12/29/2010	14:00	Hardness by Calculation	4,801
AC05616	DZMW-1 / PT #4	12/29/2010	14:00	Magnesium	738
AC05616	DZMW-1 / PT #4	12/29/2010	14:00	pH	7.09
AC05616	DZMW-1 / PT #4	12/29/2010	14:00	Potassium	253
AC05616	DZMW-1 / PT #4	12/29/2010	14:00	Sodium	7,466
AC05616	DZMW-1 / PT #4	12/29/2010	14:00	Specific Conductance - Lab	79900
AC05616	DZMW-1 / PT #4	12/29/2010	14:00	Sulfate	3000
AC05616	DZMW-1 / PT #4	12/29/2010	14:00	Total Dissolved Solids	25916
AD00157	DZMW-1/PT#5	1/11/2011	13:35	Alkalinity	104.8
AD00157	DZMW-1/PT#5	1/11/2011	13:35	Alkalinity, Bicarbonate (CaCO3)	104.2
AD00157	DZMW-1/PT#5	1/11/2011	13:35	Alkalinity, Carbonate (CaCO3)	0.6
AD00157	DZMW-1/PT#5	1/11/2011	13:35	Calcium	424
AD00157	DZMW-1/PT#5	1/11/2011	13:35	Chloride	2451
AD00157	DZMW-1/PT#5	1/11/2011	13:35	Magnesium	192
AD00157	DZMW-1/PT#5	1/11/2011	13:35	pH	7.78
AD00157	DZMW-1/PT#5	1/11/2011	13:35	Potassium	43.5
AD00157	DZMW-1/PT#5	1/11/2011	13:35	Sodium	1,295
AD00157	DZMW-1/PT#5	1/11/2011	13:35	Specific Conductance - Lab	11240
AD00157	DZMW-1/PT#5	1/11/2011	13:35	Sulfate	1349
AD00157	DZMW-1/PT#5	1/11/2011	13:35	Total Dissolved Solids	821
AD00157	DZMW-1/PT#5	1/11/2011	13:35	Total Hardness	1,849
AD00316	DZMW-1 / PT#6	1/13/2011	16:10	Alkalinity	136
AD00316	DZMW-1 / PT#6	1/13/2011	16:10	Alkalinity, Bicarbonate (CaCO3)	315
AD00316	DZMW-1 / PT#6	1/13/2011	16:10	Alkalinity, Carbonate (CaCO3)	1.02
AD00316	DZMW-1 / PT#6	1/13/2011	16:10	Calcium	159
AD00316	DZMW-1 / PT#6	1/13/2011	16:10	Chloride	75
AD00316	DZMW-1 / PT#6	1/13/2011	16:10	Hardness by Calculation	540
AD00316	DZMW-1 / PT#6	1/13/2011	16:10	Magnesium	34.7
AD00316	DZMW-1 / PT#6	1/13/2011	16:10	pH	7.54
AD00316	DZMW-1 / PT#6	1/13/2011	16:10	Potassium	2.45
AD00316	DZMW-1 / PT#6	1/13/2011	16:10	Sodium	41.6
AD00316	DZMW-1 / PT#6	1/13/2011	16:10	Specific Conductance - Lab	1189
AD00316	DZMW-1 / PT#6	1/13/2011	16:10	Sulfate	403
AD00316	DZMW-1 / PT#6	1/13/2011	16:10	Total Dissolved Solids	5930

Qualifier	Units	Analyst	Date Analyzed	Time Analyzed	**ARCADIS**	**FCT**
	mg/L	JFP	1/12/2011	09:52		
	mg/L	JFP	2/4/2011	10:30		
	mg/L	JFP	2/4/2011	10:30		
	mg/L	JLK	2/7/2011	18:02	13500	
	mg/L	JNG	1/26/2011	10:44		
	mg/L	JNG	1/26/2011	10:44		
	pH	DWM	12/30/2010	09:25		
	mg/L	JNG	1/26/2011	10:44		
	mg/L	JNG	1/26/2011	10:44		
	uS/cm	JFP	1/24/2011	13:55	35600	32000-43000
	mg/L	JLK	2/7/2011	18:02		
	mg/L	JFP	1/5/2011	15:45		
	mg/L	JFP	1/12/2011	09:52		
	mg/L	JFP	2/4/2011	10:30		
	mg/L	JFP	2/4/2011	10:30		
	mg/L	JNG	1/25/2011	12:18		
	mg/L	JLK	1/15/2011	13:18	2500	
	mg/L	JNG	1/25/2011	12:20		
	pH	JFP	1/12/2011	09:00		
	mg/L	JNG	1/25/2011	12:18		
	mg/L	JNG	1/25/2011	12:18		
	uS/cm	JFP	1/24/2011	13:55	8290	
	mg/L	JLK	1/15/2011	13:18		
	mg/L	JFP	1/18/2011	15:00		
	mg/L	JNG	1/25/2011	12:20		
Q	mg/L	DWM	2/4/2011	10:30		
	mg/L	JFP	2/4/2011	10:30		
	mg/L	JFP	2/4/2011	10:30		
	mg/L	JNG	1/25/2011	11:36		
	mg/L	JLK	1/15/2011	13:18	80	
	mg/L	JNG	1/25/2011	13:55		
	mg/L	JNG	1/25/2011	11:40		
	pH	JFP	1/14/2011	16:00		
	mg/L	JNG	1/25/2011	11:40		
	mg/L	JNG	1/25/2011	11:40		
	uS/cm	JFP	1/24/2011	13:55	968	
	mg/L	JLK	1/15/2011	13:18		
	mg/L	JFP	1/18/2011	15:00		

ARCADIS

Appendix F

Final Water Quality Data

March 01, 2011

OUC The Reliable One®

WATER QUALITY LABORATORY

Technical Report for:

Steve Lockington

WQLAB Job Number:

110214001

Report to:

Steve Lockington
3800 Gardenia Ave
Orlando, FL 32839

Total Number of Pages **8** **(Including Cover Page)**

Estimates of uncertainty of analysis are available on request.
These results relate only to the samples tested.

Test results contained in this data package meet the requirements of the National Environmental Laboratory Accreditation Conference and/or state specific certification programs, as applicable.

John N. Gray
Laboratory Manager

Certification: FLDOH Certification Number E53566

March 01, 2011

Steve Lockington
3800 Gardenia Ave
Orlando, FL 32839

Re WQLAB Project Number: **110214001**
Client Project Description:

Enclosed is the report of laboratory analysis for the following samples:

Sample Number	Sample Description	Date Collected
AD00817	D2MW-1/UMZ	2/10/2011
AD00818	D2MW-1/LMZ	2/10/2011
AD00819	UFMW-1	2/10/2011

Footnotes are given at the end of the report, when applicable.

If you have any questions or comments concerning this report, please do not hesitate to contact us.

Sincerely,

John N. Gray
Laboratory Manager

Enclosures

Batch No: 2,009

Associated Samples

AD00817 AD00818 AD00819

QA Sample ID: AD00817

		Method Blanks	MS (%)	DUPL (RPD)
Specific Conductance - Lab	2/15/2011	0.48	101.4	0.308

Batch No: 2,010

Associated Samples

AD00817 AD00818 AD00819

QA Sample ID: AD00817

		LCS (%)	DUPL (RPD)
pH	2/11/2011	98.8	0.535

Batch No: 2,115

Associated Samples

AD00817 AD00818 AD00819

QA Sample ID: AD00817

		Method Blanks	LCS (%)	MS (%)	DUPL (RPD)
Alkalinity	2/15/2011	1.0U	99.2	108	0.00

Batch No: 2,116

Associated Samples

AD00817 AD00818 AD00819

QA Sample ID: AD00817

		Method Blanks	LCS (%)	DUPL (RPD)
Total Dissolved Solids	2/15/2011	5.0U	105	3.82

Batch No: 2,208

Associated Samples

AD00817 AD00818 AD00819

QA Sample ID: AD00819

		Method Blanks	LCS (%)	MS (%)	DUPL (RPD)
Sodium	3/1/2011	1.0U	97.4	98.4	1.23

Batch No: 2,209

Associated Samples

AD00817 AD00818 AD00819

QA Sample ID: AD00819

		Method Blanks	LCS (%)	MS (%)	DUPL (RPD)
Calcium	3/1/2011	1.0U	101.9	105.1	2.04

Batch No: 2,210

Associated Samples

AD00817 AD00818 AD00819

QA Sample ID: AD00819

		Method Blanks	LCS (%)	MS (%)	DUPL (RPD)
Potassium	3/1/2011	1.0U	99.6	99.6	0.00

Batch No: 2,211

Associated Samples

AD00817 AD00818 AD00819

QA Sample ID: AD00819

		Method Blanks	LCS (%)	MS (%)	DUPL (RPD)
Magnesium	3/1/2011	1.0U	102	98.2	10.1

Steve Lockington
3800 Gardenia Ave
Orlando, FL 32839

March 01, 2011
Project No: 110214001

Laboratory Report

Project Name
Sample Designation **D2MW-1/UMZ**
Matrix **DW**
WQLAB Sample Number **AD00817**
Date/Time Collected **02/10/11** **10:50**
Date/Time Logged-In **02/11/11** **14:00**

Parameters	Results	Units	Method	MDL	PQL	Date/Time Analyzed		Analyst
Specific Conductance - Field	1156	uS/cm	SM2510B	1	5	02/10/11	10:50	JLK
Field pH	7.23	pH	SM4500 HB	1	1	02/10/11	10:50	JLK
Field Temperature	24.6	C	SM2550B			02/10/11	10:50	JLK
Field Turbidity	0	NTU	EPA 180.1			02/10/11	10:50	JLK
Chloride	68.8	mg/L	EPA300.0	2.00	2	02/17/11	13:53	JLK
Sulfate	354	mg/L	EPA300.0	12.5	12.5	02/17/11	13:53	JLK
Calcium	152	mg/L	EPA200.7	10.0	10.0	03/01/11	10:26	JNG
Potassium	3.02	mg/L	EPA200.7	1.0	1.0	03/01/11	10:23	JNG
Magnesium	30.7	mg/L	EPA200.7	1.0	1.0	03/01/11	10:23	JNG
Sodium	41.5	mg/L	EPA200.7	10.0	10.0	03/01/11	10:26	JNG
Alkalinity	136.8	mg/L	SM2320B	1	1	02/15/11	10:00	JFP
Alkalinity, Bicarbonate (CaCO3)	136.42	mg/L	SM2320B		0	02/14/11	10:00	JFP
Alkalinity, Carbonate (CaCO3)	0.361	mg/L	SM2320B		0	02/14/11	10:00	JFP
Specific Conductance - Lab	973	uS/cm	SM2510B	1	1	02/15/11	10:30	JFP
pH	7.45	pH	SM4500HB	1	1	02/11/11	14:10	JFP
Total Dissolved Solids	800	mg/L	SM2540C	5	5	02/15/11	11:45	JFP

Project Name
Sample Designation **D2MW-1/LMZ**
Matrix **DW**
WQLAB Sample Number **AD00818**
Date/Time Collected **02/10/11** **13:55**
Date/Time Logged-In **02/11/11** **14:00**

Parameters	Results	Units	Method	MDL	PQL	Date/Time Analyzed		Analyst
Specific Conductance - Field	1549	uS/cm	SM2510B	1	5	02/10/11	13:55	JLK
Field pH	7.98	pH	SM4500 HB	1	1	02/10/11	13:55	JLK
Field Temperature	25.0	C	SM2550B			02/10/11	13:55	JLK
Field Turbidity	0	NTU	EPA 180.1			02/10/11	13:55	JLK
Chloride	149	mg/L	EPA300.0	5.00	2	02/17/11	14:24	JLK
Sulfate	459	mg/L	EPA300.0	12.5	12.5	02/17/11	14:24	JLK
Calcium	171	mg/L	EPA200.7	10.0	10.0	03/01/11	10:30	JNG
Potassium	5.55	mg/L	EPA200.7	1.0	1.0	03/01/11	10:28	JNG
Magnesium	40.3	mg/L	EPA200.7	10.0	1.0	03/01/11	10:30	JNG

Steve Lockington
3800 Gardenia Ave
Orlando, FL 32839

March 01, 2011
Project No: 110214001

Laboratory Report

Project Name
Sample Designation **D2MW-1/LMZ**
Matrix **DW**
WQLAB Sample Number **AD00818**
Date/Time Collected **02/10/11** **13:55**
Date/Time Logged-In **02/11/11** **14:00**

Parameters	Results	Units	Method	MDL	PQL	Date/Time Analyzed	Analyst
Sodium	83.3	mg/L	EPA200.7	10.0	10.0	03/01/11 10:30	JNG
Alkalinity	283.6	mg/L	SM2320B	1	1	02/15/11 10:00	JFP
Alkalinity, Bicarbonate (CaCO3)	281.31	mg/L	SM2320B		0	02/14/11 10:00	JFP
Alkalinity, Carbonate (CaCO3)	2.25	mg/L	SM2320B		0	02/14/11 10:00	JFP
Specific Conductance - Lab	1558	uS/cm	SM2510B	1	1	02/15/11 10:30	JFP
pH	7.93	pH	SM4500HB	1	1	02/11/11 14:10	JFP
Total Dissolved Solids	1038	mg/L	SM2540C	5	5	02/15/11 11:45	JFP

Project Name
Sample Designation **UFMW-1**
Matrix **DW**
WQLAB Sample Number **AD00819**
Date/Time Collected **02/10/11** **13:40**
Date/Time Logged-In **02/11/11** **14:00**

Parameters	Results	Units	Method	MDL	PQL	Date/Time Analyzed	Analyst
Specific Conductance - Field	605	uS/cm	SM2510B	1	5	02/10/11 13:40	JLK
Field pH	7.02	pH	SM4500 HB	1	1	02/10/11 13:40	JLK
Field Temperature	22.8	C	SM2550B			02/10/11 13:40	JLK
Field Turbidity	0	NTU	EPA 180.1			02/10/11 13:40	JLK
Chloride	16.8	mg/L	EPA300.0	1.0	2	02/17/11 13:05	JLK
Sulfate	0.25 U	mg/L	EPA300.0	0.25	12.5	02/17/11 13:05	JLK
Calcium	99.2	mg/L	EPA200.7	10.0	10.0	03/01/11 10:34	JNG
Potassium	1.87	mg/L	EPA200.7	1.0	1.0	03/01/11 10:32	JNG
Magnesium	3.21	mg/L	EPA200.7	1.0	1.0	03/01/11 10:32	JNG
Sodium	24.6	mg/L	EPA200.7	1.0	10.0	03/01/11 10:32	JNG
Alkalinity	126.9	mg/L	SM2320B	1	1	02/15/11 10:00	JFP
Alkalinity, Bicarbonate (CaCO3)	126.71	mg/L	SM2320B		0	02/14/11 10:00	JFP
Alkalinity, Carbonate (CaCO3)	0.184	mg/L	SM2320B		0	02/14/11 10:00	JFP
Specific Conductance - Lab	601	uS/cm	SM2510B	1	1	02/15/11 10:30	JFP
pH	7.19	pH	SM4500HB	1	1	02/11/11 14:10	JFP
Total Dissolved Solids	376	mg/L	SM2540C	5	5	02/15/11 11:45	JFP

FLDOH Certification Number E53566
USEPA ID #FL00049

John N. Gray
Laboratory Manager

Steve Lockington
3800 Gardenia Ave
Orlando, FL 32839

March 01, 2011
Project No: 110214001

Laboratory Report

Project Name:

Footnotes

A	*Absent of Bacteria*
I	*The reported value is between the laboratory method detection limit and the practical quantitation limit.*
J	*Estimated value; value may not be accurate*
J1	*Surrogate recovery limits have been exceeded*
J3	*The reported value failed to meet the established quality control criteria for either precision or accuracy.*
J4	*The sample matrix interfered with the ability to make an accurate determination.*
J5	*The data are questionable because of improper laboratory or field protocols.*
K	*Off-scale low. Actual value is known to be less than the value given.*
L	*Off-scale high. Actual value is known to be greater than the value given.*
LCS	*Laboratory Control Sample*
LCSD	*Laboratory Control Sample Duplicate*
MS	*Matrix Spike*
MSD	*Matrix Spike Duplicate*
NC	*Laboratory lacks NELAC certification for this analyte.*
NS	*Not Screened*
P	*Presence of Bacteria*
Q	*Sample held beyond the accepted holding time.*
RPD	*Relative Percent Difference*
T	*Value reported is less than the method detection limit.*
U	*The compound was analyzed for but not detected.*
V	*The analyte was detected in both the sample and the associated blank.*
PQL	*The lowest result that can be routinely quantified and reported.*
MDL	*Method detection limit.*
Y	*The laboratory analysis was from an improperly preseved sample.*

Approved by:

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Laboratory Manager