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August 14, 2009

Mr. Scott Miller
Remedial Project Manager
U.S. Environmental Protection Agency
Region IV, Superfund North Florida Section
61 Forsyth Street, SW
Atlanta, GA 30303-3104

Subject: Transmittal of the "Supplemental 2009 Hawthorn Group Investigation and Monitoring Well Installation Report, Koppers Inc. Site, Gainesville, Florida"

Dear Mr. Miller:

On behalf of Beazer East, Inc., attached is the report entitled "Supplemental Hawthorn Group Investigation and Monitoring Well Installation Report, Koppers Inc. Site, Gainesville, Florida." This was prepared in accordance with the *Supplemental 2009 Hawthorn Group Investigation and Monitoring Well Installation Workplan, Koppers Inc., Gainesville, Florida*, dated January 14, 2009 at the request of U.S. EPA. Please feel free to contact me at (303) 665-4390, if you have any comments or questions.

Sincerely,

James R. Erickson

James R. Erickson, P.G.
Principal Hydrogeologist

Enclosure

cc: W. O'Steen, EPA
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SUPPLEMENTAL 2009 HAWTHORN GROUP INVESTIGATION AND MONITORING WELL INSTALLATION REPORT

KOPPERS INC. SITE
GAINESVILLE, FLORIDA

Prepared For:

Beazer East, Inc.

Prepared by:

GeoTrans, Inc.
363 Centennial Parkway, Suite 210
Louisville, Colorado 80027

August 14, 2009

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ACRONYMS

ASTM	American Society of Testing and Materials
Beazer	Beazer East, Inc.
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
DNAPL	Dense Nonaqueous Phase Liquid
EPA	Environmental Protection Agency
GRU	Gainesville Regional Utilities
GCTL	Groundwater Cleanup Target Level
HG	Hawthorn Group
ID	Inside Diameter
IDW	investigational derived wastes
KI	Koppers, Inc.
MCL	Maximum Contaminant Level
NAPL	Nonaqueous Phase Liquids
PID	Photoionization Detector
Site	Koppers portion of the Cabot Carbon/Koppers Superfund Site
SJRWMD	St. John’s River Water Management District
SVOCs	Semi-Volatile Organic Compounds
UF	Upper Floridan
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

This report presents results of the hydrogeologic investigation of the Hawthorn Group (HG) deposits and monitoring well installation associated with the Koppers Inc. portion of the Cabot Carbon/Koppers Superfund Site in Gainesville, Florida (the Site) in March and April 2009. The Site location is shown on Figure 1-1.

The U.S Environmental Protection Agency (EPA) April 4, 2006 *Five-Year Review Report for the Cabot Carbon/Koppers Superfund Site* recommended Beazer East, Inc. (Beazer) conduct further investigation of the HG deposits. On behalf of Beazer, GeoTrans implemented an investigation in August through November 2007 to address the U.S. EPA's concerns. Well installation and water quality sampling that was performed under this investigation are described in the March 18, 2008 report entitled *Supplemental Hawthorn Group Investigation and Monitoring Well Installation Report, Koppers Inc. Site, Gainesville, Florida*. Based on the findings of that investigation, the U.S. EPA requested additional characterization to determine the extent of potential groundwater impacts in the HG deposits to the east of the Site and to investigate the potential presence of Dense Nonaqueous Phase Liquid (DNAPL) in the HG deposits at locations along the eastern Site property boundary.

To address these requests, on behalf of Beazer, GeoTrans prepared the January 14, 2009 *Supplemental Hawthorn Group Investigation and Monitoring Well Installation Workplan, Koppers Inc. Site, Revision #3, Gainesville, Florida* for the U.S. EPA. This revision of the workplan addressed the U.S. EPA's comments on previous workplan drafts. The U.S. EPA provided approval of the workplan via e-mail on January 15, 2009.

The investigation of free-phase DNAPL in shallow HG deposits was performed by collecting soil core samples at nine locations in the Upper Hawthorn deposits and at two locations in the Lower Hawthorn deposits. All of the soil core sample borings were advanced along the eastern Site property boundary. The off-Site extent of potential constituent impacts to groundwater in the HG deposits was investigated through the installation of four groundwater monitoring wells at two well cluster (well pair) locations, all located to the east and northeast of the Site. One Upper Hawthorn and one Lower Hawthorn monitoring well pair were installed at both of the cluster locations. Originally, three well cluster locations had been planned; however, because of difficulties in obtaining access to one of the proposed locations (HG-28 well cluster), well installation work at that location has been postponed until permission can be obtained from the land owner. With this exception, all other soil boring and well installation work was performed in accordance with the workplan.

Section 2.0 of this report discusses project objects and approach. Section 3.0 discusses the drilling, including on-Site borings and off-Site monitoring well construction. Section 4.0 discusses the HG deposits geology and groundwater flow. Section 5.0 presents the results of the water quality sampling in the new HG monitoring wells and Section 6.0 presents the conclusions.

2.0 PROJECT OBJECTIVES AND APPROACH

The objectives of this field investigation were the following: 1) To investigate the lateral extent of free-phase DNAPL in Surficial and HG deposits along the eastern Site property boundary; and 2) To further delineate dissolved-phase constituent concentrations in the Upper and Lower Hawthorn deposits off-Site to the east of the Site.

This report documents these investigations by describing the installation of four additional groundwater monitoring wells in the Upper and Lower Hawthorn at off-Site locations to the east and northeast of the Site and soil core samples from 13 DNAPL investigative borings along the eastern Site property boundary.

The technical challenge to the implementation of this program was to prevent new wells and investigative borings from inadvertently providing future vertical conduits for the downward migration of Site constituents. One of the lessons learned from Upper Floridan (UF) Aquifer monitoring well installations is that even with extraordinary precautions to prevent "drag down" of constituents from overlying deposits, it is difficult to completely eliminate the potential for "drag down." The hydraulic-head differential across the HG deposits is difficult to overcome during well installation at the Site. Similarly, it will be difficult to ensure long-term integrity of the grout seal outside of the casing, where the possibility exists for the monitoring wells to become direct conduits to the Upper or Lower Hawthorn. The same is true for the on-Site DNAPL investigative borings. Isolation casings were used to limit potential migration between hydrostratigraphic units while advancing the borings, and the borings were abandoned immediately after their targeted depths had been reached. However, as with the well installations, the hydraulic head differential across the HG deposits makes it difficult to completely eliminate potential constituent migration pathways, even with careful drilling and abandonment procedures.

2.1 SITE LOCATION AND DESCRIPTION

The Site is located in the City of Gainesville, in Alachua County, Florida (Figure 1-1). The Site encompasses approximately 90 acres and has been used as an active wood-treating facility for more than 90 years. Adjacent properties include the former Cabot Carbon portion of the Superfund site to the east, private residences to the west and northwest, and commercial facilities and private residences to the north and south.

Detailed descriptions of the locations of the Site former source areas are provided in the GeoTrans (2004a) report. The Site hydrogeologic conceptual model is provided in the groundwater flow and transport modeling report (GeoTrans, 2004b). Previous Hawthorn Group characterization is described in the August through November 2007 monitoring well installation report (GeoTrans, 2008).

2.2 HYDROGEOLOGY OF HAWTHORN GROUP DEPOSITS

The HG deposits underlie the Surficial Aquifer and consists of a thick sequence of low-permeability unconsolidated sedimentary deposits. These deposits are approximately 115 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. The HG deposits are not a major source of groundwater for this area. Vertical hydraulic-head distributions in the HG deposits are controlled by interbedded low-permeability clays. The horizontal groundwater flow component for this formation is only about a factor of two greater than the vertical flow component, when typically in interbedded sedimentary deposits the horizontal component is orders of magnitude greater.

The Upper Hawthorn consists of low to moderate permeability deposits between the HG deposits upper clay unit and the middle clay unit. The Lower Hawthorn consists of low to moderate permeability deposits between the HG deposits middle clay unit and the lower clay unit. Lateral groundwater flow within the Upper Hawthorn is generally to the northeast at the Site, similar to the Surficial Aquifer flow direction. A groundwater divide in the Lower Hawthorn at the Site results in groundwater on the eastern half of the Site flowing to the north-northeast and groundwater on the western half of the Site flowing to the west-northwest.

2.3 HAWTHORN GROUP MONITORING WELLS

Prior to this investigation, a total of 39 HG monitoring wells (Figure 2-1) had been completed on or near the Site. Nineteen monitoring wells are completed in the Upper Hawthorn and 20 monitoring wells are completed in the Lower Hawthorn.

Under this program, four new HG monitoring wells were installed; all of the new wells are located to the east and northeast of the Site. Continuous geologic core was collected at each of the two well cluster locations to accurately define lithologic contacts and depths. Because two wells were located at both well cluster sites, geologic core samples were collected only from the Lower Hawthorn well installation boring at each of the two nested well sites. In accordance with the workplan, the monitoring well isolation casing(s), well completion depths, and screened intervals were based on Site-specific depths to HG permeable deposits.

The new and previously existing monitoring well locations are shown on Figure 2-1. Similar to previously installed HG monitoring wells, wells with an “S” designation were completed in the Upper Hawthorn and wells with a “D” designation were completed in the Lower Hawthorn.

2.3.1 Well Locations

The EPA requested additional off-site water quality characterization downgradient of monitoring well nests HG-21S/D, -20S/D, and -26S/D. To respond to EPA’s request, three monitoring well nests were proposed downgradient of these well locations. As indicated previously, only two of the three monitoring well nests were installed and include the following:

Monitoring Wells HG-27S and -27D

Monitoring wells HG-27S and -27D were installed in the Upper and Lower Hawthorn, respectively. These wells are located approximately downgradient of the Koppers Former North Lagoon Area and off-Site HG monitoring wells HG-21S and -21D, and were installed to further quantify constituent concentrations observed in these wells.

Monitoring Well HG-29S and -29D

Monitoring wells HG-29S and -29D were installed in the Upper and Lower Hawthorn, respectively, near the northern boundary of the former Cabot Carbon site and approximately downgradient of the Koppers Former Process Area. Monitoring wells HG-29S and -29D were installed to further quantify potential constituent concentrations downgradient of monitoring wells HG-26S and -26D wells.

2.4 DNAPL INVESTIGATIVE BORING LOCATIONS

The objective of the DNAPL investigative boring program was to assess and quantify the potential for lateral migration of DNAPLs from the former Site source areas to the eastern Site property boundary. To achieve this, 11 boreholes were advanced into the Upper Hawthorn and two boreholes were advanced into the Lower Hawthorn to investigate the potential presence of DNAPLs along the eastern Site property boundary. The boring locations are downgradient of the former source areas where DNAPLs would most likely be present if lateral migration was on-going at the Site. The locations for borings UHB-1 through UHB-11, and LHB-1 and LHB-2 are shown in relation to the former source areas and existing shallow HG monitoring wells in Figure 2-2.

3.0 DRILLING AND MONITORING WELL CONSTRUCTION

Field work on the Upper and Lower Hawthorn monitoring wells and the DNAPL investigative borings began on March 9, 2009 and was completed on April 23, 2009. Drilling and well construction were performed by Boart Longyear of Ocala, Florida under the direction of GeoTrans.

3.1 DRILLING APPROACH

Prior to drilling, each location was cleared for utilities through the Sunshine State One Call System. After utility locations had been marked and cleared, HG monitoring well boring HG-27S and -27D were advanced to a depth of approximately 6 feet below ground surface (bgs) using an air-knife (vacuum-drill). The borings for wells HG-29S and -29D and many of the DNAPL investigative borings were advanced to a depth of about 5 feet using a hand auger. The air-knife and hand auger were used to help ensure that any utilities that may have been present were safely cleared at the well locations.

Apart from preliminary air-knife and hand auger work at the monitoring well locations, rotasonic drilling was the only method used to drill, advance temporary casing, and continuously sample during this project. The rotasonic rig was also used to install isolation casings and 2-inch PVC, screened monitoring wells. The rotasonic drilling method is commonly used in Florida and employs the use of high-frequency, resonant energy to advance a core barrel and/or casing into subsurface formations. The resonant energy is transferred down the drill string to the bit face at various sonic frequencies, while simultaneously rotating the drill string. Samples are collected using an inner casing as the borehole is drilled. The inner casing is typically a core barrel for the collection of samples and the outer (override) casing prevents borehole collapse. Water circulation is used to flush cuttings from the hole and to lubricate the bit surfaces as the boring is advanced.

Continuous core samples were collected from the Lower Hawthorn well borings to depths of 107 feet in HG-27D. Because the suitable upper isolation casing was not available for HG-29D, drilling started at HG-29S, which required a smaller casing size. This boring was cored continuously to a depth of 67 feet. The adjacent boring for HG-29D was drilled without coring the upper 67 feet, but was cored continuously from 67 feet to the boring total depth of 116 feet bgs. All of the Upper Hawthorn wells were advanced using the rotasonic method. One complete, continuous core was recovered from both of the well cluster locations.

Continuous cores were also collected from the DNAPL investigative borings, which were 77 feet deep in borings UHB-9 and UHB-11 and 67 feet for the remainder of the Upper Hawthorn borings. The two Lower Hawthorn borings ranged in depth from 97 feet in boring LHB-1 to 107 feet in LHB-2.

Depending on the targeted interval for each DNAPL investigative boring or the depth interval over which each monitoring well was completed, every boring had either one or two telescoping isolation casings to mitigate potential constituent “drag down.” The Upper Hawthorn monitoring wells and DNAPL investigative borings were installed using one isolation casing and the Lower Hawthorn monitoring wells and DNAPL investigative borings were installed with two isolation casings.

The single isolation casing in the Upper Hawthorn wells consisted of nominal 6-inch mild steel placed into the base of the HG upper clay unit. In the Lower Hawthorn wells, a 10-inch nominal upper isolation casing was placed into the base of the HG upper clay unit and a 6-inch nominal mild steel isolation casing was placed into the HG middle clay unit. All of the Upper and Lower Hawthorn monitoring wells were constructed using 2-inch Schedule 40 PVC casing, with 10-foot long slotted PVC screens.

Each of the Upper Hawthorn DNAPL investigative borings were continuously cored to the upper clay unit that defines the top of the HG. A 6-inch temporary isolation casing was seated in the clay and the boring was continuously advanced to the middle clay unit that defines the base of the Upper Hawthorn deposits. The Lower Hawthorn DNAPL investigative borings were continuously cored to the base of the base of the Lower Hawthorn deposits, with a 10-inch temporary isolation casing installed in the upper clay unit and a 6-inch permanent isolation casing installed in the middle clay unit.

Core runs for the HG monitoring wells and the DNAPL investigative borings were generally 20 feet in length with 100 percent recovery over all intervals sampled with the exception of from 25 to 30 feet bgs in UHB-3 due to core barrel damage. After two attempts at recovery, the intervals from 70 to 77 feet in LHB-2, and from 77 to 82 feet in HG-27D were not recovered because of grout or gravel blockage in the core barrel.

Table 3-1 summarizes the number of casings, casing installation depths and construction details for each of the wells installed under this program. A brief description of the well installations and DNAPL borings is provided below.

- Off-Site, Upper Hawthorn monitoring wells (HG-27S and HG-29S) were constructed using a single 6-inch black steel isolation casing installed in the HG deposits upper clay unit.
- Off-Site, Lower Hawthorn monitoring wells (HG-27D and HG-29D) were constructed using two isolation casings. The first (10-inch nominal black steel) isolation casing was installed in the HG deposits upper clay unit. The second isolation casing (6-inch nominal black steel) was installed in the HG deposits middle clay unit.
- On-Site, Upper Hawthorn DNAPL investigative borings (UHG-1 through UHG-11) were constructed using a single 6-inch rotasonic casing that was temporarily seated in a bentonite seal placed in the HG deposits upper clay unit.
- On-Site, Lower Hawthorn DNAPL investigative borings (LHG-1 and LHG-2) were constructed using two isolation casings. The first was a 10-inch rotasonic casing that was temporarily seated in a bentonite seal placed in the HG deposits upper clay unit. The second isolation casing was permanent 6-inch black steel that was installed in the HG deposits middle clay unit.

- On-Site, Lower Hawthorn DNAPL investigative borings LHG-1 and LHG-2 were advanced to depths of 97 feet and 117 feet, respectively. Tops of the HG deposits lower clay unit were encountered at depths of 98.0 feet and 96.5 feet, respectively. The top of the lower clay had been reported as deep as 115 feet bgs in nearby well FW-17B (the top of the lower clay has been reinterpreted at this location to 102 feet bgs). To confirm that the top of the lower clay had been encountered, two additional 10-foot rotasonic core runs (from 97.0 to 117.0) were advanced in boring LHG-2 through transitional limestone ledges and gravelly and silty interbeds. The lithologic information generated from the LHB-2 core was used in identifying the top of the lower clay unit in boring LHB-1.

Prior to drilling, targeted stratigraphic horizons for the isolation casings and for well completions were identified in logs from nearby monitoring wells. These horizons were confirmed during drilling and sampling. Major stratigraphic horizon depths encountered during drilling are summarized on Table 3-1.

3.1.1 Lower Hawthorn Monitoring Wells

Off-Site monitoring wells HG-27D and HG-29D were drilled and installed in April 2009. To mitigate potential constituent “drag down” from overlying Surficial Aquifer and Upper Hawthorn deposits, two telescoping isolation casing were installed prior to drilling into the Lower Hawthorn. A 10-inch nominal diameter black steel casing was completed into the HG upper clay unit and a 6-inch nominal diameter black steel isolation casing was completed into the HG deposits middle clay unit prior to constructing the 2-inch nominal diameter monitoring well.

Upper Isolation Casing Installation

Before the upper casing was installed, the interval from ground surface to the top of the HG deposits upper clay unit was cored using a 4-inch rotasonic sampler with 6-inch override casing. When the top of the HG upper clay unit was identified, the boring was enlarged to the targeted depth (1 to 2 feet into the HG deposits upper clay unit) using a 13-inch nominal rotasonic override casing. The 10-inch nominal upper mild steel threaded isolation casing was then installed through the rotasonic override casing. Depths to the top of the HG upper clay unit in the off-Site monitoring wells were 26.2 feet and 29.5 feet bgs at wells HG-27D and HG-29D, respectively.

When the top of the HG deposits upper clay unit was reached, the permanent isolation casing was installed by placing a 2-foot thick bentonite plug in the bottom of the borehole, then lowering the 10-inch nominal black steel permanent casing through the rotasonic override casing to the design depth. The bentonite plug served to better seal the base of the casing in the formation and also prevented cement grout from entering through the bottom of the casing. After the casing (with centralizer tabs) was placed at the design depth, it was grouted to ground surface by injecting cement-bentonite grout through a tremie pipe into the annulus while withdrawing the rotasonic casing with vibration. Grout injection continued until grout returns were observed at ground surface. This process continued until all rotasonic override casing had been removed. The casing was held in place with the rig drill drive head while the grout cured for a minimum of

12 hours before work resumed. During this time, settlement and infiltration of the grout into surrounding formation materials resulted in the grout seal dropping below land surface. Additional grout was later added to the upper part of the borehole to bring the grout seal to land surface. Liquids produced during the grouting operation were contained and processed as IDW.

Lower Isolation Casing Installation

After the grout had cured for a minimum of 12 hours, drilling continued through the inside of the 10-inch upper isolation casing. Borings were advanced using a 9½-inch outside diameter (9-inch nominal) rotasonic override casing with a 4-inch rotasonic sampler. Drilling continued until the top of the HG deposits middle clay unit had been confirmed at depths of 69.5 feet and 66.0 feet bgs in wells HG-27D and HG-29D, respectively. The borings were advanced approximately 5 feet into the HG deposits middle clay unit where a permanent 6-inch nominal, black steel, threaded isolation casing was set inside of the override casing and grouted to land ground surface.

The grouting method used to install the 6-inch nominal isolation casings was similar to the method described to install the 10-inch upper isolation casing. The casing was held in place with the rig drill drive head while the grout cured for a minimum of 12 hours before work resumed. To compensate for settlement and infiltration of the grout into surrounding formation materials, grout was added to bring it to ground surface. All liquids displaced by the grouting process were contained and processed as IDW.

Well Casing Installation

After a minimum of 12-hours had elapsed since the 6-inch isolation casing had been grouted, drilling continued through bottom of the isolation casing using 5½-inch nominal rotasonic override casing and a 3¾-inch rotasonic sampler. Drilling continued until the top of the Hawthorn Group lower clay unit was confirmed. Permanent 2-inch monitoring wells were constructed inside the rotasonic override casing as described in Section 3.2.2. Lower Hawthorn constructed well depths were 96.8 feet and 97.0 feet bgs in wells HG-27D and HG-29D, respectively.

3.1.2 Upper Hawthorn Monitoring Wells

Off-Site monitoring wells HG-27S and HG-29S were drilled and installed in April 2009, concurrent with the installation of the Lower Hawthorn monitoring wells. To mitigate potential constituent “drag down” from overlying deposits, a single isolation casing (6-inch nominal black steel) was installed into the top of the HG deposits upper clay unit at each of these monitoring well locations prior to drilling into the Upper Hawthorn deposits and constructing the 2-inch monitoring well. Since the Upper and Lower Hawthorn monitoring wells are located less than 10 feet from one-another, the lithologic description from the Lower Hawthorn well was used in identifying design casing and well depths in the Upper Hawthorn wells.

Upper Isolation Casing Installation

Rotasonic drilling and sampling methods were used for all work performed at both of these monitoring well locations. The borings were advanced from ground surface to approximately 1 foot into the top of the HG deposits upper clay unit using a 10-inch nominal rotasonic override casing. The top of the HG deposits upper clay unit was encountered at depths of 26.2 feet and 29.5 feet bgs in Lower Hawthorn wells HG-27D and HG-29D, respectively.

The permanent isolation casing was installed by placing a 1-foot thick bentonite plug in the bottom of the borehole, then lowering the 6-inch permanent casing through the rotasonic override casing to the design depth. The bentonite plug served to better seal the base of the casing in the formation and also prevented cement grout from entering through the bottom of the casing. After the casing was placed at the design depth, it was grouted to ground surface by injecting cement-bentonite grout through a tremie pipe while withdrawing the rotasonic casing. Grout injection continued until grout returns were observed at ground surface. The casing was held in place by the rig drive head and filled with potable water to counteract its buoyancy. The grout was allowed to cure for a minimum of 12 hours during which settlement and infiltration of the grout into surrounding formation materials resulted in the grout seal dropping below land surface. Additional grout was later added to the upper part of the borehole to bring the grout seal to land surface. Liquids produced during the grouting operation were contained and processed as IDW.

Well Casing Installation

Drilling continued inside of the grouted 6-inch isolation casings to advance the borehole to the final completion depth. The borings were advanced using a 6-inch nominal diameter rotasonic override casing with a rotasonic sampler. Drilling continued until the strata identified for the well completion had been encountered. Permanent 2-inch nominal diameter monitoring wells were constructed inside of the rotasonic override casing as described in Section 3.2.2.

After a minimum of 12-hours had elapsed since the 6-inch isolation casing had been grouted, drilling continued through bottom of the isolation casing using 5½-inch nominal rotasonic override casing and a 3¾-inch rotasonic sampler. Drilling continued until the strata identified for the well completion had been reached. Permanent 2-inch nominal diameter monitoring wells were constructed inside of the rotasonic override casing as described in Section 3.2.2. Upper Hawthorn constructed well depths were 61.0 feet and 55.8 feet bgs in wells HG-27S and HG-29S, respectively.

3.2 MONITORING WELL CONSTRUCTION

Monitoring well design depths were based on experience gained during previous Hawthorn monitoring well installation programs and the depths were adjusted in the field based on observed subsurface conditions. Geologic core log field forms, a photographic summary of the cores and lithologic descriptions and as-built drawings are provided in Appendices A, B and C, respectively.

The 2-inch nominal diameter monitoring wells were constructed inside of the rotasonic override casings to maintain borehole integrity during well construction. In addition, the override casing effectively performed as a tremie pipe during annulus backfilling. Typical construction details for the Upper and Lower Hawthorn monitoring wells are provided on Figure 3-1. The wells were completed in accordance with State of Florida requirements for monitoring wells and were constructed using 2-inch Schedule 40 PVC screen and casing. All PVC joints were flush threaded. The well screens were each 10 feet in length with 10-slot openings. The PVC casing extended from the top of the well screen to ground surface. The filter pack consisted of 6/20 silica sand and was poured into the borehole through the override casing. Each filter pack extended approximately 3 feet above the top of the screen. A minimum 3-foot thick bentonite seal was placed above the filter pack by slowly pouring bentonite chips inside of the override casing. The bentonite was allowed to hydrate for approximately 2 hours prior to grouting. Cement-bentonite grout was placed in borehole annulus through a ¾-inch Schedule 40 PVC tremie pipe. During placement of the filter pack, bentonite and grout seal, the override casing was progressively removed with rotasonic vibration. The vibration acted to consolidate the filter pack and seal materials.

Centralizers were placed on the 6-inch casings wherever practical; however, in some cases, variations in the nominal casing size resulted in an interference fit within the override casing. The rotasonic override casing served as an effective centralizer when physical size limitations prevented the use of external casing centralizers. With the combination of the external casing centralizers and the override casing, all well casings were approximately centered within the borehole. The 2-inch nominal well casings were set with a centralizer at the bottom and top of the well screen. Table 3-1 provides the new monitoring well screened interval depths and the zone monitored within the HG deposits.

3.2.1 Drilling Fluids Used During Well Installation

The rotasonic drilling method required the use of potable water for drilling and casing installation. A summary of water use during drilling and well construction is provided in Table 3-2. Fluids used during rotasonic drilling in the completion interval (a depth range of approximately 40 feet bgs to 55 feet bgs in the Upper Hawthorn monitoring wells and approximately 60 feet bgs to 98 feet bgs in the Lower Hawthorn monitoring wells) were "spiked" with a sodium bromide tracer. Fluids used during drilling and installation of the isolation casings were not spiked with a bromide tracer because there would be no way to measure or recover the fluids. The bromide tracer was used to help guide the duration of well development. Sodium bromide was added to the drilling water tank at an approximate concentration of 500 mg/L, based on experience gathered during previous Hawthorn Group and UF monitoring well installation programs. Drilling fluid bromide concentrations and the daily field bromide concentrations during well development are provided in Table 3-3.

3.2.2 Monitoring-Well Development

Monitoring-well development is a standard practice performed at the completion of well construction. The procedure removes fine-grained materials opposite the screened interval to improve the hydraulic connection between the aquifer and monitoring well. In addition, well development is used to recover water that was lost to the formation during drilling and well completion operations.

A July 12, 2005 U.S. EPA letter required that drilling fluids in wells constructed at the Site contain a tracer to quantify drilling fluid impacts on future groundwater samples collected from the well. As described in Section 3.2.1, a sodium bromide tracer at an approximate concentration of 500 mg/L was added to water used in drilling and well construction in the completion zones of the Upper and Lower Hawthorn monitoring wells.

The wells were developed no sooner than 24 hours after installation. Field well development forms are provided in Appendix D. Each of the monitoring wells was developed using 1.82-inch diameter Proactive Mega-Typhoon submersible pumps. The wells were periodically surged by raising and lowering the pump, which has a similar outside diameter to the inside diameter of the well. Wells HG-27S and -27D and HG-29D produced sufficient water that they could not be pumped dry at rates of up to 2 gallons per minute (gpm); however, at the lowest flow rate that the development pump would sustain (less than 0.5 gpm), it was possible to pump Upper Hawthorn well HG-29S dry. This well was allowed to recharge before pumping was resumed.

In accordance with the workplan, the target well-development criteria were the following:

1) Development would continue until the water was visually clear;
2) Development would continue until the bromide concentration in each well was below an approximate value of 30 mg/L or until a bromide concentration asymptote was reached; and
3) Wells would be developed up to a maximum of 4 hours.

Table 3-2 contains the volume of water injected to the formation during drilling versus the volume that was removed during drilling. Bromide concentrations during development were periodically measured using an Oakton Ion 5 – Acorn Series meter equipped with a bromide ion-specific probe. Turbidity was measured with a Hanna 98703 turbidity meter, and pH, conductivity and temperature were measured using a Hanna 991300 water quality meter. Field measurements were recorded on field-data sheets, which are provided in Appendix E. Table 3-3 provides sodium-bromide concentrations and turbidity levels measured during development and Table 3-4 provides field water-quality (temperature, conductivity and pH) measurements taken during well development. All development water was contained in 55-gallon drums, and transported to the Site for treatment and/or disposal.

3.3 UPPER AND LOWER HAWTHORN DNAPL BORINGS

The Upper and Lower Hawthorn DNAPL investigative borings were all locate along the eastern Site property boundary, as shown on Figure 2-2. The Site fence was temporarily removed at the drilling locations to allow access to the eastern-most part of the Koppers property. The fence was replaced after drilling had been completed.

Continuous 4-inch nominal diameter soil core samples were collected from DNAPL investigative borings UHB-1 through UHB-11 and LHB-1 and LHB-2. The cores were logged by the oversight geologist/engineer for lithology and observable creosote impacts (if any) in the Surficial Aquifer and in the Hawthorn Group deposits. All core samples were screened for VOCs using a PID, described, photographed and carefully evaluated for the presence of

DNAPLs before disposing of the core as IDW with the drill cuttings. To evaluate the potential presence of DNAPLs, the core samples were disaggregated and sprayed with potable water to facilitate the identification of residual DNAPL that DNAPL presents as small "blebs" or droplets on the surface of the wet core. These observations were recorded in the lithologic log. The core was also used to identify and describe major lithologic unit tops and bottoms.

Immediately after the targeted depths had been reached in each boring, it was backfilled with bentonite chips to ground surface using the rotasonic core barrel as a tremie pipe. The barrel was slowly withdrawn as chips were added. Since the chips were place below the water table, it was not necessary to hydrate them. The upper 3 feet of the borings were backfilled with cement grout. DNAPL staining was encountered in borings UHB-9, UHB-10 and LHB-2. The DNAPLs were below saturation and were not mobile. In these borings, a bentonite-cement grout seal was used to backfill the open borehole. The grout was placed through a tremie pipe.

Upper Hawthorn Investigation

Because all of the investigative borings were located in potentially impacted areas, they required installation of a casing into the top of the HG Upper Clay unit. The casing consisted of a temporary 7-inch nominal rotasonic override casing that was driven approximately 1 to 2 feet into the HG upper clay unit. Upon identifying the targeted depth for the temporary casing using 4-inch rotasonic core samples, the core barrel was withdrawn and the borehole was enlarged using the 7-inch temporary rotasonic casing. Approximately 5 feet of bentonite chips were added to the bottom of the casing. Potable water was added and the rotasonic casing was withdrawn approximately 5 feet using vibration. The chips were allowed to hydrate for a minimum of 1 hour before the rotasonic casing was again advanced to the base of the bentonite plug. The bentonite plug created a temporary seal with the 7-inch override casing. A 4-inch core barrel was then advanced through the bottom of the 7-inch casing to the targeted boring completion depth at the top of the HG middle clay unit.

The core samples were logged and documented as described above. After the targeted depth was reached, each boring was backfilled with bentonite chips to ground surface using the core barrel as a tremie pipe. The barrel was slowly withdrawn as chips were added. Since the chips were placed below the water table, it was not necessary to hydrate them. The upper 3 feet of the boring was backfilled with cement grout. Because nonaqueous phase liquid (NAPL) staining was observed in borings UHB-9 and UHB-10, they were backfilled to ground surface with cement grout that was injected from the bottom of the boring through a tremie pipe.

Lower Hawthorn Investigation

Similar to the Upper Hawthorn investigative borings, isolation casings were installed at key stratigraphic horizons prior to advancing the boring. The upper isolation casing was installed into the HG upper clay unit and the lower isolation casing was installed into the HG middle clay unit. The isolation casings were installed in an attempt to mitigate constituent "drag down" to the Lower Hawthorn. Isolation casing installation procedures were similar to those described for the Upper Hawthorn investigative borings. After the top of the HG upper clay unit had been confirmed in the core samples, the borehole was enlarged using a 12-inch nominal rotasonic override casing. This casing was then pulled back approximately 5 feet. Bentonite chips were poured through the casing and allowed to hydrate for a minimum of 1 hour. The casing was then pushed through the chips to the target depth within the upper clay unit.

After the bentonite had hydrated and the 12-inch override casing was in place, the 10-inch override casing was advanced through the inside of the 12-inch casing approximately 3 to 5 feet into the HG middle clay unit, where a permanent 6-inch nominal welded, mild-steel isolation casing was set inside of the 10-inch override casing and permanently grouted to land surface using a cement-bentonite grout (Section 3.5) that was placed using a tremie pipe. After a minimum grout set-up period of 12 hours, core samples were collected to the top of the Hawthorn Group lower clay unit using a 5½-inch rotasonic override casing with a 3½-inch rotasonic core barrel. The casing and core barrel were advanced through the bottom of the cement-bentonite plug in the 6-inch permanent casing.

The core samples were logged and documented as described above. After the targeted depth was reached, boring LHB-1 was backfilled with bentonite chips to ground surface using the core barrel as a tremie pipe. The barrel was slowly withdrawn as chips were added. Since the chips were place below the water table, it was not necessary to hydrate them. The upper 3 feet of the boring was backfilled with cement grout. NAPL staining was observed in boring LHB-2, therefore, it was backfilled to ground surface with cement grout that was injected from the bottom of the boring through a tremie pipe.

Upon completion of abandonment, each of the investigative boring locations was staked and clearly marked for surveying.

3.4 Geologic Core Collection

A total of 1,330 feet of 3- and 4-inch diameter geologic core were collected from the HG monitoring well and DNAPL investigative boreholes. Core was collected from the Lower Hawthorn well boring at each well cluster starting at the bottom of the air-knife or hand auger boring and extending to the total depth of the boreholes, and over the entire length of each of the DNAPL investigative boreholes. The on- and off-Site continuous core samples collected during the rotasonic drilling were described by the on-Site field hydrogeologist, photographed, and screened for volatile organic compounds (VOCs) using a photoionization detector (PID) equipped with a 10.6 eV bulb.

Geologic core log field forms, a photographic summary of the cores and lithologic descriptions, and as-built drawings are provided in Appendices A, B and C, respectively. Geologic contacts and existing clay thickness information from other, nearby borings were used to help establish design depths for the monitoring well and Lower Hawthorn DNAPL boring isolation casings. A summary of the well as-built data and depths to major stratigraphic contacts for the monitoring wells is provided in Table 3-1, which also summarizes the depths to major stratigraphic horizons in the DNAPL investigative borings.

3.5 Borehole and Casing Grouting

The cement-grout mixture and preparation used in all components of the casing installation and well construction were in accordance with American Society of Testing and Materials (ASTM) 5092 and consisted of ASTM Type I/II Portland cement, powdered bentonite, and potable city water. The cement was mixed into a smooth slurry using 6.5 gallons of water, 3 pounds of bentonite, and 94 pounds of cement. Powdered bentonite was added to the cement grout mixture to minimize shrinkage during the curing process, as required by St John's River Water Management District (SJRWMD) (Chapter 40C-3, F.A.C.). All grout used in casing installation and well construction was placed downhole using a tremie pipe, grout injection, casing displacement or other equivalent method to ensure positive displacement of downhole liquids and solids with grout. Grouting of each casing continued until grout returns were confirmed at ground surface. The grout was allowed to cure a minimum of 12 hours prior to performing additional work.

3.6 Equipment and Materials Decontamination Procedures

Drilling equipment, tools and associated materials used in well construction were decontaminated prior to first use on-Site, after the installation of each telescoping isolation casing and monitoring well, and prior to drilling at a new monitoring well location (i.e., before and after all operations). Decontamination fluids were containerized for disposal through the on-Site water treatment plant. The following decontamination procedures were used:

1) The external and internal surfaces of equipment were washed with high-pressure water until all visible dirt, grime, grease, oil, loose paint, rust flakes, etc., were removed.
2) After cleaning, the equipment/material was rinsed with potable water.
3) All decontaminated drilling equipment, casings and override casing were stored above ground on racks prior to being used in the drilling and well construction process.

3.7 Investigative Derived Waste

All investigative derived waste (IDW) originating from designated Superfund Sites must be managed as potentially hazardous waste, unless laboratory analyses establish that it can be considered a nonhazardous waste. Beazer has taken the conservative approach to treat most off-Site IDW as though it was derived from on-Site. In doing so, Beazer utilized the material handling and waste characterization process described below.

The material (drill cuttings, circulation fluids, etc.) generated from rotasonic drilling activities during the on-Site DNAPL Investigation and the off-Site installation of the Hawthorn Group monitoring wells described in this report were containerized in 55-gallon drums. Whenever possible, liquids were segregated from solids and transported to the on-Site water-treatment facility. The IDW generated during the DNAPL boring investigation was contained and treated as hazardous. Based on non-hazardous drill cutting and groundwater conditions encountered in the nearby UF sentinel wells (FW-26B and -26C), IDW from off-Site well HG-27S and –27D was treated as non-hazardous. Because petroleum distillate-like odors and

PID detections were observed in liquid and solid IDW from wells HG-29S and -29D, IDW from this location was handled as hazardous waste pending laboratory analysis.

A total of 164 drums of investigation-derived solid waste were generated during the monitoring well installation and DNAPL investigative boring process. The drummed material was managed for off-Site transport and disposal.

3.8 Surface Completion and Survey

The above-ground monitoring well completions consisted of: 1) Cutting the isolation casings below grade; 2) Constructing a concrete apron around the well; and 3) Installation of a traffic-rated flush-mount well vault. Within the vault, each monitoring well was equipped with a locking J-plug. The State Plane coordinates, ground-surface elevation next to the well and elevation of the 2-inch PVC casings were surveyed on April 14, 2009. The survey results are summarized in Table 3-5.

3.9 Monitoring Well Installation and DNAPL Boring Issues

Three notable issues were encountered during this program as described below:

1) It was not possible to obtain access to the proposed drilling location for wells HG-28S and HG-28D. This resulted in the wells not being installed as planned. It is anticipated that these wells will be installed when access issues have been resolved.

2) After completion of boring UHG-4, an attempt to collect a soil sample for the IRM for grain size analysis was attempted immediately adjacent to UHG-4. One of the hydraulic containment system perimeter pipelines was struck and damaged. Less than 50 gallons of water were released before the system was shut down.

3) IDW at off-Site well location HG-29S/D appeared to be impacted with non-Site related constituents. The soils and development water from this nested-well pair had a strong, sweet petroleum distillate and burned-wood odors, in addition to being stained with a yellow and purple substance. The IDW for this well nest was transported to the Site and segregated as hazardous waste (pending analysis).

3.10 PROGRAM TIMELINES

The well drilling installation commenced on March 9, 2009 with the Upper Hawthorn DNAPL Investigation. This part of the program was concluded and the Lower Hawthorn DNAPL Investigation was started on March 24, 2009. The Lower Hawthorn DNAPL Investigation was concluded on March 28, 2009 and the off-Site HG well installation work was commenced. The drilling and well installation program was concluded and equipment and materials were demobilized from the site on April 22, 2009. A timeline showing the program schedule is provided in Figure 3-2.

4.0 HYDROGEOLOGIC DATA ANALYSIS

4.1 GEOLOGY

The borings and monitoring wells installed under this program provide comprehensive geologic core for the Surficial and HG deposits along the eastern Site property boundary and off-Site to the east. With the exception of a few instances where the core barrel became blocked during a core run (less than 1.3% of the total cored interval), continuous cores were collected from ground surface to the targeted depths within the HG deposits. Geologic-section locations are provided in Figure 4-1 and geologic sections through the new HG monitoring wells and DNAPL investigative borings are provided in Figures 4-2 and 4-3, respectively. The geologic core from this program confirms and supports the hydrogeologic-conceptual model for the Surficial Aquifer and the HG deposits.

The Surficial Aquifer consists of approximately 20-30 feet of fine- to medium-grained sand with trace amounts of silt and clay interbedded with laterally discontinuous zones of clayey sands and sandy clays. The depth to the water table fluctuates seasonally and from ranges 3 to 15 feet bgs. During this investigation, the Surficial Aquifer was found to extend to depths of up to 19.0 feet (DNAPL boring UHB-8) to 29.5 feet (monitoring well HG-29D).

The HG deposits range from approximately 115 to 125 feet in thickness. They are comprised of interbedded clays, silty-clayey sand, sandy clay, and occasional carbonate beds. The upper surface of the HG deposits is the green-gray upper clay unit that dips generally toward the northeast at the Site. This unit typically ranges from 0.5 to 7 feet in thickness in the vicinity of the Site. During this investigation, the depth to the top of the HG deposits upper clay unit ranged from 19.0 feet bgs (DNAPL boring UHB-8) to 29.5 feet bgs (monitoring well HG-29D). The thickness of this unit was found to range from 1.7 feet (DNAPL boring UHB-6) to 9.8 feet (monitoring well HG-27D). The clay thickness observed at well cluster HG-27S/D is greater than had been previously observed at on-Site locations. The clay at this location is bifurcated by a 3-foot thick seam of medium-grained sand. Sand stringers within the HG upper clay unit are not uncommon and were encountered to varying degrees in UHB-2, -3, -4, -5, -7 and -8

Below the HG deposits upper clay unit is the Upper Hawthorn which is comprised of clayey-sand deposits. The Upper Hawthorn typically ranging in thickness from 32 to 42 feet thick in the vicinity of the Site. The Upper Hawthorn encountered during this investigation was found to range in thickness from 26.0 feet (DNAPL boring UHB-5) to 49.6 feet (DNAPL boring UHB-11), with an average thickness of approximately 37 feet.

Below the Upper Hawthorn is a second clay deposit, referred to as the HG deposits middle clay unit. This clay unit is a more effective confining unit than the upper clay unit, as hydraulic-head differences across the middle clay unit average more than 30 feet. In this field investigation, the depth to the top of the HG deposits middle clay unit ranged from 59.0 feet bgs (DNAPL boring LHB-1) to 74.4. feet bgs (DNAPL boring UHB-11). The HG deposits middle clay unit typically ranges from 12 to 15 feet thick across the Site. The thickness of this unit encountered during this investigation ranged from 10.5 feet (monitoring well HG-29D) to 19.0

feet (DNAPL boring LHB-2). The middle clay thickness in the two Lower Hawthorn borings along the eastern property boundary was 17.0 feet (LHB-1) and 19.0 feet (LHB-2).

Below the HG deposits middle clay unit is the Lower Hawthorn, which consists of clayey-sand deposits. During this investigation, the depth to the top of the HG deposits lower clay unit ranged from 96.5 feet bgs (DNAPL boring LHB-1) to 98.0. feet bgs (DNAPL boring LHB-2). The Lower Hawthorn typically ranges in thickness from 6 to 38 feet in the vicinity of the Site. The thickness of the Lower Hawthorn encountered during this investigation ranged from 11.0 feet (DNAPL boring LHB-2) to 35.0 feet (monitoring well HG-29D). The average thickness of this unit in the two borings and two wells that penetrated it was about 19 feet.

4.2 FINDINGS OF DNAPL BORING INVESTIGATION

The primary objective of the DNAPL borings was to investigate the lateral extent of free-phase DNAPL in Surficial and HG deposits along the eastern Site property boundary. Geologic core log field forms, a photographic summary of the cores and lithologic logs for the DNAPL borings are provided in Appendices A, B and C, respectively. A summary of depths to major stratigraphic contacts for the borings is provided in Table 3-1.

Free-phase DNAPL was not encountered in any core samples collected during this investigation. In addition, the majority of the borings had no evidence of DNAPL staining or residual DNAPL; however, thin zones of elevated PID detections, odor, and residual DNAPL/staining were observed in 4 of the 13 borings. DNAPL that was below residual saturation (i.e. not mobile) was observed in Upper Hawthorn borings UHB-9 and UHB-10 and in Lower Hawthorn boring LHB-2. Residual DNAPL was not observed, but dark staining was present over a thin zone in Lower Hawthorn boring LHB-1. A description of observed conditions in these borings is provided below.

Boring UHB-9

Upper Hawthorn DNAPL boring UHB-9 is located downgradient from the former Process Area where DNAPL recovery has been on-going for the past 3 years in monitoring wells HG-15S and HG-11S. DNAPL in these two on-Site wells is currently being recovered from a silty-sand deposit located immediately above the HG middle clay unit. Although discrete zones of residual DNAPL and staining were observed above the silty-sand zones in these wells during their installation, the DNAPL in these upper zones was below residual saturation (i.e. immobile).

Boring UHB-9 encountered a thin zone of residual DNAPL at a depth of 45.0 to 46.0 feet bgs. This 1-foot thick DNAPL zone was located in the middle portion of the Upper Hawthorn, approximately 22 feet above the HG middle clay unit. DNAPL sheen/blebs formed when the core was disaggregated and sprayed with water. This zone also approximately correlates with the depth of an immobile DNAPL zones encountered in monitoring well HG-15S (Figure 4-2).

The residual DNAPL was confined to a 1-foot thick, sandy, silty-gravel deposit. The lithology above and below this deposit is a lower permeability sandy, clayey silt. The residual DNAPL zone resulted in elevated PID detections and a very strong petroleum odor (see lithologic log descriptions in Appendix C). PID levels and odor were not observed below the residual DNAPL zone from a depth of 46 feet to the top of the middle clay unit (68 feet bgs) and extending into the middle clay unit to a borehole completion depth of 77 feet bgs. None of the other DNAPL zones encountered in the on-Site wells were observed in boring UHB-9, indicating that the lateral extent of the on-Site residual DNAPL zones is limited and does not extend to the Site property boundary in the vicinity of this boring location. Similarly, the silty-sand deposit, from which DNAPL is being recovered on Site, correlates approximately with the 2-foot thick gravel deposits above the middle clay unit in boring UHB-9. However, there is no evidence of DNAPL migration within this more permeable unit at the UHB-9 location.

Boring UHB-10

Upper Hawthorn DNAPL boring UHB-10 is located approximately 120 feet to the south of UHB-9. Both of these borings are located immediately to the east of the former Process area and monitoring wells HG-15S and HG-11S. Residual DNAPL in boring UHB-10 was observed in thin discrete zones within the Upper Hawthorn at depths of 31.5 feet, 37.0 to 38.0 feet, 39.0 to 39.5 feet, 44.0 feet and 44.5 feet. These DNAPL zones are located in the upper and middle portions of the Upper Hawthorn, approximately 18 feet above the middle clay unit. Visible staining was present immediately below these zones and DNAPL sheens/blebs formed when the core was disaggregated and sprayed with water. Residual DNAPL was observed along parting surfaces, fracture planes and zones of slightly enhanced permeability at the intervals described above. The residual DNAPL impacted zones corresponded to elevated PID detections and a strong petroleum odor (see lithologic log descriptions in Appendix C). Elevated PID detections were not present below a depth of 47 feet (about 2.5 feet below the observed DNAPL staining) and core samples were odorless below a depth of 57 feet.

The DNAPL impacted zones in boring UHB-10 approximately correlate with two of the upper residual DNAPL zones in HG-15S, although the vertical extent of the DNAPL zones in UHB-10 is not as extensive as observed in HG-15S. The approximate correlation of residual DNAPL zones in UHB-10 with on-Site zones is an indication that historical DNAPL migration away from the former Process area followed thin higher permeability sand stringers within lower permeability silt deposits. The fact that DNAPL is at or below residual saturation in these zones is an indication that on-going DNAPL migration is not occurring at the Site. The gravel to silty-sand deposit that overlies the middle clay unit in the former Process area was not encountered in boring UHB-10 indicating that this deposit is not laterally continuous.

Boring LHB-2

Lower Hawthorn boring LHB-2 was installed approximately 30 feet to the north of Upper Hawthorn boring UHB-10. As would be expected, some of the residual DNAPL zones in LHB-2 approximately correlated with DNAPL-impacted zones in UHB-10. In addition, residual DNAPL-impacted zones were encountered in this boring immediately below the HG upper clay unit and approximately 10 feet deeper than the residual DNAPL zones within UHB-10. Residual DNAPL in this boring was only observed in the Upper Hawthorn and was not present in Lower Hawthorn. Residual DNAPL was observed at discrete depth intervals of 27.0 to 28.0 feet in a gravelly, silty-clay deposit, and in clayey, sandy-silt deposits at 36.0 to 36.5 feet, 37.0 feet, at 41.3 to 42.5 feet and at 51.0 to 53.5 feet bgs. Visible staining was present over all of these zones and DNAPL sheens/blebs were observed when the core was disaggregated and sprayed with water. The residual DNAPL appeared to be restricted to horizontal parting surfaces, oblique fracture planes and zones of slightly enhanced permeability within a predominantly homogeneous silt deposit. The DNAPL impacts resulted in elevated PID detections and a strong to very strong petroleum odor (see lithologic log descriptions in Appendix C). Staining was not present below 53.5 feet (the deepest observed DNAPL) and PID detections and odor abated with depth below 53.5 feet and were completely absent below a depth of 66 feet.

Similar to borings UHB-9 and -10 in this area, DNAPL impacts were restricted to the upper and middle portions of the Upper Hawthorn. No DNAPL impacts were observed immediately above the HG middle clay unit. Similar to the UHB-10, a higher permeability silty-sand to gravel deposit was not present above the middle clay unit at this location.

Boring LHB-1

Lower Hawthorn boring LHB-1 is located immediately to the east of the former Drip Track area along the eastern Site property boundary. Boring LHB-1 is located approximately downgradient from on-Site Upper Hawthorn DNAPL recovery well HG-12S. All seven borings installed downgradient of the former Drip Track area and North Lagoon were absent of residual DNAPL and staining in the Upper Hawthorn. Boring LHB-1 was completed through the Upper and Lower Hawthorn deposits. The only evidence of historical DNAPL migration in this area was a minor amount of staining in the Lower Hawthorn. Distinct staining accompanied by a moderate odor was present in boring LHB-1 in the Lower Hawthorn at discreet depths of 89.0 to 90.0 feet, 92.0 feet and 93.0 feet; however, DNAPL sheens/blebs did not form when the core was disaggregated and sprayed with water. PID detections were not observed over this interval; however, the lack of PID hits may be due to the extremely humid conditions that were present when this boring was installed. The staining was observed along zones of slightly enhanced permeability within a clayey gravel matrix with occasional horizontal hard carbonate strata.

The lack of significant DNAPL impacts in the area of LHB-1 is an indication that DNAPL has not migrated off-Site in this area. The DNAPL staining in the Lower Hawthorn is within a higher permeability gravel deposit and did not extend to the top of the HG lower clay unit

4.3 OFF-SITE HAWTHORN MONITORING WELLS

Hydrogeologic data obtained from the two off-Site HG nested well pair locations are consistent with on-Site data. The HG upper, middle and lower clay units are continuous and extend off-Site to the east. The thicknesses of the HG clay units are approximately consistent with on-Site thicknesses; however, the HG middle clay unit is thicker to the northeast of the Site in monitoring well HG-27S/D.

Creosote DNAPLs were not encountered in cores obtained from monitoring well nests HG-27S/D and HG-29S/D; however, non-creosote related impacts were observed in wells HG-29S and -29D. Impacts observed in core samples and development water from these wells were characterized by the field geologist as containing strong, sweet petroleum distillate and burned-wood odors, in addition to being stained with a yellow and purple substance. Monitoring well nest HG-29S/D is located immediately downgradient from the former Cabot Carbon site northwest lagoons.

4.4 HAWTHORN GROUP DEPOSITS GROUNDWATER FLOW

Groundwater flow directs within the HG deposits is different for the Upper Hawthorn and the Lower Hawthorn. Groundwater flow within the Upper Hawthorn is primarily to the northeast, whereas groundwater flow in the Lower Hawthorn is bifurcated at the Site with flow going to the northwest and northeast. Water levels were measured by Field and Technical Services (FTS) in the newly installed and a few existing HG monitoring wells on May 27 and 28, 2009. Because of suspected water-level probe problems, the water level in well HG-29S was re-measured on June 10, 2009. Water-levels measurements and corresponding potentiometric-surface elevations are provided in Table 4-1. Groundwater-elevation contours for the Upper and Lower Hawthorn monitoring wells are presented on Figures 4-4 and 4-5, respectively.

Water-levels measured in the newly installed Upper Hawthorn monitoring wells are consistent with on-Site water levels and general groundwater flow direction. The Upper Hawthorn average groundwater flow direction is to the north-northeast toward Springstead Creek. The average hydraulic gradient across the Site is approximately 0.0077 to 0.0084 ft/ft. There is a marked decrease in the hydraulic gradient across the northern and northeastern half of the Site. The decrease in hydraulic gradient is likely an indication that the transmissivity (product of hydraulic conductivity and thickness) of the Upper Hawthorn is lower on the northern half of the Site than the southern half. The increased gradient and corresponding decreased transmissivity appears to extend off-Site to the northeast and east into the areas of the newly installed HG wells.

Water levels in the Lower Hawthorn are also consistent with on-Site water levels and average groundwater flow directions. The potentiometric-surface elevation contour map for the Lower Hawthorn shows that a groundwater divide, oriented approximately northwest to southeast, is present across the middle of the Site (Figure 4-5). Groundwater flow on the eastern half of the Site is generally to the north-northeast. Groundwater flow on the western half of the Site is generally to the west-northwest. The average hydraulic gradient in the Lower Hawthorn on the eastern half of the Site is 0.0070 ft/ft and the average hydraulic gradient on the western half of the Site is approximately 0.010 ft/ft. Contrary to the Upper Hawthorn, the hydraulic gradient of the Lower Hawthorn decreases to the north and northeast. The decrease in hydraulic gradient is an indication that the transmissivity of Lower Hawthorn deposits may be increasing in this direction.

No free-phase NAPLs or sheens were detected at monitoring well nests HG-27S/D or HG-29S/D during the water-level measurements. In addition, no NAPL sheens or free-phase product were detected in geologic core samples collected during the well installation, well development and groundwater sample collection.

5.0 WATER QUALITY SAMPLING AND ANALYSIS

Monitoring wells HG-27S, HG -27D, HG -29S and HG -29D were sampled by FTS on May 21, 2009. At the U. S. EPA request, Representatives for Cabot Carbon Corporation collected duplicate samples from these wells during the May 2009 sampling event. Both Beazer and the Cabot Carbon Corporation water samples were submitted for analyses of a similar suite of constituents. Beazer has not been provided the analysis results from the Cabot Carbon Corporation samples and therefore, they are not included with this report. The sampling procedures and results for the Beazer samples are presented below.

5.1 SAMPLING PROCEDURES

Prior to each day's sampling event, FTS staff calibrated three YSI 556 meters, two LaMotte 2020e turbidity meters, and a HACH 2100P turbidity meter. The YSI meters were used to monitor groundwater quality parameters including pH, specific conductivity, temperature, ORP and dissolved oxygen. The LaMotte 2020es and HACH 2100P were used to monitor turbidity. Decontamination of this non-dedicated sampling equipment was performed between sampling locations using an Alconox™ solution and DI water rinses.

Sampling of the HG monitoring wells was performed using low-flow purging and sampling procedures. Peristaltic pumps equipped with dedicated Teflon-line tubing were used to purge and sample the monitoring wells. Well purge rates were measured using graduated containers to adjust pumping rates to between 90-250 ml/min. Purge water was containerized in 5-gallon buckets and transferred to the on-Site treatment system. Water-level meters were used to monitor groundwater drawdown at each well during purging activities. The electronic water-level meters were decontaminated between wells using Alconox™ solution and DI rinses. Groundwater samples were collected from the dedicated Teflon-lined tubing for analysis of Volatile Organic Compounds (VOCs) by method 8260B, Semi-volatile Organic Compounds (SVOCs) by method 8270C, and dissolved metals by method 6020.

5.2 WATER QUALITY RESULTS

A total of four groundwater samples (exclusive of quality control samples) were collected from off-Site HG monitoring wells (HG-27S, HG-27D, HG-29S and HG-29D). Analytical results for VOCs, SVOCs and metals constituents are discussed below. A summary of the analysis results, the Federal maximum contaminant levels (MCLs) and Florida Groundwater Cleanup Target Levels (GCTLs) are provided in Table 5-1. The laboratory analytical and data validation reports are included in Appendix E. Concentrations for benzene, toluene, ethylbenzene and xylene (BTEX) for the new Upper Hawthorn monitoring wells are posted on Figure 5-1a. Phenol concentrations for the shallow wells are posted on Figure 5-1b. BTEX and phenol levels for the new Lower Hawthorn monitoring wells are posted on Figure 5-2a and 5-2b, respectively.

5.2.1 Volatile and Semi-Volatile Organic Analyses

Monitoring wells (HG-27S and HG-27D) located to the northeast of the Site contained select organic constituent impacts at relatively low levels, in both the Upper and Lower Hawthorn. None of the constituents in these two wells exceeded Federal MCLs. The only constituent that exceeded Florida GCTLs was phenol in monitoring well HG-27D. The Florida GTCL for phenol is 10 µg/L and the concentration measured in monitoring well HG-27D was slightly above this limit at 11 µg/L. It should be noted that phenol is one of the indicator constituents for historical operations at the former Cabot Carbon site.

Monitoring wells HG-29S and HG-29D are located to the east of the Site and approximately 100 feet downgradient of the former northwestern lagoons located on the former Cabot Carbon site. This well cluster represents the easternmost Hawthorn Group monitoring wells. Well HG-29S showed detections of terpenes, which include boreol and camphor at levels of 5,600 µg/L and 2,300 µg/, respectively. The Upper Hawthorn monitoring well (HG-29S) at this location showed the greatest impacts and contains eight organic constituents that exceed Florida GCTL standards. Two of the eight constituents (benzene and toluene) exceeded Federal MCLs (Table 5-1). Monitoring well HG-29D contained nine organic constituents that exceeded Florida GCTL standards with one constituent (benzene) that exceeded Federal MCLs.

The BTEX concentrations in this well pair far exceed any BETX concentrations detected on the Site. Similarly, the phenol-compounds concentrations (2,4-Dimethylphenol, 2-Methylphenol, 3&4-Methylphenol, phenol) for the HG-29S/D well pair are orders of magnitude higher than historical concentrations in off-Site HG monitoring wells located between the Site and the former Cabot Carbon site. Given the proximity of this well pair to the former Cabot Carbon northwest lagoons, the number and types of phenol-compounds with elevated concentrations, and the low to nondetect constituent concentrations upgradient of the well pair, it is unlikely that the source of these constituents is the Koppers, Inc. (KI) Site.

5.2.2 Metals Analyses

Groundwater samples collected from each of the wells were analyzed for dissolved arsenic, chromium, copper and zinc. These four metals were reported as being either non-detect or well below Florida GCTLs in all of the new HG monitoring wells, with the exception of arsenic. Arsenic was detected in well HG-29S at 17 µg/L, which is in excess of the Florida GTCL and Federal MCL for this metal (Table 5-1). The elevated arsenic concentration in this well is likely due to release of arsenic from naturally occurring minerals in the Lower Hawthorn. It has been previously documented (GeoTrans 2007) that arsenic is released due to the introduction of oxygenated fluids during the installation of monitoring wells in both the UF Aquifer and Lower Hawthorn.

6.0 CONCLUSIONS

Hawthorn Group DNAPL Borings

The HG DNAPL borings installed under this program demonstrate that extensive on-going DNAPL migration is not occurring in the vicinity of the eastern Site property boundary. Four of the 13 borings installed along the eastern property boundary encountered evidence of minor historic DNAPL migration in this area. Relatively thin residual/stained DNAPL zones were detected in the Upper Hawthorn in the three boring installed to the east of the former Process area; staining was also detected in one Lower Hawthorn boring installed downgradient of the former Drip Track area. All remaining borings had no evidence of historic and/or current DNAPL migration in this area. Hence, the results of this investigation indicate that on-going off-Site DNAPL migration is not currently occurring and that historic DNAPL impacts along this property boundary were relatively minor.

Hawthorn Group Deposits Hydrogeology

The hydrogeologic core data obtained from the four new monitoring wells installed under this program support the hydrogeologic conceptual model developed for these deposits. The HG deposits upper, middle and lower clay units are continuous and laterally extensive across the Site and off-Site to the east. The groundwater flow direction for the Upper Hawthorn is generally to the northeast. The groundwater flow direction for Lower Hawthorn is to the north-northeast on the eastern half of the Site and to the west-northwest on the western half of the Site.

Hawthorn Group Deposits Water Quality

The new monitoring wells installed in the off-Site Upper and Lower Hawthorn east of the Site indicate that non-Site-related impacts are present to the east of the Site in the Upper and Lower Hawthorn in monitoring wells HG-29S and HG-29D. Monitoring wells HG-27S and HG-27D, which are located to the northeast of the Site, had little to no dissolved-phase impacts. Dissolved-phase constituent impacts in monitoring wells HG-29S and -29D are orders-of-magnitude higher than those observed in upgradient, off-Site Hawthorn monitoring wells. Moreover, the suite of organic constituents (BTEX and terpenes) is different than those observed on-Site.

7.0 REFERENCES

GeoTrans, 2004a, 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, 2004b, Addendum 6: Groundwater Flow and Transport Model, Koppers Inc. Site, Gainesville, Florida, October 5, 2004.

GeoTrans, Inc. on behalf of Beazer East, Inc., Evaluation of Arsenic Detections in Groundwater in the Floridan Aquifer, March 2007.

TRC, 1997, Proposed Stage 2 Groundwater Monitoring Program, Initial Groundwater Remedial Action, August 1997.

TRC, 2002a. Soil and Ground Water Sampling Plan. Cabot Carbon/Koppers Superfund Site, Gainesville, Florida. January 2002.

TRC, 2002b. Health and Safety Plan. Cabot Carbon/Koppers Superfund Site, Gainesville, Florida. January 2002.

TRC, 2002c. Quality Assurance Project Plan for the Additional Characterization of the Hawthorn Group Formation Workplan. Cabot Carbon/Koppers Superfund Site, Gainesville, Florida. January 2002.

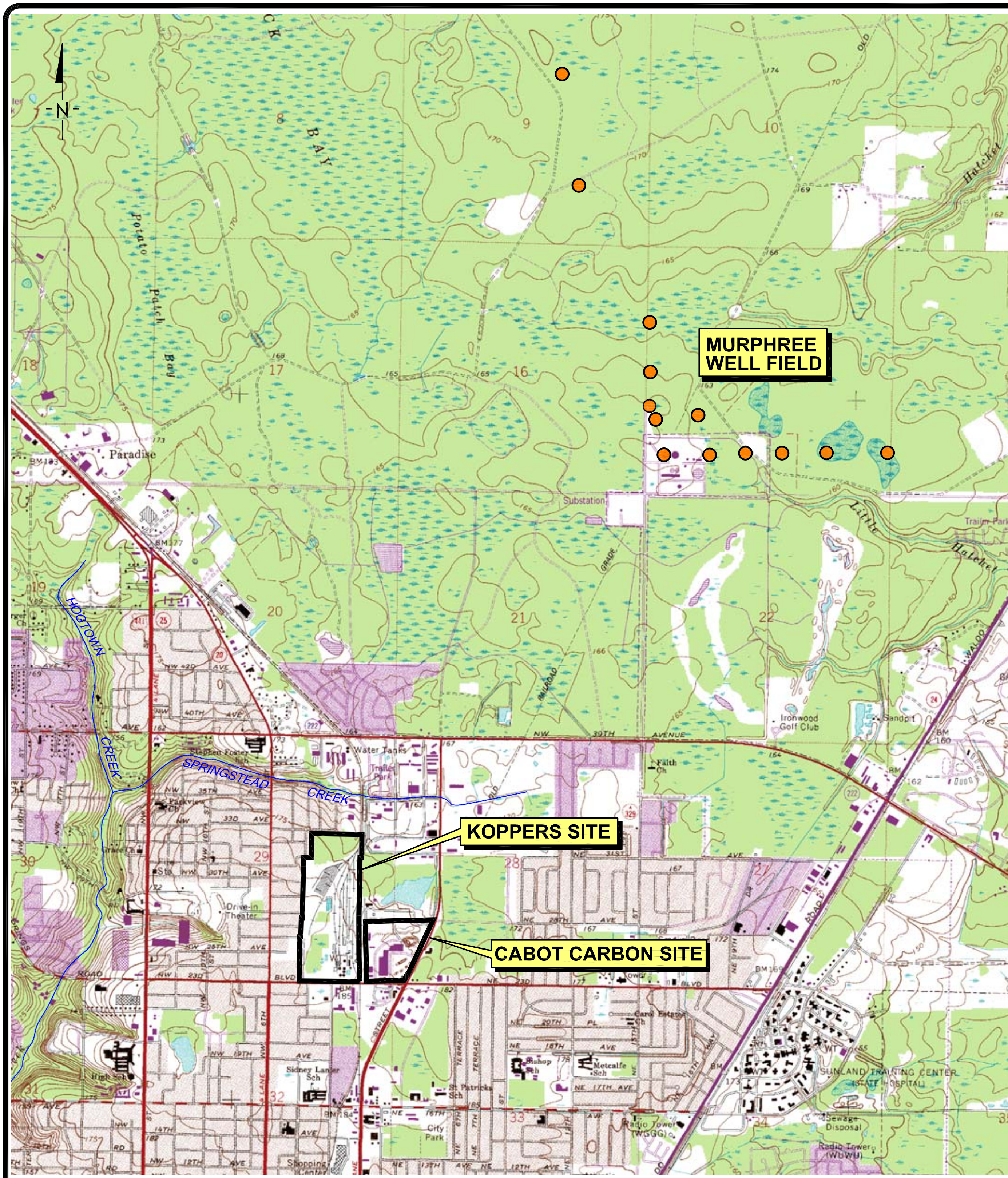
TRC, 2004, Floridan Aquifer Monitoring Plan, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida, June 2004.

U.S. EPA, July 12, 2005. Letter requiring development water to have tracer.

U.S. EPA March 1, 2007. Five-Year Review Recommendations Regarding Additional Hawthorn Investigation, Cabot/Koppers Superfund Site, Gainesville, Florida

U.S. EPA June 29, 2007. Memorandum--Cabot Carbon/Koppers NPL Site, Gainesville, Florida

FIGURES



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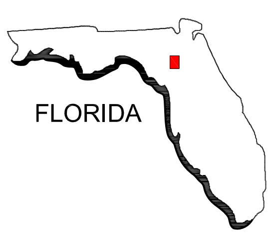

TITLE:	SITE LOCATION MAP
LOCATION:	Cabot Carbon/Koppers Superfund Site Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

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FILE	2201117002A.DWG	
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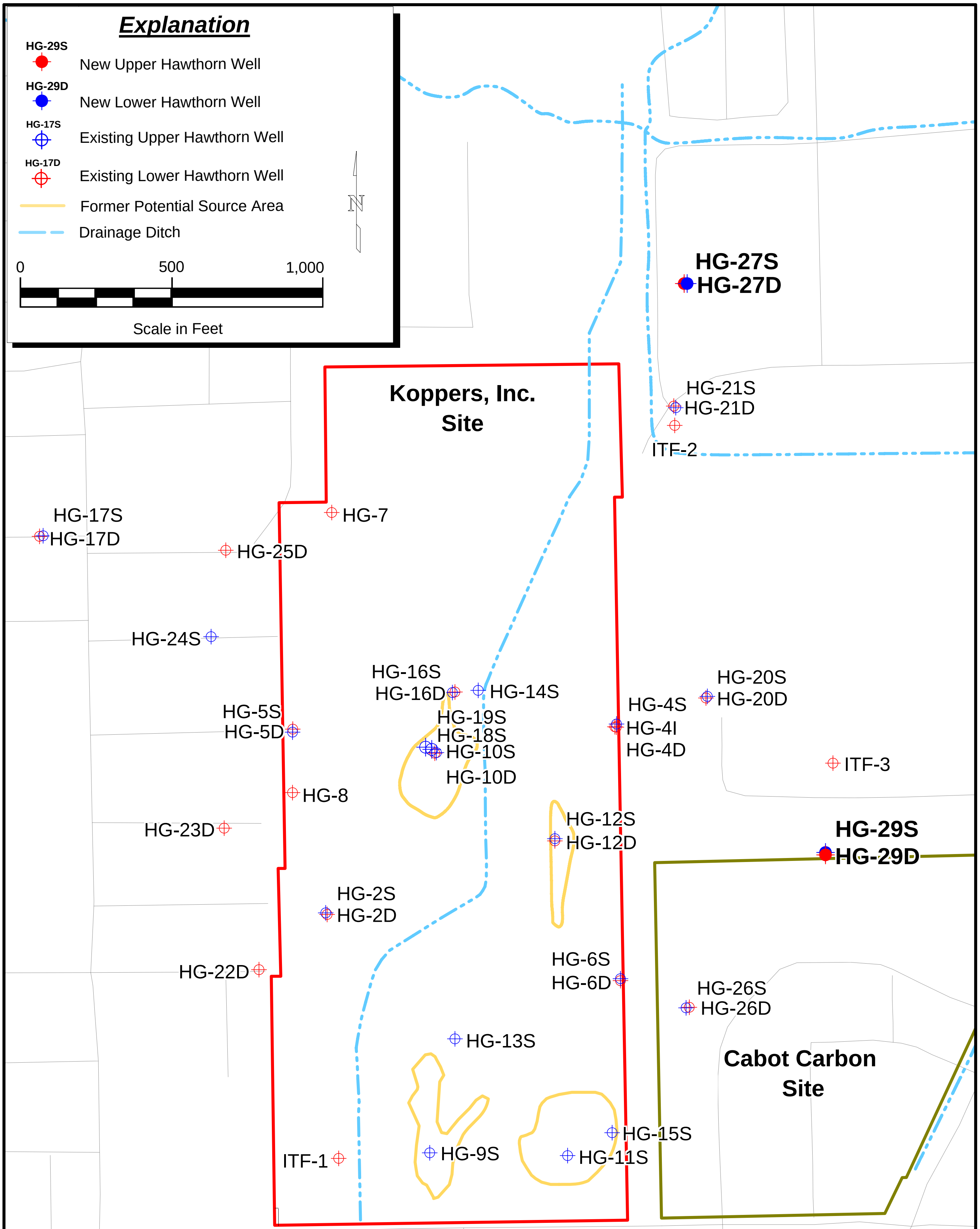

TITLE:

LOCATIONS OF EXISTING AND NEW HAWTHORN GROUP WELLS

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

GeoTrans, Inc. A TETRA TECH COMPANY

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FILE	HG Wells 022708	
DATE	01-15-08	

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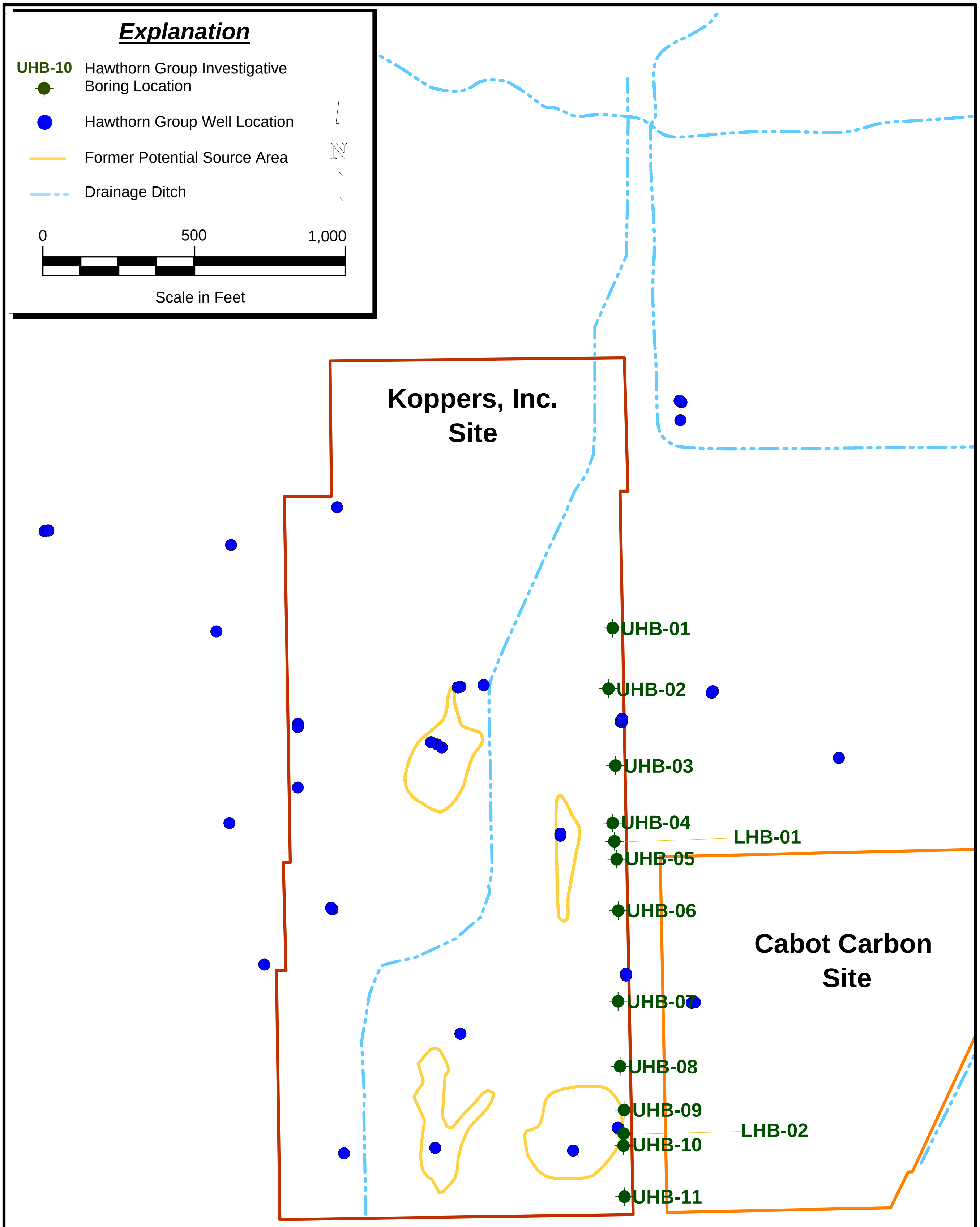

TITLE:	LOCATIONS OF HAWTHORN GROUP INVESTIGATIVE BORINGS				
LOCATION:	Cabot Carbon/Koppers Superfund Site, Gainesville, Florida				
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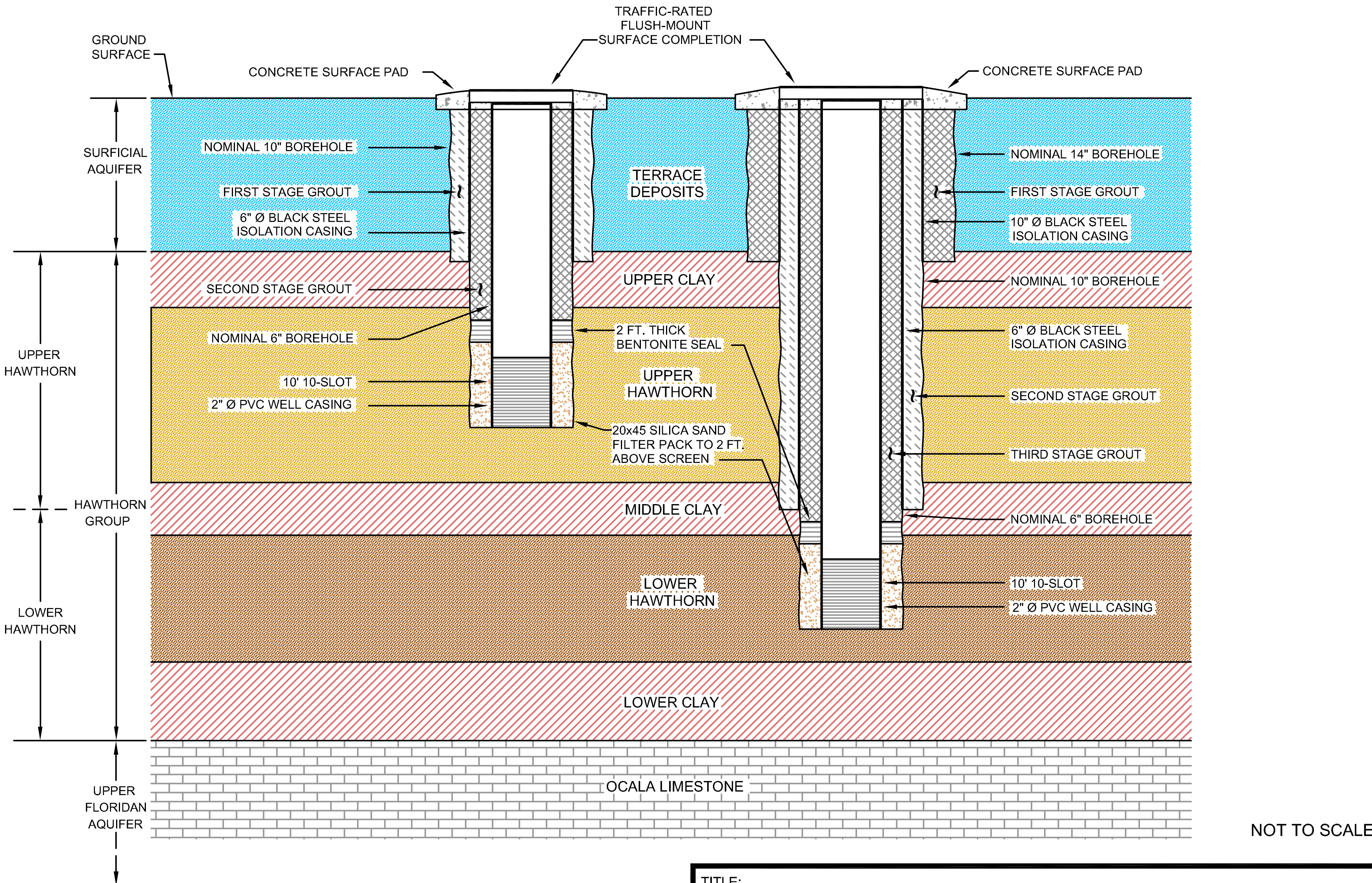

TITLE: CONCEPTUAL NEW UPPER AND LOWER HAWTHORN MONITORING WELL CONSTRUCTIONS

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

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JRE	FIGURE:
DRAFTED	DJB	3-1
PROJECT	2201173	
DATE	05-22-09	

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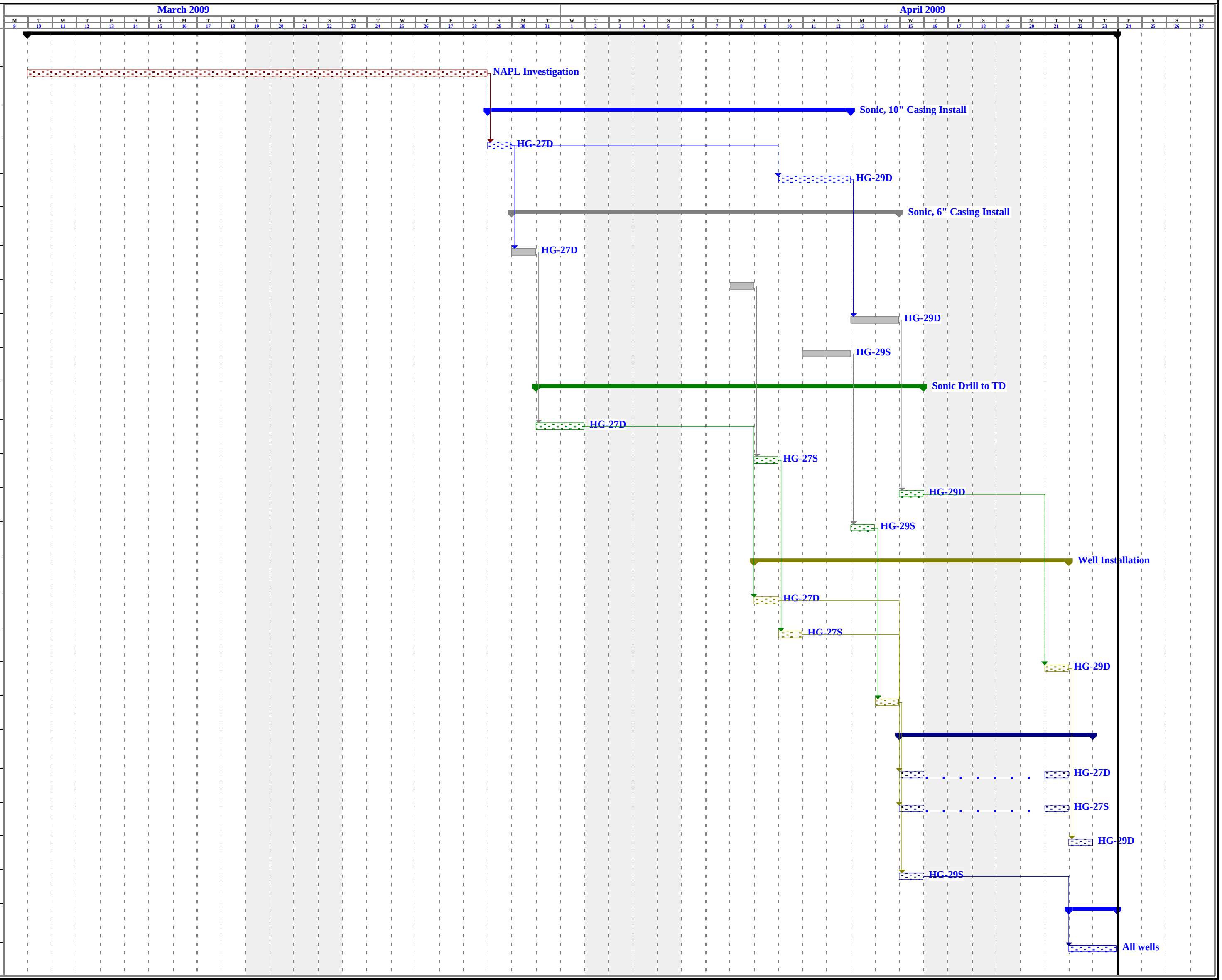
Figure 3-2 Hawthorn Group DNAPL boring and monitoring well installation timeline.

Task Name	Start	Finish
Supplemental HG Wells and LNAPL Borings	Tue 3/10/09	Thu 4/23/09
NAPL Investigation	Tue 3/10/09	Sat 3/28/09
Sonic, 10" Casing Install	Sun 3/29/09	Sun 4/12/09
HG-27D	Sun 3/29/09	Sun 3/29/09
HG-29D	Fri 4/10/09	Sun 4/12/09
Sonic, 6" Casing Install	Mon 3/30/09	Tue 4/14/09
HG-27D	Mon 3/30/09	Mon 3/30/09
HG-27S	Wed 4/8/09	Wed 4/8/09
HG-29D	Mon 4/13/09	Tue 4/14/09
HG-29S	Sat 4/11/09	Sun 4/12/09
Sonic Drill to TD	Tue 3/31/09	Wed 4/15/09
HG-27D	Tue 3/31/09	Wed 4/1/09
HG-27S	Thu 4/9/09	Thu 4/9/09
HG-29D	Wed 4/15/09	Wed 4/15/09
HG-29S	Mon 4/13/09	Mon 4/13/09
Well Installation	Thu 4/9/09	Tue 4/21/09
HG-27D	Thu 4/9/09	Thu 4/9/09
HG-27S	Fri 4/10/09	Fri 4/10/09
HG-29D	Tue 4/21/09	Tue 4/21/09
HG-29S	Tue 4/14/09	Tue 4/14/09
Well Development	Wed 4/15/09	Wed 4/22/09
HG-27D	Wed 4/15/09	Tue 4/21/09
HG-27S	Wed 4/15/09	Tue 4/21/09
HG-29D	Wed 4/22/09	Wed 4/22/09
HG-29S	Wed 4/15/09	Wed 4/15/09
Miscellaneous Completions	Wed 4/22/09	Thu 4/23/09
All wells	Wed 4/22/09	Thu 4/23/09



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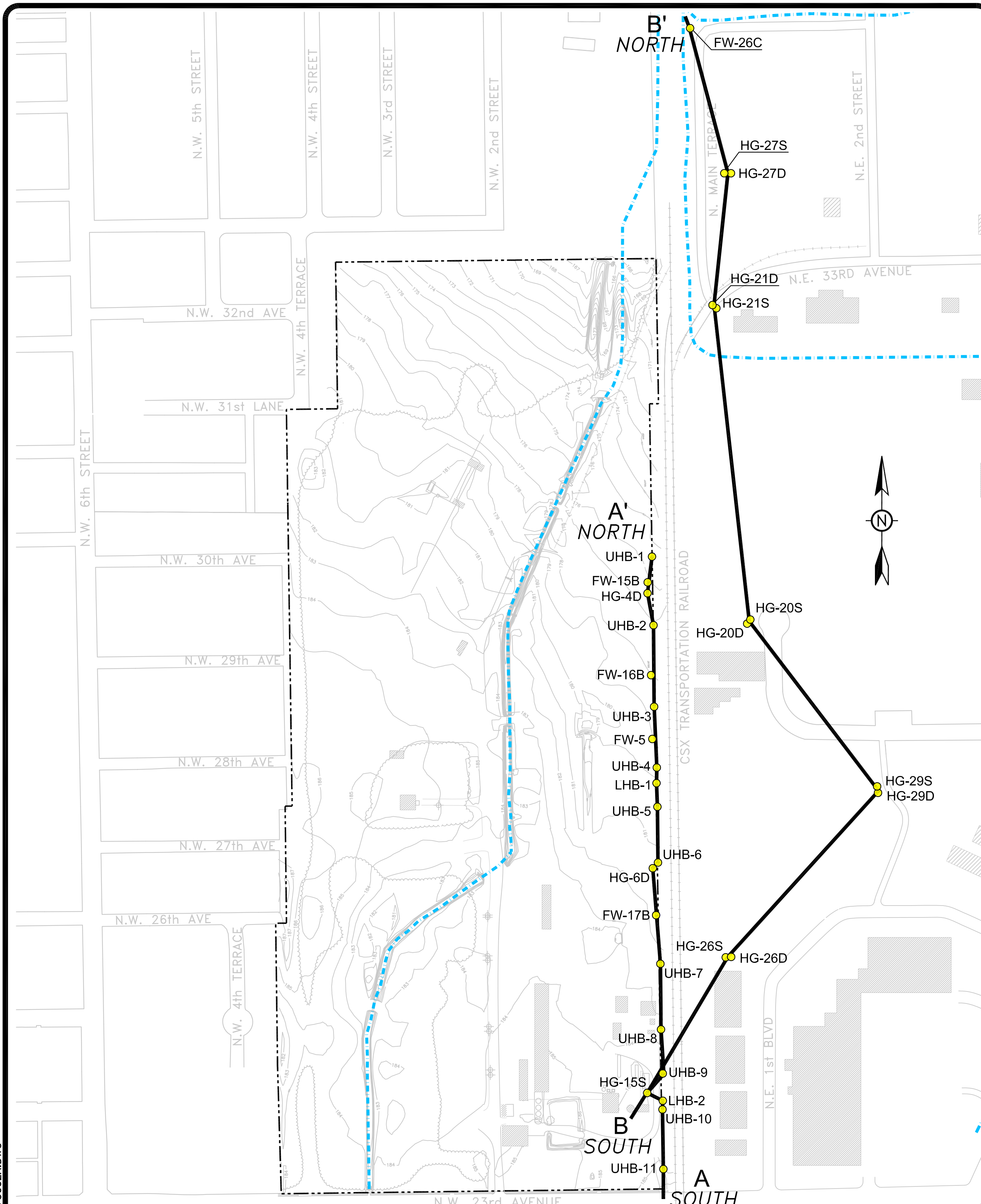

EXPLANATION

A—A' SECTION LOCATION

- - - SITE BOUNDARY

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TITLE:

GEOLOGIC-SECTION A-A' & B-B' LOCATIONS

LOCATION:

Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc.
A TETRA TECH COMPANY

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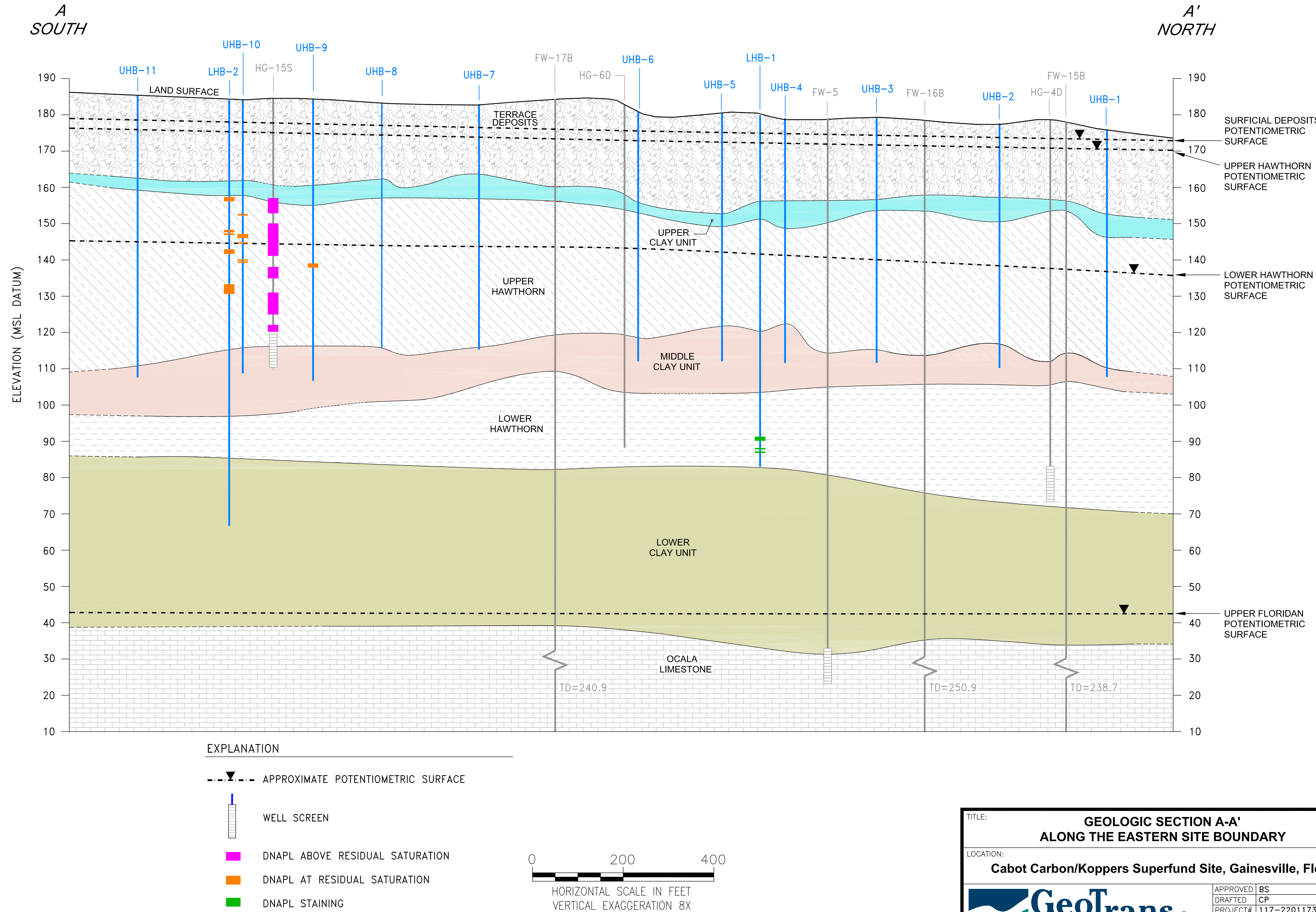
DRAFTED	CP	
PROJECT#	117-2201173.03	
DATE	7-8-09	



TITLE: GEOLOGIC SECTION A-A' ALONG THE EASTERN SITE BOUNDARY

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

GeoTrans, Inc. A TETRA TECH COMPANY

APPROVED	BS
DRAFTED	CP
PROJECT#	117-2201173.03
DATE	7-8-09

FIGURE 4-2

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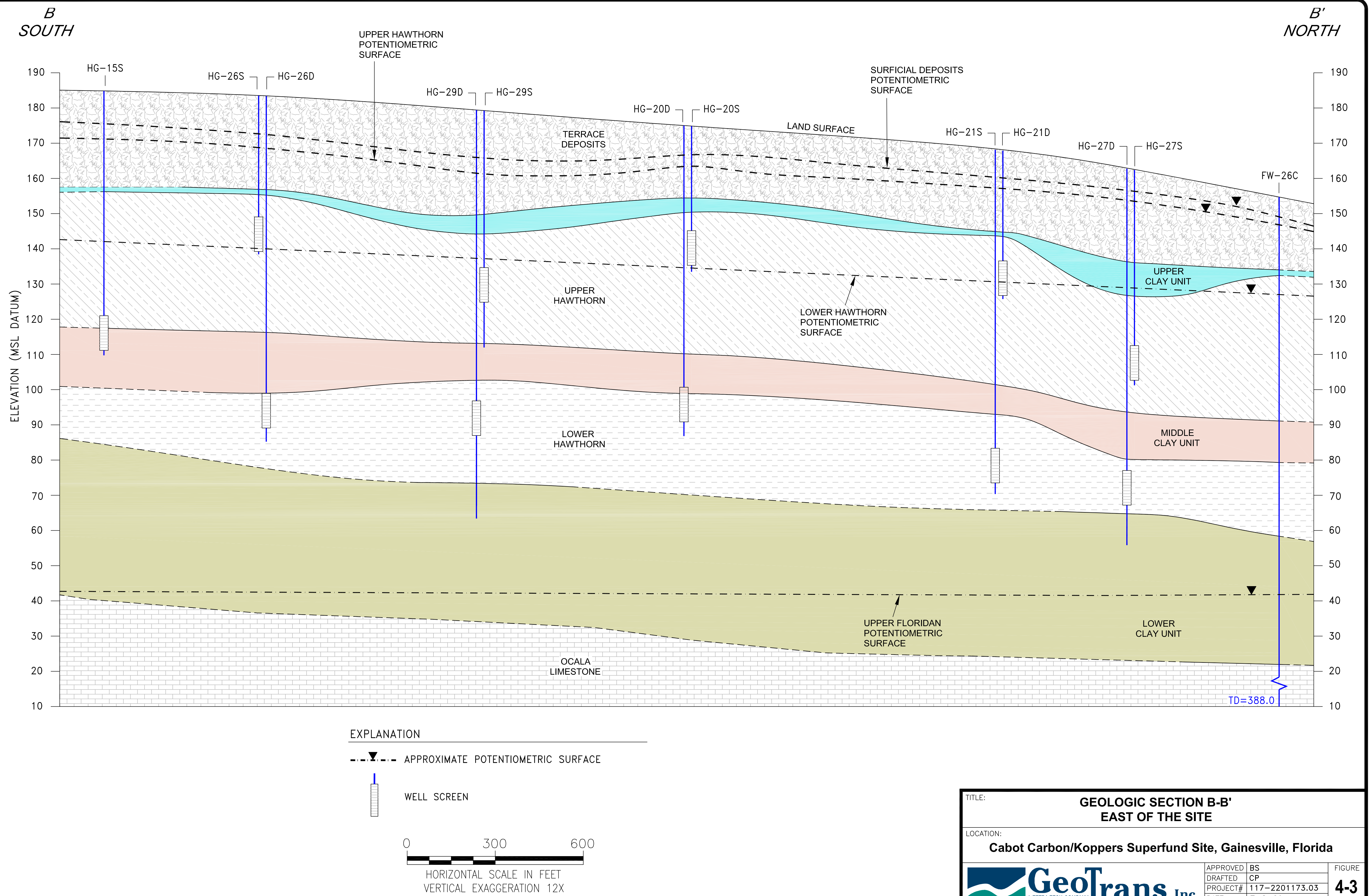

TITLE:	GEOLOGIC SECTION B-B' EAST OF THE SITE
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APPROVED	BS
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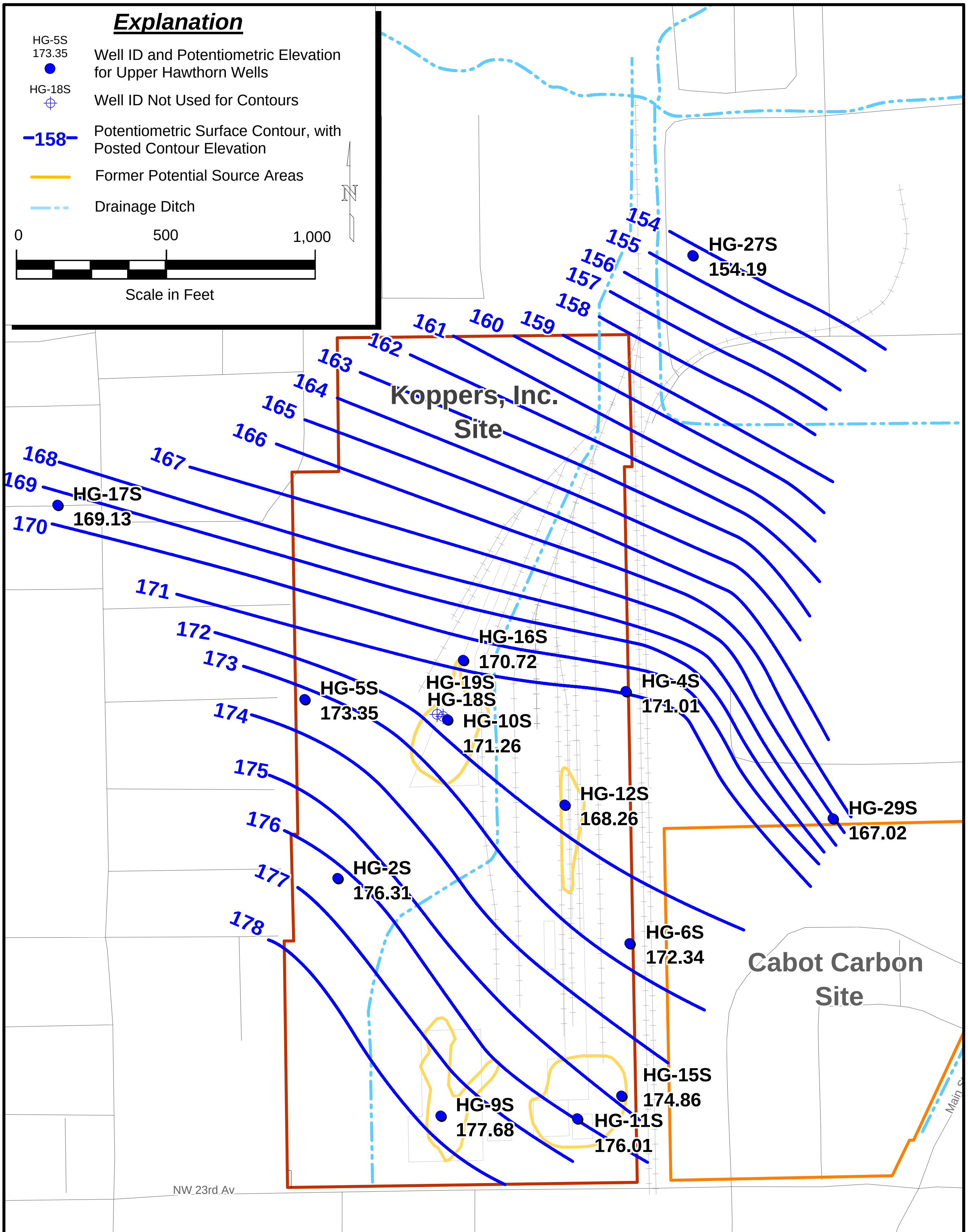
PROJECT#	117-2201173.03
DATE	7-8-09
FIGURE	4-3

GeoTrans, Inc. A TETRA TECH COMPANY



TITLE:	UPPER HAWTHORN POTENTIOMETRIC SURFACE CONTOURS FOR MAY 2009
LOCATION:	Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

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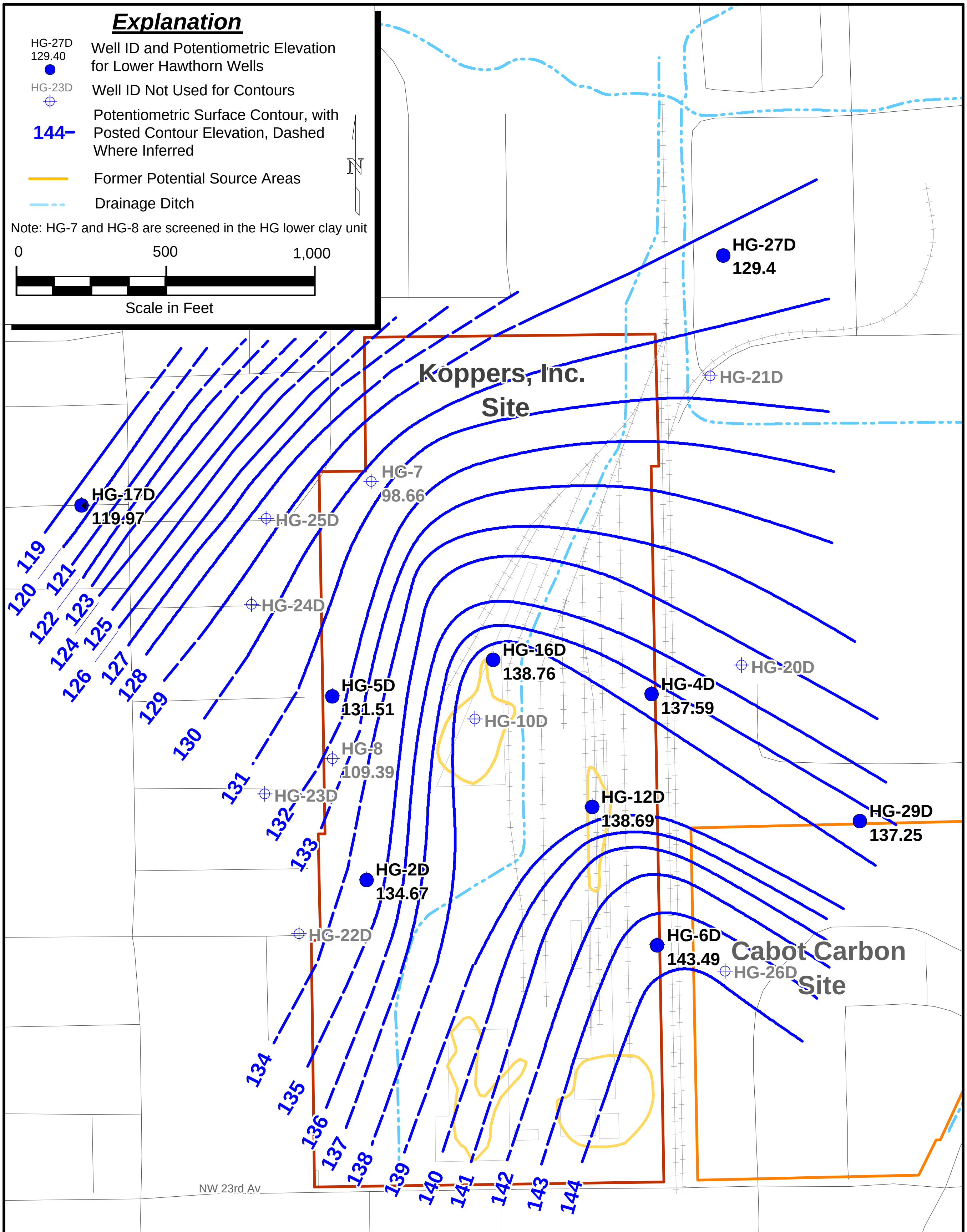

TITLE: LOWER HAWTHORN POTENTIOMETRIC SURFACE CONTOURS FOR MAY 2009

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

GeoTrans, Inc.
A TETRA TECH COMPANY

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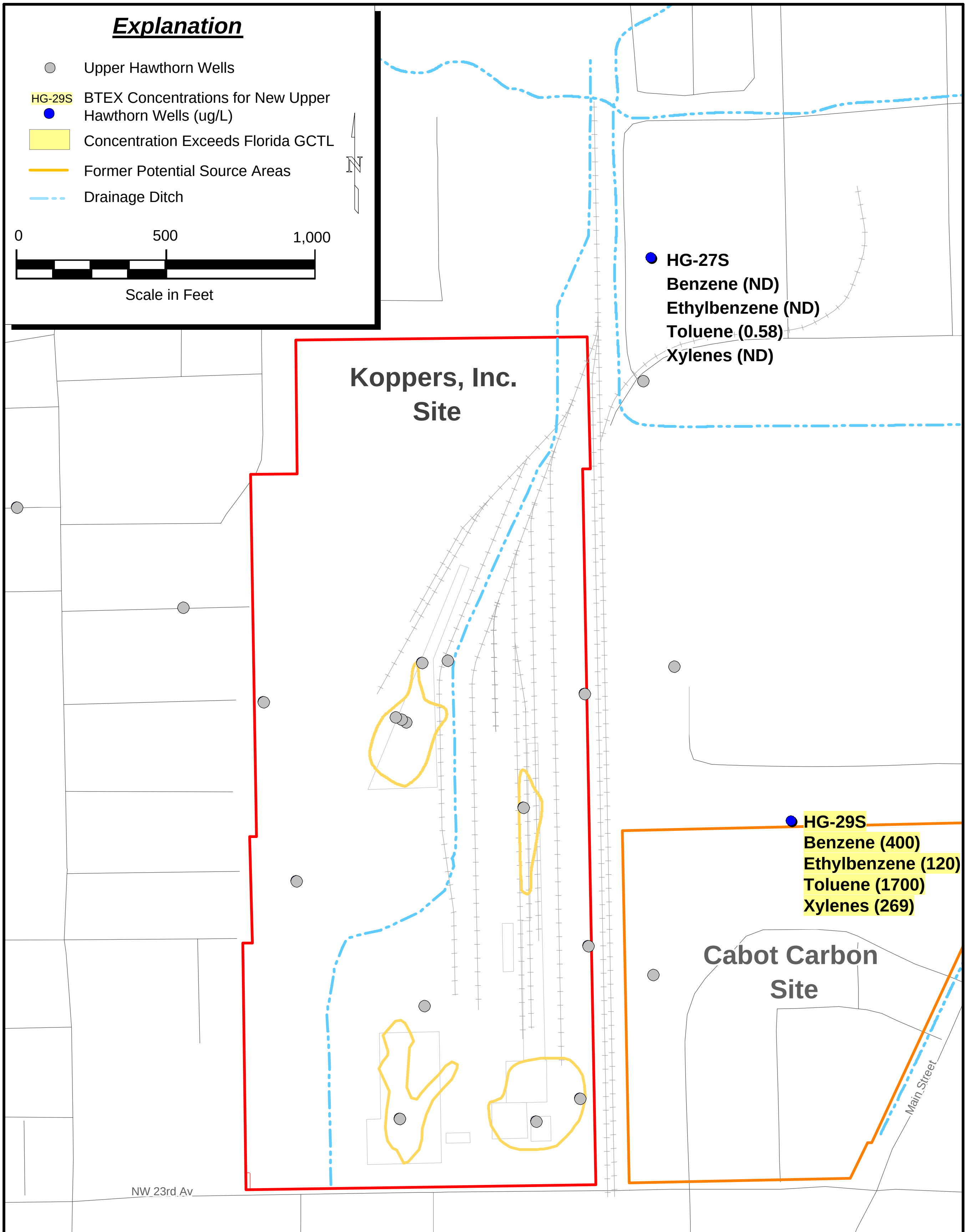

TITLE: NEW UPPER HAWTHORN WELLS WITH BENZENE, TOLUENE ETHYLBENZENE, AND XYLENE CONCENTRATIONS MAY 2009

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

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JRE	FIGURE:
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DATE	07-13-2009	

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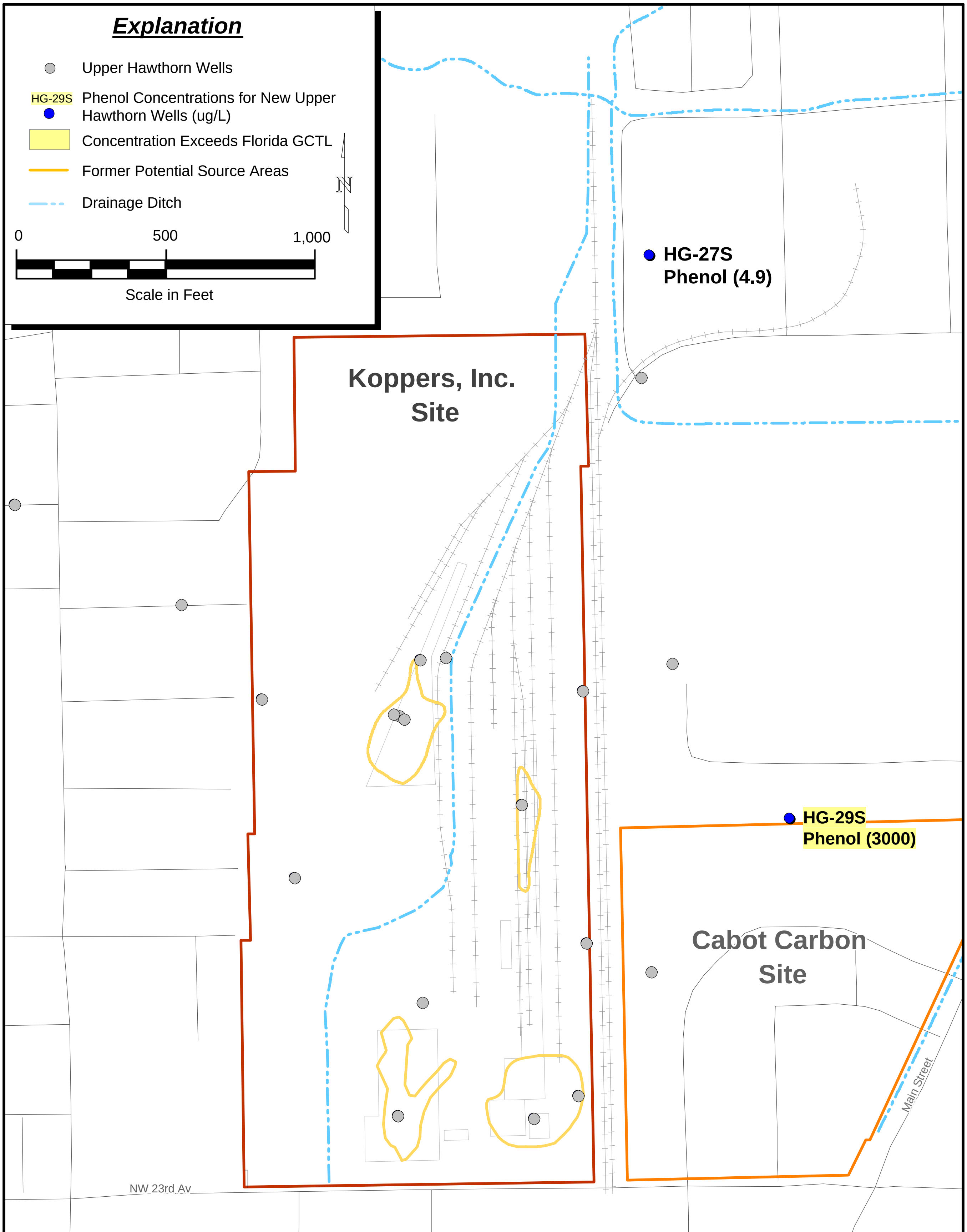

TITLE: NEW UPPER HAWTHORN WELLS WITH PHENOL CONCENTRATIONS MAY 2009

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

GeoTrans, Inc.
A TETRA TECH COMPANY

CHECKED	JRE	FIGURE:
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DATE	07-13-2009	

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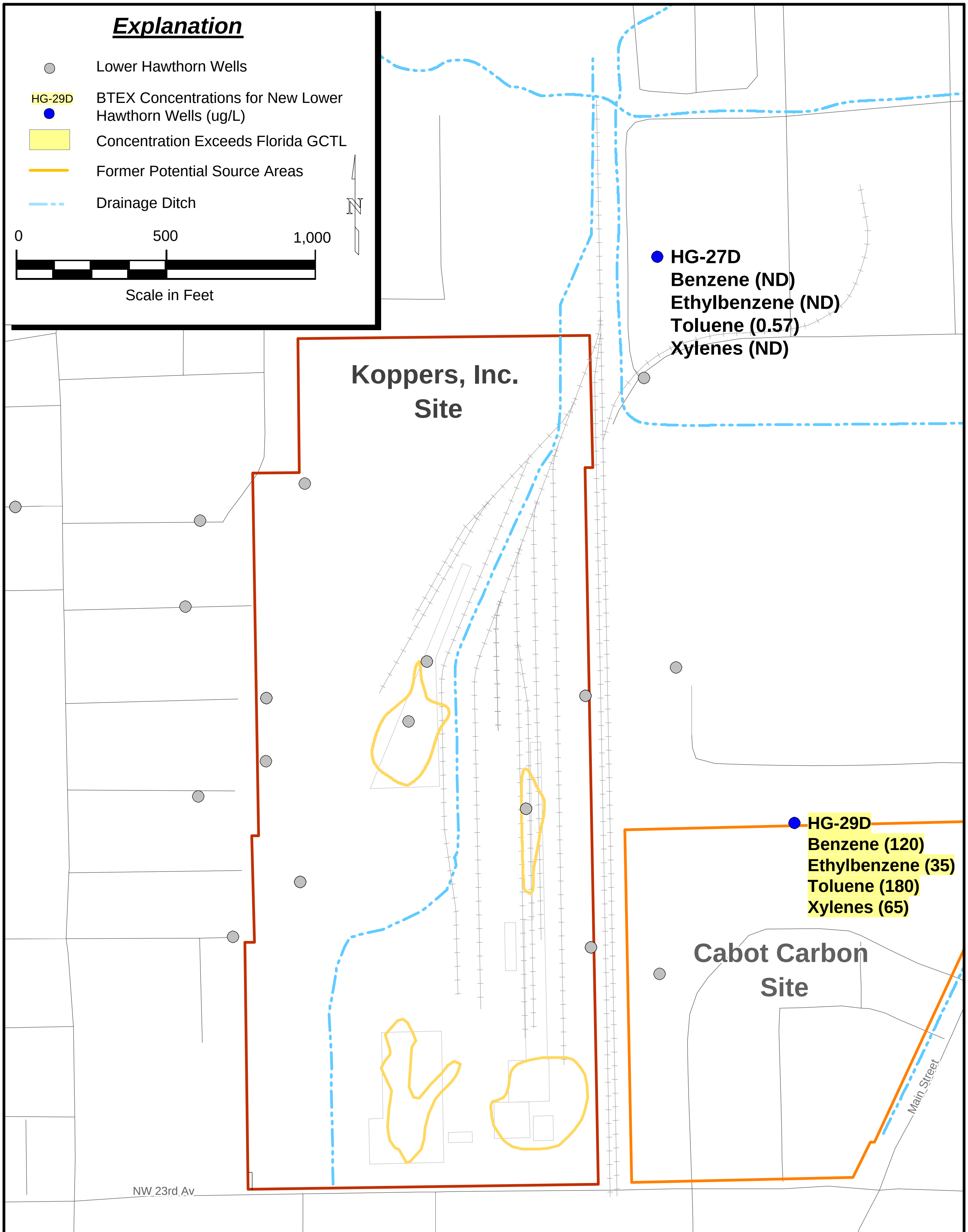

TITLE: NEW LOWER HAWTHORN WELLS WITH BENZENE, TOLUENE ETHYLBENZENE, AND XYLENE CONCENTRATIONS MAY 2009

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

GeoTrans, Inc. A TETRA TECH COMPANY

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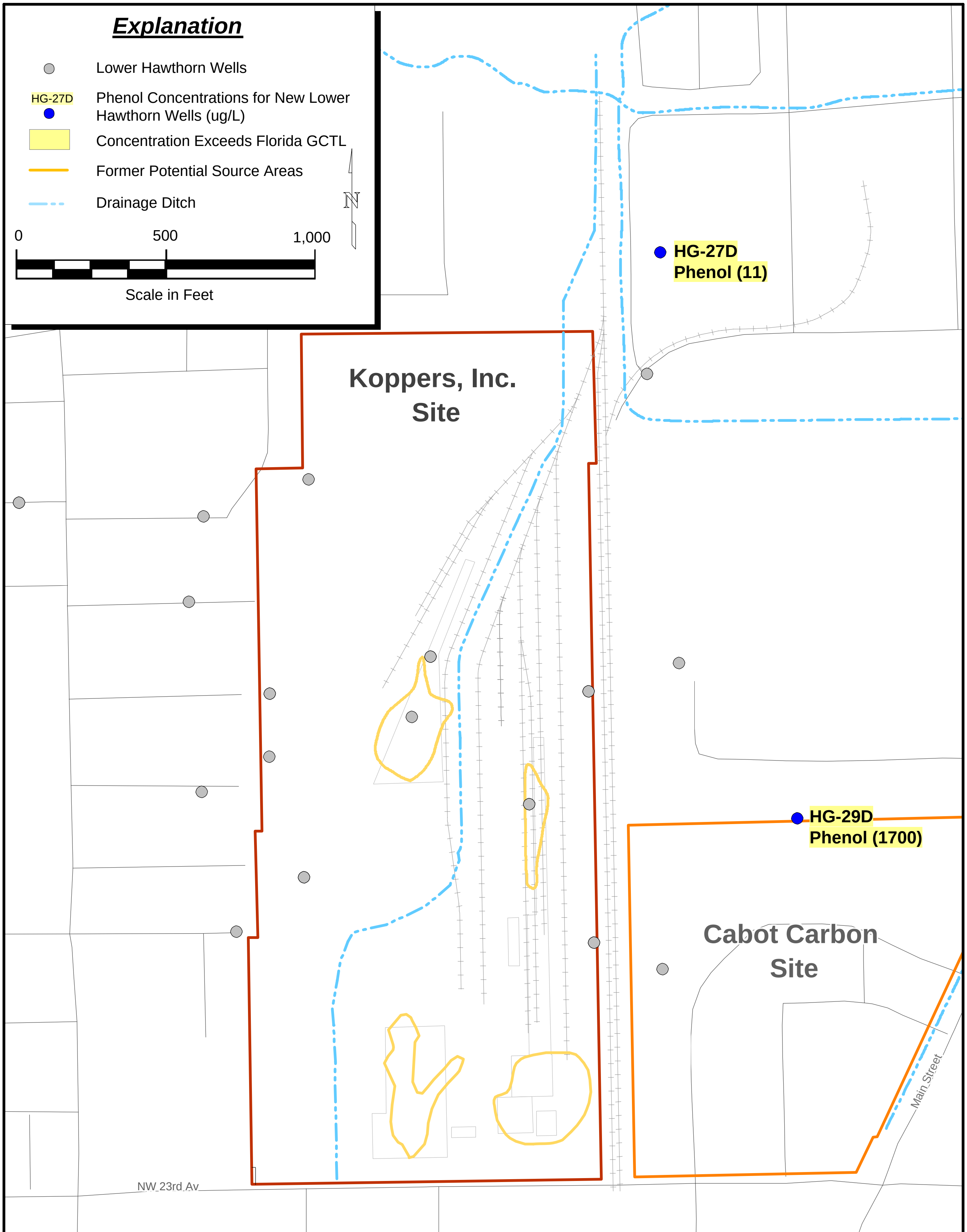

TITLE: NEW LOWER HAWTHORN WELLS WITH PHENOL CONCENTRATIONS MAY 2009

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

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JRE	FIGURE:
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FILE	WatQual Deep HG	
DATE	07-13-2009	

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TABLES

Table 3-1. Hawthorn Group Monitoring Wells and DNAPL Investigative Borings "As-Built" Summary.

Well or Boring ID	Hawthorn Group Interval Monitored	Elevation (Land Surface NGVD 29, feet AMSL)	Elevation (Top of Casing NGVD 29, feet AMSL)	Hawthorn Group					Isolation Casings		Boring Depth/Well Construction and Screened Interval					
				Upper Clay		Middle Clay		Top of Lower Clay (feet)	10-in Casing Depth (feet)	6-in Casing Depth (feet)	Boring TD (feet)	Well Total Depth (feet)	Depth to Top Filter Pack (feet)	Depth to Top Bentonite Seal (feet)	Depth to Top of Screen (feet)	Depth to Bottom of Screen (feet)
				Top (feet)	Bottom (feet)	Top (feet)	Bottom (feet)									
HG-27S	Upper	162.7	162.48	26.2	36.0					27.5	61.0	61.0	48.5	43.0	51.0	61.0
HG-27D	Lower	162.7	162.42	26.2	36.0	69.5	>82.0	97.0	27.8	74.5	107.0	96.8	84.5	79.0	86.8	96.8
HG-29S	Upper	179.3	179.17	29.5	35.0					31.3	67.0	55.8	42.3	39.3	45.8	55.8
HG-29D	Lower	179.4	179.17	29.5	35.0	66.0	76.5	106.0	32.0	71.5	116.0	97.0	83.8	79.6	87.0	97.0
UHB-1	Upper	175.8		23.0	29.0	66.5				23.0	67.0					
UHB-2	Upper	177.1		20.0	26.5	59.5				22.0	67.0					
UHB-3	Upper	179.2		20.2	24.5	62.8				23.0	67.0					
UHB-4	Upper	179.6		21.8	29.4	56.0				26.0	67.0					
UHB-5	Upper	180.6		27.5	31.0	57.0				28.0	67.0					
UHB-6	Upper	181.3		24.3	26.0	61.0				25.0	67.0					
UHB-7	Upper	182.7		19.5	25.0	66.2				23.0	67.0					
UHB-8	Upper	183.7		19.0	25.0	66.0				24.0	67.0					
UHB-9	Upper	184.4		23.0	28.3	68.0				24.0	77.0					
UHB-10	Upper	184.3		22.0	25.0	72.5				25.0	75.0					
UHB-11	Upper	185.2		22.4	24.8	74.4				22.5	77.0					
LHB-1	Lower	180.3		24.0	28.0	59.0	76.0	96.5	24.5	63.0	97.0					
LHB-2	Lower	184.2		22.0	26.4	68.0	87.0	98.0	23.0	73.0	117.0					

Notes: Gray areas represent measurements or dimensions that do not apply.

Table 3-2. Summary of Drilling Fluid Loss and Groundwater Removal During Development.

Well ID	Total Volume of Fluid Lost During Drilling[1] (gal)	Total Volume of Fluid Removed During Development (gal)	Percent of Fluid Removed vs. Fluid Lost
HG-27S	75	110	147%
HG-27D	20	275	1375%
HG-29S	50	54	107%
HG-29D	60	219	365%
TOTALS	**205**	**658**	**AVG = 321%**

Notes:

1 - Total volume of fluid lost in the completion interval during drilling and well installation.

Table 3-3. Drilling Fluid Sodium Bromide Concentrations, Daily Field Bromide Ion Concentrations and Turbidity Readings During Monitoring Well Development.

HG-27S					
Purge Date	Daily Water Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)	Turbidity Measurement at End of Day (NTU)	Total Water Volume Removed (gal)
04/15/09	55	NM	NM	NM	55
04/21/09	55	66.2	2.6	22.9	55
				Cumulative Total =	**110**

HG-27D					
Purge Date	Daily Water Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)	Turbidity Measurement at End of Day (NTU)	Total Water Volume Removed (gal)
04/15/09	165	NM	NM	NM	165
04/21/09	1,603	39.3	25.7	1.02	110
				Cumulative Total =	**275**

HG-29S					
Purge Date	Daily Water Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)	Turbidity Measurement at End of Day (NTU)	Total Water Volume Removed (gal)
04/14/09	22.5	NM	NM	NM	22.5
04/22/09	31	79	42.5	244	31
				Cumulative Total =	**54**

HG-29D					
Purge Date	Daily Water Volume Removed (gal)	Field Bromide Concentration at Start of Day (mg/L)	Field Bromide Concentration at End of Day (mg/L)	Turbidity Measurement at End of Day (NTU)	Total Water Volume Removed (gal)
04/22/09	219	62	28.9	9.95	219
				Cumulative Total =	**219**

Notes:
NM = Not measured
1. All drilling fluid sodium bromide concentrations were 500 mg/L
2. In accordance with the work plan, development was complete when NaBr concentrations were either below 30 mg/L or asymptotic, discharge was visually clear or 4 hours of development effort had elapsed (as was the case with well HG-29S).

Table 3-4. Water quality field parameter measurements during well development.

Well ID	Date	Purge Volume (gal)	Conductivity (umhos/cm)	Bromide (mg/L)	pH	Temperature (°C)
HG-27S	4/15/2009	55	NM	NM	NM	NM
	4/21/2009	55	237	2.6	8.40	24.2
HG-27D	4/15/2009	165	NM	NM	NM	NM
	4/21/2009	110	289	25.7	7.61	23.6
HG-29S	4/14/2009	22.5	NM	NM	NM	NM
	4/22/2009	31.0	339	42.5	7.27	21.5
HG-29D	4/22/2009	219	1457	28.9	6.42	26.3

Notes:
NM = Not measured

Table 3-5. DNAPL Investigative Borings and Monitoring Well Location Survey Results.

Well ID	Northing (ft)	Easting (ft)	Elevation (ft)	
			Adjacent Ground *	Top of Casing**
Off-Site Hawthorn Group Wells				
HG-27S	255087	2659467	162.7	162.48
HG-27D	255087	2659478	162.7	162.42
HG-29S	253032	2659978	179.3	179.17
HG-29D	253023	2659978	179.4	179.17

Notes: Horizontal datum (northing/easting) is NAD 83 State Plane coordinate system, Zone - Florida North stated in U.S. survey feet.

Horizontal accuracy is ± 1m (3.28 ft).

Elevation datum is NGVD 1929 stated in U.S. survey feet.

* Adjacent ground surface elevations were observed 2' north of well.

** Measuring point elevations were observed on top of 2" PVC well casing @ north rim and referenced with black permanent marker.

Survey performed by: De Grove Surveyors, Inc. of Gainesville, Florida

Boring ID	Northing (ft)	Easting (ft)	Elevation (ft)
			Adjacent Ground *
On-Site Hawthorn Group DNAPL Investigative Borings			
UHB-1	253810	2659223	175.8
UHB-2	253581	2659228	177.1
UHB-3	253309	2659230	179.2
UHB-4	253106	2659239	179.6
UHB-5	252975	2659241	180.6
UHB-6	252789	2659243	181.3
UHB-7	252451	2659251	182.7
UHB-8	252232	2659253	183.7
UHB-9	252085	2659257	184.4
UHB-10	251965	2659258	184.3
UHB-11	251766	2659261	185.2
LHB-1	253054	2659238	180.3
LHB-2	251994	2659259	184.2

Table 4-1. Hawthorn Group Monitoring Well Groundwater Elevation Summary, May and June 2009

Upper Hawthorn Wells				
Well ID	**Date**	**Top of Casing Elevation (feet AMSL)**	**Depth to Groundwater (TOC)**	**Water-level Elevation (feet AMSL)**
HG-2S	5/28/2009	189.24	12.93	176.31
HG-4S	5/28/2009	180.41	9.40	171.01
HG-5S	5/28/2009	187.86	14.51	173.35
HG-6S	5/28/2009	184.86	12.52	172.34
HG-9S	5/27/2009	186.80	9.12	177.68
HG-10S	5/27/2009	186.75	15.49	171.26
HG-11S	5/27/2009	187.79	11.78	176.01
HG-12S	5/27/2009	184.41	16.15	168.26
HG-15S	5/27/2009	187.29	12.43	174.86
HG-16S	5/27/2009	185.07	14.35	170.72
HG-17S	5/28/2009	184.56	15.43	169.13
HG-27S	5/21/2009	162.48	8.29	154.19
HG-29S	6/10/2009	179.17	12.15	167.02

Lower Hawthorn Wells				
Well ID	**Date**	**Top of Casing Elevation (feet AMSL)**	**Depth to Groundwater (TOC)**	**Water-level Elevation (feet AMSL)**
HG-2D	5/28/2009	188.88	54.21	134.67
HG-4I	5/28/2009	181.14	42.65	138.49
HG-4D	5/28/2009	180.91	43.32	137.59
HG-5D	5/28/2009	187.73	56.22	131.51
HG-6D	5/28/2009	185.02	41.53	143.49
* HG-7	5/28/2009	184.15	86.22	97.93
* HG-8	5/28/2009	189.30	80.68	108.62
HG-10D	5/27/2009	186.84	48.10	138.74
HG-12D	5/27/2009	184.64	45.95	138.69
HG-16D	5/27/2009	185.07	46.31	138.76
HG-17D	5/28/2009	184.56	64.59	119.97
HG-27D	5/21/2009	162.42	33.02	129.40
HG-29D	5/21/2009	179.17	41.92	137.25

Note: the depth to water in well HG-29S was meaured at 17.73 feet (TOC) on May 21, 2009. Because of suspected equipment problems at that time, it was re-measured on June 10, 2009.
* HG-7 and HG-8 are screened in the Hawthorn Group lower clay unit.

Table 5-1. Hawthorn Group Monitoring Well Water Quality Results.

Parameter	Federal MCL (µg/L)	Florida GCTL[1] (µg/L)	HG-27S 5/21/2009	HG-27D 5/21/2009	HG-29S 5/21/2009	HG-29D 5/21/2009
Metals						
Arsenic (dissolved)	10	10 [2]	2.6	2.0	17	0.58
Chromium (dissolved)	100	100 [2]	ND	ND	88	7.0
Copper (dissolved)	1,300	1,000 [3]	11	ND	3.8	1.0 J
Zinc, (dissolved)	5,000 [4]	5,000 [3]	7.1 J	ND	166	4.7 J
VOCs						
Benzene	5	1 [2]	ND	ND	400	120
Ethylbenzene	700	30 [3]	ND	ND	120	35
Toluene	1,000	40 [3]	0.58 J	0.57 J	1,700	180
m,p-Xylenes	-	-	ND	ND	210	49
o-Xylene	-	-	ND	ND	59	16
Xylenes (total)	10,000	20 [3]	ND	ND	269	65
SVOCs						
2,4-Dimethylphenol	-	140	ND	2.3 J	570	1,600
2-Methylnaphthalene	-	28	ND	ND	ND	ND
2-Methylphenol	-	35	ND	4.2 J	1,300	1300
3&4-Methylphenol	-	35/3.5[5]	4.8[6] J	10[6]	4,200[6]	7,800[6]
Acenaphthene	-	20	ND	ND	ND	ND
Acenaphthylene	-	210	ND	ND	ND	ND
Anthracene	-	2,100	ND	ND	ND	ND
Benzo(a)anthracene	-	0.05	ND	ND	ND	ND
Benzo(a)pyrene	0.2	0.2 [2]	ND	ND	ND	ND
Benzo(b)fluoranthene	-	0.05	ND	ND	ND	ND
Benzo(g,h,i)perylene	-	210	ND	ND	ND	ND
Benzo(k)fluoranthene	-	0.5	ND	ND	ND	ND
Carbazole	-	1.8	ND	ND	ND	ND
Chrysene	-	4.8	ND	ND	ND	ND
Dibenzo(a,h)anthracene	-	0.005	ND	ND	ND	ND
Dibenzofuran	-	28	ND	ND	ND	ND
Fluoranthene	-	280	ND	ND	ND	ND
Fluorene	-	280	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	-	0.05	ND	ND	ND	ND
Naphthalene	-	14	ND	ND	ND	68 J
Pentachlorophenol	1	1 [2]	ND	ND	ND	ND
Phenanthrene	-	210	ND	ND	ND	ND
Phenol	-	10	4.9 J	11	3,000	1,700
Pyrene	-	210	ND	ND	ND	ND
Terpenes						
trans-Anethol	-	-	----	----	ND	ND
Borneol	-	-	----	----	5,600	ND
Camphene	-	-	----	----	ND	ND
Camphor	-	-	----	----	2,300	ND
Cineole	-	-	----	----	ND	ND
Dipentene	-	-	----	----	ND	ND
Isoborneol	-	-	----	----	ND	ND
Limonene	-	700 [1,2]	----	----	ND	ND
alpha-Pinene	-	-	----	----	ND	ND
beta-Pinene	-	-	----	----	ND	ND
alpha-Terpineol	-	-	----	----	ND	ND

Notes

All results presented in µg/L.

ND - Indicates the analyte was not detected.

B - Indicates analyte was detected in the field blank.

J - Indicates result is estimated.

I - The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

Concentration exceeds Florida GCTL.

Concentration exceeds Federal MCL.