

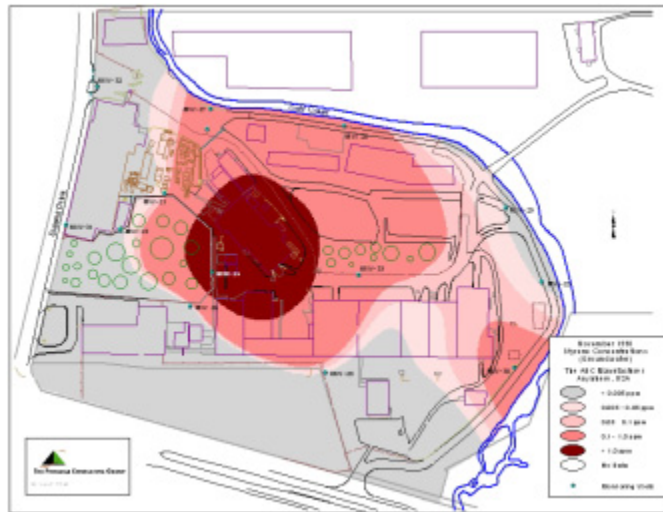


## Geographic Information System (GIS) Services

The Pinnacle Consulting Group, Inc. provides Geographic Information System/Global Positioning System (GIS/GPS) mapping and database services to clients throughout the southeast. Pinnacle specializes in combining traditional database solutions, statistical analysis, modeling, and resource management with the ability to visually depict geographic information. These advanced mapping systems integrate photographic, spatial, and descriptive data to convey issues, trends and relationships more quickly and effectively than text or tabular data.

Pinnacle provides GIS/GPS services in the following areas of interest:

- Natural Resource Inventories
- Land Use/Land Cover Change
- Landscape Analysis
- Wetland and Lake Management
- Biological Sampling
- Watershed Analysis and Management
- Forest Resource Management
- Green Space and Greenway Management
- Environmental Impact Assessment
- 3-D Visualization
- Virtual Flight Movies
- Site Investigations/Remediation
- Air Dispersion Modeling and Mapping

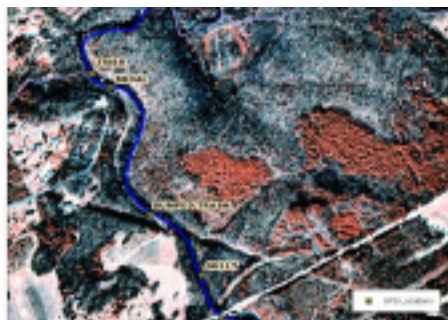


Benzene Contamination Plume




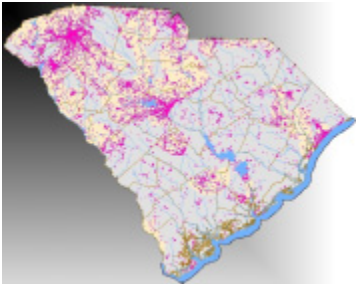
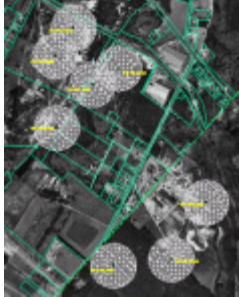
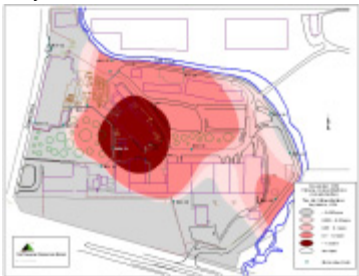
GIS/Remote Sensing Skills:

- Data Acquisition/Creation
- Photo and Image Interpretation
- Satellite Image Classification
- Data Conversion
- Spatial Analysis
- GIS on the Internet with ArcIMS™
- ArcGIS™ Customization with VBA
- ArcView® 3.2a Customization/Avenue® Programming
- Cartographic Design and Production
- GIS Requirements Analysis
- Field Data Collection with Portable GPS/GIS (ArcPAD™)



Interpretation of digital aerial infrared photography used for delineation of land use; ground reconnaissance and GPS used to identify and locate key features; data layers compiled and overlain for spatial analysis.

# Geographic Information System (GIS) Services Project Experience

Project	Project Summary
<p><i>Assessment of Urban Tree Cover in Greenville-Spartanburg Metro Area</i></p>  <p>The image shows two panels of satellite and aerial imagery. The top panel is a composite of high-resolution aerial photography (1-2 meters resolution) overlaid on satellite imagery. A text box explains that this is done to classify and quantify land cover types such as forest, grassland, residential, and commercial/industrial. The bottom panel shows a 3-D virtual flight view of Woodruff Road, comparing the area in 1981 and 1999 to show dramatic changes in land cover as a result of development.</p>	<p>Pinnacle is working in conjunction with the Strom Thurmond Institute and the Department of Forestry at Clemson University to assess and monitor the urban forest resources of the Greenville-Spartanburg corridor to provide a base understanding of the urban forest resources and how they change over time (1981, 1989, and 1999). Land cover and percent canopy data layers will be derived for the Greenville-Spartanburg area by classification of LandSat™ imagery. The methodology utilizes a combination of orthorectified high-resolution color infrared aerial photography (i.e. NAPP) and LandSat satellite imagery.</p> <p>Using the photography and ERDAS Imagine VirtualGIS, 3-D virtual flight videos have been created along corridors in the project area where significant land use changes have occurred between 1981 and 1999. These videos can be displayed side by side (i.e., same flight path, two different years) to show the dramatic changes in land cover as a result of development.</p> <p>This project will include an accuracy assessment/field data collection task to confirm the results of the automated land cover determination process. This task will be performed using a customized portable GIS interface (ArcPAD®) that results in a consistent and ready to use GIS dataset</p>
<p><i>Statewide Source Water Assessment Project, SC</i></p>  <p>The image is a map of South Carolina showing delineated wellhead protection zones (WHPZs) or source water protection areas (SWPAs). The map uses various colors to represent different protection zones across the state.</p>	<p>The South Carolina Department of Health and Environmental Control retained the Pinnacle Consulting Group in April of 2001 to inventory (i.e., map the location and record certain attributes of) Potential Contamination Sources (PCS) within delineated wellhead protection zones (WHPZs) or source water protection areas (SWPAs). The area to be inventoried consisted of approximately 12,000 square miles. The inventory process consisted of driving all of the 41,000 miles of roads within the survey area to visually identify and map the location of facilities that met the definition of a PCS. The project was performed by developing a base map of roads and other features. The base map was loaded into a portable GIS system that displayed GPS data in real time. This allowed efficient navigation of the survey areas. Attribute information was recorded using customized database forms.</p>
<p><i>Superfund Remediation Site Support</i></p>  <p>The image shows a map of a Superfund remediation site. It displays monitoring well locations (indicated by yellow dots) and their effective ranges (indicated by green circles). The map is used to visualize gaps in monitoring well coverage and to determine where to place additional monitoring wells.</p>	<p>Pinnacle GIS Analysts support several superfund site remediation efforts by maintaining a GIS database of general basemap information as well as monitoring well sampling locations and results. A recent project involved using a combination of geostatistics and ArcView. GS+, a geostatistical software package, was used to determine the effective ranges of monitoring wells in three aquifers. The effective ranges were mapped which enabled Pinnacle employees, the client, and EPA to visualize gaps in monitoring well coverage (see figure left). These maps displayed how to efficiently place additional monitoring wells so as to obtain maximum coverage while minimizing costs.</p>
<p><i>Groundwater Contaminant Analysis, SC</i></p>  <p>The image is a map showing groundwater contaminant plumes. It features a red shaded area representing the plume, with a legend indicating different concentration levels. The map is used to investigate the change in extent over time of groundwater contamination by constituents such as benzene, arsenic, etc.</p>	<p>Pinnacle analysts used ArcView and ArcView applications to investigate the change in extent over time of groundwater contamination by constituents such as benzene, arsenic, etc. ArcView Spatial Analyst was used to interpolate measured contaminant concentrations from groundwater wells located throughout the client's property. Isoconcentration plume maps were then generated for each chemical constituent (see example on reverse). The plume maps and additional GIS coverages of other groundwater characteristics enabled Pinnacle scientists to better understand the fate and transport of the contaminant plumes.</p>