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January 29, 2004

Mr. Maher Budeir, P.E.
Remedial Project Manager
South Site Management Branch
U. S. Environmental Protection Agency, Region IV
61 Forsyth Street, SW
Atlanta, GA 30303-3104

Subject: Transmittal of Work Plan, Groundwater Flow and Transport Modeling, Koppers Inc. Site, Gainesville, Florida

Dear Mr. Budeir:

Attached is a copy of the groundwater flow and transport modeling work plan that was referenced in the December 4th 2003 letter from Beazer East to U.S. EPA. We welcome your comments on the work plan. GeoTrans will proceed with model development during the review process.

Please feel free to contact Jim Erickson or Guy Roemer at GeoTrans, Inc. at 303-665-4390, if you have any comments or questions.

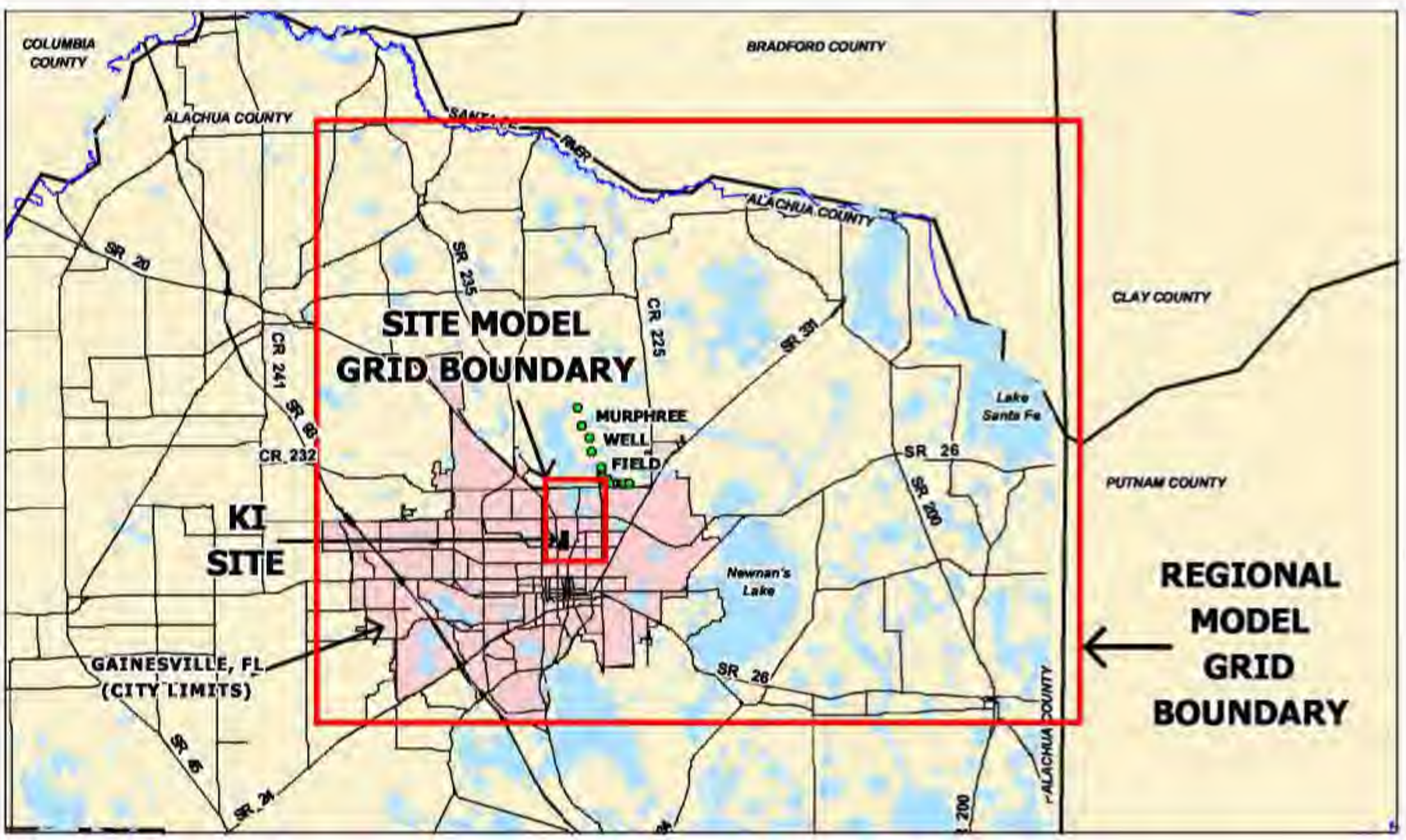
Sincerely,

James R. Erickson
Program Manager

Enclosure

cc: Kelsey Helton, FDEP
John Mousa, ACEPD
Brett Goodman, GRU
Mike Slenska, Beazer East
Tim Basilone, Koppers

WORK PLAN
GROUNDWATER FLOW AND TRANSPORT MODELING
KOPPERS INC. SITE
GAINESVILLE, FLORIDA



Prepared For:

Beazer East, Inc.

Prepared By:

GeoTrans, Inc.

January 29, 2004

WORK PLAN
GROUNDWATER FLOW AND TRANSPORT MODELING
KOPPERS INC. SITE
GAINESVILLE, FLORIDA

EXECUTIVE SUMMARY

This work plan presents a three-dimensional computer modeling approach for evaluating groundwater flow and constituent transport at the Koppers, Inc. (KI) site in Gainesville, Florida (Site). The modeling approach involves the use of two separate models: 1) A three-dimensional fate and transport model of the Surficial Aquifer, Hawthorn Group, and the Upper Floridan deposits (Site Model), and 2) An updated version of the existing Gainesville Regional Utility (GRU) Floridan Aquifer groundwater flow model (CH2M HILL, 1993) (Regional Model).

The combination of the Site Model and Regional Model will provide a comprehensive evaluation of fate and transport within the Surficial Aquifer, Hawthorn Group, and the Upper Floridan deposits and the potential for constituent transport from the Site to the Murphree Well Field. The primary objective of the Site Model is to evaluate groundwater flow, solute transport and constituent transport mechanisms in the Surficial, Hawthorn Group, and Upper Floridan deposits at the Site; the primary objective of the Regional Model is to evaluate the potential for constituent transport from the Site to the Murphree Well Field.

The Site Model will be a 10-layer model that encompasses an area of approximately 5-square miles around the Site. All major lithologic units within the Surficial Aquifer, Hawthorn Group, and the Upper Floridan deposits will be incorporated into the model to accurately represent groundwater flow and solute transport conditions at the Site. Recent Site characterization data will be incorporated into the model to ensure that it accurately represents our current understanding of Site conditions. The groundwater flow component of the Site Model will be calibrated to monitoring well water-level data both on-site and off-site. The solute transport component of the Site Model will be qualitatively calibrated to the available on-site and off-site constituent concentration data. A mechanism that could result in the observed distribution of constituents in the Hawthorn Group deposits and Floridan Aquifer has not been identified. The current vertical distribution of Site constituents in the Hawthorn Group deposits may be a result of the recent monitoring well installation, older monitoring wells that are screened across multiple units, historical injection of condensate fluids on the Cabot Carbon site, or natural contaminant migration. This issue will be examined during Site Model development.

An updated and improved version of the 1993 CH2M HILL Regional Model will be developed and used to simulate potential constituent transport within the Floridan Aquifer from the Site to the Murphree Well Field. Recent aquifer-test data and municipal well pumpage rates will be incorporated into the model to ensure that it more accurately represents current conditions. Select transmissivity and recharge zones will be modified based on recent data for this area to ensure that the model parameter values reflect the current knowledge of the aquifer systems. In addition, the southern external model boundary will be extended to the south to minimize the effects of this boundary on the Murphree Well Field pumpage simulations. No major recalibration of the Regional Model is anticipated at this time.

1.0 INTRODUCTION

The Site is an active wood-treating facility located within the city limits of Gainesville, Florida. The approximately 80 years of operation have resulted in creosote NAPLs infiltrating into shallow groundwater. NAPLs are primarily restricted to four source areas of the Site: 1) Former north lagoon, 2) Former south lagoon, 3) Former cooling pond area, and 4) Former drip-track area. The primary dissolved-phase constituents of concern at the Site are polynuclear aromatic hydrocarbons (PAHs), of which naphthalene is the most mobile of the PAH constituents and the largest component by weight in creosote.

Extensive investigation and characterization programs have been ongoing at the Site since the mid 1980s. These programs established that NAPLs and dissolved-phase Site constituents are primarily confined to the Surficial Aquifer and the upper Hawthorn Group deposits beneath the Site. Four Floridan Aquifer monitoring wells were installed at the Site in 2003 to investigate the potential of vertical migration of Site constituents into the upper Floridan Aquifer. Groundwater samples collected from these wells in May 2003 contained slightly elevated concentrations of naphthalene (1.7 and 15.8 g/L) in two of the four wells, in addition to miscellaneous volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). Groundwater samples collected in November 2003 were nondetect for three of the four wells and contained 6.9 g/L of naphthalene in one of the wells. The presence of Site constituents in Floridan Aquifer wells is being further evaluated to see if these constituents are a result of natural vertical transport through the Hawthorn Group deposits or if they were artificially introduced. Future sampling events for these wells will help to confirm potential transport mechanisms for constituents in the Floridan Aquifer.

The potential for vertical migration of Site constituents into the Floridan Aquifer, in conjunction with lateral transport to the Murphree municipal well field is of concern. As a result, Beazer has initiated a multi-faceted investigation, characterization and analysis program to evaluate the potential of Site constituents migrating into the Upper Floridan Aquifer and impacting municipal well fields. This modeling effort is one component of this multi-faceted program.

PROJECT UNDERSTANDING

This work plan presents a three-dimensional computer modeling approach for evaluating groundwater flow and dissolved-phase constituent transport at the Site. The computer modeling approach involves the use of two separate models: 1) A new three-dimensional model of the Surficial Aquifer, Hawthorn Group, and the Upper Floridan deposits at the Site (Site Model), and 2) An updated version of the existing Gainesville Regional Utility (GRU) Floridan Aquifer model (CH2M HILL, 1993) (Regional Model). The primary objective of the Site Model is to evaluate groundwater flow and constituent transport mechanisms in the Surficial Aquifer, Hawthorn Group, and the Upper Floridan deposits at the Site. However, the model will be constructed to allow it to be used to evaluate various remedial-designs alternatives, as necessary. The primary objective of the Regional Model is to evaluate the potential for constituent transport within the Floridan Aquifer from the Site to the Murphree municipal well field. The combination of the two models allows for a detailed evaluation of both vertical and lateral constituent transport at the Site, and the potential for Site constituents impacting the water quality at the Murphree Well Field.

CONCEPTUAL GROUNDWATER FLOW MODEL

The conceptual groundwater flow model for the on-site and off-site systems is primarily based on five reports.

1) TRC report (September 1999) entitled *"Revised Supplemental Feasibility Study Volumes 1 and 2, Cabot Carbon/Koppers Superfund Site, Gainesville, Florida";*

2) TRC report (September 2002) entitled *"Field Investigation Activities Report: Cabot Carbon / Koppers Superfund Site, Gainesville, Florida";*

3) TRC report (August 2003) entitled *"Addendum Hawthorn Group Field Field Investigation Report: Cabot Carbon / Koppers Superfund Site, Gainesville, Florida";*

4) CH2M HILL report (March 1993) entitled, *"Evaluation and Modeling of the Floridan Aquifer System in the Vicinity of the Murphree Well Field: Technical Memorandum No. 4";* and

5) GeoSys, Inc. report (April 2000) entitled, *"Update of the Geology in the Murphree Well Field Area".*

In addition to the five reports identified above, GeoTrans has reviewed federal and state agency reports and data to help ensure that pertinent hydrogeologic data for the area are incorporated into the models.

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 (TRC, 2002). The Surficial Aquifer consists of approximately 20- to 30-feet of Pliocene to Pleistocene marine terrace deposits (Figures 1 and 2). These deposits primarily consist of unconsolidated, fine- to medium-grained sand, with thin layers of interbedded silt and clay deposits.

A thick sequence of interbedded low-permeability unconsolidated deposits separates the overlying Surficial Aquifer from the underlying Floridan Aquifer. These low-permeability deposits are named the Hawthorn Group and are approximately 120 to 125 feet thick. The Hawthorn Group primarily consists of interbedded clays, clayey sand, silty-clayey sand, and some carbonate deposits (Figures 1 and 2).

Underlying the Hawthorn Group is the Upper Floridan Aquifer. The Ocala Limestone is the major water-producing unit within the Upper Floridan Aquifer. The closest municipal water-supply wells completed within this unit are at the Murphree Well Field, located over 2 miles northeast of the Site. A large drawdown cone within the Upper Floridan Aquifer has resulted from the more than 30 years of pumpage at this well field. This drawdown cone extends to the Site and influences groundwater flow rates and directions in the Upper Floridan Aquifer.

The Upper Floridan Aquifer is separated from the Lower Floridan Aquifer by approximately 200 feet of low-permeability deposits, in addition to numerous intra-aquifer semi-confining low-permeability deposits. These low-permeability deposits may isolate the Lower Floridan Aquifer from the overlying aquifers. The Lower Floridan Aquifer unit is not included in the Site Model because it has no impact on constituent transport through the Hawthorn Group deposits. However, the Regional Model includes both the Upper and Lower Floridan Aquifer units and can be used to evaluate potential Site impacts, if any, to the Lower Floridan Aquifer. It also should be noted that all presently known active water supply wells in the county draw from the Upper Floridan aquifer (CH2MHill, 1993).

Groundwater flow within the Surficial Aquifer at the Site is primarily to the northeast, with a smaller component of flow to the north along the western KI property boundary (TRC, 1999). The wetlands and Springstead Creek northeast of the Site appear to be groundwater discharge points for the Surficial Aquifer in this area. A groundwater hydraulic-barrier system has been in operation at the Site since 1995 to prevent off-site migration of constituents in the Surficial Aquifer. This system has influenced shallow groundwater flow directions and rates at the Site since 1995. With the construction of the hydraulic-barrier system, groundwater flow directions have been modified by the capture system; however, the overall direction of flow remains north-northeast. The groundwater flow velocity within the Surficial Aquifer is estimated to be approximately 125 ft/yr (TRC, 1999).

Groundwater flow within the Hawthorn Group deposits is primarily vertical through clay layers with horizontal flow in the more sandy layers. The clay layers tend to restrict vertical migration of contaminants, whereas the sandy layers act as buffers to vertical contaminant migration by providing layers where dilution and dispersion can reduce concentrations. The vertical hydraulic-head difference between the Surficial and Lower Hawthorn Group deposits is typically greater than 30 feet. This significant vertical hydraulic gradient is primarily due to the interbedded low-permeability deposits within the Hawthorn Group that restricts hydraulic communication between the Surficial and Floridan Aquifers within this area. The large vertical hydraulic gradient across the Hawthorn Group deposits makes a determination of lateral groundwater flow directions difficult for this unit because relatively small differences in the monitoring well screen elevations corresponds to significant changes in the measured groundwater elevation for the well. With a 30-foot hydraulic-head difference over an approximately 100-foot thick deposit, a 10-foot difference in screen elevation can correspond to as much as 3 feet of groundwater elevation change. Hence, differences in monitoring well screen elevations can have significant impacts on the interpreted groundwater flow direction. Therefore, potentiometric surface maps constructed for the upper, intermediate and lower hydrostratigraphic units within the Hawthorn Group deposits need to account for differences in monitoring well screen elevations used in the construction of these surfaces. The lateral directions for groundwater flow within the Hawthorn Group deposits appear to range from northwest to northeast.

CONCEPTUAL CONSTITUENT TRANSPORT MODEL

Dissolved-phase constituents in the Surficial Aquifer at the Site are primarily a result of over 80 years of wood-treating activities at the Site. The four areas of the Site that appear to be the primary sources of Site constituents are the former north lagoon, south lagoon, cooling pond, and drip track areas. Creosote NAPLs and wastewater associated with the Site operations in these areas infiltrated into the shallow groundwater system. Monitoring wells at the Site have only detected a limited amount of free-phase NAPL, because the NAPLs have likely reached their residual saturation. Although the NAPL is at residual saturation, a significant mass of NAPL is potentially present in the subsurface providing a long-term source to dissolved-phase constituents. This NAPL is not recoverable because it is trapped within individual aquifer pores. Previous investigations at the Site concluded that NAPLs were primarily restricted to the Surficial Aquifer as a result of the low-permeability clay deposits in the upper part of the Hawthorn Group. Additional investigations are planned for 2004 to more accurately define the lateral and vertical distribution of NAPL source areas.

The primary constituents of concern at the Site are PAHs, with naphthalene being the most mobile of the PAH compounds. The dissolved-phase PAH constituents are present in the Surficial Aquifer beneath the majority of the Site and extend off-site to the northeast and east. Further movement of these dissolved constituents across the site boundary in the Surficial Aquifer is being prevented by the hydraulic-barrier system that has been in operation since 1995.

The vertical extent of the dissolved-phase constituents beneath the Site is not completely defined. Groundwater samples in select monitoring wells installed into the upper, intermediate and lower Hawthorn Group deposits detected organic constituents. It is not clear if these constituents are a result of natural migration or if they were artificially introduced. Because of the significant driving force resulting from the approximately 30-foot head difference between the Surficial Aquifer and lower Hawthorn Group deposits, there is a potential for short-circuiting of impacted groundwater through old wells screened across low-permeability confining units or drag-down during well installation. In addition, the historical operation of the Cabot Carbon site condensate fluid injection well may be responsible for the observed organic constituents in the lower Hawthorn Group deposits. The model will be used to evaluate the potential for natural migration of constituents, accelerated migration of constituents as a result of monitoring well design/installation and the potential for condensate fluid injection on the Cabot Carbon site impacting the KI site.

2.0 SITE MODEL DEVELOPMENT

This section discusses the approach to developing the Site Model. Included in this section will be a discussion of the areal and vertical extent of the model, the numerical model code, model calibration, and sensitivity analyses.

Approach

Model development will start with compiling all pertinent hydrogeologic, water quality and anthropogenic data into a working conceptual model for the aquifer systems. This conceptual model forms the basis for the development and design of the numerical groundwater flow and solute transport models.

Geographical Information Systems (GIS) tools will be used to expedite model development, design and analysis. GeoTrans has developed and customized GIS software programs for graphical development of model data sets, efficient model calibration, and to provide the ability to automatically superimpose model results on Site base maps and data. Our model development software programs are compatible with either ArcView or MapInfo GIS systems.

The first step in model development will be to electronically transfer pertinent hydrogeologic data, lithologic information from electrical resistivity surveys, and Site features into a relational GIS system. These data and features will be used to design the three-dimensional model in the GIS system. GeoTrans' customized programs automate the development of the model grid, model layers, model zonations, aquifer properties, and model-boundary conditions. After the model design is completed, the requisite model data sets will be automatically created and exported from the GIS system to begin the model simulations. The use of coupled relational GIS/model software allows for efficient model development and data set quality assurance/quality control (QA/QC).

The coupled GIS software and model are utilized throughout the model development and calibration process. The results of each model simulation are automatically converted to GIS compatible files to allow graphical representation of model results directly on site features, base maps and data. The graphical display of model results accelerates the identification of potential model problem areas and expedites the calibration/sensitivity analysis.

Model Area and Vertical Extent

One critical aspect in the development of a groundwater flow model is the definition of the external model boundaries. Two common external model boundary problems encountered in the design of model grids are: 1) Setting external boundaries too close to the area of interest, and 2) Artificially constraining the system with specified-head boundary conditions around the model area. It is important that external model boundaries are set far enough from the area of interest such that they do not overly constrain modeling results. Similarly, it is important that technically defensible boundary conditions that are representative of the regional and local hydrogeologic systems be established for the model.

The proposed lateral extent of the Site Model in relation to the Regional Model is shown in Figure 3. The Site Model grid extends from approximately 2,000 feet to the south of the Site to approximately 2 miles north, where it incorporates the southwestern corner of the Murphree Well Field (Figure 4). The approximately 5-square mile model area was chosen to incorporate major hydrologic stresses in the area and to help ensure that the external model boundary conditions do not artificially constrain flow and transport modeling results at the Site. The proposed model grid is aligned north/south for consistency with the alignment of the regional model. The model grid was extended to the northeast to incorporate pumpage from the Murphree Well Field to ensure that this major hydrologic stress is accurately represented in the Site Model.

The Site Model grid will contain about 6,808 grid cells per model layer. The grid spacing will be smallest on the Site and gradually increase in size with distance away from the Site. The smallest grid size will be 60 feet by 60 feet on the Site and the largest grid cell size will be 500 feet by 500 feet near the external boundaries (Figures 4 and 5). The Site property contains approximately 2,800 of the 6,808 grid cells in the Site Model to ensure accurate representation of the Site hydrogeologic features and constituent data. The grid spacing on the Cabot Carbon site will be 100 feet by 100 feet to provide sufficient detail of flow conditions at this adjoining site.

The advective -dispersion transport equation is more difficult to solve numerically than the groundwater flow equation, and numerical oscillation can develop when advection is the dominant transport component. Numerical instability can also develop as a result of a model time step that is too large in relation to the grid size. The Peclet Number is a measure of the maximum grid size that is consistent with the dispersion coefficient and the Courant Number is a measure of the maximum grid size that is consistent with the model simulation time steps. The model grid size for this site was designed to ensure that both the Peclet Number and Courant Number were within acceptable ranges for the model simulations. Mass balance will be maintained throughout the simulations within acceptable standards.

The vertical extent of the Site Model will include the Surficial Aquifer, Hawthorn Group and Upper Floridan Aquifer deposits. Electrical resistivity surveys will be used to define and extrapolate Site geology to off-site locations to provide information on the continuity and lateral extent of Surficial and Hawthorn Group deposits.

It is anticipated that the Site Model will require 10 model layers to incorporate major lithologies in the Surficial Aquifer and the Hawthorn Group deposits, and to provide the detail required to simulate vertical transport from the Site to the Upper Floridan Aquifer (Figures 1 and 2). In general, model layers were assigned to each of the major hydrostratigraphic deposits beneath the Site. The major clay and sand deposits within the Hawthorn Group deposits are represented by separate model layers to more accurately simulate flow and transport through deposits. The Surficial Aquifer is represented in the model by one layer, the Hawthorn Group deposits are represented by eight model layers, and the Upper Floridan Aquifer is represented by one layer. The Hawthorn Group locally contains six hydrostratigraphic units; however, the upper two hydrostratigraphic units in the Hawthorn Group were represented with two model layers each to increase the numerical accuracy of the model for simulating flow and transport through these units. The use of multiple layers within a hydrostratigraphic unit will allow for a more accurate representation of the advancing plume front and will minimize numerical dispersion (spreading) of the plume. In addition to improving the numerical accuracy of the model, subdividing the upper hydrostratigraphic units will allow greater flexibility in evaluating containment alternatives for the Site. The spatial variability and heterogeneity of the hydrostratigraphic units will be incorporated into the model data sets. Individual model layers may vary in thickness from about 1 foot (Upper Hawthorn Group clay unit) to greater than 50 feet (intermediate and lower Hawthorn Group clayey sand deposits).

MODEL BOUNDARY CONDITIONS

External model boundary conditions are specified in a model to establish a baseline regional groundwater flow across the model area. Model layers 1 and 10 will contain a combination of no-flow and specified-head boundaries. The external boundaries for model layers 2 through 9 will initially be no-flow boundaries. Model layers 2-9 represent both low- and intermediate-permeability deposits of the Hawthorn Group. Lateral flow within these layers is assumed to be an insignificant component of the water budget for the modeled units. If early simulations indicate that this simplification may affect the modeling results at the Site, these external boundary conditions will be changed to constant-head or constant-flux boundaries. The external model boundary conditions for model layer 10 are shown in Figure 4. A no-flow boundary will be established on the northern and eastern sides of the model and specified-head boundary conditions will be established on the southern and northwestern corner of the model. The specified-head boundary conditions for the southern and northwestern model boundaries approximately parallels the potentiometric surface elevation contours of the drawdown cone from the Murphree Well Field. The no-flow boundary conditions on the eastern and northern sides of the model are perpendicular to the potentiometric surface contours; hence groundwater flow is parallel to these boundaries. External model boundaries for model layer 1 will consist of specified-head boundary conditions in the southwestern and northeastern corners of the model and no-flow conditions for the other sides.

Internal model boundary conditions for the wetlands, creeks and surface drainage will consist of either specified heads, the River Package or the Drain Package. The River Package simulates water leakance through the base of rivers and streams. Groundwater discharges into the river nodes when the water table is above the river elevation; conversely, the aquifer is recharged by the river nodes when the water table drops below the river elevation. The Drain Package is similar to the River Package, with the exception that a drain node only allows flow in one direction. Unlike the River Package, when the water table drops below the drain node, it does not allow water to flow back into the aquifer. It is currently anticipated that the wetlands to the northeast of the Site will be simulated with either a specified head or the River Package. The Springstead Creek will be simulated with the River Package to account for shallow groundwater discharge into the creek. The surface drainage channel through the central area of the Site will be simulated with the Drain Package to allow for groundwater discharge into the drainage channel during high water-table conditions and no groundwater discharge during low water-table conditions. Recharge will be applied to the uppermost model layer as a percentage of monthly precipitation.

NUMERICAL MODEL CODE

The numerical modeling code proposed for this Site is MODFLOWT (GeoTrans, 1997). MODFLOWT is an extension of the U. S. Geological Survey (USGS) MODFLOW code, with the added capability of simulating solute transport. MODFLOW is the code currently being used by GRU in its existing Regional Model. MODFLOWT will be used for both the Site Model and the Regional Model.

MODFLOWT will be used to estimate travel times of the most mobile Site constituents from the Site to the Murphree Well Field. Unlike particle tracking, solute-transport models allow for the consideration of dispersion, biodegradation and retardation processes to obtain more realistic estimates of travel times and dissolved-phase constituent distributions.

ZONEBUDGET (Harbaugh, 1990) will be also used in conjunction with the MODFLOWT code to help quantify changes in groundwater flow rates and directions resulting from various remedial alternatives. ZONEBUDGET works directly with MODFLOWT simulation output files and can provide flow rates for various “what-if-scenarios.”

CALIBRATION AND SENSITIVITY ANALYSIS

The Site Model will be used to simulate both groundwater flow and solute transport, requiring a separate calibration for both the groundwater flow and transport components of the model. The groundwater flow component of the model is the most critical because advective transport (i.e. groundwater flow) is the principal transport mechanism for Site constituents. Three additional transport mechanisms that control constituent migration are dispersion, retardation and degradation processes. Dispersion will spread the plume both laterally and vertically; retardation will slow the rate of plume migration; and degradation will slow the rate of migration and limit the lateral extent of the plume. However, because advective transport controls the large-scale movement of constituents, it is the more important of the two model calibrations.

Model calibration and sensitivity analyses will be performed with the parameter estimation package PEST. PEST is a nonlinear parameter estimator that automatically adjusts model parameters to obtain the best fit to Site data. Benefits of using PEST include:

1) More rapid calibration compared to manual methods;
2) Estimation of parameter uncertainties and sensitivities as part of the calibration process;
3) Improved estimation of model parameters than obtainable by manual calibration techniques; and
4) Minimization of bias during calibration step.

The groundwater flow calibration for the Site Model will be performed by adjusting model parameter values to match monitoring well data. Site water-level data prior to the start of the Surficial Aquifer hydraulic-barrier system in 1995 will be used for the steady-state calibration and Site water-level data collected after the start of the hydraulic-barrier system will be used for the transient calibration. It is anticipated that monitoring well data from the adjacent Cabot Carbon site, County and GRU will also be used in the Site Model calibration.

The solute-transport calibration of the Site Model will be performed by comparing the model predicted constituent distributions to monitoring well concentrations. It is anticipated that the solute-transport calibration will be qualitative, since the current vertical distribution of constituents in the Hawthorn Group deposits are suspect.

Limited site-specific data are available for quantifying retardation parameter values and constituent degradation rates. The vertical constituent distributions are hypothesized to be a result of both natural and artificially enhanced migration. The calibration will consist of adjusting model transport parameter values within the range of literature values to obtain the most reasonable fit to Site data.

3.0 REGIONAL MODEL UPDATE

The Regional Model was developed approximately 10 years ago to evaluate wellhead protection for GRU's Murphree Well Field. Since the development of the Regional Model, additional data have been collected for the Upper Floridan Aquifer. As part of this modeling effort, these new data will be incorporated into the model data sets. In addition, the discretization of transmissivity and recharge zones, and their assigned values in the model area between the Site and Murphree Well Field will be evaluated. Verbal communications with CH2M HILL and GRU indicate that the transmissivity and recharge zones assigned to the model were based on a non-unique calibration of the model. The appropriateness of these zones and the potential impacts on fate and transport simulations will be evaluated, because there are limited field measurements and data to verify the technical basis for these model zones. In addition, pumping rates for individual wells within the Murphree Well Field will be updated in the model.

The southern model boundary will also be extended further to the south to minimize the effects of this boundary on Murphree Well Field pumpage. Initial model runs indicate that the drawdown cone resulting from the pumpage at the Murphree Well Field is being artificially impacted by the location of this external boundary condition. The relative effects of this boundary on model simulations at the Site are unknown at this time.

The modifications proposed for the Regional Model should not require a major recalibration of the model. The relative impacts that these changes have on the model predictions will be evaluated; however, there are no plans at this time to recalibrate the Regional Model.

4.0 TRANSPORT SIMULATIONS

Fate and transport simulations of the more mobile Site constituents will be performed after the Regional Model has been updated and the Site Model has been calibrated to Site groundwater flow conditions. The Site and Regional Models will be used to evaluate: 1) Dissolved-phase constituent migration from the start of wood-treating operations to present day, and 2) Future dissolved-phase constituent migration based on the currently available constituent distribution data. Modeling runs that simulate the start of wood-treating operations approximately 80 years ago will be used to help analyze potential transport mechanisms at the Site. It has been hypothesized that the current vertical distribution of Site constituents may be a result of both natural and artificially induced migration/injection. The Site Model can help evaluate this potential by simulating dissolved-phase naphthalene transport from the four known NAPL areas at the Site. The naphthalene constituent distribution predicted by the Site Model will be compared to the estimated present day constituent distribution to determine if the current distribution is a result of natural migration, enhanced constituent migration and/or condensate injection at the Cabot Carbon site. This analysis will help resolve issues and questions associated with expected migration rates through undisturbed Hawthorn Group deposits.

The second use of the Site and Regional models will be to predict future transport of Site constituents based on the currently observed vertical and lateral distribution of Site constituents. Based on the currently known distribution of Site constituents, the Site model will be used to simulate future transport of these constituents through the Surficial and Hawthorn Group deposits into the Upper Floridan Aquifer. The Regional Model will be used to simulate lateral transport within the Upper Floridan Aquifer to evaluate the potential of Site constituents reaching the Murphree Well Field.

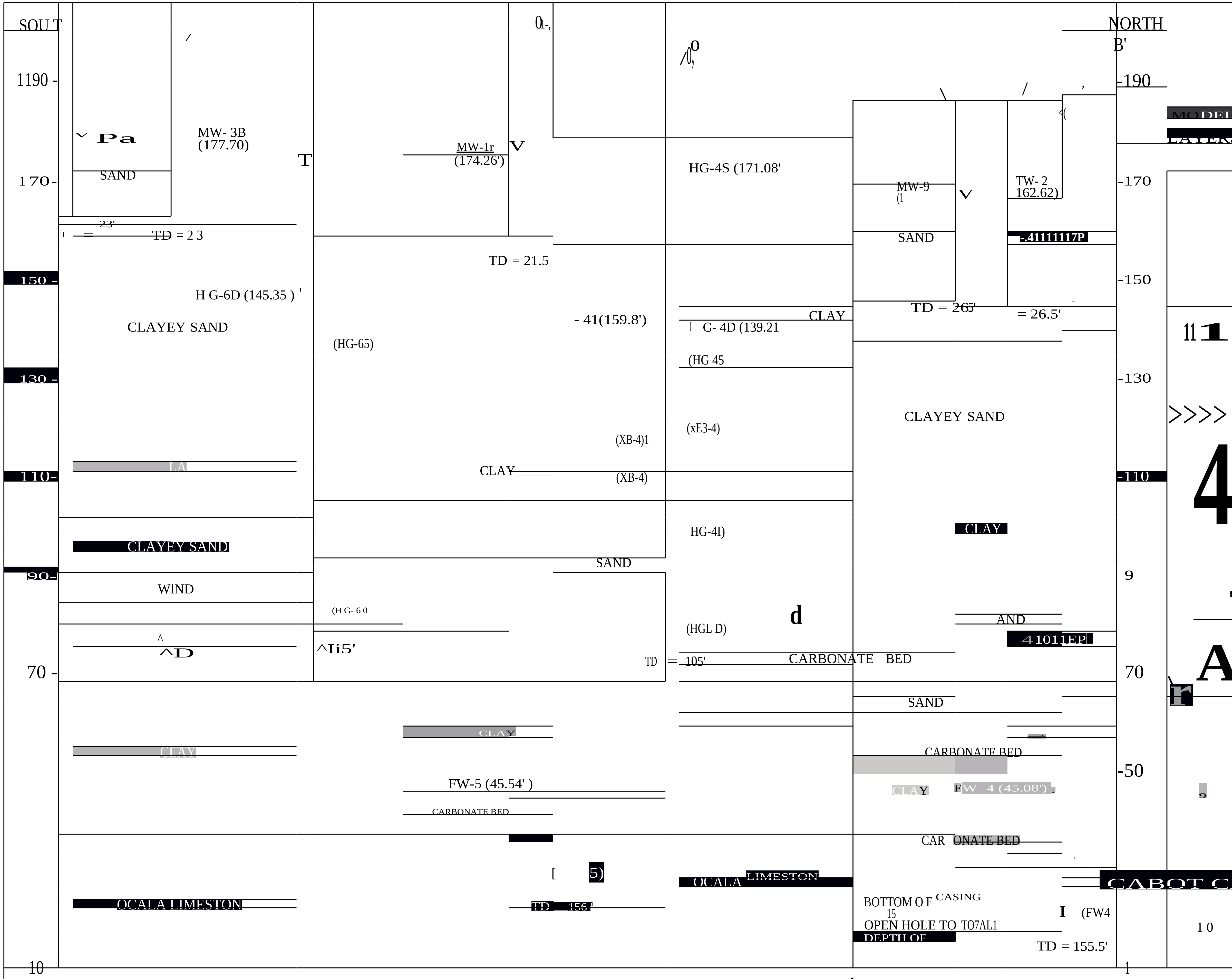
Known NAPL areas at the Site will be incorporated into the Site model as a constant concentration boundary flux condition. The constituent fluxes or concentrations entering the Upper Floridan Aquifer from the Site Model will be used as initial starting fluxes or concentrations for the Regional Model. Solute transport simulations will be performed to calculate travel times from the Site to the Murphree Well Field. Concentration plume maps will also be generated to delineate the lateral extent of the most mobile Site constituents. Several transport simulations will be performed based on the results of the sensitivity analyses from the models to bound travel times from the Site to the Murphree Well Field within the uncertainty of model parameter values.

5.0 REPORTING AND TECHNICAL MEETING

A comprehensive report will be developed that details the Site Model development, simulations and results. Additionally, the report will describe the evaluation of the Regional Model and any corresponding modifications that were made to its design and data sets. The report will include color graphics to effectively communicate the modeling results and potential impacts on the local groundwater flow system. Model results will help to quantify the importance of biodegradation and other processes, thereby refining the site conceptual model. Model results also will help quantify plumes that develop from various sources including the condensate injection well on the Cabot Carbon site. Finally, model results will be used to help evaluate the vertical migration pathways.

It is anticipated that the results of the model development, calibration and simulations will be presented at a meeting of interested parties.

FIGURES



HORIZONTAL SCALE FEET: 0 250 500

VERTICAL SCALE FEET: 0 20 m

MODIFIED FROM TRC FILE 32811AFIR-02 REV.08/27/03

SECTION B-B

EAST SIDE OF SITE

CABOT CARBON/KOPPERS

SUPERFUND SITE

GAINESVILLE, FLORIDA

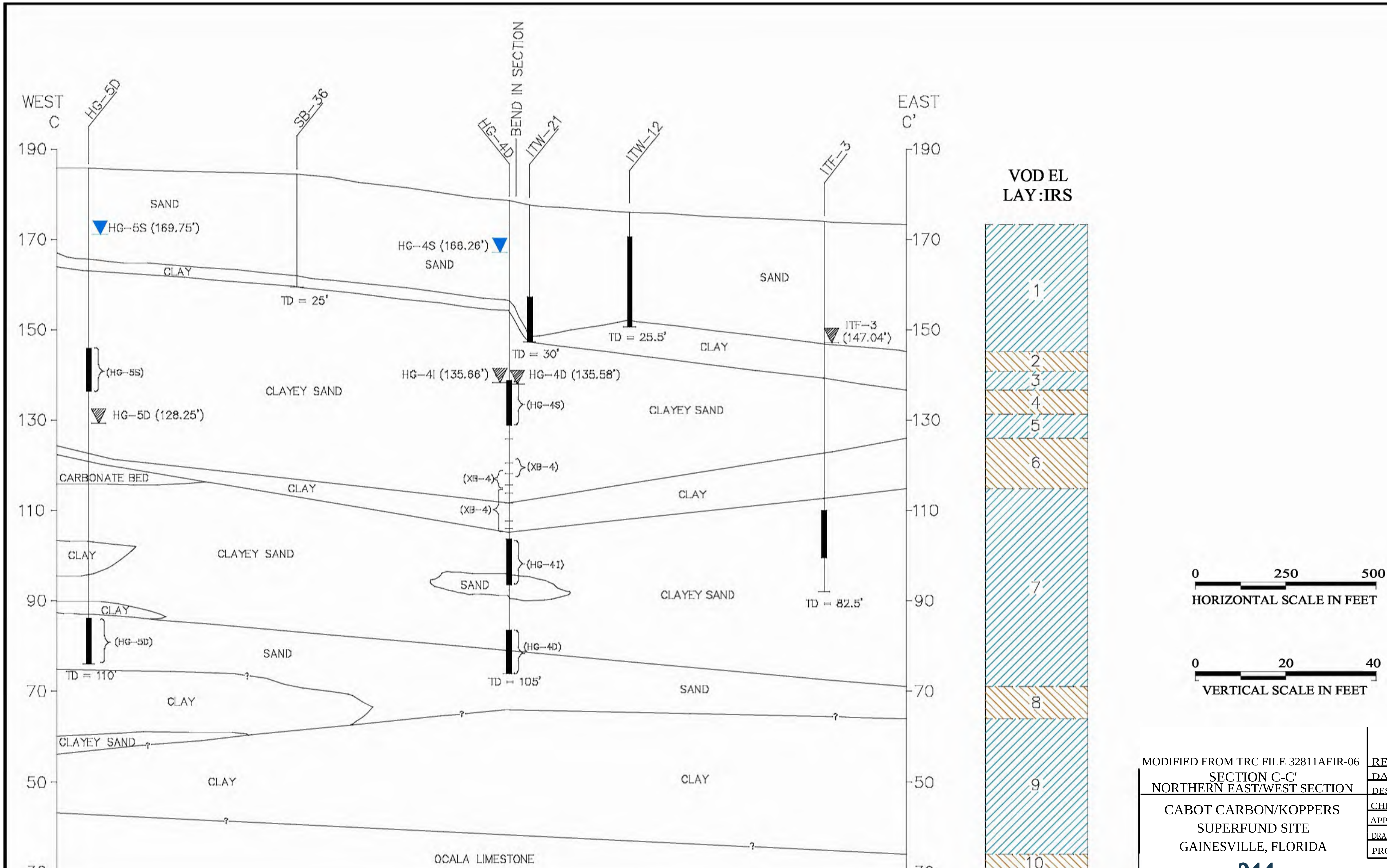
DSGNED:

CHECKED

DRAWN: DUB

PROD.: 2.201.043

Figure



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SECTION C-C'
NORTHERN EAST/WEST SECTION

CABOT CARBON/KOPPERS
SUPERFUND SITE
GAINESVILLE, FLORIDA

REV. 08/27/03	
DATE: 01/05/04	
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CHECKED:	CR
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Figure2

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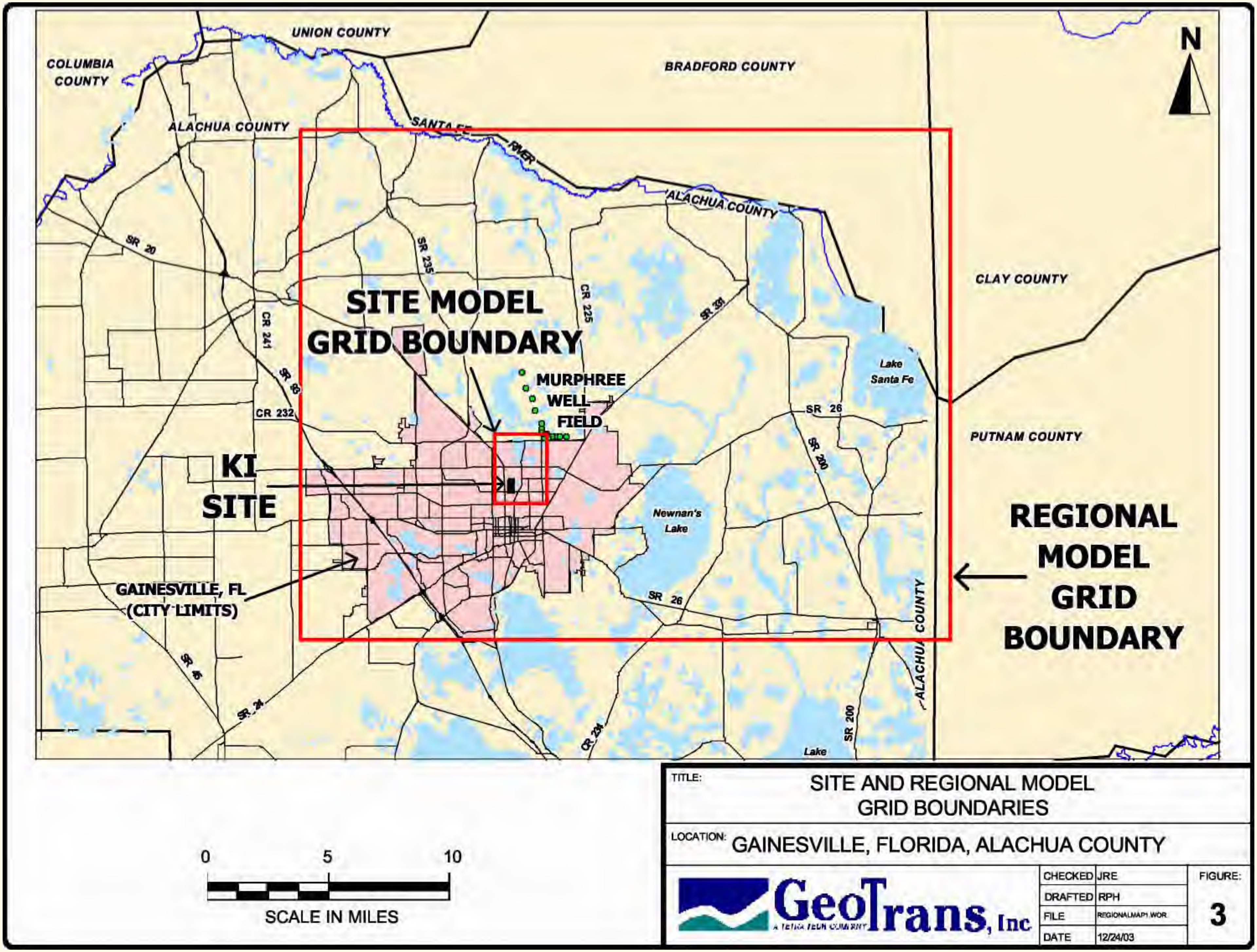
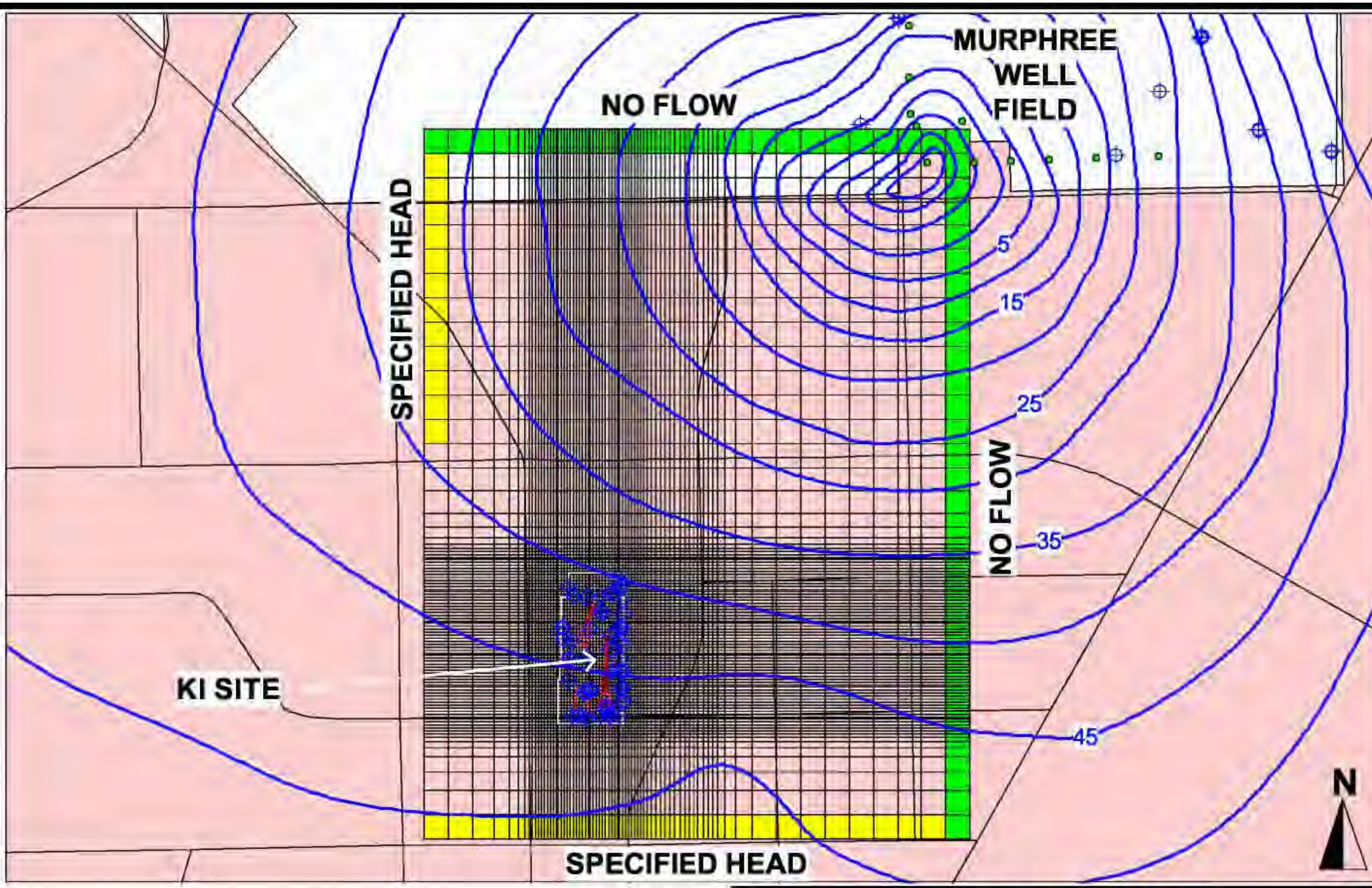


TITLE: SITE AND REGIONAL MODEL GRID BOUNDARIES

LOCATION: GAINESVILLE, FLORIDA, ALACHUA COUNTY

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JRE	FIGURE:
DRAFTED	RPH	3
FILE	REGIONALMAP1.WOR	
DATE	12/24/03	

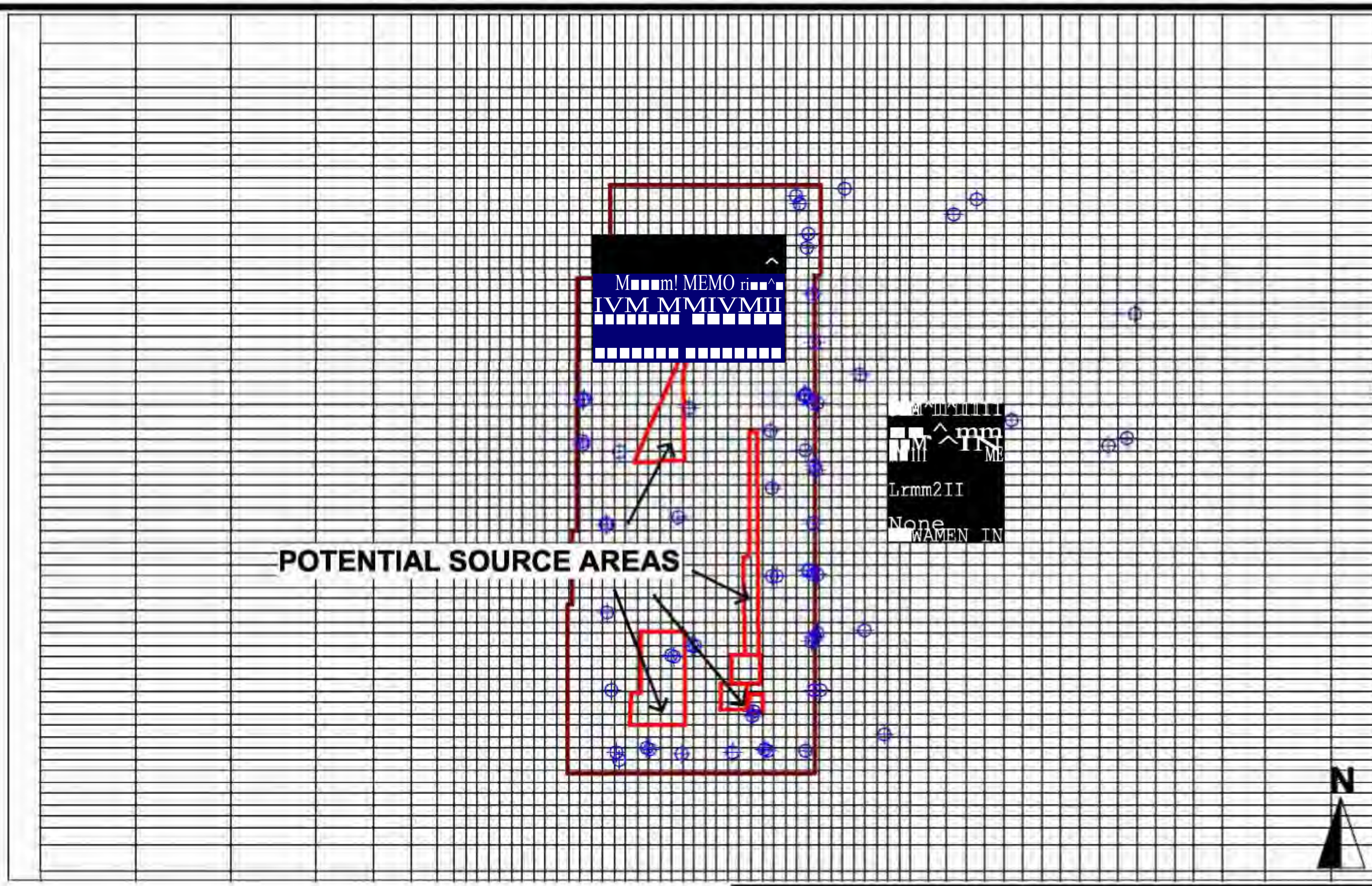


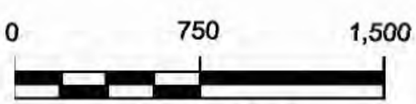
TITLE: SITE MODEL GRID AND BOUNDARY CONDITIONS

LOCATION: GAINESVILLE, FLORIDA, ALACHUA COUNTY

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JRE	FIGURE:
DRAFTED	RPH	4
FILE	REGIONALMAP.WOR	
DATE	12/24/03	





TITLE:

CLOSEUP OF SITE MODEL GRID

LOCATION: GAINESVILLE, FLORIDA, ALACHUA COUNTY

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CHECKED	JRE	FIGURE:
DRAFTED	RPH	5
FILE	REGIONALMAP.WOR	
DATE	12/24/03	