Final Report

2006 NSDI Cooperative Agreement Program

Category 2: Framework Client Development:
Creating sustainable client applications for Framework data

Leveraging the NSDI: Empowering Local Incident Response Communities using OpenGIS Web Services and Interoperable Client Applications for Framework Data

The Carbon Project, a member of the geoLeaders Network

25 Mall Road, Suite 300, Burlington, MA 01803

info@TheCarbonProject.com

www.TheCarbonProject.com

The Carbon Project
Innovative Geosocial Solutions

Final Report

Agreement Number: 06HQAG0113

Report Type: Final Report

Project Title: Framework Client Development: Creating sustainable client applications for Framework data

Geographic Extent Served by Project: State of North Carolina

Organization:

The Carbon Project, a member of the geoLeaders Network

25 Mall Road, Suite 300

Burlington, MA 01803

Internet Address: http://www.thecarbonproject.com

Project Leader:

Jeff Harrison, President and CEO

  Carbon Project, Inc.

  Phone: 703.491.9543, FAX: 703.491.0873, jharrison@thecarbonproject.com

Collaborating Organizations:

Julia Harrell, GIS Coordinator

  NC Department of Environment and Natural Resources, ITS Division

  Phone: 919.715.0363, julia.harrell@ncmail.net

  Internet Address: http://www.enr.state.nc.us/

Twyla McDermott, GIS Manager and Corporate Strategic Technology Planner

  City of Charlotte, Office of Strategic Technology Planning

  Phone: 704.336.8066, tmcdermott@ci.charlotte.nc.us

Internet Address: http://www.charmeck.org/

Bridget Hayes, GIS Coordinator

Charlotte Fire Department

Phone: 704-432-0850, bhayes@ci.charlotte.nc.us

Internet Address: http://www.charmeck.org/Departments/Fire/Home.htm

Charles Friddle, GIS Director

Wake County GIS Department

Phone: 919.856.6375, cfriddle@co.wake.nc.us

Internet Address: http://www.wakegov.com/departments/gis.htm

Brenda Smith, Geospatial Information Officer

US Environmental Protection Agency, Office of Environmental Information

Phone: 202.564.2034, Smith.Brenda@epamail.epa.gov

Internet Address: http://www.epa.gov/oei/

Project Narrative

The Carbon Project, a member of the geoLeaders Network, was selected for a grant from the National Spatial Data Infrastructure (NSDI) Cooperative Agreement Program (CAP) to develop an easy-to-use application that accesses online geographic data services and allows users to seamlessly share event-specific location content. The application, Gaia 3 for Incident Response (Gaia 3/IR), was to be freely available and tailored to the needs of the incident response and recovery community.

Gaia 3/IR is a free application for accessing, visualizing and sharing geospatial content. Developed with CarbonTools PRO[1], Gaia 3/IR provides superior functionality for using an array of National Spatial Data Infrastructure (NSDI) Framework Data. Open Geospatial Consortium, Inc. (OGC) Web Map and Web Feature Services (WMS and WFS), OGC GML, Microsoft Virtual Earth, Google Earth KML, ESRI Shapefiles and more are easily integrated with Gaia 3/IR - giving users the ability to create custom views and gain access to relevant data.

The project involved the collaboration of the NC Dept. of Environment and Natural Resources (NC DENR), the City of Charlotte, NC, Wake County, NC, the U.S. Environmental Protection Agency (EPA), The Carbon Project, and the geoLeaders Network. The effort also engaged State, County and Municipal government organizations in a collaborative requirements process and then developed and deployed an

---

[1] www.CarbonTools.com

interoperable software application with the ability to access Open Geospatial Consortium, Inc. (OGC) Web services, including Framework data as Geography Markup Language (GML) from Web Feature Services (WFS), GPS and other sources in support of decision-making processes. The project also provided software development tools and training to local organizations.

Gaia 3/IR is a sophisticated, yet easy-to-use, situational awareness application intended to support the incident response and management community. It is designed to be usable by non-GIS professionals, such as first responders, crisis managers and emergency operations center personnel. Users of Gaia 3/IR are able to access maps and geospatial features in an easy-to-use and understandable manner. Gaia 3/IR takes full advantage of the CarbonTools PRO caching capability, thus enabling users to pre-load all maps, aerial photography or other maps and features. Data from web services is also updated when internet connection is available.

In addition, Gaia 3/IR includes support for Global Positioning System (GPS) "Track Me" functions and uses United States National Grid (USNG)[2] coordinates - supporting a nationally consistent language of location.

Gaia 3/IR also includes powerful CarbonCloud and Geospatial Notes functions that provide the foundation for creating and sharing geospatial content. The CarbonCloud P2P Framework can be used over the Internet or with local networks, independent of any Internet connection. Survivable, computer-to-computer Ad-Hoc networks connect users when the Internet is not available, providing a redundant communications framework for incident response. In addition, users can develop and search groups in CarbonCloud, making for a unique capability that enhances all levels of environmental incident response. CarbonCloud is used to exchange Notes with digital photos, custom map symbols and text, allowing users to create and share their own environmental incident response information in their own community networks.

Gaia 3/IR supports the new American National Standard for Homeland Security Mapping – Point Symbology for Emergency Management. This standard allows users to rapidly interpret map data and disseminate consistent, usable information. It forms the framework for the Notes symbology in Gaia 3/IR. The American National Standard for Homeland Security Mapping – Point Symbology for Emergency Management was developed through the Federal Geographic Data Committee (FGDC) Homeland Security Working Group.[3]

The project also provided added benefit by developing and releasing a second version of Gaia 3 without the p2p communications framework. This application is available as a free download at http://www.thecarbonproject.com/gaia.php. Source code for Gaia 3 was provided to local and state organizations as part of the project.

---

[2] http://www.fgdc.gov/usng/index.html
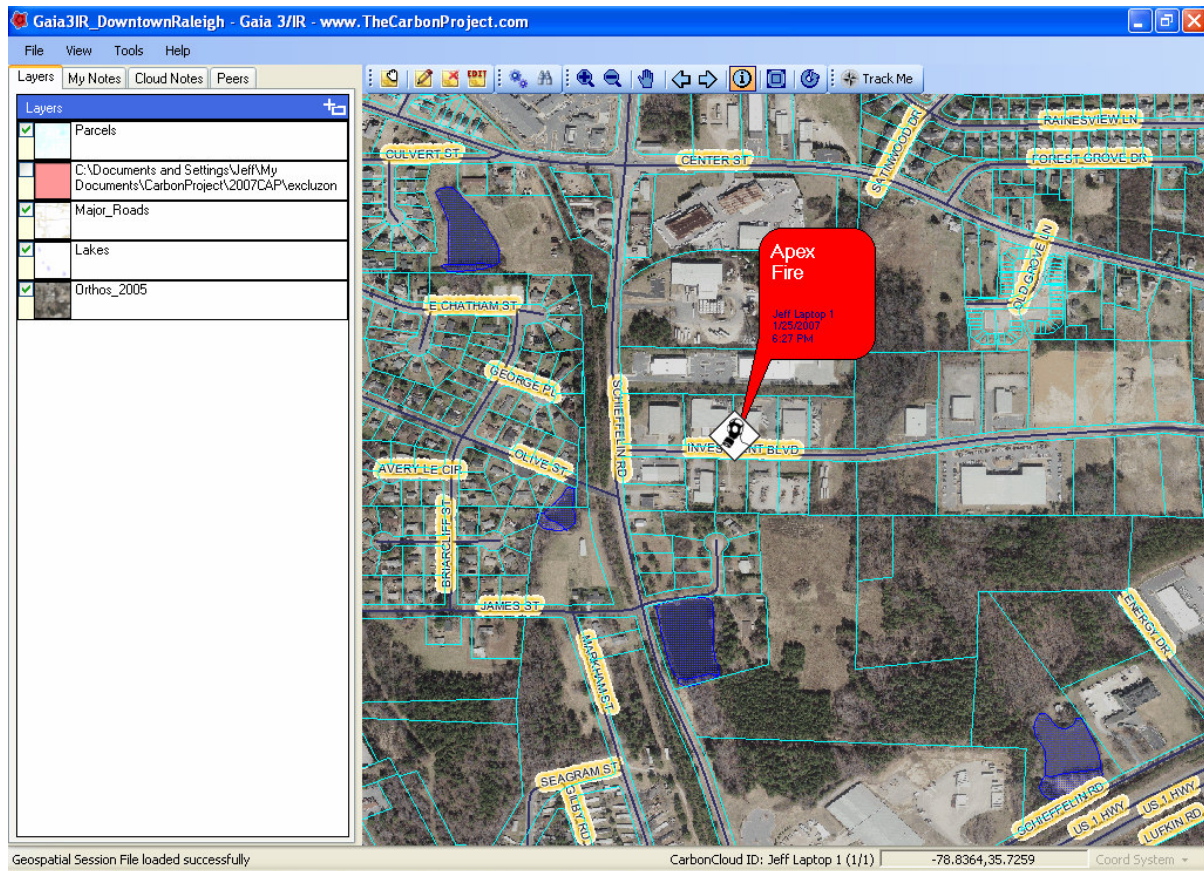[3] http://www.fgdc.gov/HSWG/testing/ref_pages/SymbologyBackground_ref.htm

Figure 1 - Gaia 3/IR is a free application for accessing, visualizing and sharing geospatial content. In this example, Gaia 3/IR is accessing WMS and local data resources from Wake County, NC.

Status of data access activities

1. *What Framework data theme(s) will be accessed under this project?*
   a. Orthoimagery, elevation, transportation, hydrography, governmental unit boundaries.

2. *What is the data volume of Framework data anticipated for access (geographic coverage, dataset size, feature count)?*
   a. In total, several hundred gigabytes of Framework Data and other sources may be accessed via WFS during this project as well as terabytes of Orthoimagery, depending on the needs of Gaia 3/IR users. This data can include Transportation, Hydrography and Governmental Unit boundary features. However, it is likely that the average Gaia 3/IR user will access Framework data for local areas, resulting in much lower data volumes.
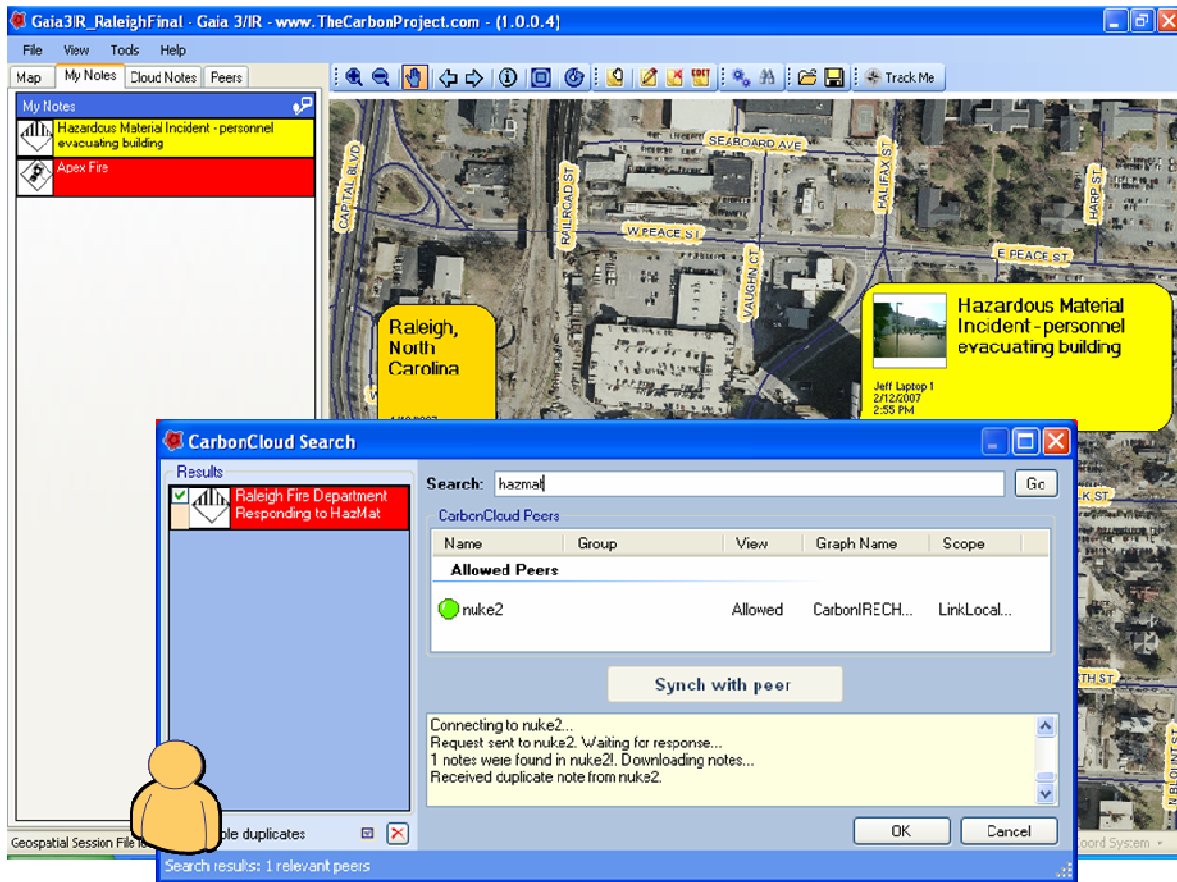
Figure 2 - Gaia 3/IR includes p2p search, support for GPS, United States National Grid (USNG) coordinates, and the American National Standard for Homeland Security Mapping – Point Symbology for Emergency Management.

3. *Who are the primary organizations providing data for this project?*
   a. NCOneMap, Wake County, The National Map, EPA WFS, GlobeExplorer, Microsoft Virtual Earth, Yahoo! Maps, CustomWeather, CubeWerx, USGS, North Carolina localities including Raleigh and Charlotte. In addition, Gaia 3/IR can access local data sources including Shapefiles, Google Earth KML/KMZ and GPS data feeds connected to mobile computers.

Status of Framework Client Development

1. *What is the status of software development?*
   a. Initial requirements assessments for Gaia 3/IR were completed during onsite visits to North Carolina in May and June 2006. Community feedback was integrated into the application design. Prototype components

of both ((Echo))MyPlace™, a test platform for basic Gaia 3/IR functions, and CarbonCloud™, a peer-to-peer (P2P) framework for sharing location content, were tested. Beta versions of Gaia 3/IR and CarbonCloud were successfully demonstrated to community stakeholders in Raleigh, NC on August 30, 2006 and in Charlotte, NC on November 1, 2006. Overall development was completed on schedule by March 1, 2007 (below).
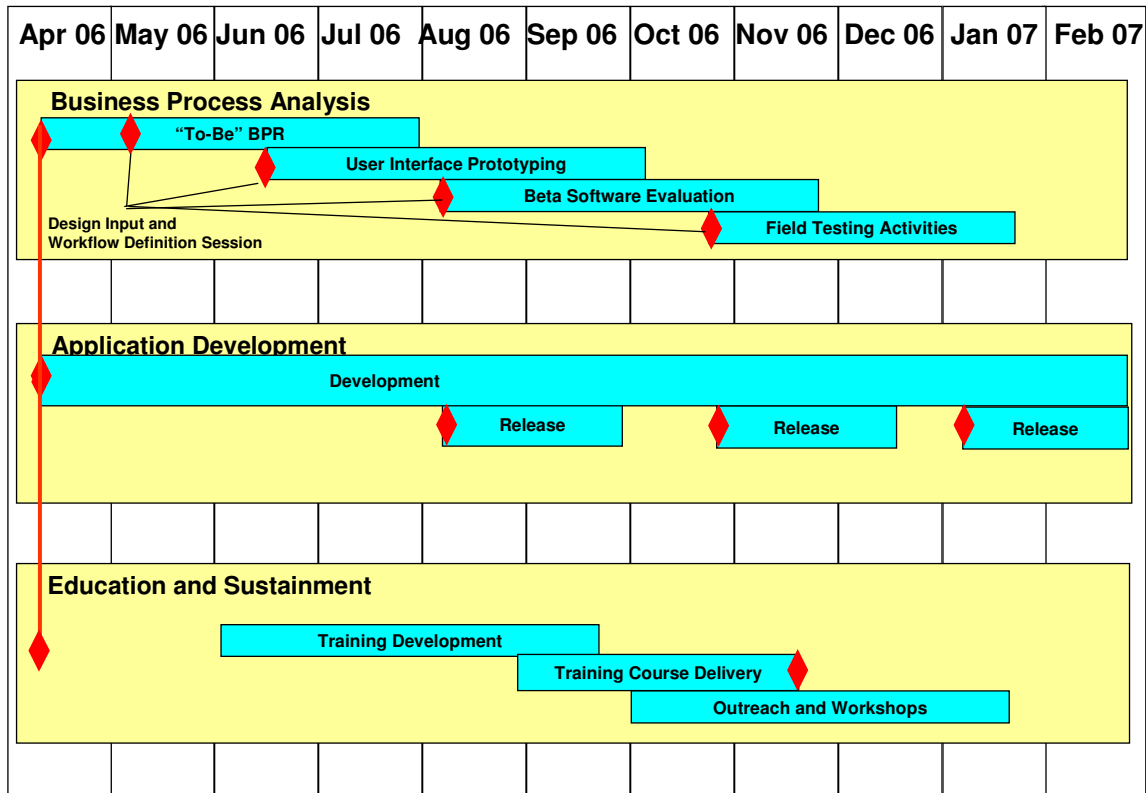

Figure 3 - Gaia 3/IR development schedule and high level tasks.

2. *How will the client software be evaluated and quality assured?*
   a. The client software was evaluated by a series of onsite and remote meeting workshops conducted as part of User Interface Prototyping, Beta Software Evaluation, and Field Testing Activities. Overall quality assurance was maintained as an integrated part of the Gaia 3/IR application development process (summarized below).
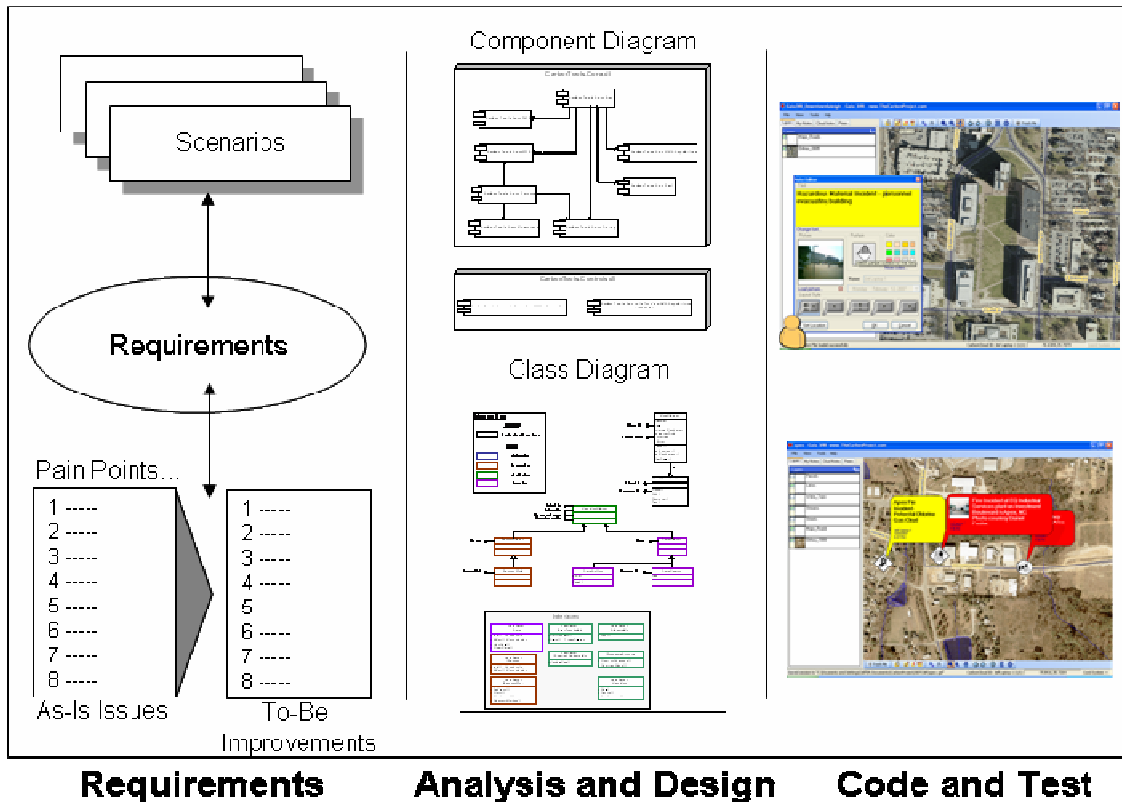
Figure 4 - Gaia 3/IR application development process.

To help develop specific workflows implemented in Gaia 3/IR, representatives from each of the participating local and state government partners participated in a series of functional requirements and workflow sessions with The Carbon Project team to ensure that the application meets the needs of many groups across a common set of location-based tasks. The partners employed an iterative development process whereby the local and state government partners engage in a series of design input and workflow definition sessions with The Carbon Project.

3. *Describe your experience and purpose in accessing the data services?*
   a. Gaia 3/IR is intended targets non-GIS users and provides "one-click" access to open-geospatial services including WMS and WFS. The UI is tailored to target the needs of the Incident Response and recovery communities. The application was designed to present a clean and friendly "first view" with preset connections to relevant maps and geospatial data, have simple navigation tools. However, other than high quality orthoimagery via government-operated WMS and base mapping

from commercial mapping services it was challenging to locate usable Framework WFS with data over North Carolina to support the project.

4. *Describe any internal or external users that are using this client.*
    a. Gaia 3/IR can be internal and external users. The basic functions and software components have been tested "internally" several times at public events in Boston[4], Vancouver[5], Washington, DC and North Carolina[6] and personnel from NC DENR are now using the application. The application was demonstrated to multiple organizations in North Carolina during the NC GIS conference in March 2007.

5. *Identify plans for promotion and distribution of this software.*
    a. Gaia 3/IR will be freely downloadable from a link on the NC OneMap portal and The Carbon Project website. Outreach activities to inform NC local governments of Gaia 3/IR will be conducted by members of the NC Geographic Information Coordinating Council, via announcements to NC listservs, and by presentations at events such as the NC GIS conference.[7] Project partners have each been provided a commercial developer license of CarbonTools PRO and received training in its use in May and June 2007. The Carbon Project will also engage rural/small NC communities through the Local Government Subcommittee of the NC Geographic Information Coordinating Council, and provide the same CarbonTools PRO licenses and training opportunities to a select number of smaller agencies. This will provide for a wider cross-section of NC Local Governments to contribute to future development to this application. The Carbon Project is committed to maintaining and further developing Gaia 3/IR post-CAP.

Project Management

1. *Will this project's activities continue in the future?*
    a. We hope so. Initial response to the application has been positive and the project team is working with various stakeholders to advance a coordinated set of activities to test the application.

---

[4] http://carboncloud.blogspot.com/2006/07/first-carboncloud-demo.html
[5] http://carboncloud.blogspot.com/2006/08/carboncloud-in-vancouver_08.html
[6] http://carboncloud.blogspot.com/2006/09/carboncloud-in-north-carolina.html

[7] http://carboncloud.blogspot.com/2007/03/positive-energy-at-nc-gis-2007.html

2. *Describe the next phase in your project.*
   a. Next phase will depend on requirements of stakeholders, but we anticipate feedback on usability, Framework Data access and p2p functions.

3. *Requirements (more technical assistance, software, other)?*
   a. Additional assistance is needed to identify usable Web Feature Services (WFS) to support this project. The new NSDI WFS for Hydrography, Transportation and Governmental Unit Boundaries will be a much needed asset.

4. *What areas need work?*
   a. Overall, the application is working very well. As stated above, additional assistance is needed to identify usable Web Feature Services (WFS) to support this type of project.

Figure 5 - Attendees at the NC GIS conference trying Gaia 3/IR in March 2007.

Feedback on Cooperative Agreements Program

1. *What are the program strengths and weaknesses?*

    a. Strengths-Good management, fairly easy to understand the process and become engaged.

    b. Weaknesses-Several of the automated grant application tools used at the beginning of the program did not function correctly.

2. *Where does the program make a difference?*

    a. The program helps develop key elements of the NSDI. Overall, the program is making good progress but additional emphasis needs to be placed on promoting an online infrastructure of standards-based location content that can flexibly support operational incident response requirements. We suspect that funding issues are holding back development of this online infrastructure.
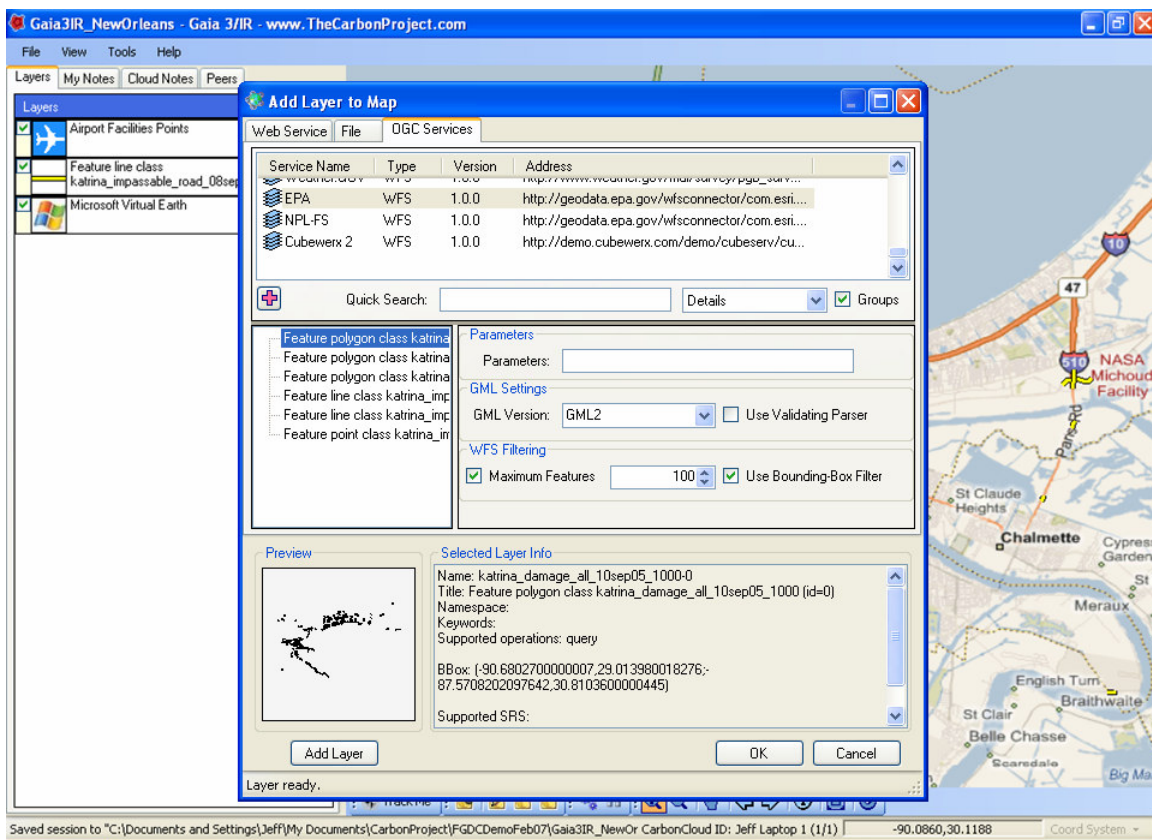

Figure 6 - Gaia 3/IR can access a variety of data sources including WMS, WFS, WCS, Microsoft Virtual Earth, Yahoo! Maps, Google Earth KML/KMZ, ESRI Shapefiles and many others. In the example above a WFS from EPA is accessed, providing GML data about Hurricane Katrina damage over New Orleans.

3. *Was the assistance you received sufficient or effective?*

    a. Yes

4. *What would you recommend doing differently?*
   a. We recommend maintaining a list of WFS-based Framework Data services. We are not able to identify these services using the GOS Portal.

5. *Are there factors that are missing or need to consider that were missed?*
   a. The CAP program may wish to consider promoting development of online infrastructures of standards-based location content by coordinating with Homeland Security and critical infrastructure protection functions. For example, there is no reason why a low-cost program cannot provide grant incentives to hundreds of localities across the nation to make their own framework data available via simple Web Map and Features Servers so that these sources can be used for situational awareness in times of need, or used to guide tourists to key destinations on most other days. This type of investment is a "win-win" for the Nation.
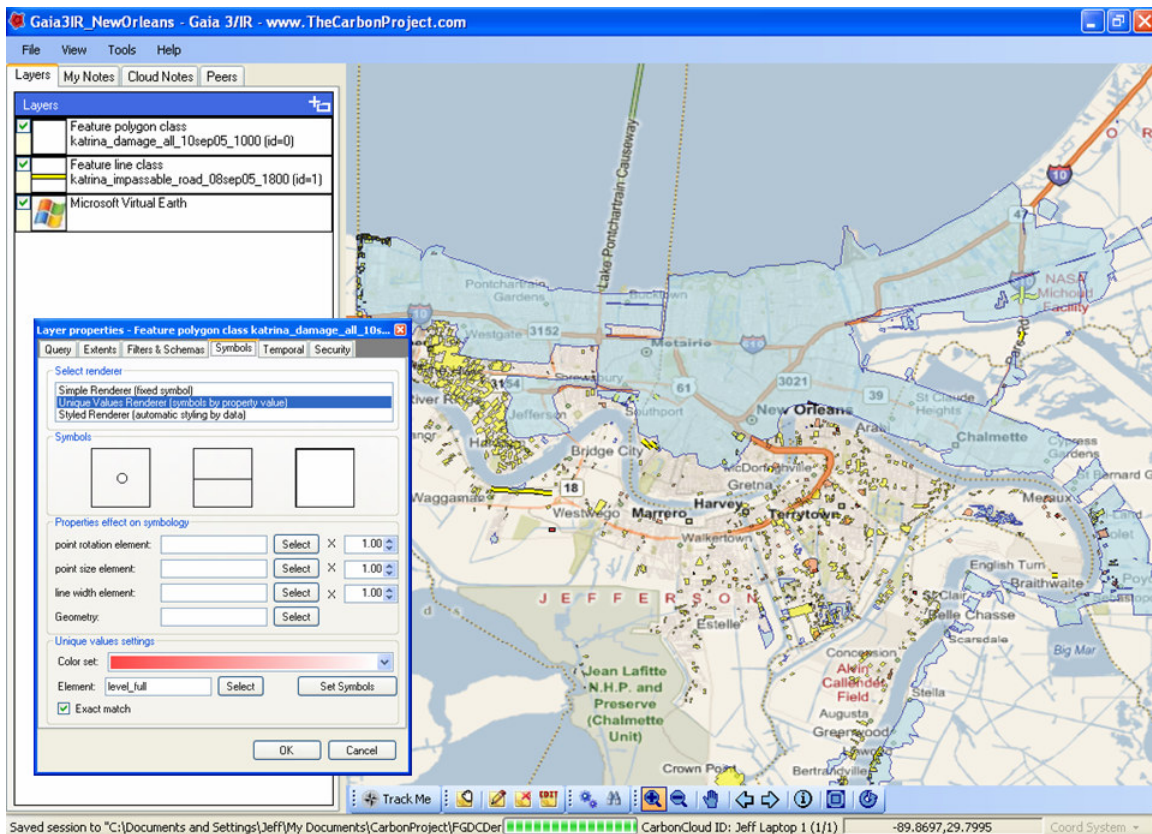
Figure 7 - Gaia 3/IR includes advanced renderers for GML that use the properties of data for flexible symbology. In the example above, GML from an EPA WFS is symbolized and combined with Microsoft Virtual Earth.

6. *Are there program management concerns that need to be addressed? Time frame?*
    a. No

7. *If you were to do this again, what would you do differently?*
    a. Nothing, the program is functioning well for this project.