NJ GIS Update

A newsletter about NJDEP's Geographic Information System *Issue #41 Winter 2000-2001*

New Jersey Develops Interactive Map to Explore Brownfield Opportunities

Information on New Jersey's Brownfields is now available through an interactive mapping application on the internet. The interactive map, called i-MapNJ Brownfields, allows users to consider brownfield redevelopment opportunities and explore New Jersey data. One of the first of its kind, i-MapNJ Brownfields was developed as a joint effort between the New Jersey Department of Environmental Protection (DEP), Office of Information Technology, Office of State Planning, Governor's Urban Coordinating Council, and the Brownfields Redevelopment Task Force.

A brownfield is "any former or current commercial or industrial site that is currently vacant or underutilized and on which there has been, or there is suspected to have been, a discharge of contamination," according to New Jersey's Brownfield and Contaminated Site Remediation Act. To promote brownfield use, at i-MapNJ Brownfields, users can review brownfield site and marketing data. All that is needed to access this wealth of information is an internet connection and Internet Explorer version 4.0 or higher.

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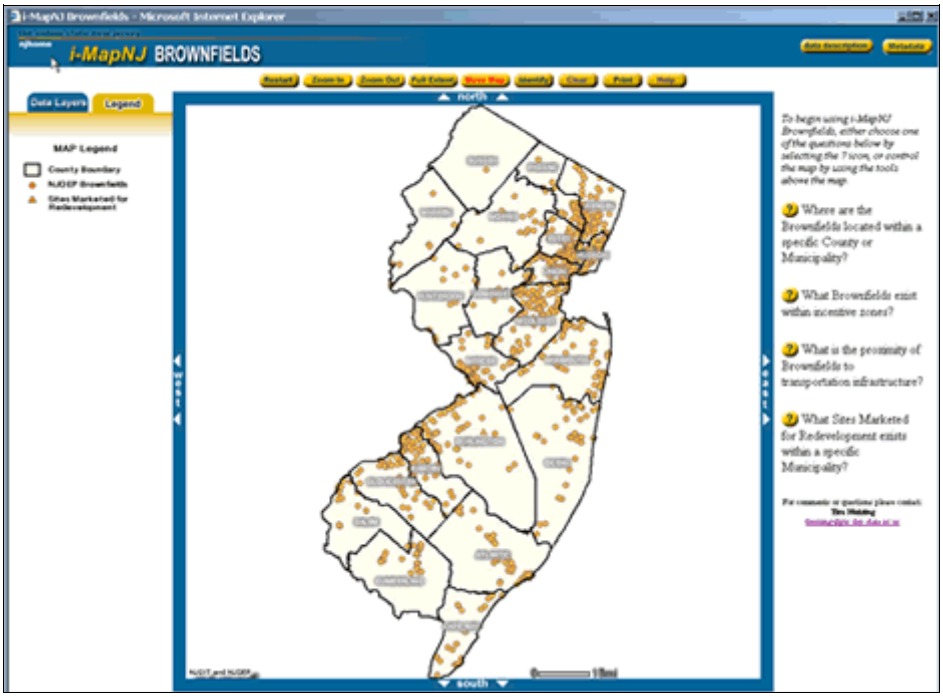

Using the National Standard for Spatial Data Accuracy to Assess Some Geospatial Reference Data for New Jersey

Introduction

The proliferation of computerized Geographic Information Systems (GIS) in society over the past decade has spurred the development of new Federal standards concerning Geospatial Data Positional Accuracy. The National Standard for Spatial Data Accuracy (NSSDA) outlines a testing and statistical methodology for assessing and reporting positional accuracy of fully georeferenced maps and digital geospatial data in either raster, point, or vector format (Federal Geographic Data Committee, 1998). Positional-accuracy reports are designed for FGDC compliant metadata. The N.J. Geological Survey developed an ArcView GIS extension that facilitates the NSSDA test methodology. This ArcView extension was used to evaluate three reference data themes for New Jersey. The procedures and results of these tests are presented here along with discussions on why testing of data is needed.

Why be concerned about the accuracy of geospatial data?

Using GIS is convenient and powerful when conducting spatial analyses and producing computerized maps, but it can also be very confusing. Users are typi-

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Spatial Data Accuracy

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cally faced with difficult decisions about which data set to use in a project. They want to use readily available data, but when they use GIS to plot some data collected in the field at a mapped location, it doesn't show up at the same place with respect to different base maps and reference themes. You may have heard statements like "The data I collected along side a road using a Global Positioning System (GPS) shows up in GIS as being in the middle of a pond! Why? Which data set is accurate?" The Federal government has been addressing aspects of Geospatial Data Accuracy over the past few years in order to provide guidelines to the GIS community so that situations like this can be avoided.

Prior to the digital revolution, cartographers were mainly concerned about producing paper maps at specific map scales. With GIS, the mapping community can now automatically visualize information at various scales, combining various types of data, from varying source scales with different graphic resolutions. GIS users must be concerned with geospatial data accuracy in order to understand the limitations and implications of their handiwork. As recently stated in the Minnesota Planning Positional Accuracy Handbook (http://www.mnplan.state.mn.us/press/accurate.html.) "Decisions made on data of known quality are made with greater confidence and are more easily explained and defended".

National Mapping Accuracy Standard (1941-47)

Prior to the development of the NSSDA, the mapping community relied on the National Mapping Accuracy Standard (NMAS) for map-accuracy guidelines. The U.S. Bureau of the Budget first issued accuracy standards in 1941 for the production of paper maps. Subsequently revised in 1943 and 1947, the NMAS provides recommended threshold values for horizontal and vertical accuracy that are dependent on map scale and based on a 90 percent confidence level. Horizontal accuracy is expressed in *map inches* whereas vertical accuracy is expressed with respect to *contour intervals*. The NMAS accuracy testing relies on locating "well-defined points" that are identifiable on both the map and on the ground. For horizontal accuracy, not more than 10 percent of points tested between the mapped and actual locations can exceed 1/30 inch for maps with scales larger than 1:20,000. Similarly, not more than 10 percent of points tested can exceed 1/50 inch for maps with scales of 1:20,000 and smaller. At all map scales, the maximum allowable vertical tolerance is one-half contour interval.

The NMAS has been the basis for guiding the production quality of our digital geospatial data and making quality statements on its accuracy for many years. Data documentation for N.J. Department of Environmental Protection (NJDEP) GIS themes typically includes statements assuring data users that the information meets the NMAS. The 1998 NJDEP GIS Mapping and Digital Data Standards include discussion on New Jersey base maps that meet NMAS and provides translated threshold values of the NMAS for various map scales in feet (for example, +/- 33.3 feet at 1:12,000 scale).

National Standard for Spatial Data Accuracy (1998)

The NSSDA is one of five aspects of geospatial data quality that the FGDC is addressing. Other aspects include attribute accuracy (descriptive information), logical consistency (data geometry), completeness (data content), and lineage (data sources and processing steps). The NSSDA was developed out of the recognition of the growing need for digital spatial data to provide a common language for reporting data accuracy.

The NSSDA outlines a test methodology that requires checking the location differences for at least 20 points located both on the data theme being checked, and an *independent* reference theme of higher accuracy. The differences in the x- and y-coordinates for both sets of

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ESRI User Conference 2000 Report

The 20th annual ESRI User Conference (UC) was held in San Diego from June 26 – 30, 2000. This was ESRI's largest conference yet, attended by an estimated ten thousand people. Several NJDEP staff had the opportunity to attend the UC and presented papers on current NJDEP GIS projects. The theme this year was "Geography, Our Global Network," which was underscored by the unveiling of the Geography Network: http://www.geographynetwork.com. According to ESRI, "The Geography Network is a global network of geographic information users and providers." The emphasis is on the sharing of geographic information via the Internet, making geographic content more widely available. The network uses ArcIMS technology, open systems and industry standards and protocols. This enables the creators of geographic data to provide access to data, maps and geographic services via the Internet. The Geography Network was shown live during the opening session of the conference, and Hank Garie of the NJ Office of GIS got up on stage to show a link to New Jersey open space data via the Geography Network.

The emphasis on the Internet continued throughout the conference with many sessions on the newly released ArcIMS software. Other major topics included developments in what is now known as the ArcGIS product family, encompassing the complete ESRI product line. The most notable development is the pending release of new versions of Arc/Info 8.1 and ArcView 8.1 which were extensively demonstrated as beta versions. Both products feature Internet access to ArcIMS services and enable the integration of a user's local data with data streamed in over the Internet. To make this even easier, geographic coordinate and datum projections are handled "on-the-fly" so that local data overlays correctly with layers acquired via the Internet. Users of ArcView software will note that the new version will

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ESRI User Conference

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be very different than ArcView 3.x, and is essentially components (ArcCatalog, ArcMap, and ArcTools) pulled from ArcInfo 8.1. Because the software uses the same core technology, the same extensions can be used for ArcInfo and ArcView.

For diehard users of ArcView 3.x, ESRI stated that this technology, in addition to the Avenue scripting language, would continue to be supported by the company for the foreseeable future. Users need not abandon their ArcView 3.x projects, and further, ESRI will allow users to continue to run ArcView 3.x even after upgrading to ArcView 8.1 (this came directly from David Maguire, Director of Products).

There are many other developments that can only be mentioned here. One of these is the new Geodatabase, which replaces the geo data file system (coverages and shapefiles) used in previous ESRI products. The geodatabase allows geographic data to be stored in enterprise DMBS such as ArcSDE, Oracle, Sybase, etc., and incorporates important enhancements in terms of the way data are stored and manipulated. ArcView 8.1 will make use of a "personal geodatabase" that stores data in a Microsoft Access database.

Important news for those concerned with data documentation, both ArcInfo 8.1 and ArcView 8.1 integrate metadata support within ArcCatalog. This provides support for FGDC compliant metadata as well as customizable metadata profiles. Further, because ArcCatalog uses the XML standard, it will be possible to import and export metadata from other tools that support XML (such as NJDEP's NJMetaLite, see p. 10).

ESRI also showed off the new ArcPad product, that brings GIS functionality to the mobile computing platform (MS-Window CE devices and some GPS receivers). Those who are interested in this platform can download an evaluation version of the software from the ESRI web site: http://www.esri.com.

New Jersey continues to be a recipient of several awards and honors. A map by the New Jersey Pinelands Commission, *New Jersey Pinelands Management Areas*, won first place in the best small format category (see p. 10). Also, a map created by the NJDEP Division of Forestry entitled, *Ecological Land Types of the Hudson Valley Section*, was published in the Fifteenth Annual ESRI Map Book (see p. 13) distributed at the conference. Additionally, the Burlington County Office of GIS was the recipient of an ESRI Special Achievement Award. Congratulations to our New Jersey Winners!

A highlight of the conference is the opportunity to interact with Jack Dangermond, President of ESRI. Jack is usually around for the duration of the conference, and, if you are lucky, you get a chance for a chat or at least a photo opportunity with him. During the closing session, Jack and top ESRI staff answered questions collected during the conference and afterwards took questions from the audience. This is always an interesting and unpredictable session. Exciting pronouncements from Jack included the statement that ESRI had no interest in going public, and that ESRI would not abandon the ArcView 3.x product. Also, even though there was great interest in the development of a software tool that would translate Avenue code to Visual Basic, ESRI had no plans to take on such a project.

The annual User Conference is the place to see the latest developments in the world of ESRI GIS, and to interact with ESRI technical staff and other users of ESRI products. The message of the 2000 conference is that GIS is moving rapidly to the Internet as a universal tool, and is quickly becoming a major component on mainstream enterprise-wide information systems.

This year's conference is scheduled for July 9-13, 2001, to be held at the San Diego Convention Center. Additional information about UC 2000 and the upcoming conference is available at the ESRI website: http://www.esri.com/events/uc/index.html.

Submitted by Paul Caris

i-MapNJ Brownfields

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Work on this project began after Governor Christine Todd Whitman "ask[ed] the DEP, in consultation with the Brownfields Task Force, to gather information relating to all brownfield sites in New Jersey and make it available and regularly updated on the Web" in a speech dated September 26, 2000.

i-MapNJ Brownfields utilizes ArcIMS, a new mapping software from the Environmental Systems Research Institute (ESRI) that allows users to utilize Geographic Information System (GIS) technology over the internet. Visitors familiar with GIS technology can enter the site and begin controlling the map by using common GIS tools and the data layers list.

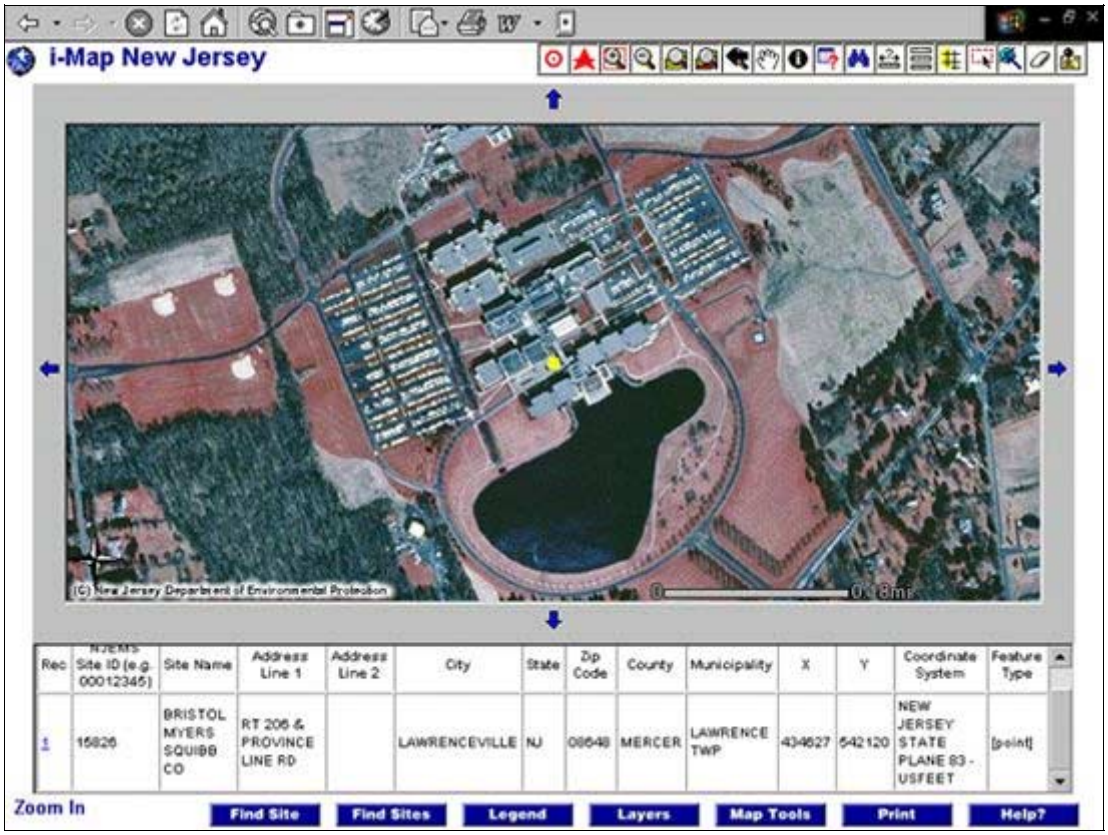
Because ease of use was an important consideration when developing this project, visitors new to such technology can choose from a list of questions to access valuable information. Questions that can be answered at i-MapNJ Brownfields include: "Where are the Brownfields located within a specific county or municipality?" "What Brownfields exist within incentive zones?" "What is the proximity of Brownfields to transportation infrastructure?" and "What sites marketed for redevelopment exist within a specific municipality?"

Basic data descriptions are available from the site, as well as more technical documentation called metadata. Because not all data available through i-MapNJ Brownfields is complete, the datasets will be updated as more complete data becomes available through the collaborating State agencies.

i-MapNJ Brownfields can be found at http://njgeodata4.state.nj.us/i-map/brownfields

Submitted by Marla R. Chassels

i-MapNJ NJEMS/GIS Integrates NJEMS and GIS



The New Jersey Department of Environmental Protection has developed an Intranet mapping application called i-MapNJ NJEMS/GIS that enables NJDEP staff to view and perform basic GIS analysis on data residing in NJDEP's New Jersey Environmental Management System (NJEMS). Up until now, users of NJEMS for permitting and enforcement activities have not had the benefit of being able to easily use GIS tools to support decision making. At the same time, NJDEP's GIS users have not had the opportunity to use a live multi-media regulated site GIS layer, supported by the wealth of information from NJEMS. This prototype application in its first developmental phase provides NJDEP staff with the ability to observe the spatial relationships of sites with respect to each other and in relation to GIS mapped features. Since this application runs in a Web browser, a user does not have to have any GIS software installed locally on their PC to access the application.

American Management Systems (AMS) was the contractor that worked with NJDEP to develop the application. AMS has been developing NJEMS for several years, and was familiar with the NJEMS database that contains NJDEP's permitting and enforcement data. Environmental Systems Research Institute (ESRI) was also involved as a subcontractor and served as a GIS advisor over the course of the project. ESRI was especially helpful in the early design stages with respect to data storage and system architecture issues.

The key GIS data layer that needed to be generated for the application was a dynamic, live NJEMS sites layer. To produce this, a table consisting of basic site information including Site ID, Site Name, Site Address, and Site Location Coordinates (mostly of GPS origin) was created. The table is updated every 15 minutes to reflect any changes to sites in the NJEMS system. Using ESRI's ArcSDE (Spatial Database Engine) software, the table is spatially enabled and exists as a sites GIS data layer.

The NJDEP's permit and enforcement data in NJEMS are stored in Oracle tables. Specific data fields from these tables were identified for inclusion in the application by AMS and members of the NJEMS-GIS integration steering committee (NJDEP program staff). Select NJDEP GIS data layers were reformatted to ArcSDE format, and ESRI's Internet Map Server (ArcIMS) software was used for creating and deploying the application's Internet map services.

A NJDEP user can launch this application in one of two ways. If a user has identified a site while working in NJDEP's NJEMS application, they can mouse-click on the "GIS" button on the NJEMS toolbar. This immediately launches the i-MapNJ NJEMS/GIS application in a separate web browser window. A map view appears, zoomed to the site, with the site's location symbolized overtop of a digital orthophotograph (spatially registered aerial photo). Basic information pertaining to the site appears in a tabular data frame. Non-NJEMS users can launch the application through the Environmental Data Exchange (ENDEX) web site as one of the ENDEX interactive mapping and analysis applications.

Once the application is launched, the user has the capability to perform some basic NJEMS site data searches based on NJDEP agency activity, discharged parameter, program interest, and violations. These searches can be limited to sites with a radial range of a particular location (NJEMS site location, any address, or NJ State Plane coordinate), or to sites within the boundaries of a selected county, municipality, or watershed. An example might be a search that would produce all active sites having an air program interest within 3 miles of company XYZ. Another example might be a

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GIS Available in the Public Access Center

The public is invited to come in and learn about GIS technology and how the department is using it for environmental decision-making by using a GIS workstation that has been placed in the NJDEP Public Access Center (PAC). In addition to being able to view demos, the public will be able to use GIS software and NJDEP GIS data to independently view areas of particular interest including counties, municipalities, and watersheds. Among the GIS data sets that can be examined and used for analysis are land use, geology, wetlands and soils. In addition, the NJDEP's 1995 aerial digital orthophotography can also be displayed. The NJDEP views this GIS workstation as a critical resource to provide the public with hands-on access to environmental geographic information. The PAC is located on the 1st floor of the NJDEP building at 401 E. State St., Trenton NJ. and is open to the public 9:00 a.m. - 5:00 p.m. Monday through Friday. For more information, call 609-777-3373, or visit http://www.state.nj.us/dep/gis/pac.htm.

Submitted by Diana West

i-MapNJ NJEMS/GIS

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search that would produce all active sites having a water quality program interest that discharged mercury within the Arthur Kill watershed between January 1, 2000 and December 31, 2000.

When the searches are executed, the application renders a map of the area displaying the locations of the NJEMS sites that met the search criteria. Users can then display additional GIS data layers and use GIS tools provided in the ArcIMS viewer to perform some basic GIS analysis.

In the next developmental phase, the i-MapNJ NJEMS/GIS application will be modified to include NJ STORET water quality data and made available to the public as an Internet application.

Submitted by Lou Jacoby

Spatial Data Accuracy

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points are then computed and expressed in *map units* as a residual of the means squared, commonly referred to as the Root-Mean-Square Error (RMSE). The NSSDA requires reporting the RMSE at the 95% confidence level (RMSEr). This means that the RMSE is multiplied by a factor of about 2.0, depending upon whether the horizontal (1.7308) or vertical (1.9600) accuracy is measured. This approach also assumes that the horizontal error is normally distributed and independent in each the x- and y-directions.

The NSSDA also provides standardized accuracy statements for preparing FGDC-compliant data documentation (metadata). If the data set has been tested, the accuracy statement will read:

Tested _____ (meters, feet) (Horizontal,vertical) accuracy at 95% confidence level.

If the data are not tested but were compiled to meet a certain threshold value, then the *'Compiled to meet'* replaces *'Tested'* in the accuracy statement.

The reader is urged to obtain the NSSDA document and the Minnesota Positional Accuracy Handbook to become familiar with the theories, methods, limitations, and reporting requirements associated with the use of the recommended methods of assessing geospatial data accuracy.

An ArcView Implementation of the NSSDA Test Methodology

RMSEr2.avx is an ArcView 3.x extension that implements the NSSDA test methodology. It provides interactive tools for evaluating the NSSDA accuracy value and the Root-Mean-Square-Error (RMSEr) distance between a pair of GIS themes, with one being the check theme and a second the reference theme having greater accuracy. The extension is written so that cumulative test statistics can be obtained with fully operable zoom and pan functions in the View window. It is an upgrade extension, providing user options for generating a dBase file that stores test-point coordinates and test results on the computer hard drive. Test results are displayed on the screen and in the optional dBase file, with accuracy output reported for both RMSE and NSSDA (RMSEr @ 95% confidence level). The RMSEr2 application assumes that horizontal error is normally distributed and independent in each the x- and y-component. The extension and User's Guide in HTML format can be downloaded from the ESRI ArcView scripts web site on the Internet at: http://gis.esri.com/arcscripts/scripts.cfm.

Two methods of testing are available with RMSEr2.avx:
1) Horizontal positional accuracy using the mouse cursor for data input from two displayed themes, and
2) Vertical positional accuracy for a grid with cell-based elevation values tested against any other theme with visibly displayed elevation values for manual entry into a text-input box. The vertical accuracy test is dependent on an active ArcView Spatial Analyst extension.
Three tests of positional accuracy were conducted using RMSEr2.avx:

1) The horizontal accuracy of the 1:24,000-scale, vectorized stream coverage for New Jersey was tested against the 1:12,000-scale U.S. Geological Survey (USGS) Orthophoto Quarter Quadrangle (DOQQ) raster imagery,

2) Elevation differences were measured between 100-ft cell elevation GRIDS for New Jersey and topographic-elevation contours from georeferenced USGS 7-1/2' Topographic Quadrangle images, and

3) The mapped positions of Hunterdon County roads collected using Global Positional Systems (GPS) were tested against the DOQQ imagery.

Only Test 1 meets the NSSDA criteria for obtaining an accuracy value of a test theme using an independent theme of higher accuracy. Tests 2 and 3 did not meet all of the criteria but were conducted to measure positional differences

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Data News

1995/97 Land Use/Land Cover Update Project Completed

With the recent delivery of data sets for watershed management areas (WMAs) 17 and 18 this past November, the land use/land cover update project has been completed. This brings to a close a nearly two year mapping program in which the 1986 land use layers were updated to the 1995/97 digital imagery.

In addition to capturing land use/land cover changes, the mapping effort greatly improved the quality of the land use data through several means. First, the minimum mapping unit, the smallest ground area that is delineated, was reduced from 2.5 acres in the 1986 data set to 1 acre for the update. This reduction was applied not only to the 1995/97 data but also to the 1986 polygons. Second, several additional land use categories were included in this mapping effort. Residential areas, for example, can now be queried based on lot size and density since the single residential class used in the 1986 baseline data was divided into five more specific categories. Similar additions were also made to the forest class, and to several other individual land use categories. Lastly, each polygon also was evaluated for the amount of impervious surface it contains. Visual estimates were made for every polygon, with values reported in 5 percent increments. These values can be used to estimate the total amount of impervious surface existing for any area as of the 1995/97 imagery.

While the data layers are known as the 1995/97 updates, it is important to note that these data sets include both the 1986 polygon and land use attribute information, and the 1995/97 data. A 1986 baseline data layer was created for each WMA, and changes described above were captured only by adding appropriate line work and codes to this baseline data set. No 1986 data were eliminated in this process. These resultant data sets can, then, be used directly to analyze land use/land cover changes over this time period without having to compare several other separate data layers. Changes in general or specific land use categories can be investigated through fairly direct queries of these data sets, greatly simplifying land use change analysis.

All of the data capture and analysis for this project was done by Aerial Information Systems, Inc., (AIS), of Redlands, Ca, under the direction of the Bureau of Geographic Information and Analysis (BGIA). The BGIA was fortunate to have AIS on the project, since they created the original 1986 land use coverages as part of the ITUM data development effort. Several of the key AIS personnel involved in the update process were also involved in the 1986 project, which allowed for a continuity that is rarely possible in such data development efforts. AIS had a clear understanding of NJDEP data needs and development objectives, as well as an in-depth understanding of the varied New Jersey landscape. This knowledge, along the obvious pride that AIS has in its work, has resulted in the development of a very high quality data set.

NJDEP has completed its internal QA/QC of all data sets, and prepared final versions of all WMA layers. These are now available in DEP through the DEP Theme Selector extension, and to the public through the GIS web site (http://www.state.nj.us/dep/gis). These final versions will replace the draft versions which have been available throughout the course of the project.

Submitted by John Tyrawski

NJGS Bedrock Geology CD

Bedrock geologic maps of northern, central, and southern New Jersey are now available in compact disc (CD) format. The CD also includes digital versions of all New Jersey's 172 topographic quadrangles at 1:24,000-scale, and 14 regional maps at 1:100,000-scale. CD00-1, Bedrock Geology (1 to 100,000-scale) and Topographic Base Maps (1 to 24,000- and 1 to 100,000-scales) of New Jersey, 2000. New Jersey Geological Survey CD Series.

For more information, visit http://www.state.nj.us/dep/njgs/pricelst/index.htm and follow the link for Compact Disc under "NJ GEOLOGICAL SURVEY PUBLICATIONS."

Submitted by Ron Pristas

Trivia Time!

1. From what year is the department's oldest set of digital orthophotography?
   a) 1990
   b) 1991
   c) 1992
2. What ESRI GIS software excels in enabling users to access and enter GIS data while in the field?
   a) ArcPad
   b) ArcRemote
   c) ArcField
3. What forum meets every 8 weeks to provide information on NJDEP GIS developments?
   a) SMAC
   b) GAG
   c) GIS Users Group
   d) GASP
4. What data format provides enhanced editing capability and premiered with ArcInfo8?
   a) ArcSuperShape
   b) Geodatabase
   c) Geodatalayer
5. If you can't find the accuracy level of a data set, no matter how closely you examine it or who you ask, where do you look?
   a) Larry's office
   b) Data directory
   c) Metadata
   d) a and c
6. What kind of information can be obtained from the NJDEP GIS web site (http://www.state.nj.us/dep/gis)?
   a) Data downloads
   b) Upcoming meetings and events
   c) Interactive mapping
   d) All of the above

Answers: 1 - b, 2 - a, 3 - c, 4 - b, 5 - c, 6 - d

Spatial Data Accuracy

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between source and derivative data (Test 2) and independent data of approximately the same reported accuracy (Test 3).

Horizontal Accuracy of 1:24,000 Scale Digital-Line-Graph Hydrography

The horizontal accuracy of the stream coverage for New Jersey was tested using the 1995-1997 DOQQ imagery. The stream coverage is currently available by county from the NJDEP as ARC/INFO line coverages based on the USGS 1:24,000 Digital Line Graph (DLG) files, with subsequent editing and updating. The streams are digitized from USGS 7-1/2' topographic quadrangle maps. The DOQQ imagery was produced by the USGS through a State/ Federal partnership agreement with the NJDEP with 1-meter resolution to meet the NMAS at the 1:12,000 scale. Horizontal and vertical residuals of aerotriangulated tie-points from ground-control are equal to or less than 2.5 meters, and therefore the DOQQs adequately serve as independent reference coverage by exceeding the accuracy of the check theme(s).

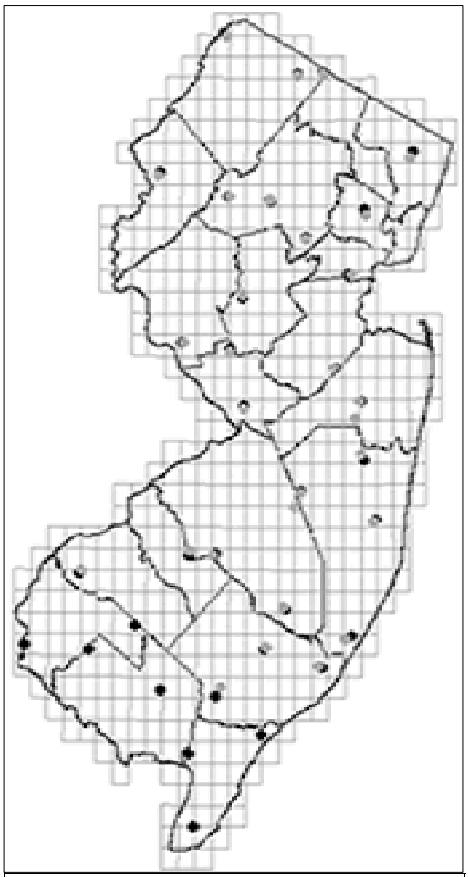

Figure 1 *Location of reference points for testing (black) and some-test point locations (gray)*

Figure 2 *The NJ streams coverage tested 203.08 feet horizontal accuracy at the 95% confidence level*

Stream intersections were compared between the check (vector coverages) and reference themes (DOQQs) at 36 point locations statewide (Fig. 1). The random points were generated within the N.J. State boundary theme using the ArcView extension rand#gen.avx. Zero values were chosen for the minimum distance to the polygon boundary and for minimum distance between points. Stream intersections lying closest to the reference point locations were identified, and consecutive points were digitized on both the check (vector) and reference (raster) themes. Figure 2 shows a screen-captured image of the test elements and results. The stream vectors are shown as white lines on a raster-image base, with both reference (upper left) and check (lower right) points.

The cumulative root-mean-square error (RMSEx) for 36 points tested at 117.33 ft. The horizontal accuracy (RMSEx at the 95% confidence interval) was calculated at 203.08 ft. (horizontal accuracy = RMSEx * 1.7308).

A Measurement of Elevation Differences between a Digital Elevation Model for New Jersey and 7-1/2' Topographic Contours

The vertical accuracy test option within RMSEr2.avx was used to measure elevation differences between 7-1/2' elevation themes for New Jersey. N.J. Geological Survey DGS99-4 (http://www.state.nj.us/dep/njgs/geodata/dgs99-1.htm) is a set of ARC/INFO GRID digital elevation themes with 100-ft. grid cells (Fig. 3).

These data are derived from the U.S. Geological Survey 30-meter Digital Elevation. The grids are georeferenced to the NAD83, N.J. State Plane Coordinate system with elevation values in integer feet. The data are clipped to the NJDEP State boundary theme, and to a set of nine, 30-minute (longitudinal) polygons covering New Jersey (Fig. 3). Thirty-seven (37) random points were generated within the N.J. State boundary theme us-

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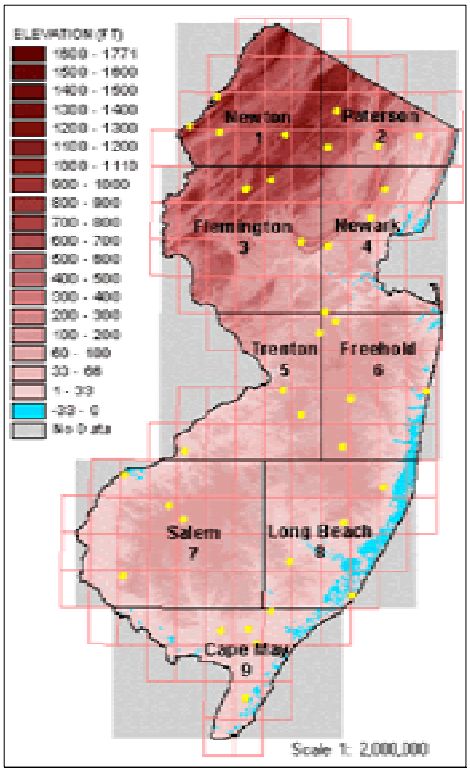

Figure 3 *Njdem100 coverage tested 42.5 feet vertical accuracy at the 95% confidence level*

Up Close, But Not Too Personal — Tom McKee

This month we are taking an up close (but not too personal) look at Tom McKee of the Division of Watershed Management. In each installation of this series we'll visit GIS Users throughout the department to explore the many different ways the technology is managed and applied to environmental protection.


Photo by Al Conte

Tom got his start in GIS while working with hazardous waste investigations and clean-ups. Initially he would consult with the GIS Unit for background information before going out into the field. Examination of chromate waste sites, land-use, and aerial photographs improved his ability to perform responsible party site identification. He then chose to empower himself by learning how to put this information together so he could control the format. Tom kept up with the GIS field. People started coming to him with questions and he became recognized as a local GIS expert. This experience set him up for his current role as GIS coordinator for the Division of Watershed Management (DWM).

DWM's mission is to implement statewide watershed management, which includes developing a pollution prevention plan for each watershed and educating people on how they affect watersheds in their everyday life. GIS is relied on to play an important part in fulfilling this mission. Tom has his hands full interfacing between the technical staff and management regarding what is available and what is needed. He's obtained data development funds to contribute towards the 1995/97 land use, new digital elevation models (30 ft to 10 ft that are hydro corrected), and updated sewer service areas. He plays an active role in the inter-divisional Watershed Data Managers Team and gives valuable support to less experienced GIS users in DWM.

Tom has been involved with many GIS projects; recently these have included map design for **Watershed View,** a CD featuring GIS data and the ArcExplorer software for viewing it. Watershed View was designed to allow end users with no GIS capability to answer questions about watershed management. The **Watershed Rule** is a currently proposed rule regarding sewer service area expansion for implementing the watershed management program. The Department hopes to steer growth to established areas. Tom is doing impact analysis to determine the different ways land use will be affected depending on how the new rule is written. The **Surface Water Quality Mapping** project has been ongoing for some time but will soon be finished. Surface water quality standards have been added as attributes to the detailed county based hydrography. This will give users the standard to which a particular water body should meet. All of the aforemen-

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The BGIA Buzz

Karen Cuts Commute

Karen Mitchell has left the BGIA to work closer to home. Last July she joined the Hunterdon County Division of GIS as a GIS Specialist. She is working carefully to insure that all of Hunterdon's coverages are current and accurate. She is also involved in converting all of their data into geodatabases in ArcSDE, and will be working on implementing ArcIMS in the near future, including application development. Other duties include coordination with outside contractors and maintenance of their database. Best wishes Karen!

Metadata Champion in Our Midst

John Bocchino, NJDEP's Data/Metadata Manager, recently won a Metadata Jeopardy contest sponsored by the Federal Geographic Data Committee (FGDC) at its second "Train the Trainer" seminar held in Denver, Colorado last September. Since John not only completed the first seminar, but also developed a metadata training program for NJ (see p. 11), he was invited back as a guest trainer .

The contest also featured prominent FGDC personnel Rick Pearsall and Lynda Wayne. Rick is the FGDC Metadata Coordinator, and Lynda is the FGDC Metadata Education Coordinator.

It was a very close contest, but John won by answering questions such as "where in the standard can users find an estimate of accuracy of the horizontal positions of the spatial objects?" and "where in the standard can users find an explanation of the fidelity of the relationships in the data set and the tests used?"

Speaking of fidelity of relationships, John is engaged to Genevieve Elizabeth Riehle. The wedding is planned for October 2001. Congratulations John!

Scott Haag Interns for ENDEX

ENDEX recently brought on a new intern to assist with some metadata and other GIS duties. Intern Scott Haag will graduate this spring from Rutgers with a degree in Natural Resource Management. He is also completing a Geomatics certificate at Rutgers. Scott's background includes working as a field scout at Rutgers and interning at both Transamerica and CRRSA.

His first day on the job at NJDEP Scott received a crash course in using NJMetaLite. Since then, he has been helping to bug check the program as well as writing and QA/QCing metadata. Welcome Scott!


Photo by Al Conte

Tom McKee

(Continued from page 8)

tioned GIS projects have important implications for the Department. The watershed management approach is being used by programs throughout the Department including Permitting, Underground Storage Tanks, Surface Water Quality, and Land Use Regulation.

Tom does most of his work in the core ArcView but also uses the Spatial Analyst extension, and ArcInfo8. Much of the data Tom receives is in Grid format, which makes the Spatial Analyst extension helpful particularly for tabulating areas. Like most of us he's still learning ArcInfo8 and is looking forward to ArcView8. Future challenges include using satellite imagery from Landsat 7 with ArcView's Image Analysis extension and ERDAS IMAGINE. This imagery will be an important supplement to the aerial photography. Although not taken at as large a scale (i.e. the features are smaller and less detailed) it can be updated much more often. Tom predicts that "the quality, quantity and timeliness of GIS data will rapidly increase over the next few years, due to the ready availability of satellite data from missions such as NASA's Landsat 7 and a number of commercial ventures. With the GIS products derived from this data we will be able to quickly and thoroughly assess environmental impacts and identify trends".

Tom's breadth of knowledge is rooted in his desire to keep up with the technology. He is currently pursuing a certificate in Geomatics at Rutgers University, and has attended several important conferences most recently ASPRS (American Society of Photogrammetry & Remote Sensing) and the USGS State Mapping conference.

Tom balances his GIS work with a lot of play. He's part of the musical group *Flagstone*. Featuring a harp, flute, violin, dulcimer and guitar. *Flagstone* entertains with folk and Irish music. If you would like to know more about Tom's projects or about GIS initiatives within DWM, he can be reached on GroupWise or at 609-292-1592.

Submitted by Angela Witcher

Spatial Accuracy

(Continued from page 7)

ing the ArcView extension rand#gen.avx. Zero values were used for the minimum distance to the polygon boundary and for minimum distance between random points. At least 4 random points were generated within each 30-minute polygon. Five (5) points were used in the Cape May polygon (Fig. 3). Reference elevations were taken from the set of 1:24,000 scale USGS 7-1/2 minute topographic quadrangles (http://www.state.nj.us/dep/njgs/geodata/dgs99-1.htm). Elevation values for the grid were consecutively checked against topographic elevation contour lines or benchmark locations located closest to the randomly generated points. The cumulative root-mean-square error (RMSEz) for 37 points tested at 21.67 ft. The vertical accuracy (RMSEz at the 95% confidence interval) was calculated at 42.4869 ft. (vertical accuracy = RMSEz * 1.960).

A Measurement of Positional Differences between GPS Road Intersections Located on NJDEP 1995-1997 DOQQ Imagery

RMSEr2.avx was used to measure the difference in map position between GPS road coverage of Hunterdon County and the 1995-1997 NJDEP DOQQs. The horizontal accuracy of the GPS road coverage is reported at ± 1-5 meters (Mapco, 1996), and the accuracy of the DOQQs is reported to be about the same. However, the two data sets were independently developed, and were therefore tested in an effort to see what value of positional error can be expected from their use.

Thirty-two (32) reference points were generated in the Hunterdon County boundary polygon using the same generation criteria as for the first test (Fig. 4). The position of road intersection located closest to the random reference points were identified on both GPS (check) and DOQQ (reference) themes. The RMSEx for 36 points tested at 15.67 ft. The horizontal accuracy was calculated at 27.12 ft.

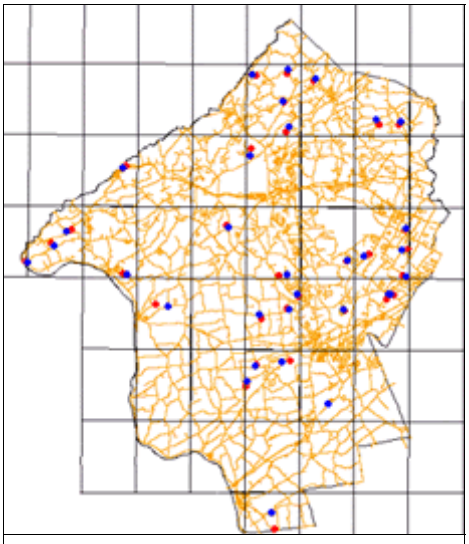


Figure 4. *Location of 32 reference points used for testing the mapped position of road intersections from GPS and DOQQ coverages for Hunterdon County.*

Discussion

A test of the spatial accuracy of some geospatial reference data for New Jersey shows the absolute accuracy of DLG data derived from 7-1/2' topographic quadrangles are less than we might expect. Test1 results show that the locations of our 1:24,000-scale DLG streams and rivers commonly display positional errors on the order of 100 feet when used in a GIS. Even though the topographic quadrangles and derivative DLG data were compiled to meet the NMAS value of ± 40 ft. accuracy, modern methods of defining, obtaining, and processing geographic information have limited the usefulness of much of these 'legacy' data. Test 2 produced results that are in line with the NMAS for vertical accuracy, but it is important to remember that the DEM data were both *derived from and tested against* 7-1/2' topographic source data and therefore the test results do not reflect the true accuracy of the DEMs. Based on the results of Test1, it is expected that areas of moderate to high topographic relief probably contain elevation errors exceeding the 1:24,000-scale NMAS for vertical accuracy. On the other hand, Test 3 results are encouraging. GPS and DOQQ data show good agreement and

(Continued on page 11)

Geomatics Training Available to State Government

Rutgers University's Cook College Office of Continuing and Professional Education (OCPE) has assembled an excellent professional certificate program in Geomatics. Geomatics is a term used to describe the related fields of Geographic Information Systems (GIS), Global Positioning Systems (GPS), and Remote Sensing. Many state employees have traveled to New Brunswick to take advantage of these classes. Now, DEP in conjunction with the Office of Information Technology (OIT) and OCPE, are offering these classes in the Trenton area during office hours. The result is greater access to advanced training in the mapping technologies for state employees.

Last spring, DEP's Bureau of Geographic Information & Analysis (BGIA) proposed to OCPE the concept of delivering Geomatics training to the Trenton area. Although GIS, Remote Sensing, and GPS have been around for several years, many state agencies have not taken advantage of these relatively new technologies. At a meeting of all parties at the statewide SMAC/URISA conference in March, the process began. And on Thursday, September 21st, the first class kicked off at an OIT computer lab in Trenton.

Four courses were offered in the Pilot Project. These were *Fundamentals of GIS, Cartography for GIS Users, What's New in ArcInfo8,* and *ArcView Spatial & Network Analyst*. State agencies taking advantage of this program include DEP, OIT, Community Affairs, Education, Health and Senior Services, Agriculture, Treasury, Law & Public Safety, and Commerce & Economic Development.

The spring semester is about to begin and will include the following courses, *Desktop Mapping with ArcView, Design & Management of Spatial Databases* and *Using GIS for Environmental Management and Analysis.* Courses begin in April. DEP employees should contact Angela Witcher of the BGIA through GroupWise for enrollment requirements. All other state employees should contact Suzy Hess of OIT: shess@oit.state.nj.us.

Many thanks to the DEP Training Team, BGIA, OIT Office of GIS and OCPE for partnering to bring Geomatics courses to state personnel. Geomatics will be crucial for advancing careers and improving state decision-making using GIS.

Submitted by Larry Thornton and Angela Witcher

New Version of NJMetaLite Available

NJMetaLite (NJML), the free metadata entry tool developed by the New Jersey Department of Environmental Protection (NJDEP) GIS staff, is being upgraded to version 2.1. This latest upgrade continues NJDEP's commitment to providing a free, easy to use, metadata creation tool. We continue to refine the work originally begun by the USGS and the United Nations Environment Programme, the creators of MetaLite, an easy to use but minimally Federal Geographic Data Committee (FGDC) compliant metadata creation tool.

Over the past year and a half, NJDEP's GIS staff has added to MetaLite to include many fields that members of the New Jersey GIS community have requested (hence the name change to NJMetaLite). Also, many FGDC required fields are populated automatically with values specific to New Jersey. Our hope is that these additions simplify the process for users to create FGDC compliant metadata.

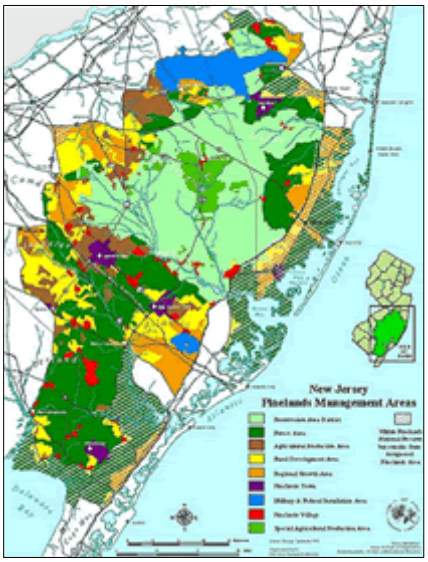
This upgrade includes the ability to enter multiple entities and attributes for a data set as well as the ability to enter multiple sources. This is a considerable improvement over the previous versions of NJMetaLite, which put entity and attribute information as well as additional source information into the supplemental information field. In response to numerous requests we have also included the ability to import .xml files*****. This feature should greatly improve the ability of users to transfer records from one computer to another, as well as simplify the process of upgrading to newer versions. To upgrade from a previous version of NJMetaLite, users simply export their record, making sure he/she has selected XML (under MP in the main menu). Then, when the new version is installed, the import feature (under File in the main menu) is used to import the .xml file created in the previous version.

We are now in the process of testing NJMetaLite 2.1 Beta. If you have any questions or comments, or to report any bugs, please contact Tim Huizing at thuizing@gis.dep.state.nj.us or 609-633-1262. NJMetaLite 2.1 Beta is available on the internet at http://www.state.nj.us/dep/gis/endex/njml.htm.

***** *Thanks to Andy Rowan of the newly established GIS Center and Jianye Chen of Rutgers for their programming help.*

Submitted by Tim Huizing

New Jersey Map Wins 1st Place at 2000 ESRI Conference



The NJ Pinelands Commission's map, *New Jersey Pinelands Management Area*, was awarded 1st Place at the ESRI Map Gallery for the category Best Cartographic Design — Small Format. Congratulations for a job well done! For more information about this map visit http://www.state.nj.us/dep/gis/mapcon13.htm.

Riding the GIS Train

Train travel is one of the most vivid ways of experiencing geography. That is why it was chosen as the theme around which to develop GIS Day on November 15, 2000. On GIS Day, users and vendors throughout the world open their doors to schools, businesses, and the general public to showcase GIS applications. This year our guests were two 5th grade classes: one from Grant Elementary School in Trenton and the other from Roosevelt Elementary School in New Brunswick. The day was split between exploring mapped information with GIS, and riding a train to identify the mapped features in reality.

Students from Trenton started at the GIS lab at the NJ Department of Environmental Protection. Students from New Brunswick started at the computer lab at the Bloustein School of Planning and Public Policy at Rutgers University. In the morning they had a brief introduction to GIS and hands-on exercises with the ArcView software. They identified the train line between New Brunswick and Trenton; then used aerial photography to identify 7 sites that could be seen from the train. These included man-made structures (parking lots, schools, and industrial buildings) and natural features (woods and wetlands).

After this introduction, students from the two schools "traded places" by taking the **GIS Train**, courtesy of NJ Transit. Trenton kids went to New Brunswick, New Brunswick kids went to Trenton. While on the train, they tried to identify the 7 sites they saw in the aerial photographs. "Answers" to the identification problems were discovered when they reached their destinations. A second set of hands-on exercises were completed after the train ride, using GIS to explore the urban and natural environment of their destination or home city.

Student response was enthusiastic. Eagerly interacting with the computer, they willingly tried out new technology. Many students had never ridden a train, looked at an aerial photograph, or interacted with a mapping application before. Nevertheless, they were widely successful in identifying features and exploring data. Bilingual education was necessary for some students, but with translation and clear visual map display, all were able to participate. Attentiveness and intelligent questions assured us of a successful learning experience. Picture taking and laughter assured us that it was also memorable. After a pizza lunch students in both classes returned home on the train.

Support comes from employees and students of NJ Transit, Rutgers University, NJ Dept of Environmental Protection, NJ Office of State Planning, & NJ Office of Information Technology. For more information, contact Angela Witcher of the NJ Dept. of Environmental Protection (email: awitcher@gis.dep.state.nj.us) or Lyna Wiggins of Rutgers University (email: lyna@rci.rutgers.edu).

Submitted by Angela Witcher and Lyna Wiggins

Spatial Data Accuracy

(Continued from page 9)

illustrate the effective collection and processing of modern data for use in GIS.

The NSSDA method does not include recommended threshold values for categorization or certification of geospatial data based on the results of accuracy testing. The FGDC has left these types of decisions up to individual agencies or organizations to define and defend. Much more testing of data is necessary to understand their usefulness, and to form the basis for future certification procedures. It should come as no surprise to seasoned GIS users that much of our older legacy reference coverages are of limited value for conducting detailed spatial analyses. New Jersey needs to develop new sets of topographical-based digital data in order to meet the demands of current GIS agencies and users. At a minimum, the accuracy of legacy data layers should be tested, and the results recorded as metadata records in order to provide GIS users with guidelines about the limitations and usefulness of these products.

References

Federal Geographic Data Committee, 1998, Geospatial Positioning Accuracy Standards: Part3: National Standard for Spatial Data Accuracy: FGDC-STD-007.3, Washington, D.C., http://www.fgdc.gov/standards/status/sub1_3.html.

Mapco, 1996, GPS/VIDEO Road Inventory Report for County of Hunterdon, *for*, Planned Dynamics Inc., Middletown, NY 10940

Submitted by Gregory C. Herman and Michael W. Girard of the NJ Geological Survey

2001 Metadata Training Workshop Dates

For NJDEP staff – GIS Training Room, 401 E. State Street, Trenton:

Thursday, May 17
Thursday, September 13
Thursday, December 6

(we will take non-DEP folks if seats are available)

For anyone – Bloustein School, Rutgers, New Brunswick :

Friday, March 9

To register, contact:

Paul Caris, NJDEP
Phone: 609-633-1235
Email: pcaris@gis.dep.state.nj.us

For more information, visit:

http://www.state.nj.us/dep/gis/endex/training.htm

Submitted by Paul Caris

2000 NJDEP Mapping Contest Winners

Standing (left to right): Patty Leidner, Chris Capelli (ESRI), Jeff Tash, Jeff Hoffman, Shannon Mail, Bob Tudor (Deputy Commissioner), Pete Wilkins, Ric Skinner, Andy Hendrickson, Zehdreh Allen-Lafayette. *Kneeling (left to right):* Patricia Hicks, Tom McKee.

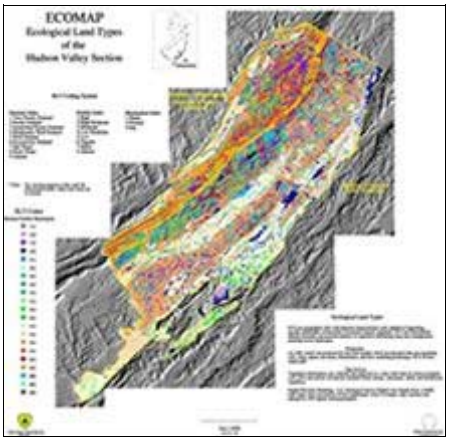
Winners of the 2000 NJDEP Mapping Contest

June 8th, 2000

Best GIS Application	Jeff Hoffman – 1st	*A Comparison of Nitrate-Based Carrying Capacities in Cape May County.*
	Lee Lippincott – 2nd	*Using Chemical Fluorescense as an Indicator of Source Water Quality and Drinking Water Treatment Efficiency.*
Best Use of GIS to Inform	Zehdreh Allen-Lafayette – 1st	*Dinosaur Posters*
	Paul Bowers, Andy Hendrickson, Richard Lathrop, Jr. – 2nd	*Boater's Guide to Barnegat Bay*
Best Use of GIS Analytical Capabilities	Jeff Tash, Marjorie Kaplan, Ernie Hahn, Larry Thornton, John Tyrawski – 1st	*Using Land Use/Land Cover Data for Integrated Land and Natural Resources Watershed Indicators*
	Jessica Leifeste – 2nd	*Risk of Agricultural Pesticide Contamination of Public Water Wells in New Jersey*
Most Innovative Use of GIS	Ric Skinner – 1st	*Spatial Data Fashion*
	Tom McKee – 2nd	*Exploring New Jersey's Watersheds with Watershed View*
Black and White	Patricia Hicks	*Whippany River Watershed Surface Water and Wetlands*
Small Format	Andy Hendrickson & Pete Wilkins	*New Jersey Pinelands Management Area*
"Mine's Not Good Enough"	Shannon Mail – 1st	*BurLink Shuttle Route*
	John Sell – 2nd	*WMA3*
Most Attractive Map	Zehdreh Allen-Lafayette	*Dinosaur Posters*
Rookie of the Year (DEP)	Jeff Tash, Marjorie Kaplan, Ernie Hahn (with Larry Thornton, John Tyrawski) – 1st	*Using Land Use/Land Cover Data for Integrated Land and Natural Resources Watershed Indicators*
	Paul Bowers, Andy Hendrickson, Richard Lathrop Jr. – 2nd	*Boater's Guide to Barnegat Bay*
Best Overall Map (DEP)	Jeff Tash, Marjorie Kaplan, Ernie Hahn, Larry Thornton, John Tyrawski – tie for 1st	*Using Land Use/Land Cover Data for Integrated Land and Natural Resources Watershed Indicators*
	Zehdreh Allen-Lafayette – tie for1st	*Dinosaur Posters*
	Paul Bowers, Andy Hendrickson, Richard Lathrop Jr. – 2nd	*Boater's Guide to Barnegat Bay*
Best Overall Map (Non-Profit)	Shannon Mail	*BurLink Shuttle Route*
Best Overall Map (Student)	Jessica Leifeste	*Risk of Agricultural Pesticide Contamination of Public Water Wells in New Jersey*
Best Overall Map (County Gov't)	Patty Leidner	*Tracking Hurricane Floyd in Hunterdon County, New Jersey*

To view the winning maps and find out more about the map makers, go to http://www.state.nj.us/dep/gis/mapcon13.htm

NJDEP Map Published in ESRI Map Book, Volume 15



Congratulations to Craig Coutros and Jim Dunn for the publication of their map, *Ecological Land Types of the Hudson Valley*, in the latest ESRI Map Book, *Applications of Geographic Information Systems (p. 39)*. Inclusion in the ESRI Map Book is a worldwide competitive process that only a select company of mapping experts ever attain. The map shows the current progress of the New Jersey Forest Service's participation in the USDA Forest Service's Ecological Classification Project (ECOMAP). The Ecological Land Type (ELT) level of the national hierarchy depicts site potential for a section of New Jersey. Each ELT delineated is the result of an Arc/Info model which incorporated soil properties, moisture, fertility, slope, aspect, and elevation. For more information about this map, visit the 12th Annual NJDEP Mapping Contest page at http://www.state.nj.us/dep/gis/mapcon.htm. Excellent job mappers!!

The only way for NJDEP staff to get a map into the prestigious ESRI Map Book is to enter a map in the NJDEP GIS Mapping Contest. Winners' maps are displayed at the annual ESRI conference and automatically enter the competition for publication in the ESRI Map Book. **The next NJDEP competition will be on April 12, 2001. Mark your calendars!**

2001 NJDEP GIS Users Group Meetings

The NJDEP GIS Users Group meets every two months to discuss various topics of interest to users of the Department's Geographic Information System: database development, software distribution, applications, training, technical issues, user concerns, etc. All NJDEP GIS users and potential users are invited to attend.

All meetings are: 10:00 am to Noon
1st floor Public Hearing Room
401 E. State St.

Thursday,	February 22,	2001
Thursday,	April 12,	2001 – **Mapping Contest**
Thursday,	June 14,	2001
Thursday,	August 9,	2001
Thursday,	October 11,	2001
Thursday,	December 13,	2001

New Jersey GIS Update

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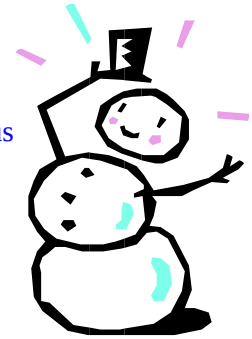

LAST CHANCE!

Unless you contact us, you WILL NOT receive future copies of the *New Jersey GIS Update* through the mail!

The latest editions of the *GIS Update* are posted digitally in PDF format* on the BGIA web page: http://www.state.nj.us/dep/gis. The newsletter can either be viewed online or downloaded to your computer for viewing offline or printing.

If you are already being notified via email when the latest *Update* has been posted to the web, you *will* continue to receive these notifications. If you would like to get on this email list, send your name and email address to mchassel@dep.state.nj.us, and please include whether you are currently receiving the *Update* or are a new subscriber.

If you have a compelling reason to continue receiving the *GIS Update* in paper format, you must contact us with details as well as your name and mailing address. Requests will be taken at 609-777-0672, mchassel@dep.state.nj.us or at the mailing address on the left.

* NOTE: Adobe Acrobat Reader is required to view the PDF files and can be downloaded from http://www.adobe.com/prodindex/acrobat/readstep.html.

GIS Events

97th AAG Annual Meeting

February 27-March 3, 2001 in New York, NY

Information about the Association of American Geographers 97th Annual Meeting can be found at:

http://www.aag.org/AnnualMeetings/Intro.html

14th Annual NJDEP Mapping Contest

Thursday, April 12, 2001 in Trenton, NJ

Open to New Jersey state employees, members of non-profit organizations, college students, and county government employees.

http://www.state.nj.us/dep/gis/mapcon14.htm

ESRI User Conference 2001

July 9-13, 2001 in San Diego, CA

21st Annual ESRI International User Conference. This event is the largest and most technically comprehensive GIS conference ESRI holds each year.

http://www.esri.com/events/uc/index.html

Northeast Arc Users Group

September 23-26, 2001 in Worcester, MA

16th Annual NEARC Users Group Conference details available at:

http://www.northeastarc.org/

39th Annual URISA Conference

October 20-24, 2001 in Long Beach, CA

Call for Presentations by the Urban and Regional Information Systems Association – Abstracts due March 1, 2001

http://www.urisa.org/2001AnnualConference/callforpresannual.htm

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