

Development and Maintenance of a Comprehensive Geographic Information System for North Carolina

Background

A geographic information system (GIS) is a decision-support tool that allows the user to analyze data based on geographic location. Almost all county governments and many municipalities in North Carolina use GIS in achieving their business goals. GIS is used in local government for siting of new facilities, emergency response, vehicle routing, crime analysis and various planning activities. State government agencies also use this technology for emergency response, environmental protection, transportation planning, land conservation planning, economic development and a host of other activities.

GIS allows the user to combine many types of data onto a digital map and then analyze that information in an efficient manner. For example, the multitudes of data that are necessary for the complex analysis and synthesis inherent in transportation development are available on a computer, literally at a person's fingertips, and can reduce the need to spend time and money visiting sites and doing extensive hands-on surveys and research. Some GIS data layers do exist in North Carolina, but the full benefits of GIS are not being realized in terms of productivity and efficiency because data layers are incomplete, out-of-date or completely nonexistent for some resources. This situation results from a lack of financial and human resources at the local, state and federal government levels to create and maintain GIS information that is instrumental for good decision-making.

Enhancing North Carolina's shared GIS database is a critical step toward more effective and efficient transportation planning while recognizing the value of North Carolina's natural and cultural resources. The development and maintenance of electronic data-sharing using GIS was identified by the N.C. General Assembly "NCDOT Project Delivery Study Final Report" (a study commissioned by the Joint Legislative Transportation Oversight Committee) as a means of providing an analytical and visualization tool to synthesize and communicate information for planning and project development. Similarly, current, accurate GIS data will make many other state and local government programs more efficient if they rely on geographic information in their decision-making processes.

Proposal

The Interagency Leadership Team, comprised of 10 state and federal agencies that are involved in the transportation planning, economic development, cultural resource preservation and environmental decision-making process, proposes that:

1. North Carolina establish a major, focused effort to create or update 171 GIS data layers and then maintain them on a specified regular schedule depending on the type of data. With this concentrated effort, the majority of these data can be updated within one year after funding is made available. A few other data layers require a three to five-year development period. These data include water and sewer infrastructure, wetlands, historic and archeological sites, stream location and topographic mapping.
2. The Center for Geographic Information and Analysis (CGIA), an agency in the Department of Environment and Natural Resources, in cooperation with the N.C. Department of Transportation, will manage the proposed multi-year data development effort. CGIA is the lead state agency in North Carolina for GIS.
3. The updated and maintained GIS database will be available over the Internet through NC OneMap. NC OneMap is a statewide, Internet-accessible GIS data resource that now includes data from more than 90 city, county, regional, state and federal government agencies. Data layers that are protected by provisions in the General Statutes will only be accessible by agency staff and others on a restricted access basis. Otherwise, the data will be available to all governmental decision-making agencies.

Costs and Benefits

The **cost** of this initiative consists of development, maintenance and project management costs. Data development will be performed primarily by private sector contractors. Maintenance of the data layers will be led by state government staff with most of the technical work performed by the private sector. Project management will be focused on ensuring that data is developed consistently using best practices and that dependencies between data layers are handled efficiently early in the process and consistently throughout the duration of the project and across all 171 GIS data layers. Agencies in addition to those represented on the Interagency Leadership Team will also benefit from the investment in GIS data. Those potential benefits likely exceed the quantitative and qualitative benefits presented here. Examples include: regional planning organizations (such as Metropolitan Planning Organizations and Rural Planning Organizations), county and municipal programs and activities, Wildlife Resource Commission and U.S. Fish and Wildlife Service endangered species recovery planning and implementation, Crime Control and Public Safety emergency planning and response, and U.S. Army Corps of Engineers civil works projects.

The project costs are:

- **\$38.2 million** - data development/enhancement for this multi-year initiative. Approximately \$26.3 million (69 percent) will go to the private sector to perform data development for certain data layers in cooperation with the responsible state agencies.
- **\$4.7 million** - recurring annual maintenance cost to keep the data layers current on an ongoing basis. Approximately \$4 million (87 percent) will go to the private sector.

The **benefits** to be realized from implementing this project and sustaining the enhanced, shared GIS database are:

- **Cost savings** can be realized through decreasing the amount of overall time for project delivery through better screening of projects for the transportation project approval process and use of GIS to reduce the number of alternatives that need to be carried forward for detailed studies. The largest cost savings are derived from reducing the escalating construction costs due to inflation and direct labor savings.
- **Current and reliable data for decision-making:** Each agency that is a stakeholder in the transportation planning and environmental/cultural resource review process can be assured that it is accessing the most current data supplied by the source agency. Economic development projects can be more accurately placed on sites. The stakeholders will be able to be confident of the accuracy, currency and completeness of the GIS data since it has been updated and maintained specifically to improve those key aspects of the data.
- **Improved decision-making** will occur with current, reliable information. The early identification and avoidance of key environmental resources will result in greater efficiencies in the delivery of transportation projects and better predictability of project costs and schedules. These reductions of impacts to these resources will also improve the overall quality of life for North Carolina's residents. Secondary benefits will come from non-transportation related programs and activities at the local, state and federal levels. One example is the use of GIS in local planning and development efforts.
- **Productivity gains:** A savings in staff resources will be realized in the review agencies in the long term once the GIS database is up-to-date, available and routinely used by the stakeholders in the transportation planning process. The time and resources spent researching and studying transportation alternatives, many of which are eventually deemed unviable because of the impact to resources, will be greatly reduced.

The following summarizes the potential cost savings:

1. The greatest savings for using GIS in the transportation and environmental decision-making process relates to the cost savings that can be realized from developing projects faster. For every year projects are delayed, an estimated 4 percent inflation rate can be applied to the construction cost of transportation projects. If GIS had been in place for 2006, an estimated **\$34 million** could have been saved in conjunction with the \$850 million in projects that are underway in the project development process.

2. The availability of complete, accurate and up-to-date GIS data layers would enable more effective screening of projects to eliminate the direct labor costs associated with meetings and preparation for those meetings, as well as the increase in construction costs due to inflation associated with ineffective use of time. A cost avoidance of **\$3.05 million** could be realized as a result of using GIS data in this manner.
3. In the project development process, most of the cost and time savings are realized in the reduction of the number of alternatives carried forward for detailed study if GIS information plus “field-truthing” could be used to make a corridor decision for new location projects. Generally, the availability of complete, accurate and up-to-date GIS information will improve the quality of decisions made, especially at the beginning of the project development process. The annual estimated time-savings for the Merger 01 (project development process) is 7,132 man-days and results in an annual cost savings of **\$3.08 million**. This is largely attributed to the following activities: preliminary design and minimization of impacts, environmental screening and analysis, collection of background information for projects, and land suitability/environmental features mapping.
4. NCDOT’s NPDES Compliance Program, which is managed by the Highway Stormwater Program, could not cost-effectively meet compliance requirements without the use of GIS. Reliable, maintained GIS layers is paramount to the sustainability of NCDOT’s compliance with the Clean Water Act NPDES regulations. The annual savings as a result of having complete, accurate and up-to-date GIS data layers is estimated to be **\$640,000**. In addition, NCDOT’s Total Maximum Daily Loading program would cost an additional **\$2.5 million annually** without the use of GIS and its supporting data layers.
5. A time savings of 2,810 man-days per year and an estimated cost savings of **\$964,415** per year can be realized for transportation-related (non-Merger) programs and activities, which includes division-design-construct projects, NCDOT’s Secondary Road Program, NPDES field compliance activities, rail projects, the comprehensive transportation planning process and the preparation of feasibility studies.
6. The N.C. Stream Mapping Program will provide a comprehensive digital map of stream locations useful to an array of federal, state and local governments, as well as the private sector and general public. The projected cost for the remainder of the Stream Mapping Project is \$3.1 million per year for the next four years. State agencies and local governments have developed cost-to-benefit numbers that accumulate an annual benefit of **\$5.6 million** per year. Details on these savings are provided below:
 - a. *Department of Transportation and Ecosystem Enhancement Fund*: Improved estimation and efficiency for mitigation/stream restoration will generate \$2.05 million in additional stream mitigation credits.
 - b. *Local Government Savings*: Improved data will result in increased efficiency for site plan reviews. The city of Durham projects a savings of \$215,730 per year. Expanded to other local governments, this will create \$3.06 million in savings for local governments.
 - c. *Department of Environment and Natural Resources, Division of Water Quality*: Efficiencies through a reduction of field work will be provided to applicants and environmental consultants in the development of plans and applications for submission to DWQ. This savings is projected to provide \$450,000 in annual savings to this community.

Ultimately, GIS can facilitate the collective efforts to deliver transportation solutions in a timely manner while enhancing the natural and human environment and economic development potential in North Carolina. In addition, GIS will support and enhance analysis and decision-making for many other programs and activities at the local, state and federal levels.