

Beazer

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August 18, 2006

Ms. Amy McLaughlin
Remedial Project Manager
United States Environmental Protection Agency
Region IV, Superfund North Florida Section
61 Forsyth Street, SW
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RE: Transmittal of the "Addendum to the Floridan Aquifer Monitoring Plan
Cabot Carbon/Koppers Superfund Site, Koppers, Inc. Site, Gainesville, Florida"

Dear Ms. McLaughlin:

Enclosed please find a copy of the document entitled "*Addendum to the Floridan Aquifer Monitoring Plan, Cabot Carbon/Koppers Superfund Site, Koppers, Inc. Site, Gainesville, Florida*" ("Floridan Monitoring Plan Addendum").

Beazer East, Inc. ("Beazer") is providing this Floridan Monitoring Plan Addendum to the United States Environmental Protection Agency ("USEPA") to provide a proposed approach for an updated Floridan Aquifer monitoring program at the Koppers portion of the Cabot Carbon/Koppers Superfund Site located in Gainesville, Florida ("Site"). The enclosed Floridan Monitoring Plan Addendum provides a discussion of prior groundwater monitoring results from the existing monitoring wells located at and around the Site; provides a discussion of the proposed monitoring well locations, sampling frequencies, and analytical parameters for future Floridan Aquifer groundwater monitoring events; and, provides a description of the location and construction configuration for proposed new monitoring wells as discussed in the recently submitted "*Supplemental Upper Floridan Aquifer Monitoring Well Installation – Addendum to the Floridan Aquifer Monitoring Plan*", *GeoTrans and Geohazards*, July 26, 2006.

Ms. Amy McLaughlin
August 18, 2006
Page 2

Following your review of the enclosed document if you should have any questions or wish to discuss this matter prior to issuance of an approval to proceed, please contact me at 412-208-8867, or Mr. Jim Erickson with GeoTrans, Inc. at 303-665-4390.

Sincerely,



Michael Slenska, P.E.
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Enclosure

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**ADDENDUM TO THE FLORIDAN AQUIFER
MONITORING PLAN
CABOT CARBON/KOPPERS SUPERFUND SITE**

**KOPPERS INC. SITE
GAINESVILLE, FLORIDA**

August 18, 2006



**ADDENDUM TO THE FLORIDAN AQUIFER
MONITORING PLAN
CABOT CARBON/KOPPERS SUPERFUND SITE
KOPPERS, INC. SITE
GAINESVILLE, FLORIDA**

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August 18, 2006

TABLE OF CONTENTS

TABLES	iii
1.0 INTRODUCTION	1
1.1 MONITORING PLAN ADDENDUM ORGANIZATION.....	1
2.0 BACKGROUND	3
2.1 SITE DESCRIPTION	3
2.2 SITE HYDROGEOLOGIC CONCEPTUAL MODEL.....	3
2.3 REGIONAL HYDROGEOLOGY.....	4
3.0 UPPER FLORIDAN AQUIFER HYDROGEOLOGIC DATA SUMMARY	6
3.1 WATER-LEVEL DATA	6
3.2 WATER-QUALITY DATA	8
3.2.1 Organic Constituents.....	9
3.2.2 Metal Constituents	11
3.2.3 Well Casing Preferential Pathways.....	12
4.0 FLORIDAN AQUIFER MONITORING PLAN.....	15
4.1 MONITORING OBJECTIVES AND APPROACH	15
4.2 EXISTING MONITORING PROGRAM AND PROPOSED CHANGES.....	15
4.3 MONITORING LOCATIONS	16
4.3.1 Existing Monitoring Well Locations	16
4.3.2 Proposed New Monitoring Well Designs	17
4.3.3 Proposed Abandonment of Monitoring well FW-6	17
4.4 MONITORING PARAMETERS	18
4.5 SAMPLING FREQUENCY	18
4.6 SAMPLING AND ANALYSIS PROCEDURES.....	18
4.7 DATA EVALUATIONS	19
5.0 REPORTING	20
6.0 REFERENCES	21
APPENDIX A: STANDARD OPERATING PROCEDURES	1
APPENDIX B: QUALITY ASSURANCE PROJECT PLAN.....	1

FIGURES

Figure 2-1	Site Location Map.
Figure 2-2	Hydrostratigraphy of Deposits Beneath the Site.
Figure 3-1	Locations of Upper Floridan Aquifer Monitoring wells.
Figure 3-2	Temporal hydraulic-head measurements for wells FW-3, FW-4, FW-6 and FW-8.
Figure 3-3	Upper Floridan Aquifer potentiometric surface contours for May 2006.
Figure 3-4	Temporal plot of naphthalene concentrations for Upper Floridan Aquifer wells.
Figure 3-5	Temporal plot of acenaphthene concentrations for Upper Floridan Aquifer wells.
Figure 3-6	Temporal plot of fluorene concentrations for Upper Floridan Aquifer wells.
Figure 3-7	Temporal plot of benzo(a)pyrene concentrations for Upper Floridan Aquifer wells.
Figure 3-8	Temporal plot of carbazole concentrations for Upper Floridan Aquifer wells.
Figure 3-9	Temporal plot of dibenzofuran concentrations for Upper Floridan Aquifer wells.
Figure 3-10	Temporal plot of benzene concentrations for Upper Floridan Aquifer wells.
Figure 3-11	Temporal plot of phenol concentrations for Upper Floridan Aquifer wells.
Figure 3-12	Temporal plot of 3&4 methylphenol concentrations for Upper Floridan Aquifer wells.
Figure 3-13	Temporal plot of 2,4-dimethylphenol concentrations for Upper Floridan Aquifer wells.
Figure 3-14	Temporal plot of 2 methylphenol concentrations for Upper Floridan Aquifer wells.
Figure 3-15	Temporal plot of dissolved chromium concentrations for Upper Floridan Aquifer wells.
Figure 3-16	Temporal plot of dissolved arsenic concentrations for Upper Floridan Aquifer wells.
Figure 3-17a	Upper Floridan 2006 water quality results for Zone 1 wells FW-10B through FW-23B and most recent sample results for wells FW-1 through FW-9 and MWTP-MW-1.
Figure 3-17b	Upper Floridan 2006 water quality results for Zone 2 wells FW-10B through FW-23B.
Figure 3-17c	Upper Floridan 2006 water quality results for Zone 3 wells FW-10B through FW-23B.
Figure 3-17d	Upper Floridan 2006 water quality results for Zone 4 wells FW-10B through FW-23B
Figure 3-18	Temporal plot of pH trends for monitoring wells FW-2 through FW-5 and FW-7 through FW-9.
Figure 4-1	Locations of proposed Upper Floridan Aquifer monitoring wells.
Figure 4-2	Conceptual alternative well design for the Upper Floridan Aquifer with multiple-screen intervals and telescoping casing.
Figure 4-3	Typical proposed Upper Floridan Aquifer monitoring well for the LTZ.

TABLES

Table 3-1.	Hydraulic-head measurements for the Upper Floridan Aquifer wells (January, March, May, and June and July, 2006).
Table 3-2a.	Upper Floridan Aquifer transect wells water quality results for January 2006.
Table 3-2b.	Upper Floridan Aquifer source area and transect wells water quality results for March 2006.
Table 3-2c.	Upper Floridan Aquifer property boundary wells water quality results for May 2006.
Table 3-2d.	Upper Floridan Aquifer water quality results for wells FW-10B through FW-23B for June and July 2006.
Table 4-1	Analyte List.
Table 4-2	Monitoring well sampling frequency

1.0 INTRODUCTION

The primary objective of this report is to update the existing Upper Floridan (UF) Aquifer monitoring plan, entitled *Floridan Aquifer Monitoring Plan, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida* (TRC, June 2004b) to include procedures necessary to collect representative water-level and water quality data from existing and future Site UF Aquifer monitoring wells. This revised Floridan Aquifer Monitoring Plan Addendum (the Addendum) presents the monitoring program for the UF Aquifer at the Koppers portion of the Cabot Carbon/Koppers Superfund Site in Gainesville, Florida (the Site). This Addendum focuses on the UF Aquifer monitoring and does not address the ongoing Surficial Aquifer monitoring program for the groundwater containment system, which is performed in accordance with the Proposed Stage 2 Groundwater Monitoring Program, Initial Groundwater Remedial Action (TRC, 1997).

The revision to the existing UF Aquifer monitoring plan is needed as a result of the Site investigation program performed in 2005 and 2006, which included the installation of 14 UF Aquifer Upper Transmissive Zone (UTZ) monitoring wells and the instrumentation of these wells with Westbay Multi-Port Systems (Westbay Systems). The GeoTrans (2006) report entitled *Supplemental Upper Floridan Aquifer Monitoring Well Installation -- Addendum to the Floridan Aquifer Monitoring Plan, Koppers Inc. Site, Gainesville, Florida*, discusses the monitoring well installation program and data.

This Addendum also incorporates the proposed installation of one additional UTZ monitoring well and four additional UF Aquifer Lower Transmissive Zone (LTZ) monitoring wells to provide further characterization of the UF Aquifer underlying the Site. The locations and rationale for five additional monitoring wells were previously discussed in GeoTrans (2006) and is repeated in Section 4.3.

Hydrogeologic and water quality data for the UF Aquifer have been collected at the Site starting with the installation of monitoring well FW-1 in 1992. Since the installation of this first UF Aquifer monitoring well, a total of 24 UF Aquifer monitoring wells have been installed on Site and within the immediate vicinity of the Site. Section 3.0 in this Addendum presents a summary of water quality data collected to date from these 24 UF Aquifer wells.

1.1 MONITORING PLAN ADDENDUM ORGANIZATION

This addendum includes the following discussions. Section 2.0 presents a brief Site description and hydrogeologic conditions at the Site. Section 3.0 presents a discussion of historical water quality data for the UF Aquifer collected at and in the immediate vicinity of the Site. Section 4.0 presents the monitoring plans, including a description of the monitoring well design, constituents of concern, sampling locations and frequencies, sampling procedures, and a summary of QA/QC requirements and procedures. Section 5.0 describes the data management and reporting requirements for the monitoring program and Section 6.0 includes references used in the preparation of this plan.

Standard Operating Procedures (SOPs) for Westbay System sampling and decontamination are provided in Appendix A. Details of the Quality Assurance Project Plan are provided in Appendix B.

2.0 BACKGROUND

2.1 SITE DESCRIPTION

The Site is located in the City of Gainesville, Alachua County, in northern Florida (Figure 2-1). The Site encompasses approximately 90 acres in a mixed-used industrial, commercial and residential area within the city limits. To the east of the Site is the former Cabot Carbon facility, a portion of which has been redeveloped for commercial use. The Koppers and the former Cabot Carbon facility together comprise the Cabot Carbon/Koppers Superfund Site.

The Site has little relief with land-surface gently sloping to the northeast. Land-surface elevation ranges from 185 feet on the southern end to 165 feet above mean sea level (msl) on the northern end of the Site.

The main historic and current processing facilities are located in the southern portion of the Site. They include a tank farm, cylinder drip tracks, treating cylinders' wastewater system, and drying kilns. A cooling water pond was also formerly located in this area. The central and northern portions of the Site are currently used as wood product storage areas. The Site also contains a network of rail tracks and access roads.

Two historic lagoons, referred to as the former North and South Lagoons, were used to manage wastewater generated by the treatment process. The former North Lagoon reportedly operated from 1956 until the 1970s. The operational period of the former South lagoon is not known, but aerial photography indicates that the South Lagoon was not operated as long as the North Lagoon, and was closed at approximately the same time. Both the former North and South lagoons are closed, covered and graded, and the areas are currently used for wood product storage and for open space, respectively.

2.2 SITE HYDROGEOLOGIC CONCEPTUAL MODEL

The hydrogeologic conceptual model for the Site and surrounding areas was developed based on a comprehensive review of previous investigative reports and hydrogeologic data for the area. A number of Site investigations (TRC, 1999; TRC, 2002a and 2002c; TRC, 2003a) provided background information on the Site hydrogeologic conceptual model. Historical water quality data for the Surficial Aquifer, Hawthorn Group and Upper Floridan Aquifer were obtained from three TRC reports (2003b, 2003d and 2004a) and two RETEC reports (RETEC, 2005a and 2005b). Previous regional modeling work by CH2M HILL (1993) provided background information on the regional aquifer systems and GeoSys (2000) provided information on the Murphree Wellfield production wells. GeoTrans completed a detailed evaluation of potential source areas and the spatial distribution of NAPL at the Site (2004b), created a groundwater flow and transport model at the Site based on these data sources (GeoTrans, 2004c), and recently installed 14 UF Aquifer monitoring wells (GeoTrans, 2006). Additional sources of information used to develop the conceptual model included hydrogeologic

and hydrologic databases containing aquifer characteristics, well logs, groundwater levels, aquifer-test results, groundwater municipal pumpage volumes/rates, and precipitation.

2.3 REGIONAL HYDROGEOLOGY

The Site is located in the Northern Highlands of Alachua County, where the Hawthorn Group confines the Floridan Aquifer. Four principal hydrostratigraphic units are present in this area: 1) Surficial Aquifer; 2) Hawthorn Group; 3) Upper Floridan Aquifer; and 4) Lower Floridan Aquifer (Figure 2-2).

Surficial Aquifer

The Surficial Aquifer consists of approximately 20- to 30-feet of Pliocene to Pleistocene marine terrace deposits. These deposits primarily consist of unconsolidated, fine- to medium-grained sand with thin layers of interbedded silt and clay deposits. Depth to groundwater for the Surficial Aquifer at the Site typically ranges from 3 to 10 feet below ground surface. The Surficial Aquifer flow direction is controlled by surface topography and localized discharge points such as wetlands, creeks, drainage ditches and the Surficial Aquifer extraction system. The Surficial Aquifer is not a major source of potable groundwater; however, locally some wells have been installed for irrigation use.

Hawthorn Group

The Hawthorn Group underlies the Surficial Aquifer and consists of a thick sequence of laterally-continuous, low-permeability unconsolidated sedimentary deposits that effectively limits vertical groundwater flow. Hawthorn Group deposits are approximately 120 to 125 feet thick beneath the Site and separate the overlying Surficial Aquifer from the underlying Floridan Aquifer with low-permeability clay, clayey-sand, and silt deposits interbedded with higher-permeability sand, silty-sand and carbonate deposits. Because the Hawthorn Group is comprised primarily of low-permeability materials, it is not a major groundwater source for wells in this area. In general, flow within the Hawthorn Group parallels that of overlying surface drainages.

Upper Floridan Aquifer

The UF Aquifer underlies the Hawthorn Group deposits. The two primary formations that comprise the UF Aquifer are the Ocala Limestone and the Avon Park (Figure 1-3). The UTZ is a secondary water-producing interval for the UF Aquifer and is located in the uppermost portion of the Ocala Limestone. The thickness of the UTZ is also highly variable, ranging from 50- to 100-feet in thickness. The Lower Transmissive Zone (LTZ) is the major water-producing interval for the Murphree Wellfield in Alachua County. The LTZ is located at the contact of the Ocala Limestone and Avon Park and is highly variable in thickness ranging from 20 to 100 feet (GeoSys, Inc., 2000). Approximately 85 percent of the Murphree Wellfield production is obtained from the LTZ and 15 percent is obtained from the UTZ (GeoTrans, 2004b). The UTZ and LTZ are separated by approximately 100 feet of dense, low-permeability carbonate deposits that produce limited quantities of water. The regional groundwater flow direction in the UF

Aquifer is to the west and northwest; however, groundwater withdrawals from the Murphree Wellfield have changed groundwater flow directions across a large area of the county. Because of Murphree Wellfield withdrawals, the UF Aquifer average groundwater flow direction at the Site is to the northeast. A more thorough discussion of the hydrogeologic SCM is provided under separate cover in the report entitled: *Addendum 7: Groundwater Flow and Transport Model* (GeoTrans, 2004b).

Lower Floridan Aquifer

The Lower Floridan Aquifer is separated from the Upper Floridan Aquifer by approximately 200 feet of low-permeability carbonate deposits, in addition to numerous intra-aquifer low-permeability zones. The Lower Floridan Aquifer is effectively isolated from the Upper Floridan Aquifer, with limited potential for groundwater flow between them. No known water supply wells within Alachua County are completed in the Lower Floridan Aquifer (CH2M HILL, 1993).

Vertical hydraulic gradients between each of the four principal hydrostratigraphic units are downward, with considerable difference in hydraulic head (i.e., approximately 90 feet) between the Lower Hawthorn and the UF Aquifer. The large difference in hydraulic head indicates that the Hawthorn Group lower clay unit minimizes hydraulic communication between these two units.

3.0 UPPER FLORIDAN AQUIFER HYDROGEOLOGIC DATA SUMMARY

A total of 24 UF Aquifer monitoring wells have been installed on Site and in the immediate vicinity of the Site (Figure 3-1). The first UF Aquifer monitoring well installed at the Site was FW-1 in 1992. Monitoring wells FW-2 through FW-5 were installed in 2003 and wells FW-6 through FW-9 were installed in 2004. Monitoring wells FW-10B through FW-16B were installed in late 2005 and wells FW-17B through FW-23B were installed in early 2006. Monitoring wells MWTP-MW-1 and MWTP-MW-2 were installed by GRU in fall 2003 to serve as sentinel wells for the Murphree Wellfield. Well MWTP-MW-1 is monitored routinely by Beazer; however well MWTP-MW-2 is located approximately 4,000 feet to the east of the Site and is not part of this Floridan Aquifer Monitoring Program.

Monitoring wells FW-10B through FW-21B were installed to address concerns by the EPA, FDEP and stakeholders for a more comprehensive monitoring program for the UF Aquifer. Eight (FW-10B through FW-17B) of the 12 monitoring wells were installed as a “transect”, with wells spaced on approximately 300-foot centers. The objective of this monitoring well transect was to provide a downgradient line of wells for detection of potential Site constituents. The remaining four monitoring wells (FW-18B through FW-21B) were installed immediately adjacent to the four source areas and are termed the “source area” monitoring wells. Monitoring wells FW-22B and FW-23B were not required by the EPA. They were voluntarily installed by Beazer along the northern Site boundary and are termed “boundary” monitoring wells.

Water-level and water-quality data have been collected from these wells since their installation. These data are summarized below.

3.1 WATER-LEVEL DATA

Monitoring Wells FW-1 through FW-9 and MWTP-MW-1

Routine water-level measurements for the UF Aquifer have been collected in wells FW-2 through FW-5 since June of 2003. Measurements were collected a minimum of semi-annually with more frequent quarterly to bimonthly measurements starting in 2004. Water-level measurements for well FW-6 started in July 2004 and have been measured approximately biweekly. Water-level measurements for wells FW-7 through FW-9 started in November 2004 and have been measured approximately semi-annually with more frequent quarterly to monthly measurements starting in 2005.

Water-level measurements for well FW-1 may have been collected sporadically since 1992; however, the database of Site information only contains measurements starting in June 2004, after the well was backfilled. Monitoring well FW-1 was installed in 1992 to a depth of 310 feet (above the LTZ), with an uncased hole from 151 to 310 feet. Although this monitoring well was always clean, because of concerns that it could provide a conduit for Site constituents to the LTZ, this monitoring well was backfilled to a depth of approximately 166 feet in March 2004 and now monitors approximately the upper 20 feet of the UTZ (TRC, 2004a).

Water-level measurements for GRU sentinel wells MWTP-MW-1 and MWTP-MW-2 have been collected approximately semi-annually since late 2003. The collection of water-level measurements in well MWTP-MW-2 was discontinued in May 2004 because of its distant location from the Site.

The most frequent and continuous set of water-level data for the UF Aquifer at the Site are for monitoring well FW-6 where measurements have been collected approximately biweekly since its installation in 2004. A temporal plot of water-level data for monitoring well FW-6 is provided in Figure 3-2. Water-level trends for this well indicate that the potentiometric surface for the UF Aquifer has risen approximately 10 feet from July 2004 to March 2006. This rise in the potentiometric surface is likely due to a combination of increased recharge from precipitation and reductions in groundwater withdrawals at the Murphree Wellfield over this time period.

Temporal plots of wells FW-3, FW-4 and FW-8 also are provided in Figure 3-2. These temporal plots show that water levels in the UF Aquifer fluctuate seasonally as a result of changes in precipitation and pumpage at the Murphree Wellfield.

Monitoring Wells FW-10B through FW-23B

Monitoring wells FW-10B through FW-23B were installed in 2005 and 2006. These wells are instrumented with the Westbay System, such that water-level measurements cannot be obtained directly and need to be calculated from pressure transducer readings at each of the four discrete measurement ports in the well. Pressure readings were obtained from these wells in January, March, May, June and July 2006. The calculated hydraulic-head elevation for these multiple measurement dates are provided in Table 3-1 and a discussion of these data are provided below. Temporal plots of these hydraulic-head data are not provided given the short period of record.

Issues with obtaining accurate hydraulic-head data with the Westbay System are discussed in the GeoTrans (2006) report and summarized here. Hydraulic heads are calculated based on the pressure reading and the elevation of the Westbay System measurement ports. The elevation of the Westbay System measurement port is based on the surveyed elevation of the 4-inch ID steel casing and construction as-builts of the Westbay System. Small errors in the elevation of the port based on the construction as-builts are reflected directly in the calculated hydraulic head. Another potential error in the Westbay System port measurements is the fact that the wells may not be perfectly vertical. Therefore, establishing the elevation of the measurement ports from construction as-builts does not account for changes in the measurement port elevation because of borehole deviations. A few tenths of feet difference in the measurement-port elevation results in a similar error in the calculated hydraulic head. In addition, even with accurate measurements on the Westbay System casing and coupling lengths, it is difficult to quantify the effects of casing/coupling stretch in the downhole location of the ports. A few tenths of feet stretch in the casing will result in the calculated hydraulic-head values to be off by a corresponding amount.

Potentiometric Surface and Hydraulic Gradients

A comprehensive water-level measurement program was initiated to collect hydraulic-head data from all UF Aquifer monitoring wells on-Site and in the immediate vicinity. Water level and/or formation pressures were obtained on May 16-21, 2006 for all 24 UF monitoring wells at the Site. Water levels in monitoring wells FW-1 through FW-9 and MWTP MW-1 were obtained with a water-level meter probe and water levels for the 56 Westbay System zones in monitoring wells FW-10B through FW-23B were calculated from formation pressures measured with the sample-probe transducer. Formation pressures were converted to hydraulic-head elevations. The results of the water-level measurements and hydraulic-head calculations are presented in Table 3-1.

The potentiometric surface resulting from the hydraulic-head data obtained in May 2006 is shown in Figure 3-3. The potentiometric surface elevation contours for hydraulic heads in the upper 20 feet of the UF Aquifer indicate a predominantly northeastern groundwater flow direction across the Site. Along the western Site property boundary the groundwater flow direction is more northerly. Within the central portion and along the eastern boundary of the Site the flow direction is more to the northeast.

The horizontal hydraulic gradient across the Site is approximately 7.3×10^{-4} ft/ft, resulting in a total hydraulic-head change of approximately 2 feet from the southern to the northern Site property boundary (approximately 3,100 feet). This relatively small hydraulic-head gradient is an indication that the transmissivity (product of hydraulic conductivity and aquifer thickness) value of the UF Aquifer is moderately high and consistent with the value used in the GeoTrans numerical model. In general, the higher the transmissivity value of the aquifer, the smaller the hydraulic gradient (GeoTrans, 2004c).

The small hydraulic gradient magnifies the difficulty of correlating water levels obtained with a water-level meter probe in the original monitoring wells (FW-1 through FW-9 and MWTP-MW-1), with hydraulic heads calculated from pressure measurements in vertically discrete zones in the Westbay Systems for new monitoring wells (FW-10B through FW-23B). Therefore, some of the potentiometric elevations obtained from pressure measurements in the Westbay System ports do not correlate with water-level measurements in the previous UF monitoring wells at the Site.

3.2 WATER-QUALITY DATA

In general, groundwater samples have been collected routinely from the UF Aquifer monitoring wells since their installation. Water quality results for monitoring wells FW-1 through FW-9, and MWTP-MW-1 are summarized in temporal plots. Temporal plots of routinely detected organic constituents are provided in Figures 3-4 through 3-14. Temporal plots of dissolved arsenic and chromium are provided in Figures 3-15 and 3-16. No temporal plots of constituents were developed for monitoring wells FW-10B through FW-23B because of the limited number of sampling rounds available for these wells.

The results of the groundwater samples shown in Figures 3-4 through 3-14 are compared to both Federal Maximum Concentration Limits (MCLs) and the State of Florida Groundwater Cleanup Target Level (GCTL) standards.

3.2.1 ORGANIC CONSTITUENTS

Monitoring Wells FW-1 through FW-9 and MWTP-MW-1

The following discussion of temporal trends is for monitoring wells FW-1 through FW-9 and MWTP-MW-1 only. The temporal plots demonstrate that typically low concentrations of organic constituents are detected in these wells during the first couple of sampling events and that these concentrations decline with time (Figures 3-4 through 3-14). In the majority of these wells the organic constituent concentrations are low to nondetect. All of these UF Aquifer wells are currently below Federal MCLs and Florida GCTL concentration limits, with the exception of a few organic constituents in FW-6. The only monitoring well that has elevated organic constituents is monitoring well FW-6; however, these constituent concentrations are hypothesized to be a result of “drag down” of drilling fluids and mud during the installation of this well. Constituent concentration trends support this hypothesis in that the majority of the constituents have continued to decline since this well was installed. One of many examples of this ongoing decline in concentration is naphthalene, with an initial concentration of 2,560 µg/L in July 2004 and a June 2006 concentration of 450 µg/L. The majority of the other organic constituents for this well show a similar trend in declining concentrations. The following organic constituents have shown significant declines since the initial sample collected in July 2004; 1) Acenaphthene, 2) Fluorene, 3) Carbazole, 4) Dibenzofuran, 5) 3&4 Methylphenol, and 6) 2,4 Dimethylphenol. Benzene concentrations increased in this well during 2004 up to 14 µg/L; however, concentrations have steadily declined since the end of 2004. These trends are consistent with the conceptual model of “drag down” of impacted drilling fluids during the well installation.

The only monitoring well with phenol concentrations that exceed the Florida GCTL standard of 10 µg/L is monitoring well FW-3 (Figure 3-11). Phenol concentrations in this well have fluctuated above and below the Florida GCTL standard during 2005. The June 2006 sample from this well is nondetect for phenol.

Monitoring Wells FW-10B through FW-23B

Two complete sample rounds have been performed for monitoring wells FW-10B through FW-23B since their installation. The first round of samples was collected from January to May 2006 and the second round was collected at the end of June and beginning of July 2006. In addition, confirmation samples were collected for select wells in March 2006. Results of the first sampling round for these wells, performed from January to May 2006, were previously provided by Beazer to the EPA in correspondence dated February 10, 2006, April 3, 2006 and June 12, 2006. Tables 3-2a, 3-2b and 3-2c provide summaries of these sample results. The second complete sample event for these wells was performed in June and July 2006 and the results of these analyses are provided in Table 3-2d. Figures 3-17a through 3-17d show the

distribution of water quality detections for sampling zones 1 (shallowest) through 4 (deepest) for wells FW-10B through FW-23B.

The results of the second sampling event in June and July, 2006 show organic impacts in the same wells that contained impacts during the first sampling event. Monitoring well FW-12B is the only transect well with significant organic impacts. The major changes to concentration trends in monitoring well FW-12B are detections of low levels of benzene in zones 1, 3 and 4 and detections of naphthalene at 49 µg/L in zone 1. All other concentration trends were essentially similar to the March 2006 sampling event. Transect monitoring well FW-16B contained one zone with one constituent (benzene at 1.7 µg/L) that was slightly above the Florida GCTL standard of 1 µg/L. Monitoring wells FW-20B and FW-21B are the only source area wells with organic impacts. There are six organic constituents that exceed Florida GCTL standards in these two wells: 1) Acenaphthene, 2) Benzene, 3) Carbazole, 4) Dibenzofuran, 5) 2-Methylnaphthalene, and 6) Naphthalene. Although these same constituents were present in these wells during the first sampling event, the concentrations from the second sampling event are higher than the first sampling event. The upper two sampling zones of source area monitoring well FW-20B contained select organic constituents above Florida GCTL. These same two zones are the only zones in this well with constituents that exceed Florida GCTL standards. Conversely, source area monitoring well FW-21B previously had organic impacts exceeding Florida GCTL standards in the uppermost sampling zone. The second sampling event shows select organic impacts exceeding Florida GCTL standards in all four sampling zones. The only organic constituent that exceeds Federal MCL standards for monitoring wells FW-20B and FW-21B is benzene. Monitoring well FW-20B has benzene (5.3 µg/L) in the uppermost sampling zone that slightly exceeds the Federal MCL standard of 5 µg/L. No other sampling zones for this well exceeded Federal MCL standards. Monitoring well FW-21B has benzene concentrations in the upper three zones of 16.0, 5.8 and 6.1 µg/L, respectively, that exceed Federal MCL standards.

Fluctuations in organic constituent concentrations for the two sampling events are not unexpected given historical concentration trends for UF Aquifer monitoring wells at this Site. A longer period of monitoring will be required to establish concentration trends and to analyze constituent fate and transport for these areas. The first sampling round was performed after well development, where groundwater withdrawal from these wells pulled groundwater in from surrounding areas. The initial concentrations may still show the effects of well development. Alternatively, the increase in concentration may reflect vertical migration along the well casing from overlying impacts in these source areas. The technical concern of creating preferential pathway as a result of installing monitoring wells within the source areas was detailed in the GeoTrans (2004a) workplan entitled: *Addendum to the Floridan Aquifer Monitoring Program, Supplemental Upper Floridan Aquifer Monitoring Well Installation, Koppers, Inc. Site, Gainesville, Florida*, in addition to a number of letters (Beazer letter to EPA dated July 27, 2005; Beazer letter to EPA dated August 7, 2005) discussing this issue. Two groundwater sample rounds are insufficient to evaluate the significance of these constituent concentrations. However and most importantly, the fact that transect monitoring wells downgradient from these source areas do not show significant impacts is an indication that these elevated concentrations are localized and not areally extensive.

Monitoring wells FW-22B and FW-23B are located along the northern Site boundary. Low concentrations of select organic constituents that are below Florida GCTL standards were detected in these wells; however, phenol (20 µg/L) in the lowermost zone of well FW-22B was the only constituent that exceeded the GCTL standard of 10 µg/L. Conversely, phenol concentrations in the three uppermost zones of well FW-22B were all nondetect. A longer period of record will be needed to evaluate if this detection is anomalous for this well. No other organic constituents exceeded Florida GCTL standards in these wells.

In summary, the two sampling events for monitoring wells FW-10B through FW-23B are consistent with each other. The same three wells with organic impacts from the first sampling event were impacted in the second event. No new transect wells contained impacts, with the exception of a low benzene concentration in the uppermost sampling zone in monitoring well FW-16B. In general, constituent concentrations increased in the two source zone monitoring wells. Insufficient data are available to fully analyze the significance of this increase.

3.2.2 METAL CONSTITUENTS

The Floridan Aquifer Monitoring Plan requires that groundwater samples from this Site be analyzed for the following metals: 1) Arsenic, 2) Chromium, 3) Copper and 4) Zinc. The metal that has historically exceeded Federal MCLs or Florida GCTL standards is arsenic. In general, all the remaining metals are below standards. A summary of the metal analysis results is provided below.

Monitoring Wells FW-1 through FW-9 and MWTP-MW-1

A temporal plot of dissolved chromium is provided in Figure 3-15. This plot shows that dissolved chromium concentrations are nondetect or slightly above detection for all wells. Although chromium has historically been associated with Site operations, there is no evidence of chromium impacts to the UF Aquifer.

Water quality data collected as part of this program further supports the hypothesis that previously detected elevated arsenic concentrations in the UF Aquifer are likely due to the introduction of oxygenated drilling fluids, which mobilized naturally occurring arsenic minerals in this aquifer. Elevated dissolved-phase arsenic concentrations were not detected in the new UF monitoring wells after extensive well development, supporting the conceptual model of a natural source of arsenic in the UF Aquifer being mobilized by the introduction of drilling fluids.

A temporal plot of dissolved arsenic is provided in Figure 3-16. This plot shows that arsenic was historically elevated in a number of monitoring wells at the Site and has since declined with each successive sampling event. The only monitoring wells with dissolved arsenic concentrations that currently exceed Federal MCLs and State GCTL standards are FW-3, FW-7 and FW-9. Monitoring well FW-3 arsenic concentrations have fluctuated over the period of record for this well. The most recent dissolved arsenic sample for well FW-3 is 54 µg/L. The pH trends for this well indicate that vertical leakage of groundwater may be occurring outside of the well casing, as will be discussed below. This fluctuation in arsenic concentration may be associated with vertical leakage of oxygenated groundwater outside of the well casing.

Monitoring well FW-7 is located immediately downgradient of the northern Site boundary and has the highest dissolved arsenic concentration observed in monitoring wells at the Site. Arsenic in this monitoring well was initially measured at 197 µg/L in November 2004 immediately after it was installed. The arsenic concentration for this well has steadily declined from this elevated concentration to below the Federal MCL and Florida GCTL standard of 10 µg/L, in the December 14, 2005 sampling event. The most recent concentration for monitoring well FW-7 is 13 µg/L. Concentration trends for this monitoring well and others support the conceptual model of naturally occurring arsenic.

Monitoring well FW-9 is located approximately 1,000 feet to the west of the Site and is hydraulically side-gradient to the Site. Arsenic concentrations in this well have fluctuated from nondetect to 25 µg/L over the period of record. The three most recent sampling events show arsenic concentrations for this monitoring well above 20 µg/L. The elevated arsenic concentration in this well and fluctuations over time are consistent with the conceptual model of naturally occurring arsenic.

Monitoring Wells FW-10B through FW-23B

Dissolved chromium concentrations in monitoring wells FW-10B through FW-23B are consistent with the sample results for wells FW-1 through FW-9. Dissolved chromium concentrations are all less than Florida GCTL standard of 100 µg/L. There are only two wells that exceeded a dissolved chromium concentration of 10 µg/L. Monitoring wells FW-10B and FW-11B contained dissolved chromium concentrations of 12 and 11 µg/L, respectively, in one sample zone for each of these wells during the first sampling event.

Dissolved arsenic concentrations in monitoring wells FW-10B through FW-23B are consistent with wells FW-1 through FW-9. The majority of the dissolved arsenic concentrations are nondetect, with only three wells with select sampling zones that currently exceed the standard. Monitoring well FW-11B currently has the highest dissolved arsenic concentration of 65 µg/L in zone 2 and monitoring well FW-15B has the second highest concentration of 20 µg/L in zone 1.

3.2.3 WELL CASING PREFERENTIAL PATHWAYS

One of the biggest technical challenges with the installation of monitoring wells at this Site is ensuring a complete and uncompromised grout seal outside the well casings. The approximately 90-feet of head differential across the Hawthorn Group lower clay represents a significant hydraulic driving force from the impacted Hawthorn Group deposits to the UF Aquifer. An incomplete or compromised grout seal would provide a direct preferential pathway for transporting impacts from overlying deposits into the UF Aquifer.

Direct evidence documenting the presence of preferential pathways outside of well casings is difficult to obtain because natural tracers are not available to identify mixing of groundwater in the UF Aquifer with groundwater from the HG deposits and Surficial Aquifer. The well construction designs for monitoring wells FW-2 through FW-5 provide data which

appears to indicate vertical leakage is occurring in some of the wells at the Site. Monitoring wells FW-2 through FW-5 were constructed with an annular bentonite grout seal from 6 feet below the top of the HG lower clay unit to the top of the screen interval in the Ocala Limestone. A cement grout was utilized to seal the borehole annulus from the top of the bentonite grout to land surface. Groundwater coming in contact with the cement grout will tend to have elevated pH values (> 8.0 pH units) and groundwater in contact with the bentonite grout will tend to have a neutral pH of around 7.0 to 7.5 pH units. The pH of the UF Aquifer should be approximately neutral at 7.0 to 7.5 pH units. Hence, groundwater in UF Aquifer monitoring wells FW-2 through FW-5, with significantly elevated pH values, is an indication of potential vertical leakage from the overlying HG deposits.

Temporal plots of pH trends for monitoring wells FW-2 and FW-5 indicate elevated pH values (Figure 3-18). Monitoring wells FW-3 and FW-5 have some of the highest pH values for wells at the Site. Monitoring well FW-3 shows a significant increase in pH starting in 2004 and continuing into 2005. There were six sampling events for well FW-3 during this time period that showed pH values greater than 10 pH units, with the highest pH values of 12.5 pH units measured in June 2005. These high pH values are not typical for the UF Aquifer or the overlying deposits, where the pH should be approximately neutral at around 7 to 7.5 pH units.

The most likely explanation for these elevated pH levels in monitoring well FW-3 is cement grout contamination. The well construction as-builts for this well indicate that cement grout was only used to seal the borehole from land surface to 6 feet below the top of the HG lower clay unit. Approximately 23 feet of bentonite grout was then used to seal the borehole annulus from the HG lower clay unit to the UF Aquifer and 4 feet of bentonite chips was placed below the bentonite grout and above the screen filter pack. A bentonite grout typically has a pH of approximately 7 to 7.5 pH units and therefore, would not result in the elevated groundwater pH values measured in this well. Cement grout is the only plausible material that could account for elevated pH values in this well. The fact that the cement grout is only present above the HG lower clay unit is an indication that vertical migration may have occurred outside of the well casing. The pH values in monitoring well FW-3 have steadily declined since June 2005 and is currently at a pH value of 9.0. This decline would be expected with the curing of the cement grout over time; however, preferential pathways would still be present.

Monitoring well FW-5 shows similar pH trends to those observed in FW-3; however, the pH values in this well were not as high. The pH values trend for monitoring well FW-5 closely mimics the trend observed in monitoring well FW-3, with the maximum pH value of 10.3. Monitoring wells FW-2 and FW-4 show similar trends to those observed for FW-3 and FW-5; however, pH values for these wells are lower than for wells FW-3 and FW-5, indicating that vertical leakage may not be as extensive in these wells.

The pH values from monitoring wells FW-7 through FW-9 are also shown in Figure 3-18. The pH values for these wells are significantly lower than wells FW-2 through FW-5, indicating that vertical leakage may not be as significant in these wells. In addition, the well construction from wells FW-7 through FW-9 is different from wells FW-2 through FW-5, in that approximately 10 feet of bentonite chips was placed above the screen interval and cement grout was placed from the top of the bentonite chips to land surface. Hence, cement grout is located

vertically closer to the screen interval, yet the groundwater pH values for these wells are lower than FW-2 through FW-5. The fact that lower pH groundwater is present in monitoring wells FW-7 through FW-9 is an indication that vertical leakage may not be as significant at these well locations.

4.0 FLORIDAN AQUIFER MONITORING PLAN

This section includes a discussion of the following key monitoring plan components:

- Monitoring objectives and approach;
- Discussion of existing Floridan aquifer monitoring wells;
- Preliminary design considerations and locations of four proposed LTZ monitoring wells;
- Site constituents; and
- Sampling and analysis plans.

4.1 MONITORING OBJECTIVES AND APPROACH

The primary objective of this Addendum is to update the original UF Aquifer monitoring plan (TRC, 2004b) to document procedures necessary to collect representative data from new and proposed UF Aquifer monitoring wells installed as part of the Cabot Carbon/Koppers Superfund Site groundwater monitoring program.

The approach for this monitoring plan is to periodically collect groundwater samples for water quality analysis and to measure potentiometric water levels to evaluate groundwater flow directions in the UF Aquifer at the Site. Data generated by this program will be used to validate the accuracy of the numerical groundwater model, to refine the conceptual Site model and to provide sentinel water quality monitoring points for the UF Aquifer to assure continued protection of the source of drinking water for the City of Gainesville (i.e. the UF Aquifer).

4.2 EXISTING MONITORING PROGRAM AND PROPOSED CHANGES

The current Floridan Aquifer Monitoring Plan (TRC, 2004b) requires semi-annual (2nd and 4th quarters) sampling of seven wells (FW-2, FW-4, FW-5, FW-7, FW-8, FW-9 and MWTP-MW-1) and quarterly sampling of two wells (FW-3 and FW-6). The wells are sampled by low-flow/low-stress methods using a bladder pump (Teflon[®] bladder and Teflon[®]-lined tubing). The purge water is monitored for changes in pH, specific conductance, temperature, dissolved oxygen, oxidation-reduction potential, and turbidity. Groundwater samples are submitted to the laboratory for analysis of the parameters listed in Table 2 of the TRC (2004b) Monitoring Plan. Prior to sampling, the wells are gauged for depth to water and NAPL. NAPLs have never been detected in any of the UF monitoring wells since the start of UF Aquifer monitoring in 1992.

The recent installation of the 14 new UF Aquifer monitoring wells, with a total of 56 discrete sampling zones, provides a comprehensive network of monitoring wells. Eight of the 14 wells were installed as a monitoring well transect, with wells spaced on approximately 300-foot centers. The objective of this monitoring well transect was to provide a downgradient line of wells for detection of potential Site constituents. In addition to these 14 recently installed wells Beazer has proposed the installation of five additional wells to provide a second transect of

nested wells located downgradient of the first transect. The second well transect will be located along the northern Site boundary, with nested wells completed in both the UTZ and LTZ. This second transect will provide sentinel wells for the LTZ, in addition to providing a second transect for the UTZ. These monitoring wells will be instrumented with the Westbay System, such that multiple discrete vertical zones can be sampled in each well. The 14 recently installed wells in addition to the proposed five new wells will contain approximately 72 discrete sampling zones. For comparison, the existing Florida Monitoring Program contains nine wells, with one sampling zone per well for a total of nine sampling zones.

4.3 MONITORING LOCATIONS

With the installation of the 19 new wells, on-going sampling of the majority of the previous UF Aquifer monitoring wells is no longer needed. Continued sampling of these wells serves no technical purpose given the recently installed wells and that samples from these wells are only representative of the upper 20 feet of the UTZ. Beazer proposes to remove seven of the nine monitoring wells currently being sampled from the Floridan Aquifer program. These seven wells will be retained for water-level monitoring; however, future groundwater quality sampling will cease for these wells. The seven monitoring wells proposed for elimination are wells FW-2, FW-3, and FW-5 through FW-9.

Proposed monitoring locations will provide water quality and flow direction data for the Floridan Aquifer at, and downgradient of the Site, as required by objectives for this Addendum. Monitoring locations will include 16 existing monitoring wells including MWTP-MW-1, FW-4, and FW-10B through FW-23B. Proposed monitoring locations also include one additional UF Aquifer monitoring well to be completed in the UTZ (FW-24B) and four monitoring wells that are proposed to be completed in the LTZ downgradient of the Site (FW-4C, and FW-22C through FW-24C). The locations of the 21 wells proposed for the UF Aquifer monitoring program are shown in Figure 4-1.

4.3.1 EXISTING MONITORING WELL LOCATIONS

Monitoring wells FW-10B through FW-23B are located on Site and are screened across the UTZ. Each of the monitoring wells is capable of monitoring and discretely sampling four zones, evenly distributed across the UTZ. A schematic drawing of the monitoring well and Westbay System design is provided as Figure 4-2.

Monitoring well MWTP-MW-1 is a sentinel well installed by Gainesville Regional Utilities (GRU) to monitor UF Aquifer water quality between the Site and the Murphree Well Field. This well has historically been part of the Floridan Monitoring Program and will continue to be utilized for this purpose. Well FW-4 is located in the northeastern corner of the Site and will be regularly monitored under the revised Floridan Monitoring program. A LTZ well (FW-4C) will be installed adjacent to monitoring well FW-4 to provide vertically discrete samples of the LTZ.

4.3.2 PROPOSED NEW MONITORING WELL DESIGNS

Proposed UTZ monitoring well FW-24B will be constructed as a four-zone multi-port completion, similar to monitoring wells FW-10B through FW-23B. To prevent potential aquifer cross contamination or drilling fluid drag-down, this monitoring well would be installed using the same triple telescoping casing design as was used in monitoring wells FW-10B through FW-23B. The proposed location for this monitoring well is along the western Site boundary approximately 200 feet west of monitoring well FW-2.

Proposed LTZ monitoring well FW-4C will be installed at the location of UTZ monitoring well FW-4. LTZ monitoring wells FW-22C and FW-23C will be co-located with UTZ monitoring wells FW-22B and FW-23B, respectively and LTZ monitoring well FW-24C will be co-located with proposed UTZ monitoring well FW-24B. FW-4C and FW-23C will provide water quality data and water-level data for LTZ flow to the north and north-northeast of the Site and FW-22C and FW-24C will provide this information for LTZ flow to the northwest of the site.

To avoid potential aquifer cross contamination, the proposed design for these monitoring wells will use telescoping casings to isolate the Surficial Aquifer, Hawthorn Group deposits, UTZ and LTZ. The proposed design will consist of three isolation casings to minimize the potential for vertical migration from the overlying Surficial Aquifer and HG deposits. The uppermost isolation casing will be completed into the HG middle clay unit, the second isolation casing will be completed into the HG lower clay unit, the third isolation casing will be completed into the semi-confining unit underlying the UTZ and the 4-inch well casing will be completed in the top of the LTZ (Figure 4-3). The LTZ monitoring wells will be completed as open boreholes across the LTZ interval (approximately 80 feet thick). A Westbay system will be installed in the open borehole to isolate approximately three sample zones. In the event that an open borehole completion is not feasible in the LTZ, an alternative well design will be proposed.

4.3.3 PROPOSED ABANDONMENT OF MONITORING WELL FW-6

Monitoring well FW-6 was installed immediately downgradient of the former North Lagoon into the UF Aquifer using mud-rotary drilling methods in July 2004. Monitoring well FW-6 has contained elevated concentrations of Site-related constituents since its installation; however, the constituent concentrations have declined since the first sample in 2004. It has been theorized that residual NAPLs, mixed with drilling fluids, were dragged-down during installation of this monitoring well. The recently installed UF monitoring wells (FW-10B through FW-23B) demonstrate that wide-spread impacts are not present in the UF Aquifer; results of this extensive UF Aquifer investigation program support the conceptual model for drilling induced impacts in monitoring well FW-6. Given that water quality results for monitoring well FW-6 are localized and are most likely due to drilling fluid impacts, it is proposed to discontinue monitoring at this location and to abandon this well. Water-quality data from this monitoring well are compromised and are of no technical use. Monitoring well FW-20B is located less than 100 feet downgradient of this location; data from this monitoring well will act as an effective substitute.

The FW-6 well abandonment will be conducted in accordance to Saint Johns River Water Management District (SJRWMD) regulations.

4.4 MONITORING PARAMETERS

Table 4-1 provides a list of the constituents that samples will be analyzed for during each monitoring event. The constituents of concern (COCs) are chemicals detected in shallow Site groundwater that may be related to historic Site operations.

4.5 SAMPLING FREQUENCY

Existing monitoring data do not indicate significant seasonal variation in constituent concentrations. The proposed sampling frequencies will provide data on temporal variations in water quality conditions, and are appropriate given estimated transport times within the UF Aquifer.

Table 4-2 provides sample frequency information for the new and proposed UF Aquifer monitoring wells. One of the semiannual sampling events will be timed to coincide with the annual Stage 2 Monitoring Program sampling event.

The proposed sampling frequency for the new and proposed UF Aquifer monitoring wells will be quarterly for the first year and semiannually for two additional years. Following the two years of semiannual monitoring, the data will be evaluated to determine an appropriate sampling frequency.

4.6 SAMPLING AND ANALYSIS PROCEDURES

The monitoring addressed by this Addendum will be performed on the recently installed and proposed monitoring wells equipped with Westbay Systems. SOPs for Westbay System sampling and decontamination are provided in Appendix A. Field and sample documentation procedures outlined in the June 2004 sampling plan will be used under this Addendum. The Quality Assurance Project Plan (QAPP) for the monitoring program is presented in Appendix B. The QAPP includes detailed procedures for handling, documenting and analyzing groundwater samples. In particular, the QAPP provides detailed information that is directly applicable to the work described herein, with supplemental and/or modification as necessary for the specific objectives of this work, including the following topics:

- Quality Control Parameters;
- Groundwater Sample Collection;
- Chain-of-Custody and Sample Handling;
- Analytical Procedures and Methods;
- Field Calibration Procedures;
- Laboratory Calibration Procedures;

- Data Reduction, Validation, Verification and Reporting;
- Groundwater Sample Quality Control; and
- Internal Laboratory QC Checks.

Monitoring wells to be sampled under this program (with the exception of monitoring wells FW-4 and MWTP-MW-1) are equipped with Westbay Systems, where purging of the sample zone is not required and it is not necessary to confirm that sample water is representative of the formation by measuring field parameters. In addition, the Westbay equipment typically collects groundwater samples in four individual bottles (about 250 ml each). A total of four sample runs are required for each Westbay sampling port to obtain sufficient volume for analysis of the COCs. The measurement of field parameters during the collection of these samples is not feasible, given the procedures and limited volume of groundwater collected with the Westbay sampling system. Hence, field parameters will not be routinely measured during sampling using the Westbay System.

Monitoring wells FW-4 and MWTP-MW-1 are conventional monitoring wells (i.e. not equipped with a Westbay System) and will be sampled using conventional or low-flow methods, as described in the *Floridan Aquifer Monitoring Plan, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida* (TRC, 2004b).. Monitoring at these wells will include measurement of water levels with a probe and purging a minimum of three casing volumes (with containment of the water for disposal through the on-Site water treatment system). During the purging process, measurements of temperature, dissolved oxygen, pH, conductivity and ORP will be made to document that water from the monitoring wells are representative of formation conditions.

4.7 DATA EVALUATIONS

The information collected for this Addendum monitoring program will be evaluated in conjunction with the currently available data to update the conceptual model of the UF Aquifer potential for constituent transport. In particular, the following aspects will be evaluated using the data gathered:

- Further characterization of groundwater quality within the UF Aquifer. In particular, past detections will be verified and the data will be reviewed for indications of trends and variations in concentration;
- Fate and transport analyses to evaluate the potential for Site constituent impacts to the Murphree Wellfield; and
- Further characterization of temporal variations in groundwater flow directions in the UF Aquifer.

5.0 REPORTING

Data reports will be generated after each sampling event describing field activities and testing. The reports will provide a summary of groundwater conditions within the UF Aquifer, including data trends and groundwater flow direction. Each report will include tables, figures and appendices necessary to document and support the sampling event results.

The data reports will be submitted by Beazer East to:

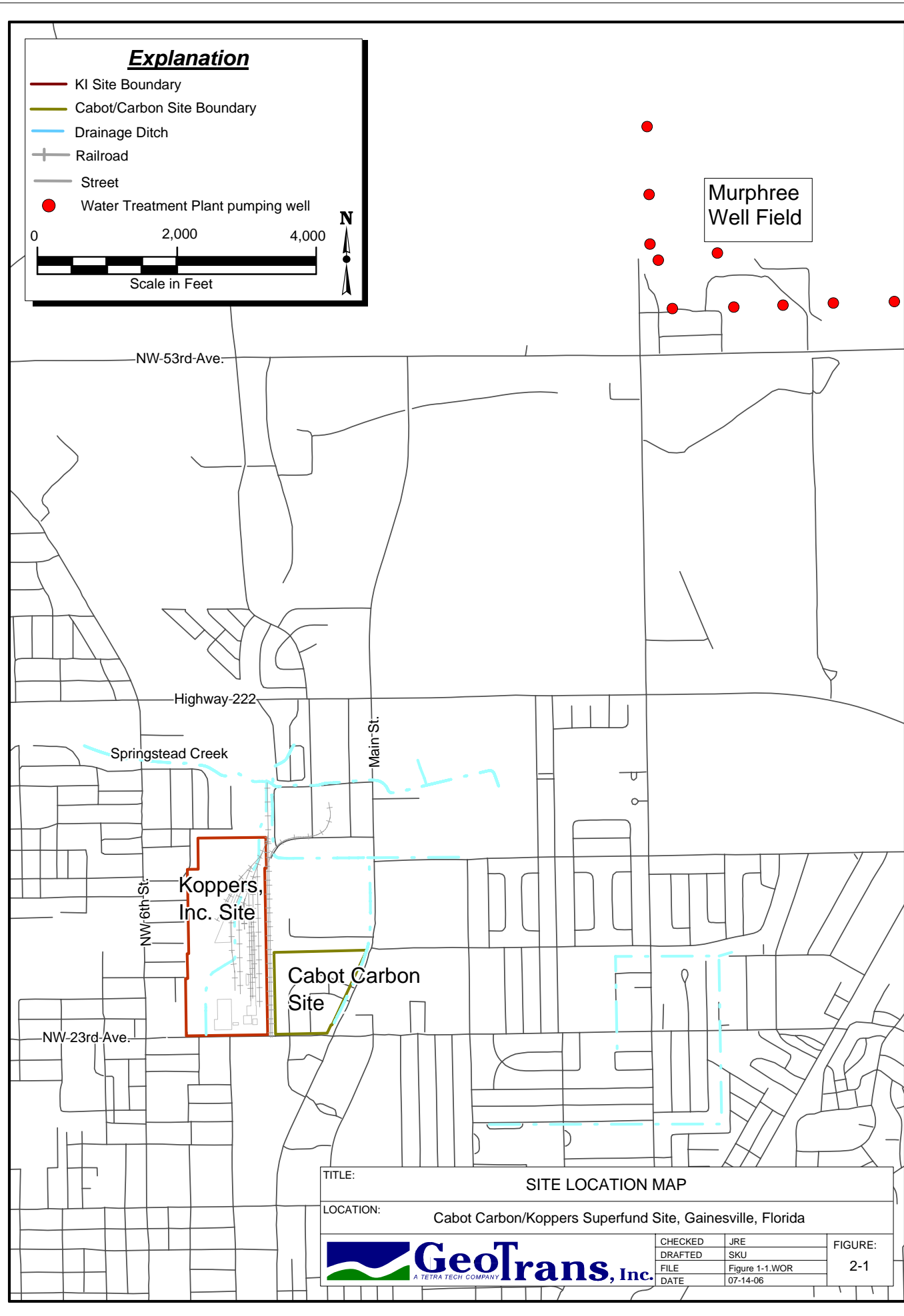
- United States Environmental Protection Agency, Region IV (EPA);
- The Florida Department of Environmental Protection (FDEP);
- The Alachua County Environmental Protection Division (ACEPD); and
- Gainesville Regional Utilities (GRU).

6.0 REFERENCES

- CH2M HILL, 1993, Evaluation and Modeling of the Floridan Aquifer System in the Vicinity of the Murphree Well Field: Technical Memorandum No. 4, March 1993.
- GeoSys, 2000, Update of the Geology in the Murphree Well Field Area, prepared for Gainesville Regional Utilities, April, 2000.
- GeoTrans, 2004a, Addendum to the Floridan Aquifer Monitoring Program, Supplemental Upper Floridan Aquifer Monitoring Well Installation, Koppers, Inc. Site, Gainesville, Florida, June 24, 2004.
- GeoTrans, 2004b, Data Report for Additional Investigation of Hawthorn Group DNAPL Source Evaluation for the Koppers Industries Property, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida, September, 2004.
- GeoTrans 2004c, Addendum 6: Groundwater Flow and Transport Model, Draft Report, Koppers, Inc. Site, Gainesville, Florida, October, 2004.
- GeoTrans, 2006, Supplemental Upper Floridan Aquifer Monitoring Well Installation -- Addendum to the Floridan Aquifer Monitoring Plan, Koppers Inc. Site, Gainesville, Florida, July 26, 2006.
- TRC, 1997, Supplemental Feasibility Study, Cabot Carbon/Koppers Industries, Inc. Site, Gainesville, Florida, January 1997.
- TRC, 1999, Revised Supplemental Feasibility Study Volumes 1 and 2, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida, September 1999.
- TRC, 2002a, Workplan for Additional Characterization of the Hawthorn Group Formation, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida, January 2002.
- TRC, 2002b, Revised Sampling and Analysis Plan (SAP), Cabot Carbon/Koppers Superfund Site, Gainesville, Florida, February 2002.
- TRC, 2002c, Field Investigation Activities Report, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida, September 2002.
- TRC, 2003a, Final Workplan Addendum for Additional Characterization of the Hawthorn Group Formation, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida, April 2003.
- TRC, 2003b, Addendum Hawthorn Group Field Investigation Report, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida, August 2003.

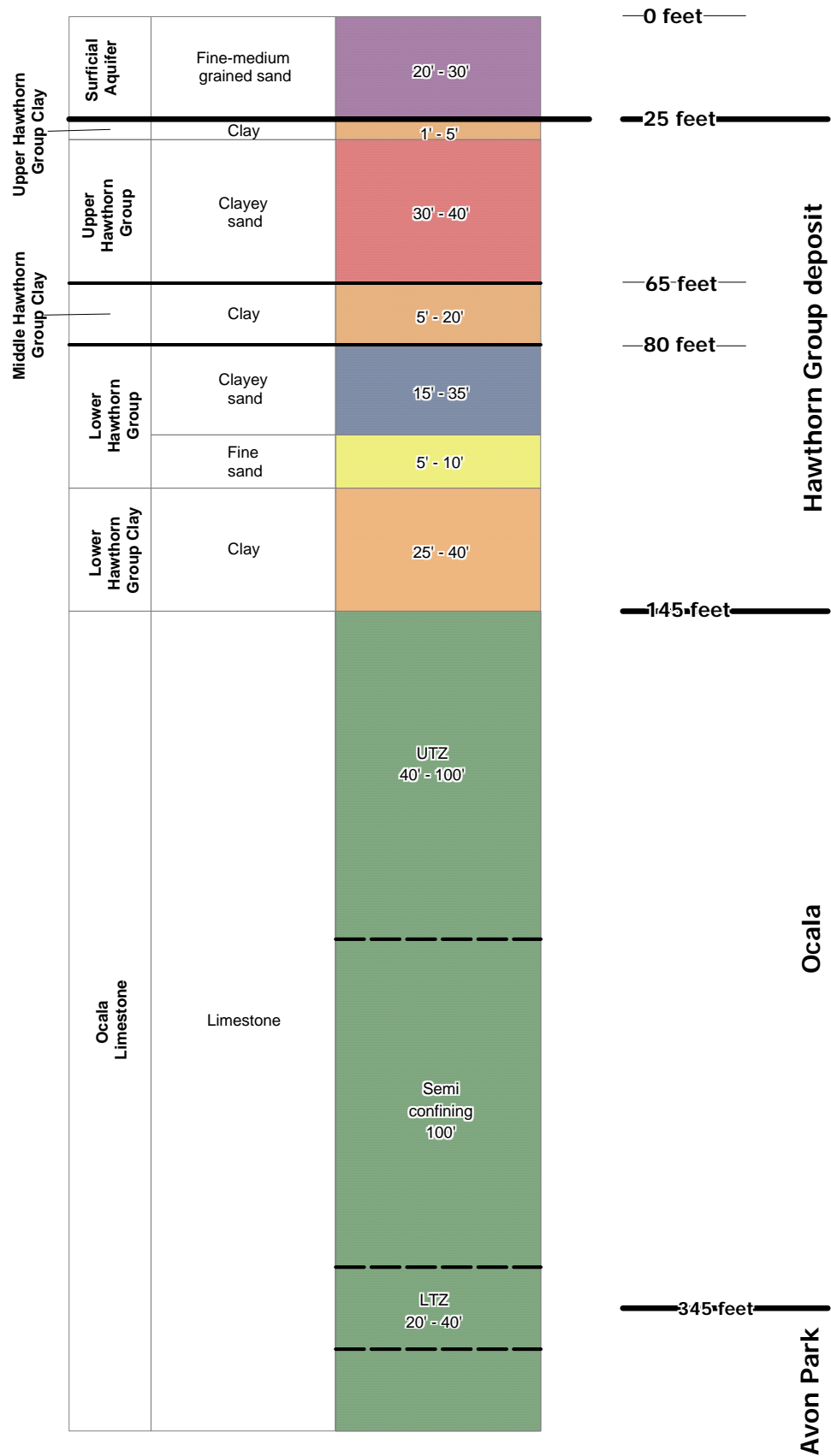
- TRC, 2003c, Draft Fourth Addendum to the Workplan for Additional Investigation of the Hawthorn Group Formation Abandonment of Monitoring Wells, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida, November 2003.
- TRC, 2003d, Second Addendum to the Workplan for Additional Investigation of the Hawthorn Group, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida, November 2003.
- TRC, 2004a, Well Abandonment and Modification, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida, April 2004.
- TRC, 2004b, Floridan Aquifer Monitoring Plan, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida, June 2004.
- RETEC, 2005a, Annual Stage 2 Groundwater Monitoring Report, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida, April 2005.
- RETEC, 2005b, First Semiannual Stage 2 Groundwater Monitoring Report, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida, November 2005.


FIGURES



TITLE:		SITE LOCATION MAP	
LOCATION:		Cabot Carbon/Koppers Superfund Site, Gainesville, Florida	
CHECKED		JRE	FIGURE: 2-1
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DATE		07-14-06	





TITLE: HYDROSTRATIGRAPHY OF DEPOSITS BENEATH SITE			
LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida			
 GeoTrans, Inc. <small>A TETRA TECH COMPANY</small>	CHECKED	JRE	FIGURE: 2-2
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	DATE	07/14/06	

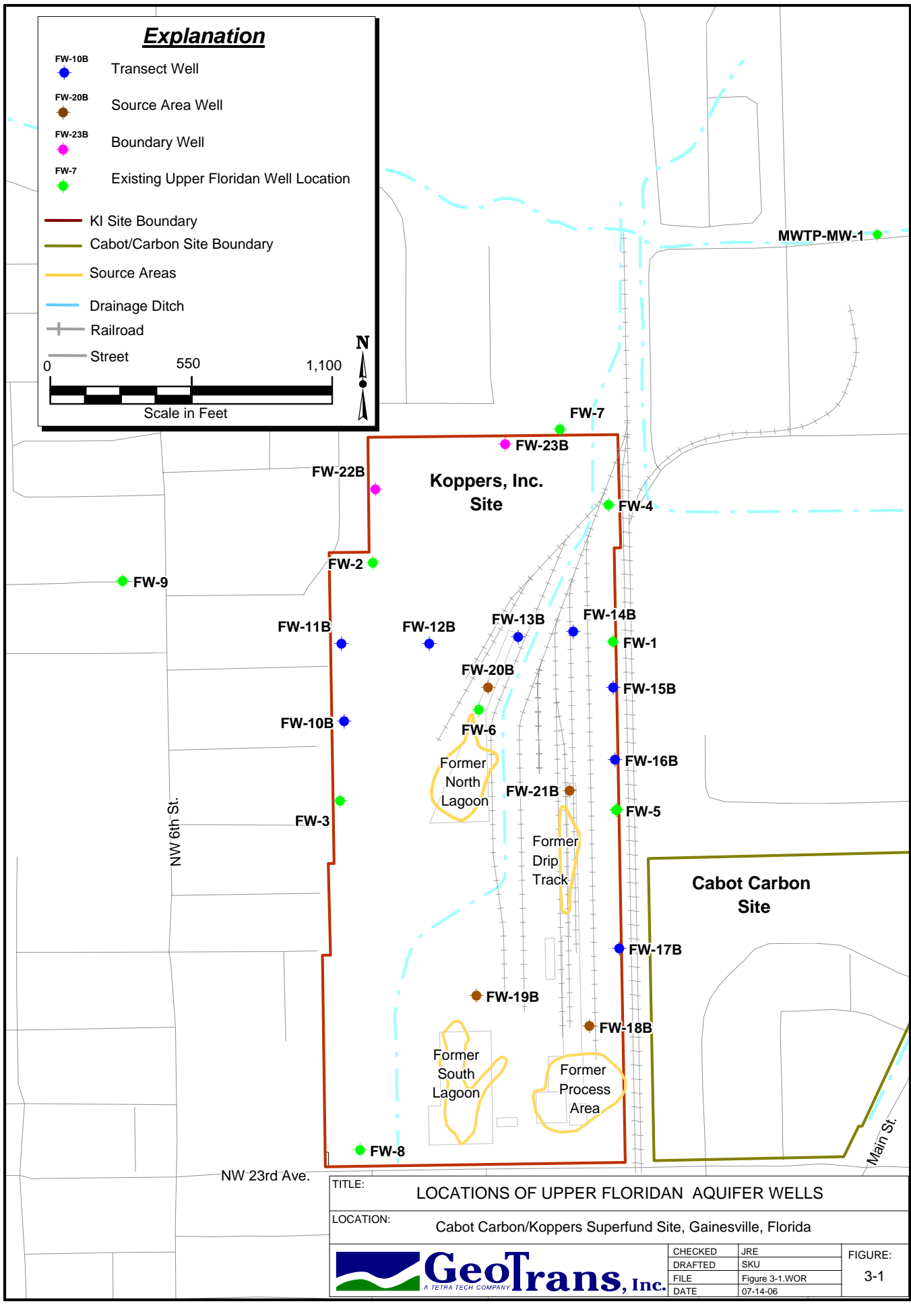
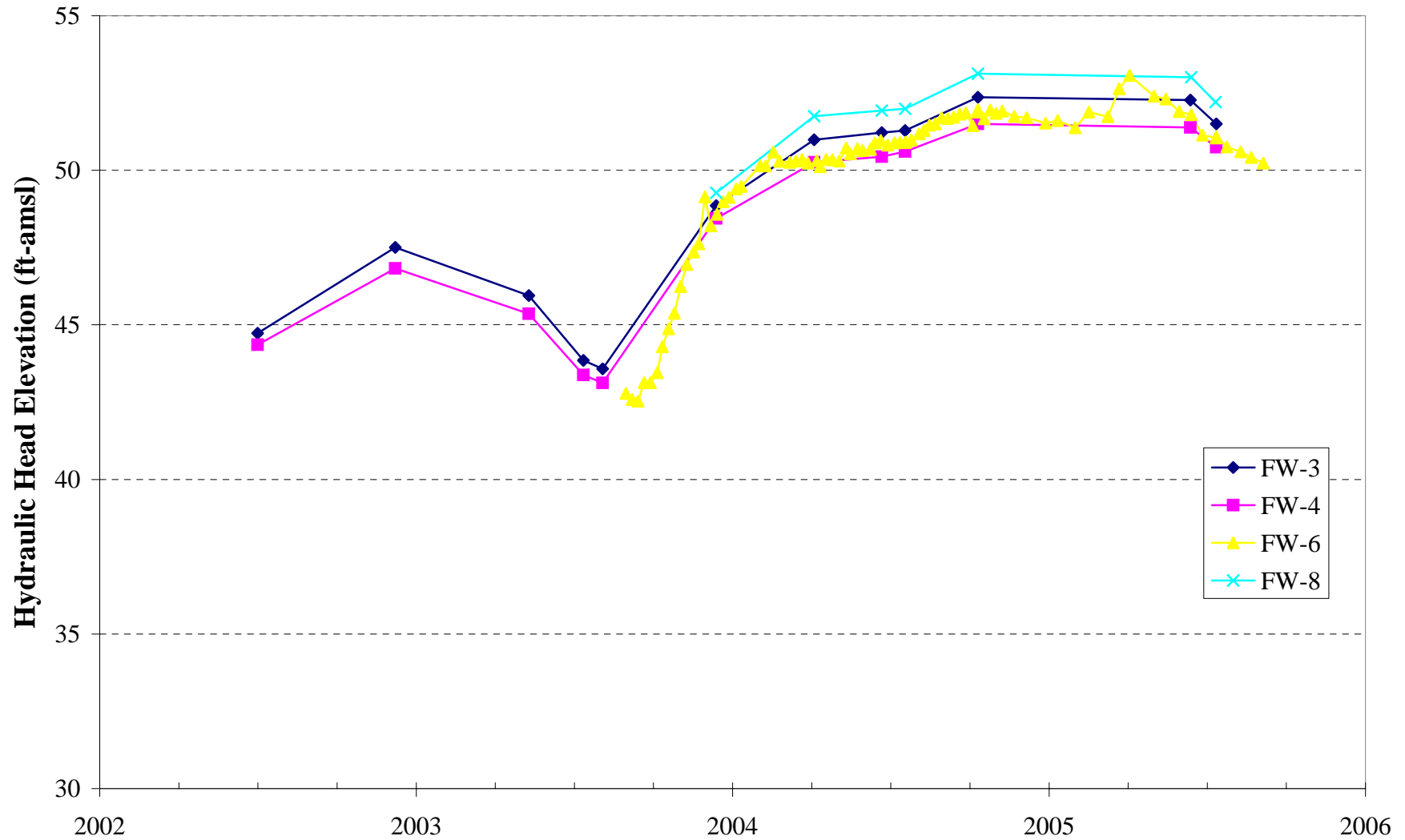


Figure 3-2. Temporal hydraulic-head measurements for wells FW-3, FW-4, FW-6 and FW-8.



Explanation

- FW11B
52.30 Well ID and Potentiometric Elevation for Zone 1
- FW-7
51.18 Well ID and Potentiometric Elevation
- MWTP-MW 1
5/18
49.09 Water Treatment Plant Monitoring Well 2006 Measurement Date and Potentiometric Elevation

-53.0- Potentiometric surface contour, with posted contour elevation.

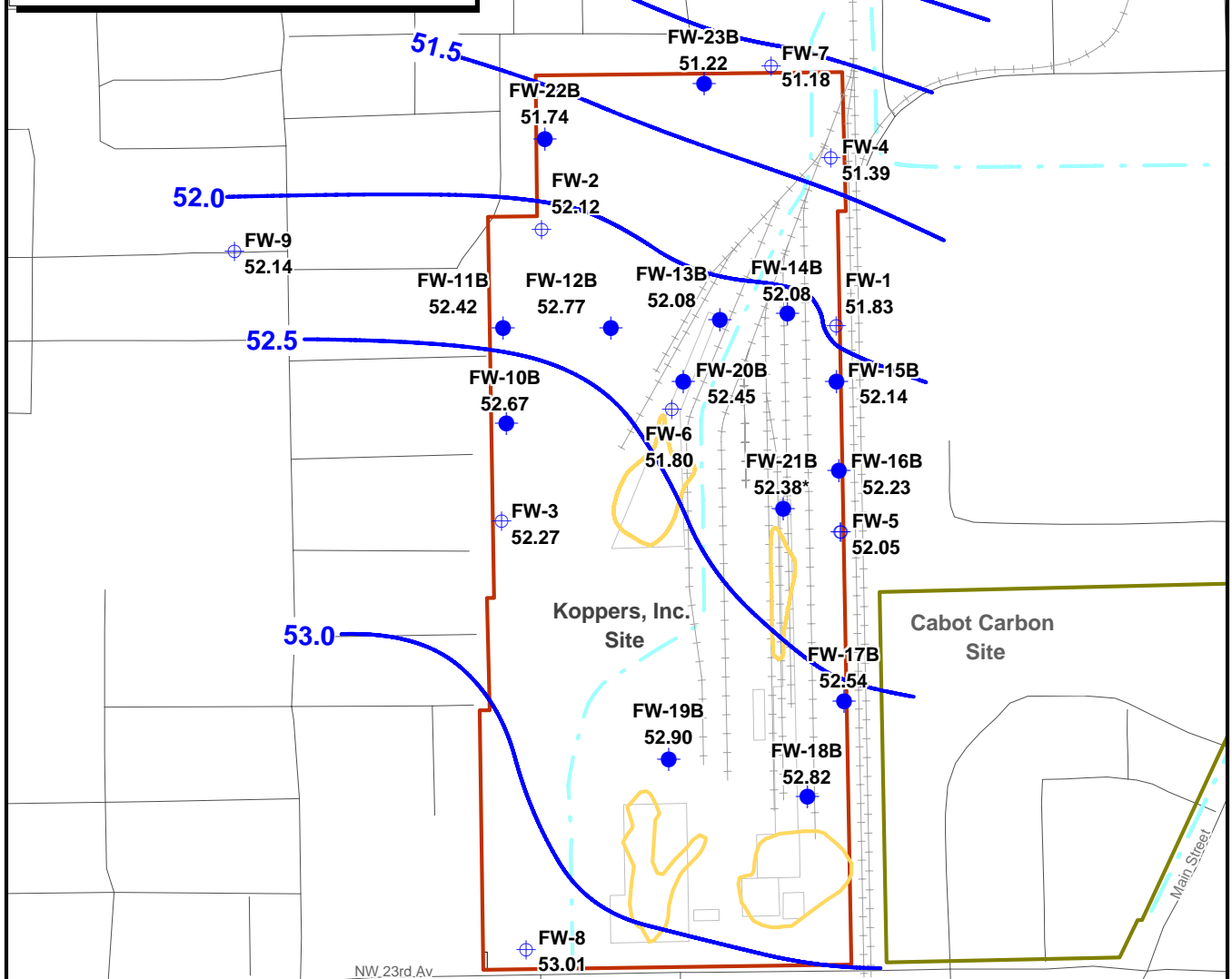
— KI Site Boundary

— Cabot/Carbon Site Boundary

— Source Areas

— Drainage Ditch

* - Potentiometric Elevation from Zone 2



TITLE: UPPER FLORIDAN AQUIFER POTENTIOMETRIC SURFACE CONTOURS FOR MAY 2006

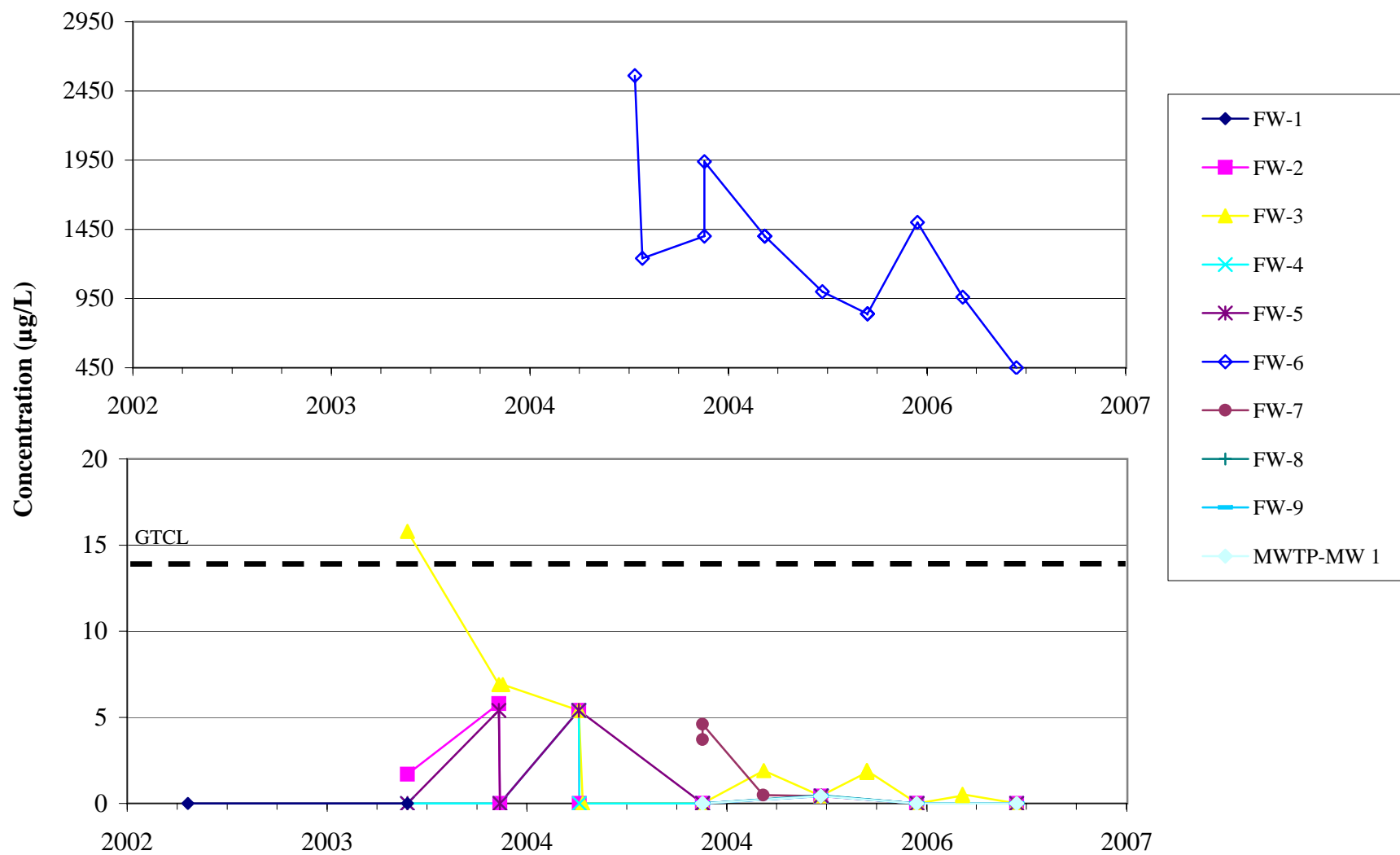
LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida



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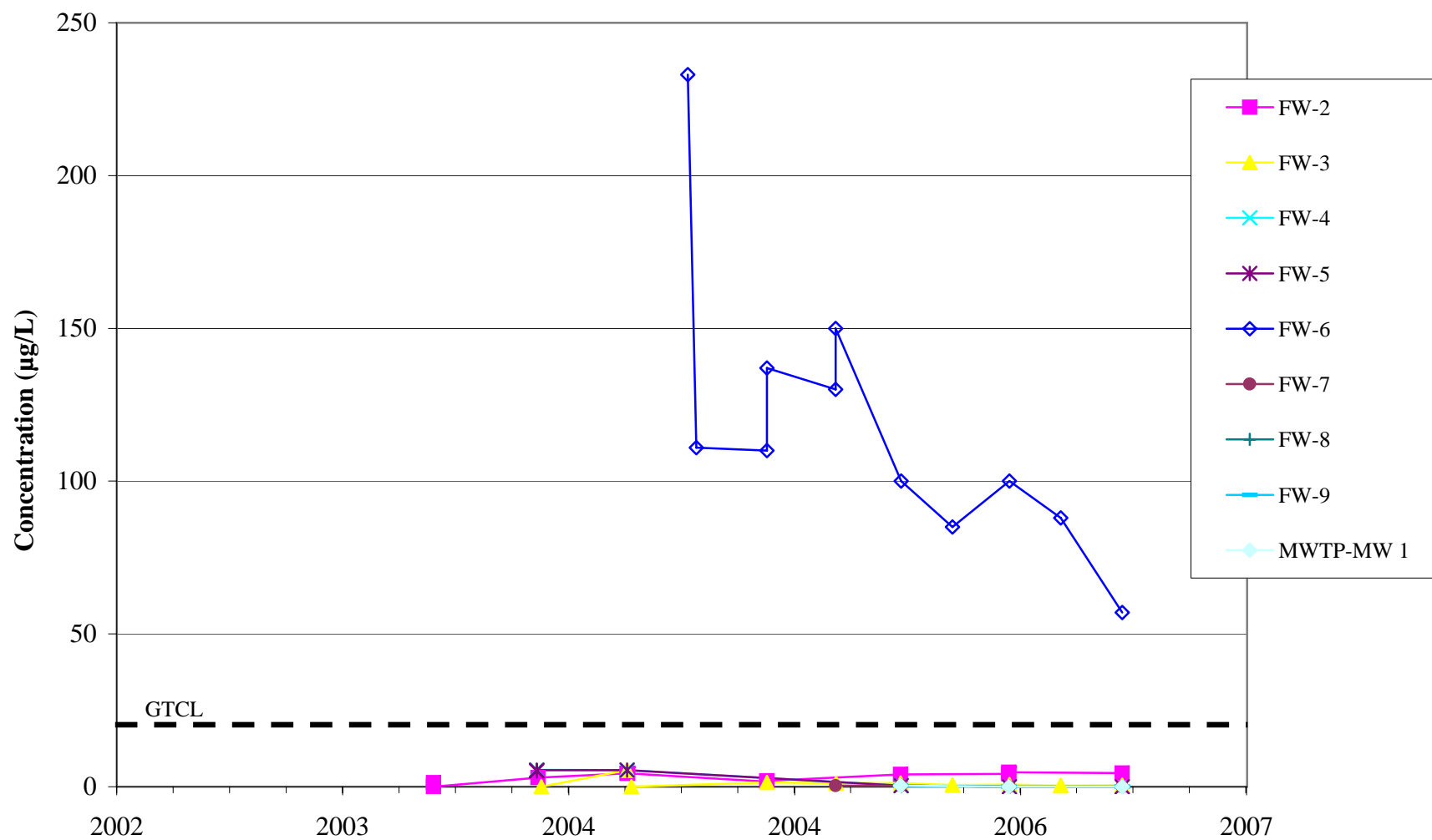
FIGURE:
3-3

Figure 3-4. Temporal plot of naphthalene concentrations for Upper Floridan Aquifer monitoring wells.



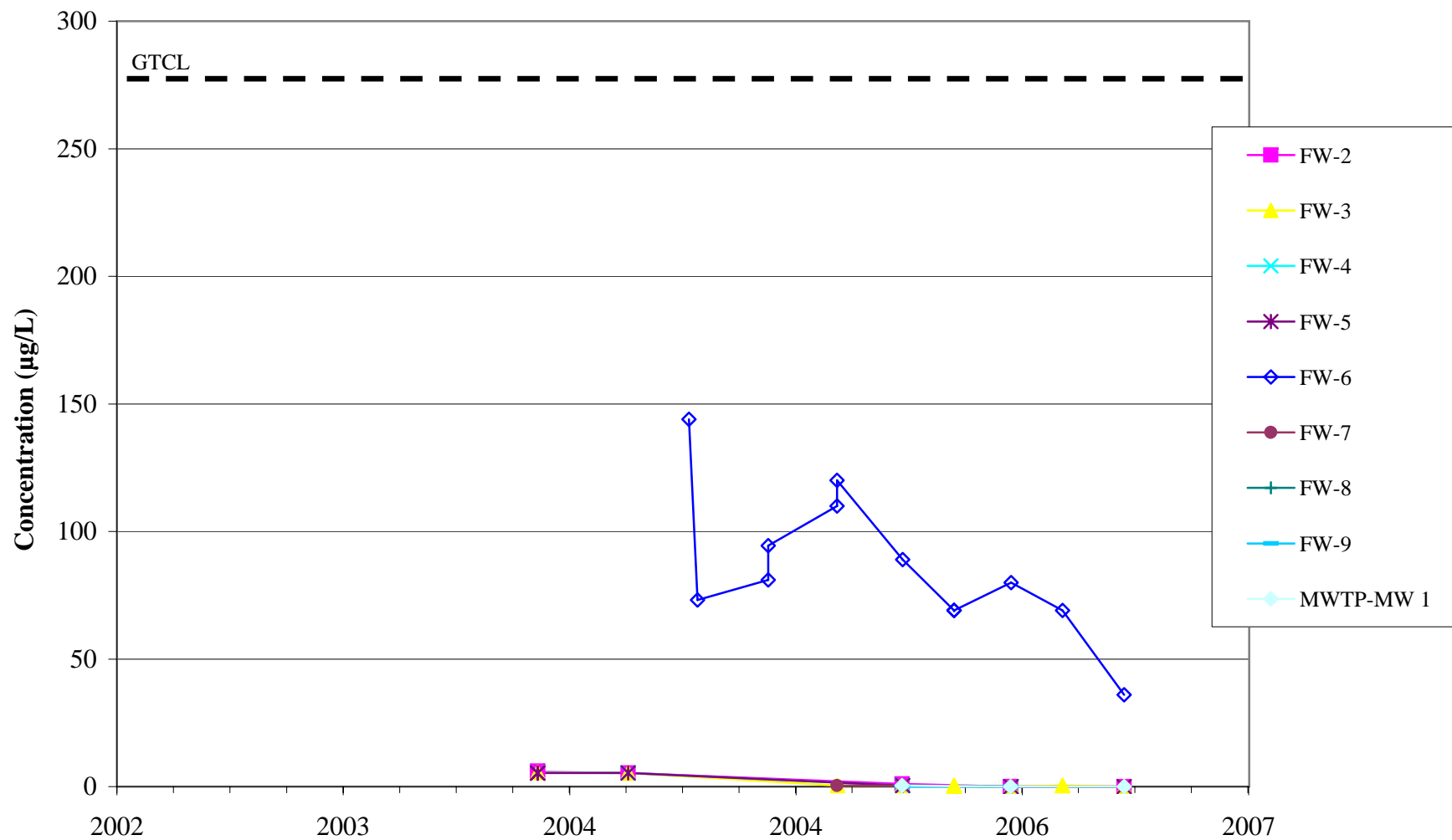
* - Non-detect values are shown as 0 µg/L.

Figure 3-5. Temporal plot of acenaphthene concentrations for Upper Floridan Aquifer monitoring wells.



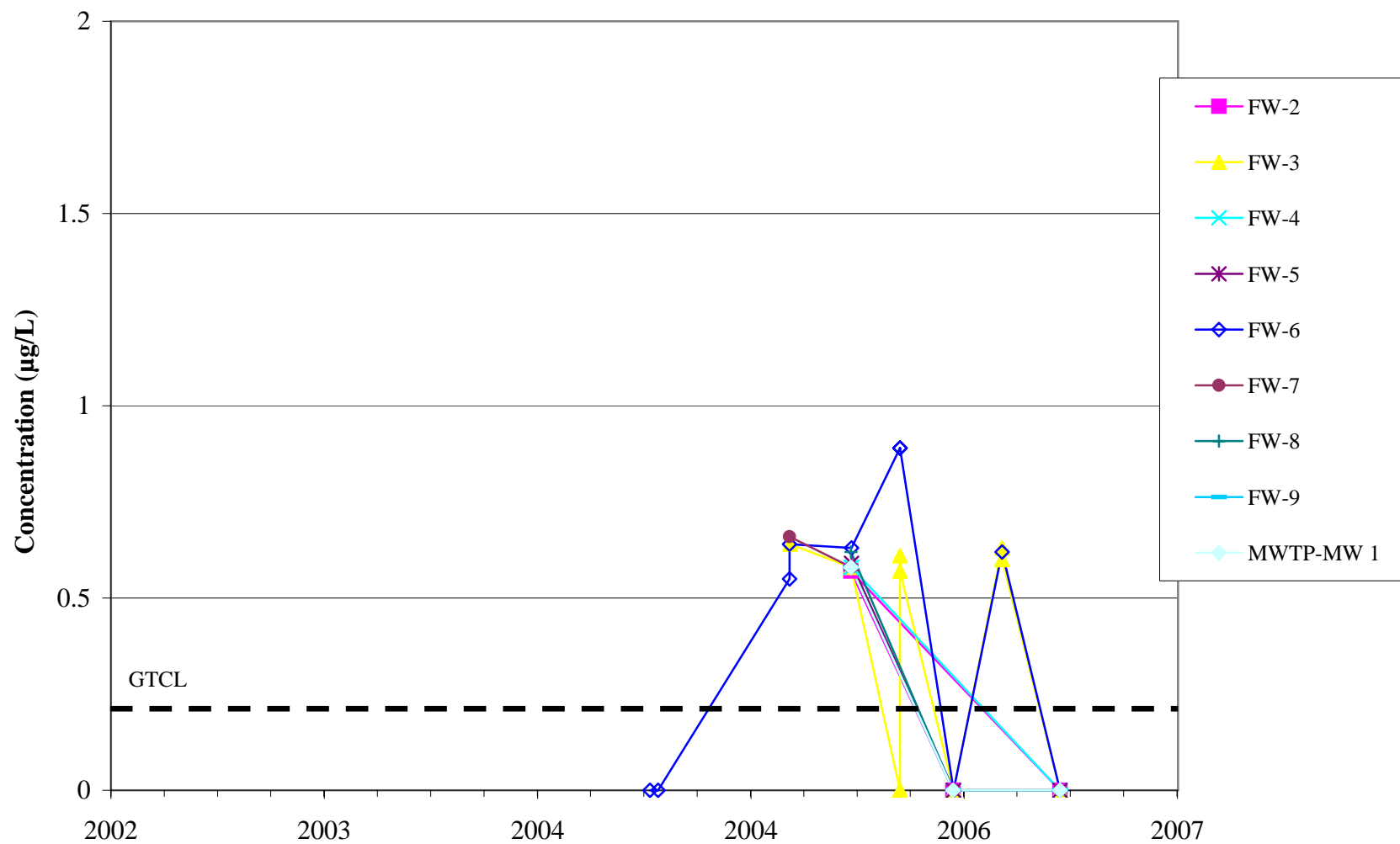
* - Non-detect values are shown as 0 µg/L.

Figure 3-6. Temporal plot of fluorene concentrations for Upper Floridan Aquifer monitoring wells.



* - Non-detect values are shown as 0 $\mu\text{g/L}$.

Figure 3-7. Temporal plot of benzo(a)pyrene concentrations for Upper Floridan Aquifer monitoring wells.



* - Non-detect values are shown as 0 µg/L.

Figure 3-8. Temporal plot of carbazole concentrations for Upper Floridan Aquifer monitoring wells.

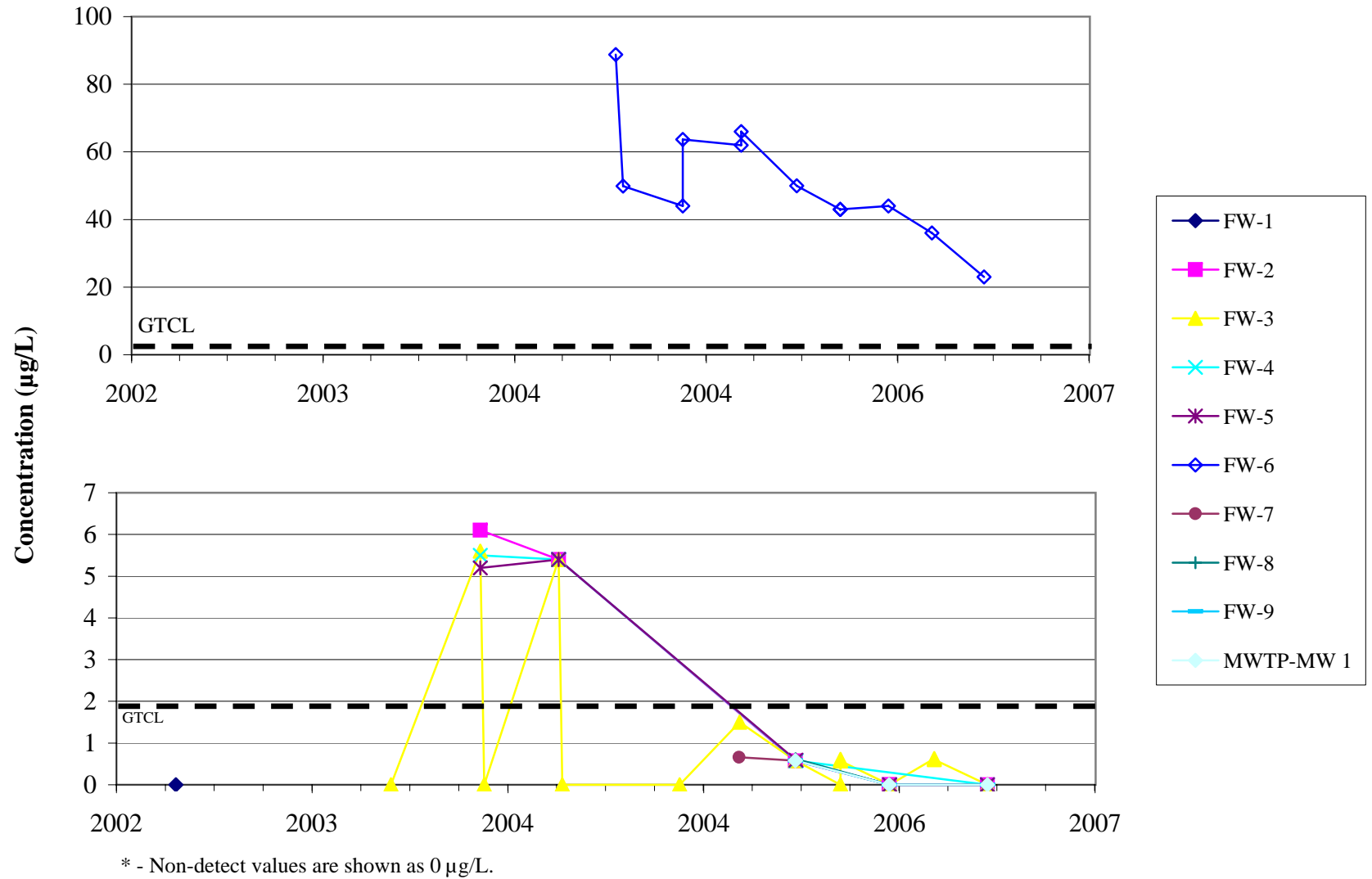
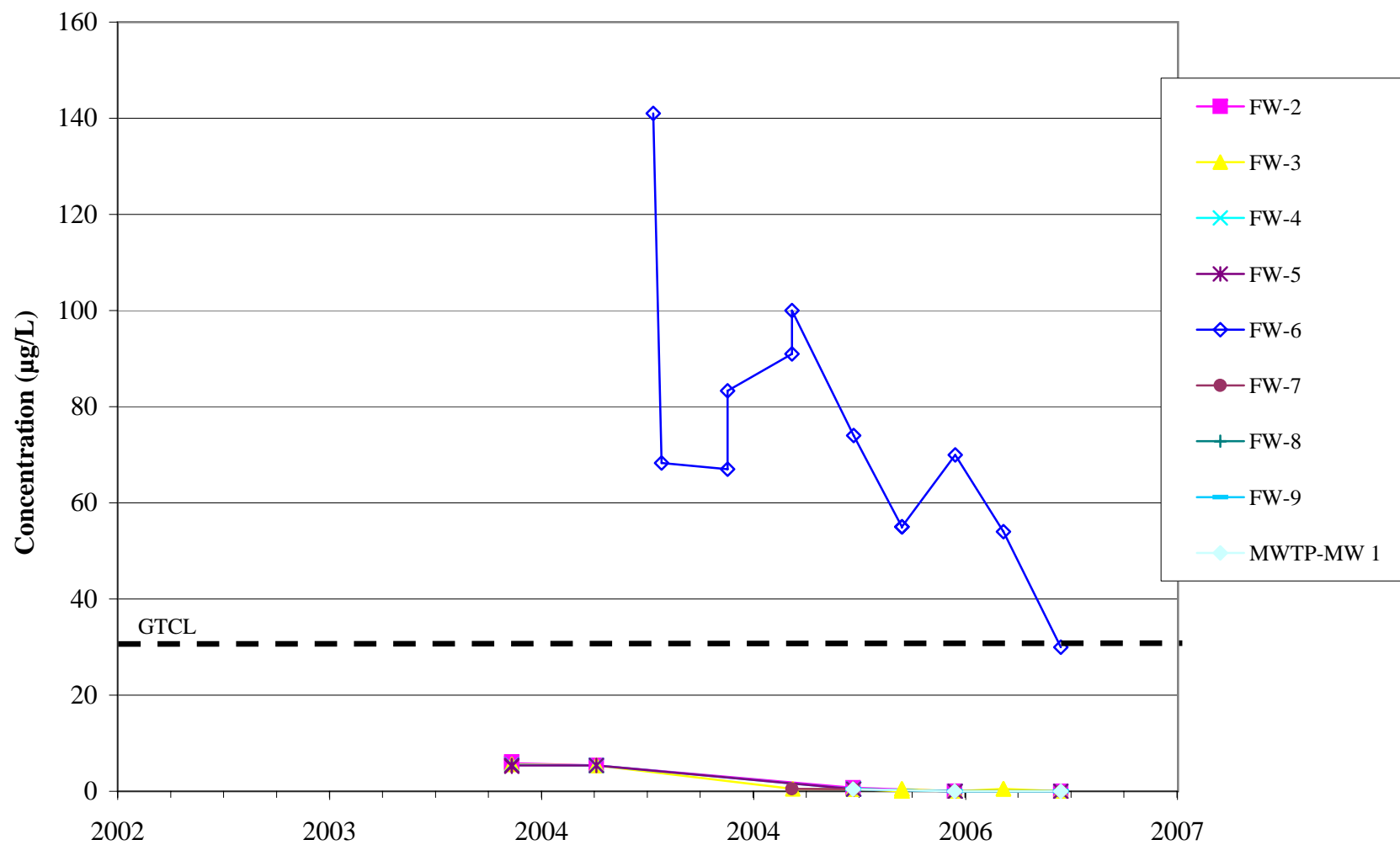
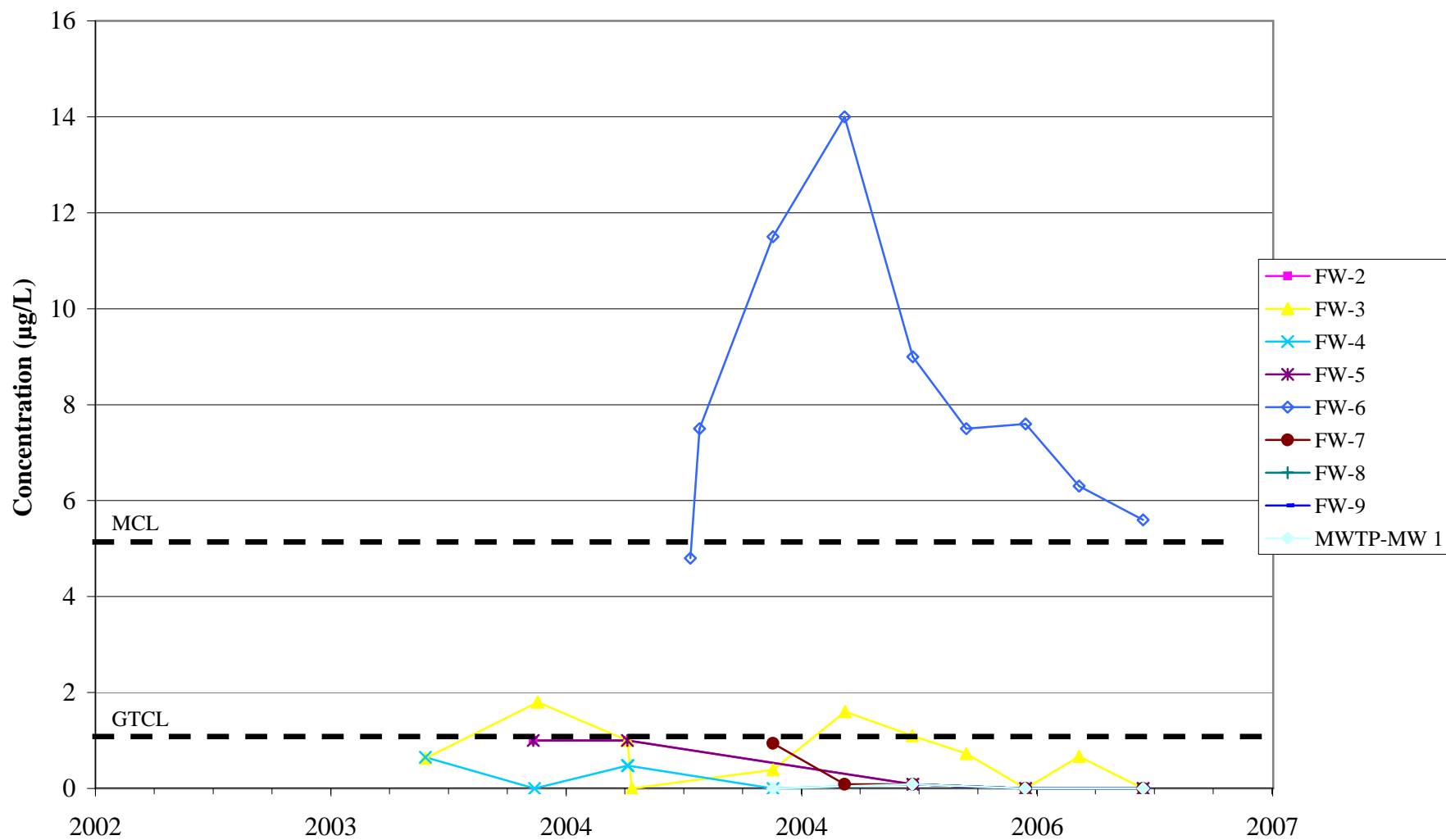


Figure 3-9. Temporal plot of dibenzofuran concentrations for Upper Floridan Aquifer monitoring wells.



* - Non-detect values are shown as 0 µg/L.

Figure 3-10. Temporal plot of benzene concentrations for Upper Floridan Aquifer monitoring wells.



* - Non-detect values are shown as 0 µg/L.

Figure 3-11. Temporal plot of phenol concentrations for Upper Floridan Aquifer monitoring wells.

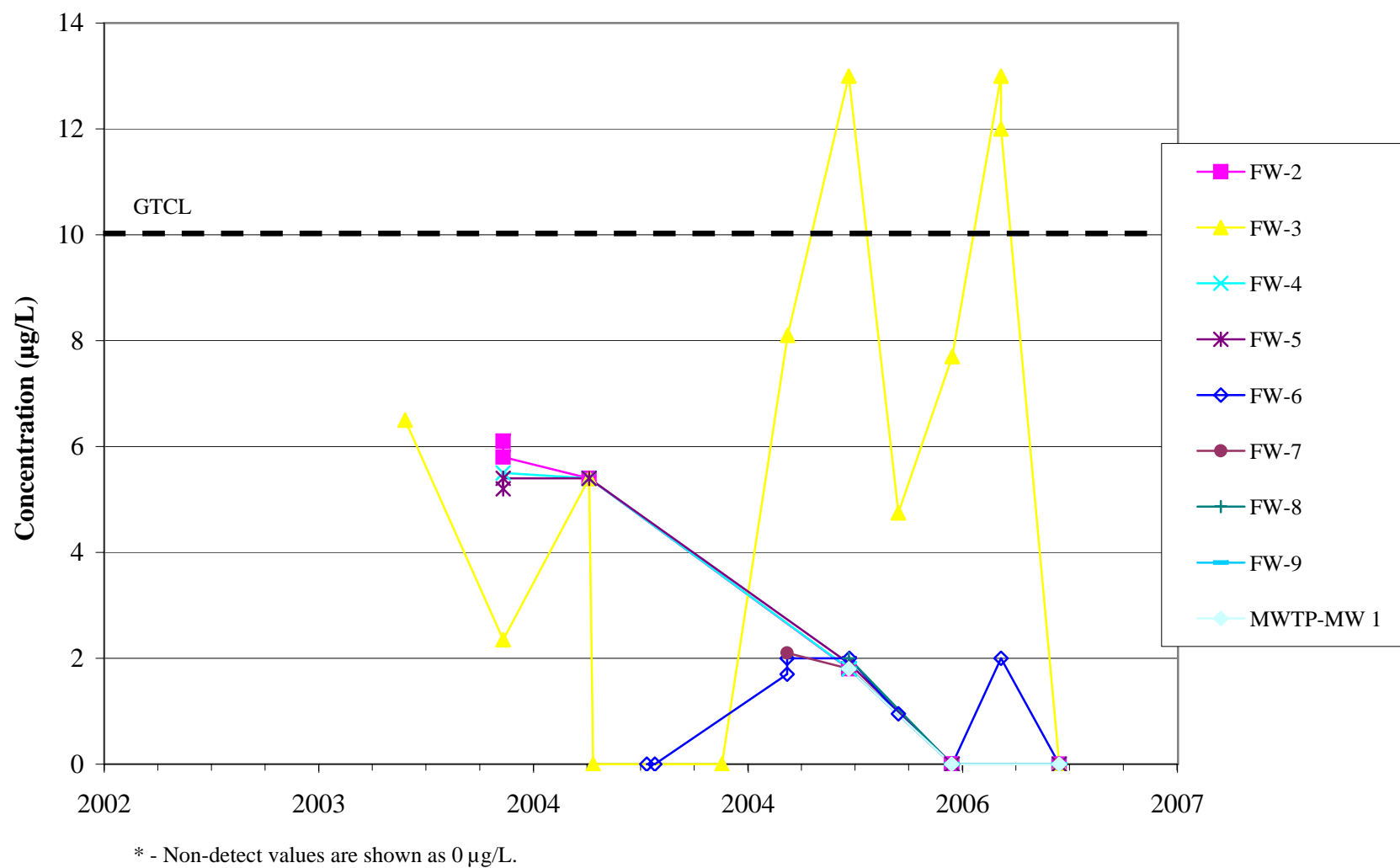
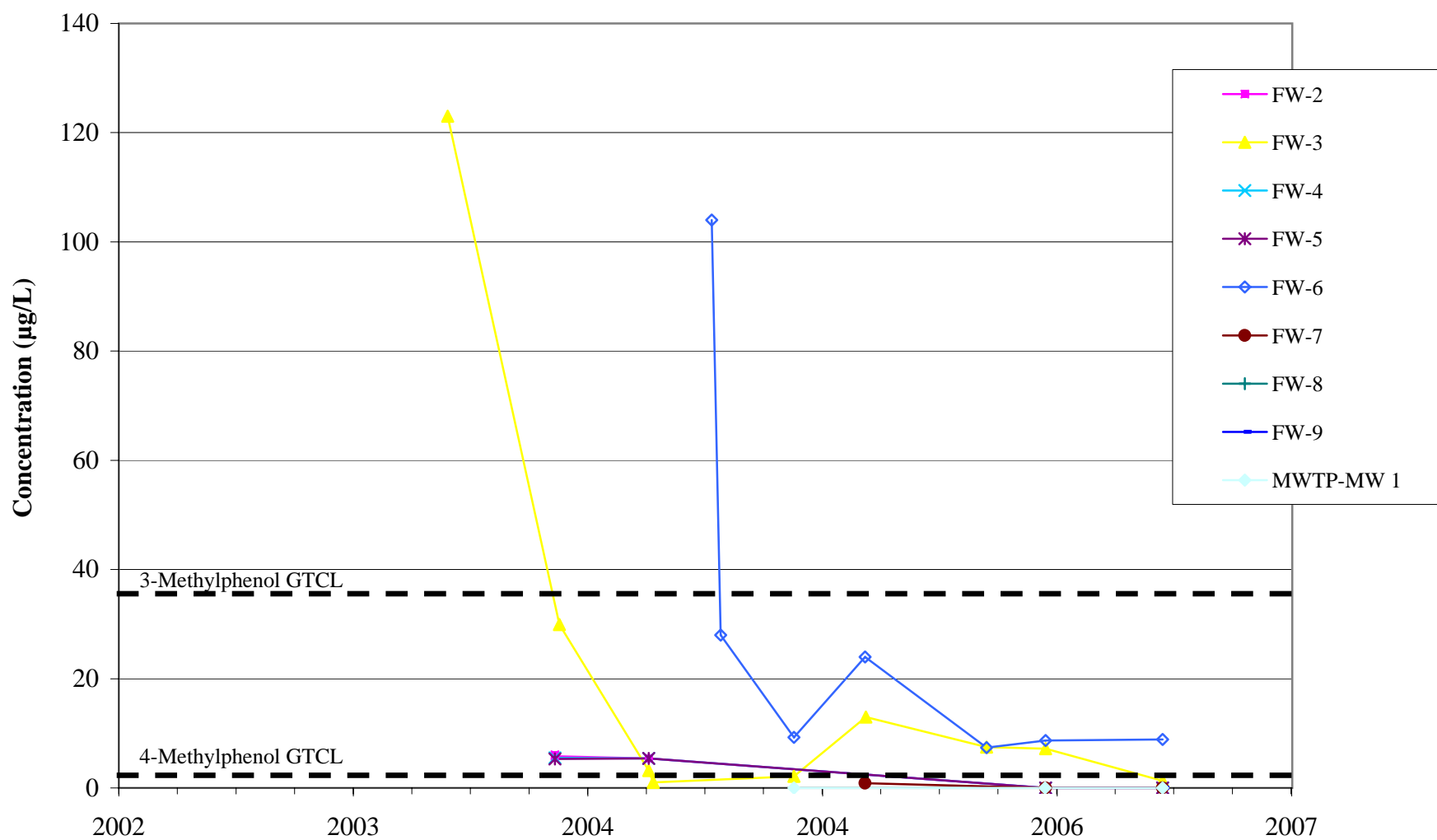
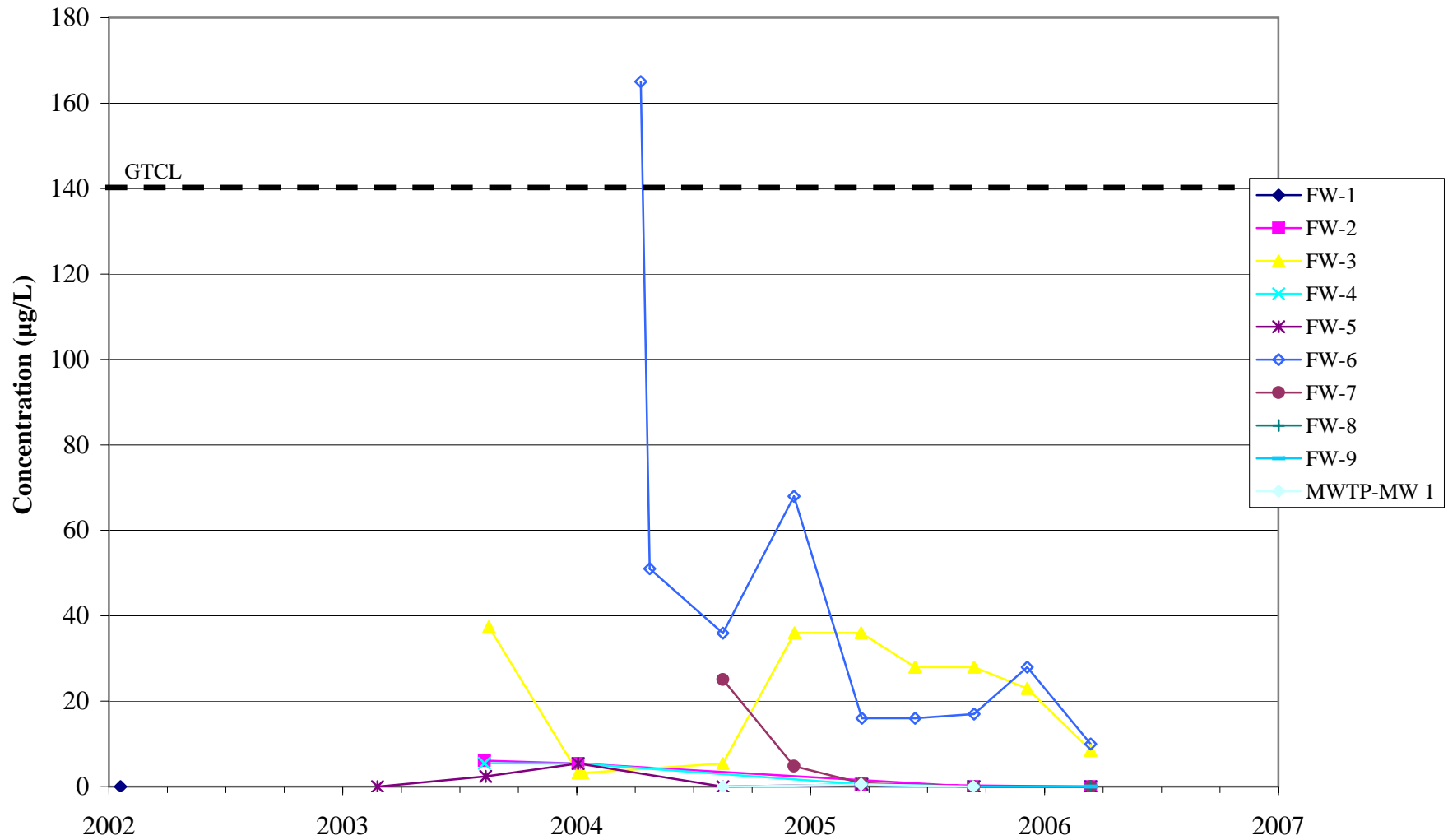


Figure 3-12. Temporal plot of 3&4 methylphenol concentrations for Upper Floridan Aquifer monitoring wells.



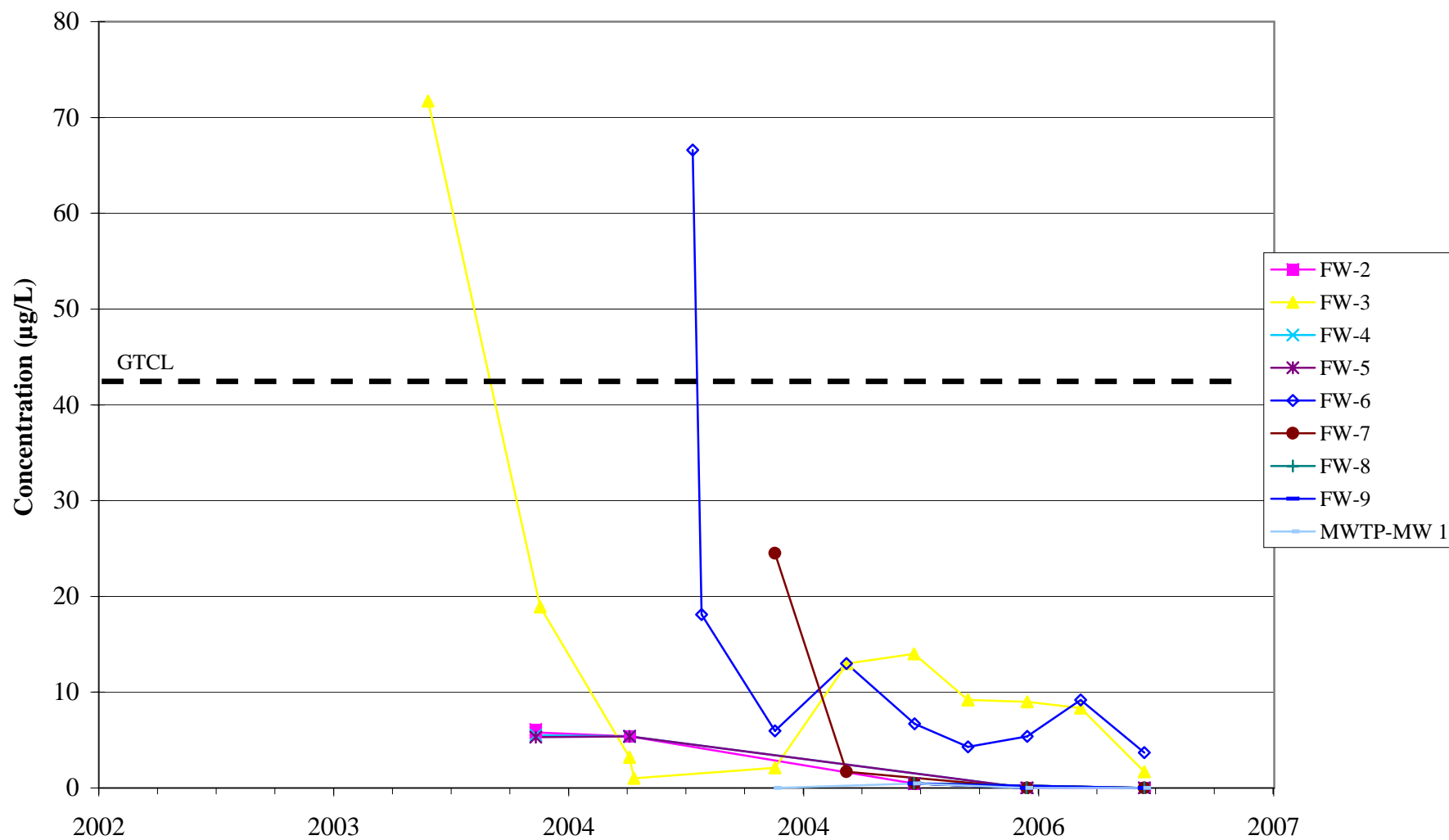
* - Non-detect values are shown as 0 $\mu\text{g/L}$.

Figure 3-13. Temporal plot of 2,4 dimethylphenol concentrations for Upper Floridan Aquifer monitoring wells.



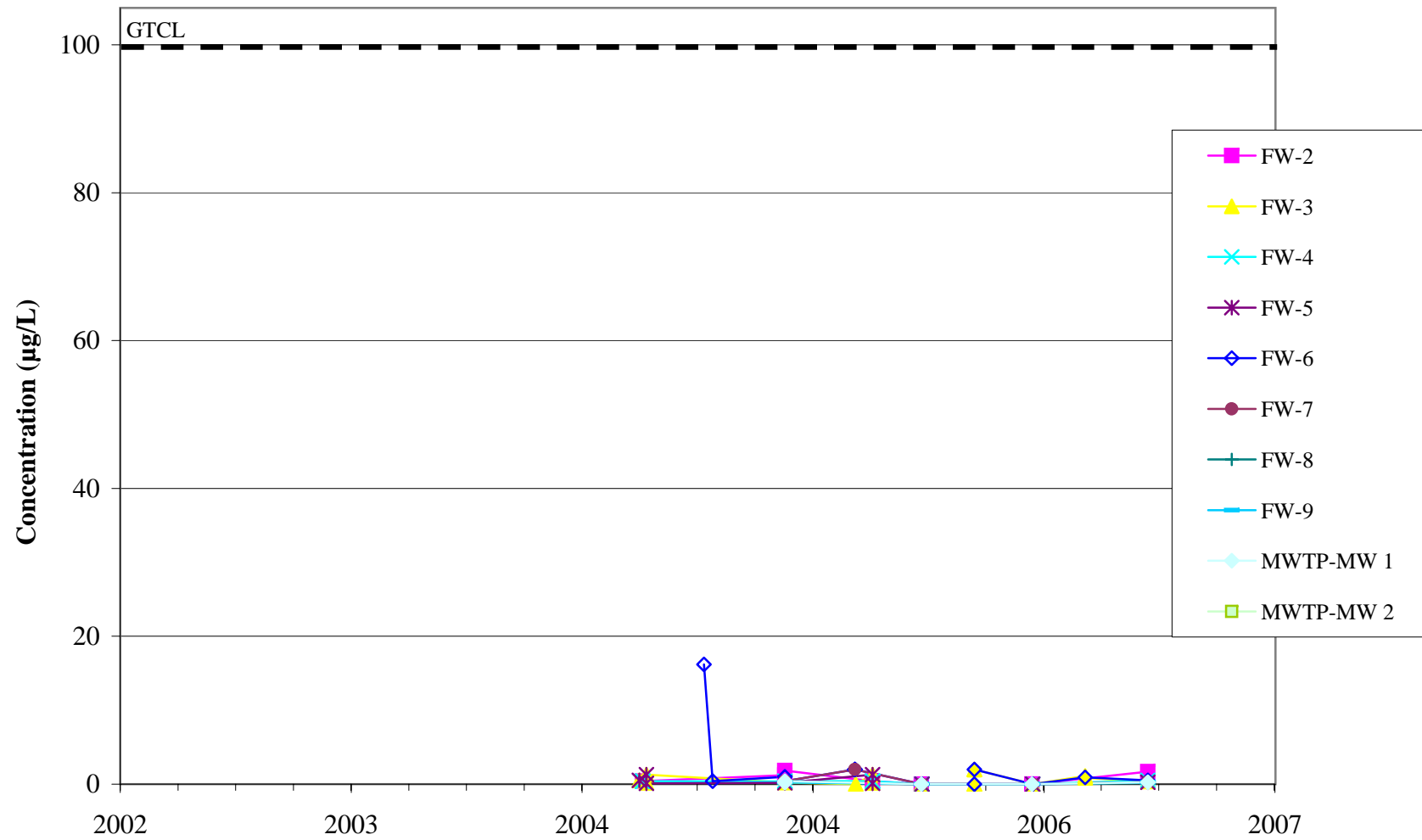
* - Non-detect values are shown as 0 $\mu\text{g/L}$.

Figure 3-14. Temporal plot of 2 methylphenol concentrations for Upper Floridan Aquifer monitoring wells.



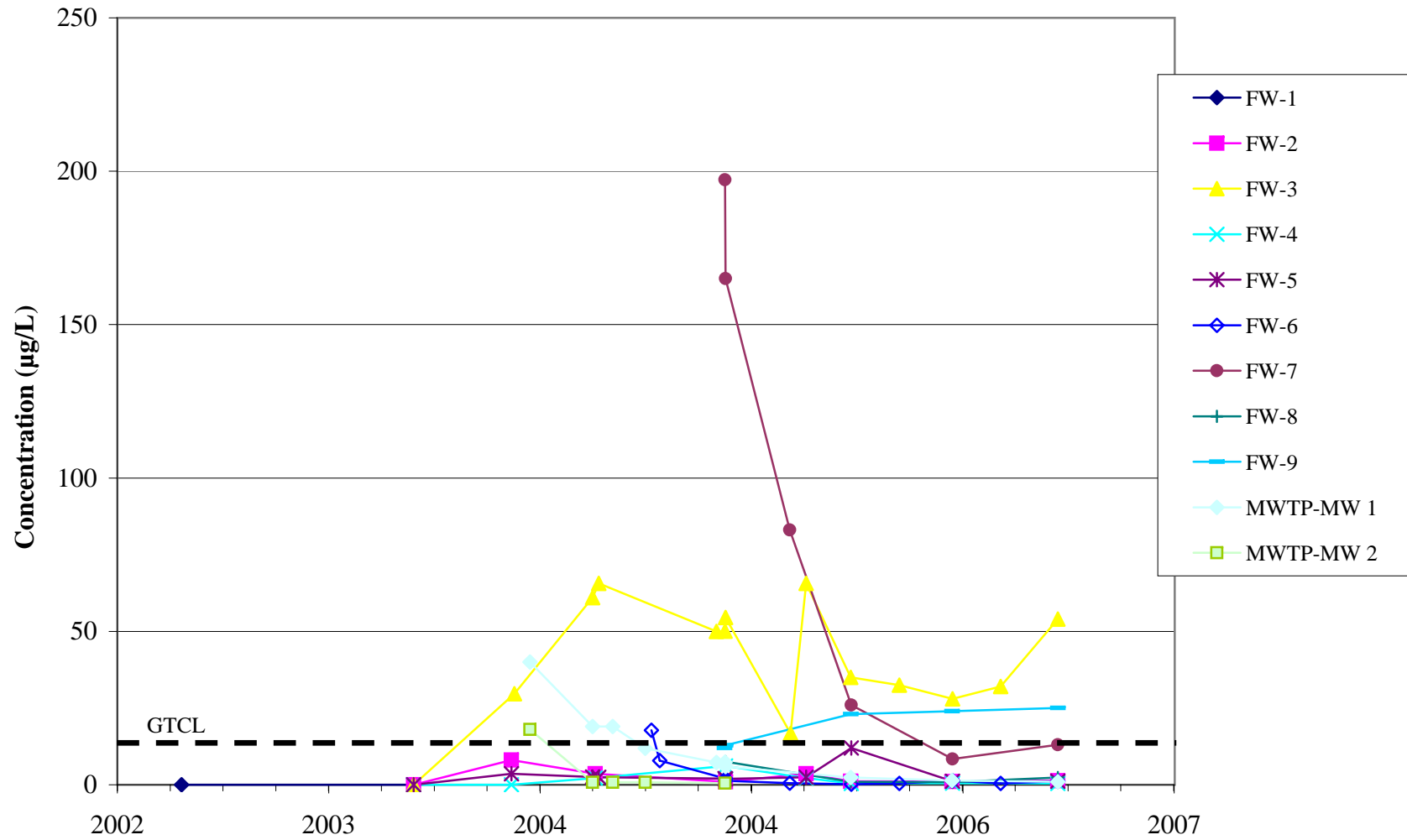
* - Non-detect values are shown as 0 µg/L.

Figure 3-15. Temporal plot of dissolved chromium concentrations for Upper Floridan Aquifer monitoring wells.



* - Non-detect values are shown as 0 µg/L.

Figure 3-16. Temporal plot of dissolved arsenic concentrations for Upper Floridan Aquifer monitoring wells.



* - Non-detect values are shown as 0 µg/L.

Explanation

- FW-10B

New Upper Floridan Well Location
- FW-9

Existing Upper Floridan Well Location
- MWTP-MW-1

Water Treatment Monitoring Well
- Blank value indicates the analyte was not detected above the laboratory detection limit.
- * - Average concentration of duplicate samples.
- I - Reported value between laboratory method detection limit and the laboratory practical quantitation limit.
- J - Reported value is estimated.
- B - Sample below the blank action level following field blank contamination.
- Result is above the Florida GCTL.
- Result is above the Florida GCTL but below Federal MCL.
- KI Site Boundary
- Cabot/Carbon Site Boundary
- Source Areas



FW-22B

Date	5/21/06	6/29/06
Acenaphthene	11	8.2
Indeno(123-cd)pyrene	0.85 I	
Flourene		0.39 IJ

FW-20B

Date	3/10/06	7/6/06
2-Methylnaphthalene	6.6	62
Acenaphthene	54	63
Anthracene	5.8	4.9 IJ
Benzene	24	53
Carbazole	26	22
Dibenzofuran	26	33
Ethylbenzene		0.45 IJ
Fluoranthene	6.4	7.6
Fluorene	39	41
Naphthalene		650
Phenanthrene	42	50
Pyrene	2.6 IJ	3.3 IJ
Toluene		0.34 IJ
Xylenes		5.3

FW-2

Date	12/13/05	6/14/06
Acenaphthene	4.45*	4.5 J

FW-12B

Date	1/24/06	3/6/06	7/7/06
2,4-Dimethylphenol	6.2	4.4 IJ	39
2-Methylnaphthalene			0.93 IJ
2-Methylphenol			22
3,4-Methylphenol			1.9 IJ
Acenaphthene	1.1 IJ		0.92 IJ
Benzene			1.5
Ethylbenzene			0.79 IJ
Naphthalene			49
Toluene			2.1
Xylenes			3.6 IJ

FW-9

Date	12/13/05	6/14/06
No organics detected		

FW-11B

Date	1/15/06	3/4/06	6/30/06
4-Methylphenol		6.5	
Acenaphthene	4.1 IJ		5.8
Dibenzofuran			0.68 IJ
Fluorene	1.4 IJ		0.62 IJ
Naphthalene		1.5 IJ	

FW-10B

Date	1/23/06	6/27/06
No organics detected		

FW-3

Date	3/7/06	6/14/06
2,4-Dimethylphenol	23*	8.5
2-Methylphenol	8.35*	1.7 IJB
3&4-Methylphenol	7.85*	1.3 IJB
Acenaphthene		0.52 IJ
Benzene	0.665*	
Ethylbenzene	0.14* J	
Naphthalene	0.495*	
Phenol	12.5* J	
Toluene	0.75* JB	0.45 IJ
Xylenes (total)	0.66*	

FW-6

Date	3/7/06	6/14/06
2,4-Dimethylphenol	28	10
2-Methylnaphthalene	77	22 I
2-Methylphenol	9.2	3.7 IJB
3&4-Methylphenol	14 J	8.9 IJB
Acenaphthene	88	57
Acenaphthylene		1.0 IJ
Anthracene	9.8	7.3
Benzene	6.3	5.6
Benzo(a)anthracene	1.2 J	0.8 J
Carbazole	36	23

FW-6

Date	3/7/06	6/14/06
Chrysene	1.1 J	
Dibenzofuran	54	30
Ethylbenzene	0.89 J	0.9 J
Fluoranthene	32	22
Fluorene	69	36
Naphthalene	960	450
Phenanthrene	110	54
Pyrene	16	9.5
Toluene	1.6 B	1.4 B
Xylenes (total)	7.3	6.1 B

FW-21B

Date	3/9/06	7/6/06
2,4-Dimethylphenol	6.6	10 IJ
2-Methylnaphthalene	6.9	86
Acenaphthene	13	80
Anthracene		3.1 IJ
Carbazole	0.88	71
Dibenzofuran	5.6	45
Ethylbenzene		13
Fluoranthene		0.48 IJ
Fluorene	7	49
Naphthalene	140	1100
Phenanthrene	31	
Toluene		0.95 IJ
Xylenes		13.7

FW-8

Date	12/13/05	6/14/06
No organics detected		

FW-19B

Date	3/5/06	7/6/06
Acenaphthene	0.26 *	0.8 IJ

FW-18B

Date	3/9/06	6/26/06
No organics detected		

FW-23B

Date	5/20/06	6/26/06
2,4-Dimethylphenol	6.1* I	12
2-Methylphenol	5.1 *	8.3
4-Methylphenol	2.2* I	
Acenaphthene	0.51* I	
Naphthalene	1.3* I	2.5 IJ
Phenol		2.1 IJ
Toluene		0.37 IJ

MWTP-MW-1

Date	12/13/05	6/14/06
No organics detected		

FW-7

Date	12/14/05	6/14/06
Toluene	0.23 J	

FW-4

Date	12/14/05	6/14/06
No organics detected		

FW-13B

Date	1/17/06	6/28/06
No organics detected		

FW-14B

Date	1/18/06	6/28/06
No organics detected		

FW-15B

Date	1/20/06	6/27/06
No organics detected		

FW-16B

Date	1/24/06	3/4/06	6/29/06
2,4-Dimethylphenol	56	26	68
2-Methylphenol	6.1 IJ	6.4	11
Benzene			1.7
Ethylbenzene			1.0
Naphthalene			9.9
Toluene			2.0
Xylenes			1.99 IJ

FW-5

Date	12/14/05	6/14/06
No organics detected		

FW-17B

Date	3/8/06	7/6/06
No organics detected		

Koppers, Inc.
Site

Cabot Carbon Site

TITLE: UPPER FLORIDAN 2006 WATER QUALITY RESULT FOR ZONE 1
WELLS FW-10B THROUGH FW-23B AND MOST RECENT SAMPLE
RESULTS FOR WELLS FW-1 THROUGH FW-9

LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida



CHECKED	JRE
DRAFTED	SKU
FILE	MPWell_contaminant_map
DATE	07-21-06

FIGURE:
3-17a

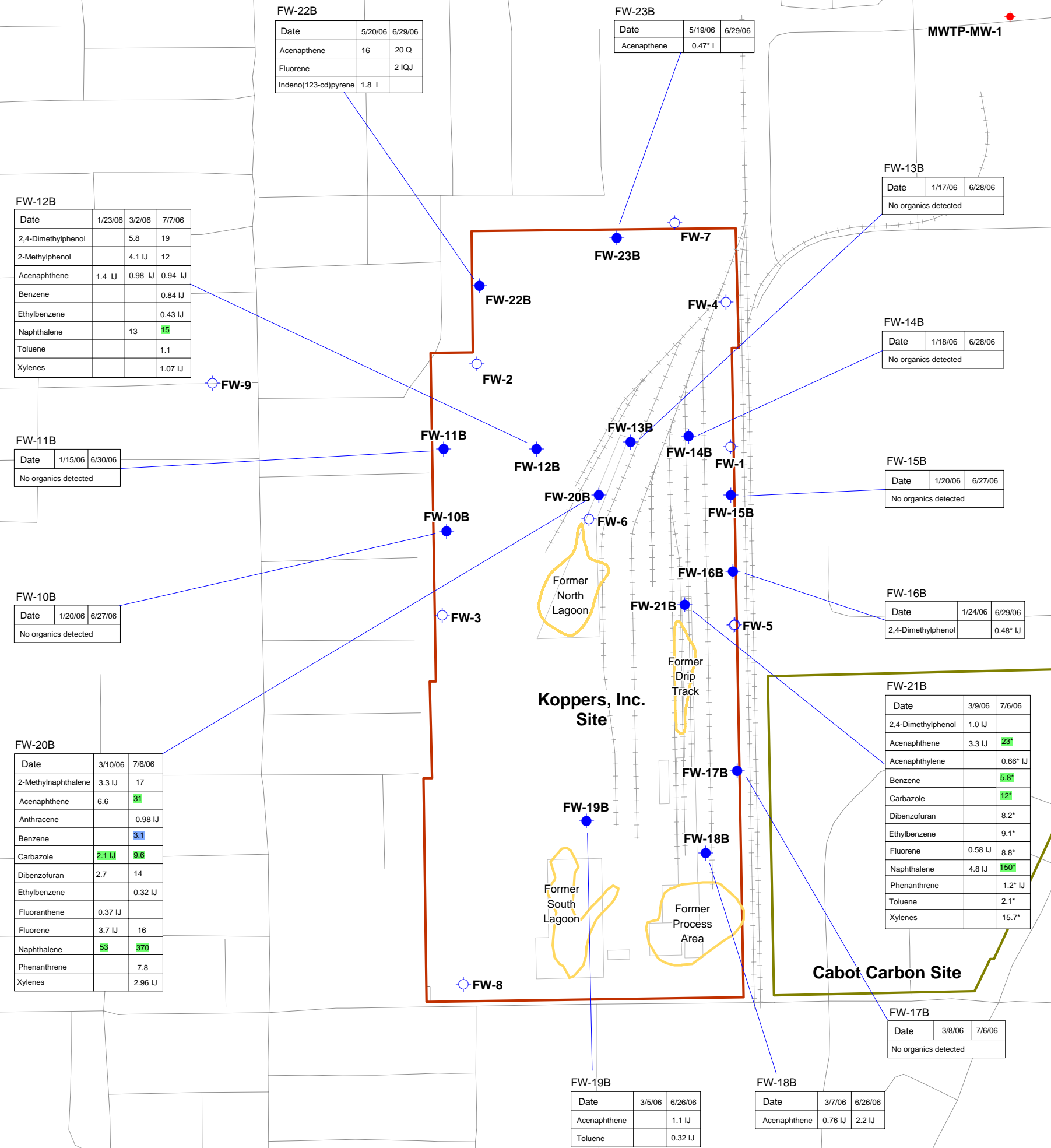
Explanation

- FW-10B

New Upper Floridan Well Location
- FW-9

Existing Upper Floridan Well Location
- MWTP-MW-1

Water Treatment Monitoring Well
- Blank value indicates the analyte was not detected above the laboratory detection limit.
- * - Average concentration of duplicate samples.
- I - Reported value between laboratory method detection limit and the laboratory practical quantitation limit.
- J - Reported value is estimated.
- Result is above the Florida GCTL.
- Result is above the Florida GCTL but below Federal MCL.
- KI Site Boundary
- Cabot/Carbon Site Boundary
- Source Areas



FW-10B

New Upper Floridan Well Location

FW-9

Existing Upper Floridan Well Location

MWTP-MW-1

Water Treatment Monitoring Well

Blank value indicates the analyte was not detected above the laboratory detection limit.

* - Average concentration of duplicate samples.

I - Reported value between laboratory method detection limit and the laboratory practical quantitation limit.

J - Reported value is estimated.

Result is above the Florida GCTL.

Result is above the Florida GCTL but below Federal MCL.

KI Site Boundary

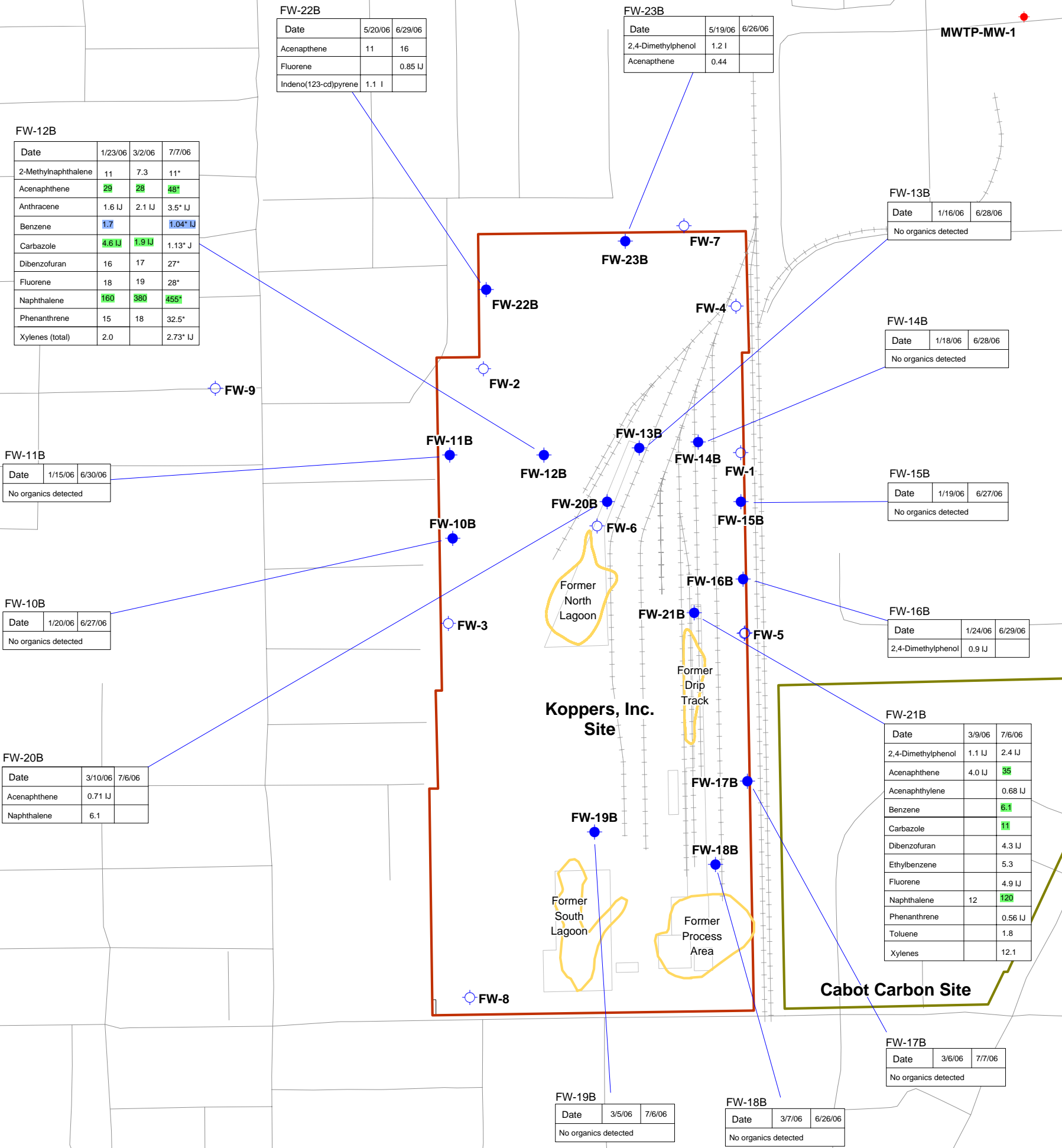
Cabot/Carbon Site Boundary

Source Areas

0450900

Scale in Feet

N



Explanation

- FW-10B

New Upper Floridan Well Location
- FW-9

Existing Upper Floridan Well Location
- MWTP-MW-1

Water Treatment Monitoring Well
- Blank value indicates the analyte was not detected above the laboratory detection limit.
- * - Average concentration of duplicate samples.
- I - Reported value between laboratory method detection limit and the laboratory practical quantitation limit.
- J - Reported value is estimated.
- Result is above the Florida GCTL.
- Result is above the Florida GCTL but below Federal MCL.
- KI Site Boundary
- Cabot/Carbon Site Boundary
- Source Areas



FW-12B

Date	1/23/06	3/1/06	7/7/06
2-Methylnaphthalene	12	19*	32
Acenaphthene	40	43.5*	61
Benzene	2.2	3.4*	4.2
Carbazole	16	21.5*	32
Dibenzofuran	15	17.5*	26
Ethylbenzene			0.45 IJ
Fluorene	17	22*	31
Naphthalene	280	650*	650
Phenanthrene	4.8 IJ	1.7 IJ	
Phenol		7.8*	
Toluene			0.44 IJ
Xylenes (total)	2.1	3.4*	5.8

FW-22B

Date	5/20/06	6/28/06
Acenaphthene	7.8	3.9 IJ
Indeno(123-cd)pyrene	0.76 I	
Phenol		20
Xylenes (total)		0.36 IJ

FW-23B

Date	5/19/06	6/26/06
No organics detected		

MWTP-MW-1

FW-13B

Date	1/16/06	6/28/06
No organics detected		

FW-14B

Date	1/17/06	6/28/06
No organics detected		

FW-15B

Date	1/19/06	6/27/06
No organics detected		

FW-16B

Date	1/24/06	3/3/06
2,4-Dimethylphenol		1.1 IJ
Indeno(123-cd)pyrene	0.049 IJ	

Cabot Carbon Site

FW-21B

Date	3/9/06	7/6/06
2,4-Dimethylphenol	4.0 IJ	
Acenaphthene	1.8 IJ	4.7 IJ
Benzene		1.3
Carbazole		2.3 IJ
Dibenzofuran		1.3 IJ
Ethylbenzene		1.2
Fluorene		1.3 IJ
Naphthalene	8.3	14
Toluene		0.54 IJ
Xylenes (total)		3.2 IJ

FW-17B

Date	3/8/06	7/6/06
No organics detected		

FW-19B

Date	3/5/06	7/6/06
No organics detected		

FW-18B

Date	3/7/06	6/26/06
No organics detected		

Koppers, Inc.
Site

Former
North
Lagoon

Former
Drip
Track

Former
South
Lagoon

Former
Process
Area

TITLE: UPPER FLORIDAN 2006 WATER QUALITY RESULTS FOR
ZONE 4 WELLS FW-10B THROUGH FW-23B

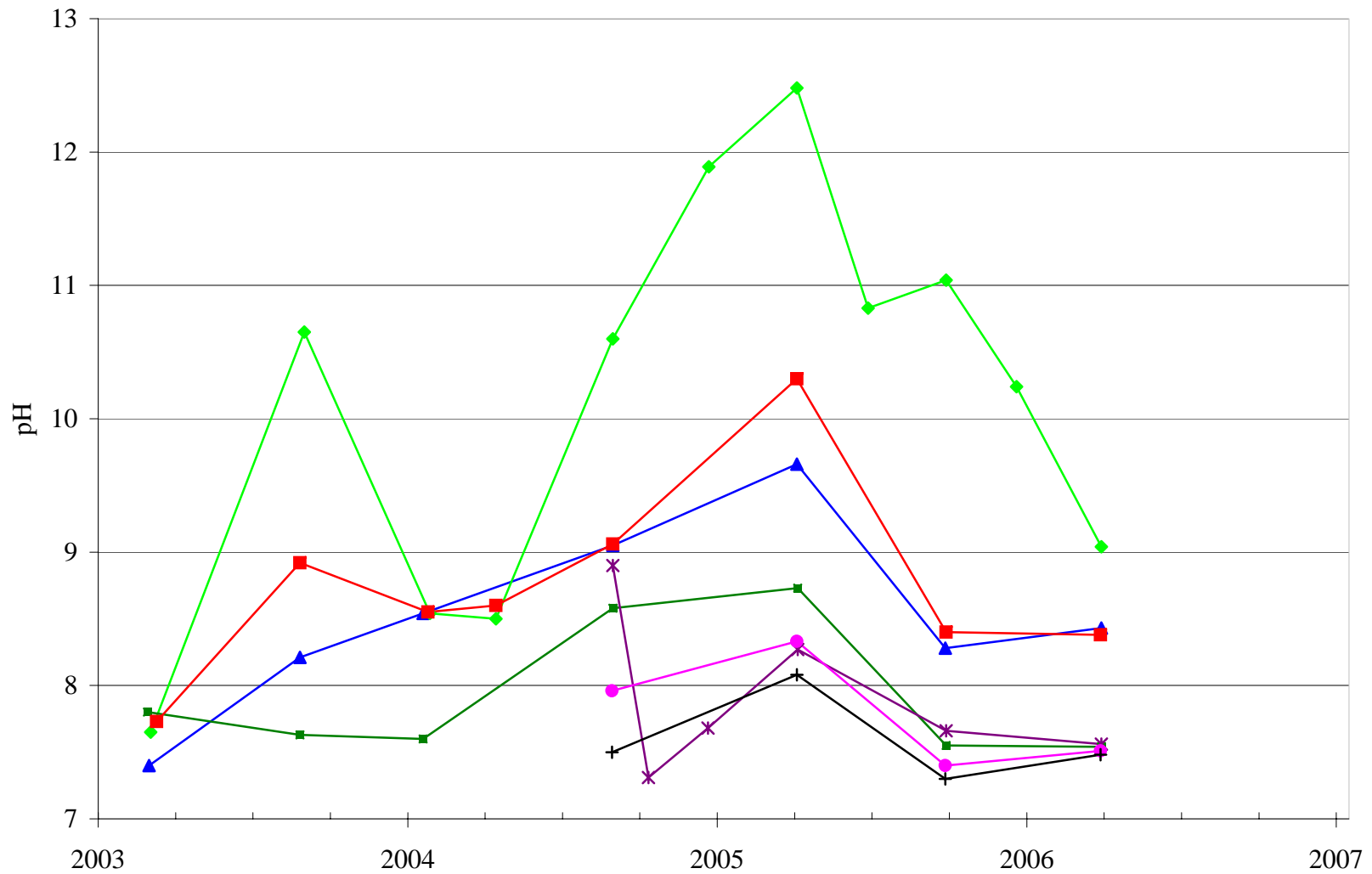
LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

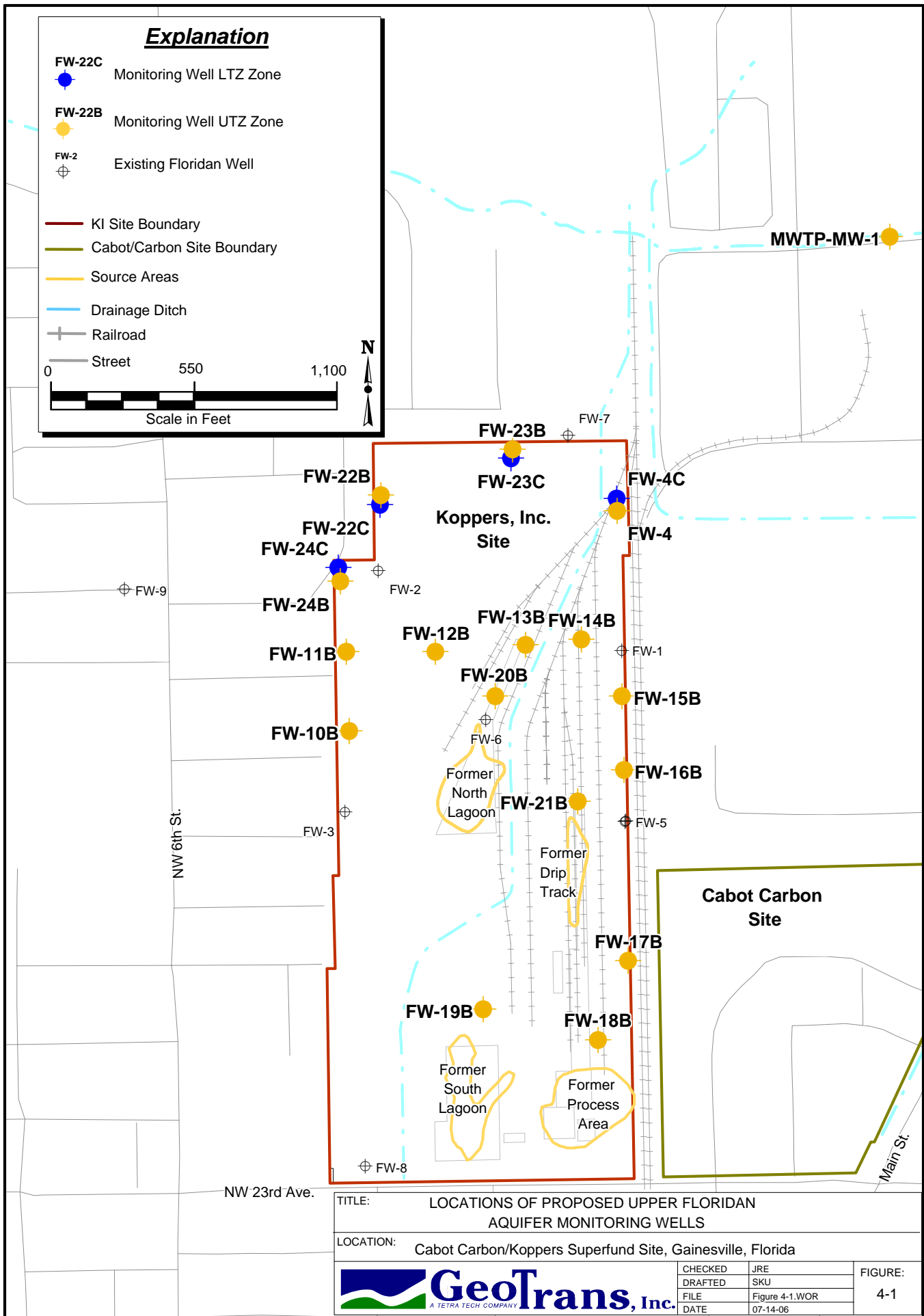


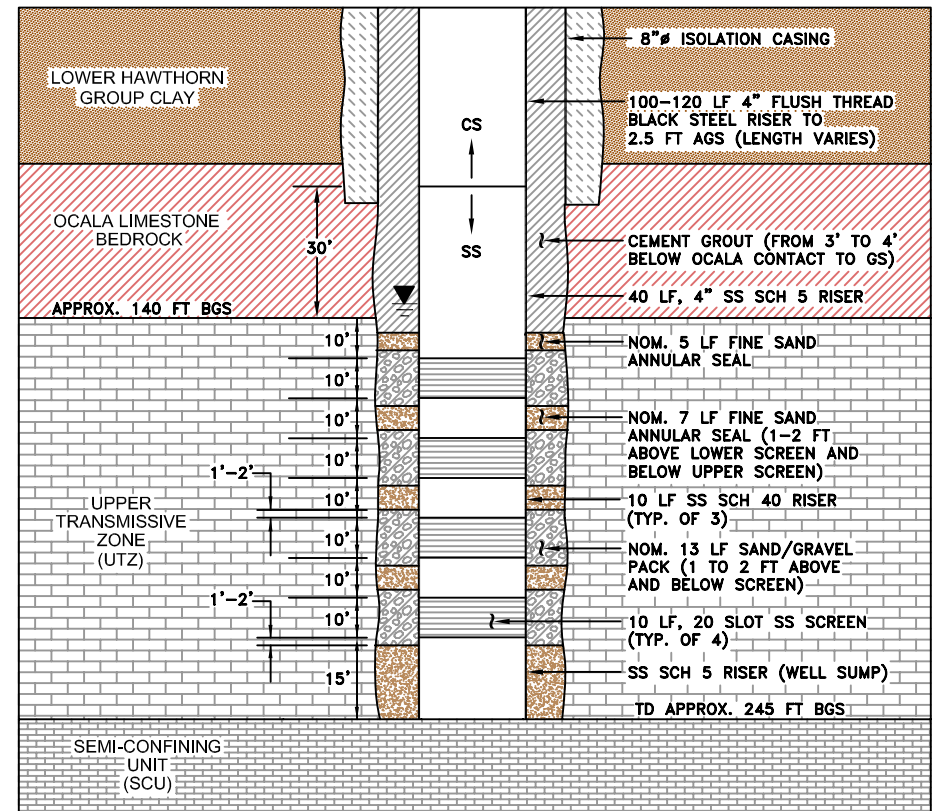
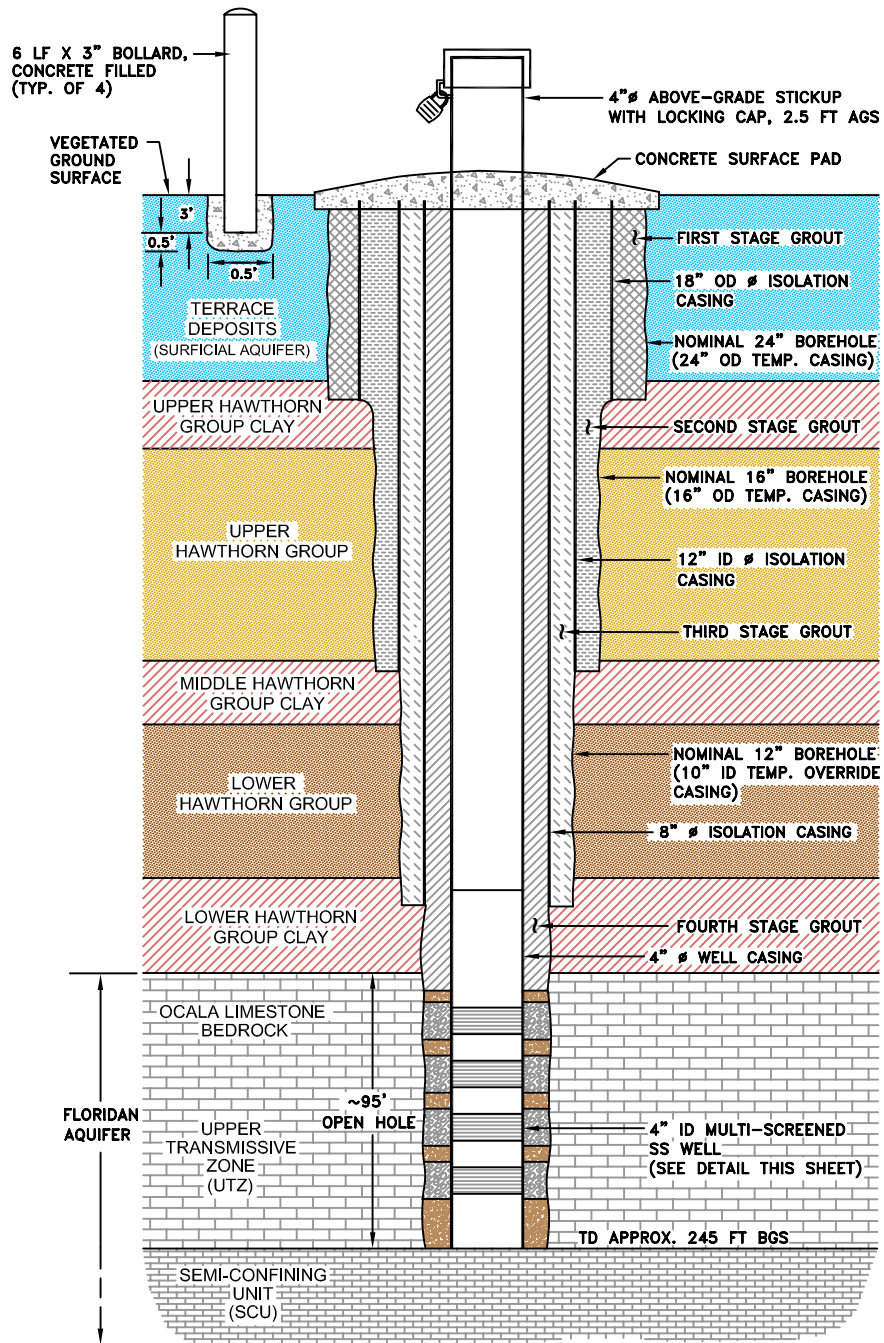
CHECKED	JRE
DRAFTED	SKU
FILE	MPwell_contaminant_map
DATE	07-21-06

FIGURE:
3-17d

Figure 3-18. Temporal plot of pH trends for monitoring wells FW-2 through FW-5 and FW-7 through FW-9.







NOT TO SCALE

TITLE:

CONCEPTUAL ALTERNATIVE WELL DESIGN FOR THE UPPER FLORIDAN AQUIFER WITH MULTIPLE-SCREEN INTERVALS AND TELESCOPING CASING

LOCATION:

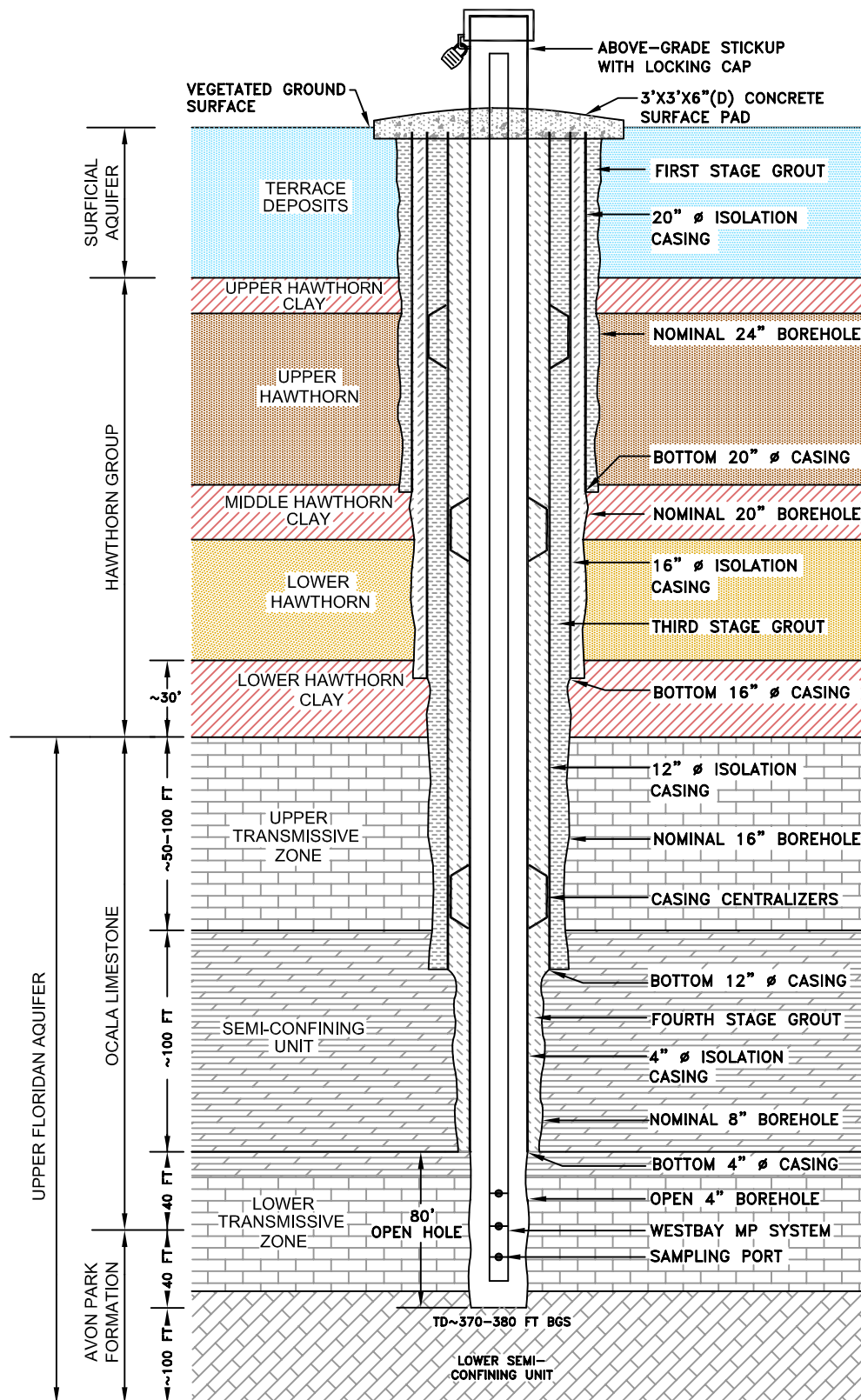
Cabot Carbon/Koppers Superfund Site, Gainesville, Florida



CHECKED	JT
DRAFTED	CP
FILE	2201083028A.DWG
DATE	7-18-06

FIGURE:

4-2



NOT TO SCALE

TITLE: TYPICAL PROPOSED UPPER FLORIDAN AQUIFER
MONITORING WELL FOR THE LOWER TRANSMISSIVE ZONE

LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida



CHECKED	JE
DRAFTED	DB
FILE	Rev Fig5b_082106
DATE	08/21/06

FIGURE:
4-3

TABLES

Table 3-1. Hydraulic-head measurements for the Upper Floridan Aquifer wells (January, March, May, and June and July, 2006).

Well I.D.	MP System Zone	Measurement Event							
		January 2006		March 2006		May 2006		June/July 2006	
		Date	Piezometric Elevation (ft ngvd-29)	Date	Piezometric Elevation (ft ngvd-29)	Date	Piezometric Elevation (ft ngvd-29)	Date	Piezometric Elevation (ft ngvd-29)
FW-1	NA					05/16/06	51.83		NM
FW-2	NA					05/16/06	52.12	6/15/2006	51.39
FW-3	NA					05/16/06	52.27	6/15/2006	51.5
FW-4	NA					05/16/06	51.39	6/15/2006	50.75
FW-5	NA					08/16/06	52.05	6/14/2006	51.31
FW-6	NA					05/16/06	51.80	6/15/2006	51.05
FW-7	NA					05/16/06	51.18	6/15/2006	50.59
FW-8	NA					05/16/06	53.01	6/14/2006	52.21
FW-9	NA					05/16/06	52.14	6/14/2006	51.38
FW-10B	1	01/23/06	53.46			05/16/06	52.67	06/27/06	51.49
	2	01/20/06	53.51			05/16/06	52.68	06/27/06	51.52
	3	01/20/06	53.49			05/16/06	52.66	06/27/06	51.48
	4	01/23/06	53.45			05/16/06	52.64	06/27/06	51.46
FW-11B	1	01/15/06	53.02	03/04/06	53.58	05/16/06	52.42	06/30/06	51.43
	2	01/15/06	53.00			05/16/06	52.45	06/30/06	51.43
	3	01/15/06	53.01			05/16/06	52.43	06/30/06	51.44
	4	01/14/06	53.01			05/16/06	52.43	06/29/06	51.51
FW-12B	1	01/24/06	52.79	03/06/06	53.25	05/16/06	52.09	07/07/06	50.99
	2	01/23/06	52.80	03/02/06	53.28	05/16/06	52.07	07/07/06	50.99
	3	01/23/06	52.82	03/02/06	53.28	05/16/06	52.07	07/07/06	51.02
	4	01/23/06	52.80	03/01/06	53.24	05/16/06	52.05	07/07/06	51.00
FW-13B	1	01/17/06	52.73			05/16/06	52.08	06/28/06	50.81
	2	01/17/06	52.76			05/16/06	52.11	06/28/06	50.84
	3	01/16/06	52.78			05/16/06	52.09	06/28/06	50.84
	4	01/16/06	52.74			05/16/06	52.07	06/28/06	50.80
FW-14B	1	01/17/06	52.78			05/16/06	52.08	06/28/06	51.02
	2	01/17/06	52.80			05/16/06	52.11	06/28/06	51.03
	3	01/17/06	52.76			05/16/06	52.07	06/28/06	51.01
	4	01/17/06	52.65			05/16/06	52.05	06/28/06	50.97
FW-15B	1	01/20/06	52.98			05/16/06	52.14	06/27/06	50.85
	2	01/20/06	52.98			05/16/06	52.15	06/27/06	50.83
	3	01/19/06	52.94			05/16/06	52.15	06/27/06	50.84
	4	01/19/06	52.90			05/16/06	52.11	06/27/06	50.82
FW-16B	1	01/24/06	52.90	03/04/06	53.38	05/16/06	52.23	06/29/06	51.21
	2	01/24/06	52.92			05/16/06	52.21	06/29/06	51.19
	3	01/24/06	52.97	03/03/06	53.37	05/16/06	52.23	06/29/06	51.20
	4	01/24/06	52.91	03/03/06	53.35	05/16/06	52.19	06/29/06	51.20

Table 3-1 (cont). Hydraulic-head measurements for the Upper Floridan Aquifer wells (January, March, May, and June and July, 2006).

Well I.D.	MP System Zone	Measurement Event							
		January 2006		March 2006		May 2006		June/July 2006	
		Date	Piezometric Elevation (ft ngvd-29)	Date	Piezometric Elevation (ft ngvd-29)	Date	Piezometric Elevation (ft ngvd-29)	Date	Piezometric Elevation (ft ngvd-29)
FW-17B	1			03/08/06	53.79	05/17/06	52.54	07/06/06	51.50
	2			03/08/06	53.74	05/17/06	52.45	07/06/06	51.50
	3			03/08/06	53.70	05/17/06	52.41	07/07/06	51.37
	4			03/08/06	53.68	05/17/06	52.37	07/06/06	51.30
FW-18B	1			03/09/06	54.02	05/17/06	52.82	06/26/06	51.96
	2			03/07/06	53.91	05/17/06	52.77	06/26/06	51.85
	3			03/07/06	53.89	05/17/06	52.73	06/26/06	51.83
	4			03/07/06	53.87	05/17/06	52.69	06/26/06	51.81
FW-19B	1			03/05/06	53.98	05/17/06	52.90	07/06/06	51.81
	2			03/05/06	53.99	05/17/06	52.88	07/06/06	51.81
	3			03/05/06	53.99	05/17/06	52.88	07/06/06	51.80
	4			03/05/06	53.97	05/17/06	86.59*	07/06/06	51.78
FW-20B	1			03/10/06	53.47	05/17/06	52.45	07/06/06	51.30
	2			03/10/06	53.48	05/17/06	52.41	07/06/06	51.28
	3			03/10/06	53.43	05/17/06	52.37	07/06/06	51.22
	4			03/10/06	53.42	05/17/06	52.35	07/05/06	51.27
FW-21B	1			03/09/06	53.56	05/17/06	82.06*	07/05/06	51.13
	2			03/09/06	53.54	05/17/06	52.38	07/05/06	51.16
	3			03/09/06	53.52	05/17/06	52.37	07/05/06	51.12
	4			03/09/06	53.48	05/17/06	52.35	07/05/06	51.08
FW-22B	1					05/21/06	51.74	06/29/06	51.21
	2					05/20/06	51.91	06/29/06	51.21
	3					05/20/06	51.68	06/29/06	51.19
	4					05/20/06	51.69	06/28/06	51.09
FW-23B	1					05/19/06	51.22	06/26/06	50.69
	2					05/19/06	51.20	06/26/06	50.69
	3					05/19/06	51.27	06/26/06	50.70
	4					05/19/06	51.26	06/26/06	50.65

Notes:

* - Questionable measurement due to discrepancy with other data.

NM = Not Measured

Table 3-2a. Upper Floridan Aquifer transect wells water quality results for January 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-10B				FW-11B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			1/23/2006	1/20/2006	1/20/2006	1/23/2006	1/15/2006	1/15/2006	1/15/2006	1/14/2006
Arsenic (total)	-	-	25	2.1	1	6.6	6.8	47	34	14
Chromium (total)	-	-	2.4	10	12	3.8				
Copper (total)	-	-	2.0	2.7	5.6	8.1		3	14	2
Zinc (total)	-	-	110	170	170	360	710	1,200	1,100	790
Organic Chemicals										
Sample Date			1/23/2006	1/20/2006	1/20/2006	1/23/2006	1/15/2006	1/15/2006	1/15/2006	1/14/2006
2,4-Dimethylphenol	-	140								
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20								
Acenaphthylene	-	-					4.1 I,J			
Anthracene	-	2,100								
Benzene	5.0	1.0								
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28								
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280					1.4 I,J			
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14								
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10								
Pyrene	-	10								
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000								

Table 3-2a (cont.). Upper Floridan Aquifer transect wells water quality results for January 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-12B				FW-13B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			1/24/2006	1/23/2006	1/23/2006	1/23/2006	1/17/2006	1/17/2006	1/16/2006	1/16/2006
Arsenic (total)	-	-	11	7.6	2.2	2.2	6.8 *	12	3.5	4.2
Chromium (total)	-	-	2.8	3.6	2.6	2.7	4.2 *	2.2		
Copper (total)	-	-	3.0			3.9		2.9		6.3
Zinc (total)	-	-	95	230	280	250	690 *	610	980	670
Organic Chemicals										
Sample Date			1/24/2006	1/23/2006	1/23/2006	1/23/2006	1/17/2006	1/17/2006	1/16/2006	1/16/2006
2,4-Dimethylphenol	-	140	6.2	I,J						
2-Methylnaphthalene	-	28			11	12				
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20	1.1 I,J	1.4 I,J	29	40				
Acenaphthylene	-	-								
Anthracene	-	2,100			1.6 I,J					
Benzene	5.0	1.0			1.7	2.2				
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8			4.6 I,J	16				
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28			16	15				
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280			18	17				
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14			160	280				
Pentachlorophenol	1	-								
Phenanthrene	-	210			15	4.8 I,J				
Phenol	-	10								
Pyrene	-	10								
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000			2	2.1				

Table 3-2a (cont.). Upper Floridan Aquifer transect wells water quality results for January 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-14B				FW-15B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			1/18/2006	1/18/2006	1/18/2006	1/17/2006	1/20/2006	1/20/2006	1/19/2006	1/19/2006
Arsenic (total)	-	-	3.9	8.5	1.3	3.3	8.9	2.3	2.8	11
Chromium (total)	-	-			4.3	2.3		4.3	4.3	4.5
Copper (total)	-	-	4.4		10	5.2		7.8	4.4	13
Zinc (total)	-	-	410	680	940	1,400	20	39	76	49
Organic Chemicals										
Sample Date			1/18/2006	1/18/2006	1/18/2006	1/17/2006	1/20/2006	1/20/2006	1/19/2006	1/19/2006
2,4-Dimethylphenol	-	140								
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20								
Acenaphthylene	-	-								
Anthracene	-	2,100								
Benzene	5.0	1.0								
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28								
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280								
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14								
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10								
Pyrene	-	10								
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000								

Table 3-2a (cont.). Upper Floridan Aquifer transect wells water quality results for January 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID			
			FW-16B			
			Zone 1	Zone 2	Zone 3	Zone 4
Metals						
Sample Date			1/24/2006	1/24/2006	1/24/2006	1/24/2006
Arsenic (total)	-	-	19	4	1.7	2.4
Chromium (total)	-	-		5	5.2	6.9
Copper (total)	-	-				2.5
Zinc (total)	-	-	34	13	210	460
Organic Chemicals						
Sample Date			1/24/2006	1/24/2006	1/24/2006	1/24/2006
2,4-Dimethylphenol	-	140	56		0.9 I,J	
2-Methylnaphthalene	-	28				
2-Methylphenol	-	35	6.1 I,J			
4-Methylphenol †	-	-				
Acenaphthene	-	20				
Acenaphthylene	-	-				
Anthracene	-	2,100				
Benzene	5.0	1.0				
Benz(a)anthracene	-	-				
Benzo(a)pyrene	0.2	-				
Benzo(b)fluoranthene	-	-				
Benzo(g,h,i)perylene	-	-				
Benzo(k)fluoranthene	-	-				
Carbazole	-	1.8				
Chrysene	-	-				
Dibenz(a,h)anthracene	-	-				
Dibenzofuran	-	28				
Ethylbenzene	700	700				
Fluoranthene	-	280				
Flourene	-	280				
Indeno(1,2,3-cd)pyrene	-	0.05				0.049 I,J
Naphthalene	-	14				
Pentachlorophenol	1	-				
Phenanthrene	-	210				
Phenol	-	10				
Pyrene	-	10				
Toluene	1,000	1,000				
Xylenes (total)	10,000	10,000				

Notes:

* Average concentration of sample and duplicate.

† Analyte cannot be separated from 3-Methylphenol.

- No published standard.

I Reported value between the laboratory method detection limit and the laboratory practical quantitation limit.

J Reported value is estimated.

Blank value indicates the analyte was not detected above the laboratory detection limit.


 Result is above the Florida GCTL. Result is above the Florida GCTL, but below the Federal MCL.

Table 3-2b. Upper Floridan Aquifer source area and transect wells water quality results for March 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID	Well ID				Well ID
			FW-11B	FW-12B				FW-13B
			Zone 1	Zone 1	Zone 2	Zone 3	Zone 4	Zone 1
Metals								
Sample Date			3/4/2006	3/6/2006	3/2/2006	3/2/2006	3/1/2006	3/9/2006
Arsenic (dissolved)	10	10	6.3		2	0.55		0.8
Chromium (dissolved)	100	100	11	2.2				
Copper (dissolved)	1,300	-						
Zinc (dissolved)	-	-	1300.0	17	58	14	19 *	
Organic Chemicals								
Sample Date			3/4/2006	3/6/2006	3/2/2006	3/2/2006	3/1/2006	3/9/2006
2,4-Dimethylphenol	-	140		4.4 I,J	5.8			
2-Methylnaphthalene	-	28				7.3	19 *	
2-Methylphenol	-	35			4.1 I,J			
4-Methylphenol †	-	-	6.5					
Acenaphthene	-	20			0.98 I,J	28	43.5 *	
Acenaphthylene	-	-						
Anthracene	-	2,100				2.1 I,J		
Benzene	5.0	1.0					3.4 *	
Benz(a)anthracene	-	-						
Benzo(a)pyrene	0.2	-						
Benzo(b)fluoranthene	-	-			U,J			
Benzo(g,h,i)perylene	-	-						
Benzo(k)fluoranthene	-	-						
Carbazole	-	1.8				1.9 I,J	21.5 *	
Chrysene	-	-						
Dibenz(a,h)anthracene	-	-						
Dibenzofuran	-	28				17	17.5 *	
Ethylbenzene	700	700						
Fluoranthene	-	280						
Flourene	-	280				19	22 *	
Indeno(1,2,3-cd)pyrene	-	0.05						
Naphthalene	-	14	1.5 I,J		13	380	650 *	
Pentachlorophenol	1	-						
Phenanthrene	-	210				18	1.7 *I,J	
Phenol	-	10					7.8 *	
Pyrene	-	10						
Toluene	1,000	1,000						
Xylenes (total)	10,000	10,000					3.4 *	

Table 3-2b (cont.). Upper Floridan Aquifer source area and transect wells water quality results for March 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-16B				FW-17B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			3/4/2006	3/4/2006	3/3/2006	3/3/2006	3/8/2006	3/8/2006	3/8/2006	3/8/2006
Arsenic (dissolved)	10	10			0.71			1.4	1.4	1.7
Chromium (dissolved)	100	100								2.1
Copper (dissolved)	1,300	-								
Zinc (dissolved)	-	-	27		15			680	1,000	570
Organic Chemicals										
Sample Date			3/4/2006	3/4/2006	3/3/2006	3/3/2006	3/8/2006	3/8/2006	3/8/2006	3/8/2006
2,4-Dimethylphenol	-	140	26	26						
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20								
Acenaphthylene	-	-								
Anthracene	-	2,100								
Benzene	5.0	1.0								
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28								
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280								
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14	6.4	6.4						
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10								
Pyrene	-	10								
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000								

Table 3-2b (cont.). Upper Floridan Aquifer source area and transect wells water quality results for March 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-18B				FW-19B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			3/9/2006	3/7/2006	3/7/2006	3/7/2006	3/5/2006	3/5/2006	3/5/2006	3/5/2006
Arsenic (dissolved)	10	10	0.8			1	3.1 *	2.2	13	4.8
Chromium (dissolved)	100	100								4.6
Copper (dissolved)	1,300	-							4.1	
Zinc (dissolved)	-	-					551 *	56	51	24
Organic Chemicals										
Sample Date			3/9/2006	3/7/2006	3/7/2006	3/7/2006	3/5/2006	3/5/2006	3/5/2006	3/5/2006
2,4-Dimethylphenol	-	140								
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20		0.76 I,J			0.26 *			
Acenaphthylene	-	-								
Anthracene	-	2,100								
Benzene	5.0	1.0								
Benzo(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28								
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280								
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14								
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10								
Pyrene	-	10								
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000								

Table 3-2b (cont.). Upper Floridan Aquifer source area and transect wells water quality results for March 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-20B				FW-21B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			3/10/2006	3/10/2006	3/10/2006	3/10/2006	3/9/2006	3/9/2006	3/9/2006	3/9/2006
Arsenic (dissolved)	10	10	4.4	11	1.5	0.6				0.54
Chromium (dissolved)	100	100								
Copper (dissolved)	1,300	-				3.7				
Zinc (dissolved)	-	-	20	320	43	11		13		
Organic Chemicals										
Sample Date			3/10/2006	3/10/2006	3/10/2006	3/10/2006	3/9/2006	3/9/2006	3/9/2006	3/9/2006
2,4-Dimethylphenol	-	140					6.6	1 I,J	1.1 I,J	4 I,J
2-Methylnaphthalene	-	28	6.6	3.3 I,J			6.9			
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20	54	6.6	0.71 I,J	0.53 I,J	13	3.3 I,J	4 I,J	1.8 I,J
Acenaphthylene	-	-								
Anthracene	-	2,100	5.8							
Benzene	5.0	1.0	2.4							
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8	26	2.1 I,J			0.88			
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28	26	2.7 I,J			5.6			
Ethylbenzene	700	700								
Fluoranthene	-	280	6.4	0.37 I,J						
Flourene	-	280	39	3.7 I,J			7	0.58 I,J		
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14		53	6.1	3.3 I,J	140	4.8 I,J	12	8.3
Pentachlorophenol	1	-								
Phenanthrene	-	210	42							
Phenol	-	10								
Pyrene	-	10	2.6 I,J							
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000								

Notes:

* Average concentration of sample and duplicate.

† Analyte cannot be separated from 3-Methylphenol.

- No published standard.

I Reported value between the laboratory method detection limit and the laboratory practical quantitation limit.

J Reported value is estimated.

Blank value indicates the analyte was not detected above the laboratory detection limit.

Result is above the Florida GCTL.

Result is above the Florida GCTL, but below the Federal MCL.

Table 3-2c. Upper Floridan Aquifer property boundary wells water quality results for May 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-22B				FW-23B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			5/21/2006	5/20/2006	5/20/2006	5/20/2006	5/20/2006	5/19/2006	5/19/2006	5/19/2006
Arsenic (dissolved)	10	10	1.4	3.4	6.1	5.3				
Chromium (dissolved)	100	100								
Copper (dissolved)	1,300	-				3.2				
Zinc (dissolved)	-	-			15	26				
Organic Chemicals										
Sample Date			5/21/2006	5/20/2006	5/20/2006	5/20/2006	5/20/2006	5/19/2006	5/19/2006	5/19/2006
2,4-Dimethylphenol	-	140					6.05 *I		1.2 I	
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35					5.05			
4-Methylphenol †	-	-					2.2 *I			
Acenaphthene	-	20	11	16	11	7.8	0.505 *I	0.47 I	0.44	
Acenaphthylene	-	-								
Anthracene	-	2,100								
Benzene	5.0	1.0								
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28								
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280	0.85 I	1.8 I	1.1 I	0.76 I				
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14					1.3 *I			
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10								
Pyrene	-	210								
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000								

Notes:

* Average concentration of sample and duplicate.

† Analyte cannot be separated from 3-Methylphenol.

- No published standard.

I Reported value between the laboratory method detection limit and the laboratory practical quantitation limit.

J Reported value is estimated.

Blank value indicates the analyte was not detected above the laboratory detection limit.


 Result is above the Florida GCTL. Result is above the Florida GCTL, but below the Federal MCL.

Table 3-2d. Upper Floridan Aquifer water quality results for wells FW-10B through FW-23B for June and July 2006

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-10B				FW-11B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			6/27/2006	6/27/2006	6/27/2006	6/27/2006	6/30/2006	6/30/2006	6/30/2006	6/29/2006
Arsenic (dissolved)	10	10	14	10	1.1	0.94	4.2	65	14	9.1
Chromium (dissolved)	100	100	0.72 B	0.66 B	0.72 B	0.94 B	0.58 B	0.58 I	0.63 I	0.51 I
Copper (dissolved)	1,300	-	56		0.35 B	0.31 B	0.6 IJ	3.3	0.6 I	
Zinc (dissolved)	-	-	36	9.4 B	9 B	7.4 B	510	1100	750	760
Organic Chemicals										
Sample Date			6/27/2006	6/27/2006	6/27/2006	6/27/2006	6/30/2006	6/30/2006	6/30/2006	6/29/2006
2,4-Dimethylphenol	-	140								
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20					5.8			
Acenaphthylene	-	-								
Anthracene	-	2,100								
Benzene	5.0	1.0								
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28					0.68 IJ			
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280					0.62 IJ			
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14								
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10								
Pyrene	-	210								
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000								

Table 3-2d (cont.). Upper Floridan Aquifer water quality results for wells FW-10B through FW-23B for June and July 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-12B				FW-13B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			7/7/2006	7/7/2006	7/7/2006	7/7/2006	6/28/2006	6/28/2006	6/28/2006	6/28/2006
Arsenic (dissolved)	10	10	2.3	0.41 I			5.4	0.47 I	0.43 I	
Chromium (dissolved)	100	100	0.67 B	0.67 B	0.71* I	0.67 B	0.56 I	0.47 I	0.54 I	0.59 I
Copper (dissolved)	1,300	-	0.48 I		0.41* I		0.3 I			0.37 I
Zinc (dissolved)	-	-	21 B	34 B	14.2*	35	280	3.7 I	4.8	22
Organic Chemicals										
Sample Date			7/7/2006	7/7/2006	7/7/2006	7/7/2006	6/28/2006	6/28/2006	6/28/2006	6/28/2006
2,4-Dimethylphenol	-	140	39	19						
2-Methylnaphthalene	-	28	0.93 IJ		11*	32				
2-Methylphenol	-	35	22	12						
4-Methylphenol †	-	-	1.9 IJ							
Acenaphthene	-	20	0.92 IJ	0.94 IJ	48*	61				
Acenaphthylene	-	-								
Anthracene	-	2,100			3.5* IJ					
Benzene	5.0	1.0	1.5	0.84 IJ	1.04* IJ	4.2				
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8			1.13* J	32				
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28			27*	26				
Ethylbenzene	700	700	0.79 IJ	0.43 IJ		0.45 IJ				
Fluoranthene	-	280								
Flourene	-	280			28*	31				
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14	49	15	455*	650				
Pentachlorophenol	1	-								
Phenanthrene	-	210			32.5*					
Phenol	-	10								
Pyrene	-	210								
Toluene	1,000	1,000	2.1	1.1		0.44 IJ				
Xylenes (total)	10,000	10,000	3.6 IJ	1.07 IJ	2.73* IJ	5.8				

Table 3-2d (cont.). Upper Floridan Aquifer water quality results for wells FW-10B through FW-23B for June and July 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-14B				FW-15B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			6/28/2006	6/28/2006	6/28/2006	6/28/2006	6/27/2006	6/27/2006	6/27/2006	6/27/2006
Arsenic (dissolved)	10	10	0.6	1	3.06* J	0.74	20	2.3*	7.6	14
Chromium (dissolved)	100	100	0.59 I	0.61 I	0.7* I	0.57 I	0.71 B	0.82* B	2.3 B	0.75 B
Copper (dissolved)	1,300	-				0.63 I	0.38 B	0.38* B	0.53 B	1 B
Zinc (dissolved)	-	-	15	140	101* J	240	13 B	3.2* B	6.4 B	8.6 B
Organic Chemicals										
Sample Date			6/28/2006	6/28/2006	6/28/2006	6/28/2006	6/27/2006	6/27/2006	6/27/2006	6/27/2006
2,4-Dimethylphenol	-	140								
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20								
Acenaphthylene	-	-								
Anthracene	-	2,100								
Benzene	5.0	1.0								
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28								
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280								
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14								
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10								
Pyrene	-	210								
Toluene	1,000	1,000								
Xylenes (total)	10,000	10,000								

Table 3-2d (cont.). Upper Floridan Aquifer water quality results for wells FW-10B through FW-23B for June and July 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-16B				FW-17B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			6/29/2006	6/29/2006	6/29/2006	6/29/2006	7/6/2006	7/6/2006	7/7/2006	7/6/2006
Arsenic (dissolved)	10	10							0.33 I	
Chromium (dissolved)	100	100	1 B	1.05* JB	0.51 B	0.58 B			0.4 B	
Copper (dissolved)	1,300	-		0.15* I		0.29 I				
Zinc (dissolved)	-	-	30 B	5.3* B	2.5 B	22 B	24	130	270	55
Organic Chemicals										
Sample Date			6/29/2006	6/29/2006	6/29/2006	6/29/2006	7/6/2006	7/6/2006	7/7/2006	7/6/2006
2,4-Dimethylphenol	-	140	68	0.48* IJ		1.1 IJ				
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35	11							
4-Methylphenol †	-	-								
Acenaphthene	-	20								
Acenaphthylene	-	-								
Anthracene	-	2,100								
Benzene	5.0	1.0	1.7							
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28								
Ethylbenzene	700	700	1							
Fluoranthene	-	280								
Flourene	-	280								
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14	9.9							
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10								
Pyrene	-	210								
Toluene	1,000	1,000	2							
Xylenes (total)	10,000	10,000	1.99 IJ							

Table 3-2d (cont.). Upper Floridan Aquifer water quality results for wells FW-10B through FW-23B for June and July 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-18B				FW-19B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			6/26/2006	6/26/2006	6/26/2006	6/26/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006
Arsenic (dissolved)	10	10					4		4.6*	
Chromium (dissolved)	100	100	0.81 B	0.9	0.87 B	0.79 B				
Copper (dissolved)	1,300	-	0.84 I	0.41	0.36 I	0.29 I				
Zinc (dissolved)	-	-		11	2.5 B	5.3 B	600			
Organic Chemicals										
Sample Date			6/26/2006	6/26/2006	6/26/2006	6/26/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006
2,4-Dimethylphenol	-	140								
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20		2.2 IJ			0.8 IJ	1.1 IJ		
Acenaphthylene	-	-								
Anthracene	-	2,100								
Benzene	5.0	1.0								
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28								
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280								
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14								
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10								
Pyrene	-	210								
Toluene	1,000	1,000						0.32 IJ		
Xylenes (total)	10,000	10,000								

Table 3-2d (cont.). Upper Floridan Aquifer water quality results for wells FW-10B through FW-23B for June and July 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-20B				FW-21B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006
Arsenic (dissolved)	10	10								
Chromium (dissolved)	100	100								
Copper (dissolved)	1,300	-								
Zinc (dissolved)	-	-								
Organic Chemicals										
Sample Date			7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006
2,4-Dimethylphenol	-	140					10 IJ		2.4 IJ	
2-Methylnaphthalene	-	28	62	17			86			
2-Methylphenol	-	35								
4-Methylphenol †	-	-								
Acenaphthene	-	20	63	31			80	23*	35	4.7 IJ
Acenaphthylene	-	-						0.66* IJ	0.68 IJ	
Anthracene	-	2,100	4.9 IJ	0.98 IJ			3.1 IJ			
Benzene	5.0	1.0	5.3	3.1			16	5.8*	6.1	1.3
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8	22	9.6			71	12*	11	2.3 IJ
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28	33	14			45	8.2*	4.3 IJ	1.3 IJ
Ethylbenzene	700	700	0.45 IJ	0.32 IJ			13	9.1*	5.3	1.2
Fluoranthene	-	280	7.6				0.48 IJ			
Flourene	-	280	41	16			49	8.8*	4.9 IJ	1.3 IJ
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14	650	370		0.89 IJ	1100	150*	120	14
Pentachlorophenol	1	-								
Phenanthrene	-	210	50	7.8		0.33 IJ	31	1.2* IJ	0.56 IJ	
Phenol	-	10								
Pyrene	-	210	3.3 IJ							
Toluene	1,000	1,000	0.34 IJ				0.95 IJ	2.1*	1.8	0.54 IJ
Xylenes (total)	10,000	10,000	5.3	2.96 IJ			13.7	15.7*	12.1	3.2 IJ

Table 3-2d (cont.). Upper Floridan Aquifer water quality results for wells FW-10B through FW-23B for June and July 2006.

Constituent	Federal MCL (µg/L)	Florida GCTL (µg/L)	Well ID				Well ID			
			FW-22B				FW-23B			
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Metals										
Sample Date			6/29/2006	6/29/2006	6/29/2006	6/28/2006	6/26/2006	6/26/2006	6/26/2006	6/26/2006
Arsenic (dissolved)	10	10	1.9			7.9				
Chromium (dissolved)	100	100	0.61 B	0.7 B	0.47 B	0.61 I	0.84 B	0.87 B	0.69 B	0.94 B
Copper (dissolved)	1,300	-	0.3 I	0.37 I		0.62 I	0.46 I		0.39 I	
Zinc (dissolved)	-	-	960	6.1 B	7 B	45	7.1 B	5.9 B	9.5 B	4.9 B
Organic Chemicals										
Sample Date			6/29/2006	6/29/2006	6/29/2006	6/28/2006	6/26/2006	6/26/2006	6/26/2006	6/26/2006
2,4-Dimethylphenol	-	140					12			
2-Methylnaphthalene	-	28								
2-Methylphenol	-	35					8.3			
4-Methylphenol †	-	-								
Acenaphthene	-	20	8.2	20 Q	16	3.9 IJ				
Acenaphthylene	-	-								
Anthracene	-	2,100								
Benzene	5.0	1.0								
Benz(a)anthracene	-	-								
Benzo(a)pyrene	0.2	-								
Benzo(b)fluoranthene	-	-								
Benzo(g,h,i)perylene	-	-								
Benzo(k)fluoranthene	-	-								
Carbazole	-	1.8								
Chrysene	-	-								
Dibenz(a,h)anthracene	-	-								
Dibenzofuran	-	28								
Ethylbenzene	700	700								
Fluoranthene	-	280								
Flourene	-	280	0.39 IJ	2 IQJ	0.85 IJ					
Indeno(1,2,3-cd)pyrene	-	0.05								
Naphthalene	-	14					2.5 IJ			
Pentachlorophenol	1	-								
Phenanthrene	-	210								
Phenol	-	10				20	2.1 IJ			
Pyrene	-	210								
Toluene	1,000	1,000				0.36 IJ	0.37 IJ			
Xylenes (total)	10,000	10,000								

Notes:

* Average concentration of sample and duplicate

† Analyte cannot be separated from 3-Methylphenol

- No published standard.

I Reported value between the laboratory method detection limit and the laboratory practical quantitation limit.

J Estimated value

Q Sample held beyond the accepted holding time

Blank value indicates the analyte was not detected above the laboratory detection limit.

Result is above the Florida GCTL.

Result is above the Florida GCTL, but below the Federal MCL.

Table 4-1. Analyte List.

GROUND WATER TEST DESCRIPTION	ANALYTICAL METHOD
Inorganics	
Arsenic, dissolved	EPA 6020
Chromium, dissolved	
Copper, dissolved	
Zinc, dissolved	
Volatile Organic Compounds (VOCs)	
Benzene	EPA 8260B
Ethylbenzene	
Toluene	
Total Xylenes	
Phenols	
2-4-Dimethylphenol	EPA 8270C
2-Methylphenol	
3&4-Methylphenol	
Phenol	
Pentachlorophenol	EPA 8270C SIM
Polyaromatic Hydrocarbons (PAHs)	
2-Methylnaphthalene	EPA 8270C
Acenaphthene	
Acenaphthylene	
Anthracene	
Benzo(g,h,i)perylene	
Carbazole	
Chrysene	
Dibenzofuran	
Fluorene	
Fluoranthene	
Naphthalene	
Phenanthrene	
Pyrene	
Benzo(a)anthracene	EPA 8270C SIM
Benzo(a)pyrene	
Benzo(b)flouranthene	
Benzo(k)flouranthene	
Dibenzo(a,h)anthracene	
Indeno(1,2,3-cd)pyrene	

Table 4-2. Monitoring well sampling frequency.

WELL I.D.	SAMPLING FREQUENCY			
	Year 1	Year 2	Year 3	Year 4
Upper Floridan Multi-Port and Screened Wells				
FW-4	Quarterly	Semiannual	Semiannual	Reevaluate Sampling Frequency
FW-10B				
FW-11B				
FW-12B				
FW-13B				
FW-14B				
FW-15B				
FW-16B				
FW-17B				
FW-18B				
FW-19B				
FW-20B				
FW-21B				
FW-22B				
FW-23B				
Proposed Upper Floridan UTZ Multi-Port Well				
FW-24B	Quarterly	Semiannual	Semiannual	Reevaluate Sampling Frequency
Proposed Upper Floridan LTZ Multi-Port Well				
FW-4C	Quarterly	Semiannual	Semiannual	Reevaluate Sampling Frequency
FW-22C				
FW-23C				
FW-24C				
GRU Sentinel Monitoring Well				
MWTP-MW-1	Semiannual	Semiannual	Semiannual	Reevaluate Sampling Frequency

APPENDIX A: STANDARD OPERATING PROCEDURES

WESTBAY MULTI-PORT SYSTEM SAMPLING AND DECONTAMINATION PROCEDURES

The Westbay Multi-Port System (Westbay System) is a multi-level sampling system that allow discrete groundwater samples to be collected from multiple intervals within a single monitoring well. Each interval is isolated with the use of packers to seal the well annulus between the monitoring zones. Each monitoring interval contains a measurement port and a pumping port. Sampling should be performed by a qualified individual trained in the operation of the Westbay System.

1.0 Westbay System Sampling Procedures

- 1.1 The sampling procedures outlined in this section are the same for each monitoring zone in every well. Within each monitoring interval, a measurement port is installed as part of the MP System. The measurement ports incorporate a valve in the wall of the coupling, with an alignment notch on the opposite, inside wall of the coupling.
- 1.2 The Westbay sampling probe (currently the MOSDAX Sampler Probe Model 2531), the Westbay MOSDAX Automated Groundwater Interface (MAGI), Westbay sample bottles, and laboratory supplied sample bottles are required to perform the sampling.
- 1.3 Review Westbay's as-built well diagrams to determine the depths of each monitoring zone and associated measurement ports for the well being sampled.
- 1.4 Assemble the tripod and wireline cable reel above the well, and attach the evacuation port coupling to the top of the MP System. Designate a location with a clean stable surface for handling the sample bottle string such that the bottles do not come in contact with the ground surface.
- 1.5 Using new disposable gloves, assemble the sample bottles (maximum of 4) using the wrenches provided in the Westbay kit to snug the connections between the sample bottles and the connector tubing. Confirm that the o-rings on the connector tubing are present and intact. Replace o-rings if necessary. Using the valve tool, close the valve on the bottom sampling tube, and open the valves between each bottle.

- 1.6 The sample bottles can now be attached to the sampling probe. The MAGI also needs to be connected to the sampling probe. Lastly, attach the MAGI to the battery source by clipping the red lead to the positive battery terminal and the black lead to the negative battery terminal. NOTE: It is important to connect the sampling probe to the MAGI prior to connecting the MAGI to the power source to avoid the potential for an electric shock to the sampling technician or an electrical surge to the MAGI.
- 1.7 The sampling probe and bottles are now ready to be placed in the monitoring well. Ensure the cable reel brake is on, and there is adequate slack in the wireline cable to maneuver the sampling train into the monitoring well without kinking the cable. Using the MAGI, activate the location arm on the sampling probe so it is in the extended position (the MAGI display should indicate 15 to 16 revolutions). Carefully lift the sampling train into the monitoring well, paying special attention to the connection between the wireline and sampling probe so as not to kink the wireline. Lower the sample bottles and probe until the location arm is firmly seated in the alignment notch of the evacuation collar.
- 1.8 Remove the slack from the wireline cable, and zero the reel counter.
- 1.9 With the sampling probe seated in the evacuation collar, the following Westbay surface function checks must be performed and recorded on the groundwater sampling form:
- Record the ambient pressure indicted by the MAGI. This pressure reading is required once per well, unless the well is being sampled over multiple days, in which case the ambient pressure should be recorded at the start of sampling on subsequent days.
 - Activate the shoe. The shoe should extend and the MAGI display should indicate 16 to 19 revolutions (23 revolutions in open air outside of the evacuation collar).
 - Close the sampler valve. The motor should run for approximately 5 seconds, and the MAGI display will indicate 1 revolution.
 - Attach the vacuum pump to the fitting on the vacuum coupling. Note the pressure reading on the MAGI. Begin applying a vacuum with the vacuum pump. The MAGI display should maintain a constant pressure. If the pressure reading begins decreasing, inspect for leaks at the face seal of the probe, the connection to the pump, and the connection at the probe sampling valve. Repeat procedure as necessary to ensure seals and connections are secure.
 - Open the sampler valve.

- Use the vacuum pump to apply a vacuum to the sample bottles. The vacuum should be applied until the pressure inside the sample bottles is below 4 pounds per square inch (psi) as displayed on the MAGI.
- Close the sampler valve. A vacuum has now been applied to the sample bottles.
- Retract the shoe.
- Confirm the cable reel brake is on and the reel counter has been zeroed. Retract the location arm.

1.10 The sampling probe and bottles can then be lowered into the MP System well. The sampling train should be lowered to the approximate sample depth, until the MAGI beeps indicating the sampling probe has reached the magnetic reference installed on the MP System (note that the beep system is not always reliable, so the depth readings should be monitored). Raise the sampling probe approximately 3 feet to ensure the sampling probe location arm is above the measurement port.

1.11 The location arm should then be activated, and the sampling probe and bottles can be lowered until the location arm is secured in the measurement port alignment notch. The depth on the wireline reel counter should be checked against the Westbay System as-built well diagram to verify the sample probe and bottles are at the correct measurement port.

1.12 When the sample probe and bottles are located at the correct measurement port, the following steps are required, including recording data on the groundwater sampling form:

- Tighten the brake on the cable reel.
- Record the pressure reading inside the casing as displayed on the MAGI.
- Activate the shoe, noting that a pressure change on the MAGI display should occur indicating a connection with the formation when the shoe is fully extended.
- Record the pressure reading of the formation as displayed on the MAGI.
- Open the sampler valve. NOTE: the pressure displayed on the MAGI will jump to a significantly lower reading due to the vacuum applied to the sample bottles. The pressure will then begin to climb as the sample bottles are filled with groundwater.
- Allow the sample bottles to fill with groundwater until the pressure displayed on the MAGI is the same as the formation pressure noted prior to opening the sampler valve. NOTE: The Westbay MOSDAX Sampler Probe Model 2531 pressure transducer has a reported accuracy of ± 0.25 %.

- Close the sampler valve.
 - Retract the shoe.
 - Record the pressure reading inside the casing as displayed on the MAGI. The pressure reading should be similar to the original casing pressure recorded prior to activating the shoe.
 - Ensure there is no slack in the wireline cable, and the cable reel brake is applied. Retract the location arm, and retrieve the sample probe and bottles.
- 1.13 When the sampling probe reaches the top of the MP System, activate the location arm and seat the probe in the alignment notch of the evacuation coupling. Provide adequate slack in the cable so the probe will reach the designated bottle handling area without kinking the cable.
- 1.14 Paying special attention not to kink the wireline cable at the connection to the sampling probe, remove the sample probe and bottles from the monitoring well and lay out the unit on a split PVC casing or other clean, level surface.
- 1.15 Close each of the valves connecting the sample bottles. Each of the bottles can then be separated from the sampling train.
- 1.16 The sample bottles can then be used to fill laboratory-prepared sample containers. Hold the sample bottle vertically over the laboratory sample container, with the top of the bottle pointed away from the sampler's face. Slowly open the top valve to release the pressure from within the bottle. Close the top valve once the pressure has been released. The bottom valve can then be opened and the groundwater can be directed into the laboratory container.
- 1.17 Ice should be present during each sampling event, and samples are to be placed in a cooler with ice immediately after the samples are transferred from the Westbay bottles to the laboratory supplied bottles. In the event a laboratory bottle is only partially filled with the sample collected on a particular run, the laboratory bottle should be closed and placed in a cooler with ice until subsequent runs with the Westbay sampling probe and bottles are performed to complete the sample collection.
- 1.18 In the event multiple runs with the Westbay sampling probe and bottles are required to collect the full sample volume from a particular monitoring zone, the Westbay sampling

equipment does not need to be decontaminated between runs. Each run with the sampling probe and bottles should be recorded and performed as described above in Sections 1.6 and 1.9.

- 1.19 Each sample will be appropriately labeled, logged on the chain-of-custody, and packaged in a cooler with ice for delivery to the laboratory.

2.0 Westbay Sampling Probe and Bottles Decontamination Procedures

- 2.1 The Westbay sampling probe and bottles must be decontaminated prior to moving between each monitoring zone (but not for multiple use within a single zone). Before disconnecting the sampling probe and bottles from the MAGI, activate the shoe so it is extended out from the sampling probe and open the sampling port valve. The decontamination process includes the following:

- The equipment decontamination wash solution will consist of Liquinox (or equivalent) and store-bought distilled water. The equipment rinse solution will consist of store-bought distilled water. The wash and rinse process can be performed in clean 5-gallon plastic buckets.
- Ensure that all the valves between sample bottles are open. Separate the sample bottles from their end caps (valves and connection lines between sample bottles).
- Wash the Westbay sample bottles in the wash solution by using a brush to scrub the inside and outside of the sample bottle. The bottle should then be rinsed by pouring distilled water over the outside and through the inside of the sample bottle.
- Disconnect the sample bottle end caps (valves) from the connection lines. Swirl the end caps in the wash solution and use a dedicated wash squirt bottle to direct a spray of wash solution through the valve. Rinse with distilled water, including using a dedicated rinse squirt bottle to rinse the valve.
- Use a dedicated wash squirt bottle to direct a spray of wash solution through the connector line. Use a dedicated rinse squirt bottle to rinse the connector lines with distilled water. Inspect o-rings for damage or wear, and replace if necessary.
- The sampling probe should NOT be completely submerged in the wash solution. A scrub brush saturated in the wash solution may be used to scrub the exterior of the probe. The sample tool must be disconnected from the MAGI prior to cleaning. To clean the sample tool, use the dedicated wash squirt bottle to direct a spray of wash

solution through the sampling port of the extended shoe. The wash solution will run through the inside of the tool, and exit through the bottom of the sampling probe. Use the dedicated rinse squirt bottle to rinse the sampling probe with distilled water by directing a spray of distilled water through the sampling port of the extended shoe. Finally, rinse the exterior of the sampling probe with distilled water. Visually inspect the sampling port o-ring (seal) for damage or wear and replace as necessary to ensure a seal between the sample tool and sample port.

- 2.2 Following decontamination, the Westbay sampling probe and bottles should be either returned to the storage container, or assembled for additional sampling on a split PVC casing or other clean, level surface.
- 2.3 Reference the Westbay Operations Manual for complete instructions on care, storage, and use of the sampling probe and bottles. Among the details noted in the manual, it is extremely important that the sampling probe is NOT exposed to below freezing temperatures or the pressure transducer could be damaged.

APPENDIX B: QUALITY ASSURANCE PROJECT PLAN

TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	GENERAL APPROACH.....	1
1.1.1	Field Schedule.....	1
2.0	PROJECT DESCRIPTION.....	4
3.0	PROJECT ORGANIZATION AND RESPONSIBILITY.....	5
3.1	PROJECT MANAGER	5
3.2	FIELD TEAM LEADER	5
3.3	SITE HEALTH AND SAFETY OFFICER.....	6
3.4	LABORATORY PROJECT MANAGER	6
3.5	LABORATORY QUALITY ASSURANCE MANAGER	7
3.6	LABORATORY DIRECTOR	7
3.7	GENERAL PROJECT RESPONSIBILITIES.....	7
4.0	QA OBJECTIVES FOR MEASUREMENT DATA.....	9
4.1	DATA QUALITY OBJECTIVES	9
4.1.2	NON-CLP LABORATORY METHODS.....	10
4.2	QUALITY CONTROL PARAMETERS	10
5.0	SAMPLING PROCEDURES	13
5.1	INVESTIGATION DATA COLLECTION	14
5.1.1	Westbay MP System Sampling Procedures.....	14
5.1.2	Westbay Sampling Probe and Bottles Decontamination Procedures	18
5.1.3	Conventional Sample Collection Procedure (Well MWTP-MW-1).....	19
6.0	CHAIN-OF-CUSTODY RECORDS AND SAMPLE HANDLING	22
6.1	CHAIN-OF-CUSTODY RECORDs	22
6.2	SAMPLE HANDLING.....	23
6.2.1	Sample Containers	23
6.2.2	Sample Preservation.....	23
6.2.3	Sample Shipment	23
6.2.4	Sample Designation	24
6.3	LABORATORY SAMPLE DOCUMENTATION	25
7.0	ANALYTICAL PROCEDURES AND METHODS.....	27
8.0	CALIBRATION PROCEDURES AND FREQUENCY	29
8.1	FIELD CALIBRATION PROCEDURES	29
8.2	LABORATORY CALIBRATION PROCEDURES	30
8.3	GROUNDWATER ANALYTICAL PROCEDURES	32
9.0	DATA REDUCTION, VALIDATION, VERIFICATION AND REPORTING	33
10.0	QUALITY CONTROL CHECKS AND REQUIREMENTS.....	35
10.1	GROUNDWATER SAMPLE QUALITY CONTROL.....	35
10.2.1	Initial And Continuing Calibration	38
10.2.2	Preparation Blanks	38
10.2.3	Matrix Spike And Matrix Spike Duplicate Analyses	38
10.2.4	Surrogate Spike Standard Performance Evaluation.....	39
10.2.5	Calibration Check Compounds And Reagent Blanks.....	39
10.2.6	Quality Control Charts.....	39
10.3	ORGANIC ANALYSIS - GAS CHROMATOGRAPH.....	40
10.3.1	Initial Calibration Verification.....	40
10.3.2	Continuing Calibration Verification	40

10.3.3	Surrogate Spike Standard Performance Evaluation.....	40
10.3.4	Reagent Blank.....	40
10.3.5	Matrix Spike/Matrix Spike Duplicate Analyses	41
10.4	ORGANIC ANALYSIS - GAS CHROMATOGRAPH/MASS SPECTROMETERS	41
10.4.1	Tuning And GC/MS Mass Calibration	41
10.4.2	GC/MS Initial System Calibration.....	41
10.4.3	System Performance Check Compound Response	42
10.4.4	GC/MS Continuing System Calibration	42
10.4.5	Calibration Check Compounds.....	42
10.4.6	Surrogate Spike Standard Performance Evaluation.....	43
10.4.7	Internal Standard Performance Evaluation	43
10.4.8	Reagent Blanks And Matrix Spike/Matrix Spike Duplicate Analyses	43
10.5	METALS BY INDUCTIVELY COUPLED PLASMA	43
10.5.1	Initial And Continuing Calibration And Calibration Verification.....	44
10.5.2	Preparation Blank Analysis.....	44
10.5.3	ICP Interference Check Sample Analysis.....	44
10.5.4	Matrix Spike Sample Analysis.....	45
10.5.5	Duplicate Sample Analysis.....	45
10.6	METALS BY FURNACE ATOMIC ABSORPTION	45
10.7	GENERAL CHEMISTRY PARAMETERS	46
11.0	PERFORMANCE AND SYSTEM AUDITS.....	48
11.1	PERFORMANCE AUDITS	48
11.1.1	Laboratory Performance Audits.....	48
11.1.2	Field Performance Audits	48
11.2	SYSTEM AUDITS	49
11.2.1	Laboratory System Audits	49
11.2.2	Field System Audits.....	49
12.0	ASSESSMENT PROCEDURES FOR DATA ACCEPTABILITY.....	50
12.1	PRECISION.....	50
12.2	ACCURACY	50
12.3	COMPLETENESS.....	50
12.4	REPRESENTATIVENESS	51
12.5	COMPARABILITY.....	51
13.0	Preventive Maintenance Procedures And Schedules.....	52
13.1	GLASSWARE PREPARATION.....	52
13.2	ROUTINE PREVENTIVE MAINTENANCE	53
14.0	CORRECTIVE ACTION	54
14.1	FIELD CORRECTIVE ACTIONS.....	54
14.2	LABORATORY CORRECTIVE ACTIONS.....	55
15.0	QA REPORTS TO MANAGEMENT	56
16.0	DOCUMENTATION AND RECORDS KEEPING	57
16.1	PROJECT FILES MANAGEMENT	57
16.2	PROJECT FILES CATEGORIES	58
16.3	PROJECT COMPUTER FILES	58
16.3.1	Computer File Names	58
16.3.2	Computer File Backups.....	58
17.0	REFERENCES	59

TABLES

Table 1.1	Summary of Samples Collected During UF Aquifer Groundwater Monitoring
Table 1.2	Analytical Methods for Chemical Analyses
Table 4.1	Data Quality Objective Process for the UF Aquifer Monitoring Wells
Table 4.2	Groundwater Analyses and Quality Control Objectives
Table 7.1	Basic Quality Control Requirements for Level 3
Table 10.1	Field Collection Quality Assurance Requirements for UF Aquifer Groundwater Samples
Table 10.2	Surrogate Compounds and Acceptable Recoveries

1.0 INTRODUCTION

The Addendum to the Floridan Aquifer Monitoring Plan (the Addendum; GeoTrans 2006) outlines changes to the Floridan Aquifer Monitoring Plan required to characterize the Upper Floridan (UF) Aquifer using the updated conceptual model and data that generated by sampling a system of new UF Aquifer monitoring wells that were installed in 2005 and 2006.

The Site is located in Gainesville, Florida, approximately 90 miles northwest of Orlando. The Site encompasses 90 acres in an industrial and commercial area. Site location figures are provided in the Addendum and site geology, stratigraphy and conceptual model are discussed in the Addendum. A description of the site and background for work covered under this QAPP is also provided in the Addendum.

Under the Addendum, groundwater samples will be collected from a total of 21 monitoring wells. Sixteen of the wells have been installed and five are proposed. Fourteen of the 16 existing wells are equipped with 4-port Westbay multiport sampling systems, for a total of 56 samples. Wells FW-4 and MWTP-MW-1 are not equipped with a Westbay system; a single sample will be collected from this well. The five proposed wells will each be equipped with 4-port Westbay systems; when they are installed, a total of 20 samples will be collected from these wells. Table 1.1 provides a list of all sample locations (including proposed wells) and the number of samples (exclusive of QA/QC samples) to be collected at each location and Table 1.2 outlines the analytical methods for the physical and chemical analyses.

1.1 GENERAL APPROACH

Groundwater samples will be collected from the designated wells at the specified sampling frequency in the Addendum to evaluate water quality and direction of groundwater flow in the UF Aquifer. Data generated during the monitoring program will be used to confirm or revise the present Site conceptual model. Information gathered during the monitoring program will also be used to provide “sentry” information for the McMurphree Wellfield, in the unlikely event that constituents are detected above Federal MCLs or State GTCLs that may eventually impact groundwater extracted by the wellfield.

1.1.1 FIELD SCHEDULE

Field work is ongoing with quarterly sample collection and groundwater treatment. The schedule for installation of the single proposed additional UTZ well and four proposed LTZ wells described in the Addendum is dependant upon EPA approval of the well designs and locations. Well installation is anticipated to be completed by late 2006 to early 2007.

TABLE 1.1

**SUMMARY OF SAMPLES COLLECTED DURING UF AQUIFER
GROUNDWATER MONITORING**

SAMPLE LOCATION/WELL	TOTAL NO. OF SAMPLE PORTS/NUMBER OF SAMPLES COLLECTED
FW-10B	4 groundwater
FW-11B	4 groundwater
FW-12B	4 groundwater
FW-13B	4 groundwater
FW-14B	4 groundwater
FW-15B	4 groundwater
FW-16B	4 groundwater
FW-17B	4 groundwater
FW-18B	4 groundwater
FW-19B	4 groundwater
FW-20B	4 groundwater
FW-21B	4 groundwater
FW-22B	4 groundwater
FW-23B	4 groundwater
FW-24B (proposed)	4 groundwater
FW-4C (proposed)	3 groundwater
FW-22C (proposed)	3 groundwater
FW-23C (proposed)	3 groundwater
FW-24C (proposed)	3 groundwater
FW-4	1 groundwater
MWTP-MW-1	1 groundwater
Total Number of Groundwater Samples = 74	

TABLE 1.2

ANALYTICAL METHODS FOR CHEMICAL ANALYSES

GROUNDWATER TEST DESCRIPTION	ANALYTICAL METHOD
Volatile Organic Compounds (VOCs)	EPA 8260B
Semivolatile Organic Compounds (SVOCs)	EPA 8270
Pentachlorophenol (PCP)	EPA 8270 (SIM)
Noncarcinogenic Polyaromatic Hydrocarbons (PAHs)	EPA 8270
Potentially Carcinogenic PAHs	EPA 8270 (SIM)
Dissolved Metals (Arsenic, Chromium, Copper, Zinc)	EPA 6020

SIM = Selective Ion Monitoring.

2.0 PROJECT DESCRIPTION

The Addendum was prepared to address UF Aquifer groundwater monitoring. Site history, physical layout, geology, hydrogeology, conceptual model and various regulatory determinations are provided in the text of the Addendum and in numerous other documents and are not provided as part of this QAPP.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The following sections detail the responsibilities of key personnel in implementation of the Addendum at the Cabot Carbon/Koppers Superfund Site in Gainesville, Florida. Depending on the extent of the work, any one individual may fill two or more of the positions described below.

All personnel, including subcontractors, will have the required training, physical screening and certification before entering the Site or working on the project at off-Site locations. It is the responsibility of site personnel to be aware of the required certifications and to stay current with monitoring and educational programs. Personnel eligibility to work at the Site will be verified before the work commences.

3.1 PROJECT MANAGER

The Project Manager will be the primary point of contact and will have the primary responsibility for technical, financial and scheduling matters for this investigation. Duties will include:

- Procurement, along with administrative personnel, and supervision of subcontractor services including review of subcontract work and approval of subcontract invoices.
- Assignment of duties to the project staff and orientation of the staff to the needs and requirements of the project as they relate to the project objectives.
- Project scheduling.
- Establishment and maintenance of a project recordkeeping system.
- Review of all major project deliverables for technical accuracy and completeness.
- Project closeout.
- Responsibility for the project file.

3.2 FIELD TEAM LEADER

The Field Team Leader will be responsible for field activities and data evaluation, including items as follows:

- Supervising the collection of the samples and providing for their proper documentation, handling and shipment.
- Coordinating field-related activities with the Project Manager.
- Preparing and reporting the field investigation data for evaluation procedures.
- Verifying that the project-specific objectives and the Health and Safety Plan (HSP) are reviewed with all potential onsite personnel.
- Maintaining communications between the Field Team Leader and the Project Manager.
- Scheduling and maintaining a field services crew to perform project-specific requirements in a time- and cost-efficient manner.

- Preparing field sampling procedures and documentation in accordance with the appropriate guidance documents (EPA, 1996)
- Inspecting supplies and consumables as they arrive onsite.

3.3 *SITE HEALTH AND SAFETY OFFICER*

The Site Health and Safety Officer (SHSO) will be responsible for verifying that project personnel adhere to the site safety requirements. These responsibilities include:

- Conducting the health and safety training for project personnel and subcontractors, as appropriate.
- Modifying health and safety equipment or procedure requirements based on data gathered during the site work.
- Determining and posting locations and routes to medical facilities, including poison control centers, and arranging for emergency transportation to medical facilities.
- Notifying local public emergency officers, i.e., police and fire departments, of the nature of the field operation and posting their telephone numbers.
- Observing work party members for symptoms of exposure or stress.
- Providing first aid if necessary onsite.
- Performing site audits to verify adherence to the requirements of the project Health and Safety Plan.

The SHSO has the authority to stop any operation that threatens the health or safety of the team or surrounding populace. The daily health and safety activities may be conducted by the SHSO or his designee.

3.4 *LABORATORY PROJECT MANAGER*

The Laboratory Project Manager will be responsible for:

- Validating or assigning a designee who is independent of the analyst and the project to validate the data packages using review methods described in Section 9.0.
- Final review of the data package to ensure data is transcribed correctly and a complete and correct data package is reported to the user.

3.5 *LABORATORY QUALITY ASSURANCE MANAGER*

The Laboratory Quality Assurance (QA) Manager is responsible for laboratory audits and monitoring adherence to the laboratory QA objectives. The Laboratory QA Manager acts independently of the personnel performing analyses. His responsibilities include:

- Writing, maintenance, and implementation of laboratory analysis SOPs.
- Review of site-specific QAPP for laboratory analytical requirements.
- Conducting laboratory performance and system audits on a monthly and quarterly basis, respectively.
- Initiating system corrective actions and review whether corrective action taken appropriately resolved the problem.

3.6 *LABORATORY DIRECTOR*

The Laboratory Director is ultimately responsible for all aspects of the analytical services provided for this project including the production of analytical reports and the scheduling and maintenance of an ample working staff and equipment to perform the laboratories duties for this project in a timely and cost-efficient manner. Responsibilities of the Laboratory Director include:

- Collaborating with the project management in establishing analytical programs.
- Serving as liaison between the laboratory and other project personnel.
- Serving as the "collection point" for reporting of nonconformances and changes in laboratory activities, which are then reported to project management.
- Maintaining and releasing laboratory testing data and results.
- Responsibility for laboratory and data activities by the analytical services staff.

3.7 *GENERAL PROJECT RESPONSIBILITIES*

The Laboratory Director and Field Team Leader are responsible for the effective day-to-day management of their respective staffs as well as direct communication and liaison with the client. Their specific QA function is to oversee all project procedures and quality assurance/quality control (QA/QC) procedures required by site-specific objectives as described in the associated workplan.

The Section Managers and Supervisors are responsible for the provisions of consistent and accurate laboratory data and technical reports produced by the personnel under their supervision. These individuals are responsible for ensuring that all personnel under their direction are knowledgeable of the QA/QC requirements of the specific projects and their organization.

It is the responsibility of the laboratory analysts and field team members to perform all required QC checks to ensure that each batch of data being generated passes all required QC criteria. Individual field team members must bring any unusual observation or analytical problem to the immediate attention of the Field Team Leader or Supervisor.

4.0 QA OBJECTIVES FOR MEASUREMENT DATA

4.1 DATA QUALITY OBJECTIVES

The data quality objective (DQO) process is a strategic planning approach based on scientific methods to prepare data collection activities. It is a systematic approach for defining the pertinent criteria for a sampling program including:

- Where to collect samples.
- How to collect samples.
- Tolerable levels of decision errors.
- How many samples to collect.

Thereby, the DQO process ensures that the type, quantity and quality of environmental data used to evaluate the attainment of the remediation standards are appropriate for the intended use.

The development of the DQOs is based on the intended use of the data. Listed below are the four primary data quality levels and the respective data uses:

- DQO Level 1 – Initial Site Characterization and/or Monitoring During Remedy Implementation.
- DQO Level 2 – Site Characterization and Evaluation of Remedial Alternatives.
- DQO Level 3 – Data Collection for Risk Assessment and Potentially Responsible Party (PRP) Determination.
- DQO Level 4 – Data Collection for Litigation/Enforcement Activities.

The DQO process consists of seven steps. The DQO process for the Site is shown in Table 4.1.

The output from each step influences the items in the following steps:

- Step 1: State the problem to be resolved.
- Step 2: Identify the decision(s) or question(s) the data will be used to resolve and what actions will result.
- Step 3: State the inputs or list of variables to be measured and other supporting information needed to answer the questions posed in Step 2.
- Step 4: Define the boundaries of the study/remediation area including the population of interest, and the spatial and temporal limits.
- Step 5: Develop the decision rule(s) including test hypothesis and a quantitative statement on how data will be used to make the decision.
- Step 6: Develop acceptable uncertainty constraints for the decision process including false positive and false negative decision error rates.

- Step 7: Optimize the design within the constraints of project goals.

No level I, II or IV procedures are planned for this project. Field determinations of pH, specific conductance, and temperature are required by the Addendum only for conventionally sampled wells to determine adequate well stabilization (most wells addressed under the Addendum are equipped with Westbay sampling systems and do not require purging and therefore, field parameter monitoring). As such, these field parameters will not be counted as part of a field analysis procedure typically performed by a mobile laboratory. The following section describes the use of the analytical level selected for this investigation.

4.1.2 NON-CLP LABORATORY METHODS

Level III analysis will be performed for those parameters where Contract Laboratory Program (CLP) methods are not available or in cases where the rigid CLP reporting is not necessary to accomplish the immediate objective. Level III data provide precise, accurate, and defensive data suitable to meet the data objectives for this project.

4.2 *QUALITY CONTROL PARAMETERS*

The quantitative criteria used to determine data quality are presented in Table 4.2. The following is a brief description of the terms which appear in these tables:

- Reference: The reference of the EPA-approved standard analytical methodology used for each procedure.
- Precision: A measure of the mutual agreement among individual measurements of the same property under prescribed similar conditions. Precision is evaluated based on the relative percent difference (RPD) of duplicate matrix spikes or samples, as appropriate. The matrix spike duplicate RPDs are parameter- and method-specific. Duplicate sample RPDs are typically 30 percent for aqueous media. The method of calculation for RPD is defined in Section 12.1.
- Accuracy: The degree of agreement of a measurement with an accepted reference or true value. Accuracy is evaluated based on the percent recovery of spiked samples. The matrix spike recoveries for organic analyses are method- and parameter-specific and are typically used as an advisory QA/QC measure due to the difficulty associated with recovering spiked organic parameters. The method of calculation for percent recovery is defined in Section 12.2.
- Completeness: A measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under normal conditions. The method of calculation for percent completeness is defined in Section 12.3. Results of the

analyses to be performed will be used for site characterization and as such will have a minimum completeness of 90 percent.

The Addendum is designed to ensure that analytical data obtained represents current conditions found at the Site and will produce data of comparable quality. Sample locations were selected to ensure data are suitable for their intended use and adequately characterize the site and screen appropriate remedial technologies and collection mechanisms are designed to produce comparable data. Additionally, standard recognized analytical methodologies will be utilized to ensure comparability. These specifications have been instituted to ensure sample representativeness and data comparability.

TABLE 4.1**DATA QUALITY OBJECTIVE PROCESS
FOR THE UF AQUIFER MONITORING WELLS**

DQO STEP	WORKPLAN ELEMENT
Statement of the problem.	<ul style="list-style-type: none">• Determine groundwater flow direction and evaluate groundwater quality in the Upper Floridan Aquifer.
Identify the decisions the data will be used to resolve.	<ul style="list-style-type: none">• What is the direction of groundwater flow?• What is the water quality in the Upper Floridan Aquifer?
State the variables to be measured.	<ul style="list-style-type: none">• Concentrations of ROD Constituents of Interest⁽¹⁾ in the Upper Floridan Aquifer.• Water levels or piezometric pressure in the monitoring wells.
Define the boundaries of the study area including spatial and temporal limits.	<ul style="list-style-type: none">• The boundaries of the study area include the KII site boundaries, downgradient wellfields and nearby adjacent areas.• The measurements will reflect current conditions, although they are assumed to be reflective of the recent past, particularly for water level.
Decision rules.	<ul style="list-style-type: none">• The groundwater quality must show no impact from concentration of the Constituent of Interest at or below Federal MCLs or State GTCLs..• Water levels must demonstrate a pattern so that groundwater flow direction and gradient can be determined.
Uncertainty constraints for the decision process.	<ul style="list-style-type: none">• Unknown potential for offsite sources that may contribute contaminants to the intermediate aquifer.• Laboratory artifacts may influence data quality and decision making.
Optimize design with constraints of the project goals.	<ul style="list-style-type: none">• See Section 5.0.

TABLE 4-2
GROUNDWATER ANALYSES AND QUALITY CONTROL OBJECTIVES

Parameter	EPA Method	Detection Limit (µg/L)	Accuracy (%)	Precision (%)	Completeness (%)	Type of Container	Preservative	Analytical Holding Time	Remarks
Phenols									
2,4-Dimethylphenol	8270	5.0 µg/L	35-88	±30	90	Two 1 liter amber	None; cool to 4°C	7 days to extract; 40 days after extraction	Three one liter amber vessels are required for both phenols and PAHs.
2-Methylphenol		5.0 µg/L	36-116						
3&4-Methylphenol		1.0 µg/L	46-109						
Pentachlorophenol		1.0 µg/L	26-158						
Phenol		2.0 µg/L	28-91						
PAHs									
2-Methylnaphthalene	8270 (SIM)	5.0 µg/L	36-124	±30	90	Two 1 liter amber	None; cool to 4°C	7 days to extract; 40 days after extraction	Three one liter amber vessels are required for both phenols and PAHs.
Acenaphthene		5.0 µg/L	51-126						
Acenaphthylene		5.0 µg/L	56-131						
Anthracene		5.0 µg/L	54-117						
Benzo(a)anthracene		MDL	55-132						
Benzo(a)pyrene		0.2 µg/L	51-141						
Benzo(b)fluoranthene		MDL	43-135						
Benzo(g,h,i)perylene		5.0 µg/L	36-157						
Benzo(k)fluoranthene		MDL	57-137						
Carbazole		1.0 µg/L	70-130						
Chrysene		1.0 µg/L	55-134						
Dibenzo(a,h)anthracene		MDL	41-144						
Dibenzofuran		5.0 µg/L	53-129						
Fluoranthene		5.0 µg/L	52-128						
Fluorene		5.0 µg/L	55-126						
Indeno(1,2,3-cd)pyrene		0.05 µg/L	30-172						
Naphthalene		5.0 µg/L	40-110						
Phenanthrene		5.0 µg/L	54-128						
Pyrene		5.0 µg/L	53-128						
VOCs									
Benzene	8260B	0.5 µg/L	72-124	±30	90	Three 40-mL VOA	Acidify to pH<2 with HCl	14 days	
Toluene		0.5 µg/L	86-119						
Ethylbenzene		0.5 µg/L	87-122						
Xylene		0.5 µg/L	80-121						
Metals									
Arsenic, total and dissolved	6020	0.5 µg/L	80-120	±30	90	100 ml poly	Acidify to pH<2 with NO ₃		Metals samples require total and dissolved (filtered and unfiltered). Filtration to be performed in the field.
Chromium, total and dissolved		2.0 µg/L	80-120						
Copper, total and dissolved		2.0 µg/L	80-120						
Zinc, total and dissolved		40 µg/L	80-120						

5.0 SAMPLING PROCEDURES

Implementation of the Addendum will be performed according to the standards set forth by the EPA Region IV Environmental Investigation Standard Operating Procedures and Quality Assurance Manual (EPA, 1996) or other approved industry-accepted and/or regulatory standards

5.1 INVESTIGATION DATA COLLECTION

Implementation of the Addendum will include groundwater and piezometric data collection and evaluation activities. Wells FW-10B through FW-24B, FW-4C and FW-22C through FW-24C (including proposed new wells) will be sampled using procedures for the Westbay system.

The Westbay MP System is a multi-level sampling system that allows discrete groundwater samples to be collected from multiple intervals within a single well. Each interval is isolated with the use of packers to seal the well annulus between the monitoring zones. Each monitoring interval contains a measurement port and a pumping port. Sampling should be performed only by a qualified individual trained in the operation of the Westbay sampling system.

Well MWTP-MW-1 is a conventionally completed well and will be sampled by conventional methods. Procedures to be used in performing Westbay sampling and decontamination and conventional sampling, with the proposed laboratory analyses, are discussed below.

5.1.1 WESTBAY MP SYSTEM SAMPLING PROCEDURES

Procedures defined in this section and in Section 5.1.2 are also presented in the Addendum Standard Operating Procedures.

1. The sampling procedures outlined in this section are the same for each monitoring zone in every well. Within each monitoring interval, a measurement port is installed as part of the MP System. The measurement ports incorporate a valve in the wall of the coupling, with an alignment notch on the opposite, inside wall of the coupling.
2. The Westbay sampling probe (currently the MOSDAX Sampler Probe Model 2531), the Westbay MOSDAX Automated Groundwater Interface (MAGI), Westbay sample bottles, and laboratory supplied sample bottles are required to perform the sampling.

3. Review Westbay's as-built well diagrams to determine the depths of each monitoring zone and associated measurement ports for the well being sampled.
4. Assemble the tripod and wireline cable reel above the well, and attach the evacuation port coupling to the top of the MP System. Designate a location with a clean stable surface for handling the sample bottle string such that the bottles do not come in contact with the ground surface.
5. Using new disposable gloves, assemble the sample bottles (maximum of 4) using the wrenches provided in the Westbay kit to snug the connections between the sample bottles and the connector tubing. Confirm that the o-rings on the connector tubing are present and intact. Replace o-rings if necessary. Using the valve tool, close the valve on the bottom sampling tube, and open the valves between each bottle.
6. The sample bottles can now be attached to the sampling probe. The MAGI also needs to be connected to the sampling probe. Lastly, attach the MAGI to the battery source by clipping the red lead to the positive battery terminal and the black lead to the negative battery terminal. NOTE: It is important to connect the sampling probe to the MAGI prior to connecting the MAGI to the power source to avoid the potential for an electric shock to the sampling technician or an electrical surge to the MAGI.
7. The sampling probe and bottles are now ready to be placed in the well. Ensure the cable reel brake is on, and there is adequate slack in the wireline cable to maneuver the sampling train into the well without kinking the cable. Using the MAGI, activate the location arm on the sampling probe so it is in the extended position (the MAGI display should indicate 15 to 16 revolutions). Carefully lift the sampling train into the well, paying special attention to the connection between the wireline and sampling probe so as not to kink the wireline. Lower the sample bottles and probe until the location arm is firmly seated in the alignment notch of the evacuation collar.
8. Remove the slack from the wireline cable, and zero the reel counter.
9. With the sampling probe seated in the evacuation collar, the following Westbay surface function checks must be performed and recorded on the groundwater sampling form:

Record the ambient pressure indicated by the MAGI. This pressure reading is required once per well, unless the well is being sampled over multiple days, in which case the ambient pressure should be recorded at the start of sampling on subsequent days.

- Activate the shoe. The shoe should extend and the MAGI display should indicate 16 to 19 revolutions (23 revolutions in open air outside of the evacuation collar).
 - Close the sampler valve. The motor should run for approximately 5 seconds, and the MAGI display will indicate 1 revolution.
 - Attach the vacuum pump to the fitting on the vacuum coupling. Note the pressure reading on the MAGI. Begin applying a vacuum with the vacuum pump. The MAGI display should maintain a constant pressure. If the pressure reading begins decreasing, inspect for leaks at the face seal of the probe, the connection to the pump, and the connection at the probe sampling valve. Repeat procedure as necessary to ensure seals and connections are secure.
 - Open the sampler valve.
 - Use the vacuum pump to apply a vacuum to the sample bottles. The vacuum should be applied until the pressure inside the sample bottles is below 4 pounds per square inch (psi) as displayed on the MAGI.
 - Close the sampler valve. A vacuum has now been applied to the sample bottles.
 - Retract the shoe.
 - Confirm the cable reel brake is on and the reel counter has been zeroed. Retract the location arm.
10. The sampling probe and bottles can then be lowered into the MP System well. The sampling train should be lowered to the approximate sample depth, until the MAGI beeps indicating the sampling probe has reached the magnetic reference installed on the MP System (note that the beep system is not always reliable, so the depth readings should be monitored). Raise the sampling probe approximately 3 feet to ensure the sampling probe location arm is above the measurement port.
11. The location arm should then be activated, and the sampling probe and bottles can be lowered until the location arm is secured in the measurement port alignment notch. The depth on the wireline reel counter should be checked against the Westbay as-built well diagram to verify the sample probe and bottles are at the correct measurement port.
12. When the sample probe and bottles are located at the correct measurement port, the following steps are required, including recording data on the groundwater sampling form:

- Tighten the brake on the cable reel.
 - Record the pressure reading inside the casing as displayed on the MAGI.
 - Activate the shoe, noting that a pressure change on the MAGI display should occur indicating a connection with the formation when the shoe is fully extended.
 - Record the pressure reading of the formation as displayed on the MAGI.
 - Open the sampler valve. NOTE: the pressure displayed on the MAGI will jump to a significantly lower reading due to the vacuum applied to the sample bottles. The pressure will then begin to climb as the sample bottles are filled with groundwater.
 - Allow the sample bottles to fill with groundwater until the pressure displayed on the MAGI is the same as the formation pressure noted prior to opening the sampler valve. NOTE: The Westbay MOSDAX Sampler Probe Model 2531 pressure transducer has a reported accuracy of ± 0.25 %.
 - Close the sampler valve.
 - Retract the shoe.
 - Record the pressure reading inside the casing as displayed on the MAGI. The pressure reading should be similar to the original casing pressure recorded prior to activating the shoe.
 - Ensure there is no slack in the wireline cable, and the cable reel brake is applied. Retract the location arm, and retrieve the sample probe and bottles.
13. When the sampling probe reaches the top of the MP System, activate the location arm and seat the probe in the alignment notch of the evacuation coupling. Provide adequate slack in the cable so the probe will reach the designated bottle handling area without kinking the cable.
14. Paying special attention not to kink the wireline cable at the connection to the sampling probe, remove the sample probe and bottles from the well and lay out the unit on a split PVC casing or other clean, level surface.
15. Close each of the valves connecting the sample bottles. Each of the bottles can then be separated from the sampling train.
16. The sample bottles can then be used to fill laboratory-prepared sample containers. Hold the sample bottle vertically over the laboratory sample container, with the top of the bottle pointed away from the sampler's face. Slowly open the top valve to release the pressure

from within the bottle. Close the top valve once the pressure has been released. The bottom valve can then be opened and the groundwater can be directed into the laboratory container.

17. Ice should be present during each sampling event, and samples are to be placed in a cooler with ice immediately after the samples are transferred from the Westbay bottles to the laboratory supplied bottles. In the event a laboratory bottle is only partially filled with the sample collected on a particular run, the laboratory bottle should be closed and placed in a cooler with ice until subsequent runs with the Westbay sampling probe and bottles are performed to complete the sample collection.
18. In the event multiple runs with the Westbay sampling probe and bottles are required to collect the full sample volume from a particular monitoring zone, the Westbay sampling equipment does not need to be decontaminated between runs. Each run with the sampling probe and bottles should be recorded and performed as described above in Sections 1.6 and 1.9.
19. Each sample will be appropriately labeled, logged on the chain-of-custody, and packaged in a cooler with ice for delivery to the laboratory.

5.1.2 WESTBAY SAMPLING PROBE AND BOTTLES DECONTAMINATION PROCEDURES

1. The Westbay sampling probe and bottles must be decontaminated prior to moving between each monitoring zone (but not for multiple use within a single zone). Before disconnecting the sampling probe and bottles from the MAGI, activate the shoe so it is extended out from the sampling probe and open the sampling port valve. The decontamination process includes the following:
 - The equipment decontamination wash solution will consist of Liquinox (or equivalent) and store-bought distilled water. The equipment rinse solution will consist of store-bought distilled water. The wash and rinse process can be performed in clean 5-gallon plastic buckets.
 - Ensure that all the valves between sample bottles are open. Separate the sample bottles from their end caps (valves and connection lines between sample bottles).

- Wash the Westbay sample bottles in the wash solution by using a brush to scrub the inside and outside of the sample bottle. The bottle should then be rinsed by pouring distilled water over the outside and through the inside of the sample bottle.
 - Disconnect the sample bottle end caps (valves) from the connection lines. Swirl the end caps in the wash solution and use a dedicated wash squirt bottle to direct a spray of wash solution through the valve. Rinse with distilled water, including using a dedicated rinse squirt bottle to rinse the valve.
 - Use a dedicated wash squirt bottle to direct a spray of wash solution through the connector line. Use a dedicated rinse squirt bottle to rinse the connector lines with distilled water. Inspect o-rings for damage or wear, and replace if necessary.
 - The sampling probe should NOT be completely submerged in the wash solution. A scrub brush saturated in the wash solution may be used to scrub the exterior of the probe. The sample tool must be disconnected from the MAGI prior to cleaning. To clean the sample tool, use the dedicated wash squirt bottle to direct a spray of wash solution through the sampling port of the extended shoe. The wash solution will run through the inside of the tool, and exit through the bottom of the sampling probe. Use the dedicated rinse squirt bottle to rinse the sampling probe with distilled water by directing a spray of distilled water through the sampling port of the extended shoe. Finally, rinse the exterior of the sampling probe with distilled water. Visually inspect the sampling port o-ring (seal) for damage or wear and replace as necessary to ensure a seal between the sample tool and sample port.
2. Following decontamination, the Westbay sampling probe and bottles should be either returned to the storage container, or assembled for additional sampling on a split PVC casing or other clean, level surface.
 3. Reference the Westbay Operations Manual for complete instructions on care, storage, and use of the sampling probe and bottles. Among the details noted in the manual, it is extremely important that the sampling probe is NOT exposed to below freezing temperatures or the pressure transducer could be damaged.

5.1.3 CONVENTIONAL SAMPLE COLLECTION PROCEDURE (WELL MWTP-MW-1)

Well MWTP-MW-1 is a conventional monitoring well and is not equipped with a Westbay system. As such, this well will be sampled using conventional methods. A list of basic

equipment required for sampling this well is provided below (Site-specific conditions may warrant the addition or deletion of some equipment):

- pH meter
- Conductivity meter
- Field logbook/well sampling forms
- Large capacity DOT-approved containers for investigation-derived waste containment (if required)
- A decontaminated or dedicated submersible pump with power source

The following general sampling procedures will be followed:

- The static water level in the well will be determined to calculate the amount of standing water in the well (well volume). The water level, well total depth, well diameter and calculated well volume will be recorded.
- Well purging will be initiated using a submersible pump, bailer or other approved device. During conventional purging, field water quality parameters including pH, temperature and conductivity will be measured and recorded. Odors, water color and other observations will be recorded on a well sampling form. Water will be withdrawn from the well until at least three well volumes have been removed and three successive measurements of field water quality vary by less than 10 percent. Alternatively, low-flow sampling may be performed in accordance with procedures specified in the Floridan Aquifer Monitoring Plan (TRC, June 2004).
- After the purging criteria have been satisfied, all well development apparatus will be removed from the well followed by decontamination of the apparatus and probes.
- If a bailer is used to collect the samples a disposable or decontaminated should be lowered to the middle of the screen in the monitoring well and withdrawing it slowly through the water column. Clean nylon rope will be used. If this is not feasible, a submersible pump will be used to collect the samples.
- Vials for volatile organic compounds are to be filled first, directly from the bailer. Sample containers will be filled so that no headspace is present after the cap is attached.
- Samples to be analyzed for dissolved metals will be filtered after the sample is collected. The filtered sample will be placed in a new clean container.

Each sample will be appropriately labeled and logged on to the chain-of-custody sheet and placed in an iced chest for delivery to the laboratory.

6.0 CHAIN-OF-CUSTODY RECORDS AND SAMPLE HANDLING

The primary objective of sample custody is to create an accurate written verified record, which can be used to trace the possession and handling of the samples from the moment of collection through data analysis and reporting. A sample is under a person's custody if:

- It is in that person's possession.
- It is in that person's view, after being in that person's possession.
- It was in that person's possession and that person locked it up and maintains access control.
- It is in a designated secure area.

6.1 CHAIN-OF-CUSTODY RECORDS

A Chain-of-Custody record will be used as physical evidence to document sample custody. The Chain-of-Custody record provides the means to identify, track, and monitor each individual sample from the point of collection through final data reporting. A Chain-of-Custody record will be required for each shipment of samples. In addition, the sampler will designate which samples are to be used for laboratory QA/QC purposes. Corrections will consist of line-out deletions that are initialed and dated; erasures or "white-out" will not be permitted. The following information will appear on the Chain-of-Custody record:

- Project name and identification number.
- Name of site.
- Sampling location(s) and identification number(s).
- Sampling dates and times for samples.
- Number of samples.
- Number of sample containers.
- Analyses requested.
- Sample preservation (other than cooling to 4°C).
- Name of laboratory.
- Signature of sampler.

The sampler will complete a Chain-of-Custody record to accompany each sample shipment from the field to the laboratory. After completion of the Chain-of-Custody record, one copy will be placed in a plastic bag and secured in the cooler and one copy will be retained by the sampler for the project file. The courier's signature is not required on the Chain-of-Custody form if samples are in sealed coolers with custody seals and the Chain-of-Custody form is placed inside the cooler.

The laboratory representative who accepts the incoming sample shipment will inspect the samples and documents and immediately report discrepancies or damaged samples, labels, etc. to the Project Manager and will sign and date the Chain-of-Custody record to acknowledge receipt of samples. This signed copy will be returned with the analytical reports.

6.2 *SAMPLE HANDLING*

6.2.1 *SAMPLE CONTAINERS*

Sampling kits will be provided to the Field Team Leader by the laboratory. The Project Manager or designee will be responsible for ordering sampling kits for the duration of the project. Sampling kits will be shipped directly to the Site prior to the start of each sampling event.

Upon arrival, designated personnel will check each shipment to verify that the correct number and type of containers have been shipped and received. The sample custodian will be notified if discrepancies exist between the sample shipment and sample order. The sampling kits will be enclosed in coolers, and will include the appropriate sample containers, Chain-of-Custody record forms, appropriate shipping blanks and field blanks (using “store-bought” distilled water). Completed sampling kits will be returned to the sample custodian by the field sampler after the samples have been collected.

Each sample container will be individually labeled. Clear plastic tape will be placed over each completed label to protect it from damage. The field team leader will assure that each box of sample containers has its appropriate certificate from the supplier.

6.2.2 *SAMPLE PRESERVATION*

Sample preservation requirements are specified in Table 4.2 for each type of analysis to be performed. The field team leader will assure that the appropriate equipment for sample preservation is available in the field and that proper documentation of preservation has been made in the field sampling logbook.

6.2.3 *SAMPLE SHIPMENT*

Samples will be packed in the following manner for shipment:

- Each sample container will be wrapped in bubble pack or other packing material, placed in separate, sealable plastic bags, and then placed in an ice chest precooled to 4° C with ice or Blue Ice® packages, either of which must be double-bagged.
- The completed Chain-of-Custody record going to the laboratory will be placed in a sealable plastic bag, which will then be placed in the cooler.
- The cooler lid will then be taped shut with strapping/packaging tape.
- A custody seal will be completed, signed and attached to the lid and the front of the cooler for hinged coolers. Two custody seals will be attached to coolers with removable lids. One will be attached to the front and one to the back of these coolers. A label will be filled out and attached to each cooler.
- The coolers will be hand-delivered or shipped via overnight carrier, while maintaining Chain-of-Custody, to the laboratory at the end of each day's sampling.

The field team leader will check each sample shipment to assure proper labeling, packaging and documentation.

6.2.4 SAMPLE DESIGNATION

As outlined in the Addendum, the primary purpose of the field investigation activities is to further evaluate groundwater quality and movement in the Upper Floridan Aquifer.

The primary field activities to be conducted include:

- Installation of five new groundwater monitoring wells, to be completed in the Upper Floridan Aquifer, as described in the Addendum.

The sampling efforts to be used in support of these field activities will incorporate the following strategies:

- Follow appropriate protocols in the Health and Safety Plan to minimize exposure to potentially contaminated media.
- Follow labeling protocols for each sample collected. Each sample will be labeled according to the well name, followed by the sample zone. For example, zone 3 in well FW-22B will be identified as FW-22B-3. Quality control samples that are generated in the field will be assigned a

“dummy” identifier that cannot be identified by the laboratory from investigative samples. The identifier used for the quality control samples will be recorded in the field notes as the sample is processed.

- Place samples in laboratory-certified clean receptacles.
- Adhere to field sample collection and handling procedures as described herein, and supported by QC measures outlined in this document.
- Follow sample packaging and Chain-of-Custody protocols to assure that samples which may be analyzed are delivered to the laboratory and stored appropriately. Detailed protocols are provided in Section 6.1

6.3 *LABORATORY SAMPLE DOCUMENTATION*

Upon arrival at the laboratory, samples will be logged in using the following procedures:

- Sample containers will be examined to verify whether the shipping container seals are intact or broken. Containers with broken seals will not be accepted for analysis.
- Coolers will be opened and determined if proper temperature has been maintained during shipment. The temperature upon receipt is recorded on the Chain-of-Custody Record.
- If samples have been damaged during shipment, the remaining samples shall be carefully examined to determine whether they were affected. Any samples affected shall also be considered damaged. It will be noted on the Chain-of-Custody Record that specific samples were damaged and that the samples were removed from the sampling program. Field personnel will be notified as soon as possible that samples were damaged and that they must be resampled, if possible.
- The samples received will be compared against those listed on the Chain-of-Custody Record and verified that sample holding times have not been exceeded. Results from analyses performed after the given time period may be considered suspect.
- The person doing the check-in will then sign and date the Chain-of-Custody Record and attach any waybill to the Chain-of-Custody Record.

Upon verification of sample receipt at the laboratory, a unique laboratory identification number will be assigned to the sample. This assignment of a different sample identification serves two purposes. First, it places sample identifications into a uniform format for tracking. Second and most important, the separate identification ensures samples anonymity to the analyst of the sample's site and potential identification of field QC samples.

Once samples have been logged in and transferred to the proper storage areas, the laboratory department manager is responsible for their proper storage and condition.

Each affected laboratory department manager is given Laboratory Sample Chronicles, which lists the laboratory sample identification, sample matrix, parameters for analysis, and required completion date. These forms are used to document sample custody while the samples are in-house. All Chain-of-Custody Records and Sample Chronicles are typically kept on file by the Laboratory Quality Assurance Manager.

Copies of the completed Chain-of-Custody Records and an analysis narrative presenting laboratory sample identifications and their correlating field assigned sample identifications will be included in the data package for delivery to the data user.

7.0 ANALYTICAL PROCEDURES AND METHODS

All analyses will be performed using analytical procedures from either the latest edition of EPA's *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, Third Edition*, incorporating any applicable latest available updates, "Methods for Chemical Analysis of Water and Wastes," March, 1983 (EPA-600/4-79-020), or American Standard Testing Methods (ASTM). The exact analytical procedures suggested to be used are referenced in Section 1.0, Table 1.3, and Section 4.0, Table 4.2. All analyses will be performed by a certified or approved analytical laboratory capable of providing quality and reliable data via the data quality objectives stated in the work plans. All procedures for environmental sample analysis, handling, storage, preparation, documentation while in the laboratory's custody, and deliverable requirements will be followed by the investigation contractor's personnel, as stated in the laboratory's SOPs or QA manual.

Summaries of the analytical procedures for groundwater, the analytical QA control limits, and the detection limits to be used for the listed parameters are presented in Table 4.2.

The minimum QA/QC deliverables for groundwater analyses are indicated as follows:

- Case Narrative
- Sample Analysis Receipt
- Sample Cross Reference (if required)
- Chain-of-Custody Records
- Analysis Report
 - Preparation and Analysis Run Logs
 - Raw Data and Chromatograms
- QC Summary
 - Minimum Detection Limit Summary
 - Initial Calibration Data
 - Detailed QA/QC Data
 - Corrective Action Reports

Once a laboratory is selected, representative examples of the QA/QC documentation will be provided in the final laboratory report. Table 7.1 provides the Level 3 laboratory documentation requirements from the laboratory.

TABLE 7.1
BASIC QUALITY CONTROL REQUIREMENTS FOR LEVEL 3

EPA LEVEL 3 QC REQUIREMENTS
<ul style="list-style-type: none">• Laboratory Audit• PE Sample⁽¹⁾• QA Plan Review• Use EPA-approved Methods⁽²⁾• Monthly Review• 10% Field Duplicates• Review of Final Data

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(1) PE = Performance Evaluation Samples.

(2) Includes methods from SW-846.

8.0 CALIBRATION PROCEDURES AND FREQUENCY

8.1 FIELD CALIBRATION PROCEDURES

Field equipment requiring calibration includes groundwater monitoring equipment such as water level probes, electrical conductivity (EC) probes, pH meters and internal pressure transducers within the Westbay sampling tools. These instruments will be calibrated to standards in accordance with procedures and schedules outlined in the manufacturer's handbook. Calibration will be performed and documented prior to the start of work every day that the instruments are in use. Equipment requiring daily calibration will be uniquely identified by using the manufacturer's trade name, model, and serial number or other means. The results of calibration and record of repairs will be recorded in a daily logbook.

Scheduled routine calibration of testing equipment does not relieve field personnel from the responsibility of employing properly functioning equipment. If an individual suspects an equipment malfunction, the device will be removed from service, tagged so that it is not inadvertently used, and the appropriate personnel notified so that a recalibration or repair can be performed, or substitute equipment can be obtained.

Results of activities performed using equipment that has failed recalibration will be evaluated. If the activity results are adversely affected, the results of the evaluation will be documented and the appropriate personnel notified.

If QC audits as discussed in Sections 10.0 and 11.0 result in detection of unacceptable conditions or data, the Field Activities Manager will be responsible for developing and initiating corrective action. The Project Manager will be notified if nonconformance of the specific program is significant or requires special expertise not readily available to the project team. Corrective action may include:

- Reanalyzing samples if holding time criteria permits.
- Resampling and analyzing.
- Evaluating and amending sampling and analytical procedures.

8.2 LABORATORY CALIBRATION PROCEDURES

Calibration procedures will be as defined in EPA standard methods. For analysis of groundwater and soil gas samples, the required calibrations will be performed in accordance with EPA-established methods. Analytical calibrations for groundwater and soil gas will be performed as discussed below. Specific calibration procedures will be incorporated into the laboratory report as part of the QA/QC documentation.

Major instrumentation used for analysis include gas chromatograph (GC)/mass spectrometers (MS) for organic analyses, electron capture detector (ECD) for pesticide analysis and inductively coupled, argon plasma, and atomic absorption spectrophotometers for inorganic analyses. Pursuant to standard laboratory procedures, continuing calibration will be performed daily prior to analysis. Initial calibration for volatiles and semivolatiles consists of analyzing standard calibration gases containing compounds of interest at five concentration levels. One of the levels is prepared at or near the detection limit. Average response factors (RF) are generated for each compound as follows:

$$RF = (A_x C_{is} / A_{is} C_x)$$

where:

- A_x = Area of the characteristic ion for the compound being measured.
- A_{is} = Area of the characteristic ion for specific internal standard.
- C_x = Concentration of the compound being measured ($\mu\text{g}/\mu\text{L}$).
- C_{is} = Concentration of the specific internal standard ($\mu\text{g}/\mu\text{L}$).

Percent RSD in the RF for compounds of interest must be less than or equal to 30 percent. Initial calibration for external standards will be performed by preparing a minimum of five concentration levels for each parameter of interest. Each calibration standard is analyzed, and the area response versus the concentration is tabulated. The ratio of response to concentration (calibration factor) is a constant over the working range, less than or equal to a difference of 20 percent. Once the initial criteria are met, a daily point calibration mix is checked. The percent difference must be less than or equal to 15 percent.

A calibration-check compound (CCC) mixture will be analyzed by the laboratory at least once per day, or once every 12 hours during the analysis, whichever is more frequent. The CCC mixture will contain each of the target analytes. The percent difference for the CCC mixture should be less than 20 percent for VOCs. The CCC will be used to check the validity of the

initial calibration. A system performance-check compound (SPCC) mixture will be analyzed every 12 hours, or once per day, whichever is more frequent. The minimum RF value for a SPCC compound is 0.300 for volatiles. The SPCC is used to check the performance of the GC/MS system. The SPCC mixture will contain each of the target analytes. The above criteria must be met before sample analysis begins. The compounds used in the CCC and SPCC are listed in EPA Method 8230. Each time the standards are injected, the RF is calculated. These RFs must be within ± 30 percent RSD.

A CCC mixture for SVOCs will be analyzed every 12 hours, or once per day, whichever is more frequent. The percent difference for the CCC mixture should be less than 20 percent for SVOCs. The CCC will be used to check the validity of the initial calibration. An SPCC mixture will be analyzed every 12 hours, or once per day, whichever is more frequent. The minimum RF value for a SPCC compound is 0.250 for SVOCs. The SPCC is used to check the performance of the GC/MS system. The above criteria must be met before sample analysis begins. The compounds used in the CCC and SPCC are listed in EPA Method 8270. Each time the standards are injected, the RF is calculated. These RFs must be within ± 30 percent RSD.

Detection limits for analytes (parameters) are listed in Table 4.2.

The inorganic instrumentation for analysis of metals includes an inductively coupled, argon plasma simultaneous spectrophotometer (ICAP) and a graphite furnace atomic absorption (GFAA) spectrophotometer. Standards will be prepared by diluting stock solutions. They will be prepared fresh each time an analysis is to be made. At least three concentrations will be prepared in an appropriate range. After initial calibration, a continued calibration verification will be conducted at a frequency of 10 percent, or every 2 hours. The same continuing calibration standard will be used throughout the analytical run. To verify linearity, an ICAP standard at least two times the detection limit will be analyzed at the beginning and at the end of each sample analysis run. A calibration blank will be analyzed at each wavelength after every initial and continuing calibration verification, at a frequency of 10 percent, or every 2 hours during a run. Specific instrumentation calibration criteria will be incorporated in this document as part of the selected laboratories' QA/QC documentation.

Corrective action will be initiated when the following problems arise with precision and accuracy of the spike data: (1) when a data point falls beyond the established upper or lower control limit, (2) when there are seven consecutive points on the same side of the mean on a control chart, and (3) less than 50 percent of the data points fall within plus or minus one relative

standard deviation of the mean. The first step will be to repeat the analysis on the matrix spike/spike duplicate which failed. If this set of data falls within the control limits, the analysis may be treated as a random error. If the repeated analysis continues to show error, a laboratory control spike/spike duplicate can be attributed to matrix interference. If the laboratory control spike/spike duplicate is out of control, the following measures will be taken:

- Analysis is stopped.
- Calculations are checked.
- Standards are verified.
- Instruments are checked for proper performance through accuracy and precision testing.

Additional corrective actions will be included in the selected laboratories' documentation.

Laboratory control samples will be analyzed for each sample run or batch. Duplicate samples will be analyzed at a frequency of 10 percent of the samples or a minimum of one per sample run or batch.

8.3 *GROUNDWATER ANALYTICAL PROCEDURES*

Table 4.2 lists the specific analyses and EPA methods for the groundwater investigation, as well as the preservatives, analytical hold times and sample volumes associated with these methods. Complete Chain-of-Custody documentation will be initiated in the field, and will accompany the samples to the analytical laboratory. Laboratory QA/QC procedures will be equivalent to those required by EPA-CLP laboratories.

9.0 DATA REDUCTION, VALIDATION, VERIFICATION AND REPORTING

Data evaluation, transfer, and support are essential functions in summarizing information to support conclusions. It is essential that these processes are performed accurately and, in the case of data reduction, accepted statistical techniques are used.

The first level of review and consequent data reduction, validation and reporting is done at the laboratory. Data reduction, validation and reporting at the laboratory will be implemented in accordance with standard EPA methods for analytical and QA protocols. In general, the laboratory reviews will be performed by the laboratory analyst, the QA officer and laboratory management.

The second level of data review is conducted outside the laboratory. The data will be reviewed with respect to its usage for regulatory, health/risk and remedial statements in view of QC parameters.

The sampling contractor will follow the Sample Management Office (SMO) guidelines as described in the EPA technical directive document (EPA No. HQ8410-01, Contract No. 68-01-6699). Ten percent of the analyses will be validated pursuant to EPA guidelines and reported with documentation complete enough for independent review.

For nonroutine analysis service measurements, the data validation, reduction and reporting will be done at the laboratory level. At this time no requirements for nonroutine analysis are anticipated. The data reviewers include analysts, QA officers, and management. The data are reduced and validated by the laboratory in accordance with individual analytical methodology, QC procedures, the use of appropriate standards and correct transcription. Data will be reviewed outside the laboratory for project usability by qualified hydrogeologists or chemical engineers. Data from nonroutine analyses, which will be used for risk assessment purposes, will be evaluated using the raw data, QC samples and laboratory performance criteria. The review will include the following:

- Instrument calibrations.
- Standards.
- Analytical methodology.
- Detection limits.
- Holding times.
- Blanks for contamination.
- Accuracy, precision and completeness.

- Data reduction, validation and reporting.
- Proper units are reported.

Besides this review of analytical results and project-specific precision, accuracy, and completeness requirements, the Laboratory Department Manager will perform unannounced audits of report forms and other data sheets, as well as regular reviews of instrument logs, performance test results, and analysts' performance. Any review of analytical results or internal QA/QC checks that indicate problems will prompt immediate corrective actions to be taken, including review of all data collected since the previous approved QC audits for validity.

Where the data does not meet QC requirements specified in this document for the items indicated above, the data will be flagged with qualifiers. Commonly used qualifiers include:

- J - Estimated, usable for limited purposes. The data are qualitatively acceptable, but not quantitatively acceptable.
- R - Rejected, unusable. The data are qualitatively and quantitatively unacceptable.
- [] – The result is between the Instrument Detection Limit (IDL) and the contract required detection level (CRDL) and is subject to inaccuracies common to the lower end of the instruments' linearity.
- No qualifier – Data are acceptable.

Field data validation will be based on field logbooks and field audits with regard to proper calibration and procedures. Field data will be evaluated by the sampling and/or reporting contractor.

Management of the data generated by the investigations will be handled as follows:

- Laboratory data (or field data) is received.
- Laboratory data reviewed for completeness and accuracy by QA/QC Manager.
- Errors or corrections are made by the laboratory (or field engineer for field data).
- Original data reports and corrected data reports are filed by data coordinator.
- Copies of original or corrected data are distributed to the appropriate organization.

10.0 QUALITY CONTROL CHECKS AND REQUIREMENTS

QC procedures and checks are used to verify the accuracy of investigation data. Field QC checks are used to identify potential problems with sampling procedures such as the inconsistent use of standard operating procedures (SOPs; provided in Appendix A of the Addendum) or field-introduced sample or water supply contamination and/or problems with sample homogeneity or representativeness. Laboratory QC checks are used to identify potential problems with analytical procedures such as the misapplication of required analytical methodologies or other laboratory-related problems which could result in inaccurate data reporting. The laboratory QC checks and procedures presented in this section are required for most of the applicable methods; however, the frequency of the QC checks stated are to be used as guidelines and are not necessarily absolute requirements.

10.1 GROUNDWATER SAMPLE QUALITY CONTROL

Table 10.1 outlines the basic field QC requirements for water samples. Groundwater sampling requires trip blanks (only for VOCs), equipment rinsates, field blanks and field duplicates. The following information defines and explains the required field QC samples. Filtration blanks will also be collected.

- Trip Blanks - Trip blanks are analyte-free water taken from the laboratory to the sampling site and returned to the laboratory with the VOC samples. One trip blank will accompany each cooler containing VOC samples. Each will be stored at the laboratory with the samples and analyzed by the laboratory. Trip blanks will be analyzed only for VOC water samples.
- Equipment Rinsates - Equipment rinsates are the final, analyte-free water rinsate from equipment cleaning. If equipment rinsates are generated (i.e., if disposable bailers are not used), they will be collected daily during a sample event. Initially, only samples collected every other day will be analyzed. If compounds of concern (COCs) are detected in the rinsate, the remaining samples will be analyzed. The results from the blanks will be used to flag or assess the levels of analytes in the samples. This comparison is made during data validation. The rinsates will be analyzed for the same parameters as the investigative samples. Equipment rinsate samples will be collected from sampling equipment such as reusable Teflon® and stainless steel bailers and Westbay sampling bottles.
- Field Blanks - Field blanks consist of the source water used in decontamination. At a minimum, one field blank from each event and each source of water will be collected and analyzed for the same parameters as the related samples.

- Field Duplicates/Splits - The duplicates for water samples will be collected simultaneously. Field duplicates will be collected at a frequency of 10 percent of the total number of sampling points. Duplicates will be sent to the primary laboratory for analysis.
- Filtration Blanks - Groundwater monitoring well samples scheduled for analysis of dissolved metals will be filtered through a 0.45-micrometer (μm) filter within 24 hours after collection. All filtered samples will be processed (filtered) in the field. If disposable filters are not used, the cleaning procedures for the filtration apparatus, the potential for cross-contamination, and the potential contribution to the sample from the filter itself will be assessed and a filtration blank will be collected for approximately every 15 samples filtered. The filtration blank will be prepared by passing reagent water through a freshly cleaned filtration apparatus, then preserving the sample (if required) for the analyses planned. This sample may also be prepared by filtration of the sample blank aliquot scheduled for inorganic analysis.

Table 10.1

**FIELD COLLECTION QUALITY ASSURANCE REQUIREMENTS
FOR UFA GROUNDWATER SAMPLES**

ANALYSIS	TRIP BLANK	FIELD BLANK ⁽¹⁾	FIELD DUPLICATE ⁽²⁾	MATRIX SPIKE AND MATRIX SPIKE DUPLICATES ⁽³⁾
Organics ⁽⁴⁾	1 per 20 samples or 1 per sample shipment, whichever is greater	1 per 20 samples or 1 per sample shipment, whichever is greater	1 per 10 samples or 1 per sample shipment, whichever is greater	1 per 20 samples or 1 per sample shipment, whichever is greater
Inorganics ⁽⁵⁾	None	1 per 20 samples or 1 per sample shipment, whichever is greater	1 per 10 samples or 1 per sample shipment, whichever is greater	1 per 20 samples or 1 per sample shipment, whichever is greater

Notes:

- (1) Field blanks will be collected during groundwater sampling procedures only when non-dedicated sampling equipment is used. Field Blanks require an additional sample volume. Note that field forms will be labeled so the laboratory cannot identify the sample as a blank.
- (2) Field duplicates require an additional sample volume. Note that field duplicates will be labeled so the laboratory cannot determine that the sample is a field duplicate. Field duplicates will be collected as split samples from the investigative sample.
- (3) MS/MSD samples require two additional sample volumes for organic analysis. Matrix spike samples require an additional sample volume for inorganic analysis.
- (4) Includes VOCs, SVOCs and pesticides/PCBs.
- (5) Includes metals.

10.2 INTERNAL LABORATORY QC CHECKS

The following internal laboratory QC checks, which are consistent with EPA Level 3 QC guidelines as indicated in EPA SW-846, are performed for most analyses whenever applicable, to ensure the measurement systems are under control:

- Initial and continuing calibrations.
- Preparation blanks.
- Matrix spike and matrix spike duplicate analysis.
- Surrogate spike standard performance evaluation (typically for organic analyses only).
- Calibration check compounds and reagent blanks (typically for organic analyses only).
- Quality control charts.

10.2.1 INITIAL AND CONTINUING CALIBRATION

Each measurement system must be calibrated immediately prior to use and be shown to maintain the calibration throughout the course of the analysis. Calibration procedures and frequencies are discussed in Section 8.

10.2.2 PREPARATION BLANKS

A preparation blank is run with each batch of samples received for analysis, depending on the analysis. Compound responses observed in the blank at levels above the reportable detection limit are reviewed for possible laboratory contamination. If high blank values are observed, laboratory glassware and reagents may need to be checked for contamination and the analysis of future samples halted until the system can be brought under control. A high blank value is typically defined as a value greater than the method detection limit.

10.2.3 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE ANALYSES

For analyses with which matrix spiking is possible, 1 in 20 samples are analyzed as matrix spikes and matrix spike duplicates. The percent recovery for spiked samples is calculated using the

equations given in Section 12.0 and compared to the accuracy criteria specified in Table 4.2. The relative percent difference of replicate spikes is calculated using the equations given in Section 12.0 and compared to the precision criteria specified in Table 4.2.

10.2.4 SURROGATE SPIKE STANDARD PERFORMANCE EVALUATION

Surrogate standards are defined as nonpriority pollutant compounds used to monitor the percent recovery efficiencies of the analytical procedures on a sample-by-sample basis. Surrogate standard determinations are performed on all samples and blanks. All samples are fortified with surrogate spiking compounds before purging or extraction to monitor the preparation and analysis of samples.

Surrogate compounds and recovery levels for the associated analyses are presented in Table 10.2. When the surrogate recovery level is outside of the control limits, the laboratory must take the following actions:

- Check calculations to assure there are no errors, check internal standard and surrogate spiking solutions for degradation or contamination and check instrument performance.
- Recalculate or reinject/repurge the sample or re-extract and reanalyze the sample.

If any of the measures listed above fails to correct the problem, the system will be considered out of control and the problem must be corrected before continuing.

10.2.5 CALIBRATION CHECK COMPOUNDS AND REAGENT BLANKS

The calibration check compounds and reagent blanks are analyzed periodically throughout the course of the analysis, depending on the required analysis. The frequencies and methods to be used are discussed in Section 8.0.

10.2.6 QUALITY CONTROL CHARTS

QC charts are plots of multiple data points from the same or similar samples of processes versus time. QC charts are established for evaluation of the precision and accuracy of QC measures of

each analysis after every 20 determinations. A detailed description of the use and production of QC charts is given in Section 12.0.

10.3 ORGANIC ANALYSIS - GAS CHROMATOGRAPH

This section outlines the minimum QC operations necessary to satisfy the analytical requirements associated with the determination of organic parameters using gas chromatographic techniques.

10.3.1 INITIAL CALIBRATION VERIFICATION

In order to verify the linearity of the initial calibration curve, the RSD between calibration factors must not differ by more than 30 percent. Alternatively, the linear regression coefficient must be at least 0.995.

10.3.2 CONTINUING CALIBRATION VERIFICATION

The working calibration curve or calibration factor must be verified after every ten samples by the analysis of a continuing calibration verification (CCV) solution. If the response for any analyte varies from the predicted response by more than ± 15 percent, a new curve must be prepared and all preceding samples reanalyzed.

10.3.3 SURROGATE SPIKE STANDARD PERFORMANCE EVALUATION

Surrogate standards will be used for gas chromatographic procedures as described previously in Section 10.2.4. Surrogate compounds and recovery levels in Table 10.2 are taken from the applicable method.

10.3.4 REAGENT BLANK

Each batch of samples will be accompanied by a reagent blank. The reagent blank will be carried throughout the entire analytical procedure including sample preparation or extraction, as applicable, to check contamination introduced by exposure to the laboratory environment.

10.3.5 MATRIX SPIKE/MATRIX SPIKE DUPLICATE ANALYSES

These parameters will be run at the frequency as stated previously in Section 10.2.3 and will follow the procedures as described in the individual applicable methods.

10.4 ORGANIC ANALYSIS - GAS CHROMATOGRAPH/MASS SPECTROMETERS

This section outlines the minimum QC operations necessary to satisfy the analytical requirements associated with the determination of various organics using gas chromatographic/mass spectrometric techniques. At all times, the most current versions of the required protocol will be employed by the laboratory. Not all of the GC/MS organic analyses are applicable or amenable to all of the QC checks or procedures presented below. For instance, tuning and mass calibrations are typical of volatile and semivolatile organic analyses. For clarification of which QC measures are applicable to a particular analytical procedure, all GC/MS organic analyses to be used are derived from SW-846, Third Edition.

10.4.1 TUNING AND GC/MS MASS CALIBRATION

Prior to initiating data collection, it is necessary to establish that a given GC/MS meets the standard mass spectral abundance criteria. This is accomplished through the analysis of tuning compounds, specific compounds like decafluorotriphenylphosphine (DFTPP) for acid and base/neutral extractable compounds, and b-bromofluorobenzene for VOCs. The ion abundance criteria for each calibration compound should be met before any samples, blanks or standards can be analyzed.

10.4.2 GC/MS INITIAL SYSTEM CALIBRATION

Prior to the analysis of samples and after tuning criteria have been met, the GC/MS system must be initially calibrated at a minimum of five concentrations to determine the linearity of response utilizing target compound standards. Once the system has been calibrated, the calibration must be verified each 12-hour time period for each GC/MS system.

For VOCs, a minimum of five different concentrations plus the three designated internal standards at constant concentrations will be used to develop the calibration curve. Once the initial calibration is validated, the average response factors and percent relative standard deviations for all TCL VOCs will be calculated and reported.

For extractable organic compounds, a minimum of five standard concentrations plus six internal standards at constant concentrations will be used to develop the calibration curve. Once the initial calibration is validated, the average response factors and percent relative standard deviations for all TCL extractable compounds will be calculated and reported.

10.4.3 SYSTEM PERFORMANCE CHECK COMPOUND RESPONSE

A system performance check will be performed on the calibration curve before it is used. For volatile organics, the five SPCCs are chloromethane, 1,1-dichloroethane, bromoform, 1,1,2,2-tetrachloroethane, and chlorobenzene. For extractable organics, the SPCCs are N-nitroso-di-n-propylamine, hexachlorocyclopentadiene, 2,4-dinitrophenol, and 4-nitrophenol. These compounds are used to check compound instability and check for degradation caused by contaminated lines or active sites in the system and are usually the first to show poor performance and tend to decrease in response as the chromatographic system or the standard material begins to deteriorate. Therefore, they must meet the minimum requirements when the system is calibrated.

10.4.4 GC/MS CONTINUING SYSTEM CALIBRATION

A continuing calibration standard will be run every 12 hours during sample analysis. The response factor data from the standards for each 12 hours will be compared with the average response factors from the initial calibration for each instrument. If the minimum response factors for individual compounds in the verification standard fall outside acceptable QC criteria, appropriate corrective action will be taken prior to further sample analysis.

10.4.5 CALIBRATION CHECK COMPOUNDS

After the system performance check is met, calibration check compounds are used to check the validity of the initial calibration. If the response for any calibration check compound varies from the calibrated response by more than the criteria limits, corrective action will be taken.

10.4.6 SURROGATE SPIKE STANDARD PERFORMANCE EVALUATION

All samples are fortified with surrogate spiking compounds before purging or extraction in order to monitor preparation and analysis of samples. Surrogate standards are defined as nonpriority pollutant compounds used to monitor the percent recovery efficiencies of the analytical procedures on a sample-by-sample basis. When the surrogate recovery level is outside limits, the laboratory must take corrective actions which may include checking calculations, internal standard and surrogate spiking solutions for degradation, reinjecting/repurging the sample or extract, or reanalyzing the sample. Surrogate recovery limits for the applicable methods are presented in Table 10.2.

10.4.7 INTERNAL STANDARD PERFORMANCE EVALUATION

Internal standards are nonpriority pollutant compounds used to monitor instrument performance and quantitation of target compounds. The internal standards will be used to confirm the integrity of the instrumental analysis and will be checked as required in the current protocol.

10.4.8 REAGENT BLANKS AND MATRIX SPIKE/MATRIX SPIKE DUPLICATE ANALYSES

In addition to the standards and checks stated previously, reagent blanks and matrix spike/matrix spike duplicate analyses will be performed in order to check the quality of the distilled water used for analysis and to evaluate the effect of the sample matrix on the methodology used. All samples processed with a reagent blank that is contaminated will be re-extracted and reanalyzed. If the percent recovery or relative percent difference values for matrix spike analyses fall outside QC limits, other QC parameters will be evaluated to determine whether an error in spiking occurred or whether the entire set of samples requires reanalysis. These parameters will be run at the frequency as stated previously in Section 10.2.4 and will follow the procedures as described in the individual applicable methods.

10.5 METALS BY INDUCTIVELY COUPLED PLASMA

This section outlines the minimum QA operations necessary to satisfy the analytical requirements associated with the determination of metals by Inductively Coupled Plasma (ICP).

At all times, the most current revisions of the applicable protocol will be implemented by the laboratory.

10.5.1 INITIAL AND CONTINUING CALIBRATION AND CALIBRATION VERIFICATION

At the start of instrumental operation, the ICP will be calibrated according to the manufacturer's instructions and current protocol. Immediately after the ICP system has been calibrated, the accuracy of the initial calibration shall be verified and documented for every analyte by the analysis of EPA Initial Calibration Verification (ICV) solutions at each wavelength used for analysis. When measurements exceed the control limits for inorganic analyses, the analysis must be terminated, the problem corrected, the instrument calibrated, and the initial calibration reverified.

During continued analysis of metals by ICP, CCV solutions will be analyzed at each wavelength after every tenth sample. Each CCV analyzed must reflect the conditions of analysis of all associated analytical samples (the preceding 10 samples or the samples up to the last CCV).

If the deviation of the CCV is greater than the control limits specified, the analysis must be stopped, the problem corrected, the instrument must be recalibrated, the continuing calibration verified and the reanalysis of the preceding 10 samples or all analytical samples analyzed since the last good calibration verification must be performed for the analytes affected.

10.5.2 PREPARATION BLANK ANALYSIS

At least one preparation (or reagent) blank consisting of deionized distilled water processed through each sample preparation procedure will be analyzed with every 20 samples, or with each group of samples digested, whichever is more frequent. Specific procedures are detailed in the current protocol.

10.5.3 ICP INTERFERENCE CHECK SAMPLE ANALYSIS

To verify the inter-element and background correction factors, an ICP Interference Check Sample, Laboratory Control Sample and Linear Range Verification Sample will be analyzed at

least twice per 8 hours of operation, or once during and again at the end of analysis. If these monitoring checks fall outside the allowable criteria, appropriate corrective action will be taken in accordance with current protocol.

10.5.4 MATRIX SPIKE SAMPLE ANALYSIS

Matrix spike sample analysis is designed to provide information about the effect of sample matrix on the digestion and measurement methodology. The spike is added before the digestion and prior to any distillation steps. At least one spiked sample analysis will be performed on each group of samples of a similar matrix type and concentration (i.e., low, medium) for every 20 samples. Samples identified as field blanks cannot be used for spike sample analysis. Spike recovery limits range from 80 to 120 percent for metals as defined in the current protocol. If these limits are not obtained, appropriate action will be taken.

10.5.5 DUPLICATE SAMPLE ANALYSIS

At least one duplicate sample will be analyzed from each group of samples of a similar matrix type and concentration (i.e., low, medium) for every 20 samples. Samples identified as field blanks cannot be used for duplicate sample analysis. A control limit of 30 percent RPD for aqueous samples shall be used for original and duplicate values greater than or equal to five times the detection limit. A control limit of (\pm) the detection limit shall be used for aqueous sample values less than five times the detection limit and \pm two times the detection limit shall be used for solid samples.

10.6 METALS BY FURNACE ATOMIC ABSORPTION

Furnace Atomic Absorption (AA) analysis will be performed on metals not amenable to analysis by ICP. These metals include arsenic, lead, selenium and thallium. The analysis of these metals by Furnace AA will be conducted in accordance with current protocol.

All furnace analyses, except during full Methods of Standard Addition (MSA), will require duplicate injections for which the average absorbance or "concentration" will be reported. All analyses should fall within the calibration range. The raw data package will contain both absorbance of "concentration" values (the average value) and the RSD or coefficient of variance

(CV) for the duplicate injections. For concentrations greater than the Contract Required Detection Limit (CRDL), duplicate injection readings should agree within 30 percent RSD, or the sample will be rerun once, as specified in current protocol.

All furnace analyses will require at least a single analytical spike to determine if the MSA will be required for quantification. The spike will be analyzed and prepared in accordance with current protocol.

An initial calibration curve will be established using a blank and a minimum of four standards of different concentrations. The calibration curve will be confirmed with a standard and reagent blank before sample analysis.

To assure instrumental stability, a calibration check will be run every 10 samples. If these instrument calibration checks should fall outside allowable criteria, the instrument will be recalibrated and all samples that were run prior good calibration will be reanalyzed.

The AA analysis will include at least one reagent blank, before the digestion sample spike and sample duplicate, for every 20 samples of similar matrices.

10.7 GENERAL CHEMISTRY PARAMETERS

Matrix spikes, duplicates and reagent blanks will be run at frequency described in the current protocol or as described previously in general terms in Section 10.2.

TABLE 10.2
SURROGATE COMPOUNDS AND ACCEPTABLE RECOVERIES

METHOD	SURROGATE	PERCENT RECOVERY (Aqueous Samples)
EPA 8260B	Dibromofluoromethane	80-120
	Toluene-d8	80-120
	4-Bromofluorobenzene	80-120
EPA 8270	Nitrobenzene d-5	40-110
	2-Fluorobiphenyl	40-120
	p-Terphenyl d-14	55-160
	2-Fluorophenol	30-110
	2,4,6-Tribromophenol	55-140
	Phenol-d6	40-110

11.0 PERFORMANCE AND SYSTEM AUDITS

Two types of audit procedures may be conducted during any environmental investigation: performance and system audits. These audits may be performed on the laboratory as well as field activities. The Project Manager will monitor and audit the performance of the QA procedures. Audits may be scheduled to evaluate the execution of sample identification, sample control, Chain of Custody procedures, field notebooks, sampling procedures and field measurements.

The Project Manager will request confirmation of audits performed by personnel from the selected laboratory in accordance with the QA/QC documentation.

11.1 performance audits

11.1.1 LABORATORY PERFORMANCE AUDITS

Laboratory performance audits are typically conducted by the Laboratory Quality Assurance Manager on a regular basis (monthly or bimonthly). Each laboratory analyst is given a performance evaluation sample containing analytes for the parameters which he/she usually performs. These audit samples are used to identify problems in sample preparation or analysis techniques or methodologies which could lead to future analytical problems.

Additionally, the laboratory performance audits include verification of each analyst's record keeping, proper use and understanding of procedures, and performance documentation. Corrective action will be taken for any deficiencies noted during the audit.

11.1.2 FIELD PERFORMANCE AUDITS

Field performance audits are performed directly by the Team Leader and indirectly by the performance of field QC samples. All field obtained data will be reviewed on an ongoing basis as they are generated by the Team Leader for accuracy and clarity in order to ensure their reproducibility after completion of field activities. The analytical results of the field banks and duplicate/replicate samples are indirect audits of the level of performance of field activities. If

significant inconsistencies occur in the evaluation of these field QC samples, corrective actions may be required.

11.2 system audits

11.2.1 LABORATORY SYSTEM AUDITS

Laboratory system audits are typically conducted by the Laboratory Quality Assurance Manager on a quarterly basis. These audits are used to ensure that all aspects of this QC manual are operative. This involves a thorough review of all laboratory methods performed and documentation to confirm that work is performed according to project specifications.

In some cases, outside certification agencies conduct performance and system audits to verify contract compliance or the laboratory's ability to meet certification requirements on methods of analysis and documentation.

11.2.2 FIELD SYSTEM AUDITS

Field system audits will be performed by the Team Leader by inspection of all field site activities. All ongoing activities will be monitored by the Team Leader to verify work is being performed according to the approved work plans and all procedures and analyses are conducted according to procedures outlined in this QAPP. Any time a deficiency is noted during this ongoing system audit, the Team Leader will inform the field staff immediately so corrective actions may be implemented.

12.0 ASSESSMENT PROCEDURES FOR DATA ACCEPTABILITY

The following discussion describes the procedures that will be employed to evaluate the precision, accuracy, and completeness as well as the representativeness and comparability of the generated data.

12.1 PRECISION

Precision is a measure of agreement among individual measurements of the same property under prescribed similar conditions. Precision is assessed by calculating the RPD of replicate spike samples or replicate sample analyses according to the following equation:

$$RPD = \frac{|R1 - R2|}{(R1 + R2)/2} \times 100$$

Where R1 = result 1, and
R2 = result 2

12.2 ACCURACY

Accuracy is a measure of the closeness of an individual measurement to the true value. Accuracy is measured by calculating the percent recovery (R) of known levels of spike compounds as follows:

$$R = \frac{\text{determined value of spiked sample}}{\text{theoretical value of spiked sample}} \times 100$$

12.3 COMPLETENESS

Completeness is a measure of the amount of valid data obtained from a measurement system, expressed as a percentage of the number of valid measurements that should have been collected. It is calculated as follows:

$$\text{Completeness (\%)} = \frac{\text{number of valid samples reported}}{\text{total number of samples analyzed}} \times 100$$

12.4 REPRESENTATIVENESS

Representativeness is a qualitative assessment of whether data represent the media measured. Representativeness should be considered in development of data collection schemes (e.g., sampling locations, frequency, completeness and laboratory analytical scheme).

12.5 comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another data set. Comparability is dependent upon consistency in sample collection procedures, sample preservation methods, analytical methods and units of data expression. Verification of implementation of the procedures through audit and validation procedures will assure that the comparability requirements are being met.

12.6 QUALITY CONTROL CHARTS

QC charts are prepared after every 20 analytical determinations to graphically evaluate precision and accuracy criteria. The charts are prepared by calculating the mean value of the determinations and setting control limits at ± 2 standard deviations from that mean. The following equations are used:

$$mean = \bar{x} = \sum_{i=1}^n x / n$$

$$standard\ deviation = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2}$$

The control limits should approximate the values given in Table 4.1. If the limits are found to be outside these values, the measurement system is examined to determine if possible problems exist.

13.0 PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

Periodic preventive maintenance is required for equipment whose performance can affect results. Instrument manuals will be kept on file for calibration, operation, maintenance and troubleshooting.

Preventive maintenance such as lubrication, source cleaning, detector cleaning, and the frequency of such maintenance is performed according to the manufacturer's instructions. Chromatographic carrier gas purification traps, injector liners, and injector septa are cleaned or replaced on a regular basis. Precision and accuracy data are examined for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance will be performed when an instrument begins to degrade as evidenced by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity or failure to meet the QC criteria.

13.1 GLASSWARE PREPARATION

Glassware used for conventional chemistries is thoroughly cleaned with hot soapy water, triple-rinsed with tap water, and triple-rinsed with distilled water immediately after each use. Other special procedures are as follows:

- Inorganic Analyses
 - Wash with hot soapy water.
 - Rinse three times with tap water.
 - Rinse three times with deionized water.
 - Rinse with 1:1 nitric acid.
 - Rinse three times with tap water.
 - Rinse three times with deionized water.
- Organic Analyses
 - Rinse with methylene chloride.
 - Wash with hot soapy water.
 - Rinse three times with tap water.
 - Rinse three times with distilled water.
 - Rinse three times with acetone.
 - Rinse three times with tap water.
 - Rinse three times with distilled water.
 - Heat at 500° C for 2 hours.

13.2 ROUTINE PREVENTIVE MAINTENANCE

The following procedures are suggested preventive maintenance techniques for the main analytical instruments required for this investigation. This list is not comprehensive and should be only considered an initial guideline.

- pH Meters
 - Store electrodes in pH 7 buffer when not in use.
 - Keep hole for filling solution plugged to prevent evaporation of filling solution when not in use.
 - Replace filling solution as needed.
- Conductivity Meters
 - Keep battery fully charged.
 - Replatinize cell when response becomes erratic or platinum black has flaked off the cell.
- Gas Chromatographs
 - Change septa daily.
 - Periodically clean detectors.
 - Replace columns when instrument response deteriorates.
- Mass Spectrometer
 - Periodically dismantle and clean the ionizing source.
- Inductively Coupled Plasma Spectrophotometers
 - Change pump tubing as needed.
 - Clean nebulizer daily as needed.
 - Periodically clean and replace torch and chimney extension.
- Atomic Absorption Spectrophotometers
 - Clean contact cylinders daily.
 - Check pyrolytic tube and platform daily.
 - Replace contact cylinders every 3 months or as needed.
- Analytical Balance
 - Check daily with Class S weights.
 - Clean and calibrate once per year.

14.0 CORRECTIVE ACTION

Whenever quality deficiencies for field or laboratory activities are observed that warrant management attention, the QA officer will issue a formal corrective action request, with copies of the request forwarder to the Project Manager. The Project Manager will complete the form and sign it when corrective action has been implemented. The original will be returned to the QA officer "to close the loop." The QA officer maintains a record of corrective action requests.

Items that require immediate correction by the operator or analyst will not use the formal corrective action request system. These kinds of corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The investigative action must be taken promptly, the event should be reported to the Project Manager and, if appropriate, laboratory management.

Immediate corrective action may be necessary if:

- QC data are outside the warning or acceptable windows for precision and accuracy.
- Blanks contain target analytes above the acceptable levels.
- Undesirable trends are detected in spike recoveries or RPD between duplicates.
- There are unusual changes in detection limits.

The EPA-CLP Scope of Work (SOW) has specific requirements for corrective actions being performed in certain situations. These corrective actions will be performed as stated in the CLP SOW. Corrective actions to be taken for the non-CLP parameters will be similar to those in the CLP, including re-extraction and reanalysis as necessary. Laboratory-derived control limits for precision and accuracy or limits specified in this plan will be used to assess performance.

14.1 FIELD CORRECTIVE ACTIONS

Field corrective actions are based on the comparability of field measurement data such as pH, specific conductance, temperature, water level height, DNAPL presence and thickness, and well depth, etc. It can also include comparability of laboratory analytical results (such as site qualifiers) if this is not possible. Laboratory personnel are alerted that corrective actions may be necessary if:

- QA data are outside the warning or acceptable windows for precision and accuracy established for laboratory control samples.
- Blanks contain contaminants at concentrations above the levels specified in the laboratory quality management plan for a target compound.
- Undesirable trends are detected in matrix spike recoveries or RPD between matrix spike duplicates or surrogates.
- There are unusual changes in detection limits.
- Deficiencies are detected during audits, or from the results of performance evaluation samples.

14.2 LABORATORY CORRECTIVE ACTIONS

If nonconformances in analytical methodologies, QA sample results, etc., are identified by the bench analyst, corrective actions will be implemented immediately. Corrective action procedures will be handled initially at the bench level by the analyst, who will review the preparation or extraction procedure for possible errors and check the instrument calibration, spike and calibration mixes, instrument sensitivity, etc. The analyst will immediately notify his/her supervisor as to problems that are identified and the investigation which is being conducted. If the problem persists or cannot be identified, the matter will be referred to the laboratory supervisor and the laboratory Project Manager for further investigation. Once resolved, full documentation of the corrective action procedure is filed by the Project Manager for the contracted laboratory, and the Project QA Officer is provided a corrective action memorandum for inclusion into the project file if data are affected.

Data deemed unacceptable following the implementation of the required corrective action measures will not be accepted, and follow-up corrective action measures will be explored.

15.0 QA REPORTS TO MANAGEMENT

This QAPP provides a documentable mechanism for the assurance of quality work performed at the Cabot Carbon/Koppers Superfund Site. Audit report will be provided to management by the Laboratory Director as a means of tracking program performance. Auditing requirements are discussed in Section 11.0. Additionally, periodic assessments of measurement data accuracy, precision, and completeness and significant QA/QC problems will be provided to management by the Laboratory Quality Assurance Manager or the Laboratory Project Manager.

Field QA reports will be submitted periodically during field activities to report the daily field progress, compiled field data sets, and corrective action documentation. Any situations requiring immediate corrective action measures will be brought to the attention of the Project Manager.

The Project Manager will prepare and issue a QA summary report within 30 days of the completion of a sampling event.

16.0 DOCUMENTATION AND RECORDS KEEPING

These document control procedures apply to project documents that specify quality requirements or prescribe how project activities affecting quality will be conducted. The purpose of these procedures is to present protocol for document control. These procedures include the management of project files, computer files, drawings and document review.

The following project personnel are responsible for document control procedures:

- Project Coordinator - Responsible for controlling and reviewing the document control procedure.
- Project Manager - Assists the Project Coordinator with implementation of these procedures.
- Design Engineer/Technical Personnel - Assists the Project Coordinator, as requested.
- Project QA Officer - Responsible for the maintenance and distribution of the QAPP and for verifying compliance with the QA program. The Project QA Officers will manage the QAPP in accordance with this project.

The QAPP will be maintained by the Project QA Officer. Copies of the QAPP will be assigned to the appropriate QA Officers, Project Coordinator, Project Director and Project Manager. An original of each revision of the QAPP will be kept in the project files. Changes to the QAPP, whether originated by the appropriate QA Officers or other project team members, will be made by the Project QA Officer. Each version of the QAPP will be identified within the introduction, which will summarize the revision and the date of the superseded document. A revision document form will be kept by the Project QA Officer in the project QA files.

Other QA documents, including audit documents, corrective action documents, and documents verifying that corrective action has been completed, will be maintained by the Project QA Officer in the project QA files. QA-related correspondence will be filed with the general project correspondence.

16.1 PROJECT FILES MANAGEMENT

The Project Coordinator is responsible for maintenance of the active project files during the project. Contractor Project Managers may be designated as caretakers of the project files for

specific Elements or Components of work. Files not in active use will be kept in a secured file storage area. Files in active use will be checked out by replacing the file with a checkout card marked with the individual's name, date and the name of the file checked out.

Working files will be maintained by the Contractor Project Manager until such time as that document becomes final. The Project Coordinator will maintain a library of final SOW deliverables.

16.2 PROJECT FILES CATEGORIES

Project files will be maintained in folders labeled with appropriate descriptive file categories.

16.3 PROJECT COMPUTER FILES

Most project documents are computer-generated. The files will be maintained in computer storage while the project is active and in archived storage after the project has been completed. The following sections describe management of project computer files in additional detail.

16.3.1 COMPUTER FILE NAMES

Computer file names will be maintained within the main project folder and subfolder (as appropriate) with a name that is descriptive of the content of the files. The filename extension will correspond to the program used to create the file.

16.3.2 COMPUTER FILE BACKUPS

Data backups will be made on a regular basis.

The older backup will be kept at the office and the more recent backup will be kept at a separate secure location. Each Friday, the newer backup will be returned to the office and the older backup overwritten and removed to the separate secure location.

17.0 REFERENCES

- Beazer East, Inc. *Proposed Revised Remedial Strategy for the Cabot/Koppers Superfund Site*. November 1993.
- Black & Veatch. *Remedial Investigation/Supplemental Feasibility Study Report (Revision 1) Analysis of Alternatives. Cabot Carbon/Koppers (Koppers Portion) Superfund Site Gainesville, Alachua County, Florida*. April 23, 2001.
- Environmental Science and Engineering, Inc. (ESE). *Feasibility Study Final Report. Remedial Investigation/Feasibility Study at the Cabot Carbon/Koppers Site, Gainesville, Florida*. May 1990.
- Hunter/Environmental Science and Engineering, Inc. (ESE). *Volume I - Remedial Investigation/Risk Assessment at the Carbon/Koppers Site, Gainesville, Florida*. September 1989.
- International Technology Corporation (IT). *Remedial Investigation Report, FDER Cabot Carbon/Koppers Site*. 1987.
- McLaren/Hart. *Site Characterization Data Report for the Initial Soil and Groundwater Remedies. Cabot Carbon/Koppers Superfund Site, Gainesville, Florida*. April 1993.
- TRC Environmental Solutions, Inc. *Supplemental Feasibility Study, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida*. January 1997.
- TRC. *Revised Supplemental Feasibility Study, Cabot Carbon/Koppers Industries, Inc. Site, Gainesville, Florida*. September 1999.
- TRC. *Workplan for Additional Characterization of the Hawthorn Group Formation, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida*. November 2001.
- TRC. *Floridan Aquifer Monitoring Plan, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida*. June 2004.
- U.S. Environmental Protection Agency. *SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition*.
<http://www.epa.gov/epaoswer/hazwaste/test/main.htm>
- U.S. Environmental Protection Agency. *Memorandum from Don R. Clay: Considerations in Groundwater Remediation at Superfund Sites and RCRA Facilities -- Update*. May 1992a.
- U.S. Environmental Protection Agency (EPA). *Estimating Potential for Occurrence of DNAPL at Superfund Sites*. January 1992b.
- U.S. Environmental Protection Agency. *Record of Decision*. September 1990.

U.S. Environmental Protection Agency Region 4. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*. May 1996.

U.S. Environmental Protection Agency. Technical directive document. EPA No. HQ8410-01, Contract No. 68-01-6699.