

SPECIAL PUBLICATION SJ2012-SP8

**EXPANDED EXECUTIVE SUMMARY
SEMINOLE COUNTY
MARKHAM REGIONAL WATER TREATMENT PLANT
AQUIFER STORAGE AND RECOVERY SYSTEM**



Expanded Executive Summary
Seminole County
Markham Regional Water Treatment Plant
Aquifer Storage and Recovery System

Prepared for:

St. Johns River Water Management District
P.O. Box 1429
Palatka, FL 32178

and

Seminole County Environmental Services
500 West Lake Mary Boulevard
Sanford, FL 32773

Prepared by:

Camp Dresser & McKee Inc.
8381 Dix Ellis Trail, Suite 400
Jacksonville, FL 32256

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Contents

Section 1	Introduction	
1.1	Purpose of Expanded Executive Summary	1-1
1.2	Overview of St. Johns River Water Management District ASR Program	1-1
1.3	Project Timeline and Overall Cost	1-1
1.4	Section Summaries	1-4
Section 2	Program Plan	
2.1	Program Plan	2-1
Section 3	Desktop Assessment of ASR	
3.1	Project Objectives	3-1
3.2	Site Selection	3-1
3.3	Water Supply Availability	3-3
3.4	Preliminary Layouts	3-3
	3.4.1 Design Overview	3-3
	3.4.2 Exploratory Well Construction	3-5
	3.4.3 ASR Well Construction	3-5
	3.4.2 Confining Zone Well Construction	3-5
3.5	Hydrogeologic Testing	3-8
	3.5.1 Exploratory Well Testing	3-8
Section 4	Cooperator Agreement	
4.1	Cooperator Agreement	4-1
Section 5	Preliminary Basis of Design	
5.1	Basic Operational Concept	5-1
	5.1.1 ASR and Monitoring Wells	5-1
	5.1.2 Pipeline	5-1
	5.1.3 Pilot ASR System Capacity	5-1
	5.1.4 Recovery Efficiency	5-8
5.2	Preliminary List of Drawings and Specifications	5-8
5.3	Exploratory Well Construction Program	5-9
5.4	Testing of Exploratory Well	5-10
	5.4.1 Site-Specific Lithology	5-11
	5.4.2 Site-Specific Hydrostratigraphy	5-12
	5.4.3 Water Quality Profile	5-13
5.5	FGS Leaching Study	5-13
5.6	Expansion Plan	5-14
Section 6	Project Design	
6.1	ASR Well and Monitoring Well Drilling and Testing Program	6-1

6.2	Conceptual Cycle Testing Plan	6-2
6.3	Development of Plans and Specifications	6-4
6.3.1	ASR Well, Monitoring Wells, and Surface Facilities.....	6-4
6.3.2	Pretreatment System	6-7
Section 7	Regulatory Permitting	
7.1	Permits	7-1
7.1.1	FDEP Underground Injection Control (UIC) Permit.....	7-1
7.1.2	SJRWMD Consumptive Use Permit (CUP).....	7-1
7.1.3	SJRWMD Well Construction Permits	7-1
7.1.4	FDEP Public Water Supply (PWS) Permits.....	7-2
Section 8	ASR Facilities Construction, Start-up, Monitoring, and Training	
8.1	Construction and Testing of the ASR Well and Monitoring Wells	8-1
8.1.1	Hydrogeologic Framework	8-1
8.1.2	ASR Well	8-1
8.1.3	Storage Zone Monitoring Well 2	8-4
8.1.4	Confining Zone Monitoring Well 1.....	8-4
8.1.5	ASR Storage Zone Characteristics.....	8-4
8.2	Surface Facilities Construction	8-5
8.2.1	Jack & Bore Directional Drill Pipeline	8-5
8.2.2	Markham Regional WTP Pipeline.....	8-5
8.2.3	Pretreatment System	8-6
8.2.3.1	Dechlorination System.....	8-6
8.2.3.2	Degasification System	8-7
8.2.3.3	Additional Site Work	8-7
8.3	Startup Activities	8-7
8.3.1	ASR System	8-7
8.3.2	Pretreatment System	8-8
8.4	Permit Clearances	8-9
8.5	Transfer of Facilities to Cooperator.....	8-9
Section 9	Cycle Operational Monitoring and Evaluations	
Section 10	Preliminary Feasibility Determination and Conclusion	
Section 11	References	
Appendices		
<i>Appendix A</i>	St. Johns River Water Management District Aquifer Storage and Recovery Construction and Testing Program Plan	
<i>Appendix B</i>	Memorandum of Understanding	
<i>Appendix C</i>	Evaluation of Expanability of ASR Wellfield, Seminole County, Florida	
<i>Appendix D</i>	FDEP Underground Injection Control Permit and Administrative Order	
<i>Appendix E</i>	Substantial Completion Certificate	

Appendix F Supplemental DVD(s)

DVD 1

Reports

Desktop Assessment of Aquifer Storage and Recovery for Seminole County, Florida. Report dated October 2002.

Bench Scale Geochemical Assessment of Water-Rock Interactions: Seminole County ASR Core Samples. Report submitted by Florida Geologic Survey, dated April 28, 2005.

Exploratory Well Project Report for Seminole County, Florida. Report dated June 2005.

Aquifer Storage and Recovery System Project Completion Report for Seminole County, Florida. Report dated September 2008.

Aquifer Storage and Recovery System Operation and Maintenance Manual for Seminole County, Florida. Report dated April 2009.

Procedures and Costs for Plugging and Abandonment of Aquifer Storage and Recovery System Wells, Seminole County, FL, Markham Water Treatment Plant. Memo Dated December 30, 2009.

Cycle Testing and Monitoring Program, Seminole County Markham WTP ASR Project. Report dated February 2010.

Seminole County Aquifer Storage and Recovery Well Modification Results. Letter Dated September 22, 2010.

Aquifer Storage and Recovery Pretreatment System Project Report for Seminole County, Florida. Report Dated October 2010.

Aquifer Storage and Recovery Pretreatment System Operations and Maintenance Manual for Seminole County, Florida. Report Dated December 2010.

Seminole County Markham WTP ASR Project Cycle Testing Report. Letter Dated July 8, 2011.

Seminole County Markham Regional Water Treatment Plant ASR Project, Preliminary Design Report for a Reclaimed Water Interconnect. Report Updated August 2011.

Expanded Executive Summary, Seminole County Markham Regional Water Treatment Plant Aquifer Storage and Recover System. Report Dated September 2011.

Plans and Specifications

Seminole County Markham ASR – Phase I Specifications. Dated August 2004.

Seminole County Markham ASR – Phase I Plans. Dated September 2004.

Seminole County Markham ASR – Phase II Specifications. Dated December 2005.

DVD 1 (cont.)

Seminole County Markham ASR – Phase II Plans. Dated December 2005.

ASR Dechlorination/Degasification System and the Seminole County Markham Regional WTP Specifications. Dated May 2009.

ASR Dechlorination/Degasification System and the Seminole County Markham Regional WTP Plans. Dated May 2009.

Permits

Permit Applications

Application to Construct a Class V Injection Well System, Seminole County Markham ASR Project. Dated June 2005.

Application for a Specific Permit to Construct PWS Components, Seminole County Markham ASR Project Phase II Construction – Eastern Extension. Dated December 2005.

Application for a Specific Permit to Construct PWS Components, Seminole County Markham ASR Project Phase II Construction – Southern Extension. Dated December 2005.

Consumptive Use Permit Application for Seminole County Markham ASR Project. Dated February 2006.

Seminole County ASR Project Consumptive Use Permit Renewal Permit No: 103709. Dated October 8, 2009.

Markham Potable Water ASR Project Class V ASR Injection Well Permit – Renewal. Dated December 28, 2010.

Markham Potable Water ASR Project Class V ASR Injection Well Permit – Renewal RAI Response. Dated August 24, 2011.

Issued Permits

FDEP PWS Permits: 59-0079860-175, 59-0079860-202, 59-0079860-203, 59-0079860-208, 59-0079860-277, and PWS permit clearances

SJRWMD Consumptive Use Permit 103709 (April 2006 and December 2009)

FDEP UIC Permit 59-0250382-001-UC, Minor Permit Modifications 1 and 2, Major Permit Modification 3, Administrative Order AO-09-0003

Well Construction Permits 103835-1, 103842-1, and 103843-1

Right of Way Construction Permit 82122

DVD 2

Appendix C – Markham ASR Video Log from Exploratory Well Project Report for Seminole County, Florida. Dated June 2005.

DVD 3

Appendix D - ASR-1 Video Log from Aquifer Storage and Recovery System Project Completion Report for Seminole County, Florida. Report dated September 2008.

DVD 4

Appendix D - SZMW-2 Video Log from Aquifer Storage and Recovery System Project Completion Report for Seminole County, Florida. Report dated September 2008.

DVD 5

Appendix D - CZMW-1 Video Log from Aquifer Storage and Recovery System Project Completion Report for Seminole County, Florida. Report dated September 2008.

List of Figures

	<i>Page:</i>
Figure 1-1 Cooperative ASR Sites.....	1-2
Figure 3-1 Potential ASR Sites.....	3-2
Figure 3-2 Preliminary Site Plan.....	3-4
Figure 3-3 Exploratory Well Construction Diagram	3-6
Figure 3-4 ASR Well Construction Diagram.....	3-7
Figure 5-1 Proposed Well Location Map.....	5-2
Figure 5-2 Proposed ASR Well Construction Diagram.....	5-3
Figure 5-3 Proposed Confining Zone Monitoring Well Construction Diagram.....	5-4
Figure 5-4 Proposed Piping Layout	5-5
Figure 5-5 Proposed Piping Layout	5-6
Figure 5-6 Proposed Wellhead Piping Construction Diagram	5-7
Figure 5-7 Location of Proposed ASR and Associated Monitoring Wells.....	5-15
Figure 6-1 Final ASR and Monitoring Wells Design Plans.....	6-5
Figure 6-2 Final ASR Site Layout.....	6-6
Figure 6-3 Final ASR Pretreatment Piping Plan	6-8
Figure 8-1 Final Site Layout	8-2
Figure 8-2 Final ASR and Monitoring Wells Construction Diagrams.....	8-3

List of Tables

	<i>Page:</i>
Table 1-1 Seminole County Markham ASR Project Cost Summary	1-3
Table 2-1 SJRWMD ASR Construction and Testing Program Proposed Funding for Fiscal Years 2001 to 2006	2-2
Table 6-1 Cycle Testing Program	6-3
Table 6-2 Cycle Testing Monitoring Plan	6-3
Table 9-1 Cycle Testing Program for the Seminole County Markham Regional WTP ASR Project.....	9-1

Section 1

Introduction

1.1 Purpose of Expanded Executive Summary

This Expanded Executive Summary summarizes the work accomplished by CDM for the Seminole County Aquifer Storage and Recovery (ASR) Project at the Seminole County Markham site at Wilson Elementary School north of the Markham Regional Water Treatment Plant (WTP). The ASR system consists of an ASR well, two storage zone monitoring wells, and one confining zone monitoring well, as well as a pretreatment system to reduce potential arsenic mobilization in the ASR storage zone. Digital copies of previous reports, memorandums, permits, and other associated documents are also included on a DVD in **Appendix F**.

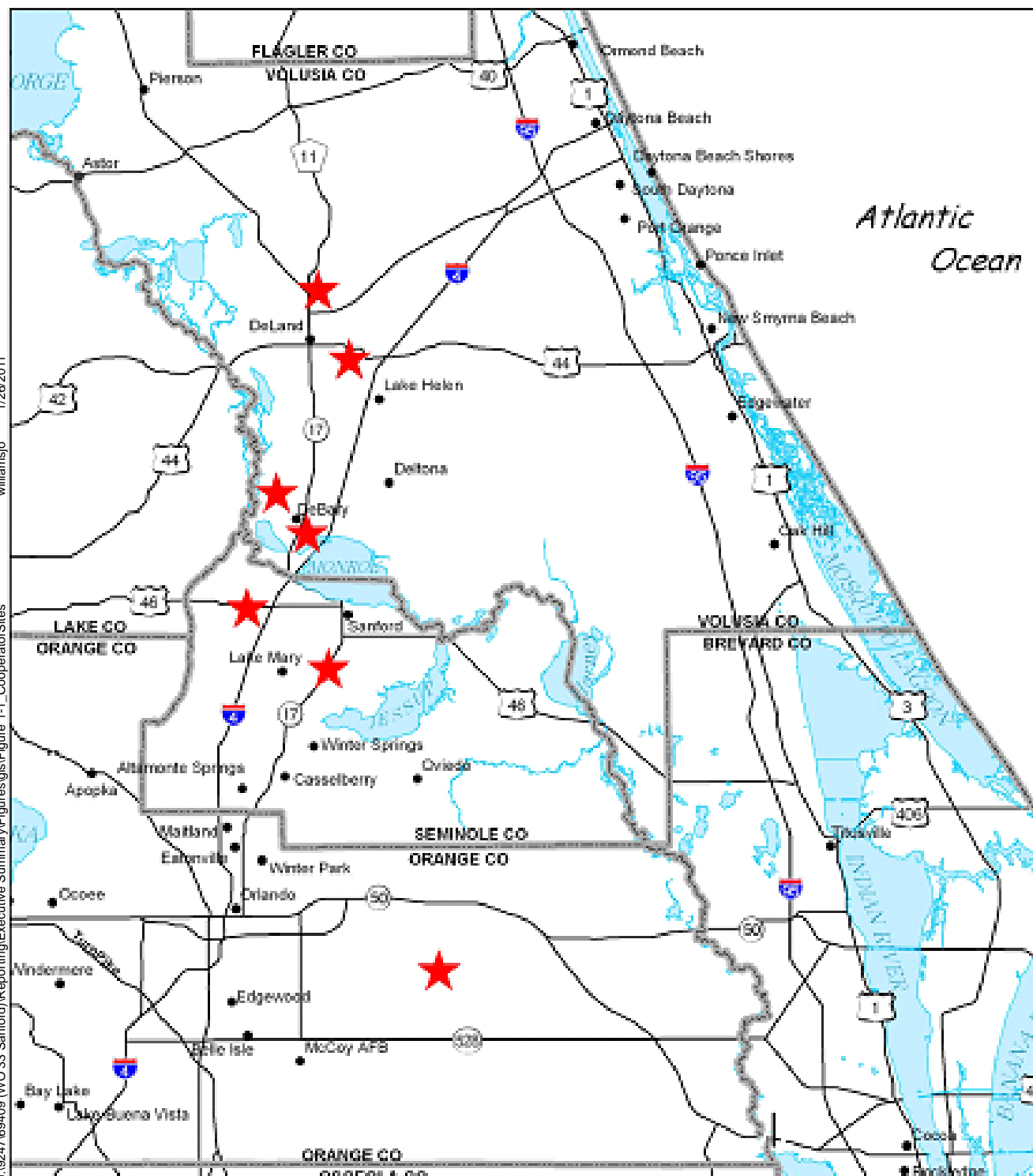
1.2 Overview of St. Johns River Water Management District ASR Program

The St. Johns River Water Management District (SJRWMD) is investigating several alternative water supply strategies to be used in conjunction with fresh groundwater to meet future potable water demands. ASR has been identified as being an important component in the development of alternative water supplies, as it can potentially provide very large volumes of seasonal water storage, such as for excess wet-season surface water flows. The SJRWMD sponsored an ASR feasibility and testing program for higher demand areas within the priority water resource caution areas in east central Florida to evaluate if ASR can be used successfully as a tool to help meet future potable water demands. Five cities and counties partnered with SJRWMD as cooperators in the program. The Cooperator ASR sites are shown on **Figure 1-1**.

1.3 Project Timeline and Overall Cost

The SJRWMD identified the need for alternative water supplies to meet projected future demands in its 2000 District Water Supply Plan (DWSP) and in 2002 the SJRWMD prepared the ASR Construction and Testing Program Plan. The following project milestones with dates are detailed below:

- CDM performed a desktop evaluation on the feasibility of ASR in Northwest Seminole County and submitted the report, Desktop Assessment of ASR for Seminole County, Florida, in October 2002.
- In June 2004, CDM completed the drilling and construction of an exploratory well at Wilson Elementary School just north of the Markham Regional WTP site.
- In June 2005, upon completion of the exploratory well testing and evaluation program, CDM submitted the final Exploratory Well Project Report for Seminole County, Florida detailing the well construction, testing and evaluation program, the results of the evaluation, and recommendations for moving forward.



Cooperative ASR Sites



Cooperators

City of DeLand
Volusia County
Seminole County
City of Sanford
Orange County



0 3 6 Miles



reality = 0.9666666666666667

Figure 1-1
Cooperator ASR Sites

- The final ASR system design was completed in December 2005.
- Construction of the ASR system was completed in May 2008, which included the ASR well, storage zone monitoring wells, confining zone monitoring well, and associated piping.
- In September 2008, CDM submitted the ASR Project Completion Report for the Seminole County, Florida detailing the construction, testing and evaluations, startup activities, and results.
- The final ASR pretreatment system design was completed in May 2009.
- Construction of the pretreatment system was completed in January 2010.
- In October 2010, upon completion of all testing, and training activities for the pretreatment system, CDM submitted the final ASR Pretreatment System Project Report, Seminole County, Florida detailing the construction, testing, and startup activities for the system.

The total capital cost of the project including, the desktop assessment, exploratory well construction and testing, design and construction of the ASR system and pretreatment system, permitting, cycle testing, analyses, and reporting was approximately \$6.0 million, detailed in **Table 1-1**.

Table 1-1 Seminole County Markham ASR Project Cost Summary		
W.O. NUMBER	DESCRIPTION	PROJECT COST
SF409F2	Desktop Assessment for Seminole County	\$65,300
SF409F5	Exploratory Well for Seminole County	\$651,794
SF409F6	FGS Leachability Study for Seminole Exploratory Well	\$27,400
SF409F11	ASR Design, Permitting and Sitework	\$263,242
SF409F15	ASR Permit Processing for Seminole Markham Site	\$8,480
SF409F19	Seminole ASR Test Well Construction & Testing	\$2,000,917
SF409F20	Seminole ASR Test Well Construction & Testing	\$561,355
SF409F27	Seminole ASR Test Well Construction & Testing	\$451,707
SF409F28	Seminole Markham ASR Test Well Construction, Operations Manual, Record Drawings, and Startup Training	\$127,089
SF409F29	Sitework Construction of the Pre-Treatment System for the Seminole County ASR Project	\$34,474

Table 1-1 Seminole County Markham ASR Project Cost Summary		
W.O. NUMBER	DESCRIPTION	PROJECT COST
SF409F32	Partial Sitework Construction of the Pre-Treatment System for the Seminole County ASR Project	\$23,176
SF409F34	Construction of Pre-Treatment System	\$923,928
SF409F35	Construction of Pre-Treatment System	\$431,556
SF409F37	Seminole PDR for Reclaimed Water Interconnect	\$7,000
SF409F38	Seminole ASR PDR for Reclaimed Water Interconnect	\$19,918
SF409F40	Seminole ASR Cycle Test Evaluation and UIC Permit Renewal	\$44,000
Total:		\$5,641,336

1.4 Section Summaries

The following details the sections included in this report:

- **Program Plan:** Includes a summary of the ASR Construction and Testing Program Plan prepared by the SJRWMD in 2002.
- **Desktop Assessment of ASR:** Details the initial ASR feasibility study for Seminole County.
- **Cooperator Agreement:** Summary of the Memorandum of Understanding (MOU) between SJRWMD and Seminole County.
- **Preliminary Basis of Design:** Details the design, testing, and construction of the exploratory well, and presents the preliminary basis of design for the ASR system.
- **Project Design:** Details the design of the ASR system and the pretreatment system.
- **Regulatory Permitting:** Summarizes the permits obtained for the construction, operations and testing associated with the ASR system.
- **ASR Facilities Construction, Start-up, Monitoring, and Training:** Summarizes the construction, testing, and startup activities of the ASR system and pretreatment system.
- **Cycle Testing Operational Monitoring and Evaluations (Ongoing):** Details the cycle testing program and current status of the system.
- **Preliminary Feasibility Determination and Conclusions:** Details ASR feasibility and future steps and considerations.

Section 2

Program Plan

2.1 Program Plan

In 2002, the SJRWMD in conjunction with the District's ASR Contractors prepared an ASR Construction and Testing Program Plan to be used as a guide by all Cooperators. A copy of the Program Plan is included in **Appendix A**. The goal of the ASR Construction and Testing Program is to examine the appropriateness of integrating ASR technology into regional water resource and water supply development projects. To achieve this goal, the SJRWMD identified several objectives that would need to be met:

- Determine the extent to which ASR could be applied to meet local or regional water supply needs through use of alternative water supplies (i.e., surface waters, reclaimed waters) to supplement limited groundwater supplies.
- Establish the fundamental criteria for successful application of ASR within the SJRWMD.
- Provide test sites for a variety of applications in order to identify and address the different issues (e.g., permitting/regulatory, technical, logistics, political) unique to each application.
- Identify and secure Cooperators, through executed agreements, to participate in ASR construction and testing which would result in development of a functional ASR facility to be used by the Cooperator at the conclusion of the testing period.
- Demonstrate the extent to which ASR can be safely and successfully used within the SJRWMD.

The Program Plan established a framework for selecting ASR construction and testing projects. Facility planning factors included: demand, supply, storage requirements, and proposed use. Hydrogeologic factors included: storage zone confinement, transmissivity, aquifer gradient and direction, recharge and native water quality, and interfering uses and environmental impacts.

The Program Plan included the proposed budget and funding for ASR construction and testing for the fiscal years 2002-2006. The plan identified funding with SJRWMD ad valorem and Florida Forever funds, as well as Cooperator funding in the form of in-kind services and/or cash contributions. Total program costs were budgeted for \$19.72 million, and are shown in **Table 2-1**.

<p>Table 2-1 SJRWMD ASR Construction and Testing Program Proposed Funding for Fiscal Years 2001 to 2006 (\$ millions)</p>							
Sources	Fiscal Year						Total
	2001	2002	2003	2004	2005	2006	
SJRWMD ad valorem	0.00	0.35	0.00	0.00	0.00	0.00	0.35
Florida Forever	2.38	1.60	2.50	2.50	2.50	0.00	11.47
Cooperators	1.83	1.06	1.67	1.67	1.67	0.00	7.90
Total	4.21	3.01	4.17	4.17	4.17	0.00	19.72
Disbursements	0.00	6.22	4.17	4.17	4.17	1.00	19.72

The Program Plan identified the responsibilities of the SJRWMD to be:

- Selecting projects to be included in the ASR Construction and Testing Program;
- Providing partial funding for each project; and
- Take the lead in negotiating complex regulatory issues that may arise pertaining to ASR implementation at each site.

The Cooperator responsibilities were also identified and included:

- Providing an ASR facility site;
- Providing logistical support, including but not limited to, facility access, a suitable source of water for testing and operations, power supply, and disposal of recovered water during initial testing and operational startup;
- Support, which may include direct financial contribution or in-kind services, such as assistance during sampling, monitoring, and other testing and operational activities;
- Assistance in resolving any regulatory issues that may arise, including preparation for participation in agency meetings; and
- Upon completion the Cooperator would also be responsible for continued operation of the ASR facilities, assuming that their operational success has been demonstrated during the test program.

The SJRWMD prepared a detailed list of standard tasks for the ASR projects. The list would be adapted to the individual needs and opportunities at each site. The tasks include:

- **Task 1: ASR Construction Testing and Program Plan**

- **Task 2:** Project Evaluation and Site Selection
- **Task 3:** Cooperator Agreement
- **Task 4:** Site Specific Data Collection and Preliminary System Design
- **Task 5:** ASR Pilot Project Design
- **Task 6:** Regulatory Permitting
- **Task 7:** ASR Facilities Construction, Monitoring, and Testing
- **Task 8:** Startup and Training
- **Task 9:** Large Cycle Operational Monitoring Evaluations
- **Task 10:** Peer Review of ASR Consultant Team Work

Section 3

Desktop Assessment of ASR

3.1 Project Objectives

The primary objective of the ASR program is to evaluate the feasibility of ASR to provide the seasonal storage capacity needed to use the St. Johns River system as a potable water supply. A secondary benefit of the ASR project may be the creation of a vertical or lateral salinity barrier that could protect the Upper Floridan Aquifer from salt water intrusion. To accomplish this objective, the recommended ASR strategy for Seminole County was to select a site which had a high probability of success with respect to ASR implementation and to drill an exploratory well to collect site-specific data. Based on the results of hydrogeologic testing of the exploratory well, the feasibility of successfully implementing ASR would be determined. The exploratory well testing would provide data necessary to select the ASR storage zone and for the evaluation of the effectiveness of well design and storage capacity of the ASR well within the selected storage zone.

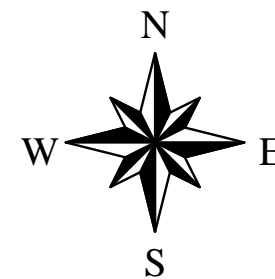
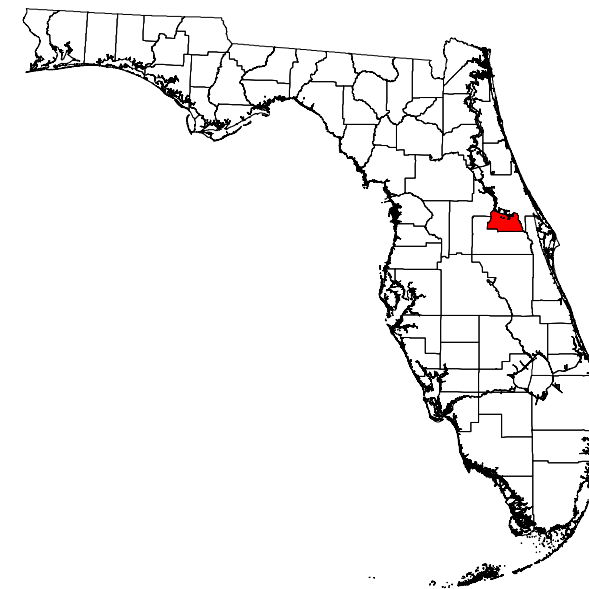
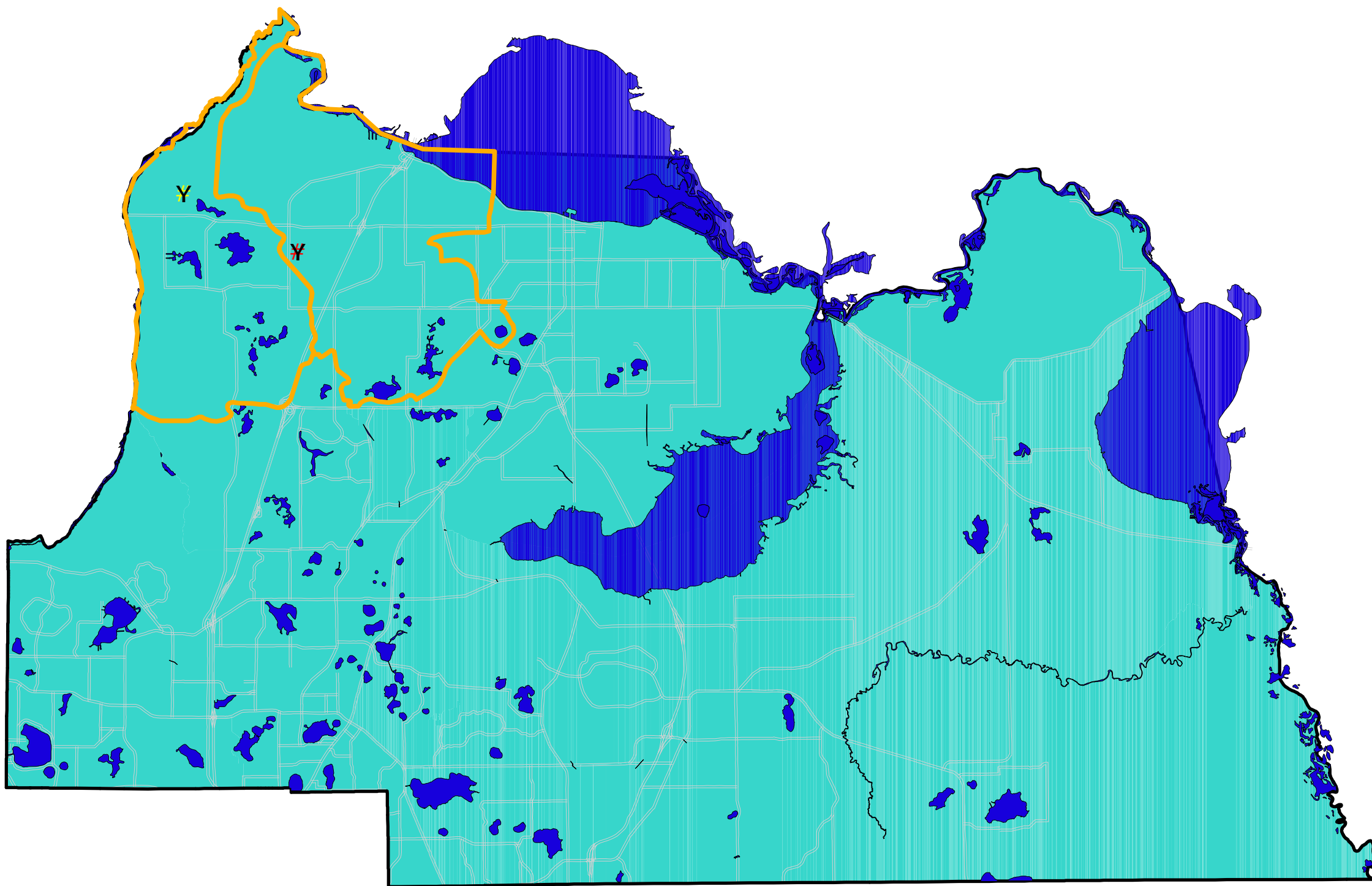
CDM performed a desktop evaluation on the feasibility of ASR in the northwest part of Seminole County. Two potential sites owned by the County were evaluated for the desktop feasibility investigation: the Markham Regional WTP site and the Yankee Lake site. The desktop evaluation consisted of an engineering and hydrogeological evaluation of the two candidate sites for an ASR well for Seminole County, shown on **Figure 3-1**. The desktop assessment report summarized the results of the evaluation and was submitted as final in October 2002 and is included on the DVD in Appendix F. The following sections summarize the results presented in the report.

3.2 Site Selection

The Markham Regional WTP site is located on the Wilson Elementary School property approximately 3,000 feet north of the Seminole County Markham Regional WTP. The site was attractive in that it is located near the water treatment and distribution infrastructure. The Yankee Lake site is located closer to the saline water interface in the Floridan Aquifer. The advantages of the Yankee Lake site were that it has ample room for well construction and testing activities and a considerable amount of site-specific hydrogeologic data available from a SJRWMD Lower Floridan Aquifer test well. Both the Markham Regional WTP and Yankee Lake sites are known to have mildly brackish water in the uppermost part of the Lower Floridan Aquifer, the most likely ASR storage zone.

Based on the hydrogeologic data available during the desktop evaluation, ASR was determined to be feasible at both sites and no overriding hydrogeologic reasons were found to exist to prefer one site over the other. Estimates of probable capital costs for the conceptual designs prepared for the two sites were comparable. Therefore, from a cost standpoint, one site was not preferred over another.

Desktop Assessment of ASR
for Seminole County, FL



13000 0 13000 Feet

LEGEND

Potential ASR Well Sites

- Markham Regional WTP Site
- Yankee Lake Site
- Study Area Drainage Basin
- County Boundary
- Major Roads
- Water Body

Figure 3-1
Potential ASR Sites

Upon completion of the desktop evaluation it was recommended that a test well be installed at the Markham Regional WTP site to obtain site-specific hydrogeological data to confirm ASR feasibility. The primary reason for selecting this site over the Yankee Lake site was availability of water for cycle testing. The Markham Regional WTP site has a nearby water main for supplying water and Yankee Lake had no nearby source of water. An Upper Floridan Aquifer well would have needed to be installed at the Yankee Lake site to evaluate ASR feasibility.

3.3 Water Supply Availability

At the time of the desktop assessment, three existing water treatment facilities and one facility under construction supplied water to the northwest Seminole County service area. At that time, these facilities typically pumped 6.8 million gallons per day (mgd), but had a total well-pumping capacity of 15.5 mgd. Therefore, additional raw water would be available on an average annual basis at all four wellfields.

In addition to the facility capacity data, water use records (EN-50 logs) for year 2001 were obtained from the SJRWMD in order to review monthly water use and calculate maximum month use in northwest Seminole County. For each month, the total water produced from the three existing WTPs was calculated. As expected, water usage was at its lowest during the wet season (May through September). The maximum to average ratio (135/110) was approximately equal to 1.23. The monthly water use data indicated that at least 1 mgd of water would be available for ASR system cycle testing during the months of May through August. The well pumping capacity at the Markham Regional WTP, as permitted through the FDEP, was 3.0 mgd average daily flow and 6.75 mgd maximum daily flow. It was estimated that once the Markham WTP was on-line, at least 1 mgd would be physically available for cycle testing and operation year-round.

3.4 Preliminary Layouts

3.4.1 Design Overview

Based on the desktop assessment, the pilot ASR system was recommended to be designed for a capacity of 1.0 mgd. **Figure 3-2** shows the preliminary site plan prepared for the desktop assessment. The recommended ASR system components were identified:

- An exploratory well, which would later be used as a storage zone monitoring well,
- A confining zone monitoring well,
- An ASR well,
- Wellhead and associated above-ground appurtenances, and
- Ancillary facilities such as fencing pump house, booster pumps, and chlorination system with detention tank.

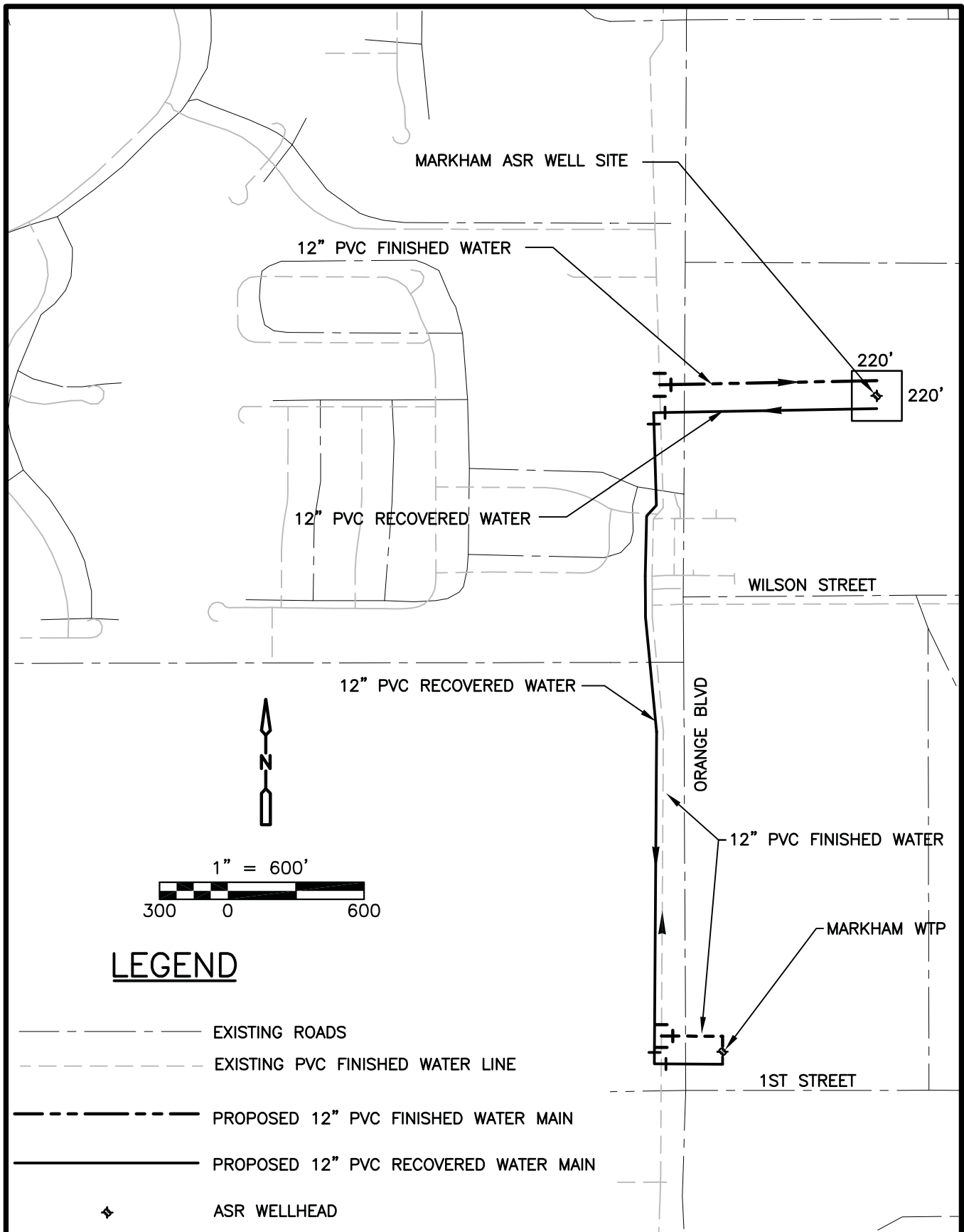
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FIGURE6-3

L:\9247\36299\FIGURES\



Desktop Assessment of ASR
For Seminole County, FL

Figure 3-2
Preliminary Site Plan

3.4.2 Exploratory Well Construction

The purpose of the exploratory well was to allow for the collection of site-specific data on aquifer hydraulics and localized groundwater quality, and to be used as a storage zone monitoring well during cycle testing of the system. The exploratory well was planned for installation approximately 400 feet (ft) from the proposed ASR well location. A preliminary exploratory well construction diagram prepared for the desktop assessment is shown on **Figure 3-3**. The limited available data on the deep hydrogeology of northwest Seminole County suggest that the top of the Lower Floridan Aquifer occurs at approximately 1,000 feet below land surface (ft bls), and that 5,000 mg/L isochlor occurs at about 1,350 ft bls to 1,400 ft bls (Spechler and Halford, 2001). Based on these data it was determined that the ASR storage zone would be located between 1,000 ft bls and 1,400 ft bls. Therefore, it was anticipated that the 6.625-inch outer diameter steel casing would be set to approximately 1,050 ft bls, with the exact depth depending on data collected during pilot drilling and testing.

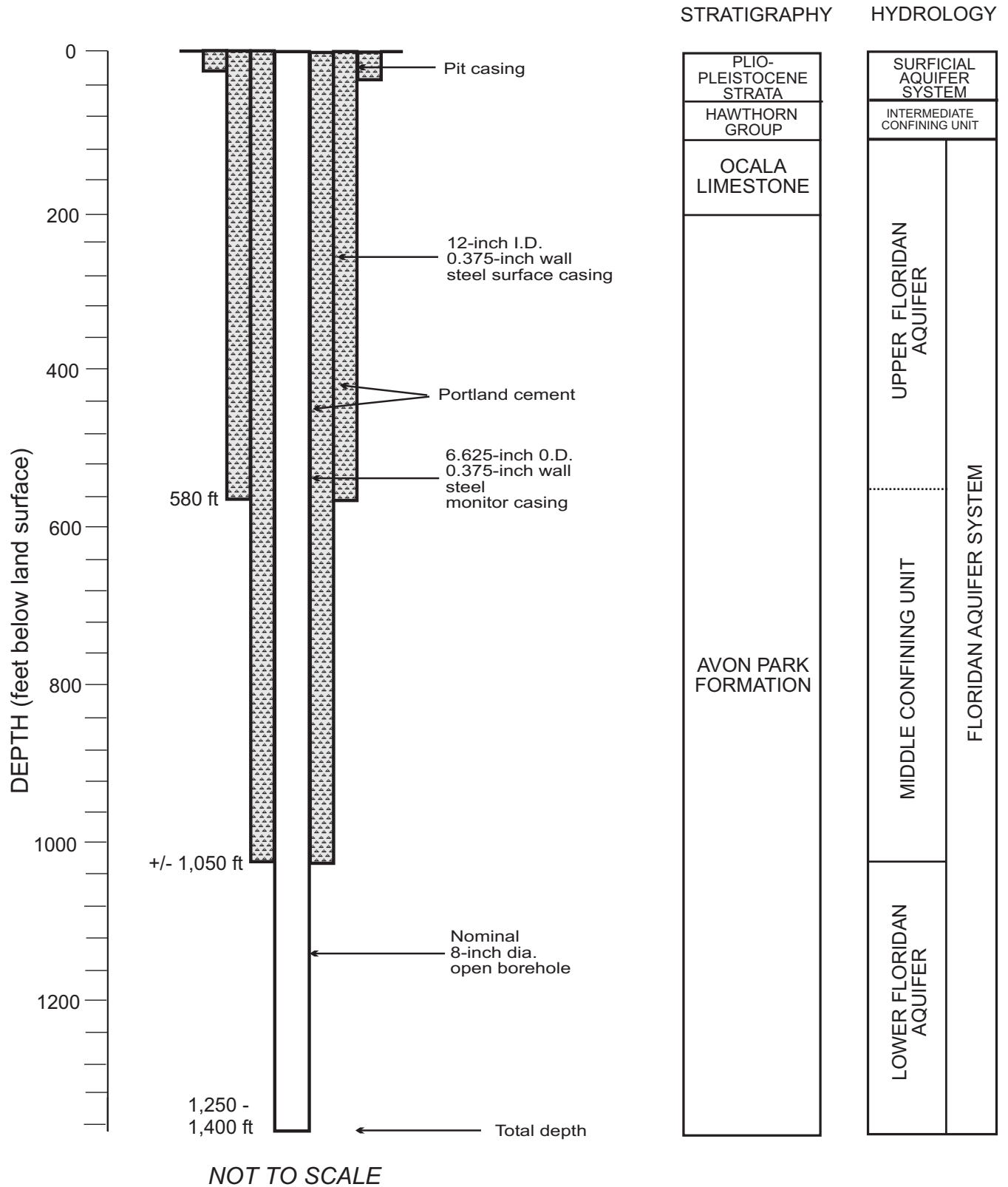
3.4.3 ASR Well Construction

Casing depths of the surface and injection casings for the ASR well would be determined from hydrogeologic data collected during the drilling of the exploratory well and adjusted, if necessary, for borehole-specific conditions. The injection casing would be set just above the top of the ASR storage zone. The preliminary ASR well construction diagram for the Markham Regional WTP ASR site is provided on **Figure 3-4**.

3.4.4 Confining Zone ASR Monitoring Well Construction

The confining zone monitoring well was planned for installation in a water-producing interval above the storage zone located approximately 100 ft from the ASR well. This monitoring well serves to detect upward migration of injected fluids and associated pressure changes. Except for depth, the confining zone monitoring well would be constructed similarly to the storage-zone monitoring well. The confining zone monitoring well would have a 6.625-inch outer diameter steel casing. Both the storage zone and confining zone monitoring wells would be equipped with dedicated submersible sampling pumps and combination water quality and level monitoring probes.

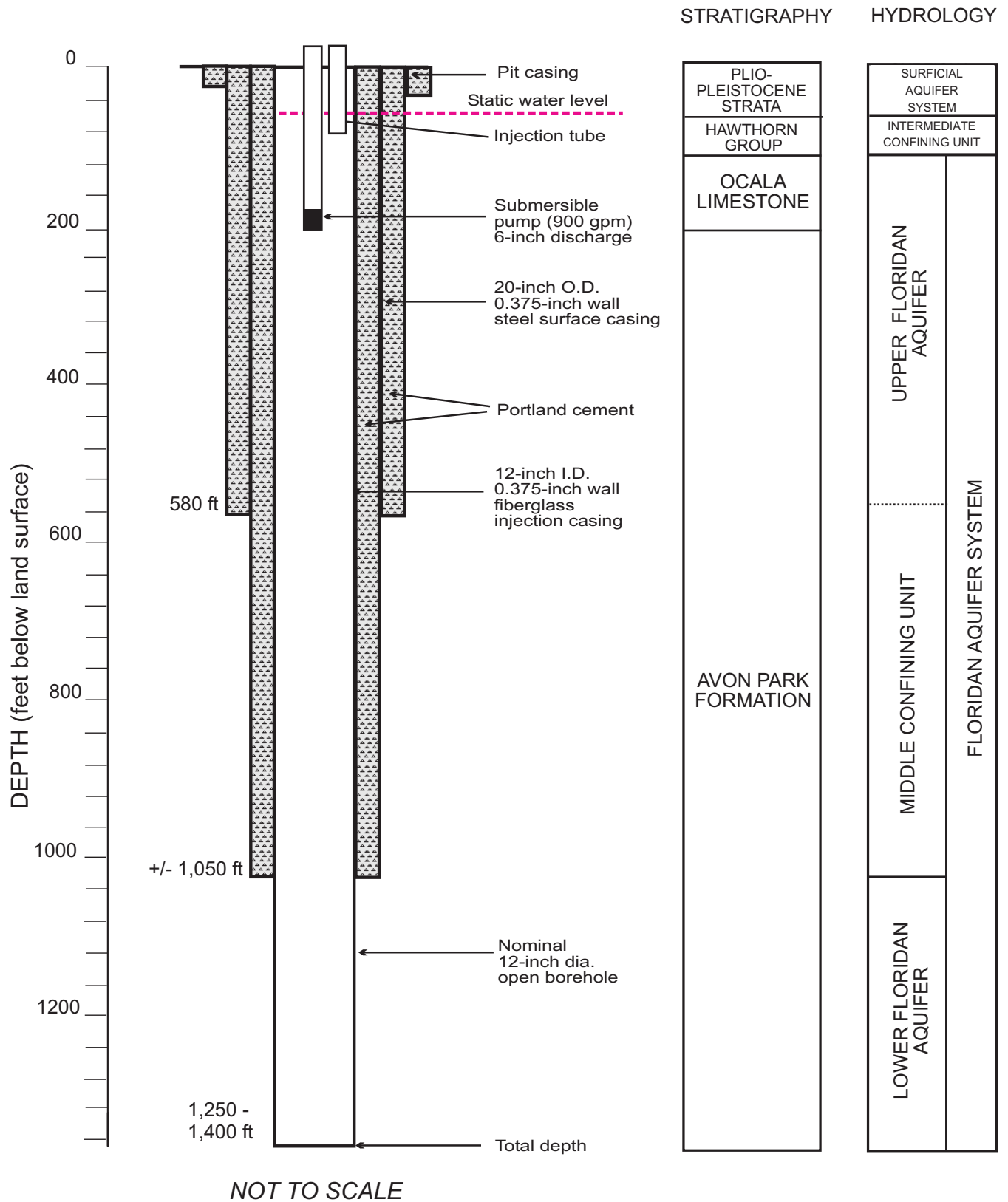
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Desktop Assessment of ASR
For Seminole County, FL

Figure 3-3
Exploratory Well Construction Diagram

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Desktop Assessment of ASR
For Seminole County, FL

Figure 3-4
ASR Well Construction Diagram

3.5 Hydrogeologic Testing

3.5.1 Exploratory Well Testing

Exploratory well sampling and testing is a crucial part of successful ASR system design and implementation. This is particularly important because areas that are most suitable for ASR wells typically have little available site-specific hydrogeology data, since these areas tend to be slightly brackish, making them unsuitable for potable water wells. Consequently, a thorough sampling and testing regime was planned for the selected site so that site-specific data needed to assess the potential for success of ASR could be collected.

The hydrogeologic testing program included:

- While drilling the 8-inch diameter bore hole using the reverse-air rotary method, collect reverse-air discharge water at each drill rod addition (20 to 30 foot intervals) and analyze for chlorides and specific conductance.
- While drilling the 8-inch diameter bore hole using the reverse-air rotary method, collect approximately five, 4-inch diameter cores and perform five packer tests in order to obtain data on the porosity, hydraulic conductivity, and water quality of the upper part of the Upper Floridan Aquifer.
- Collect a water sample from the completed well after a step-drawdown test and analyze for primary and secondary inorganic drinking water parameters, as well as major cations and anions.
- Collect cuttings at 10-foot intervals during drilling for examination by a geologist for lithology, fossils, diagenetic (i.e., layering and porosity of sediments) features, and apparent porosity and permeability. Prepare and examine thin sections of cutting and core samples from the storage zone for texture, composition (mineralogy), and diagenesis. The SJRWMD ASR program geochemical sampling and testing protocol would be implemented to evaluate the potential for adverse fluid-rock interaction.
- Complete a full suite of geophysical logs on the borehole including:
 - Caliper,
 - Natural gamma ray,
 - Dual-induction (or 16- and 64-inch normal resistivity),
 - Sonic with Variable Density Log,
 - Dynamic and static flows,

- Dynamic and static temperature,
 - Dynamic and static fluid resistivity, and
 - Down-hole video survey
-
- Complete two step-drawdown tests on the open hole interval. The first test on the middle confining zone and the second test on the entire completed 8-inch borehole. The time-drawdown data from the step-drawdown test and flow meter log results would provide information on the transmissivities of both the middle confining zone and the overall storage zone.
 - Complete a step-drawdown test on the completed well.

The results of the hydrogeologic testing program would provide data that allow for an evaluation of ASR feasibility at the site.

Section 4

Cooperator Agreement

4.1 Cooperator Agreement

On August 5, 2003, the SJRWMD and Seminole County entered into a Memorandum of Understanding (MOU) #SG341AA. The MOU was for the County to share funding costs with SJRWMD to design, permit and construct an ASR system on County property. The MOU expired on August 5, 2008. A copy of the MOU is included in **Appendix B**. The MOU established that:

- Both the SJRWMD and the County would have programmatic authority and established funding sources to cost-share the project.
- The goal of the project is to demonstrate that ASR is a feasible technology for utilities in the East-Central Florida region.

The MOU included a Statement of Work identifying the goals of the project and a scope of work for the project. The scope of work included the tasks that would be performed under the MOU, which were consistent with the tasks identified in the Program Plan (Section 2).

Amendment #1 to the MOU was issued on January 11, 2007, and included a revised Statement of Work, which included work associated with the design, construction, permitting, and testing of the pretreatment system. Amendment #2 to the MOU was issued on August 8, 2008 to extend the MOU expiration date to September 30, 2010. Amendment #3 to the MOU was issued on December 3, 2009, and included the incorporation of the pretreatment system. Amendment #4 was issued to extend the MOU expiration date to September 30, 2012. Copies of the amendments are included in Appendix B

Section 5

Preliminary Basis of Design

5.1 Basic Operational Concept

5.1.1 ASR and Monitoring Wells

As part of the Exploratory Well Project Report (CDM, 2005), CDM prepared a preliminary ASR system design. The design consisted of an ASR well, one storage zone monitoring well, and one confining zone monitoring well (referred to as shallow Floridan monitoring well in the Exploratory Well Project Report) completed above the ASR storage zone. The exploratory well was proposed to serve as storage zone monitoring well 1 (SZMW-1) located approximately 500 feet west of the proposed ASR well location. A site plan showing the proposed well locations is provided in **Figure 5-1**. Proposed construction diagrams for the ASR well and confining zone monitoring well 1 (CZMW-1), are shown on **Figures 5-2 and 5-3**.

Prior to construction of the ASR system, a second storage zone monitoring well was added to meet the requirements of the FDEP Underground Injection Control (UIC) permit. The second storage zone monitoring well (SZMW-2) was proposed to be located at the original location of the ASR well. The proposed location of the ASR well was moved approximately 350 feet west (or 150 feet east of the exploratory well). Additional information on the final location of the ASR well and monitoring wells is provided in Section 6.

5.1.2 Pipeline

The conceptual design included tapping into the County's finished water line west of the ASR well, along Orange Boulevard, with a supply line and separate return line back to the Markham Regional WTP, where the recovered water could be disinfected and discharged into the distribution system. **Figures 5-4 and 5-5** present the preliminary piping layout and **Figure 5-6** presents the wellhead piping construction diagram, as presented in the Exploratory Well Project Report (CDM, 2005.)

5.1.3 Pilot ASR System Capacity

The capacity of a one-well pilot ASR system depends largely upon the specific injectivity (the inverse of specific capacity) of the ASR well. The target capacity of the pilot ASR system was a minimum of 1 mgd (694 gallons per minute (gpm)). The completed exploratory well had a specific capacity of 8.7 gallons per minute per foot at a pumping rate of 261 GPM, which corresponds to 80 feet of drawdown at a 1 mgd pumping rate. A drawdown of 80 feet or less at a 1 mgd pumping rate would be expected in a larger diameter well, which would be acceptable for an ASR system. This translates into an injection pressure of approximately 34 pounds per square inch (psi) needed to inject the source water into the ASR well.

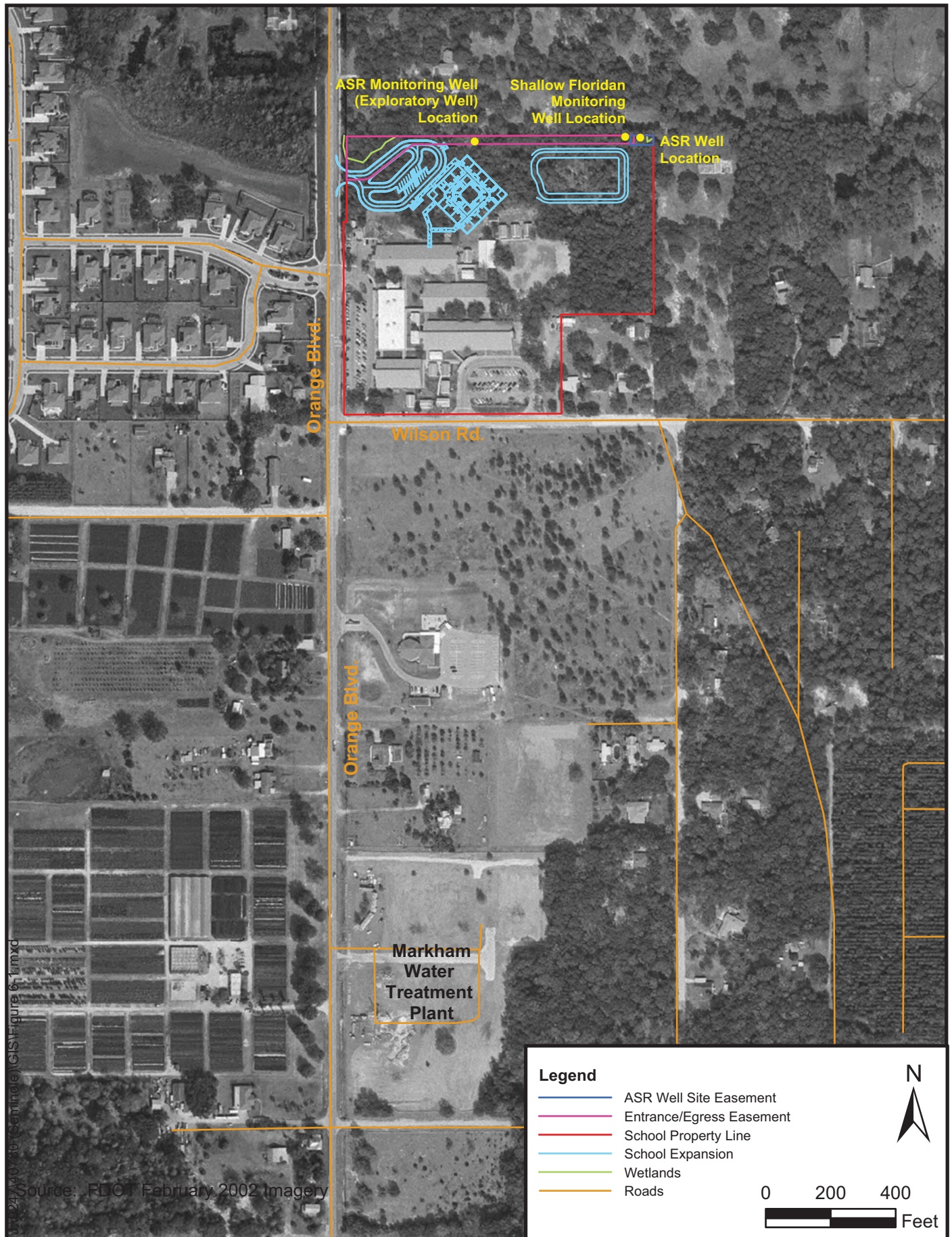
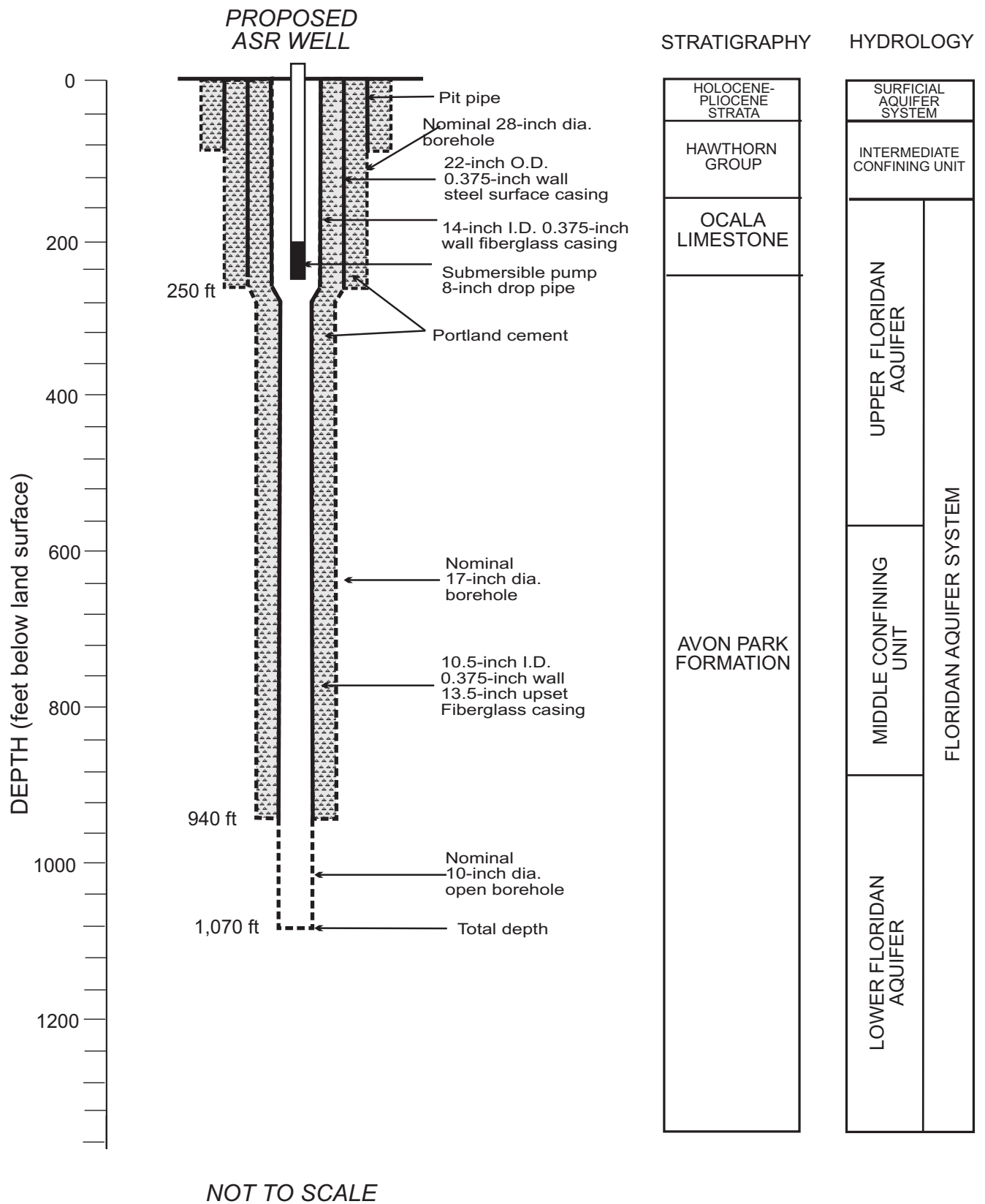
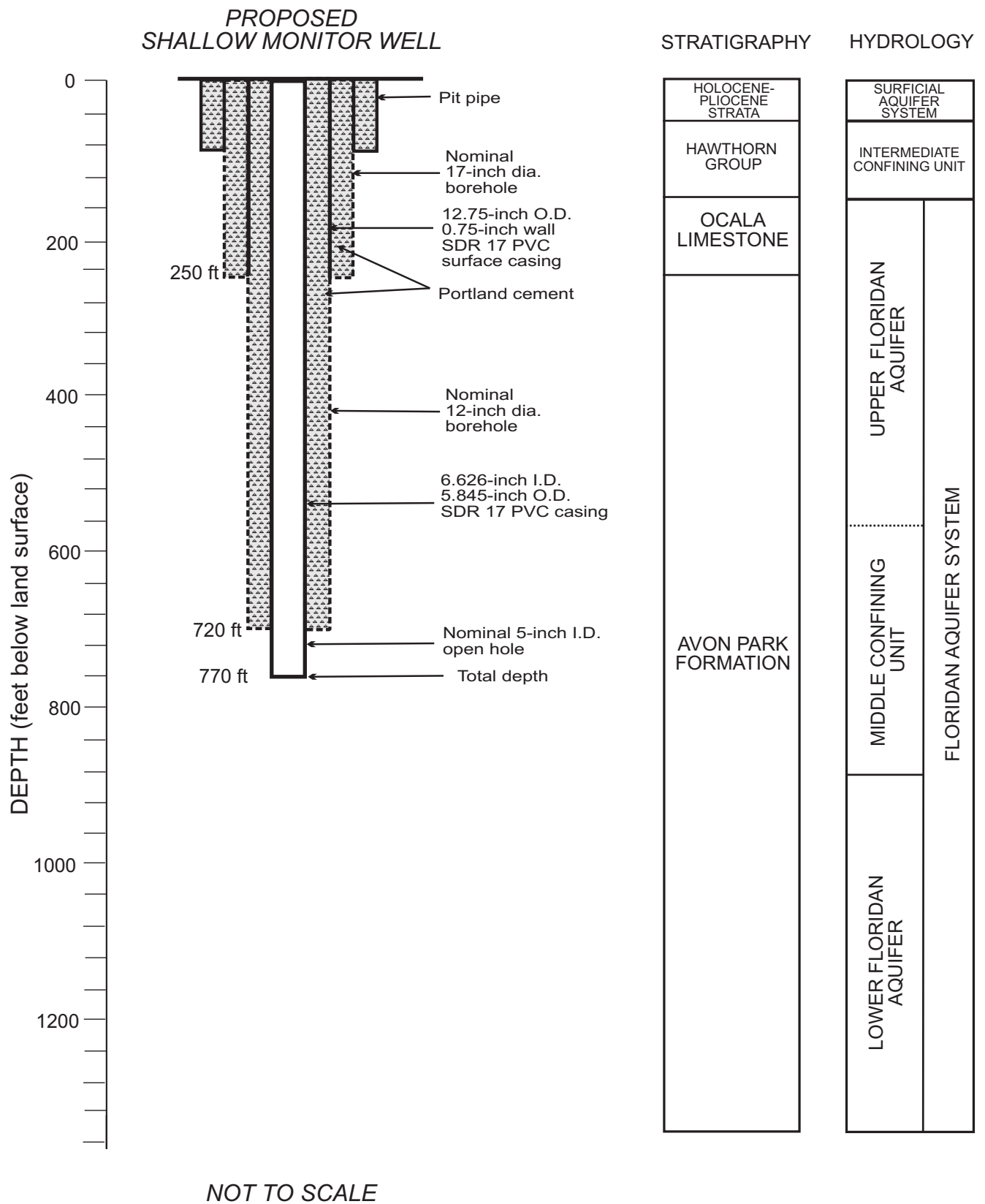


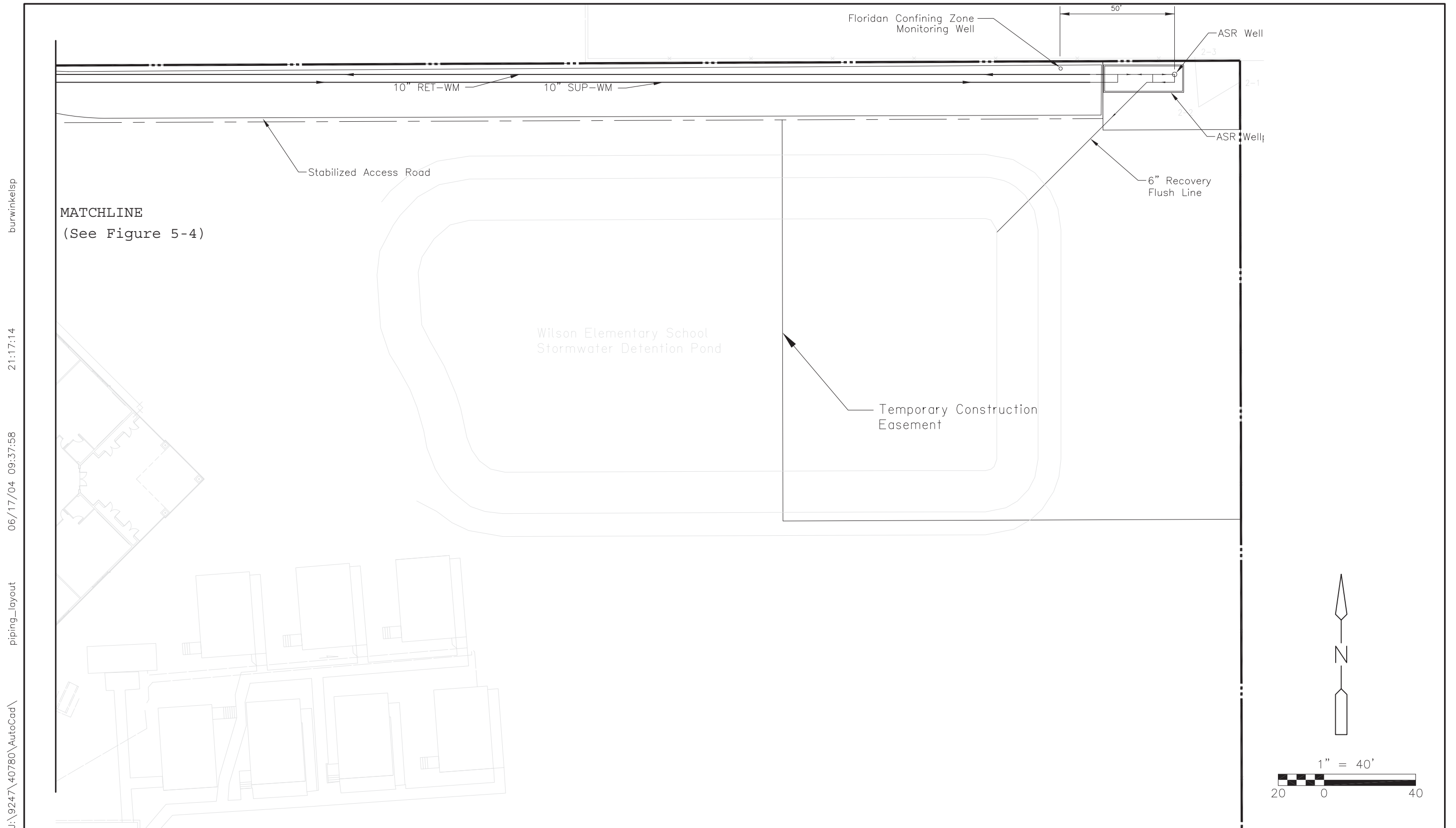
Figure 5-1
Proposed Well Location Map

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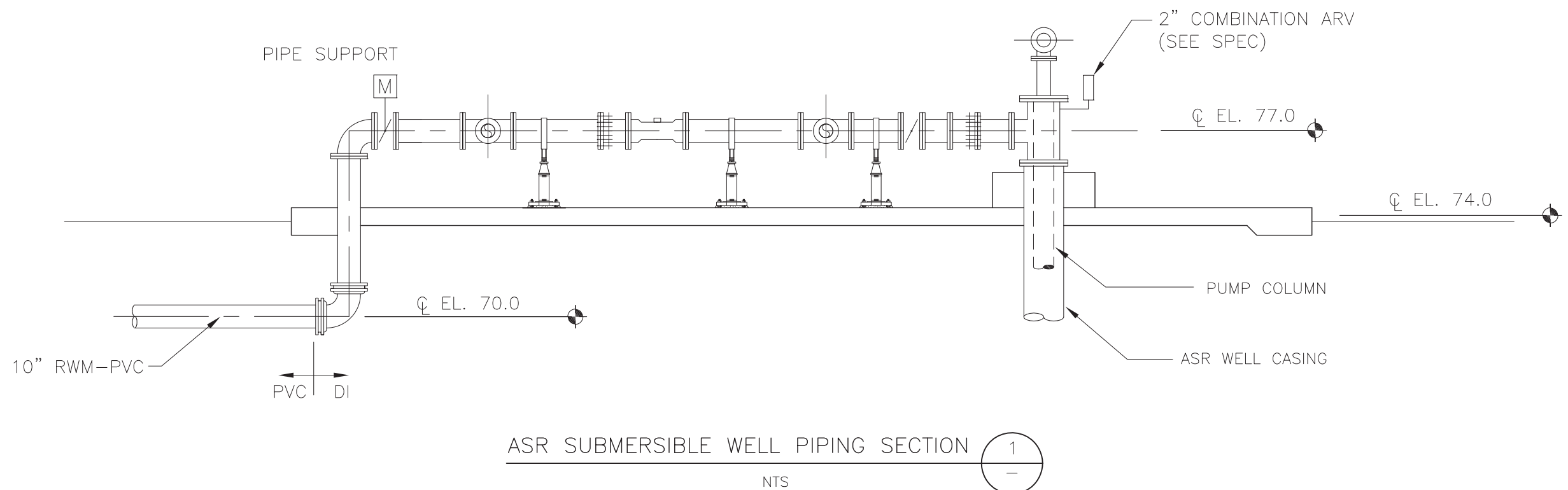
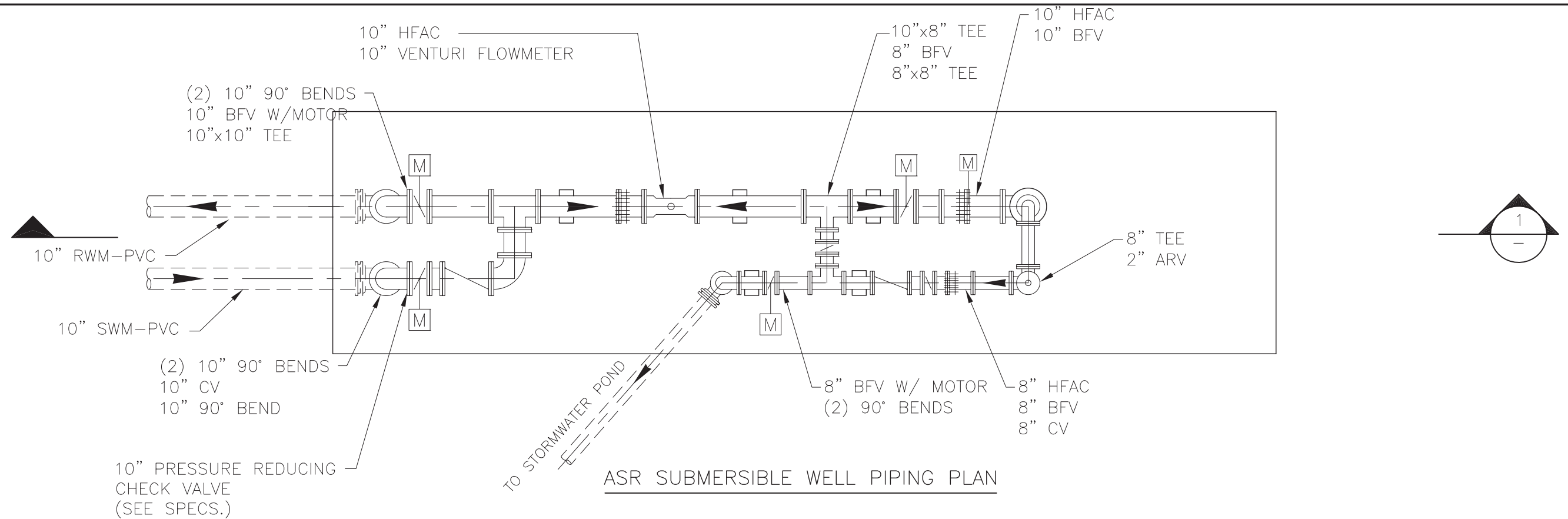
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5.1.4 Recovery Efficiency

The recovery efficiency of the ASR system is dependent upon a number of variables including storage zone water quality (primarily salinity), the transmissivity, dispersivity, leakances, nature of hydraulic conductivity (conduit/fracture versus matrix), effective porosity, heterogeneity and anisotropy of the ASR storage zones, and hydraulic gradients of the aquifer. Solute-transport modeling can be used to predict ASR system performance, but the results of such modeling are dependent on accurate data for model calibration. Modeling studies performed by CDM (Maliva *et al.*, 2003) and others (Merritt, 1985; Quinones-Aponte and Wexler, 1995, Yobbi, 1996; 1997) all indicate that storage zone salinity is an important, if not the most important, variable in controlling the recovery efficiency of ASR systems in brackish water. Lower salinities favor high recovery efficiencies because more mixing of recharge water and native water can occur before the recharge water exceeds drinking water standards for TDS and chloride.

The low salinities, in the Markham Regional WTP ASR site storage zone, as well as in the adjoining confining strata, are favorable for high recovery efficiencies.

5.2 Preliminary List of Drawings and Specifications

The major preliminary design elements as reported in the Exploratory Well Project Report (CDM, 2005) consisted of:

- A 10.5-inch diameter ASR well;
- A 6.625-inch diameter Floridan Aquifer storage zone monitoring well (*i.e.* exploratory well);
- A 6.625-inch diameter confining zone monitoring well completed above the ASR storage zone;
- A submersible pump for the ASR well;
- 925 feet of 10-inch diameter supply water main between the ASR well and the County's finished water line along Orange Boulevard;
- 3,280 feet of 10-inch diameter return water main between the ASR well and the Markham Regional WTP;
- 72 feet of 6-inch diameter flush line to the proposed stormwater retention pond at Wilson Elementary school;
- A pressure reducing check valve and control valves; and
- Instrumentation and controls.

The following drawings and specifications were included in the Exploratory Well Project Report for Seminole County, Florida (CDM, 2005):

- Well construction and testing diagrams for the ASR well;
- Well construction and testing diagrams for the Floridan Aquifer confining zone monitoring well (also referred to as shallow monitoring well in the Report);
- Piping layout of the utility connections; and
- Wellhead construction and piping diagram for the ASR well.

5.3 Exploratory Well Construction Program

The Exploratory Well Project Report was submitted as final in June 2005 and is included on the DVD in Appendix F. Sections 5.2 and 5.4 provide a summary of that report. An exploratory well program was implemented at the Markham Regional WTP site to obtain site-specific data on hydrogeology and water quality in order to further assess ASR feasibility, identify a potential ASR system storage zone, and evaluate potential ASR system performance. The testing program included obtaining a 2.5-inch diameter core from 600 to 1,352 ft bls, geophysical logging, core porosity and permeability measurements, packer testing, thin-section and x-ray diffractometry analyses, step-drawdown testing, and whole-rock and water chemical analyses.

Drilling was initiated in January 2004 and completed in June 2004. The exploratory well was constructed with:

- 24-inch diameter steel pit pipe set to 93 ft bls (temporary);
- 23-inch diameter borehole drilled to 249 ft bls using mud-rotary drilling;
- 16-inch diameter steel casing set to 249 ft bls;
- Nominal 15-inch diameter borehole to a depth of 601 ft bls using reverse-air rotary drilling;
- 10-inch diameter steel casing set to 601 ft bls;
- 2.5-inch continuous wireline coring to 1,352 ft bls;
- 10-inch diameter borehole to a depth of 1,352 ft bls using reverse-air rotary drilling;
- Back-grouted the ASR well to a depth of 1,070 ft bls;
- 5-inch diameter steel casing set to 940 ft bls; and
- ASR storage zone 940-1,070 ft bls.

5.4 Testing of Exploratory Well

The Markham Regional WTP ASR exploratory well project had an extensive testing program in order to obtain site-specific hydrogeologic data to be used to identify a potential ASR system storage zone and evaluate potential ASR system performance. Testing included:

- Well cuttings and core samples were described in the field according to rock type, color, texture, mineralogy, and apparent porosity. Identification of dolomite and calcite were confirmed by screening using dilute hydrochloric acid and alizarin red staining.
- Geophysical logging program designed to collect information on the hydrogeology of penetrated strata, data on borehole geometry that would assist in the setting and cementing of casing strings, determining packer intervals, and identifying and evaluating potential ASR storage zones and confining strata.
- Thin sections prepared for 21 samples of the exploratory well core and cuttings from 750 to 1,345 ft bls. The objective of the thin section analyses was to obtain information on the lithology and composition of the main rock types encountered in the core, particularly mineralogy, texture, porosity (abundance and type), and apparent hydraulic conductivity. The sampled interval included the ASR storage zone and adjoining confining strata. The samples included representatives of the main rock types observed in the core.
- X-ray diffraction (XRD) analyses performed on four bulk rock samples to confirm the mineralogical characterization made by thin section petrography. Samples were analyzed from 975 (both moldic and laminated dolostone lithologies), 1,010 and 1,076 ft bls.
- Whole-rock elemental analyses of core samples from 905, 974, 1,007, 1,028.5, 1,046.5, and 1,061.5 ft bls were performed by the Florida Geological Survey (FGS) using inductively coupled plasma spectrometry (ICP).
- Samples of the discharge water from the reverse-air circulation system were collected during drilling, and the remaining of the core hole to total depth, and analyzed in the field for pH, specific conductance, and chloride concentration. In general, the reverse-air discharge water can provide some semi-quantitative insights into changes in aquifer water quality with depth.
- A total of eleven packer tests performed on the reamed hole in order to obtain site-specific information of water quality and aquifer hydraulics. Ten of the tests were performed using a straddle packer assembly with a 20 ft spacing between elements.

- A total of 25 core samples were analyzed for porosity and hydraulic conductivity (both vertical and horizontal) by the FGS.
- A step-drawdown test was performed on the completed Exploratory Well. The objectives of the test were (1) to evaluate potential ASR well yields, (2) obtain an estimated transmissivity for the ASR storage zone, and (3) obtain aquifer water quality data on the ASR storage zone.

A summary of the site-specific lithology and hydrostratigraphy based on the results of these tests is summarized below.

5.4.1 Site-Specific Lithology

The site specific lithology at the Markham Regional WTP site was derived from drill cuttings and continuous core samples and can be summarized by the following general descriptions:

- 0-57 ft bls - sand/silty sand, dark brown to grayish brown, mostly very fine to fine grained size quartz sand, undifferentiated plio-pliestocene surficial deposits.
- 57-80 ft bls - clay with sand, silt, greenish gray, Hawthorn Group.
- 80-95 ft bls - clay with sand, silt, and shell hash, greenish gray, Hawthorn Group.
- 95-100 ft bls - marl, phosphatic sands, mostly medium to coarse grained, silt, shell, gray, Hawthorn Group.
- 100-140 ft bls - phosphatic dolostone, microcrystalline, pale olive, Hawthorn Group.
- 140-147 ft bls - clay, marl, greenish gray, Hawthorn Group.
- 147-153 ft bls - clay phosphatic dolostone, microcrystalline, pale olive, Hawthorn Group.
- 153 - 249 ft bls - limestone, pale yellow, Ocala Formation.
- 249-275 ft bls - limestone, pale yellow, Avon Park Formation.
- 275-575 ft bls - dolostone and limestone, pale yellow to yellowish brown, Avon Park Formation.
- 575-1198 ft bls - dolostone, laminate, light to dark yellowish brown, Avon Park Formation.
- 1198-1352 ft bls - dolostone and limestone, laminate, light to dark yellowish brown, Avon Park Formation.

5.4.2 Site Specific Hydrostratigraphy

The site specific hydrostratigraphy at the Markham Regional WTP ASR site can be summarized by the following general descriptions:

- 0-57 ft bls – surficial aquifer system; the surficial aquifer system strata consist predominantly of unconsolidated fine quartz sand and silt of Holocene to Pliocene age. The base of the surficial aquifer system at the Markham site is located approximately 57 ft bls.
- 57-153 ft bls – intermediate confining unit; described as pale olive to greenish gray clays, marls, and dolostones of the Hawthorn Group. The intermediate confining unit is present at the Markham site from approximately 57 to 153 ft bls.
- 153-575 ft bls – Upper Floridan Aquifer system; the top of the Floridan Aquifer system is placed at approximately 153 ft bls, at which depth there is a sharp contact from phosphatic microcrystalline dolostones (Hawthorn Group) to soft, porous non-phosphatic fossiliferous limestone (Ocala Formation). The contact between the Ocala Limestone and Avon Park Formation occurs at approximately 249 ft bls at the Markham site. The Floridan Aquifer system continues into the limestones and dolostones of the Avon Park Formation. The boundary between the Upper Floridan Aquifer and middle semiconfining unit is marked by an overall decrease in transmissivity. The main flow zones in the public water supply production wells, in the Upper Floridan Aquifer at the nearby Markham WTP, are intervals of fractured dolomite. The base of the Upper Floridan Aquifer is therefore placed at the depth of the lowest fractured dolostone interval in the upper part of the Avon Park Formation, which occurred at 575 ft bls in the Markham ASR exploratory well. The Upper Floridan Aquifer consists of limestone from 153 to 275 ft bls and interbedded limestone and dolostone from 275 to 575 ft bls. The entire Upper Floridan Aquifer contains freshwater.
- 575-947 ft bls – middle semiconfining unit; a sequence consisting virtually entirely of dolostone with varying abundances of moldic porosity (Avon Park Formation). The boundary between the middle semiconfining unit and the Lower Floridan Aquifer is placed at approximately 947 ft bls, below which depth there is an increase in the abundance of high porosity and/or fractured intervals, as indicated by increases in sonic transit times.
- 947-1,352 ft bls – Lower Floridan Aquifer system; the Lower Floridan Aquifer is generally marked by an abundance of high porosity and /or fractured intervals producing relatively high transmissivities and significant production zones. Water quality decreases rapidly below 1,300 ft bls, becoming more saline. The Lower Floridan Aquifer at the Markham site consists of dolostone from approximately 947 to 1,210 ft bls. A major flow zone is present in fractured rock at approximately 1,090 ft bls. Low porosity limestone is present from 1,210 to 1,270 ft bls. The remainder of the Lower Floridan Aquifer strata penetrated by the

exploratory well (1,270 to 1,351 ft bls) consists of dolostone. At depths below 1,300, some vugs are filled by anhydrite.

5.4.3 Water Quality Profile

The entire Upper Floridan Aquifer contains freshwater. The 250 mg/L chloride interface likely occurs between approximately 870 and 935 ft bls. The dynamic fluid conductivity log indicated that specific conductance (and thus salinity) gradually increases downhole from approximately 3,100 $\mu\text{mohs/cm}$ at 1,280 ft bls to approximately 4,000 $\mu\text{mohs/cm}$ at 1,304 ft bls and then rapidly increased with depth, reaching 20,000 $\mu\text{mohs/cm}$ at 1,340 ft bls.

5.5 FGS Leaching Study

The FGS was subcontracted to perform bench-scale experiments to evaluate the leachability of cores samples from the proposed ASR storage zone for arsenic and uranium. Experiments were performed on six samples from the ASR exploratory well (905, 974, 1007, 1,028.5, 1,046.5, and 1,061.5 ft bls), which include the main rock types within the proposed ASR storage zone. The experimental program includes two sets of experiments: (1) leaching under high dissolved oxygen conditions and (2) sequential extraction.

In April 2005, FGS submitted a Bench-Scale Geochemical Assessment of Water-Rock Interactions: Seminole County ASR Core Samples, which is included on the DVD in Appendix F. The maximum detected uranium concentration in the high dissolved oxygen leachability tests was 8.94 $\mu\text{g/L}$, which is well below the new USEPA MCL of 30 $\mu\text{g/L}$. Overall uranium concentrations decreased over the course of the testing.

Arsenic was leached from all samples. The maximum detected arsenic concentration in the high dissolved oxygen leachability tests was 36.73 $\mu\text{g/L}$, which occurred in the 1,061.5 ft bls sample at the beginning of cycle 1 (6/7/2004). The average arsenic concentration of the water samples extracted on 6/7/2004 was 16.1 $\mu\text{g/L}$, which exceeds the new arsenic MCL of 10 $\mu\text{g/L}$. Arsenic concentrations also decreased over the course of the testing. The average arsenic concentration at the end of cycle 3 (9/10/2004) was 8.2 $\mu\text{g/L}$. Over the course of the three high dissolved oxygen leachability cycles, the degree of arsenic leaching decreased by approximately a factor of two. Arsenic concentrations also tended to stabilize during each cycle, rather than progressively increase over time. The experimental results suggest that there is a very limited amount of arsenic in labile mineral or organic phases in the test samples, which was quickly mobilized during the experiment. Arsenic leaching in the proposed Markham ASR storage zone was, therefore, expected to be an ephemeral process.

It must be emphasized that the leaching experiments were performed under conservative laboratory conditions. The arsenic concentrations measured under the static and high dissolved oxygen experimental conditions are not representative of the concentrations that might occur in the actual ASR storage zone. A lower dissolved

oxygen concentration and fluid flow and mixing (much higher water-rock ratio) would be expected to result in lower arsenic concentrations in ASR and monitoring well samples than measured in the high dissolved oxygen leachability tests.

5.6 Expansion Plan

In 2007, CDM performed a desktop evaluation of the existing Seminole County Markham Regional WTP ASR well system to determine the potential for expandability of the existing project into a small ASR Wellfield consisting of a total of three ASR wells. A copy of the report is provided in **Appendix C**. Several criteria were considered in the placement of the two new wells and well piping, specifically required distance between ASR wells, distance from existing water supply wells, constructability, hydraulics, and easement requirements.

Based on the criteria listed above, CDM recommended placement of two additional ASR wells (ASR-2 and ASR-3), each with a capacity of 1 mgd, and two additional storage zone monitoring wells (SZMW-3 and SZMW-4) and two additional confining zone monitoring wells (CZMW-2 and CZMW-3) at the locations indicated on **Figure 5-7**.

Supply water to the new wells would be from the existing water main that runs along Orange Boulevard. ASR-2 would be served by a direct connection with the water main via an 8-inch PVC pipe. Supply water for ASR-3 would come from a connection to the existing 10-inch PVC pipe located on Wilson Elementary School property. Both ASR wells would have the ability to inject water simultaneously. A pressure sensor would be installed to shutdown both ASR wells (along with ASR-1) when fire flows are needed.

An evaluation of the existing ASR pipeline hydraulics indicated the existing 12-inch return water main (RWM) is not large enough to handle return water from all three wells simultaneously without excessive velocity. CDM recommended that, assuming the return water quality is of an acceptably high standard, the return water from ASR-3 be chlorinated at the wellhead and pumped directly into the distribution system, while the return water from ASR-1 and 2 utilizes the existing RWM. The County could opt to connect all three wells to the RWM but allow only two wells to ever run simultaneously, or, chlorinate the return water at each wellhead and pump directly into the distribution system, or a combination of both.



0 600 Feet

- Existing ASR Well
- Existing Monitoring Well
- Proposed ASR Well
- Proposed Monitoring Well
- Existing 12" HDPE RWM
- Approximate Water Distribution Main
- Proposed 8" PVC SWM
- Proposed 10" PVC RWM
- Future SR 429
- Future SR 429 Easement
- 50' x 50' Staging Area
- Construction Access
- Future Stormwater Pond

Legend

Section 6

Project Design

6.1 ASR Well and Monitoring Well Drilling and Testing Program

Details of the ASR well and monitoring well drilling and testing program can be found in the Seminole County Markham ASR Phase II Specifications dated December 2005 (Phase I pertained to construction of the water supply main and return water main). The primary components of the program included:

- Part 1 - Construction and testing of the ASR well
 - Mobilize and set up drilling equipment
 - Install and sample surficial aquifer monitoring wells
 - Install pit pipe thorough surficial unconsolidated sediments
 - Drill a nominal 28-inch diameter borehole to the top of the Avon Park Formation at approximately 250 ft bls
 - Install and cement in place approximately 250 feet of 24-inch outer diameter, 0.375-inch-wall steel surface casing
 - Drill using the reverse-air rotary method a nominal 17-inch diameter borehole to approximately 940 ft bls
 - Install and cement in place approximately 250 feet of 16-inch inner diameter, 0.375-inch wall fiberglass casing, a 14-inch inner diameter, 0.375-inch wall fiberglass adapter (20 foot section), a 12-inch inner diameter, 0.375-inch wall fiberglass adapter (20 foot section), a 10.5-inch inner diameter, 0.375-inch wall fiberglass adapter (20 foot section), and 630 feet of 10.5-inch inner diameter, 0.375-inch wall fiberglass casing (this was modified to CERTA-LOK PVC pipe during construction)
 - Drill using the reverse-air rotary method a nominal 10-inch diameter borehole to approximately 1,070 ft bls
 - Develop well until the water is free of sediment and flows clear to the satisfaction of the engineer
 - Perform geophysical logging of the borehole throughout drilling
 - Perform step drawdown test
 - Install temporary wellhead (water-tight stainless steel blind flange)
- Part 2 - Construction and testing of the storage zone monitoring well
 - Mobilize and set up drilling equipment
 - Install pit pipe thorough surficial unconsolidated sediments
 - Drill a nominal 17-inch diameter borehole to the top of the Avon Park Formation at approximately 250 ft bls
 - Install and cement in place approximately 250 feet of 12.75-inch outer diameter, 0.75-inch-wall SDR 17 PVC surface casing

- Drill using the reverse-air rotary method a nominal 12-inch diameter borehole to approximately 1,070 ft bls
 - Perform geophysical logging of the borehole
 - Perform Packer Test from 940 to 1,070 ft bls
 - Install and cement in place approximately 940 feet of 6.625-inch outer diameter, 0.390-inch wall, SDR 17 PVC casing.
 - If required, drill out a nominal 5-inch diameter open borehole from 940 to 1,070 ft bls
 - Develop monitor zone until the water is free of sediment and flows clear to the satisfaction of the engineer
 - Install temporary wellhead (water-tight stainless steel blind flange)
- Part 3 - Construction and testing of the confining zone monitoring well
- Mobilize and set up drilling equipment
 - Install pit pipe thorough surficial unconsolidated sediments
 - Drill a nominal 17-inch diameter borehole to the top of the Avon Park Formation at approximately 250 ft bls
 - Install and cement in place approximately 250 feet of 12.75-inch outer diameter, 0.75-inch-wall SDR 17 PVC surface casing
 - Drill using the reverse-air rotary method a nominal 12-inch diameter borehole to approximately 770 ft bls
 - Perform geophysical logging of the borehole
 - Perform a Packer Test from 720 to 770 ft bls
 - Install and cement in place approximately 720 feet of 6.625-inch outer diameter, 0.390-inch wall, SDR 17 PVC casing
 - If required, drill out a nominal 5-inch diameter open borehole from 720 to 770 ft bls
 - Develop monitor zone until the water is free of sediment and flows clear to the satisfaction of the engineer
 - Install temporary wellhead (water-tight stainless steel blind flange)
- Part 4 - Aquifer Performance Test for the ASR well
- Part 5 - Well disinfection

6.2 Conceptual Cycle Testing Plan

The cycle testing program was developed as part of the FDEP UIC permitting process. CDM submitted a Cycle Testing and Monitoring Program to Seminole County in April 2009. The initial cycle testing plan, as approved and incorporated into the initial UIC permit in September 2006, was modified as part of the major UIC permit modification and Administrative Order process in January 2009. The revision to the cycle testing plan established injection volumes that were expected to reach the closest storage zone monitoring well during Cycles 1 and 2 and the furthest storage zone monitoring well during Cycles 3 and 4. The entire injected volume was intended to be

recovered, dependent upon water quality results. Also, the revised cycle testing plan would allow for a range of volumes and durations to inject, store and recover water, allowing for more flexibility within the program. **Table 6-1** presents the final approved cycle testing program. The cycle testing monitoring program was also developed as part of the UIC permitting process and included bi-weekly, weekly, and monthly monitoring of various parameters from the ASR well and associated monitoring wells. **Table 6-2** summarizes the monitoring program including the parameters sampled and frequency. During both cycle testing and operational testing it may be necessary to periodically discharge water to the Wilson Elementary School retention pond or the detention ponds at the Markham Regional WTP site.

Table 6-1 Cycle Testing Program				
Cycle	Injection Volume	Storage	Recovery Volume†	Total Estimated Days
	(MG)	(days)	(MG)	(max)
1	4 to 12	10 to 30	4 to 12	54
2	4 to 12	10 to 30	4 to 12	54
3*	40 to 65	30 to 60	40 to 65	188
4**	40 to 65	30 to 60	40 to 65	188
Totals	88 to 154	80 to 180	88 to 154	484

Recovery will continue to the specified volume or until the chloride concentration in the recovered water increases to 250 mg/L, whichever is reached first.

† Recovery volumes will not exceed the injection volumes

* Used to simulate operational conditions

** Used to simulate operational conditions, if required by FDEP

Table 6-2 Cycle Testing Monitoring Plan				
Parameter	Criteria	Units	Frequency	
			ASR Well	MWs
Arsenic	10	µg/L	Twice/week	Twice/week
Chloride	250	mg/L	Weekly	Weekly
Dissolved Oxygen (field)	NA	mg/L	Weekly	Weekly
Iron, total	0.3	mg/L	Weekly	Weekly
Sodium	160	mg/L	Weekly	Weekly
pH	6.0-8.5	std. units	Weekly	Weekly
Specific Conductance (field)	NA	µmhos/cm	Weekly	Weekly
Sulfate	250	mg/L	Weekly	Weekly
Temperature (field)	NA	°C	Weekly	Weekly++
Total Dissolved Solids	500	mg/L	Weekly	Weekly
Bicarbonate	NA	mg/L	Weekly	Monthly

Table 6-2 (Continued) Cycle Testing Monitoring Plan				
Parameter	Criteria	Units	Frequency	
			ASR Well	MWs
Manganese	0.05	mg/L	Weekly	Monthly
ORP (field)	NA	mV	Weekly	Monthly
Potassium	NA	mg/L	Weekly	Monthly
Total Alkalinity	NA	mg/L	Weekly	Monthly
Total Trihalomethane	80	ug/L	Weekly	Monthly
Total Coliform	0	#/100 ml	Weekly+	Monthly
Fecal Coliform	0	#/100/ml	Weekly+	Monthly
Gross Alpha	3 / 15	pCi/L	Monthly	Monthly
Uranium	30	ug/L	Monthly	Monthly
²²⁶ Ra / ²²⁸ Ra	5	pCi/L	O	---
Primary and Secondary DW Parameters	Various		Annually	---

MWs - SZMW-1, SZMW-2, and CZMW-1

O – Only required when gross alpha exceeds 5 pCi/L, sampled beginning and end of recovery cycle.

+ – Weekly through Cycle Test 4, then twice monthly thereafter with Department written approval

++ – Weekly during recharge and recovery, monthly during storage

6.3 Development of Plans and Specifications

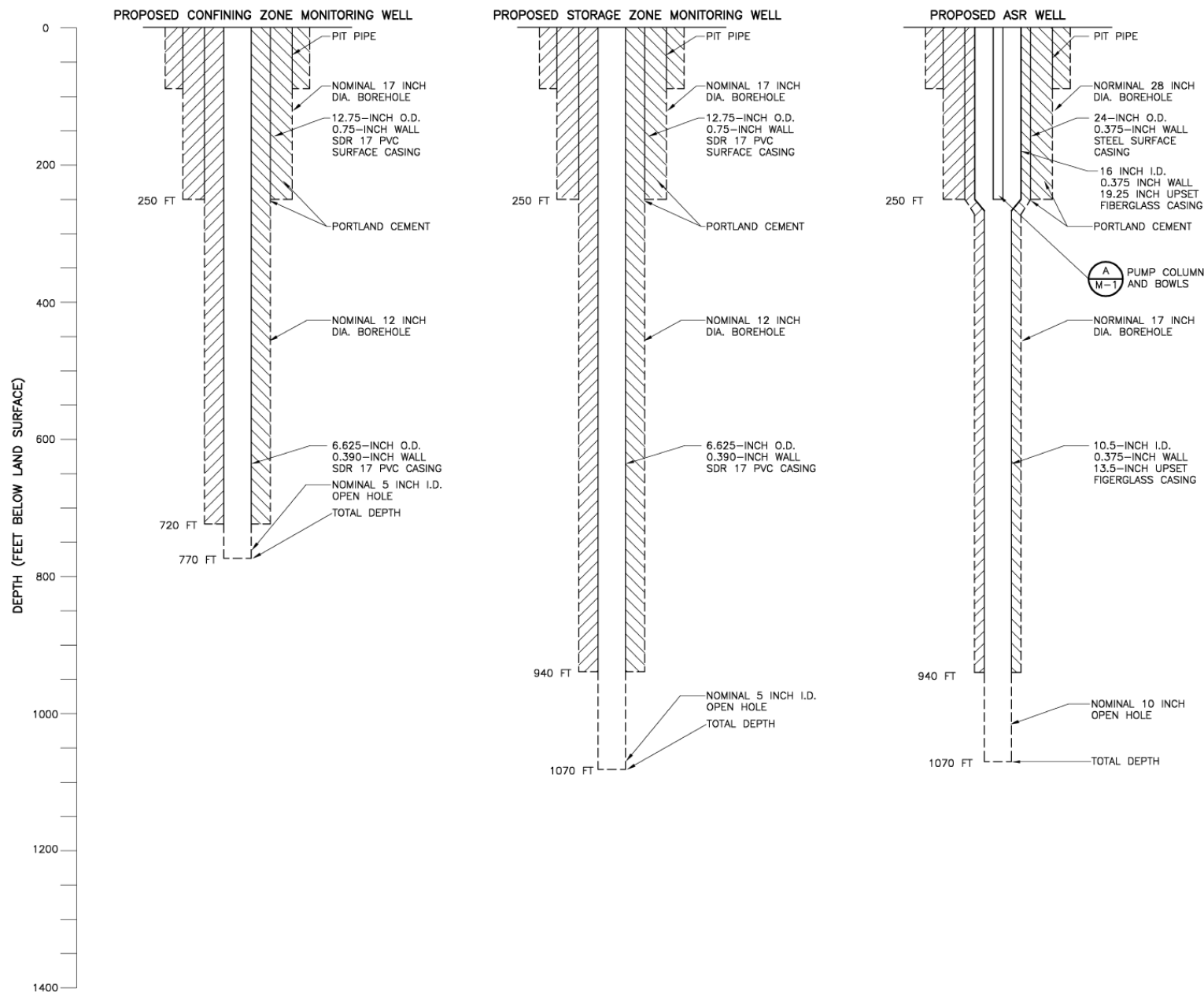
6.3.1 ASR Well, Monitoring Wells, and Surface Facilities

Plans and specifications for the ASR well, monitoring wells, and ASR surface facilities were developed by CDM. **Figure 6-1** shows the final design for the ASR well and associated monitoring wells and **Figure 6-2** shows the final site layout, the final piping plan is included in Appendix F in the Phase II Plans. The following documents were submitted to the SJRWMD and are included in Appendix F:

- Seminole County Markham ASR- Phase I Specifications dated September 2004.
- Seminole County Markham ASR- Phase I Plans dated September 2004.
- Seminole County Markham ASR- Phase II Specifications dated December 2005.
- Seminole County Markham ASR- Phase II Plans dated December 2005.

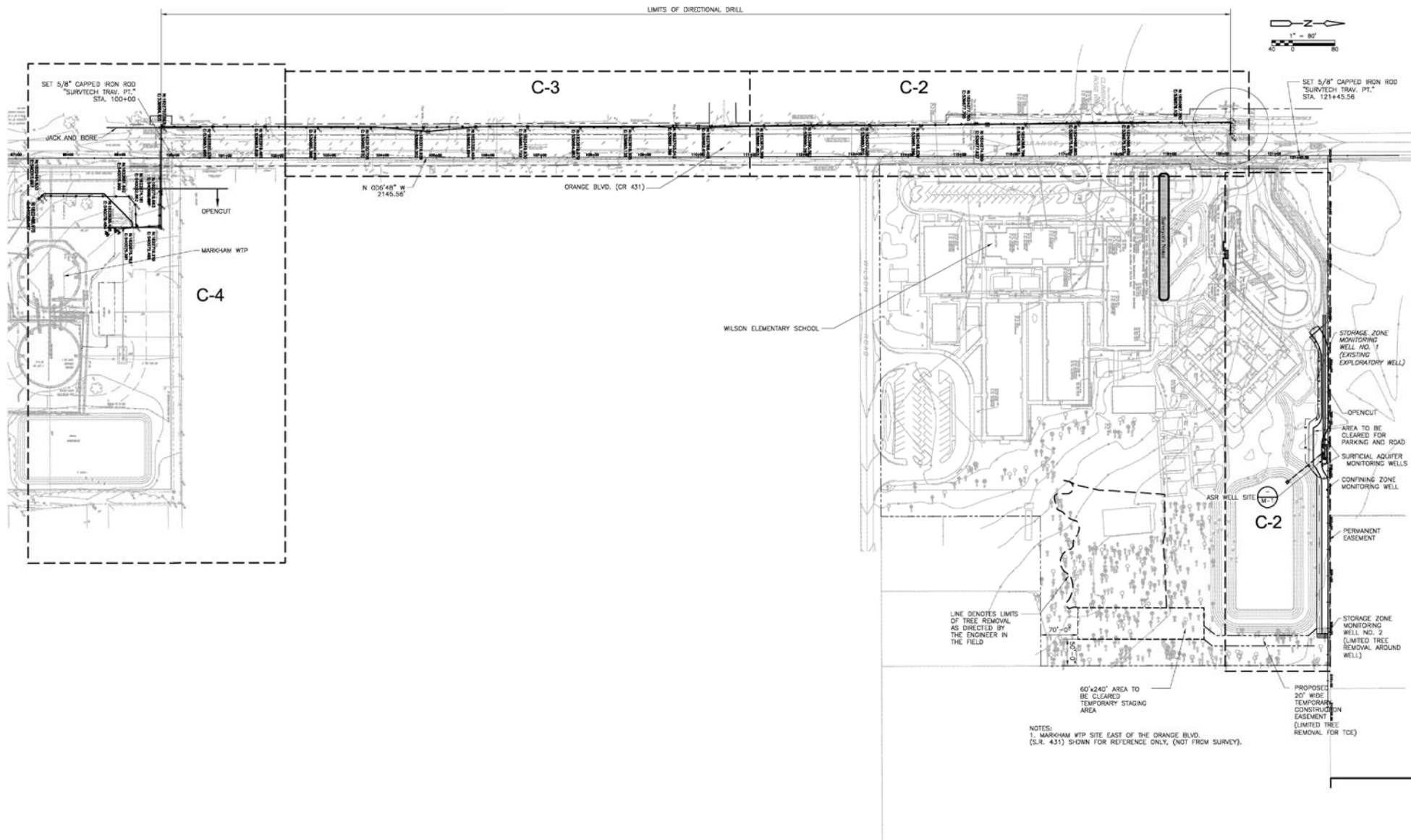
Major components include:

- ASR well,
- Storage zone monitoring wells,
- Confining zone monitoring well,



STRATIGRAPHY	HYDROLOGY	
	SURFICIAL AQUIFER SYSTEM	
HAWTHORN GROUP	INTERMEDIATE CONFINING UNIT	
OCALA Limestone	UPPER FLORIDAN AQUIFER	
AVON PARK FORMATION	MIDDLE CONFINING UNIT	FLORIDAN AQUIFER SYSTEM
	LOWER FLORIDAN AQUIFER	

Figure 6-1
Final ASR and Monitoring Wells Design Plans



Note: C-2, C-3, C-4 refers to sheets in
Seminole County Markham ASR- Phase II Plans dated December 2005.

Figure 6-2
Final ASR Site Layout

- Submersible pump,
- Valves,
- Electrical, and
- Instrumentation and Control.

6.3.2 Pretreatment System

Based on operational data for existing ASR systems and geochemical modeling performed by CDM (Bell et al, 2009) and others (Mirecki, 2006 & 2004; Arthur et al., 2003 & 2001; Welch, 1999), it was shown that injecting potable water with higher dissolved oxygen (DO) and oxidation-reduction potential (ORP) levels than native groundwater may cause naturally occurring minerals in the aquifer matrix, *i.e.* arsenopyrite, to be oxidized, releasing arsenic into the stored water, occasionally above the drinking water Maximum Contaminant Level (MCL) for arsenic (10 µg/L). Therefore, a pretreatment system was recommended to address the potential for arsenic leaching that may occur in the aquifer as a result of ASR cycle testing and subsequent full-scale operation.

The goal of pretreatment is to produce recharge water quality similar to the storage zone native groundwater through chlorine residual (Cl₂) removal and DO reduction through degasification to reduce arsenic leaching potential. Degasification systems have a tolerance of up to 1.0 mg/L Cl₂ to prevent oxidation of the membranes, removal of Cl₂ will help protect the membranes, and an additional benefit includes a decrease in ORP. The final site layout for the pretreatment system is shown on **Figure 6-3**.

Plans and specifications for the ASR pretreatment system were developed by CDM. The follow documents were submitted to the SJRWMD and are included in Appendix F:

- ASR Dechlorination/Degasification System at the Seminole County Markham Regional WTP Specifications dated May 2009.
- ASR Dechlorination/Degasification System at the Seminole County Markham Regional WTP 100% Submittal for Construction Plans dated May 2009.

Dechlorination System Components:

- Influent and effluent chlorine sensors;
- 10-inch flow and pressure regulating check valve;
- 550-gallon sodium bisulfite double walled poly tank;

- 2 peristaltic chemical metering pumps;
- Ultrasonic tank level sensor;
- Emergency eyewash and shower;
- Static mixer;
- 10-inch Venturi flow meter; and
- 24-inch diameter detention pipe.

Degasification System Components:

- Influent and effluent DO sensors;
- 4-14x24 inch Membrana Liqui-Cel® contactors;
- Liquid-ring vacuum pump;
- Nitrogen generator and buffer tank;
- Air compressor and dryer;
- Influent and effluent pressure sensors; and
- Control panel.

Shared Components include:

- System control panel;
- Influent and effluent motorized butterfly valves;
- ORP analyzer;
- Sample ports;
- By-pass piping; and
- Steel canopy and treatment system pad.

Section 7

Regulatory Permitting

7.1 Permits

Several permits were acquired prior to construction and testing activities at the Seminole County Markham Regional WTP ASR project site. The following sections summarize the permits obtained for the project, including pretreatment construction and cycle testing.

7.1.1 FDEP Underground Injection Control (UIC) Permit

FDEP Underground Injection Control (UIC) permit number 59-0250382-001-UC was issued on February 28, 2006 to construct one Class V, Group Seven, ASR injection well system (FDEP, 2006). The FDEP issued a minor modification to this permit on December 7, 2006, to change the ASR well casing material from fiberglass to polyvinylchloride (PVC). A second minor modification was issued by FDEP on June 27, 2008 to construct dechlorination and degasification pretreatment equipment for the ASR system. A third modification was issued by FDEP on November 20, 2009 for changes to the cycle testing and monitoring program, and included the Administrative Order (AO-09-0003). The AO allows Seminole County to continue ASR operations while having exceedances of the drinking water MCL for arsenic in the ASR storage zone during cycle testing. The permit expired on February 27, 2011 and the County is currently in the renewal process. The permit, modifications and AO are included in **Appendix D** and the permit application is included on the DVD in Appendix F.

7.1.2 SJRWMD Consumptive Use Permit (CUP)

A CUP was obtained to use groundwater withdrawn from the Floridan Aquifer at the Markham Regional WTP for cycle testing. The SJRWMD issued permit number 103709 on April 27, 2006. The permit expired on December 31, 2009. The permit was renewed and the current permit expires December 1, 2012. Copies of the permits are included on the DVD in Appendix F.

7.1.3 SJRWMD Well Construction Permits

Three well construction permits were acquired from the SJRWMD to construct the ASR well and Floridan Aquifer monitoring wells at the Markham site. Permit numbers 103835-1, 103843-1, and 103842-1 were issued on June 6, 2006, for wells ASR-1, SZMW-2, and CZMW-1, respectively. A right-of-way construction permit was obtained for pipeline construction activities within Seminole County Public Right-of-Ways. Permit number 82122 was issued on August 24, 2006, by Seminole County, and it expired on February 24, 2007. Copies of these permits are included on the DVD in Appendix F.

7.1.4 FDEP Public Water Supply (PWS) Permits

FDEP PWS permit number WD59-0079860-175 was acquired for the Phase I construction activities, which included construction of a dry line distribution system (supply) extension and a return water dry-line main. The permit was issued October 4, 2004, and expired on September 29, 2007.

A PWS permit was acquired to construct the southern extension of the return water main from the endpoint of the Phase I construction activities to the Markham WTP. The 12-inch main was constructed under FDEP permit number WD59-0079860-202, issued January 20, 2006, and expired on January 9, 2011.

An additional PWS permit was acquired to construct the eastern extensions of the supply and return water mains to the ASR well. The FDEP issued permit number WD59-0079860-203 on January 20, 2006, which expired on January 9, 2011.

FDEP issued permit number WC-59-0079860-208 on September 8, 2006, to equip and connect the ASR well to the previously permitted supply & return water mains between the ASR Well and the Markham WTP. The permit expires on August 21, 2011.

On August 12, 2008, FDEP issued Public Water Supply (PWS) permit number WC59-0079860-277 to construct a dechlorination and degasification system to treat potable water prior to injection to the ASR well (FDEP, 2008). On January 22, 2010 the FDEP issued the final clearance for operation of the pretreatment system. Copies of these permits are included on the DVD in Appendix F.

Section 8

ASR Facilities Construction, Start-up, Monitoring and Training

8.1 Construction and Testing of the ASR Well and Monitoring Wells

The ASR well (ASR-1), storage zone monitoring well 2 (SZMW-2), and confining zone monitoring well (CZMW-1) were constructed from August 2006 to April 2007. Well construction details were provided in the Project Record Drawings (CDM, September 2008.) The exploratory well, previously described in Sections 5.4 and 5.5, is defined as storage zone monitoring well 1 (SZMW-1). **Figure 8-1** shows the locations of the wells and the final site layout. **Figure 8-2** shows the final design of the ASR well, SZMW-2, and CZMW-1.

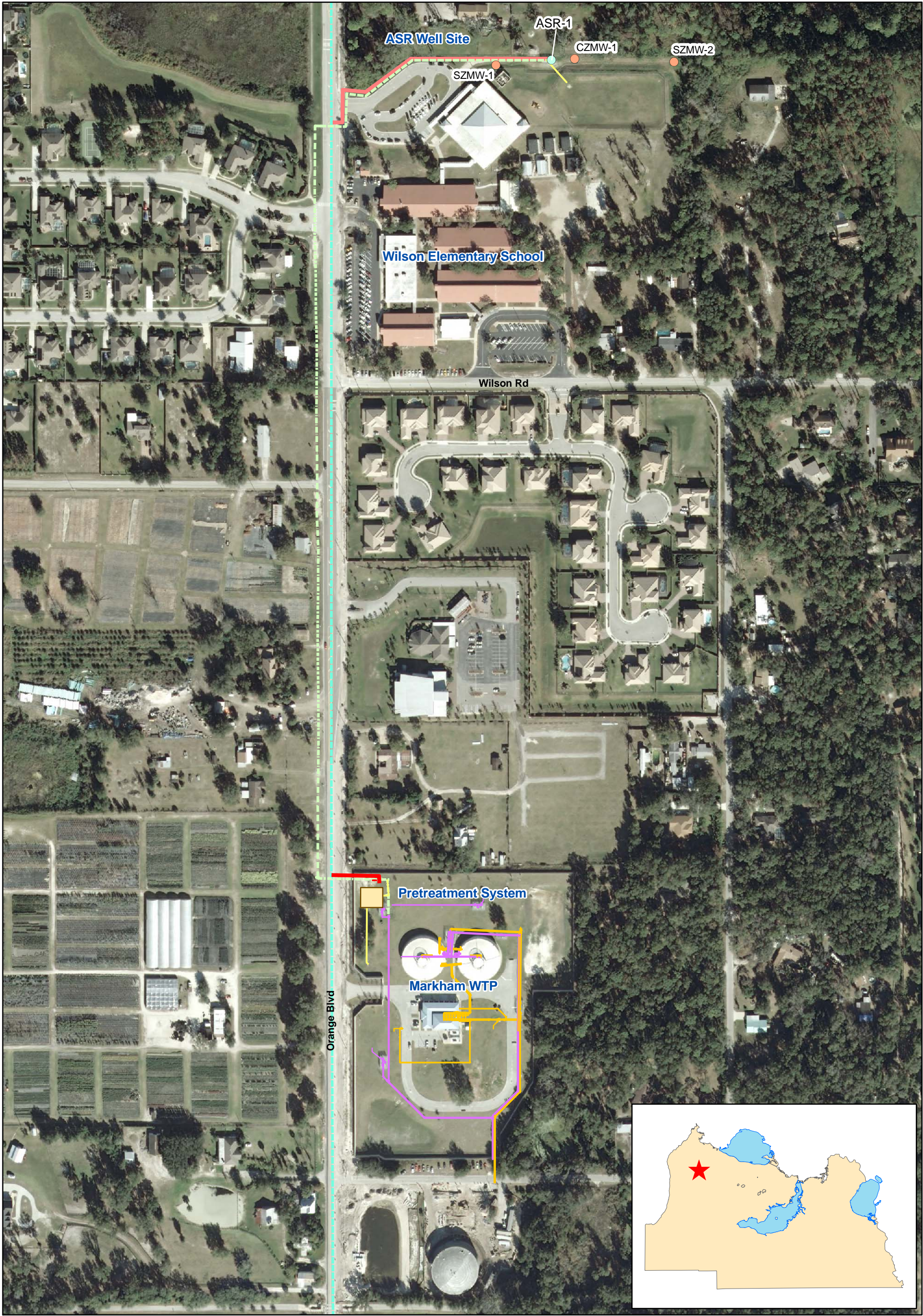
8.1.1 Hydrogeologic Framework

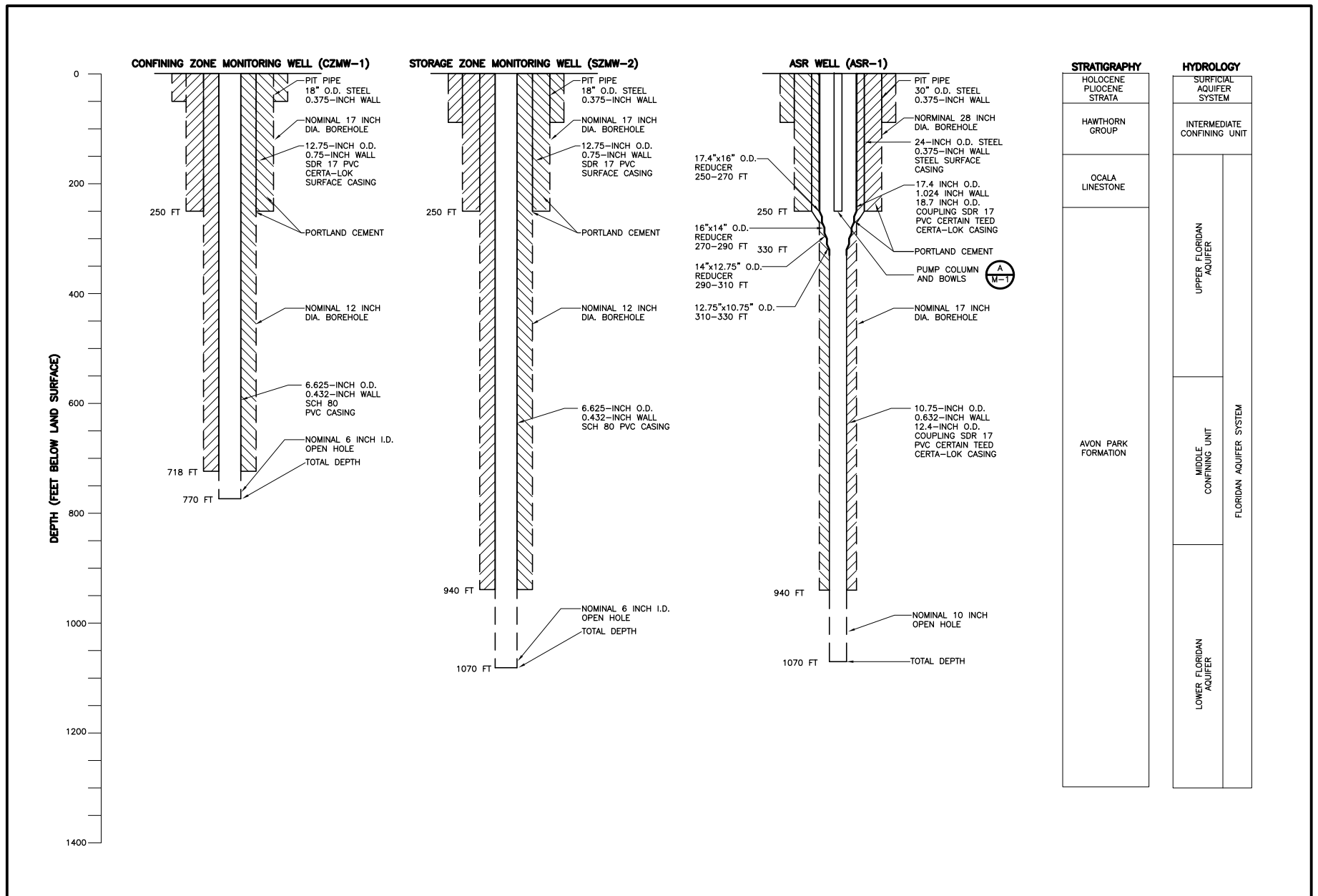
The hydrogeology of the Markham Regional WTP ASR site was evaluated from well cuttings, core, and geophysical logs obtained during the drilling of ASR-1, and monitoring wells CZMW-1, SZMW-1, and SZMW-2. Results were consistent with those from based on the exploratory well (SZMW-1) and were previously presented in Section 5.5.

8.1.2 ASR Well

Construction of the ASR well began in August 2006, with testing completed in March 2007. ASR-1 has two strings of steel casing and one string of SDR 17 PVC casing. The 24-inch steel surface casing was set to 250 ft bls and cases off the surficial aquifer system, the Hawthorn Group, and the Ocala Formation of the Upper Floridan Aquifer. The 17.4-inch OD SDR 17 PVC casing was set to 250 ft bls, where it begins a sequence of transition pipe: between 250 to 270 ft bls the pipe reduces from 17.4-inch to 16-inch OD; between 270-290 ft bls the pipe reduces from 16-inch to 14-inch OD; between 290-310 ft bls the pipe reduces from 14-inch to 12-inch OD, and finally transitions from 12-inch to 10.75-inch OD casing. This casing string, set to 940 ft bls, cases off the Upper Floridan Aquifer potable water production zones and the middle semi-confining unit, which separates the Upper and Lower Floridan Aquifers. A nominal 10-inch diameter open borehole originally extended from 940 to 1,070 ft bls.

On December 18, 2006, a preliminary pressure test was performed for 1 hour at 70 pounds per square inch (psi) on the ASR well. The ASR well pressure test was performed on December 19, 2006. The pressure test was conducted at 69 psi for 1 hour. During this time there was less than a 5% drop in pressure, which is an acceptable pressure loss.





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Figure No. 8.2
Final ASR and Monitoring Wells Construction Diagrams
Seminole County

As part of the geophysical logging program, both video logs and temperature logs were collected for the ASR well. The results of the geophysical logging did not produce any evidence that would suggest that the well casing was not structurally sound.

8.1.3 Storage Zone Monitoring Well 2

Construction of SZMW-2 began in January 2007 and was completed in April 2007. SZMW-2 has an 18-inch steel pit pipe casing set to 100 ft bls. The 12.75-inch OD SDR 17 PVC surface casing was set to 250 ft bls. The SJRWMD required that the surface casing extend completely through the Ocala Formation because the project site vicinity is located within an area of known contamination according to the FDEP (Chapter 62-524, F.A.C.) The 6.625-inch OD SDR 17 PVC casing is set from land surface to 940 ft bls. The nominal 6-inch diameter open borehole originally extended from 940 to 1,070 ft bls.

Video logs and temperature logs were collected for SZMW-2. The results of the geophysical logging did not show any evidence that would suggest that the well casing was not structurally sound.

8.1.4 Confining Zone Monitoring Well 1

Construction of CZMW-1 began in October 2006 and was completed in November 2006. CZMW-1 has an 18-inch steel pit pipe casing set to 50 ft bls. The 12.75-inch OD SDR 17 PVC surface casing was set to 250 ft bls. The SJRWMD required that the surface casing extend completely through the Ocala Formation because the project site vicinity is located within an area of known contamination according to the FDEP (Chapter 62-524, F.A.C.) The 6.625-inch OD SDR 17 PVC casing was set from land surface to 718 ft bls. A nominal 6-inch diameter open borehole extends from 718 to 770 ft bls. The purpose of CZMW-1 is to monitor if there is upward migration of injection water across the confining unit to the water supply production zone.

Video logs and temperature logs were collected for CZMW-1. The results of the geophysical logging did not show any evidence that would suggest that the well casing was not structurally sound.

8.1.5 ASR Storage Zone Characteristics

The ASR storage zone interval has an adequate transmissivity and specific capacity to efficiently accept the 1 mgd system design capacity. The storage zone rock consists mostly of dolomite in which non-carbonate inclusions are largely encapsulated within dolomite crystals. The storage zone rock was therefore expected to have a low susceptibility to adverse fluid-rock interactions, such as arsenic leaching.

Core and petrographic observations and core plug hydraulic analyses indicate that the storage zone has a pronounced hydraulic conductivity layering and thus vertical to horizontal anisotropy. The presence within the storage zone of layers with very low vertical and horizontal hydraulic conductivities creates internal confinement

within the storage zone, which is conducive for high recovery efficiencies. Similar low conductivity zones present above and below the storage zone provide external confinement.

A potential negative factor for the ASR system performance is that part of the transmissivity of the storage zone is likely fracture flow. Fracture flow can result in excessive migration of stored fluids and mixing with native formation waters. However, none of the fractures observed in the core or video of the reamed hole appeared to be major flow conduits that would result in rapid flow from the well.

8.2 Surface Facilities Construction

The following section describes the surface facility construction program followed during the Markham Regional WTP ASR project, including the pipeline, well pump and wellhead piping, and pretreatment system.

8.2.1 Jack & Bore Directional Drill Pipeline

In February 2007, the return line was installed beneath the Markham Regional WTP wall using Jack & Bore. Prior to excavating the jacking pit, all utilities were located by hand digging. Fiber optic lines, phone lines, a 12-inch diameter water main, and a 16-inch diameter sanitary force main were exposed. The jacking pit was excavated on the west side of Orange Blvd. across from the Markham Regional WTP. The casing pipe was installed in 20 feet sections and a total of 130 feet of casing was installed. Additionally 150 ft of 12-inch High-Density Polyethylene (HDPE) and two 150 ft sections of 2-inch HDPE were installed.

From February to March 2007, approximately 2,000 feet of 12-inch DR17 HDPE pipe along the west side of Orange Blvd to connect the ASR well head piping to the yard piping at the Markham WTP using directional drilling for the ASR system return line. This pipe will serve as the return line for the ASR system. The pipe was installed in four separate pulls approximately 500 feet in length.

8.2.2 Markham Regional WTP Pipeline

From February to March 2007, piping was installed at the Markham Regional WTP to tie in the new ASR return line to the existing Markham Regional WTP raw water piping system and to install a purge line from the new pipeline to an existing stormwater catch basin structure. 12-inch PVC piping, a tee with a 12-inch gate valve for the purge line, and another tee with a plug on the east end were installed. The 12-inch PVC piping ties into the 12-inch HDPE piping. Additionally, a purge line was installed using 12-inch PVC, starting with the 12-inch gate valve and terminating in the catch basin structure. All piping was installed with a minimum of 3 ft of cover.

In March 2007, the 12-inch HDPE pipe was connected to the existing 10-inch ductile iron pipe (DIP) installed during Phase I construction (January 2005). A 14-foot section of 10-inch PVC pipe was installed between the two tie-in points. A 90 degree elbow

and a 10-inch x 12-inch reducer were installed to make the connection to the 12-inch HDPE pipe.

In June 2007, two 10-inch pipelines were installed parallel to each other with 4-feet of separation. The pipe material was 10-inch C-900 PVC with bell and spigot joints. All fittings were ductile iron with mega-lug flanges. The supply line runs from a tap installed at Station 120+13.67 offset 50 feet left to Station 205+50 at the ASR well pad. The return line runs from the tie-in to the 12-inch HDPE line at Station 120+13.67 offset 64 feet left to Station 205+50 at the ASR well pad.

8.2.3 Pretreatment System

Groundwater pretreatment at the Seminole County Markham Regional WTP ASR project site consists of permanent dechlorination and degasification systems for use during cycle testing and ultimately normal ASR operation. The following sections describe the construction of these systems at the site. Construction details for the permanent dechlorination system and degasification system are provided in the ASR Dechlorination/Degasification System at the Seminole County Markham Regional WTP Project Record Drawings (CDM, 2010).

The components common between the degasification and dechlorination systems are outlined below:

- System control panel;
- Influent and effluent motorized butterfly valves;
- ORP analyzer;
- Sample ports;
- By-pass piping; and
- Steel canopy and treatment system pad.

8.2.3.1 Dechlorination System

From October 2009 through January 2010, the dechlorination system and components, including the emergency eyewash station and shower were installed. The components of the dechlorination system are outlined below:

- Influent and effluent chlorine sensors;
- 10-inch flow and pressure regulating check valve;
- 550-gallon sodium bisulfite double walled poly tank;
- 2 peristaltic chemical metering pumps;

- Ultrasonic tank level sensor;
- Emergency eyewash and shower;
- Static mixer;
- 10-inch Venturi flow meter; and
- 24-inch diameter detention pipe.

8.2.3.2 Degasification System

The degasification system was installed from July 2009 through January 2010. Revere Controls installed the SCADA program and calibrated the instruments for the pretreatment system. The components of the degasification system are outlined below:

- Influent and effluent DO sensors;
- 6-12x28 inch Membrana Liqui-Cel® contactors;
- Liquid-ring vacuum pump;
- Nitrogen generator and buffer tank;
- Air compressor and dryer;
- Influent and effluent pressure sensors; and
- Control panel.

8.2.3.3 Additional Site Work

Additional site work included installation of a secondary supply line, grading of site, and construction of access road.

8.3 Startup Activities

8.3.1 ASR System

CDM completed short-term calibration testing in May, 2008. The short-term calibration testing consisted of the following:

- Verifying proper programming and electrical valve operation;
- Calibration of the high and low pressure switches;
- Calibration of the bi-directional flow meters;
- Calibration of the level sensor;

- Calibration of the conductivity probe; and
- Testing of the electrical valves for the following scenarios:
 - Standby;
 - Purge;
 - Injection; and
 - Recovery.

CDM prepared an Operations and Maintenance (O&M) Manual detailing the one well pilot ASR system installed at the Seminole County Markham Regional WTP ASR project site (CDM, 2009). The manual describes the ASR system components, operation, the maintenance required, and troubleshooting guidelines for the equipment, including the injection well (ASR-1), confining zone monitoring well, storage zone monitoring wells, surficial aquifer monitoring wells, vertical turbine pump on the ASR well, associated source, return, and purge piping, flow control and isolation valves, and instrumentation. The manual also provides general safety requirements and safety procedures to follow when operating or performing maintenance at the Markham ASR facility. Additionally, the manual describes the monitoring and analytical requirements for the cycle testing program and required well monitoring.

On May 7, 2008 CDM, in conjunction with DCR Engineering Services, Inc., conducted O&M training of Seminole County staff on the ASR system. The training included the following:

- Overview;
- Definitions associated with Aquifer Storage and Recovery (ASR) Wells;
- Regulations associated with ASR wells;
- Operation of the ASR well;
- Maintenance of the ASR well; and
- Troubleshooting the ASR well.

8.3.2 Pretreatment System

On December 16-17, 2009, CDM and subcontractors conducted operations and maintenance (O&M) training for the County staff. The training included the following:

- First phase recap;

- ASR operation with Pretreatment;
- Data collection, entry, and reporting;
- Dechlorination System;
- Overview of degasification system and DO sensors;
- SCADA; and
- Site walk through.

CDM has also prepared a separate O&M Manual detailing the pretreatment system (CDM, 2010b). The manual describes the pretreatment system components, the operation, the maintenance required, safety, and troubleshooting guidelines.

On January 10, 2010, Revere Controls performed the Functional Demonstration Test on the ASR system. The test was witnessed by Seminole County and CDM. All functions were working properly and the ASR system was deemed fully operational.

8.4 Permit Clearances

On September 11, 2008, FDEP cleared the ASR well and the supply and return mains for service. On January 22, 2010, FDEP issued clearance for the Dechlorination and Degasification System. Copies of the clearance documentation are included in Appendix F.

8.5 Transfer of Facilities To Cooperator

Certificates of Substantial completion for the ASR system and the pretreatment system are included in **Appendix E**.

Section 9

Cycle Operational Monitoring and Evaluations

The cycle testing program for the Seminole County Markham Regional WTP ASR project was developed to be consistent with FDEP UIC permitting process. The cycle testing program consists of 4 cycles of injection, storage, and recovery of various durations, to allow for flexibility in the program and to condition the aquifer matrix with the injected water. As shown in **Table 9-1**, Cycle Tests (CTs) 1 and 2 were designed for the injected water to reach the closest storage zone monitoring well (SZMW-1) to the ASR well, and of equal volumes. CTs 3 and 4 were designed for the injected water to reach the farthest storage zone monitoring well (SZMW-2), also of equal volumes.

Table 9-1				
Cycle Testing Program for the Seminole County Markham Regional WTP ASR Project				
	Injection Volume	Storage	Recovery Volume†	Total Estimated Days
Cycle	(MG)	(days)	(MG)	(max)
1	4 to 12	10 to 30	4 to 12	54
2	4 to 12	10 to 30	4 to 12	54
3*	40 to 65	30 to 60	40 to 65	188
4**	40 to 65	30 to 60	40 to 65	188
Totals	88 to 154	80 to 180	88 to 154	484

Notes: Cycle Testing to be conducted with or without pretreatment - to be confirmed / approved with FDEP.

Target volumes are 11, 11, 51, and 51, respectively, for CT's 1, 2, 3, and 4 based on theoretical travel calculations.

Recovery will continue to the specified volume unless limited by the capacity of the Markham Regional WTP.

† Recovery volumes will not exceed the injection volumes without prior approval from FDEP and SJRWMD.

* Used to simulate operational conditions

** Used to simulate operational conditions, if required by FDEP

To date, CTs 1 and 2 have been completed. CTs 1 and 2 were conducted utilizing partial pretreatment: CT 1 utilized only degasification and CT 2 utilized only dechlorination with sodium bisulfite. CT 1 began on March 2, 2010 and was completed on June 30, 2010; CT 2 began on January 4, 2011 and was completed on March 11, 2011.

Results of CT 1 indicated that the well recovery efficiency was well below anticipated levels most likely due to inadequate flushing of native water associated with injectate losses to fracture flow components in and around the wellbore. Conductivity, chloride, sodium and TDS results in the recovered water indicated native groundwater in the ASR well storage zone, which verified the loss of injected water. The data also showed that arsenic concentrations within the aquifer storage zone had risen to levels above the drinking water maximum contaminant level (MCL) of 10 micrograms per liter (µg/L), which dictated that any recovered water must be treated prior to discharge to the designated stormwater ponds. As a result of this, a well

modification plan was developed as a way to potentially address the low recovery efficiency by eliminating some of the fracture flow paths within the wellbore. To address this issue, it was determined that the ASR would be backplugged and the target zone for back plugging was determined through Packer Testing of the ASR well. Back plugging of the ASR well occurred in July 2010 which preceded CT 2. The ASR well was back grouted to a depth of 993 ft below top of casing (btoc), SZMW-1 was back grouted to a depth of 992 ft btoc, and SZMW-2 was back grouted to a depth of 997 ft btoc.

During CT 2, the ASR pump motor experienced a malfunction, thus the ASR well was only sampled once during storage. The arsenic concentration in the one sample from the ASR well was below the detection limit (2.6 µg/L). The arsenic concentrations measured in the ASR well during recovery increased above the MCL and ranged from 28 µg/L to 52 µg/L. Arsenic was not detected in any groundwater samples collected from SZMW-1, SZMW-2, or CZMW-1 during CT-2.

During CT 2 recovery, the Carbonair activated alumina treatment system was used to treat arsenic levels greater than 10 µg/L. However, during recovery, the performance of the Carbonair treatment system decreased and only 0.97 MG of the 5.05 MG water injected were able to be recovered within the rental time constraints and funding .

Comparing the data from CT 1 to CT 2, following the backplugging of the ASR well and associated monitoring wells, the results show that the injected water is remaining in the intended storage zone and is no longer migrating offsite, thus, improving the overall ASR system performance.

Cycle tests 1 and 2 were conducted with partial pretreatment (degasification for CT 1 and dechlorination for CT 2), and very small volumes of injected water. Due to these and other factors, a complete evaluation of the performance of the ASR system with regards to preventing or reducing arsenic leaching, could not be conducted. Membrane fouling and adequate fluid management need to be addressed to move forward with future cycle testing activities.

Section 10

Preliminary Feasibility Determination and Conclusion

As part of its Districtwide water supply planning process, the SJRWMD sought to investigate several alternative water supply strategies to be used in conjunction with fresh groundwater to meet future potable water demands. ASR was identified as being an important component in the development of alternative water supplies in Florida, as it can potentially provide very large volumes of seasonal water storage, such as for excess wet-season surface water flows. As the District's program comes to a close, the ASR feasibility and testing program has resulted in many lessons learned and provided for growth potential for future ASR testing and water supply projects for several Cooperators.

The feasibility of ASR at the Seminole County Markham ASR site has not been fully determined at this time. Further cycle testing to evaluate the ASR storage zone will be needed to show ASR as a success at this site. There are several factors that need to be overcome, including a reduction in arsenic leaching from the ASR storage zone, and fluid management of discharge water. As discussed earlier, the Membrana Liqui-Cel® Degasification system encountered significant fouling issues due to microscopic impurities in the finished potable water. A pre-membrane filter trial was conducted to determine if a reduction in fouling of the membranes could be achieved with addition of filtration ahead of the contactors. The results of this filter trial are currently pending and will be included in a report that will be issued to Seminole County. The Seminole County Markham Regional WTP will soon be undergoing an upgrade to ozone treatment, which will significantly lower H₂S concentrations in the raw water and possibly aid in the reduction of fouling of the membrane contactors.

The limited fluid management at the site also needs to be addressed. A *"Preliminary Design Report for a Reclaimed Water Interconnect"*, (CDM, 2011) for discharge of ASR fluids and mixing with reclaimed water was prepared detailing connection and operation of the ASR system to the Markham Reclaimed Storage/Repump tank located adjacent to the Markham Regional WTP, and is included in Appendix F. This connection would allow an alternative disposal option for the discharge water from the ASR well, and allow for continued cycle testing and evaluation of the ASR storage zone.

Since the start of the District's ASR program, many developments both regulatory and institutional have been taken place, and many lessons have been learned regarding ASR operations and performance. The reduction of the drinking water arsenic standard from 50 µg/L to 10 µg/L, drove the need to seek a possible solution to mitigate or reduce arsenic leaching potential, thus pretreatment was instituted. The desire to allow continued development of ASR in Florida in light of this reduction in the maxim contaminant level of the arsenic standard, also led to the FDEP UIC

Administrative Order (AO) process and conditions, including institutional control for possible migration of arsenic off property. This AO process followed issuance of the UIC permit for the Seminole County Markham ASR project within an easement on the Wilson Elementary School property. Future ASR site locations should have ample property line buffer to adjacent land owners to fully contain the zone of influence for ASR wells.

Infrastructure changes have also occurred since inception of this project. Seminole County is in the process of constructing a surface water treatment plant at the Yankee Lake site; one of the sites considered for ASR in the *Desktop Assessment of Aquifer Storage and Recovery for Seminole County, Florida* (CDM, 2002). This site however, was not chosen as there was no current or planned water distribution infrastructure available for cycle testing purposes. In order to test ASR feasibility at the site a new upper Floridan Aquifer supply well and raw water pipeline would have needed to be constructed, which would have driven up the cost of the project and potentially interfered with ASR operations including cycle testing. In the future, with the new infrastructure, an ASR system could be implemented at the Yankee Lake site to store excess surface water flows following treatment. The Seminole County Markham ASR system will need to be further evaluated to determine if ASR can be used successfully as a storage/demand management tool to help meet future potable water demands.

Section 11

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Appendix A

St. Johns River Water Management District Aquifer Storage and Recovery Construction and Testing Program Plan

St. Johns River Water Management District
Aquifer Storage Recovery
Construction and Testing
Program Plan — FY 2002

St. Johns River Water Management District
and
Aquifer Storage Recovery Consultant Team:
Barnes Ferland & Associates, Inc.
Camp Dresser & McKee, Inc.
Water Resource Solutions, Inc.

Palatka, Florida
April 2002

St. Johns River Water Management District

Aquifer Storage Recovery

Construction and Testing Program Plan

1.0 Background

1.1 Introduction

The St. Johns River Water Management District (SJRWMD) in its 2000 District Water Supply Plan (DWSP) identifies the need for alternative water supplies other than fresh groundwater to meet projected future demands. Current SJRWMD groundwater modeling indicates that the increased use of groundwater to meet projected demands is likely to result in the potential for unacceptable impacts to water resources and related natural systems. The model results indicate Floridan aquifer potentiometric surface declines, reduction of spring flows, lowering of wetland and lake water levels, inland movement of saline water from coastal areas, and reduction of stream flows below minimum levels required to maintain natural systems.

The DWSP identifies surface water as one of the most cost-effective alternative water supply sources having significant capacity. Because of the seasonal variability of both quality and quantity, the use of surface water as a source of supply requires significant storage to provide a reliable supply. Other alternative sources such as seawater desalination could be developed to supplement existing freshwater supplies where needed — however, at higher cost. The use of reclaimed water or storm water for non-essential uses, such as lawn irrigation or agricultural irrigation, could also reduce the demand on limited fresh groundwater supplies.

The use of aquifer storage recovery (ASR) technology can be a cost-effective method of storing water. ASR provides a means of balancing the sources of water available for supply with the temporal aspects of water supply, water demand, and water quality. Successful ASR development generally requires that it be implemented as a component of an overall aquifer management plan. Water is stored during times when it is available, such as wet months when supply exceeds demand or when water quality is best, and is recovered during times when it is needed, such as dry months, emergencies, or when quality of water from other sources is poor. Water is stored and recovered through the same wells which, in Florida, usually penetrate the limestones of the Upper Floridan aquifer.

After appropriate development of the storage zone around an ASR well, approximately the same volume of water stored is typically recovered, without significant changes in water quality between the water recharged and recovered. The potential storage volume in the aquifer is essentially unlimited; however, care has to be taken to ensure that water level changes during recharge and recovery do not cause any significant adverse effects upon other wells or ecosystems. It is noteworthy that ASR can be developed close to the area of demand or in a more remote area for regional distribution.

The principal driving force behind ASR implementation has been its cost-effectiveness relative to other water storage alternatives, such as tanks and reservoirs, and water supply alternatives, such as demineralization/desalination of saline groundwater or surface water. The cost of meeting increasing peak demands with ASR is usually less than half the cost of meeting those demands with other water supply alternatives. An important secondary factor for ASR implementation has been its acceptance as an environmentally beneficial water management alternative. Some of the environmental benefits include reducing or eliminating the need for dams and surface storage reservoirs, reducing diversions from surface waters during low-flow periods, maintaining minimum flows and levels at lower cost, and reducing excess surface water discharge to coastal waters during wet weather periods.

ASR wellfields have been operating in the United States since the 1960s and in Florida since 1983, when the first system became operational in Manatee County. Ten ASR wellfields are now operating in Florida and about 30 more systems are in various stages of development. Within SJRWMD, the City of Cocoa ASR wellfield has been operational since 1987 and is now completing its third system expansion to 10 wells. Also, the Town of Palm Bay has a single ASR well that has been operational since 1989. Nationwide, about 50 ASR wellfields are operational, with at least 100 more in development. The largest ASR wellfield is in Las Vegas, Nevada, with a recovery capacity of about 100 million gallons per day (mgd). For the Everglades Restoration Plan in South Florida, an ASR capacity of about 1.7 billion gallons per day is planned.

For the SJRWMD ASR Construction and Testing Program, no regulatory changes are required to support proposed applications for construction and testing projects. Early coordination will be conducted with the Florida Department of Environmental Protection (FDEP) for permitting requirements. Water stored will comply with current federal and state regulations.

1.2 SJRWMD ASR Construction and Testing Program Goals and Objectives

The goal of the ASR Construction and Testing Program is to examine the appropriateness of integrating ASR technology into regional water resource and water supply development projects. Accomplishing this goal will require interfacing with governmental entities or private utilities that may actively participate, own, operate, or maintain a constructed facility arising out of this program. These entities are referred to as Cooperators. It is estimated that effective ASR could make economically feasible the use of multiple surface water or groundwater sources that may yield up to 350 mgd of additional resource. To achieve this goal, SJRWMD has identified several objectives that must be met:

- Determine the extent to which ASR can be applied to meet local or regional water supply needs through use of alternative water supplies (i.e., surface waters, reclaimed waters) in addition to limited groundwater supplies.
- Establish the fundamental criteria for successful application of ASR in SJRWMD.
- Provide test sites for a variety of applications in order to identify and address the different issues (e.g., permitting/regulatory, technical, logistics, political) unique to each application.

- Identify and secure Cooperators, through executed agreements, to participate in ASR construction and testing which would result in development of a functional ASR facility to be used by the Cooperator at the conclusion of the testing period.
- Demonstrate the extent to which ASR can be safely and successfully used within SJRWMD.

The desire of SJRWMD is to examine a broad range of ASR applications and alternative water sources. Possible ASR applications include such things as providing storage to meet seasonal supply and demand variations; supplementing water supplies for coastal communities; providing salinity intrusion control; maintaining minimum flows and levels in surface waters, wetlands, and other natural systems; impact avoidance; and agricultural irrigation. All of these ASR applications are currently in use at various locations in Florida or elsewhere in the United States.

Subject to regulatory requirements, such as treatment to meet water quality criteria, sources may include, for instance, drinking water from fresh water sources, drinking water from desalinated brackish or seawater sources, surface water from lakes and rivers, reclaimed water, groundwater from overlying or underlying aquifers, and groundwater from the same aquifer at distant locations where the water is fresh.

2.0 ASR Construction and Testing Program and Process

2.1 Framework for Selecting ASR Construction and Testing Projects

Criteria for inclusion of projects in the ASR Construction and Testing Program have been established based upon water use characteristics and the hydrogeology of the proposed project site. Those projects deemed by SJRWMD to be the more likely to contribute to successful achievement of regional water management goals are more likely to be selected for inclusion.

SJRWMD has established a process that allows for participation in the program by Cooperators. Participation in the program is guided by establishing the respective responsibilities for both SJRWMD and each Cooperator. SJRWMD may solicit participation by certain Cooperators whose participation is deemed essential to accomplishment of the program's goals and objectives. Others interested in participating in the program are encouraged to apply for consideration by submitting a letter of interest to SJRWMD. SJRWMD and its consultant team will screen proposed projects to ensure that the projects comply with SJRWMD's goals and objectives and will make decisions concerning inclusion of the proposed project in the program.

The primary feasibility factors in the Cooperator screening process are described in SJRWMD Special Publication SJ97-SP4 titled *A Tool for Assessing the Feasibility of Aquifer Storage Recovery* (CH2MHILL, 1997). These factors are highlighted in Sections 2.2 and 2.3 of this document.

2.2 Facility Planning Factors

The facility planning factors include the demands, supply, and storage needs associated with a Cooperator's water system service area.

- **Demand** — A Cooperator's demand consists of projected capacity and temporal water use patterns. A Cooperator's demand should be large enough (>1 mgd) to justify the expense of an ASR facility in lieu of conventional storage tanks.
- **Supply** — A Cooperator's water supply consists of the groundwater and/or surface water withdrawals authorized by allocations established through the SJRWMD consumptive use permitting process.
- **Storage Requirement** — A Cooperator's storage requirement is determined through evaluation of its historical average supply and demands. A Cooperator's storage requirement can be long-term storage, in which a Cooperator wishes to store excess water which is withdrawn in the future to offset the need for infrastructure expansion, or seasonal storage, in which a Cooperator wishes to store water during wet seasons and withdraw water during dry seasons.
- **Proposed Use** — A Cooperator's proposed use of ASR, as demonstrated by inclusion in a master plan or other similar document, is to provide storage to meet its future use projections using available water supply sources, in accordance with the DWSP.

2.3 Hydrogeologic Factors

The hydrogeologic feasibility factors used to evaluate an ASR storage option include storage zone confinement, transmissivity, aquifer gradient and direction, recharge and native water quality, and interfering uses and impacts.

- **Storage Zone Confinement** — The presence and degree of vertical confinement of an aquifer proposed for an ASR storage zone is important to determinations of the degree to which an ASR system can be protected from impacts and effects of external sources of contamination or competing withdrawals above or below the storage zone.
- **Storage Zone Transmissivity** — Transmissivity is a measure of water flow rate through the aquifer media. Storage zone transmissivity should be sufficiently high so that a volume of water can be injected at reasonable wellhead pressures and the same volume of water can be recovered from the storage zone without excessive drawdown in the wells. Additionally, optimal transmissivities should be sufficiently low to allow for the creation of discrete buffer and storage zones and avoid loss of stored water due to migration away from the well or significant mixing with poor/brackish quality native water.

- **Aquifer Gradient and Direction** — The aquifer gradient of a proposed site's storage zone identifies the direction of groundwater flow and any external influence from sources (e.g., recharge areas) and sinks (e.g., operating wellfields, springs). Additionally, the higher the gradient, the more likely stored water will migrate away from the well, potentially resulting in a poor recovery efficiency if the storage zone is in a brackish aquifer. Optimal gradient in the storage zone should be such that the stored water stays close to the well between recharge and recovery.
- **Recharge and Native Water Quality** — Recharge water quality determines the level of treatment that may be required prior to storage. Of critical concern is the potential for storage zone plugging due to recharge water solids content, nutrient and biological content (biofouling), and carbonate geochemistry. For SJRWMD's program, the recharge water quality must meet applicable federal and state standards.

Native water quality is an important factor in the determination of buffer and storage zone volume requirements and recovery efficiency. For example, the higher the salinity concentration of the native water, the larger the volume of recharge water required to establish the buffer zone. Additionally, native water salinity can impact the thickness of stored water in the storage zone due to the effects of density stratification within the storage zone. For example, freshwater stored in a zone with highly saline native water could result in a very thin layer of freshwater at the top of the storage zone and brackish to saline water throughout the remainder of the zone's vertical depth. This situation would, in turn, reduce recovery efficiencies.

- **Interfering Uses and Impacts** — Interfering uses result primarily from other supply wells in the vicinity of the ASR system that directly withdraw from an ASR storage zone or cause a change in the gradient that, in turn, causes migration of stored water out of the storage zone.

Impacts are considered to be any current or future contamination of the aquifer storage zone. The distance to any supply or injection well in the same aquifer zone and the distance to any contamination zone influence this factor.

SJRWMD will use these hydrogeologic and facility-planning factors as screening factors when considering potential Cooperators and proposed sites for ASR construction and testing.

2.4 Candidate Projects

SJRWMD and its consultant team have identified the following initial potential candidate projects for the ASR Construction and Testing Program:

Volusia County ASR Project — This project is proposed in association with SJRWMD's St. Johns River Water Supply Project. Successful development of water supplies from the St. Johns River is likely to depend largely on the feasibility of utilizing ASR as the primary storage technique.

Seminole County ASR Project — This project is associated with SJRWMD's St. Johns River Water Supply Project. Successful development of water supplies from the St. Johns River is likely to depend largely on the feasibility of utilizing ASR as the primary storage technique.

City of Cocoa Reclaimed Water ASR Project — This project is proposed to examine the feasibility of ASR as an effective means of storing reclaimed water during periods of excess supply for recovery and use during periods of short supply.

This document will be revised to add additional candidate projects as those projects are identified.

3.0 Project Funding

SJRWMD has developed a budget of \$11.82 million for ASR construction and testing for the fiscal year 2002–2006 period. Projects are proposed to be accomplished with SJRWMD ad valorem and Florida Forever funds as well as Cooperator funding in the form of in-kind services and/or cash contributions currently estimated at approximately \$7.90 million, for a total program budget of \$19.72 million (Table 1).

Current legislation restricts the use of Florida Forever funds to construction components of the project. Planning and design costs must be funded using ad valorem and Cooperator funds. It is SJRWMD's intent to leverage the Florida Forever funds as much as possible by favoring proposed Cooperators who are willing to provide in-kind services and direct financial contributions for projects that are deemed by SJRWMD to contribute toward achieving the goals of the program. Additionally, those potential Cooperators who apply earlier are more likely to achieve funding than those who apply later. It is estimated that the current total program funding should be sufficient to provide for at least nine ASR investigations and possibly more, depending on the extent to which Cooperators are willing to share the cost.

Table 1. SJRWMD ASR Construction and Testing Program proposed funding for fiscal years 2001 to 2006 (in dollars)

	Total for Period	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006
Sources (\$ million)							
SJRWMD ad valorem	0.350	0.000	0.350	0.000	0.000	0.000	0.000
Florida Forever	11.471	2.375	1.596	2.500	2.500	2.500	0.000
Cooperators	7.898	1.834	1.064	1.667	1.667	1.667	0.000
Total	19.719	4.209	3.009	4.167	4.167	4.167	0.000
Disbursements (\$ million)	19.719	0.000	6.219	4.167	4.167	4.167	1.000

04/03/02

4.0 Project Implementation

4.1 Responsibilities of SJRWMD

SJRWMD will be responsible for selecting those projects to be included in the ASR Construction and Testing Program and for funding a portion of each project. SJRWMD will also be responsible for coordination between governmental agencies and other entities that may be involved in the ASR Construction and Testing Program. As part of this coordination, SJRWMD will take the lead in the negotiation of complex regulatory issues that may arise pertaining to ASR implementation at each site.

Additional SJRWMD responsibilities will depend upon the agreement to be developed between SJRWMD and each Cooperator. It is anticipated that SJRWMD will provide funding for planning, design, permitting (including permit fees), construction, testing, startup, and initial operations of ASR facilities (including operator staff training and transferring operation of the facilities to the Cooperator after the test program and initial startup are completed). Alternatively, SJRWMD may provide funding to the Cooperator, who would then complete ASR project development with review and approval of progress at selected checkpoints during the term of the project.

The assigned roles of SJRWMD and the Cooperator will be established in advance for each site as conditions of the Cooperator agreement. SJRWMD's consideration of a Cooperator's proposal to participate in the program will be influenced by the extent to which the Cooperator demonstrates a willingness to provide direct financial contributions or in-kind services and a commitment to the long-term operation of the ASR facilities.

4.2 Responsibilities of the Cooperator

The Cooperator will be responsible for providing an ASR facility site and appropriate logistical support to include, at least, facility access, a suitable source of water for testing and operations, power supply, and disposal of recovered water during initial testing and also during operational startup. In general, water supply sufficient to conduct the ASR investigations requires the ability to store at least 50 million gallons of water during a typical recharge season.

Support could also include direct financial contribution toward project costs, particularly to the extent that the Cooperator wishes to assume responsibility for directing activities at its site. Support may also include in-kind services such as assistance during sampling, monitoring, and other testing and operational activities, which could vary from minor assistance during initial portions of the testing program to primary responsibility during later portions of the testing program.

Upon completion of the ASR project, the Cooperator will be responsible for continued operation of the ASR facilities, assuming that their operational success has been demonstrated during the test program. The assistance of the Cooperator in helping to resolve regulatory issues would also be expected, including preparation for and participation in agency meetings.

4.3 Project Tasks

SJRWMD has developed a detailed list of standard tasks for its ASR projects. This list of standard tasks is based upon the process utilized for successful completion of 10 operational ASR systems in Florida and 40 others throughout the United States. A brief summary is included in this document as a guide to potential Cooperators and others who may be interested. A full copy of the task list is included as Exhibit A. This list will be adapted to individual needs and opportunities at each site. It should be noted that some tasks may require greater emphasis and some will require less. Additionally, it is possible that individual needs at selected potential ASR sites may require additional tasks not identified on this list.

Each project will include project coordination, management, and other meetings.

Task 1 — ASR Construction and Testing Program Plan

The ASR Construction and Testing Program Plan is intended to be suitable for distribution to policy makers, potential Cooperators, interest groups, and the technical community. It includes a description of evaluation criteria for potential projects and a preliminary listing of regional candidate projects. This plan will be revised as necessary.

Task 2 — Project Evaluation and Site Selection

This task includes a desktop project feasibility assessment based on the assessment approach described in SJRWMD Special Publication SJ97-SP4 titled *A Tool for Assessing the Feasibility of Aquifer Storage Recovery* (CH2MHILL, 1997). If the assessment indicates that the project is feasible, the project will advance to the preparation of a Cooperator Agreement. If the project is deemed to be not feasible, it will not be further considered.

Task 3 — Cooperator Agreement

An agreement that establishes the objectives of the project and the responsibilities of SJRWMD and the Cooperator will be developed. This task also includes preparation and presentation of project information to Cooperator decision makers.

Task 4 — Site-Specific Data Collection and Preliminary System Design

This task includes site-specific data collection and preliminary system design. A data collection plan for each site will be prepared based on a review of existing information and coordination with FDEP. In particular, the plan shall address the need for initial exploratory testing as the basis of development of ASR well design criteria and whether such exploratory testing may be conducted without having to first obtain all permits for the subsequent ASR system. To the extent possible based on FDEP guidelines, SJRWMD proposes to gather hydrogeologic information from the construction and testing of an initial test well at each site, which would then be converted to an observation well for the ASR construction and testing program. The data collection plan will be implemented, the data will be evaluated, and a preliminary system design will be developed.

Task 5 — ASR Pilot Project Design

This task includes the design of well and wellhead facilities at the selected site, including the proposed data collection and monitoring programs.

Task 6 — Regulatory Permitting

SJRWMD, and its cooperators and consultants, will adhere to the necessary regulatory permitting requirements, including preparation of permit applications, and responses to requests for information from regulatory agencies. The primary permitting effort will be through FDEP.

Task 7 — ASR Facilities Construction, Monitoring, and Testing

This task includes construction of ASR and monitor wells, and associated wellhead facilities. Initial hydraulic and water quality testing would be conducted, in addition to geophysical logging, geochemical modeling, and evaluation of any additional pretreatment requirements. A series of ASR test cycles would then be conducted to address technical and other issues pertaining to each site.

Task 8 — Startup and Training

SJRWMD's consultant will provide operational training of Cooperator staff to ensure a smooth transition from the test program into full operations.

Task 9 — Large Cycle Operational Monitoring and Evaluations

Operational monitoring and evaluation of ASR system performance will be conducted during the first two to three years of operations, making any needed adjustments to improve system performance. The Cooperator will be operating the system during this period.

Task 10 — Peer Review of ASR Consultant Team Work

This task includes the review of work products produced by ASR consultant team members by other team members as considered necessary by SJRWMD.

4.4 Project Schedule

Each project will have its own schedule, to be established during initial planning. For typical ASR projects in Florida, the schedule requires about three years, within a range of 2 to 5 years. Upon completion, the ASR facility is fully operational and fully permitted. A typical timeline is illustrated in Table 2.

Initial planning and feasibility assessment typically requires about 3 to 6 months, although shorter periods are reasonable in situations where existing ASR facilities are already in operation nearby.

Agreements with Cooperators and the completion of preliminary design efforts can be accomplished in 3 to 6 months.

Facilities final design typically requires about 2 to 6 months, during which time permit applications may be submitted.

Final permit approval for ASR systems complying with current water quality standards may require from 4 to 12 months from initial submittal, depending upon the number and scope of requests for information (RFIs) made by the permitting agencies. If there exists any public opposition, the permit issuance may be delayed until the public opposition issues are sufficiently addressed.

Bidding requires approximately 2 to 4 months and construction typically requires 4 to 8 months, depending upon the complexity of the facilities, the number of bid packages, and the project delivery method.

ASR testing duration will depend upon the conditions at each site, and will vary between sites. However, a typical duration for ASR testing is about 6 to 12 months, followed by operational startup. Experience has demonstrated the wisdom of providing close monitoring of operational performance during at least the first year of full operations.

Table 2. Aquifer Storage Recovery (ASR) project schedule

Task	Duration (days)
ASR Construction and Testing Program Plan	1
Project Evaluation and Site Selection	69
Cooperator Agreement	67
Site-Specific Data Collection and Preliminary Design	70
ASR Pilot Project Design	53
Regulatory Permitting	93
ASR Facilities Construction, Monitoring, and Testing	140
Startup and Training	67
Large Cycle Operational Monitoring and Evaluations	262

EXHIBIT “A” – SCOPE OF SERVICES

The St. Johns River Water Management District (DISTRICT) is implementing the District Water Supply Plan (DWSP). Successful development and implementation of Aquifer Storage Recovery (ASR) as a component of that plan is critical. In order to successfully evaluate and account for hydrogeologic variations and source water quality, it is important to establish a comprehensive, yet flexible, approach to consistent analysis of different projects, locations, and uses. Tasks may include interface with governmental entities or private utilities that may actively participate, own, operate, or maintain a constructed facility arising out of this project. These entities are referred to as co-operators. The task list provided herein provides an outline for consistent analysis and feasibility assessment at various sites through a full-scale ASR Construction and Testing Program. The site characteristics and conditions for each potential project will dictate the specific scope of work necessary to fully investigate the feasibility of ASR at a project location.

The following tasks A and B, and their subtasks are generic project tasks for routine meetings and other tasks not specifically associated with ASR but required by DISTRICT during the course of any Water Supply or Water Resource Development Project.

Task A. Project Coordination, Management, and Meetings

The purpose of this task is to provide for project management and coordination, including meetings of concerned parties. Also included in this task is the development of, and participation in, workshops designed to communicate the purpose and progress of the ASR Construction and Testing Project to the public, as well as to provide document production support to DISTRICT as needed.

The District’s Office of Communications must approve all outreach tasks. Coordination must occur with the Office of Communications in a timely manner to provide opportunities for appropriate review. All media calls must be referred to the District’s Office of Communications.

Task A.1 Project Progress Meetings

CONTRACTOR shall prepare for, attend, and participate in project coordination and progress meetings, as scheduled by DISTRICT, related to the work performed pursuant to this AGREEMENT. This will include preparation of monthly progress reports describing recent developments along with updates of the project schedule. The primary purpose of these meetings is to provide project coordination, scheduling, and needed information exchange among the ASR project work efforts. A total of two quarterly progress meetings and two quarterly progress teleconference meetings are anticipated each year of the contract. This task represents the face-to-face meetings portion of the task.

Task A.2 Teleconference Meetings

CONTRACTOR shall prepare for and participate in periodic teleconference meetings as needed for the purpose of reporting progress and exchange of information among the interrelated ASR Construction and Testing work efforts. A total of two face-to-face quarterly progress meetings and two quarterly progress teleconference meetings are anticipated each year of the contract. This task represents the teleconference meetings portion of the task.

Task A.3 Recurring Program Meetings

CONTRACTOR shall prepare for, attend, and participate in program progress meetings as scheduled by DISTRICT for the purpose of reporting progress and exchange of information among all parties involved in water supply planning and implementation within the DISTRICT. The primary purpose of these meetings is to provide project coordination, scheduling and needed information exchange among the many related DISTRICT water supply initiatives. This will include currently ongoing initiatives as well as initiatives begun during the course of the ASR Construction and Testing Contracts. The DISTRICT may schedule up to three such meetings each year.

Task A.4 Public Workshops

CONTRACTOR shall prepare for and participate in up to a total of three (3) public workshops per project, as scheduled by DISTRICT, designed to inform interested parties in the DISTRICT regarding the purpose and progress of the ASR Construction and Testing project. Coordination is required with the District's Office of Communications as addressed in Task A.

Task A.5 Other Meetings

CONTRACTOR shall prepare for and participate in other meetings, as may be needed, as determined by and assigned by DISTRICT's Project Manager for reporting the purpose, and or progress, of the ASR Construction and Testing project to interested individuals or groups. Coordination is required with the DISTRICT's Office of Communications as addressed in Task A.

Task A.6 Document Production Assistance

CONTRACTOR shall prepare fact sheets, brochures, presentations, or other documents, as may be needed, for the purpose of providing project information in support of DISTRICT public outreach programs, or other related report preparation activities, as authorized by DISTRICT Project Manager. Coordination is required with the District's Office of Communications as addressed in Task A. Materials, as required, shall be converted to web-compatible format and transmitted electronically to DISTRICT staff for inclusion in a DISTRICT-maintained web site.

Task B. Water Supply Program and Technical Assistance

The ASR Construction and Testing project activities may interface with many other ongoing DISTRICT water supply program activities including, but not limited to the following:

- Groundwater hydrologic modeling
- St. Johns River minimum flows and levels (MFL's) determination
- Facilitated decision making process
- ASR Construction and Testing (by others)
- St. Johns River Water Supply Project

It is likely that issues related to the many ongoing DISTRICT water supply program initiatives will arise during the course of the ASR Construction and Testing project. This task provides for addressing these issues as they may arise. Upon receipt of written instruction, referred to as DISTRICT Supplemental Instructions (DSI), from DISTRICT's Project Manager, CONTRACTOR shall assist DISTRICT in the evaluation of water supply program issues or strategies, and shall prepare documentation in conformance with guidelines provided by the DISTRICT's Project Manager. The schedule for completion of each document shall be included in the DSI.

Task 1 - ASR Work Plan

- 1.1 Develop ASR work plan describing ASR program suitable for distribution to policy makers, interest groups, and technical community. Work Plan shall include:
 - 1.1.1 Executive summary
 - 1.1.2 Program goals and objectives
 - 1.1.3 Funding and participation requirements
 - 1.1.4 Project selection process
 - 1.1.5 DISTRICT and cooperator responsibilities
- 1.2 Develop evaluation criteria for potential projects that are compatible with DISTRICT goals.
- 1.3 Provide in plan a list by region of the candidate areas from which ASR projects of specific types will likely be chosen.
- 1.4 Deliverables:

Draft and Final ASR work plan document as described in section 1.1.
- 1.5 Decision Process:

Work plan shall be evaluated by DISTRICT staff for sufficiency and modified as necessary by CONTRACTOR before publication by DISTRICT. The DISTRICT will assign regional candidate sites or potential utility cooperator(s) to the CONTRACTOR for proceeding with the next task.

Task 2 - Desktop project/site feasibility and selection assessment.

- 2.1 Perform desktop assessment of assigned candidate ASR project(s). Sites will be assessed using criteria developed in Task 1.2. The assessments will include evaluation of the following:
 - 2.1.1 Project objectives (i.e., natural systems impact mitigation, seasonal storage and recovery, long term aquifer recharge, saltwater intrusion barrier, etc.).

- 2.1.2 Water supply availability for ASR testing and long-term operation:
 - 2.1.2.1 Pipe size and delivery pressure
 - 2.1.2.2 Seasonal availability
 - 2.1.2.3 Water supply trends
- 2.1.3 Water demands, including variability and demand center location relative to supply source, ASR well site, and treatment/distribution facilities.
- 2.1.4 Quality of source water (including seasonal variability) and treatment requirements of both recharged and recovered water.
- 2.1.5 Hydrogeology of proposed ASR system (including water quality, well inventory and potential hydrologic impacts such as interference effects).
- 2.1.6 Required ASR system capacity and storage volume requirements to achieve project objectives.
- 2.1.7 Conceptual design of ASR system (including cycle testing and monitoring requirements) at a level sufficient to identify site logistics (i.e., piping, electrical service provision, pumping, etc.).
- 2.1.8 Preliminary cost estimate (capital and operating). The cost estimate shall include a percentage-based allowance for final design, construction engineering, and inspection.
- 2.1.9 Preliminary appraisal of other non-technical issues (regulatory, environmental, community, land acquisition, and political support/opposition).
- 2.2 Prepare preliminary plans for site-specific hydrogeologic testing program (test well) with a construction cost estimate.
- 2.3 Deliverables:

Draft and final Technical Memorandum evaluating the technical and regulatory feasibility of assigned potential ASR project, a cost estimate (including the cost to cooperator) and an evaluation of the degree to which the project meets the construction and testing ASR program goals of the DISTRICT. The draft will be peer reviewed by the other DISTRICT CONTRACTORS and the DISTRICT.
- 2.4 Decision Process:

Pending the results of the collaborative CONTRACTOR peer review, a recommendation of the project feasibility and appropriateness of combining subsequent tasks will be determined. A decision by DISTRICT whether or not to proceed to next task will be made and subsequent task cost negotiated.

Task 3 - Cooperator Agreement

- 3.1 Submit Technical Memorandum (Task 2) to proposed Cooperator and meet to discuss ASR system objectives, conceptual design, testing program, DISTRICT-specific data collection and costs. The Technical Memorandum shall establish Cooperator goals and success criteria.
- 3.2 Prepare draft agreement with proposed Cooperator and submit to DISTRICT for review and comment. After DISTRICT approval, present draft agreement to Cooperator and assist DISTRICT in negotiations.
- 3.3 Present project before city/county commission/council/Cooperator to support staff in obtaining project agreement approval.
- 3.4 Deliverables:
 - Draft agreement between DISTRICT and Cooperator.
 - Attendance at meetings/presentations.
- 3.5 Decision Process
 - Pending the successful execution of a cooperative agreement between the DISTRICT and cooperator, the CONTRACTOR will be authorized to proceed to the next task.

Task 4 - Site-specific data collection and preliminary system design.

The approach outlined in Tasks 4 and 5 reflects the desire of the DISTRICT to coordinate with the Florida Department of Environmental Protection (FDEP) in the early stages of the test program development. The exact scope of work activities will vary dependent on specific site characteristics and conditions. The DISTRICT may authorize the CONTRACTOR to combine Task 4 and Task 5 in order to reduce costs, if the likelihood of successful permitting is sufficient to warrant the additional expenditure.

- 4.1 Develop and/or coordinate regulatory strategy for intended ASR permit application.
- 4.2 Identify agency and permit requirements applicable to site and intended use. Develop checklist of requirements.
 - 4.2.1 Obtain FDEP – Exploratory Well Construction and Testing Permit if required. This would become one of the required monitor wells for operation. If required to enter the Underground Injection Control (UIC) permit program, then the CONTRACTOR will submit an application for the Exploratory Well Construction and Testing Permit with the appropriate information required. Such information will include, but may not be limited to, (1) a conceptual plan of the project, (2) a preliminary area of review study, (3) proposed other uses of exploratory well, (4) drilling and testing plan for the exploratory well, and (5) an abandonment plan, if needed. If it is determined that sufficient information exists at the site to omit Task 4, then the scope will follow the tasks outlined in Task 5 – ASR Pilot Project Design.
- 4.3 Construct test well and obtain site-specific hydrogeologic data. The DISTRICT may elect to self-perform this sub-task. The obtained data shall include:

- 4.3.1 Analysis of well cuttings.
- 4.3.2 Geophysical logging
- 4.3.3 Water quality
- 4.3.4 Cores and/or packer tests
- 4.3.5 Step drawdown test
- 4.4 Perform compatibility analysis that includes core analysis, geochemical compatibility analysis and modeling, and analysis that considers both the test water and alternative source waters.
- 4.5 Perform analyses to establish pre-treatment requirements of potential sources of recharge water.
- 4.6 Revised impact analysis (2.1.5), which may include preliminary hydraulic modeling.
- 4.7 Deliverables:

Draft and final Technical memorandum including the results of the testing program, a revised feasibility analysis (based on site-specific data), preliminary ASR system design, and revised cost estimate. The draft will be peer reviewed by other DISTRICT CONTRACTORS, the DISTRICT, and the cooperator.
- 4.8 Decision Process

Determination and recommendation by CONTRACTOR, peer reviewed by other teams, on whether project should proceed based on test results.

Pending the results of the collaborative CONTRACTOR peer review, a recommendation of the project feasibility and the appropriateness of continuing the project will be determined. A decision by DISTRICT whether or not to proceed to next task will be made and subsequent task costs may be negotiated.

Task 5 - ASR Pilot Project Design

- 5.1 Develop ASR and monitor well drilling and testing program (including all coring, packer testing, logging, laboratory analyses, special procedures etc.).
- 5.2 Finalize siting issues and design ASR and monitor wells (allowing for variations in geologic conditions).
- 5.3 Develop drilling and testing fluid management program.
- 5.4 Design surface facilities for pumping, pretreatment, post recovery treatment etc.

5.5 Develop cyclical testing and operational program.

5.6 Develop monitoring program.

5.7 Deliverables:

Well construction and testing program for the monitor/exploration well(s) and ASR well; designs for surface facilities; and operational and monitoring program. This information may be used in the permitting documents.)

5.8 Decision Process

Upon delivery by CONTRACTOR of program documents, review and comment will be conducted by FDEP and it will be peer reviewed by other DISTRICT CONTRACTOR teams.

Upon completion of a monitoring program that is satisfactory to FDEP, the DISTRICT will make a decision on whether to proceed with regulatory permitting.

Task 6 - Regulatory Permitting

6.1 Prepare permit applications with appropriate supporting documentation. Respond to requests for information.

6.2 Coordinate with appropriate agencies and gain approval for disposal of pumped water used in testing, and supply other information as required.

6.3 Deliverables

Permit applications.

Responses to request for additional information.

Permits.

6.4 Decision Process:

Pending successful issuance of FDEP UIC permit and the ability to move the project forward in a timely manner, a decision by DISTRICT whether or not to proceed to next task will be made and subsequent task cost may be negotiated.

Task 7 - ASR Facilities Construction, Monitoring and Testing

7.1 Construct ASR well and monitoring wells, and/or provides resident observation and construction services, depending upon the project delivery approach selected for each site. The DISTRICT may elect to self-perform the well construction portion of this sub-task.

7.2 Construct surface facilities, and/or provide resident observation and construction services, depending upon the project delivery approach selected for each site.

7.3 Prepare well completion report.

- 7.4 Implement monitoring plan, including sampling and laboratory analysis in accordance with FDEP-approved Comprehensive Quality Assurance Plan.
- 7.5 Perform field activities including geophysical logging, packer tests, coring and core analysis, specific capacity tests, well acidization, step pumping and step injection tests, and aquifer performance test as applicable on ASR and monitoring wells during well construction. The DISTRICT may elect to self-perform this sub-task.
- 7.6 Perform short-term “calibration cycle” recharge, storage, and recovery testing on ASR system. Provide start-up of operations, troubleshooting, and verification of treatment equipment operation, injected water quality. Evaluate well performance and potential needs for system adjustments.
- 7.7 Confirm/evaluate geochemical compatibility of proposed source water with native water and geologic formation.
 - 7.7.1 Geochemical compatibility analysis should include core analysis, geochemical analysis and modeling in conjunction with alternative source waters.
- 7.8 Evaluate treatment requirements of recharged water and recovered water after withdrawal from ASR well and make adjustments as necessary.
- 7.9 Evaluate well performance with respect to recovery from first cycle and compare to earlier predictions. Calibrate ASR performance model to predict performance of future cycles.
- 7.10 Prepare final report on hydrology, geology, well performance, cycle testing and impacts in conformance with federal, state, and local permits.
- 7.11 Prepare operations and maintenance manual, and record drawings for well and wellhead construction.
- 7.12 Deliverables:
 - 7.12.1 Constructed facilities.
 - 7.12.2 Well completion report.
 - 7.12.3 Monthly Progress Reports for testing and monitoring results.
 - 7.12.4 Final report describing: Monitoring and facility test results (monitoring and testing data provided as appendices).
 - 7.12.5 Long-term monitoring requirements.
- 7.13 Decision Process:

Pending successful construction and demonstration that the test ASR facilities are functional and capable of enhancing cooperator’s operations, and any outstanding permitting issues have been addressed to the appropriate commenting agencies, the DISTRICT will make a decision whether to proceed with Task 8.

Task 8 - Start-up and Training

- 8.1 Provide start-up services to assist with initial operations, monitoring, data reporting, and operational adjustments, as needed.

8.2 Provide training to Cooperator staff responsible for future operation.

8.3 Deliverables:

Training programs for Cooperator staff.

8.4 Decision Process

Pending the CONTRACTOR's recommendation as to whether or not the cooperator is capable of operating and monitoring the test ASR facility in order perform the large cycle testing, a decision by DISTRICT whether or not to cooperate in large-cycle operational monitoring and evaluations will be made.

Task 9 - Large Cycle Operational Monitoring and Evaluations

9.1 Oversee operation and monitoring of operational cycles as needed (preferably 2 years or 3 large cycles). Operational monitoring should encompass a minimum of 2 large cycles. Large cycle is defined as one design cycle.

9.2 Prepare performance report for each cycle with analysis of well behavior and outline any issues that could jeopardize or improve injection process.

9.3 Address significant differences between predicted and actual recovery and make appropriate calibrations to the operational performance model. Indicate actions that might be taken to improve the system operation and performance.

9.4 Deliverables:

Assessment report on system performance.

9.5 Decision Process

Deliverables only.

Task 10 - Peer review of other ASR CONTRACTOR teamwork as determined by DISTRICT.

10.1 As directed by DISTRICT, CONTRACTOR shall review work product of other ASR CONTRACTOR teams and provide comments to DISTRICT.

10.2 Deliverables:

Review comments in letter format.

10.3 Decision Process:

None – Deliverables only.

Appendix B

Memorandum of Understanding

MEMORANDUM OF UNDERSTANDING BETWEEN:
THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
AND SEMINOLE COUNTY
FOR
AQUIFER STORAGE RECOVERY CONSTRUCTION AND TESTING

CERTIFIED COPY
 MARYANNE MORSE
 CLERK OF CIRCUIT COURT
 SEMINOLE COUNTY, FLORIDA
Caylon Coker
 DEPUTY CLERK

THIS MEMORANDUM OF UNDERSTANDING ("MOU") is made and entered into on this 5th day of August, 2003, by and between the St. Johns River Water Management District (hereinafter "District"), whose mailing address is Post Office Box 1429, Palatka, Florida 32178-1429 and SEMINOLE COUNTY ("County"), whose mailing address is 1101 E. First Street, Sanford, Florida 32771.

WITNESSETH:

WHEREAS, the parties to this MOU desire to design, permit, and construct an Aquifer Storage Recovery system (Project); and

WHEREAS, the District and the County each have programmatic authority and established funding sources to cost-share this Project,

NOW THEREFORE, in consideration of the foregoing premises, which are made a part of this MOU, the District and the County hereby agree to the following:

I. AUTHORITY:

This MOU is entered into under the following authority:

- A. The District enters into this MOU under the authority of Section 373.083, Florida Statutes, which authorizes the Governing Board to enter into agreements with other public agencies to accomplish the directives and goals of Chapter 373.
- B. The County enters into this MOU under the authority of Sections 125.01 (1)(k)1. and 125.01(1)(p), Florida Statutes, which authorize the County to enter into agreements with other public agencies to accomplish goals for providing water service to its customers.

II. TERMS:


- A. This MOU shall commence on the date of full execution and shall remain in effect for five (5) years, in accordance with this agreement.
- B. This MOU shall be reviewed annually by the parties and may be amended upon mutual agreement of the parties. Amendments and renewals shall be in writing and approved by all parties.
- C. This MOU may be terminated by either party at any time upon thirty (30) days written notice to the other party, provided however, that such termination will not relieve either party of its obligation to pay, through the date of notice of termination, its respective cost-share amount for ongoing projects or programs for which it has advanced or committed funds. The County's obligation to pay is subject to the approval of the County's annual budget. The District's obligation to pay is subject to the approval of Florida Forever funding and the annual budget by the District's Governing Board.
- D. The District agrees to fund the Project for a total amount not to exceed the amount of \$2,188,000.
- E. The County agrees to fund the Project for a total amount not to exceed \$84,000.

- F. The District and County agree that all work shall be performed in accordance with EXHIBIT "A", STATEMENT OF WORK, entitled, "Aquifer Storage Recovery Construction and Testing Demonstration Project," attached hereto and incorporated herein.

III. PROJECT MANAGEMENT:

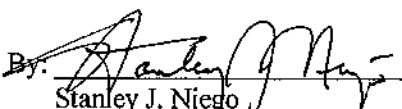
- A. Project Managers - Each party hereby designates the employee set forth below as its respective Project Manager. Project Managers shall assist with project coordination and shall be the party's primary contact person. Notices or reports shall be sent to the attention of the parties' Project Manager by U.S. mail, postage paid, to the parties' addresses as follows:

For the District:
Douglas A. Munch, P.G.
P.O. Box 1429
Palatka, Florida 32178-1429
Tel. (904) 329-4173

For the County:
J. Dennis Westrick, P.E.
500 W. Lake Mary Blvd.
Sanford, Florida 32773
Tel. (407) 665-2029
2040 

IN WITNESS WHEREOF, the following authorized representative of the District and the County have executed this Memorandum of Understanding on the date signed by each party:

Approved as to Form and Legality
District Office of General Counsel

By: 
Stanley J. Niego
Assistant General Counsel

**ST. JOHNS RIVER WATER MANAGEMENT
DISTRICT**


By: 
Printed Name: Kirby G. Green III

Title: Executive Director

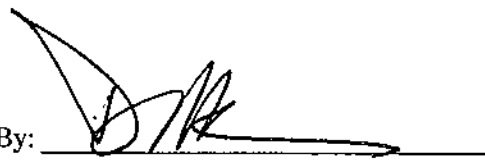
Date: 08-05-03

Approved as to Form and Legality
Seminole County

Office of the County Attorney

7-23-03
By: 

SEMINOLE COUNTY

By: 
Printed Name: Daryl G. McLain

Title: Chairman, BCC

Date: 7-23-03

**EXHIBIT A
STATEMENT OF WORK
AQUIFER STORAGE RECOVERY
CONSTRUCTION AND TESTING DEMONSTRATION PROJECT**

INTRODUCTION/BACKGROUND

Project Definition - The St. Johns River Water Management (DISTRICT) and Seminole County (COUNTY) shall jointly endeavor to design, permit, and construct an Aquifer Storage Recovery (ASR) system (Project), consisting of an exploratory well, monitoring wells, ASR test well, site work, and related pipelines and appurtenances, all defined to be part of the Project.

Project Need -- Aquifer storage recovery of water, treated to primary and secondary drinking water standards, is the primary storage method planned for surface water source development projects.

Memorandum of Understanding's (MOU) Goals -- Demonstrate that ASR is a feasible technology for utilities in the East-Central Florida region. The DISTRICT seeks to complete this cooperative project with the COUNTY and shall require its DISTRICT Contractor to prepare the design of the Project in accordance with the requirements of regulatory agencies, the COUNTY, and the DISTRICT and to obtain necessary permits and construct the Project in accordance with such design.

Consistency With DISTRICT's Mission And Goals -- This Project is included in the Water Resource Development Work Program, dated March 5, 2002, as required by Section 373.536(6)(a) 4, Florida Statutes. The design shall be consistent with DISTRICT report entitled "Desktop Assessment of Aquifer Storage and Recovery for Seminole County, Florida", prepared by Camp Dresser & McKee, Inc., and dated October 2002.

Location Of The Work -- The Project shall be located at the Wilson Elementary School property north of the Markham Water Treatment Plant in Seminole County, Florida, or a different site if mutually agreed upon by both parties.

OBJECTIVES

Statements Of The Results To Be Achieved -- The Project shall be implemented with design features approved by the DISTRICT and the COUNTY, in sequential order to provide for maximum benefit of expended funds. Sequential progress shall be based on exploration, permitting, and construction. The ASR Test Well shall be drilled in accordance with Florida Department of Environmental Protection (FDEP) Underground Injection Control (UIC) requirements, and successfully cycle-tested, to demonstrate feasibility for water storage and recovery.

SCOPE OF WORK

Outline Of Extent Of Work

Tasks 1 and 2 have been completed by the DISTRICT Contractor. Task 3 is the preparation and approval of a COUNTY Agreement. The following is an outline of the extent of work to be performed under the COUNTY Agreement:

Task 4 — Site-Specific Data Collection and Preliminary System Design

Task 5 — ASR Pilot Project Design

Task 6 — Regulatory Permitting

Task 7 — ASR Facilities Construction, Monitoring, and Testing

Task 8 — Startup and Training

Task 9 — Large Cycle Operational Monitoring and Evaluations

Task 10 — Peer Review

Brief Overview Of The Steps Of Project

The DISTRICT shall prepare a preliminary design plan for the ASR system, including an exploratory well. Based on the results of the exploratory well, final design of the ASR system shall be conducted and coordinated with FDEP UIC permitting requirements. Once the design and permit are approved, the DISTRICT shall begin construction of the ASR Test Well and related appurtenances. After completion of drilling and verification of Project requirements, cycle testing shall be performed to measure storage and recovery. If at any time the Project is deemed infeasible, the DISTRICT shall coordinate with the COUNTY the salvage of any constructed wells for monitoring purposes, or shall provide abandonment and decommissioning services as required. Upon successful demonstration of feasibility, the completed Project shall be transferred to the COUNTY for operation and ownership.

Brief Description Of The Methodology To Be Used

The DISTRICT shall utilize methodologies accepted in the professional practices of engineering and geology. Methodologies shall incorporate FDEP UIC permitting requirements and provide sufficient milestones for review, comment, and approval by the DISTRICT and the COUNTY. Construction methods shall be in accordance with the General Conditions provided for in the DISTRICT's Contractor agreement, including conformance with COUNTY local codes and requirements.

Description Of Location Of Work - The Project shall be located at the Wilson Elementary School property north of the Markham Water Treatment Plant in Seminole County, Florida. The exact Project location at the site shall be determined based on preliminary design and coordinated with the location of potable source water and discharge facilities. The ASR system shall accommodate elements of the plant's master plan, including future wellfields.

TASK IDENTIFICATION

Description Of The Work To Be Performed To Complete The Project

The following Tasks 4 through 10 are summarized from the DISTRICT Contractor agreement. These tasks shall be performed on a work-order basis as each individual task is successfully completed.

Task 4 — Site-Specific Data Collection and Preliminary System Design

This task includes site-specific data collection and preliminary system design. A data collection plan for the Project site shall be prepared based on a review of existing information and coordination with FDEP. In particular, the plan shall address the need for initial exploratory testing as the basis of development of ASR well design. The plan shall explain that exploratory testing may be conducted without having to first obtain all permits for the subsequent ASR system.

To the extent possible based on FDEP guidelines, the DISTRICT proposes to gather hydrogeologic information from the construction and testing of an initial exploratory well at the Project site, which would then be converted to an observation well for the ASR construction and testing program. The data collection plan shall be implemented, the data shall be evaluated, and a preliminary system design shall be developed. If the site is deemed to be infeasible for any reason, the DISTRICT and the COUNTY shall endeavor to locate an alternative site for the Project through mutual agreement by both parties.

Task 5 — ASR Pilot Project Design

This task includes the design of well and wellhead facilities at the selected site, including supporting infrastructure such as pipelines, electrical service, and incidental site work. The design shall also specify the proposed data collection and monitoring programs.

Task 6 — Regulatory Permitting

The DISTRICT and the COUNTY shall adhere to the necessary regulatory permitting requirements, including preparation of permit applications, and responses to requests for information from regulatory agencies. The primary permitting effort shall be through the FDEP UIC program, although other ancillary permits shall be required from local government. The DISTRICT shall provide services to support the cost of preparation of a) Well Construction permit applications, b) local government permit applications as required, c) FDEP UIC permit application, d) Consumptive Use Permit (CUP) application for testing water if necessary, e) FDEP Drinking Water System extension permit application, f) other FDEP water system permits, if required, and g) Project reports.

The DISTRICT's Agreement or contract work order with its third-party Contractor shall include site improvements required by the Project and mutually agreed upon by both parties. The COUNTY shall be responsible for processing and resolving any zoning or land use issues that may arise with regard to the Project. The COUNTY shall act as Owner of the ASR facilities for well construction, FDEP UIC, and Project related permit applications. The DISTRICT shall act as the Owner's representative in all permit related matters and pay for application fees. Upon receipt of necessary permits, the COUNTY shall provide evidence of permission to access Project site.

Task 7 — ASR Facilities Construction, Monitoring, and Testing

This task consists of construction of ASR and monitor wells, and associated pipelines, electrical service, incidental site work, and wellhead facilities. Initial hydraulic and water quality testing shall be conducted, in addition to geophysical logging, geochemical modeling, and evaluation of any additional pretreatment requirements. A series of ASR test cycles shall then be conducted to address technical and other issues pertaining to the Project site.

The DISTRICT shall provide property or easement limit field staking to define legal boundaries of construction, based on recorded easement documents furnished by COUNTY. The DISTRICT shall be responsible for construction layout, inspection, testing, and progress reporting for the Project. The COUNTY shall allow the DISTRICT full site access to inspect construction of the Project. The COUNTY shall alert the DISTRICT of any problems it knows of and the DISTRICT, when appropriate, shall require its third-party Contractor to correct any problems or non-conforming work discovered by DISTRICT inspection or COUNTY's observation.

Task 8 — Startup and Training

The DISTRICT shall provide operational training of COUNTY staff to ensure a smooth transition from the test Project into full operations.

Task 9 — Large Cycle Operational Monitoring and Evaluations

Operational monitoring and evaluation of ASR system performance shall be conducted during the first two (2) to three (3) years of operations, making any needed adjustments to improve system performance. The COUNTY shall be operating the system during this period.

Task 10 — Peer Review of DISTRICT's Work

This task includes the review of work products produced by or for the DISTRICT by other Contractors retained by the DISTRICT for the purposes of carrying out the ASR demonstration program as considered necessary by the DISTRICT. This task is not sequential and may be authorized at any time during the Project by the DISTRICT's Project Manager.

TIMEFRAMES AND DELIVERABLES**Timeframes for Sequential Completion Of Tasks (calendar days)**

Task 4, Site-Specific Data Collection and Preliminary System Design:	180 days
Task 5, ASR Pilot Project Design:	60 days
Task 6, Regulatory Permitting:	180 days
Task 7, ASR Facilities Construction, Monitoring, and Testing:	150 days
Task 8, Startup and Training:	75 days
Task 9, Large Cycle Operational Monitoring and Evaluations:	360 days
Task 10, Peer Review:	30 days

Timeframe For Completion Of Entire Project

Successive task completion without major disruption shall require a minimum of three (3) years, and up to five (5) years for final completion, in accordance with the MOU.

DISTRICT Deliverables

All deliverables shall be provided to the COUNTY in both hard copy and electronic versions. Deliverables shall generally include the following items, by task. Other elements of the Project may be added as mutually agreed upon by both parties.

Task 4, Site-Specific Data Collection and Preliminary System Design: As defined in the work order, to include the following.

- Data Collection Plan
- Preliminary Design Report
 - Exploratory Well Construction Plan
 - Exploratory Well Construction Specifications
 - Exploratory Well Contractor's Safety Plan
 - Exploratory Well Construction Schedule
 - Exploratory Well Sampling and Testing Plan
- Exploratory Well Construction Permit Application
- Well Salvage for Monitoring, or Abandonment if Site is Infeasible
- Completed Exploratory Well
- Water Quality Sampling and Testing
- Exploratory Well Project Report

Task 5, ASR Pilot Project Design: As defined in the work order, to include the following.

- ASR System Construction Plans, including Telemetry Conduit Layout
- ASR System Construction Specifications
- ASR System Construction Cost Estimate
- ASR System Construction Phase Services Plan
- ASR System Contractor's Safety Plan
- ASR System Construction Schedule
- ASR System Final Project Report

Task 6, Regulatory Permitting: The DISTRICT shall pay for all permit application fees. One (1) or more of the following deliverables shall apply to the Project, as required:

- Well Construction Permit Application(s)
- Local Government Permit Application(s)
- FDEP UIC Permit Application
- CUP Application For Testing Water
- FDEP Drinking Water System Extension Permit Application
- Other FDEP Water System Permit(s)
- Permitting Condition Progress Report(s)
- Permitting Condition Sampling And Testing Report(s)

Task 7, ASR Facilities Construction, Monitoring, and Testing: As defined in the work order, to include the following.

- Payment and Performance Bond
- Construction Survey Layout and Control
- Shop Drawings
- Updated ASR System Contractor's Safety Plan
- Updated ASR System Construction Schedule
- Monthly ASR System Project Progress Reports
- Laboratory Reports
- Well Testing Discharge Plan
- Construction Inspection and Testing Records
- Completed ASR System
- Construction Record Drawings
- Certifications of Completion
- Releases for Final Payment
- Final Construction Report
- Startup and Training Plan

Task 8, Startup and Training: As defined in the work order, to include the following.

- Operation and Maintenance Manuals
- Training Instruction
- Operating Guidelines
- Cycle Testing Plan

Task 9, Large Cycle Operational Monitoring and Evaluations: Cycle Testing Reports as defined in the work order. The DISTRICT shall provide technical oversight and assistance as required during this task.

Task 10, Peer Review: As defined in the work order.

COUNTY Deliverables

The COUNTY shall deliver the following items, according to the time they are needed as jointly determined by the COUNTY and the DISTRICT during the course of the work:

1. Timely review comments on Contractor submittals.
2. Execution of permit applications, as Project owner of the ASR facilities.
3. Relevant records pertaining to, or affecting, the Project which may consist of, but not be limited to, survey data and legal descriptions, easement documents, soils data, water facilities record drawings, site plans, right of way use requirements, and other technical information required for the planning, design, and construction of the ASR facilities at the proposed site.
4. Unique construction requirements not covered under local permits or codes, such as site lighting requirements, site access constraints, other, and any limitations on construction activities.
5. Electrical power service to the site, including offsite extensions, material purchases, new equipment, lighting, metering, and individual well service connections, in accordance with local power company requirements. The estimated capital cost to the COUNTY is \$50,000 for the furnishing of labor, equipment, and materials to install the electrical service.
6. Networked telemetry, including instrumentation and control (I&C), for well operation, if needed, except that local I&C compatible with the COUNTY's telemetry and control logic shall be provided by DISTRICT. The DISTRICT shall install COUNTY-furnished 2" PVC conduit and pull boxes from the ASR test well to the perimeter of the Markham WTP property for COUNTY's fiberoptic telemetry cable. The COUNTY shall furnish and install fiberoptic telemetry cable and panels at both ends; including conduit and cable extensions at the WTP site, any necessary building penetrations, and all connections to telemetry panels. The estimated capital cost to the COUNTY is \$10,000 for the furnishing of labor and equipment for installation of cable and panels, and the furnishing of conduit and pull box materials for the networked telemetry line.
7. Landscaping and other beautification features for the Project area, if needed, except that the DISTRICT shall restore the areas of the Project site disturbed by construction in accordance with the approved plans and specifications. The DISTRICT's restoration, as delineated in the plans and specifications shall include the following: a) grassing (seeding or sod) to the COUNTY's specification for graded restoration of the areas disturbed by construction and b) any desired or required fencing along the access road or at the wellhead.
8. Water quality sampling and testing during cycle testing phase of Project, after COUNTY assumes ownership of Project. The estimated cost to the COUNTY is \$24,000 for this water quality sampling and testing. This analytical work shall be consistent with regulatory agency permitting and monitoring requirements.
9. Information regarding features and items that are required to comply with zoning and land development codes.
10. Necessary potable water for ASR testing, permission to use COUNTY-controlled rights of way and easements for discharge purposes, and appurtenant operational requirements for the Project, including necessary coordination and related services from COUNTY's staff. In the event the COUNTY does not have an adequate allocation of water under existing CUPs for the cycle testing, then the DISTRICT shall be responsible for preparing the permit application necessary for the COUNTY to submit for DISTRICT review and approval of a separate (or additional) allocation of water sufficient for this purpose.

DISTRICT and COUNTY Responsibilities

The DISTRICT and COUNTY shall do the following in a timely manner so as not to delay the progress of the work:

1. The COUNTY is responsible to provide a Project site and associated access for the Project. If the COUNTY does not own a site suitable for the Project and elects to purchase an appropriate Project site with its own funds, the COUNTY shall coordinate the purchase with the DISTRICT. The DISTRICT shall review the COUNTY's proposed purchase agreement, if applicable, for the property needed to complete the Project, within 30 days of receipt, and either approve or recommend no purchase if the site does not meet Project requirements. The DISTRICT shall not unreasonably withhold approval of said purchase. The COUNTY shall provide evidence of ownership or easements providing access and control of facilities expected to be installed on the property. The DISTRICT shall be responsible for providing field services for surveying for property survey and stakeout, and to establish horizontal and vertical control for the Project.
2. The COUNTY shall own the Project after completion. The COUNTY agrees to assume full ownership responsibility for Project following construction and startup. The COUNTY shall participate in and accommodate operational cycle testing performed by the DISTRICT. The DISTRICT shall provide the COUNTY with data collection guidelines after cycle testing is complete.
3. The COUNTY shall be responsible for operation and maintenance of completed Project. The COUNTY agrees to assume total responsibility of ownership for continued operation, maintenance, and data collection for the system following completion of the term of this MOU, in perpetuity, but reserves the right to re-permit, modify, abandon, or decommission the Project in accordance with applicable rules and regulations should the Project cease to be functional for its intended purpose. In event of abandonment or decommissioning, the DISTRICT reserves the right to access the Project for well monitoring purposes.
4. Other elements of the Project as mutually agreed upon by both parties.

Comment And Review Time

Major milestone submittals defined in the work orders shall generally include four (4) weeks for review and comment by the DISTRICT and the COUNTY. Review and comment for lesser submittals may be reduced to three (3) weeks.

Construction-phase data that must be reviewed and approved in a shorter timeframe to facilitate Contractor's activities shall be specified in the work order or determined by the DISTRICT's Project Manager.

The DISTRICT shall compile review comments from DISTRICT staff and COUNTY Project representatives into one document for transmittal to the DISTRICT Contractor. The COUNTY shall be available for explanation, discussion, and resolution of review comments.

PROJECT BUDGET

The DISTRICT shall be responsible for all costs of the Project with the exception of capital costs listed below and like-kind services as described in this Statement of Work. The estimated cost for the DISTRICT to implement the Project is within the cost range estimated in the DISTRICT report entitled "Desktop Assessment of Aquifer Storage and Recovery for Seminole County, Florida", prepared by Camp Dresser & McKee, and dated October 2002. The COUNTY shall be responsible for the capital-related costs for the Project.

The following is a summary of DISTRICT and COUNTY estimated Project costs.

DISTRICT Work by Contractor	
Using Current Florida Forever Funding	\$ 2,188,000
COUNTY Capital-related Cost Items:	
Task 7, Electrical Service	\$ 50,000
Task 7, Networked Telemetry	\$ 10,000
Task 9, Water Quality Sampling and Analysis	\$ 24,000
Sub Total COUNTY	\$ 84,000
 TOTAL	 \$ 2,272,000

**FIRST AMENDMENT TO THE MEMORANDUM OF UNDERSTANDING BETWEEN
THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
AND SEMINOLE COUNTY
FOR AQUIFER STORAGE RECOVERY CONSTRUCTION AND TESTING**

THIS AMENDMENT is entered into by and between the GOVERNING BOARD of the ST. JOHNS RIVER WATER MANAGEMENT DISTRICT ("the District"), whose mailing address is 4049 Reid Street, Palatka, Florida 32177 and SEMINOLE COUNTY ("the County"), a political subdivision of the state of Florida whose address is Seminole County Services Building, 1101 East First Street, Sanford, Florida 32771 and is effective on the date the last party has executed same.

WHEREAS, the District and the County, entered into a Memorandum of Understanding (MOU) SG341AA on August 5, 2003, for the County to co-share funding costs with the District to design, permit, and construct an Aquifer Storage Recovery system (Project) in Seminole County, Florida.

WHEREAS, the District and the County, desire to modify the MOU.

NOW, THEREFORE, in consideration of the mutual covenants contained herein and for other good and valuable consideration, the District and the County, hereby agree to the following amendments:

II. TERMS: delete these paragraphs and replace them with the following paragraphs:

"D. The District agrees to fund the Project for a total amount not to exceed the amount of \$4,807,000."

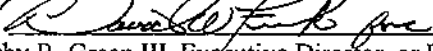
"E. The County agrees to fund the Project for a total amount not to exceed \$270,000."

"F. The District and County agree that all work shall be performed in accordance with Exhibit "A-1" - Statement of Work, entitled "Aquifer Storage Recovery Construction and Testing Demonstration Project," attached hereto and incorporated herein."

The District and the County, agree that all other terms and conditions of the original Agreement dated August 5, 2003, are hereby ratified and continue in full force and effect.

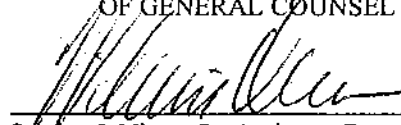
IN WITNESS WHEREOF, the parties hereto have duly executed this Amendment on the date set forth below.

ST. JOHNS RIVER WATER
MANAGEMENT DISTRICT

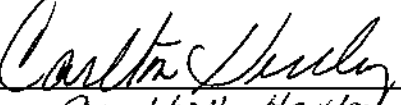
By: 
Kirby B. Green III, Executive Director, or Designee

Date: 11/1/07

APPROVED BY THE OFFICE
OF GENERAL COUNSEL


Stanley J. Niego, Sr. Assistant General Counsel

SEMINOLE COUNTY

By: 
Carlton Hewley
12-14-06

Typed Name and Title

Date: _____

Attest: 

Typed Name and Title

**EXHIBIT A-1 - STATEMENT OF WORK
AQUIFER STORAGE RECOVERY
CONSTRUCTION AND TESTING DEMONSTRATION PROJECT**

I. INTRODUCTION/BACKGROUND

Project Definition - The St. Johns River Water Management (District) and Seminole County (County) shall jointly endeavor to design, permit, and construct an Aquifer Storage Recovery (ASR) system (Project), consisting of an exploratory well, monitoring wells, ASR test well, site work, and related pipelines and appurtenances, all defined to be part of the Project.

Project Need – Aquifer storage recovery of water, treated to primary and secondary drinking water standards, is the primary storage method planned for surface water source development projects.

Memorandum of Understanding's (MOU) Goals – Demonstrate that ASR is a feasible technology for utilities in the East-Central Florida region. The District seeks to complete this cooperative project with the County and shall require its District Contractor to prepare the design of the Project in accordance with the requirements of regulatory agencies, the County, and the District and to obtain necessary permits and construct the Project in accordance with such design.

Consistency With District's Mission And Goals – This Project is included in the Water Resource Development Work Program, dated March 5, 2002, as required by Section 373.536(6)(a) 4, Florida Statutes. The design shall be consistent with District report entitled "Desktop Assessment of Aquifer Storage and Recovery for Seminole County, Florida", prepared by Camp Dresser & McKee, Inc., and dated October 2002.

Location of the Work – The Project shall be located at the Wilson Elementary School property north of the Markham Water Treatment Plant in Seminole County, Florida, or a different site if mutually agreed upon by both parties.

II. OBJECTIVES

Statements of the Results to be Achieved – The Project shall be implemented with design features approved by the District and the County, in sequential order to provide for maximum benefit of expended funds. Sequential progress shall be based on exploration, permitting, and construction. The ASR Test Well shall be drilled in accordance with Florida Department of Environmental Protection (FDEP) Underground Injection Control (UIC) requirements, and successfully cycle-tested, to demonstrate feasibility for water storage and recovery.

III. SCOPE OF WORK

Outline of Extent of Work

Tasks 1 and 2 have been completed by the District Contractor. Task 3 is the preparation and approval of a County Agreement. The following is an outline of the extent of work to be performed under the County Agreement:

Task 4 — Site-Specific Data Collection and Preliminary System Design

Task 5 — ASR Pilot Project Design

Task 6 — Regulatory Permitting

Task 7 — ASR Facilities Construction, Monitoring, and Testing

Task 8 — Startup and Training

Task 9 — Large Cycle Operational Monitoring and Evaluations

Task 10 — Peer Review

Brief Overview of the Steps of Project

The District shall prepare a preliminary design plan for the ASR system, including an exploratory well. Based on the results of the exploratory well, final design of the ASR system shall be conducted and coordinated with FDEP UIC permitting requirements. Once the design and permit are approved, the District shall begin construction of the ASR Test Well and related appurtenances. After completion of drilling and verification of Project requirements, cycle testing shall be performed to measure storage and recovery. If at any time the Project is deemed infeasible, the District shall coordinate with the County the salvage of any constructed wells for monitoring purposes, or shall provide abandonment and decommissioning services as required. Upon successful demonstration of feasibility, the completed Project shall be transferred to the County for operation and ownership.

Brief Description of the Methodology to be Used

The District shall utilize methodologies accepted in the professional practices of engineering and geology. Methodologies shall incorporate FDEP UIC permitting requirements and provide sufficient milestones for review, comment, and approval by the District and the County. Construction methods shall be in accordance with the General Conditions provided for in the District's Contractor agreement, including conformance with County local codes and requirements.

Description of Location of Work - The Project shall be located at the Wilson Elementary School property north of the Markham Water Treatment Plant in Seminole County, Florida. The exact Project location at the site shall be determined based on preliminary design and coordinated with the location of potable source water and discharge facilities. The ASR system shall accommodate elements of the plant's master plan, including future wellfields.

IV. TASK IDENTIFICATION

Description of the Work to be Performed to Complete the Project

The following Tasks 4 through 10 are summarized from the District Contractor agreement. These tasks shall be performed on a work-order basis as each individual task is successfully completed.

Task 4 — Site-Specific Data Collection and Preliminary System Design

This task includes site-specific data collection and preliminary system design. A data collection plan for the Project site shall be prepared based on a review of existing information and coordination with FDEP. In particular, the plan shall address the need for initial exploratory testing as the basis of development of ASR well design. The plan shall explain that exploratory testing may be conducted without having to first obtain all permits for the subsequent ASR system.

To the extent possible based on FDEP guidelines, the District proposes to gather hydrogeologic information from the construction and testing of an initial exploratory well at the Project site, which would then be converted to an observation well for the ASR construction and testing program. The data collection plan shall be implemented, the data shall be evaluated, and a preliminary system design shall be developed. If the site is deemed to be infeasible for any reason, the District and the County shall endeavor to locate an alternative site for the Project through mutual agreement by both parties.

Task 5 — ASR Pilot Project Design

This task includes the design of well and wellhead facilities at the selected site, including supporting infrastructure such as pipelines, electrical service, and incidental site work. The design shall also specify the proposed data collection and monitoring programs.

Task 6 — Regulatory Permitting

The District and the County shall adhere to the necessary regulatory permitting requirements, including preparation of permit applications, and responses to requests for information from regulatory agencies. The primary permitting effort shall be through the FDEP UIC program, although other ancillary permits shall be required from local government. The District shall provide services to support the cost of preparation of a) Well Construction permit applications, b) local government permit applications as required, c) FDEP UIC permit application, d) Consumptive Use Permit (CUP) application for testing water if necessary, e) FDEP Drinking Water System extension permit application, f) other FDEP water system permits, if required, and g) Project reports.

The District's Agreement or contract work order with its third-party Contractor shall include site improvements required by the Project and mutually agreed upon by both parties. The County shall be responsible for processing and resolving any zoning or land use issues that may arise with regard to the Project. The County shall act as Owner of the ASR facilities for well construction, FDEP UIC, and Project related permit applications. The District shall act as the Owner's representative in all permit related matters and pay for application fees. Upon receipt of necessary permits, the County shall provide evidence of permission to access Project site.

Task 7 — ASR Facilities Construction, Monitoring, and Testing

This task consists of construction of ASR and monitor wells, and associated pipelines, electrical service, incidental site work, and wellhead facilities. Initial hydraulic and water quality testing shall be conducted, in addition to geophysical logging, geochemical modeling, and evaluation of any additional pretreatment requirements. A series of ASR test cycles shall then be conducted to address technical and other issues pertaining to the Project site.

The District shall provide property or easement limit field staking to define legal boundaries of construction, based on recorded easement documents furnished by County. The District shall be responsible for construction layout, inspection, testing, and progress reporting for the Project. The County shall allow the District full site access to inspect construction of the Project. The County shall alert the District of any problems it knows of and the District, when appropriate, shall require its third-party Contractor to correct any problems or non-conforming work discovered by District inspection or County's observation.

Task 8 — Startup and Training

The District shall provide operational training of County staff to ensure a smooth transition from the test Project into full operations.

Task 9 — Large Cycle Operational Monitoring and Evaluations

Operational monitoring and evaluation of ASR system performance shall be conducted during the first two (2) to three (3) years of operations, making any needed adjustments to improve system performance. The County shall be operating the system during this period.

Task 10 — Peer Review of District Work

This task includes the review of work products produced by or for the District by other Contractors retained by the District for the purposes of carrying out the ASR demonstration program as considered necessary by the District. This task is not sequential and may be authorized at any time during the Project by the District's Project Manager.

V. TIME FRAMES AND DELIVERABLES

Timeframes for Sequential Completion Of Tasks (calendar days)

Task 4, Site-Specific Data Collection and Preliminary System Design:	180 days
Task 5, ASR Pilot Project Design:	60 days
Task 6, Regulatory Permitting:	180 days
Task 7, ASR Facilities Construction, Monitoring, and Testing:	150 days
Task 8, Startup and Training:	75 days
Task 9, Large Cycle Operational Monitoring and Evaluations:	360 days
Task 10, Peer Review:	30 days

Timeframe For Completion Of Entire Project

Successive task completion without major disruption shall require a minimum of three (3) years, and up to five (5) years for final completion, in accordance with the MOU.

District Deliverables

All deliverables shall be provided to the County in both hard copy and electronic versions. Deliverables shall generally include the following items, by task. Other elements of the Project may be added as mutually agreed upon by both parties.

Task 4, Site-Specific Data Collection and Preliminary System Design: As defined in the work order, to include the following.

- Data Collection Plan
- Preliminary Design Report
 - Exploratory Well Construction Plan
 - Exploratory Well Construction Specifications
 - Exploratory Well Contractor's Safety Plan

- Exploratory Well Construction Schedule
- Exploratory Well Sampling and Testing Plan
- Exploratory Well Construction Permit Application
- Well Salvage for Monitoring, or Abandonment if Site is Infeasible
- Completed Exploratory Well
- Water Quality Sampling and Testing
- Exploratory Well Project Report

Task 5, ASR Pilot Project Design: As defined in the work order, to include the following.

- ASR System Construction Plans, including Telemetry Conduit Layout
- ASR System Construction Specifications
- ASR System Construction Cost Estimate
- ASR System Construction Phase Services Plan
- ASR System Contractor's Safety Plan
- ASR System Construction Schedule
- ASR System Final Project Report

Task 6, Regulatory Permitting: The District shall pay for all permit application fees. One (1) or more of the following deliverables shall apply to the Project, as required:

- Well Construction Permit Application(s)
- Local Government Permit Application(s)
- FDEP UIC Permit Application
- CUP Application For Testing Water
- FDEP Drinking Water System Extension Permit Application
- Other FDEP Water System Permit(s)
- Permitting Condition Progress Report(s)
- Permitting Condition Sampling And Testing Report(s)

Task 7, ASR Facilities Construction, Monitoring, and Testing: As defined in the work order, to include the following.

- Payment and Performance Bond
- Construction Survey Layout and Control
- Shop Drawings
- Updated ASR System Contractor's Safety Plan
- Updated ASR System Construction Schedule
- Monthly ASR System Project Progress Reports
- Laboratory Reports
- Well Testing Discharge Plan
- Construction Inspection and Testing Records
- Completed ASR System
- Construction Record Drawings
- Certifications of Completion
- Releases for Final Payment
- Final Construction Report
- Startup and Training Plan

Task 8, Startup and Training: As defined in the work order, to include the following.

- Operation and Maintenance Manuals
- Training Instruction
- Operating Guidelines
- Cycle Testing Plan

Task 9, Large Cycle Operational Monitoring and Evaluations: Cycle Testing Reports as defined in the work order. The District shall provide technical oversight and assistance as required during this task.

Task 10, Peer Review: As defined in the work order.

County Deliverables

The County shall deliver the following items, according to the time they are needed as jointly determined by the County and the District during the course of the work:

1. Timely review comments on Contractor submittals.
2. Execution of permit applications, as Project owner of the ASR facilities.
3. Relevant records pertaining to, or affecting, the Project which may consist of, but not be limited to, survey data and legal descriptions, easement documents, soils data, water facilities record drawings, site plans, right of way use requirements, and other technical information required for the planning, design, and construction of the ASR facilities at the proposed site.
4. Unique construction requirements not covered under local permits or codes, such as site lighting requirements, site access constraints, other, and any limitations on construction activities.
5. Electrical power service to the site, including offsite extensions, material purchases, new equipment, lighting, metering, and individual well service connections, in accordance with local power company requirements.
6. Networked telemetry, including instrumentation and control (I&C), for well operation, if needed, except that local I&C compatible with the County's telemetry and control logic shall be provided by District. The District shall install County-furnished 2" PVC conduit and pull boxes from the ASR test well to the perimeter of the Markham WTP property for County's fiberoptic telemetry cable. The County shall furnish and install fiberoptic telemetry cable and panels at both ends; including conduit and cable extensions at the WTP site, any necessary building penetrations, and all connections to telemetry panels.
7. Landscaping and other beautification features for the Project area, if needed, except that the District shall restore the areas of the Project site disturbed by construction in accordance with the approved plans and specifications. The District's restoration, as delineated in the plans and specifications shall include the following: a) grassing (seeding or sod) to the County's specification for graded restoration of the areas disturbed by construction and b) any desired or required fencing along the access road or at the wellhead.
8. Water quality sampling and testing during cycle testing phase of Project, after County assumes ownership of Project. This analytical work shall be consistent with regulatory agency permitting and monitoring requirements.
9. Information regarding features and items that are required to comply with zoning and land development codes.
10. Necessary potable water for ASR testing, permission to use County-controlled rights of way and easements for discharge purposes, and appurtenant operational requirements for the Project, including necessary coordination and related services from the County's staff. In the event the County does not have an adequate allocation of water under existing CUPs for the cycle testing,

then the District shall be responsible for preparing the permit application necessary for the County to submit for District review and approval of a separate (or additional) allocation of water sufficient for this purpose.

District and County Responsibilities

The District and County shall do the following in a timely manner so as not to delay the progress of the work:

1. The County is responsible to provide a Project site and associated access for the Project. If the County does not own a site suitable for the Project and elects to purchase an appropriate Project site with its own funds, the County shall coordinate the purchase with the District. The District shall review the County's proposed purchase agreement, if applicable, for the property needed to complete the Project, within 30 days of receipt, and either approve or recommend no purchase if the site does not meet Project requirements. The District shall not unreasonably withhold approval of said purchase. The County shall provide evidence of ownership or easements providing access and control of facilities expected to be installed on the property. The District shall be responsible for providing field services for surveying for property survey and stakeout, and to establish horizontal and vertical control for the Project.
2. The County shall own the Project after completion. The County agrees to assume full ownership responsibility for Project following construction and startup. The County shall participate in and accommodate operational cycle testing performed by the District. The District shall provide the County with data collection guidelines after cycle testing is complete.
3. The County shall be responsible for operation and maintenance of completed Project. The County agrees to assume total responsibility of ownership for continued operation, maintenance, and data collection for the system following completion of the term of this MOU, in perpetuity, but reserves the right to re-permit, modify, abandon, or decommission the Project in accordance with applicable rules and regulations should the Project cease to be functional for its intended purpose. In event of abandonment or decommissioning, the District reserves the right to access the Project for well monitoring purposes.
4. Other elements of the Project as mutually agreed upon by both parties.

Comment And Review Time

Major milestone submittals defined in the work orders shall generally include four (4) weeks for review and comment by the District and the County. Review and comment for lesser submittals may be reduced to three (3) weeks.

Construction-phase data that must be reviewed and approved in a shorter timeframe to facilitate Contractor's activities shall be specified in the work order or determined by the District's Project Manager.

The District shall compile review comments from District staff and County Project representatives into one document for transmittal to the District Contractor. The County shall be available for explanation, discussion, and resolution of review comments.

VI. PROJECT BUDGET

The District shall be responsible for all costs of the Project with the exception of capital costs listed below and like-kind services as described in this Statement of Work. The estimated cost for the District was originally estimated in the District report entitled "Desktop Assessment of Aquifer Storage and Recovery for Seminole County, Florida," prepared by Camp Dresser & McKee, and dated October 2002. The County shall be responsible for the capital-related costs for the Project.

The following is a summary of District and County estimated Project costs.

District Work by Contractor	
Using Current Florida Forever Funding	\$4,807,000
County Capital-related Cost Items, including water Quality sampling and analysis, electrical services, and networked telemetry	\$ 270,000
TOTAL	\$5,077,000

**SECOND AMENDMENT TO THE MEMORANDUM OF UNDERSTANDING BETWEEN
THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
AND SEMINOLE COUNTY
FOR AQUIFER STORAGE RECOVERY CONSTRUCTION AND TESTING**

THIS AMENDMENT is entered into by and between the GOVERNING BOARD of the ST. JOHNS RIVER WATER MANAGEMENT DISTRICT ("the District"), whose mailing address is 4049 Reid Street, Palatka, Florida 32177, and SEMINOLE COUNTY ("the County"), a political subdivision of the state of Florida whose address is Seminole County Services Building, 1101 East First Street, Sanford, Florida 32771, and is effective on August 5, 2008.

WHEREAS, the District and the County entered into a Memorandum of Understanding (MOU) SG341AA on August 5, 2003, for the County to co-share funding costs with the District to design, permit, and construct an Aquifer Storage Recovery system (Project) in Seminole County, Florida, and amended the Agreement on January 11, 2007 (Amendment #1); and

WHEREAS, the District and the County desire to modify the MOU.

NOW, THEREFORE, in consideration of the mutual covenants contained herein and for other good and valuable consideration, the District and the County, hereby agree to the following amendment:

II. TERMS: delete Paragraph A of the MOU and replace with the following:

"A. This MOU shall commence on the date of full execution and shall expire on September 30, 2010."

The District and the County agree that all other terms and conditions of the original MOU and Amendment #1 are hereby ratified and continue in full force and effect.

IN WITNESS WHEREOF, the parties hereto have duly executed this Amendment on the date set forth below.

ST. JOHNS RIVER WATER
MANAGEMENT DISTRICT

By: Kirby B. Green III
Kirby B. Green III, Executive Director

Date: 8/8/08

APPROVED BY THE OFFICE
OF GENERAL COUNSEL

Stanley J. Niego, Sr. Assistant General Counsel
for Stanley J. Niego, Sr. Assistant General Counsel

SEMINOLE COUNTY

By: Brenda Carey
Brenda Carey, Chairman
Typed Name and Title

Date: 7/25/08

Attest: Maryanne Morse
Maryanne Morse, Clerk to the Board of
County Commissioners of Seminole County, Florida
Typed Name and Title

APPROVED AS TO FORM AND LEGALITY
SEMINOLE COUNTY
OFFICE OF THE COUNTY ATTORNEY

By: Susan E. Dietrich 7-30-08

**THIRD AMENDMENT TO THE MEMORANDUM OF UNDERSTANDING BETWEEN
THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
AND SEMINOLE COUNTY
FOR AQUIFER STORAGE RECOVERY CONSTRUCTION AND TESTING**

THIS AMENDMENT is entered into by and between the GOVERNING BOARD of the ST. JOHNS RIVER WATER MANAGEMENT DISTRICT ("the District"), whose mailing address is 4049 Reid Street, Palatka, Florida 32177 and SEMINOLE COUNTY ("the County"), a political subdivision of the state of Florida whose address is Seminole County Services Building, 1101 East First Street, Sanford, Florida 32771 and is effective on the date the last party has executed same.

WHEREAS, the District and the County entered into a Memorandum of Understanding (MOU) SG341AA on August 5, 2003, for the County to co-share funding costs with the District to design, permit, and construct an Aquifer Storage Recovery system (Project) in Seminole County, Florida, and amended the Agreement on January 11, 2007 (Amendment #1), and August 8, 2008 (Amendment #2); and

WHEREAS, the District and the County, desire to further amend the MOU.

NOW, THEREFORE, in consideration of the mutual covenants contained herein and for other good and valuable consideration, the District and the County, hereby agree to the following amendments:

1. **II. TERMS:** delete paragraphs D, E and F, and replace them with the following paragraphs:

"D. The District agrees to fund the Project for a total amount not to exceed \$6,005,000."

"E. The County agrees to fund the Project for a total amount not to exceed \$270,000."

"F. The District and County agree that all work shall be performed in accordance with Exhibit "A-2" – Revised Statement of Work, entitled "Aquifer Storage Recovery Construction and Testing Demonstration Project," attached hereto and incorporated herein."

The District and the County, agree that all other terms and conditions of the original MOU and amendments are hereby ratified and continue in full force and effect.

IN WITNESS WHEREOF, the parties hereto have duly executed this Amendment on the date set forth below.

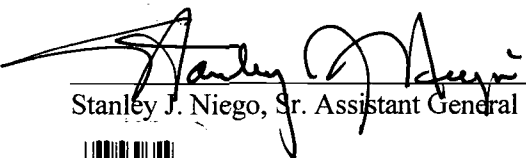
ST. JOHNS RIVER WATER
MANAGEMENT DISTRICT

By: 

Kirby B. Green III, Executive Director, or Designee

Date: 11/19/08


APPROVED BY THE OFFICE
OF GENERAL COUNSEL

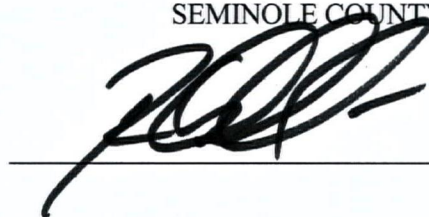

Stanley J. Niego, Sr. Assistant General Counsel



ATTEST:

BOARD OF COUNTY COMMISSIONERS
SEMINOLE COUNTY




MARYANNE MORSE, Clerk to the
Board of County Commissioners in
and for Seminole County, Florida.
_____, Chairman

Date: November 3, 2009

As authorized for execution by the Board of
County Commissioners at their November 10,
2009, regular meeting.

For Use and Reliance of Seminole County Only.
Approved as to Legal Form and Sufficiency.



County Attorney

EXHIBIT A-2 - REVISED STATEMENT OF WORK
AQUIFER STORAGE RECOVERY
CONSTRUCTION AND TESTING DEMONSTRATION PROJECT

I. INTRODUCTION/BACKGROUND

Amendment #3 includes the incorporation of pretreatment facilities into the Aquifer Storage Recovery Construction and Testing Demonstration Project in Seminole County.

Project Definition - The St. Johns River Water Management (District) and Seminole County (County) shall jointly endeavor to design, permit, and construct an Aquifer Storage Recovery (ASR) system (Project), consisting of an exploratory well, monitoring wells, ASR test well, site work, pretreatment system, and related pipelines and appurtenances, all defined to be part of the Project.

Project Need - Aquifer storage recovery of water, treated to primary and secondary drinking water standards, is the primary storage method planned for surface water source development projects.

Memorandum of Understanding's (MOU) Goals - Demonstrate that ASR is a feasible technology for utilities in the East-Central Florida region. The District seeks to complete this cooperative project with the County and shall require its District Contractor to prepare the design of the Project in accordance with the requirements of regulatory agencies, the County, and the District and to obtain necessary permits and construct the Project in accordance with such design.

Consistency with District's Mission and Goals - This Project is included in the Water Resource Development Work Program, dated March 5, 2002, as required by Section 373.536(6)(a) 4, Florida Statutes. The design shall be consistent with District report entitled "Desktop Assessment of Aquifer Storage and Recovery for Seminole County, Florida," prepared by Camp Dresser & McKee, Inc., and dated October 2002.

Location of the Work - The Project shall be located at the Wilson Elementary School property north of the Markham Regional Water Treatment Plant (WTP) in Seminole County, Florida, or a different site if mutually agreed upon by both parties. Pretreatment facilities shall be located at the Markham Regional WTP site, or a different site if mutually agreed upon by both parties.

The ASR work shall also address the potential for mineral leaching to occur in the aquifer as a result of ASR cycle testing. Potable water, which may have higher dissolved oxygen levels and higher oxidation-reduction potential than native ground water, may create a potential leaching condition in the aquifer after recharge and/or during storage and recovery. To minimize or eliminate the potential for mineral leaching, pretreatment of the water shall be investigated. Pretreatment system design, permitting, and construction may include degasification and/or dechlorination. To benefit from regulatory flexibility offered by the Florida Department of Environmental Protection (FDEP), the County agrees to apply for a Major Modification to the FDEP Underground Injection Control (UIC) permit, which shall include an Administrative Order addressing the potential for mineral leaching.

II. OBJECTIVES

Statements of the Results To Be Achieved - The Project shall be implemented with design features approved by the District and the County, in sequential order to provide for maximum benefit of expended funds. Sequential progress shall be based on exploration, permitting, and construction. The ASR Test Well

shall be drilled in accordance with FDEP UIC requirements, and cycle-tested, to demonstrate feasibility for water storage and recovery. Cycle testing may include pretreatment as determined jointly by the District and County, and as coordinated with applicable regulatory agencies.

III. SCOPE OF WORK

Outline of Extent of Work

Tasks 1, 2, and 3 have been completed by the District Contractor. The following is an outline of the extent of work to be performed under this Agreement:

Task 4 — Site-Specific Data Collection and Preliminary System Design

Task 5 — ASR Pilot Project Design, including Pretreatment System

Task 6 — Regulatory Permitting of ASR Facilities, including Pretreatment System

Task 7 — ASR Facilities, including Pretreatment System, Construction, Monitoring, and Testing

Task 8 — Startup and Training, including Pretreatment System

Task 9 — Large Cycle Operational Monitoring and Evaluations (Note: Cycle testing may include pretreatment as determined jointly by the District and the County, and as coordinated with applicable regulatory agencies.

Task 10 — Peer Review

Brief Overview of the Steps of Project

The District shall prepare a preliminary design plan for the ASR system, including an exploratory well. Based on the results of the exploratory well, final design of the ASR system shall be conducted and coordinated with FDEP UIC permitting requirements. Once the design and permit are approved, the District shall begin construction of the ASR Test Well and related appurtenances, including pretreatment system. Pretreatment system shall include dechlorination and/or degasification components. Cycle testing may include pretreatment as determined jointly by the District and County, and as coordinated with applicable regulatory agencies.

After completion of drilling and verification of Project requirements, cycle testing shall be performed to measure storage and recovery. If at any time the Project is deemed infeasible, the District shall coordinate with the County the salvage of any constructed wells for monitoring purposes, or shall provide abandonment and decommissioning services as required. After construction, startup, and training, the completed Project shall be transferred to the County for operation and ownership.

Brief Description of the Methodology to be Used

The District shall utilize methodologies accepted in the professional practices of engineering and geology. Methodologies shall incorporate FDEP UIC permitting requirements and provide sufficient milestones for review, comment, and approval by the District and the County. Construction methods shall be in accordance with the General Conditions provided for in the District's Contractor agreement, including conformance with County local codes and requirements.

Description of Location Of Work - The Project shall be located at the Wilson Elementary School property north of the Markham Regional WTP in Seminole County, Florida. The exact Project location at the site shall be determined based on preliminary design and coordinated with the location of potable source water and discharge facilities. The ASR system shall accommodate elements of the plant's master plan, including future wellfields. Pretreatment facilities shall be located at the Markham WTP site, or a different site if mutually agreed upon by both parties.

IV. TASK IDENTIFICATION

Description of the Work to be Performed to Complete the Project

The following Tasks 4 through 10 are summarized from the District Contractor agreement. These tasks shall be performed on a work-order basis as each individual task is successfully completed.

Task 4 — Site-Specific Data Collection and Preliminary System Design

This task includes site-specific data collection and preliminary system design. A data collection plan for the Project site shall be prepared based on a review of existing information and coordination with FDEP. In particular, the plan shall address the need for initial exploratory testing as the basis of development of ASR well design. The plan shall explain that exploratory testing may be conducted without having to first obtain all permits for the subsequent ASR system.

To the extent possible based on FDEP guidelines, the District proposes to gather hydrogeologic information from the construction and testing of an initial exploratory well at the Project site, which would then be converted to an observation well for the ASR construction and testing program. The data collection plan shall be implemented, the data shall be evaluated, and a preliminary system design shall be developed. If the site is deemed to be infeasible for any reason, the District and the County shall endeavor to locate an alternative site for the Project through mutual agreement by both parties.

Task 5 — ASR Pilot Project Design, including Pretreatment System

This task includes the design of well and wellhead facilities at the selected site, including supporting infrastructure such as pipelines, electrical service, and incidental site work. The design shall also specify the proposed data collection and monitoring programs.

Task 6 — Regulatory Permitting, including Pretreatment System

The District and the County shall adhere to the necessary regulatory permitting requirements, including preparation of permit applications, and responses to requests for information from regulatory agencies. The primary permitting effort shall be through the FDEP UIC program, although other ancillary permits shall be required from local government. The District shall provide services to support the cost of preparation of a) Well Construction permit applications, b) local government permit applications as required, c) FDEP UIC permit application, d) Consumptive Use Permit (CUP) application for testing water if necessary, e) FDEP Drinking Water System extension permit application, f) other FDEP water system permits and permit modifications, if required, and g) Project reports.

The District's Agreement or contract work order with its third-party Contractor shall include site improvements required by the Project and mutually agreed upon by both parties. The County shall be responsible for processing and resolving any zoning or land use issues that may arise with regard to the Project. The County shall act as Owner of the ASR facilities for well construction, FDEP UIC, pretreatment construction, and Project related permit applications. The District shall act as the Owner's representative in all

permit related matters and pay for application fees. Upon receipt of necessary permits, the County shall provide evidence of permission to access Project site.

Task 7 — ASR Facilities, including Pretreatment System, Construction, Monitoring, and Testing

This task consists of construction of ASR and monitor wells, pretreatment system, and associated pipelines, electrical service, incidental site work, and wellhead facilities. Initial hydraulic and water quality testing shall be conducted, in addition to geophysical logging, geochemical modeling, and evaluation of any additional pretreatment requirements. A series of ASR test cycles shall then be conducted to address technical and other issues pertaining to the Project site.

The District shall provide property or easement limit field staking to define legal boundaries of construction, based on recorded easement documents furnished by County. The District shall be responsible for construction layout, inspection, testing, and progress reporting for the Project. The County shall allow the District full site access to inspect construction of the Project. The County shall alert the District of any problems it knows of and the District, when appropriate, shall require its third-party Contractor to correct any problems or non-conforming work discovered by District inspection or County's observation.

Task 8 — Startup and Training

The District shall provide operational training of County staff to ensure a smooth transition from the test Project into full operations.

Task 9 — Large Cycle Operational Monitoring and Evaluations (Note: Cycle testing may include pretreatment as determined jointly by the District and the County, and as coordinated with applicable regulatory agencies.)

Operational monitoring and evaluation of ASR system performance shall be conducted during the first year of operation, making any needed adjustments to improve system performance. The County shall own, operate, and maintain the system during this period.

Task 10 — Peer Review of District's Work

This task includes the review of work products produced by or for the District by other Contractors retained by the District for the purposes of carrying out the ASR demonstration program as considered necessary by the District. This task is not sequential and may be authorized at any time during the Project by the District's Project Manager.

V. TIME FRAMES AND DELIVERABLES

The project will be completed by September 10, 2010.

District Deliverables

The District will provide all deliverables to the County in both hard copy and electronic versions. Deliverables will generally include the following items, by task. Other elements of the Project may be added as mutually agreed upon by both parties.

Task 4, Site-Specific Data Collection and Preliminary System Design: As defined in the work order, to include the following. Note: Task 4 was completed in November 2004 and is included in this Revised Statement of Work for information purposes only.

- Data Collection Plan
- Preliminary Design Report
 - Exploratory Well Construction Plan
 - Exploratory Well Construction Specifications
 - Exploratory Well Contractor's Safety Plan
 - Exploratory Well Construction Schedule
 - Exploratory Well Sampling and Testing Plan
- Exploratory Well Construction Permit Application
- Well Salvage for Monitoring, or Abandonment if Site is Infeasible
- Completed Exploratory Well
- Water Quality Sampling and Testing
- Exploratory Well Project Report

Task 5, ASR Pilot Project Design, including Pretreatment System: As defined in the work order, to include the following.

- ASR System Construction Plans, including Telemetry Conduit Layout
- ASR System Construction Specifications
- ASR System Construction Cost Estimate
- ASR System Construction Phase Services Plan
- ASR System Contractor's Safety Plan
- ASR System Construction Schedule
- ASR System Final Project Report (as may be amended for pretreatment components)

Task 6, Regulatory Permitting, including Pretreatment System: The District shall pay for all permit application fees. One (1) or more of the following deliverables shall apply to the Project, as required:

- Well Construction Permit Application(s)
- Local Government Permit Application(s)
- FDEP UIC Construction Permit Application
- CUP Application For Testing Water
- FDEP Drinking Water System Extension Permit Application
- Other FDEP Water System Permit(s)
- Permitting Condition Progress Report(s)
- Permitting Condition Sampling And Testing Report(s)

Task 7, ASR Facilities, including Pretreatment System, Construction, Monitoring, and Testing: As defined in the work order, to include the following.

- Payment and Performance Bond
- Construction Survey Layout and Control
- Shop Drawings
- Updated ASR System Contractor's Safety Plan
- Updated ASR System Construction Schedule
- Monthly ASR System Project Progress Reports
- Laboratory Reports
- Well Testing Discharge Plan
- Construction Inspection and Testing Records

- Completed ASR System
 - ASR facilities (wells and pumps)
 - Pretreatment facilities
- Construction Record Drawings
- Certifications of Completion
- Releases for Final Payment
- Final Construction Report
- Startup and Training Plan

Task 8, Startup and Training, including Pretreatment System: As defined in the work order, to include the following.

- Operation and Maintenance Manuals
- Training Instruction
- Operating Guidelines
- Cycle Testing Plan

Task 9, Large Cycle Operational Monitoring and Evaluations (Note: Cycle testing may include pretreatment as determined jointly by District and the County, and as coordinated with applicable regulatory agencies): Cycle Testing Reports as defined in the work order.

The County shall own, operate, and maintain the system after construction is completed, startup and training has been conducted, and once cycle testing begins. The District shall provide technical oversight and assistance as required during this task, subject to the availability of District funds.

Task 10, Peer Review: As defined in the work order.

County Deliverables

The County shall deliver the following items, according to the time they are needed as jointly determined by the County and the District during the course of the work:

1. Timely review comments on Contractor submittals.
2. Execution of permit applications, as Project owner of the ASR facilities.
3. Relevant records pertaining to, or affecting, the Project which may consist of, but not be limited to, survey data and legal descriptions, easement documents, soils data, water facilities record drawings, site plans, right of way use requirements, and other technical information required for the planning, design, and construction of the ASR facilities at the proposed site.
4. Unique construction requirements not covered under local permits or codes, such as site lighting requirements, site access constraints, and any limitations on construction activities.
5. Electrical power service to the site, including offsite extensions, material purchases, new equipment, lighting, metering, and individual well service connections, in accordance with local power company requirements. The estimated capital cost to the County is listed in the Project Budget for the furnishing of labor, equipment, and materials to install the electrical service.
6. Networked telemetry, including instrumentation and control (I&C), for well operation, if needed, except that local I&C compatible with the County's telemetry and control logic shall be provided by the District. The District shall install County-furnished 2" PVC conduit and pull boxes from the ASR test well to the perimeter of the Markham WTP property for County's fiberoptic telemetry cable. The County shall furnish and install fiberoptic telemetry cable and panels at both ends; including conduit and cable extensions at the WTP site, any necessary building penetrations, and all connections to telemetry panels. The estimated capital cost to the County is

listed in the Project Budget for the furnishing of labor and equipment for installation of cable and panels, and the furnishing of conduit and pull box materials for the networked telemetry line. The I&C for the pretreatment system shall be local-only; integration of pretreatment I&C into the County's networked telemetry system shall be performed by County.

7. Landscaping and other beautification features for the Project area, if needed, except that the District shall restore the areas of the Project site disturbed by construction in accordance with the approved plans and specifications. The District's restoration, as delineated in the plans and specifications shall include the following: a) grassing (seeding or sod) to the County's specification for graded restoration of the areas disturbed by construction and b) any desired or required fencing along the access road or at the wellhead.
8. Water quality sampling and testing during cycle testing phase of Project, as required by the FDEP UIC construction permit. The estimated cost to the County is listed in the Project Budget for this water quality sampling and testing. This analytical work shall be consistent with regulatory agency permitting and monitoring requirements.
9. Information regarding features and items that are required to comply with zoning and land development codes.
10. Necessary potable water for ASR testing, permission to use County-controlled rights of way and easements for discharge purposes, and appurtenant operational requirements for the Project, including necessary coordination and related services from County's staff. In the event the County does not have an adequate allocation of water under existing CUPs for the cycle testing, then the District shall be responsible for preparing the permit application necessary for the County to submit for District review and approval of a separate (or additional) allocation of water sufficient for this purpose.

District and County Responsibilities

The District and County shall do the following in a timely manner so as not to delay the progress of the work:

1. The County shall provide a Project site and associated access for the Project. If the County does not own a site suitable for the Project and elects to purchase an appropriate Project site with its own funds, the County shall coordinate the purchase with the District. The District shall review the County's proposed purchase agreement, if applicable, for the property needed to complete the Project, within 30 days of receipt, and either approve or recommend no purchase if the site does not meet Project requirements. The District shall not unreasonably withhold approval of said purchase. The County shall provide evidence of ownership or easements providing access and control of facilities expected to be installed on the property. The District shall be responsible for providing field services for surveying for property survey and stakeout, and to establish horizontal and vertical control for the Project.
2. The County shall own the Project after completion. The County agrees to assume full ownership responsibility for Project following construction and startup. The County shall participate in and perform operational cycle testing required by regulatory agencies. The District shall provide technical assistance to the County with data collection guidelines for cycle testing during the term of this MOU. District's technical assistance shall consist of management oversight for the first cycle test, then less involvement for subsequent cycle tests as County's staff becomes more experienced with operational testing and permit compliance activities.
3. The County shall be responsible for ownership, operation and maintenance of the completed Project. The County agrees to assume total responsibility of ownership for continued operation, maintenance, and data collection for the system following completion of the term of this MOU, in perpetuity, but reserves the right to re-permit, modify, abandon, or decommission the Project in accordance with applicable rules and regulations should the Project cease to be functional for its intended purpose. In

event of abandonment or decommissioning, the District reserves the right to access the Project for well monitoring purposes.

4. Other elements of the Project as mutually agreed upon by both parties.

Comment and Review Time

Major milestone submittals defined in the work orders shall generally include four (4) weeks for review and comment by the District and the County. Review and comment for lesser submittals may be reduced to three (3) weeks.

Construction-phase data that must be reviewed and approved in a shorter timeframe to facilitate Contractor's activities shall be specified in the work order or determined by the District's Project Manager.

The District shall compile review comments from the District staff and the County Project representatives into one document for transmittal to the District Contractor. The County shall be available for explanation, discussion, and resolution of review comments.

VI. PROJECT BUDGET

The District shall be responsible for all costs of the Project, subject to the availability of District funds, with the exception of the County's capital costs listed below and like-kind services as described in this Statement of Work. The estimated cost for the District was originally estimated in the District report entitled "Desktop Assessment of Aquifer Storage and Recovery for Seminole County, Florida," prepared by Camp Dresser & McKee, and dated October 2002, and updated to reflect recent and current market conditions. The County shall be responsible for the County's capital-related costs for the Project.

The following is a summary of the District's and the County's estimated Project costs.

District Work by Contractor	
Using Current Florida Forever Funding	\$ 6,005,000
County Capital-related Cost Items, including Water Quality sampling and analysis, electrical Services, and networked telemetry):	\$ 270,000
TOTAL	\$ 6,275,000

**FOURTH AMENDMENT TO THE MEMORANDUM OF UNDERSTANDING BETWEEN
THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
AND SEMINOLE COUNTY
FOR AQUIFER STORAGE RECOVERY CONSTRUCTION AND TESTING**

THIS AMENDMENT is entered into by and between the GOVERNING BOARD of the ST. JOHNS RIVER WATER MANAGEMENT DISTRICT ("the District"), whose mailing address is 4049 Reid Street, Palatka, Florida 32177, and SEMINOLE COUNTY ("the County"), a political subdivision of the state of Florida whose address is Seminole County Services Building, 1101 East First Street, Sanford, Florida 32771 and is effective on October 1, 2010.

WHEREAS, the District and the County entered into a Memorandum of Understanding (MOU) SG341AA on Aug 5, 2003, for the County to co-share funding costs with the District to design, permit, and construct an Aquifer Storage and Recovery System (Project) in Seminole County, Florida, and amended the Agreement on January 11, 2007 (Amendment #1), and August 8, 2008 (Amendment #2); and December 3, 2009 (Amendment #3); and

WHEREAS, the District and the County desire to modify the MOU.

NOW, THEREFORE, in consideration of the mutual covenants contained herein and for other good and valuable consideration, the District and the County, hereby agree to the following amendments:

II. TERMS: delete paragraphs A and F and replace them with the following:

"A. This MOU shall commence on the date of full execution and shall expire on September 30, 2012."

"F. The District and the County agree that all work shall be performed in accordance with Exhibit "A-2" – Revised Statement of Work, entitled "Aquifer Storage Recovery Construction and Testing Demonstration Project" and that all project-related data will continue to be shared with or copied to the District in a form agreed to by the District and the County."

The District and the County agree that all other terms and conditions of the original MOU and amendments are hereby ratified and continue in full force and effect.

IN WITNESS WHEREOF, the parties hereto have duly executed this Amendment on the date set forth below.

ST. JOHNS RIVER WATER
MANAGEMENT DISTRICT

SEMINOLE COUNTY

By: _____
Kirby B. Green III, Executive Director

By: _____, Chairman

Typed Name and Title

Date: _____

Date: _____

APPROVED BY THE OFFICE
OF GENERAL COUNSEL

Attest: _____

Stanley J. Niego, Sr. Assistant General Counsel

Maryanne Morse, Clerk to the Board of
County Commissioners of Seminole County, Florida

Typed Name and Title

Appendix C

Evaluation of Expandability of ASR Wellfield, Seminole County, Florida



2301 Maitland Center Parkway, Suite 300
Maitland, Florida 32751
tel: 407 660-2552
fax: 407 875-1161

Memorandum

To: Glenn Forrest, P.E.

From: Leslie Turner, P.E.

Date: October 2, 2007

*Contract No.: SF409RA Work Order 24, Project Management
& Coordination FY06-07*

Contract Title: Aquifer Storage, Recovery, Construction and Testing (ASR)

*Subject: Evaluation of Expandability of ASR Wellfield,
Seminole County, Florida*

Background

The Seminole County Aquifer Storage and Recovery Project consists of approximately 3,500 feet of supply and return water lines between the Markham Water Treatment Plant (WTP) and a single Aquifer Storage and Recovery (ASR) well (ASR-1), which is located on an easement immediately adjacent to the Wilson Elementary School Property. This project is a part of the St. Johns River Water Management District's (SJRWMD) Aquifer Storage, Recovery, Construction and Testing program. The SJRWMD would like to determine the potential for expandability of the demonstration project into a small (3 MGD) ASR Wellfield, if the ASR Test Well Program is successful. This technical memorandum outlines the criteria used in determining the potential placement of additional ASR wells and associated monitoring wells.

Well Placement Criteria

Based on certain considerations for ASR well spacing, distance from County's public supply wells, constructability, hydraulics, and easement requirements, CDM recommends placement of two additional ASR wells (ASR-2 and ASR-3), each with a capacity of 1 MGD, and two additional storage zone monitoring wells (SZMW-3 and SZMW-4) and two additional confining zone monitoring wells (CZMW-2 and CZMW-3) at the locations indicated on the



Glenn Forrest, P.E.

October 2, 2007

Page 2

attached Site Plan (Figure 1). The criteria and assumptions used in locating the wells are described in the following sections.

Spacing and Monitoring

Based on previous analysis of the exploratory well testing data, the storage zone of the ASR well will extend approximately 1,265 feet radially from the ASR well. The placement of additional wells was selected to minimize potential well interference and maximize recovery efficiencies. Based on experience at other ASR sites, recovery efficiencies are higher if the ASR wellfield shares the same "bubble". However, the operation of the ASR wellfield must be controlled to avoid entrapping native poorer quality groundwater within the ASR wellfield. As Figure 1 shows, ASR-2 would be located approximately 1,135 feet from the existing ASR well, and ASR-3 would be located approximately 825 feet from the existing well. Both proposed ASR wells would be installed to the same depth as the existing well [storage zone of 940 to 1,070 feet below land surface (bls)].

According to the FDEP ASR Position Paper (2005), at least two monitoring wells are required for each ASR well. That is, at least one storage zone monitoring well within 150 feet of the ASR well and an additional storage zone monitoring well at a greater distance but in close enough proximity to the ASR well that injected water will be encountered during a normal ASR cycle. As shown on Figure 1, two additional monitoring wells (SZMW-3 and SZMW-4) would be installed for the two proposed ASR wells. The two proposed monitoring wells, coupled with the existing storage zone monitoring wells should be sufficient to meet the FDEP requirements. The storage zone monitoring wells would be installed with an open hole section from 940 to 1,070 feet bls.

The FDEP position paper does not contain specific requirements for the construction of confining zone monitoring wells, however, based on recent experience with the ASR well, CDM believes that they may be needed. Confining zone monitoring wells are used to monitor the possible upward migration of the injected water into the water production zone above the storage zone and are typically installed within 50 feet of the ASR well. Figure 1 also presents the location of 2 confining zone monitoring wells, one for each proposed ASR well. The confining zone monitoring wells would be installed with an open hole section from 720 to 770 feet bls, consistent with the interval for CZMW-1 associated with ASR-1.



Glenn Forrest, P.E.

October 2, 2007

Page 3

Inventory of Existing Supply Wells

For the purposes of this evaluation, it was assumed that no additional water supply wells, other than those already permitted, will be constructed at the Markham Water Treatment Plant (WTP) in the future. Therefore, only the existing and permitted proposed County production wells and wells of other existing legal users were considered in the evaluation. A well inventory of permitted wells within a one mile radius of the existing ASR well was completed using the databases of SJRWMD and Seminole County followed by field verification (**Attachment 1**). The following categories of wells were identified from the inventory:

- 4-inch diameter or smaller wells – typically privately owned wells used for domestic supply or irrigation and regulated by the Seminole County Health Department;
- 6-inch diameter or larger wells which are included as part of a CUP – larger diameter wells which can be privately or publicly owned and probably used for community water supply and regulated by the SJRWMD; and
- All other wells – larger diameter wells that can be privately or publicly owned, are not used for community water supply and regulated by the SJRWMD or FDEP.

The locations of these wells are shown on **Figure A-1** and listed in **Table A-1**. Placement of the two additional ASR wells as shown was based on meeting the wellhead protection criteria per Chapter 62-521, F.A.C, which prohibits construction of new Class V injection wells within a 500-foot radial setback around potable water wells.

Hydraulics of Existing and Proposed Pipelines

The supply to the Markham ASR well connects to an existing 12-inch water main that runs along the west side of Orange Boulevard, near the Wilson Elementary School. The ASR supply is 12 inches in diameter at the point of connection to the school property and then connects to a 10-inch diameter supply water main (SWM) that connects to the ASR wellhead. The existing ASR return system consists of 10-inch diameter PVC return water main (RWM) that runs from the ASR wellhead to Orange Boulevard where it connects to a 12-inch diameter HDPE RWM that runs along the Orange Boulevard right-of-way to the Markham Water Treatment Plant. Preliminary hydraulic analyses were conducted to determine the extent to which existing SWM and RWM could be utilized to serve future ASR wells. The calculations are provided as **Attachment 2** and indicate the following:



Glenn Forrest, P.E.

October 2, 2007

Page 4

- The maximum flow the existing 12-inch HDPE RWM can accommodate is 1.9 MGD to maintain velocity in the pipe less than 5 feet per second. Therefore, only two wells could be pumped at the same time if existing RWM piping were used.
- The velocity in the existing 12-inch PVC SWM (Orange Blvd crossing) would be approximately 4.18 feet per second if both ASR-1 and ASR-3 were injected simultaneously and without fire flow demand. When fire flows are required (1,250 gpm), the velocity in the 12-inch crossing would increase to 7.94 feet per second.
- Friction losses in existing 12-inch PVC SWM (Orange Blvd crossing) would be 0.5 psi during the simultaneous injection of ASR-1 and ASR-3 while maintaining fire flow. Even though the expected pressure drop is minimal, pressure sensors would be installed to shut down both the ASR well injection when pressures drop below a preset value (*e.g.* during times of fire demand at the school).

Rights-of-Way and Easements

The location of the future Wekiva Parkway alignment as shown in Figure 1 was the preferred alternative presented by the Wekiva River Basin Commission on June 1, 2007. It was assumed that the County would have a right-of-way along the parkway and that construction within the 100-ft wide right-of-way would be allowed. Based on this assumption, future ASR wells ASR-2 and ASR-3 were placed within the future Wekiva Parkway right-of-way.

A new SWM to ASR-2 would consist of a 200 ft branch, from the distribution main running along Orange Boulevard, to the ASR well. The 8-inch PVC branch would be installed within the Wekiva Parkway right-of-way, parallel to the future Wekiva Parkway. For ASR-3, the 10-inch SWM to ASR-1 would be extended to the east within Wilson Elementary school property, assuming that easements on the Wilson Elementary School site would be available, where it would be reduced to an 8-inch PVC pipe and would run along the Wekiva Parkway right-of-way.

For the purposes of this evaluation, it was assumed that arsenic would not be an issue at the ASR wellfield (as determined upon successful completion of cycle testing and operation of ASR-1), and that water extracted from the ASR wells would meet all of drinking water criteria (Chapter 62-550, FAC). The RWM would, therefore not need to go back to the water treatment plant and could be chlorinated at the wellhead and sent directly to the water distribution system. As the existing 12-inch RWM can only handle flow from two wells at any given time, return water from ASR-2 could be chlorinated at the wellhead and tied back



Glenn Forrest, P.E.

October 2, 2007

Page 5

into the distribution main along Orange Boulevard, via approximately 200 linear feet of 10-inch PVC pipe. Return water from ASR-3 would be piped, via approximately 900 ft of 10-inch PVC pipe, along the future Wekiva Parkway and Wilson Elementary School rights-of-way back toward the existing ASR well. The pipe would then be connected to the existing 12-inch HDPE RWM going back to the water treatment plant. Due to the location of ASR-3, the option to go directly into the distribution main is not recommended.

Construction Access and Construction Staging

Access to ASR-2 would be via Orange Boulevard and the future Wekiva Parkway right-of-way. The anticipated 100-foot wide Wekiva Parkway right-of-way would provide adequate area for construction staging. Access to ASR-3 would be via the existing access road for ASR-1 and the future Wekiva Parkway right-of-way. The approximately 140 ft wide right-of-way is anticipated to be adequate for construction staging for ASR-3. Each new ASR well would be fenced within a 10-ft x 35-ft chain link enclosure.

Conclusions

CDM performed a desktop evaluation of the existing Markham ASR well system to determine the potential for expandability of the existing project into a small ASR Wellfield consisting of a total of three ASR wells. Several criteria were considered in the placement of the two new wells and well piping, specifically required distance between ASR wells, distance from existing water supply wells, future Wekiva Parkway alignment, easements and rights-of-way, proximity to the County's water mains, and construction access and staging.

Based on the criteria listed above, placement of two additional ASR wells along the future Wekiva Parkway right-of-way was determined to be the most feasible option. Supply water to the new wells would be from the existing water main that runs along Orange Boulevard. ASR-2 would be served by a direct connection with the water main via an 8-inch PVC pipe. Supply water for ASR-3 would come from a connection to the existing 10-inch PVC pipe located on Wilson Elementary School property. Both ASR wells would have the ability to inject water simultaneously. A pressure sensor would be installed to shut down both ASR wells (along with ASR-1) when fire flows are needed.

An evaluation of the existing ASR pipeline hydraulics indicated the existing 12-inch RWM is not large enough to handle return water from all three wells simultaneously without excessive velocity. CDM recommends that, assuming the return water quality is of an acceptably high standard, the return water from ASR-3 be chlorinated at the wellhead and pumped directly into the distribution system, while the return water from ASR-1 and 3



Glenn Forrest, P.E.

October 2, 2007

Page 6

utilizes the existing RWM. The County could opt to connect all three wells to the RWM but allow only two wells to ever run simultaneously, or, chlorinate the return water at each wellhead and pump directly into the distribution system, or a combination of both.

References

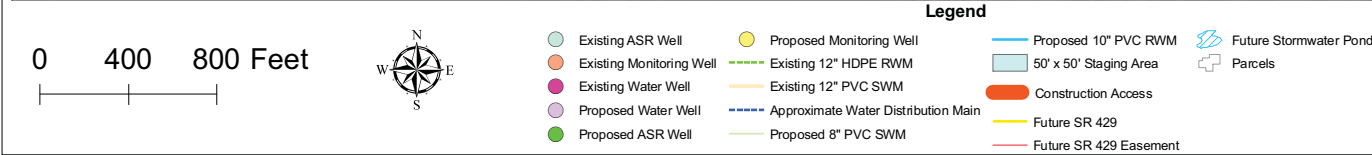
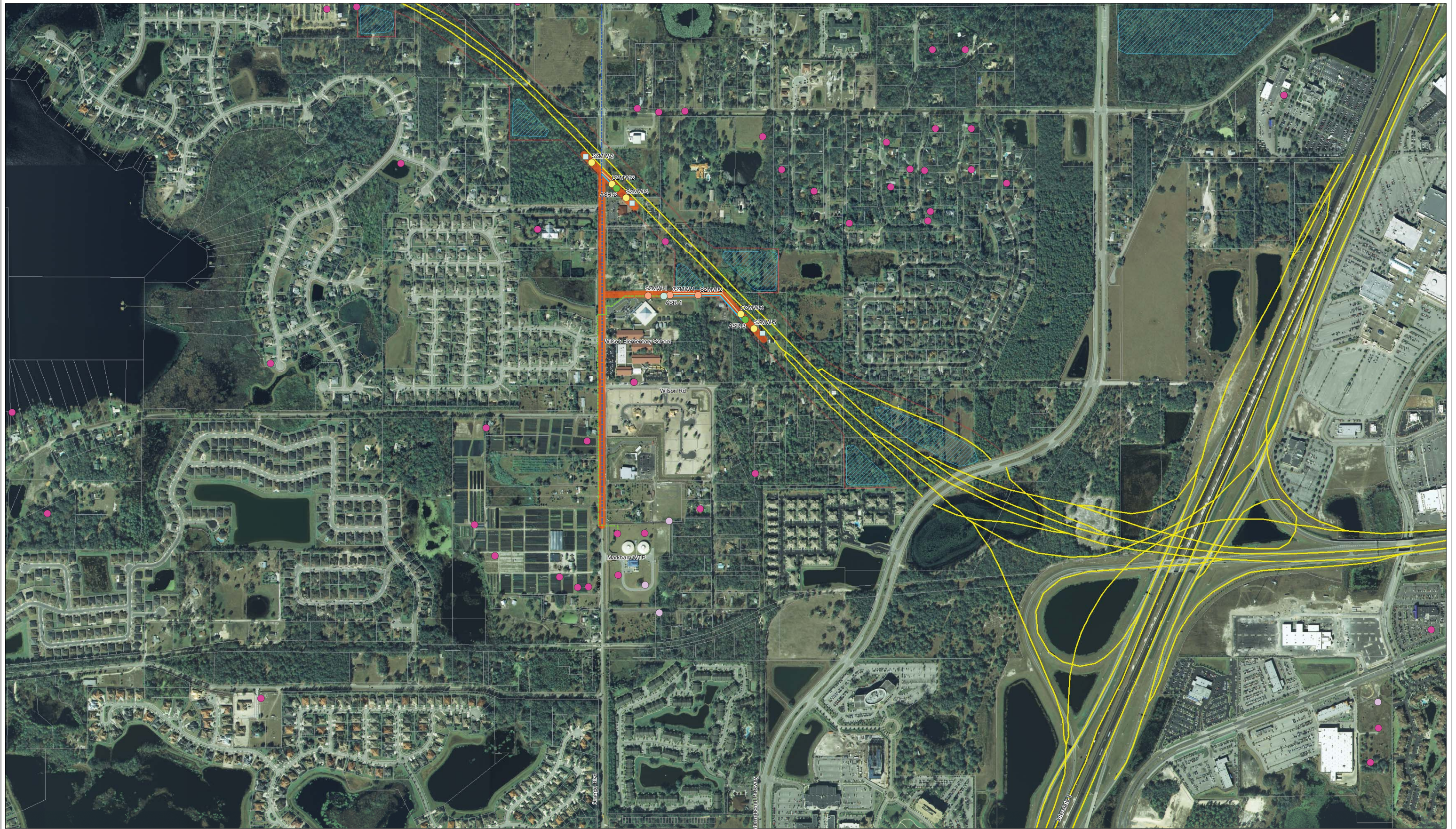
CDM, 2002. Desktop Assessment of Aquifer Storage and Recovery for Seminole County.

FDEP, 2005. Position Paper Permitting Increased Arsenic Level at Aquifer Storage and Recovery Facilities (dated June 20, 2005)

FDEP, 2006. Chapter 62-521, Florida Administrative Code – Wellhead Protection.

FDEP, 2006. Chapter 62-550, Florida Administrative Code – Drinking Water Standards, Monitoring, and Reporting.

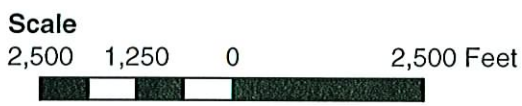
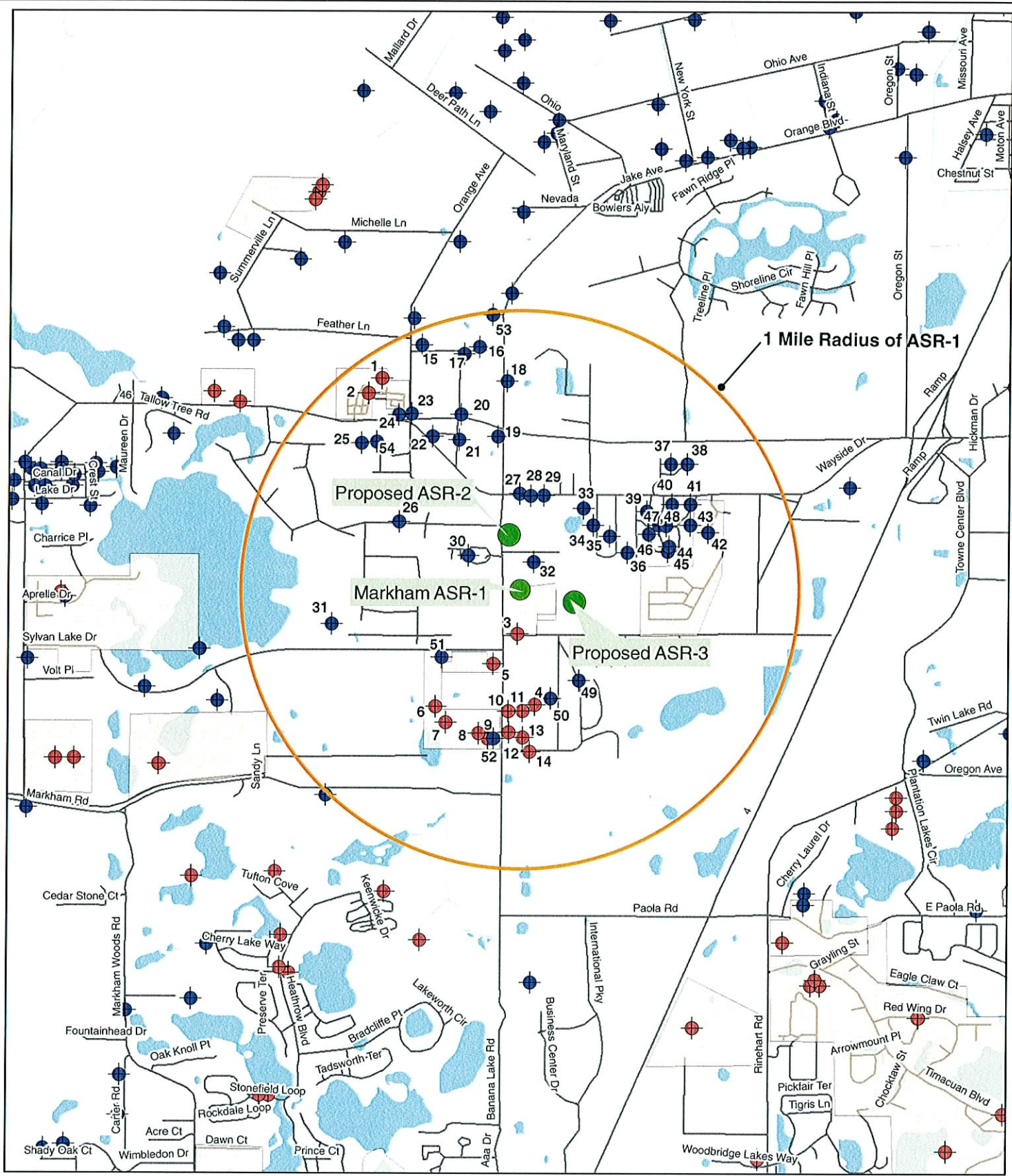
cc: Dennis Westrick
Hugh Sipes
Doug Munch
Don Maurer
Lee Wiseman
Barika Poole



ATTACHMENT 1

Well Inventory

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- Legend**
- ASR Wells
 - Wells (Building Dept.)
 - CUP Wells (SJRWMD)
 - CUP Boundary
 - Roads
 - Water



Figure A-1
Seminole County Markham ASR WTP Project
Well Inventory

Table A-1 Well Inventory Within One-mile Radius of Markham WTP ASR Well (ASR-1)						
Assigned ID	Permit Number	Diameter (in)	Depth (feet bls)	Capacity (gpm)	Location	Source
1	50932	6	206	110	NA	SJRWMD
2	50932	6	205	120	NA	SJRWMD
3	8396	8	242	600	NA	SJRWMD
4	8230	16	600	NA	NA	SJRWMD
5	8441	NA	NA	NA	NA	SJRWMD
6	8279	6	210	130	NA	SJRWMD
7	8279	6	300	300	NA	SJRWMD
8	8279	4	100	90	NA	SJRWMD
9	8279	6	200	300	NA	SJRWMD
10	8230	16	700	1500	NA	SJRWMD
11	8230	16	606	1500	NA	SJRWMD
12	8230	16	710	1500	NA	SJRWMD
13	8230	16	700	1500	NA	SJRWMD
14	8230	16	600	NA	NA	SJRWMD
15	4756	NA	NA	NA	5774 North Road	County Building Department
16	4553	NA	NA	NA	5654 North Road	County Building Department
17	4767	NA	NA	NA	5695 North Road	County Building Department
18	2158	NA	NA	NA	West Lake Est Prop Homeowners	County Building Department
19	3906	NA	NA	NA	5701 W SR 46	County Building Department
20	8516	NA	NA	NA	121 N Center Road	County Building Department
21	3106	NA	NA	NA	115 S Center Road	County Building Department
22	1724	NA	NA	NA	5950 Forest Avenue	County Building Department
23	2637	NA	NA	NA	125 N Orange Avenue	County Building Department
24	8430	NA	NA	NA	110 N Orange Avenue	County Building Department
25	9751	NA	NA	NA	6275 W SR 46	County Building Department

NA - No Data Available

SJRWMD - St. Johns River Water Management District

Table A-1 (continued)						
Well Inventory Within One-mile Radius of Markham WTP ASR Well (ASR-1)						
Assigned ID	Permit Number	Diameter (in)	Depth (feet bls)	Capacity (gpm)	Location	Source
26	8683	NA	NA	NA	593 Walden View Dr.	County Building Department
27	332	NA	NA	NA	5660 Wayside Dr.	County Building Department
28	1779	NA	NA	NA	5620 Wayside Dr.	County Building Department
29	6801	NA	NA	NA	5590 Wayside Dr.	County Building Department
30	2135	NA	NA	NA	514 Walden View Dr.	County Building Department
31	9942	NA	NA	NA	6644 Sylvan Woods Dr.	County Building Department
32	2373	NA	NA	NA	5595 Paseo Pl	County Building Department
33	9314	NA	NA	NA	5481 Wayside Dr.	County Building Department
34	160	NA	NA	NA	421 Kimberly Ct.	County Building Department
35	2637	NA	NA	NA	312 Kimberly Ct.	County Building Department
36	3747	NA	NA	NA	431 Kentwood Avenue	County Building Department
37	9298	NA	NA	NA	225 Woods TRL	County Building Department
38	8025	NA	NA	NA	112 Wyside Ct.	County Building Department
39	934	NA	NA	NA	301 Kingsbury Avenue	County Building Department
40	8026	NA	NA	NA	5201 Wayside Dr.	County Building Department

NA - No Data Available

SJRWMD - St. Johns River Water Management District

Table A-1 (continued) Well Inventory Within One-mile Radius of Markham WTP ASR Well (ASR-1)						
Assigned ID	Permit Number	Diameter (in)	Depth (feet bls)	Capacity (gpm)	Location	Source
41	7328	NA	NA	NA	5101 Wayside Dr.	County Building Department
42	3374	NA	NA	NA	5051 Knotty Pine Ct.	County Building Department
43	1124	NA	NA	NA	321 East LN	County Building Department
44	3781	NA	NA	NA	411 Wilson Place Dr.	County Building Department
45	14494	NA	NA	NA	421 Wilson Place Dr.	County Building Department
46	4550	NA	NA	NA	5211 Linwood Cir.	County Building Department
47	1305	NA	NA	NA	320 Wilson Place Dr.	County Building Department
48	4756	NA	NA	NA	321 Wilson Place Dr.	County Building Department
49	5829	NA	NA	NA	1795 Sylvan Avenue	County Building Department
50	6305	NA	NA	NA	1580 Emmett Avenue	County Building Department
51	3570	NA	NA	NA	5845 S Sylvan Lake Dr.	County Building Department
52	330	NA	NA	NA	2050 Orange Blvd	County Building Department
53	2731	NA	NA	NA	5434 Orange Blvd	County Building Department

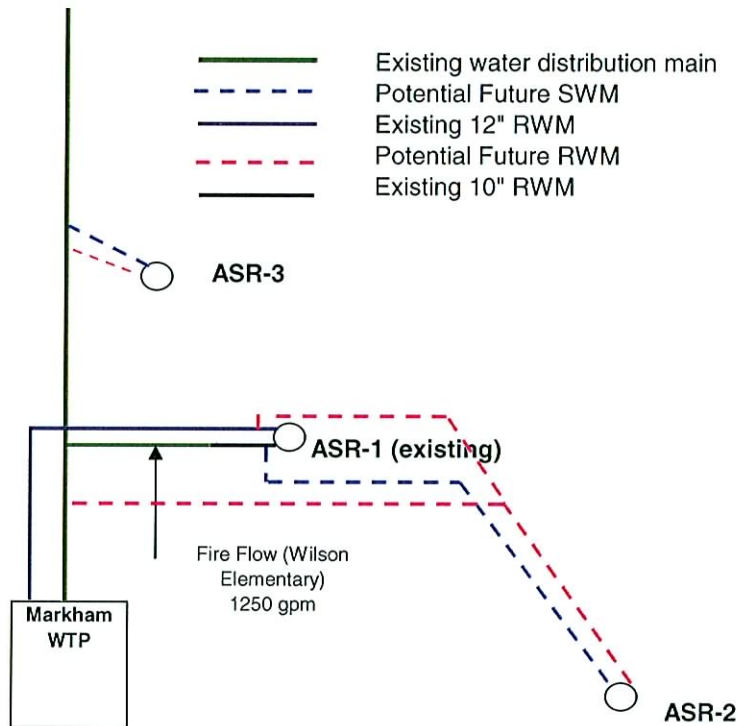
NA - No Data Available

SJRWMD - St. Johns River Water Management District

ATTACHMENT 2

Hydraulic Calculations

HYDRAULIC CALCULATIONS

SketchRWM Calculations1. Check velocity in existing 10" PVC RWM (to serve ASR-1 and ASR-3)

ASR wells pumping	Inside Dia (in.)	Area (ft ²)	Flow (gpm)	Flow (cfs)	Velocity (fps)
1	9.79	0.52	694	1.55	2.96
1 and 3	9.79	0.52	1388	3.09	5.92 ok

2. Check velocity in existing 12" HDPE RWM main

ASR wells pumping	Inside Dia (in.)	Area (ft ²)	Flow (gpm)	Flow (cfs)	Velocity (fps)
1	10.339	0.58	694	1.55	2.65
1 and 3	10.339	0.58	1388	3.09	5.30 ok
1, 3, and 2	10.339	0.58	2082	4.64	7.96 too high

SWM Calculations3. Check velocity in existing 10" PVC water main (SWM) (to serve ASR-1 and ASR-3)

ASR wells injecting	Inside Dia (in.)	Area (ft ²)	Flow (gpm)	Flow (cfs)	Velocity (fps)
1	9.79	0.52	694	1.55	2.96
1 and 3	9.79	0.52	1388	3.09	5.92 ok

4. Check velocity in existing 12" PVC water main (SWM) Orange Blvd Crossing

ASR wells in injecting	Inside Dia (in.)	Area (ft ²)	Flow (gpm)	Flow (cfs)	Velocity (fps)
1	11.65	0.74	694	1.55	2.09
1 and 3	11.65	0.74	1388	3.09	4.18 ok
Fire flow	11.65	0.74	1250	2.79	3.76 ok
1 + fire flow	11.65	0.74	1944	4.33	5.85 ok
1+ 3 + fire flow	11.65	0.74	2638	5.88	7.94 too high

6. Check head loss from Orange Blvd crossing (12" pipe) with ASR-1 and ASR-3 during school fire demand

Hazen-Williams Eqn

$$H_L = \frac{4.727 L Q^{1.852}}{C^{1.852} d^{4.871}}$$

where L = pipe length (ft)
 Q = flow (cfs)
 C = Roughness Coefficient (Hazen - Williams C Factor)
 d = pipe diameter (ft)

$$H_L = \frac{4.727(75)(5.88)^{1.852}}{(140)^{1.852}(0.9708)^{4.871}}$$

$$H_L = 1.16 \text{ ft} = 0.50 \text{ psi}$$

Appendix D

FDEP Underground Injection Control Permit and Administrative Order

FDEP Permit Number 59-0250382-001-UC

Underground Injection Control Permit

Class V ASR Injection Well

February 28, 2006



Department of Environmental Protection

Jeb Bush
Governor

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Colleen Castille
Secretary

BY ELECTRONIC MAIL:

In the Matter of an
Application for Permit by:

John Cirello, PhD, P.E.
Director of Environmental Services Department
Seminole County D.E.S.
500 West Lake Mary Boulevard
Sanford, FL 32773-0000
Cirello@seminolecountyfl.gov

Seminole County – UIC
FDEP File No. 59-0250382-001-UC
Potable Water ASR Program
Class V ASR Injection Well

NOTICE OF PERMIT ISSUANCE

Enclosed is Permit Number 59-0250382-001 to construct one Class V, Group Seven, Aquifer Storage and Recovery (ASR) injection well system, issued pursuant to Section(s) 403.087, Florida Statutes.

The purpose of the ASR well is to store and recover potable water in the Floridan aquifer in order to meet the potable water demands in a priority water resource caution area, provided that injection testing is successful.

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

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Vivian F. Garfein
Director, Central District

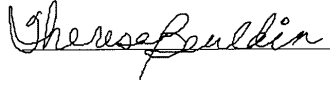
CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this PERMIT and all copies were mailed before the close of business on February 28, 2006 to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGMENT

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



Clerk

February 28, 2006

Date

VFG/CCF/dw

Enclosures

Copies furnished to:

Technical Advisory Committee



Department of Environmental Protection

Jeb Bush
Governor

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Colleen Castille
Secretary

BY ELECTRONIC MAIL: Cirello@seminolecountyfl.gov

PERMIT

PERMITTEE:

John Cirello, Ph.D., P.E.
Director of Environmental Services Department
500 West Lake Mary Boulevard
Sanford, Florida 32773-0000
Cirello@seminolecountyfl.gov

Seminole County – UIC

Permit File Number: 59-0250382-001-UC
Date of Issue: February 28, 2006
Expiration Date: February 27, 2011
County: Seminole
Latitude: 28° 48' 12" N
Longitude: 81° 21' 40" W
Markham Potable Water ASR Project
Class V ASR Injection Well

This permit is issued under the provisions of Chapter 403 of the Florida Statutes (F.S.) and Rules 62-4, 62-520, 62-528, 62-550, 62-600, 62-601, and 62-610 of the Florida Administrative Code. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents, attached hereto or on file with the Department and made a part hereof and specifically described as follows:

Construct one Class V Group Seven Aquifer Storage and Recovery (ASR) injection well system with two storage zone monitoring wells (SZMW-1 and SZMW-2), one confining zone monitoring well (CZMW-1) and two surficial aquifer monitoring wells. The basic ASR well design will consist of a 10.875-inch diameter injection well to a proposed total depth of approximately 1,070 feet and cased to approximately 940 feet below land surface (bls). The ASR system will have a maximum storage capacity of 200 to 300 MG. The overall objective of this ASR well is to store, in the Floridan aquifer, potable water from the Seminole County Department of Environmental Services potable water distribution system and retrieve the stored potable water for use in a priority water resource caution area. Initially, the ASR well will be cycle tested by injecting, storing and recovering potable water for a period of approximately 2 years. Provided that the testing is successful, the ASR will be put in use.

The Application to Construct V Injection well System, DEP Form 62-528.900(1), was received June 10, 2005, with supporting documents and additional information last received October 27, 2005. The location for this project is 1945 Orange Boulevard, Sanford, Seminole County, Florida.

Subject to Specific Conditions 1-8 and General Conditions 1-4.

PERMITTEE:

John Cirello, PhD, P.E.

Permit/Certification No: 59-0250382-001

Date of Issue: February 28, 2006

Date of Expiration: February 27, 2011

1. General Criteria:

- a. This permit approval is based upon evaluation of the data contained in the application, plans and specifications submitted in support of the application. Any changes, except as provided elsewhere in this permit, must be approved by the Department before implementation.
- b. No drilling operations shall begin without an approved disposal site for drill cuttings, fluids or waste. It shall be the Water Well Contractor's responsibility to obtain any necessary Department and local agency approval for disposal prior to the start of construction. It is anticipated that wastes will be disposed of on site using a closed loop system. In this event, permits shall be obtained accordingly.
- c. No fluid shall be injected without written authorization from the Department. The issuance of this construction permit does not obligate the Department to permit its operation, unless the well, monitoring system and surface appurtenances qualify for an operation permit.
- d. Those conditions imposed by the St. Johns River Water Management District in this project's Water Use Permit(s) regarding the testing of the ASR system remain in effect.
- e. No underground injection is allowed that causes or allows movement of fluid into an underground source of drinking water if such fluid movement may cause a violation of any primary drinking water standard or may otherwise adversely affect the health of persons.
- f. If historical or archaeological artifacts, such as Indian canoes, are discovered at any time within the project site, the permittee shall notify the FDEP Orlando Central District office and the Bureau of Historic Preservation, Division of Archives, History and Records Management, R. A. Gray Building, Tallahassee, Florida 32301, telephone number (850) 487-2073.
- g. Signatories and Certification Requirements
 - (1) All reports and other submittals required to comply with this permit shall be signed by a person authorized under Rules 62-528.340(1) or (2), F.A.C.
 - (2) In accordance with Rule 62-528.340(4), F.A.C., all reports shall contain the following certification:

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”
- h. Plugging/abandonment and Alternate use plans – Permittees who are unable to operate the ASR well to meet its intended purpose shall within 180 days of FDEP notification:
 - (1) Submit a plugging and abandonment permit application in accordance with Rules 62-528.625 and 62-528.645, F.A.C., or
 - (2) Submit an alternate use plan for the well. Alternate use may commence after the plan has been approved by the Department, including any necessary permit or permit modifications as required by the Department or any other agency.

PERMITTEE:

John Cirello, PhD, P.E.

Permit/Certification No: 59-0250382-001

Date of Issue: February 28, 2006

Date of Expiration: February 27, 2011

- i. Prior to operational testing under this permit, the permittee shall obtain from the Department, a Water Quality Criteria Exemption (pursuant to Rule 62-520.500, F.A.C.) for sodium or any secondary standards that may be exceeded, where applicable.
- j. The permittee shall be aware of and operate under General Conditions F.A.C. Rule 62-528.307(1)(a) through (x). General Conditions are binding upon the permittee and enforceable pursuant to Chapter 403 of the Florida Statutes (see attachment I).
- k. The permittee shall refer to Rule 62-610.466, F.A.C., in its entirety, to ensure compliance with all requirements for ASR wells.

2. Quality Assurance/Quality Control

- a. The permittee shall ensure that the construction of this facility shall be as described in the application and supporting documents. Any proposed modifications to this permit shall be submitted in writing to the Underground Injection Control program manager for review and clearance prior to implementation. Changes of negligible impact to the environment and staff time will be reviewed by the program manager, cleared when appropriate, and incorporated into this permit. Changes or modifications other than those described above will require submission of completed application and appropriate processing fees as per Rule 62-4.050, F.A.C.
- b. A Florida registered professional engineer, pursuant to Chapter 471, Florida Statutes (F.S.), shall be retained throughout the construction period and operational testing to be responsible for the construction operation and to certify the application, specifications and completion report and other related documents, pursuant to Rule 62-528.440(5), F.A.C. A professional engineer or professional geologist shall provide monitoring of the drilling and testing operation. The Department shall be notified immediately of any change of the Engineer of Record.
- c. All water quality samples required in this permit shall be collected and analyzed in accordance with Department Standard Operating Procedures (SOP), pursuant to the FDEP Quality Assurance, Chapter 62-160, F.A.C. The various components of the collection of the FDEP SOPs are found in DEP-SOP-001/01 (Field Procedures) and DEP-SOP-002/01 (Laboratory Procedures).
- d. The permittee shall calibrate all pressure gauge(s), flow meter(s), chart recorder(s), and other related equipment associated with the injection well system on a semi-annual basis. The permittee shall maintain all monitoring equipment and shall ensure that the monitoring equipment is calibrated and in proper operating condition at all times. Laboratory equipment, methods, and quality control will follow EPA guidelines as expressed in Standard Methods for the Examination of Water and Wastewater. The pressure gauge(s), flow meter(s), and chart recorder(s) shall be calibrated using standard engineering methods.
- e. Continuous on-site supervision by qualified personnel (engineer and/or geologist, as appropriate) is required during all testing and geophysical logging operations.
- f. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures.
- g. Hurricane Preparedness - Upon the issuance of a "Hurricane Watch" by the National Weather Service, the preparations to be made include, but are not necessarily limited to, the following:
 - (1) Secure all on-site salt and other stockpiled additive materials to prevent surface and/or ground water contamination.

PERMITTEE:

John Cirello, PhD, P.E.

Permit/Certification No: 59-0250382-001

Date of Issue: February 28, 2006

Date of Expiration: February 27, 2011

- (2) Properly secure drilling equipment and rig(s) to prevent damage to well(s) and on-site treatment process equipment.

3. Source Water Fluid Analysis

- a. Potable Water – a single event to occur within the 60 days prior to beginning cycle testing

- (1) Prior to injection, the potable water analyses shall include:

- (a) Primary and Secondary drinking water standards established in Chapter 62-550, Part III, F.A.C., (excluding asbestos, acrylamide, epichlorohydrin, and dioxin);
- (b) Giardia lamblia and Cryptosporidium (count and viability testing where applicable) dissolved oxygen, E. coli and enterococci (a single event test for characterizing the background water quality);
- (c) Fecal and total coliform.

4. Construction, Testing and Reporting

- a. Prior to the commencement of any work, the name of the Florida-registered driller(s) supervising the drilling operations and the driller's registration number shall be submitted to the Department. The permittee or the engineer of record shall provide the Department with copies of all required federal, state or local permits prior to the commencement of drilling the wells.
- b. If any problem develops that may seriously hinder compliance with this permit, construction progress or good construction practice, the Department shall be notified immediately. The Department may require a detailed written report describing what problems have occurred, the remedial measures applied to assure compliance and the measures taken to prevent recurrence of the problem.
- c. During the construction period allowed by this permit, daily progress reports shall be submitted to the Department, the U.S. Environmental Protection Agency (EPA) and the Technical Advisory Committee each week. The reporting period shall run Friday through Thursday and reports shall be mailed on Friday of each week. The report shall include, but is not limited to, the following:
 - (1) A cover letter summarizing each week's activities and a projection of activities for the next reporting period;
 - (2) Description of daily footage drilled by diameter of bit or size of hole opener or reamer being used;
 - (3) Description of work during installation and cementing of casing, including amounts of casing and cement used;
 - (4) Lithologic log with cuttings description, formation, and depth encountered;
 - (5) Collection of drilling cuttings at least every 5 feet and at every formation change;
 - (6) Water quality analyses;
 - (7) Description of work and type of testing accomplished including geophysical logging, video logs, and pumping tests;
 - (8) Description of any construction problems that developed during the reporting period and current status;

PERMITTEE:

John Cirello, PhD, P.E.

Permit/Certification No: 59-0250382-001

Date of Issue: February 28, 2006

Date of Expiration: February 27, 2011

- (9) Copies of the driller's log are to be submitted with the weekly summary;
 - (10) Description of any deviation survey conducted;
 - (11) Details of any packer tests, pump tests and core analyses; and
 - (12) Details of the additions of salt or other materials to suppress well flow (if applicable), and include the date, depth and amount of material used.
- d. Upon completion of construction of the injection well and all monitor wells, detailed in this permit, a complete set of as-built engineering drawings (Florida registered P.E. signed and sealed) shall be submitted to the Department's district office and Tallahassee UIC Program.
- e. Background ground-water quality samples shall be obtained from the ASR test well and all monitor wells for the specific water quality criteria listed for potable water in specific condition 3. "Background" means the condition of waters in the absence of the activity or discharge under consideration, based on the best scientific information available to the Department [Rule 62-520.200(3), F.A.C.]. The samples shall be taken after final completion and clearance of drilling fluids from each well, and prior to the initiation of any pump tests.
- f. Within 30 days of well completion of the ASR test well and monitor wells, the permittee or the authorized representative shall submit to the Department for each well the following information:
- (1) Certification of Class V Well Construction Completion, DEP Form 62-528.900(4);
 - (2) A copy of the St. Johns River Water Management District permit to construct a well;
 - (3) A copy of the Water Management District's Well Completion Report; and
 - (4) A copy of the Water Management District's Consumptive Use /Water Use Permit.
- g. This project shall be monitored by the Department with the assistance of the U.S. Environmental Protection Agency (EPA) - Region 4 and the Technical Advisory Committee (TAC), which consists of representatives of the following agencies:
- Department of Environmental Protection – Orlando
Department of Environmental Protection – Tallahassee
Department of Environmental Protection/Florida Geologic Survey - Tallahassee
St. Johns River Water Management District – Palm Bay
US Environmental Protection Agency, Region 4 - Atlanta
- h. Permittee shall provide copies of all correspondence relative to this permit to each member of the TAC and EPA. Such correspondence includes but is not limited to reports, schedules, analyses and geophysical logs required by the Department under the terms of this permit. The permittee is not required to provide specific correspondence to any TAC member who submits to the permittee a written request to be omitted as a recipient of specific correspondence.
- i. After completion of construction and testing, a final engineering report shall be submitted to the Department, the EPA and the TAC. The report shall include, but not be limited to, all information and data collected under Rules 62-528.605, 62-528.615, and 62-528.635, F.A.C., with appropriate interpretations. Mill certificates for the casings shall be included in the report. To the extent possible, the transmissivity and storativity of the injection zone and the maximum capacity within safe pressure limits shall be estimated. This report shall also be signed and sealed by a Florida licensed professional engineer and professional geologist.

PERMITTEE:

John Cirello, PhD, P.E.

Permit/Certification No: 59-0250382-001

Date of Issue: February 28, 2006

Date of Expiration: February 27, 2011

- j. After completion of construction and testing, the following items shall be submitted to the State Geologist at the Florida Geological Survey, 903 West Tennessee Street, Tallahassee, Florida 32304-7707:
 - (1) Cuttings obtained during well construction;
 - (2) Any cores obtained during well construction when no longer needed by the permittee;
 - (3) Any geophysical logs run during well construction; and
 - (4) A copy of the final report described in Condition 4.i. above.
 - k. A written, detailed evaluation of the ASR system performance shall be included with the permit renewal or operation permit application.
 - l. The specifications for a temporary containment structure around the borehole during the drilling of the ASR well shall be submitted to and approved by the Department prior to the ASR well construction.
5. Cycle Testing Requirements Using Potable Water
- a. After authorization by the Department, the permittee shall conduct cycle testing of the ASR well system using potable water to demonstrate that the ASR well(s) can maintain water quality standards and assimilate the design daily flows prior to receiving approval for full operation using potable water. Cycle testing using potable water shall not commence until issuance of authorization from the Department. Prior to Department authorization of operational cycle testing:
 - (1) The permittee shall submit at a minimum the following information to the U.S.EPA and to each member of the Technical Advisory Committee for review:
 - (a) Draft operation and maintenance manual;
 - (b) Lithologic and geophysical logs with interpretations;
 - (c) Results of pressure tests on the final casing for the ASR well and the storage zone monitor wells;
 - (d) Surface equipment completion certification or certification of interim completion for the purposes of testing;
 - (e) Signed and sealed as-built engineering drawings of all wellheads and subsurface well components;
 - (f) A consumptive use permit and all other applicable permits; and
 - (g) Submittal of a plugging and abandonment plan.
 - (h) Completion report for the storage zone monitoring well (SZMW-2) and the confining zone monitoring well (CZMW-1) located in the vicinity of well ASR-1.
 - (2) Before authorizing operational testing, the Department shall conduct an inspection of the facility to determine if the conditions of this permit have been met.
 - (3) The permittee shall provide an updated well inventory and physically verify all wells that are within a 1.0-mile radius of the ASR test well. Operational status, existing use, depth of final casing, and total depth of the wells shall be determined and submitted with the above-mentioned information.

PERMITTEE:

John Cirello, PhD, P.E.

Permit/Certification No: 59-0250382-001

Date of Issue: February 28, 2006

Date of Expiration: February 27, 2011

- (4) Prior to approval to inject into Class G-II ground water, the permittee shall meet the applicable criteria in Rule 62-610.466, F.A.C. Compliance with public and utility notifications in Rule 62-610.574(4), F.A.C., is also required.
- b. A cycle testing schedule shall be submitted to the FDEP for review and final authorization of cycle testing of the ASR well. The cycle testing schedule shall include a proposed monitoring parameter list based on the Primary and Secondary drinking water standards established in Chapter 62-550, Part III, F.A.C., (excluding asbestos, acrylamide, epichlorohydrin and dioxin).
- c. The Florida Geological Survey (FGS) is currently investigating the effects of ASR systems on storage zones. The Department requests that the permittee contact the Hydrogeology Program at the FGS (850-488-9380) at least 30 days prior to operational testing to allow the Survey to coordinate a sampling schedule during the operational testing phase of this project.
- d. A set back distance for the ASR well(s), in accordance with Chapter 62-521.200(7), F.A.C., has been established to be at least 500 feet from potable water supply wells.
6. Post Cycle Testing Operational Conditions Using Potable Water
- a. A qualified representative of the Engineer of Record must be present for the start-up operations and the Department must be notified in writing of the date operational testing began for the subject well.
- b. Proposed Class V ASR Test Well:

Well Name	Casing Diameter [OD] / Depth*	Injection Interval	Formation
ASR	10.5" fiber glass / 940'	940 – 1,070'	Avon Park

* below land surface; approximate depths.

Monitor Well System

Well Name	Casing Diameter / Depth*	Monitored Interval	Formation
SZMW-1 (existing explorator y well)	5" steel / 940'	940 – 1,070'	Avon Park
SZMW-2	6" PVC / 940'	940 – 1,070'	Avon Park
CZMW-1	6" PVC / 720'	720 - 770'	Avon Park
Two Surficial Aquifer Monitor Wells	2" PVC / 12'	2 - 12' (screened)	Surficial

* below land surface; approximate depths.

(SZMW – Storage Zone Monitoring Well)

(CZMW – Confining Zone Monitoring Well)

- c. Prior to operational use of the ASR, the authorization referenced in Specific 5.a. above shall have been obtained and a monitoring plan shall have been approved using the existing and newly installed monitoring wells (both SZMWs, one CZMW and both surficial aquifer monitoring wells). Results of the water quality analyses of the potable water and background water quality pursuant to Specific Conditions 3. and 4.e. of this permit shall have been submitted. Aquifer test data, analysis and evaluation shall have been submitted

PERMITTEE:

John Cirello, PhD, P.E.

Permit/Certification No: 59-0250382-001

Date of Issue: February 28, 2006

Date of Expiration: February 27, 2011

and a monitoring program plan that includes construction diagrams, well specifications, well locations, construction specifications and drilling and testing plans shall have been submitted, approved by the Department and the new wells shall have been installed.

The ASR test well shall be monitored in accordance with the approved monitoring plan referenced above. The Department anticipates that the standard monitoring parameters and frequency listed below (and attached as Table 2) will apply during each recharge and recovery period. The monitor wells shall be sampled and analyzed in accordance with the schedule listed below and on the attached Table 2 based on the approved monitoring plan. Once the monitoring plan and parameters are approved, the permittee will be submitting a summary of the monthly monitoring data developed from the injection well instrumentation. The report may include the following data:

PERMITTEE:

John Cirello, PhD, P.E.

Permit/Certification No: 59-0250382-001

Date of Issue: February 28, 2006

Date of Expiration: February 27, 2011

Parameter	Units	Recording Frequency	Frequency of Analysis	
			ASR	Monitoring Wells
Flow Rate, max.	Mgd	continuous	D/M	
Flow Rate, min.	Mgd	continuous	D/M	
Flow Rate, avg.	Mgd	continuous	D/M	
Total Volume Recharged	Mg	daily	D/M	
Total Volume Recovered	Mg	daily	D/M	
Net Storage Volume	Mg	daily	M*	
Injection Pressure, max.	Psi	continuous	D/M	
Injection Pressure, min.	Psi	continuous	D/M	
Injection Pressure, avg.	Psi	continuous	D/M	

+ -Weekly through cycle test 4, then twice monthly thereafter with Department written approval.

++ - January, April, July, October

* - Monthly net storage volume per ASR well and total ASR wellfield.

W - weekly; B - twice-monthly; D/M - daily and monthly; M - monthly; Q - quarterly.

Note: During extended storage periods (greater than 30 days), the water quality parameters listed above may be sampled and analyzed monthly.

- e. The permittee shall submit monthly results of all injection well and monitoring well data required by this permit, and monthly progress reports which include both the current status of operational testing and a summary of all monthly activities, no later than the 28th day of the month immediately following the month of record. The results and progress reports shall be sent to the Department of Environmental Protection, 3319 Maguire Boulevard, Suite 232, Orlando, FL 32803-3767. A copy of the results and reports shall also be sent to the Department of Environmental Protection, Underground Injection Control Program, Mail Station 3530, 2600 Blair Stone Road, Tallahassee, FL 32399-2400.
- f. A final engineering report shall be submitted to the Department, the FGS, EPA and each TAC member and include the following information:
 - (1) A detailed analysis of all cycle testing;
 - (2) An operation and maintenance section;
 - (3) Record drawings sealed by the Engineer of Record;
 - (4) Summary of all water quality and water level data collected, conclusions and recommendations; and
 - (5) Estimated ASR well capacity.

PERMITTEE:

John Cirello, PhD, P.E.

Permit/Certification No: 59-0250382-001

Date of Issue: February 28, 2006

Date of Expiration: February 27, 2011

7. Abnormal Events

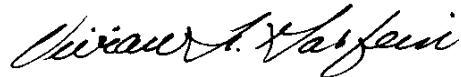
- a. In the event the permittee is temporarily unable to comply with any conditions of this permit due to breakdown of equipment, power outages, destruction by hazard of fire, wind or by other cause, the permittee shall notify the Department. Notification shall be made in person, by telephone or by electronic mail within 24 hours of breakdown or malfunction to the UIC program staff, Orlando Central District, (407) 893-3308.
- b. A written report of any noncompliance referenced in Condition 7.a. above shall be submitted to the Orlando Central District office within five days after discovery of the occurrence. The report shall describe the nature and cause of the breakdown or malfunction, the steps being taken or planned to be taken to correct the problem and prevent its reoccurrence, emergency procedures in use pending correction of the problem, and the time when the facility will again be operating in accordance with permit conditions.

8. Emergency Disposal

- a. All applicable federal, state and local permits shall be in place to allow for any alternative discharges due to emergency or planned outage conditions.
- b. Any changes in emergency disposal methods shall be submitted for TAC review and Department approval.
- c. The permittee shall notify the Department within 24 hours whenever an emergency discharge has occurred. Written notification shall be provided to the Department within five days after each occurrence. The Permittee shall indicate the location and duration of the discharge and the volume of fluid discharged.

Issued this 28th day of February, 2006.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION



Vivian F. Garfein
Director, Central District

VFG/CCF/dw

FDEP Permit Number 59-0250382-002-UC

**Underground Injection Control Permit
Potable Water ASR Program - Modification of Conditions
December 7, 2006**



Jeb Bush
Governor

Department of Environmental Protection

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Colleen Castille
Secretary

BY ELECTRONIC MAIL: Cirello@seminolecountyfl.gov

John Cirello, PhD, P.E.
Director of Environmental Services Department
500 West Lake Mary Boulevard
Sanford, FL 32773-0000
Cirello@seminolecountyfl.gov

ATTENTION John Criello, PhD, P.E.
Director of Environmental Services Department

Seminole County - UIC
Potable Water ASR Program
Construction Permit No. 59-0250382-001
Application No. 59-0250382-002
Modification of Conditions

Dear Mr. Cirello:

The Department is in receipt of your Application No. 59-0250382-002 to modify the conditions of the injection well operation permit referenced above. The conditions are changed as follows:

1. Specific Condition 6.b. of the permit is modified to refer to PVC and the reference to fiberglass is deleted in the first section which addresses the ASR well specifications.
2. Section 2.E. of the Fact Sheet is modified to refer to PVC and the reference to FRP is deleted in the section which addresses the ASR well specifications.

This letter must be attached to Injection Well Operation Permit No. 59-0250382-001 and becomes a part of and subject to all conditions of that permit.

The Department's proposed agency action shall become final unless a timely petition for an administrative hearing is filed under Sections 120.569 and 120.57 of the Florida Statutes before the deadline for filing a petition. The procedures for petitioning for a hearing are set forth below.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received by the clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000.

"More Protection, Less Process"

Printed on recycled paper.

Petitions by the applicant or any of the parties listed below must be filed within fourteen days of receipt of this written notice. Petitions filed by any persons other than those entitled to written notice under Section 120.60(3) of the Florida Statutes must be filed within fourteen days of publication of the notice or within fourteen days of receipt of the written notice, whichever occurs first.

Under Section 120.60(3) of the Florida Statutes, however, any person who has asked the Department for notice of agency action may file a petition within fourteen days of receipt of such notice, regardless of the date of publication.

The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57 of the Florida Statutes. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205 of the Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

- (a) The name, address, and telephone number of each petitioner; the name, address, and telephone number of the petitioner's representative, if any; the Department permit identification number and the county in which the subject matter or activity is located;
- (b) A statement of how and when each petitioner received notice of the Department action;
- (c) A statement of how each petitioner's substantial interests are affected by the Department action;
- (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
- (e) A statement of facts that the petitioner contends warrant reversal or modification of the Department action;
- (f) A concise statement of the ultimate facts alleged, as well as the rules and statutes which entitle the petitioner to relief; and
- (g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wants the Department to take.

A petition that does not dispute the material facts on which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

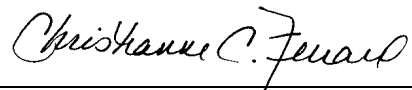
Mediation under Section 120.573 of the Florida Statutes is not available for this proceeding.

This action is final and effective on the date filed with the Clerk of the Department unless a petition is filed in accordance with the above. Upon the timely filing of a petition this order will not be effective until further order of the Department.

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

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

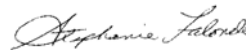


Christianne C. Ferraro, P.E.
Program Administrator
Water Facilities
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767
(407) 894-7555

Date: December 7, 2006

FILING AND ACKNOWLEDGMENT

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



Clerk

December 7, 2006

Date

CERTIFICATE OF SERVICE

This is to certify that this MODIFICATION OF CONDITIONS and all copies were delivered by e-mail before the close of business on December 7, 2006 to the listed persons by Duane Watroba.

VFG/ccf/akd/dw

cc: George Heuler, PG, UIC, Tallahassee

John Cirello, PhD, P.E.
Director of Environmental Services Department
Markham Potable Water ASR Program
Page 4

David King, SJRWMD
Lee Wiseman, Leslie Turner, CDM

FDEP Permit Number 59-0250382-003-UC

**Underground Injection Control Permit
Potable Water ASR Program - Modification of Conditions
June 27, 2008**



Florida Department of Environmental Protection

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

BY ELECTRONIC MAIL:

John Cirello, Ph.D., P.E.
Director of Environmental Services Department
500 West Lake Mary Boulevard
Sanford, Florida 32773-0000
Cirello@seminolecountyfl.gov

Attention: John Cirello, Ph.D., P.E.
Director of Environmental Services Department

Seminole County - UIC
Potable Water ASR Program
Construction Permit 59-0250382-001-UC
Application No. 59-0250382-003-UC
Modification of Conditions

Dear Dr. Cirello:

The Department is in receipt of your Application No. 59-0250382-003-UC to modify the conditions of the injection well operation permit referenced above. The conditions are changed as follows:

1. The following language is added to page one of ten of the permit:

Dechlorination and degasification pre-treatment equipment will also be constructed for the Aquifer Storage and Recovery (ASR) system. Dechlorination will occur prior to degasification using sodium bisulfite to reduce Oxidation Reduction Potential (ORP) and chlorine. Degasification will be accomplished afterwards using a Membrana Liqui-Cel system to reduce dissolved oxygen and to further reduce ORP.

This letter must be attached to Injection Well Operation Permit No. 64-0250382-001-UC and becomes a part of and subject to all conditions of that permit.

The Department's proposed agency action shall become final unless a timely petition for an administrative hearing is filed under Sections 120.569 and 120.57 of the Florida Statutes before the deadline for filing a petition. The procedures for petitioning for a hearing are set forth below.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received by the clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000.

Petitions by the applicant or any of the parties listed below must be filed within fourteen days of receipt of this written notice. Petitions filed by any persons other than those entitled to written notice under Section 120.60(3) of the Florida Statutes must be filed within fourteen days of publication of the notice or within fourteen days of receipt of the written notice, whichever occurs first.

Under Section 120.60(3) of the Florida Statutes, however, any person who has asked the Department for notice of agency action may file a petition within fourteen days of receipt of such notice, regardless of the date of publication.

The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57 of the Florida Statutes. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205 of the Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

- (a) The name, address, and telephone number of each petitioner; the name, address, and telephone number of the petitioner's representative, if any; the Department permit identification number and the county in which the subject matter or activity is located;
- (b) A statement of how and when each petitioner received notice of the Department action;
- (c) A statement of how each petitioner's substantial interests are affected by the Department action;
- (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
- (e) A statement of facts that the petitioner contends warrant reversal or modification of the Department action;
- (f) A concise statement of the ultimate facts alleged, as well as the rules and statutes which entitle the petitioner to relief; and
- (g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wants the Department to take.

A petition that does not dispute the material facts on which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under Section 120.573 of the Florida Statutes is not available for this proceeding.

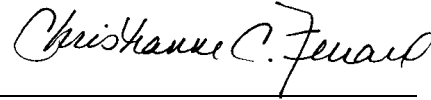
This action is final and effective on the date filed with the Clerk of the Department unless a petition is filed in accordance with the above. Upon the timely filing of a petition this order will not be effective until further order of the Department.

Any party to the order has the right to seek judicial review of the order under Section 120.68 of the Florida Statutes, by the filing of a Notice Of Appeal under Rule 9.110 of the Florida Rules of Appellate Procedure with the Clerk of the Department in the Office of General Counsel, Mail Station 35, 3900 Commonwealth Boulevard, Tallahassee, Florida, 32399-3000; and by filing a copy of the Notice Of Appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The

Notice Of Appeal must be filed within 30 days from the date when the final order is filed with the Clerk of the Department.

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

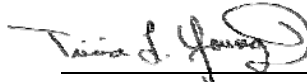


Christianne C. Ferraro, P.E.
Program Administrator
Water Resource Management
3319 Maguire Boulevard
Suite 232
Orlando, Florida 32803-3767
(407) 894-7555

Date: June 27, 2008

FILING AND ACKNOWLEDGMENT

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


Clerk

June 27, 2008
Date

VFG/CCF/AKD/dw

cc: George Heuler, PG, UIC, Tallahassee

CERTIFICATE OF SERVICE

This is to certify that this MODIFICATION OF CONDITIONS and all copies were e-mailed before the close of business on June 30, 2008 to the listed persons by Duane Watroba.

FDEP Permit Number 59-0250382-003-UC

**Underground Injection Control Permit
Potable Water ASR Program - Modification of Conditions
November 20, 2009**



Florida Department of Environmental Protection

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

BY ELECTRONIC MAIL:

Andrew Neff, P.E.
Director of Environmental Services
Seminole County Environmental Services
500 West Lake Mary Boulevard
Sanford, FL 32773-7499
aneff@seminolecountyfl.gov

Attention: Andrew Neff, P.E.
Director of Environmental Services

Seminole County - UIC
Markham Potable Water ASR Program
Construction Permit 59-0250382-001-UC
Application No. 59-0250382-003-UC
Modification of Conditions

Dear Mr. Neff:

The Department is in receipt of your Application No. 59-0259876-003-UC to modify the conditions of the injection well operation permit referenced above. The conditions are changed as follows:

1. The following language is added to page one of ten of the permit:

This Permit is issued in conjunction with Administrative Order Number AO-09-0003 (attached to this permit modification). Cycle testing and monitoring plans are modified in accordance with the attachments (1 through 3) to this permit.

This letter must be attached to Injection Well Construction Permit No. 59-0250382-001-UC and becomes a part of and subject to all conditions of that permit.

The Department's proposed agency action shall become final unless a timely petition for an administrative hearing is filed under Sections 120.569 and 120.57 of the Florida Statutes before the deadline for filing a petition. The procedures for petitioning for a hearing are set forth below.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received by the clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000. Petitions by the applicant or any of the parties listed below must be filed within fourteen days of receipt of this written notice. Petitions filed by any persons other than those entitled to written notice under Section 120.60(3) of the Florida Statutes must be filed within

fourteen days of publication of the notice or within fourteen days of receipt of the written notice, whichever occurs first.

Under Section 120.60(3) of the Florida Statutes, however, any person who has asked the Department for notice of agency action may file a petition within fourteen days of receipt of such notice, regardless of the date of publication.

The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57 of the Florida Statutes. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205 of the Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

- (a) The name, address, and telephone number of each petitioner; the name, address, and telephone number of the petitioner's representative, if any; the Department permit identification number and the county in which the subject matter or activity is located;
- (b) A statement of how and when each petitioner received notice of the Department action;
- (c) A statement of how each petitioner's substantial interests are affected by the Department action;
- (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
- (e) A statement of facts that the petitioner contends warrant reversal or modification of the Department action;
- (f) A concise statement of the ultimate facts alleged, as well as the rules and statutes which entitle the petitioner to relief; and
- (g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wants the Department to take.

A petition that does not dispute the material facts on which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

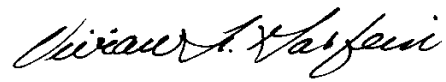
Mediation under Section 120.573 of the Florida Statutes is not available for this proceeding.

This action is final and effective on the date filed with the Clerk of the Department unless a petition is filed in accordance with the above. Upon the timely filing of a petition this order will not be effective until further order of the Department.

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

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

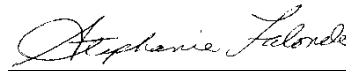


Vivian F. Garfein
Director, Central District
3319 Maguire Boulevard
Suite 232
Orlando, Florida 32803-3767
(407) 894-7555

Date: November 20, 2009

FILING AND ACKNOWLEDGMENT

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



Clerk

November 20, 2009

Date

VFG/CCF/AKD/dw

cc: George Heuler, PG, UIC, Tallahassee

CERTIFICATE OF SERVICE

This is to certify that this MODIFICATION OF CONDITIONS and all copies were e-mailed before the close of business on 11-20-09 to the listed persons by Duane Watroba.

Administrative Order Number AO-09-0003

November 20, 2009

Florida Department of Environmental Protection

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767
Phone: (407) 894-7555

BEFORE THE STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Responsible Authority:

Andrew Neff, P.E.
Director of Environmental Services
Seminole County Environmental Services
500 West Lake Mary Boulevard
Sanford, FL 32773-7499

DEP Permit No. 59-0250382-001-UC
Order No. AO-09-0003
Seminole County Markham Woods Aquifer Storage and Recovery Facility, Seminole County

DRAFT ADMINISTRATIVE ORDER

I. STATUTORY AUTHORITY

The Department of Environmental Protection (Department) issues this Administrative Order under the authority of Section 403.088(2)(f) of the Florida Statutes (F.S.). The Secretary of the Department has delegated this authority to the Director of the Central District, who issues this Order and makes the following findings of fact.

II. FINDINGS OF FACT

1. The Permittee, Andrew Neff, P.E., is a person under Section 403.031, F. S.
2. The Facility is located at the 1945 Orange Boulevard, Sanford, Seminole County, Florida. This aquifer storage and recovery (ASR) operation is subject to the requirements contained in Rules 62-4, 62-520, 62-528 and 62-550 of the Florida Administrative Code (F.A.C.), which includes underground injection control, permitting, reclaimed water management, and ground water monitoring requirements.
3. The Facility applied for a permit on June 10, 2005, under Section 403 .0876, F.S., to construct an aquifer storage and recovery (ASR) system. Permit No. 59-0250382-001-UC (Permit) constitutes Department approval for the construction of the approved ASR Facility. Operational (cycle) testing approval will require Department authorization per Specific Condition 5.a of Permit No. 59-0250382-001-UC.

4. The Department acknowledges that the site at which this Facility operates has never been used for ASR activities that may potentially affect ground water quality.
5. The availability of ground water monitoring data in the ASR aquifer is limited or does not exist for this facility.
6. The Facility has provided reasonable assurance that the water injected will meet all primary drinking water standards prior to injection.
7. The Facility has not provided reasonable assurance that the ASR activity will result in arsenic concentrations that will meet the 10 µg/L standard in the ground water. Most ASR facilities in Florida have experienced exceedances of the 10 µg/L standard either in the recovered water or the storage zone monitor wells, or both, although the injectate meets the standard. The Facility can not provide data to demonstrate this ASR project will result in compliance with the arsenic standard.

III. ORDER

Based on the foregoing findings of fact, IT IS ORDERED,

8. The Facility shall comply with all conditions of Permit No. 59-0250382-001-UC and applicable water quality standards, except as otherwise authorized under this Administrative Order.
9. If arsenic levels during operational (cycle) testing conducted under Permit No. 59-0250382-001-UC or subsequent permit modifications or renewals, or future construction permits for ASR wells, or monitor wells not covered under Permit No. 59-0250382-001-UC, are found to exceed 10 µg/L in the recovered water or any associated monitor well, the permittee shall submit a report addressing the operational (cycle) testing results of the collected ground water monitoring data including a determination after every two cycles if there is an indication that arsenic levels are decreasing. The report shall be submitted to the Department no later than 90 days following the end of the recovery period for the second cycle. The report shall include a discussion of the changes in water quality parameters exceeding maximum contaminant levels, including arsenic, during the injection, storage, and recovery periods. The discussion of the arsenic results shall address the possibility that continued cycles may allow the facility to come into compliance without pretreatment and shall include a projected time until compliance will be achieved.
10. If the arsenic standard is exceeded in recovered water or ground water as a result of ASR operations, any future ASR permits for this facility can only be issued with an associated Consent Order.
11. In addition, the Department may require certain enhancements to the ASR facility, which may include, but not be limited to, additional monitoring parameters; a greater monitoring frequency; additional monitoring wells particularly if ground water not meeting the arsenic standard may be migrating off Facility property; and a pretreatment program to reduce arsenic leaching in the storage zone.
12. If monitoring indicates that arsenic exceeding 10 µg/L is occurring off-site because of the ASR activity, the Department shall require the following:

- (a) An estimate of the vertical and lateral extent of arsenic concentration exceeding 10 µg/L
 - (b) A field-verified inventory of all water wells within the area determined by best professional judgment to include the area potentially affected by the discharge plus a safety factor of 50%, or a one-mile radius, whichever is larger (area of review)
 - (c) Provisions for alternate water supplies for water wells within the area of review
 - (d) Measures that will be taken to remove off-site contamination or risk-based corrective actions the facility will conduct under Chapter 62-780, F.A.C., including Department-approved institutional controls in accordance with the Division of Waste Management's Institutional Controls Procedures Guidance, November 2004, to prevent the construction and use of new water wells within areas of off-site contamination. The Department shall accept a local government's ordinance as an institutional control if that ordinance prohibits the construction or use of water wells within areas of off-site contamination.
 - (e) The facility may be required to sample off-site wells identified within the area of review that withdrawal from the storage zone
13. Reports or other information required by this Administrative Order shall be sent to the Department of Environmental Protection, Underground Injection Control Program, Central District, 3319 Maguire Boulevard, Suite 232, Orlando, Florida 32803-3767, and to the Department of Environmental Protection, Underground Injection Control Program, 2600 Blair Stone Road, MS 3530, Tallahassee, Florida 32399-2400.
14. This Administrative Order does not operate as a permit under Section 403.088 of the Florida Statutes. This Administrative Order shall be incorporated by reference into Permit No. 59-0250382-001-UC.
15. Failure to comply with the requirements of this Administrative Order shall constitute a violation of this Administrative Order and Permit No. 59-0250382-001-UC, and may subject the Facility to penalties as provided in Section 403.161, F.S.
16. If any event, excluding administrative or judicial challenges by third parties unrelated to the Facility, occurs which causes delay or the reasonable likelihood of delay, in complying with the requirements of this Administrative Order, the Facility shall have the burden of demonstrating that the delay was or will be caused by circumstances beyond the reasonable control of the Facility and could not have been or cannot be overcome by the Facility's due diligence. Economic circumstances shall not be considered circumstances beyond the reasonable control of Facility, nor shall the failure of a contractor, subcontractor, materialman or other agent (collectively referred to as "contractor") to whom responsibility for performance is delegated to meet contractually imposed deadlines be a cause beyond the control of Facility, unless the cause of the contractor's late performance was also beyond the contractor's control. Upon occurrence of an event causing delay, or upon becoming aware of a potential for delay, the Facility shall notify the Central District of the Department orally at (407) 894-7555 within 24 hours or by the next working day and shall, within seven calendar days of oral notification to the Department, notify the Department in writing at: Department of Environmental Protection, Underground Injection Control Program, Central District, 3319 Maguire Boulevard, Suite 232, Orlando, Florida 32803-3767 of the anticipated length and cause of the delay, the measures taken or to be taken to prevent or minimize the delay and the timetable by which Facility intends to implement these measures. If the parties can agree that the delay or anticipated delay has been or will be caused by circumstances beyond the reasonable control of the Facility, the time for performance

hereunder shall be extended for a period equal to the agreed delay resulting from such circumstances.

IV. NOTICE OF RIGHTS

17. A person whose substantial interests are affected by this Order may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received by the clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under sections 120.569 and 120.57 of the Florida Statutes, or to intervene in this proceeding and participate as a party to it. Any subsequent intervention (in a proceeding initiated by another party) will only be at the discretion of the presiding officer upon the filing of a motion in compliance with rule 28-106.205 of the Florida Administrative Code.

Under Rule 62-110.106(4), Florida Administrative Code, a person may request enlargement of the time for filing a petition for an administrative hearing. The request must be filed (received by the clerk) in the Office of General Counsel before the end of the time period for filing a petition for an administrative hearing.

Petitions by the applicant or any of the persons listed below must be filed within fourteen days of receipt of this written notice. Petitions filed by any persons other than those entitled to written notice under Section 120.60(3), Florida Statutes, must be filed within fourteen days of publication of the notice or within fourteen days of receipt of the written notice, whichever occurs first. Under Section 120.60(3), Florida Statutes, however, any person who has asked the Department for notice of agency action may file a petition within fourteen days of receipt of such notice, regardless of the date of publication.

The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within fourteen days of receipt of notice shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57, Florida Statutes. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

- (a) The name, address, and telephone number of each petitioner; the name, address, and telephone number of the petitioner's representative, if any; the Department permit identification number and the county in which the subject matter or activity is located;
- (b) A statement of how and when each petitioner received notice of the Department action;
- (c) A statement of how each petitioner's substantial interests are affected by the Department action;
- (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
- (e) A statement of facts that the petitioner contends warrant reversal or modification of the Department action;

- (f) A concise statement of the ultimate facts alleged, as well as the rules and statutes which entitle the petitioner to relief and
- (g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wants the Department to take.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under Section 120.573, Florida Statutes, is not available for this proceeding.

This Order is final and effective on the date filed with the clerk of the Department unless a petition is filed in accordance with the above. Upon the timely filing of a petition this Order will not be effective until further order of the Department.

Any party to the permit has the right to seek judicial review of the Order under Section 120.68, Florida Statutes, by the filing of a notice of appeal under Rules 9.110 and 9.190, Florida Rules of Appellate Procedure, with the clerk of the Department in the Office of General Counsel, Mail Station 35, 3900 Commonwealth Boulevard, Tallahassee, Florida, 32399-3000; and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice of appeal must be filed within 30 days from the date when this Order is filed with the clerk of the Department.

DONE AND ORDERED on this 20th day of November, 2009 in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION



Vivian F. Garfein
Director, Central District

FILED AND ACKNOWLEDGED on this date, under Section 120.52(11) of the Florida Statutes, with the designated Department Clerk, receipt of which is acknowledged.

Clerk  Date November 20, 2009

Appendix E

Substantial Completion Certificate

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT Seminole County Markham ASR Project Phase II

DATE OF ISSUANCE

OWNER: St. Johns River Water Management District (ownership to be transferred to Seminole County Environmental Services)

OWNER's Contract No.: SJRWMD SF409A (and Seminole MOU SG341AA)

CDM Project No.: 51537

CONTRACTOR: CDM Constructors Inc. **ENGINEER:** Camp Dresser & McKee Inc.

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof:

Task 7 – Construction of ASR Well, Monitor Wells, Surface Facilities, and appurtenant work, in accordance with approved Plans and Specifications dated December 2005.

To: St. Johns River Water Management District and Seminole County Environmental Services
OWNER

And To CDM Constructors Inc.
CONTRACTOR

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, and that Work is hereby declared to be substantially complete in accordance with the contract Documents on

May 7, 2008

DATE OF SUBSTANTIAL COMPLETION

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the contract Documents.

From the date of Substantial Completion, the responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties and guarantees shall be as follows:

RESPONSIBILITIES:

OWNER: Seminole County Environmental Services: security, operation, safety, maintenance, utilities, insurance

CONTRACTORS: Complete punch lists. Provide warranties and guarantees per contract.

The following documents are attached to and made a part of this Certificate:

Clarifying Statement dated June 3, 2008.

Punchlist dated May 13, 2008.

[For items to be attached see definition of Substantial Completion as supplemented and other specifically noted conditions precedent to achieving Substantial Completion as required by Contract Documents.]

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR's obligation to complete the Work in accordance with the Contract Documents.

Executed by ENGINEER on June 5, 2008
Camp Dresser & McKee Inc.

ENGINEER

By: 
(Authorized Signature)

CONTRACTOR accepts this Certificate of Substantial Completion on June 4, 2008

CDM Constructors Inc.

CONTRACTOR

By: 
(Authorized Signature)

OWNER accepts this Certificate of Substantial Completion on _____, 2008

St. John's River Water Management District

OWNER

By: _____
(Authorized Signature)

Seminole County Environmental Services

OWNER

By: _____
(Authorized Signature)

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT Seminole County Markham Regional WTP Pretreatment System Project

DATE OF ISSUANCE

September 22, 2010

OWNER: St. Johns River Water Management District (ownership to be transferred to Seminole County)

OWNER's Contract No.: SJRWMD SF409RA (and Seminole County MOU SG341AA)

CDM Project No.: 70987

CONTRACTOR: CDM Constructors Inc. **ENGINEER:** Camp Dresser & McKee Inc.

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof:

Task 7 – Construction of Pretreatment System for dechlorination and degasification of potable water prior to injection into ASR Well in accordance with approved Plans and Specifications dated June 2009. The dechlorination system generally consists of a chemical storage tank, chemical metering pumps and associated piping, instrumentation and electrical work. The degasification system generally consists of a Membrana LiquiCel system with air compressor, nitrogen generator system, vacuum pump system and associated piping, instrumentation and electrical work. This certificate of substantial completion does not include the Degasification system equipment and components. When the Degasification system is able to consistently meet acceptable performance standards for dissolved oxygen removal an additional Certificate of Substantial Completion will be completed for that work. Attached is an equipment and component list that specifies the equipment, applicable warranty period and warranty start date.

To: St. Johns River Water Management District and Seminole County

OWNER

And To CDM Constructors Inc.

CONTRACTOR

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, and that Work is hereby declared to be substantially complete in accordance with the contract Documents on

March 2, 2010

DATE OF SUBSTANTIAL COMPLETION

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the contract Documents.

From the date of Substantial Completion, the responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties and guarantees shall be as follows:

RESPONSIBILITIES:

OWNER: Seminole County: Security, operation, safety, maintenance, utilities, insurance

CONTRACTORS: Complete punch lists. Provide warranties and guarantees per contract.

The following documents are attached to and made a part of this Certificate:

Punch list dated September 22, 2010

[For items to be attached see definition of Substantial Completion as supplemented and other specifically noted conditions precedent to achieving Substantial Completion as required by Contract Documents.]

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR's obligation to complete the Work in accordance with the Contract Documents.

Executed by ENGINEER on Sept 23, 2010

Camp Dresser & McKee Inc.

ENGINEER

By:


(Authorized Signature)

CONTRACTOR accepts this Certificate of Substantial Completion on Sept 23, 2010

CDM Constructors Inc.

CONTRACTOR

By:


(Authorized Signature)

OWNER accepts this Certificate of Substantial Completion on _____, 2010

St. John's River Water Management District

OWNER

By:

(Authorized Signature)

Seminole County

Cooperator/Owner

By:

(Authorized Signature)

Seminole County
Markham Regional Water Treatment Plant
Pretreatment System Construction Project

Punch List – September 22, 2010

1. Install drain piping and pump to discharge seal water from Vacuum Pump into raw water line for Plant or ASR supply line.
2. Secure Instrument water tubing to sunshade supports and at edge of concrete slab.
3. Disable low pressure switch at ASR well pad due to low injection pressure at the well. County to monitor water main pressure and provide pretreatment system shutdown logic from alternate monitoring point.

Appendix F

Supplemental DVDs