Enterprise-wide Organizational Models

Essential to the success of Spotsylvania County’s enterprise-wide GIS effort will be how GIS fits best within the organization. There are two primary organizational structures used to implement enterprise-wide GIS within organizations throughout the United States.

The first type is a **centralized** structure. A centralized organizational structure maintains a central department or division that is responsible for all GIS services. In this type of structure GIS often has its own dedicated department or it is a division of an Information Technology or Technology Services department. The GIS department/division will employ a cadre of management, analysts, technicians, and programmers tasked with hardware, software, application development, planning, and training. Data are created and maintained by this group, or outsourced to contractors. All other participants are characterized as end-users, with only the capability to view, query, and analyze spatial data.
The second type is a **decentralized** structure. A decentralized organizational structure divides GIS responsibilities throughout various departments. Decentralized organizational structures may still have a GIS Section, operating independently or under the jurisdiction of another department. This approach divides system and data maintenance between the GIS Section and departmental end-users. During their course of daily business, users update an enterprise database (e.g., using ArcEditor to edit data). All users share responsibility for maintaining the GIS, and users within each department maintain specific data according to their thematic disciplines and specialties. This type of organizational structure enables the GIS Section to focus on hardware and software maintenance, data exchange and distribution, application/data design and development, user training and support, community extension, and technology innovation, instead of devoting time to the creation and maintenance of data.

Many local governments utilize a **hybrid** GIS organizational structure, based on centralized and decentralized organizational structures. This type of structure provides the benefits of both organizational structures in scenarios where full implementation of either organizational structure cannot be readily attained.
The following Spotsylvania County departments/divisions/offices will utilize GIS in various capacities:

- County Administration
- Code Compliance
- Commissioner of Revenue
- Economic Development
- Fire, Rescue, and Emergency Management
- Health Department
- Information Services
- Parks and Recreation
- Planning
- Schools
- Sheriff’s Office
- Utilities Department

The utilization of GIS in the aforementioned departments/divisions/offices will vary from consistent daily use to sporadic use every few weeks or months. In addition, the

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**Hybrid GIS Organizational Structure**

**Definitions Summary of Organizational Structures**

**Centralized Organizational Structure:**
All GIS tasks except data viewing and analysis are handled by a central GIS department or division. All GIS staff are located within the central GIS department or division.

**Decentralized Organizational Structure:**
GIS data updating and maintenance responsibilities are assigned to individual GIS-participating departments. Departments have their own GIS staff members.

**Hybrid Organizational Structure:**
GIS tasks may be handled centrally or at department level, depending on needs and available GIS staff at individual departments.
knowledge and understanding of GIS technology varies within and among these entities, such that there are GIS users from each functionality tier (i.e., power user, analytical user, browser user).

The County currently has a GIS Division, located within the Information Services Department. The GIS Manager will lead and coordinate the County’s GIS implementation. The GIS Division is responsible for providing enterprise-wide support to all County departments/divisions. The GIS Division’s organizational position within the Information Services Department is optimal, as GIS and Information Technology are inherently interconnected. The GIS Division will work closely with Information Services personnel to ensure that all GIS infrastructure, including data, software, hardware, network, and customer support issues are addressed.

The basic context for GIS use within the County, as a whole, has incorporated mapping and some spatial analysis. Each department/division has identified the need for a holistic coordination effort aimed at managing an integrated enterprise-wide GIS. Assessment and evaluation of the existing GIS organizational structure and staffing is critical for establishing a viable and successful GIS coordination effort.

Based on departmental interviews and information gathering, GTG has determined that Spotsylvania County currently has a hybrid GIS organizational structure. This hybrid structure is based on the GIS Division making up the County’s core GIS staff; with some GIS functions distributed within each department/division, yet the GIS Division is the focal point for GIS. GIS users within departments/divisions are responsible for some utilization and minimal maintenance of the GIS, yet each GIS-participant department has access to and support from qualified staff.

**GIS Organizational Structure Recommendations**

GTG recommends that Spotsylvania County continue to utilize a *hybrid organizational structure* for its GIS effort.

Data content and metadata standards should be created and enforced by the GIS Division. A central data repository (centralized GIS server or servers) should be created for all GIS data (including the Utilities Department’s water and sewer infrastructure data). This is especially effective with ESRI’s ArcGIS 9.x software, which is designed to operate from a single GIS server, utilizing the geodatabase model.

The GIS Division will be responsible for data creation, conversion, and maintenance for all non-departmental specific data layers, and establishing data integrity checks for critical enterprise layers such as planimetrics. GIS-participating departments should be responsible for updating and maintaining all other GIS data layers, utilizing standards developed and issued by the GIS Division.

GIS-participating departments should still have the primary authority to recommend new GIS applications for their own use, but the GIS Division should review all requests for compatibility and applicability.

The GIS Division should implement three levels of departmental support, depending upon the current level of GIS use and internal capabilities per department. This support will be coordinated with the Information Services Department, as there may be some overlap. Levels of support include:
Level 1 – GIS Division provides minimal support for department/division/office GIS activities, system and application support. The GIS Division is used primarily for strategic and procedural support. The Utilities Department is essentially at Level 1. Other departments/division, including the Planning Department should aspire to be at Level 1 in the future.

Level 2 – GIS Division provides partial support for department/division/office GIS activities. A Level 2 department/division/office will do most of its own data maintenance, but the GIS Division will provide advanced support; the GIS Division will also be responsible for advanced spatial analysis as well as application development. The Planning Department is essentially at Level 2.

Level 3 – GIS Division provides all support for department/division/office GIS activities. The GIS Division is responsible for data maintenance, complex data analysis, and cartographic products.

Each department/division should strive to achieve Level 1 support status as GIS develops and is incorporated into its respective business processes.

The GIS Division, in conjunction with the Information Services Department, should provide training and technical support for all enterprise-wide GIS applications. All GIS software training should be coordinated through the GIS Division to ensure maximum efficiency and effectiveness at a minimum cost.

Not every department/division/office at Spotsylvania County that wants to utilize GIS is able to hire or convert staff to effectively handle the tasks of data analysis and data maintenance. The GIS Division will assist these departments/divisions/offices with their GIS needs. However, as usage of GIS in the aforementioned entities grows, the GIS Division must encourage and facilitate the acquisition of appropriate resources to handle data maintenance responsibilities for these departments/divisions/offices.

To reiterate, how GIS fits within the organization is essential to the success of this enterprise-wide effort. Spotsylvania County should continue to utilize a hybrid organizational structure. Having a GIS Division is an important factor with regard to GIS success. The GIS Division should continue to be utilized to direct the overall GIS efforts of the organization. They should not conduct all daily GIS tasks for various departments. The GIS Division should provide technical expertise, training, and direction for all Spotsylvania County staff. Working in tandem with the GIS Division, the Information Services Department can provide sound and sophisticated technical services for Spotsylvania County. However, each department/division/office should eventually develop its own expertise and begin to utilize GIS in its daily routine as the County’s GIS implementation progresses.

⚠️ GIS Enterprise Staffing

Staffing issues will be critical to the success of Spotsylvania County’s enterprise-wide GIS effort. Unfortunately, staffing can also be a complex and frustrating issue. Budgetary and political realities within local governments place restraints on what can be accomplished. Ideal staffing structures are sometimes difficult to attain. Nonetheless, there are fundamental steps that Spotsylvania County can take to ensure a proper staffing foundation, which can be improved upon as time and necessity dictate.
The organizational structure of the GIS effort will have an impact on staffing issues. Organization structure and staffing are inherently interrelated. GIS staff allocations must be determined before specific job requirements and responsibilities can be agreed upon. Please refer to the previous section for organizational structure recommendations for GIS within Spotsylvania County.

The size of a local government organization plays a significant role in staffing issues. The needs of a large County are different from those of a small rural town. Based on this variability in needs, this document focuses on staffing issues related to medium-sized Counties, such as Spotsylvania, whenever possible.

At present, the GIS Division has four out of eight staff positions filled. To recover costs, the GIS Division charges fees for services. Currently four out of eight positions are funded by charge backs for service, and enough funding is in place to hire four new positions.

## Functional Areas

There are six functional areas in which most GIS positions can be classified: coordination, system support, application design, database support, user support, and production/data collection. Not all organizations will have staff members in every functional area, and often individual staff members will have responsibilities in two or more functional areas.

**Coordination:** It is vital to the success of Spotsylvania County’s GIS effort to have a GIS Manager. The GIS Manager is responsible for all resource and project coordination as well as the effective day-to-day operation of all GIS aspects. This includes hardware and software issues, database design and maintenance, technical support, and management of the GIS staff. A GIS Manager must have the technical savvy to run diverse operating systems, networks, and GIS software and the people skills to coordinate, sell, champion, teach, and referee the implementation of GIS.

**System Support:** System Support staff provides the necessary support to ensure that all GIS software, hardware, networks, and databases are properly implemented and working. Technical support for all GIS end-users is the responsibility of System Support staff. Systems Support within Spotsylvania County will be provided primarily by other personnel in the Information Services Department.

**Application Development:** Many larger organizations have their own GIS application development staff. Packages such as ESRI’s MapObjects and ArcObjects allow for custom application development to suit individual department and enterprise-wide needs. Flagship and desktop GIS packages such as ESRI’s ArcGIS allow customization of design and functionality. Recently, the development of a GIS-enabled web site has become an important goal for many Counties. Primarily developed with ESRI’s ArcIMS, these GIS-based web applications require staff for its creation and maintenance. It is recommended that Spotsylvania County work with the GIS Manager to determine which application development efforts can be implemented in-house. Given the application development resources available within the County’s Information Services Department, it is expected that many application development efforts can be led, coordinated, and/or implemented by staff within the Department, including the GIS Specialists and the IT Application Analysts. In the context of this model, the Information Services Department will be instrumental in providing ad hoc and project-driven application development.
support. Efforts that cannot be implemented in-house should be outsourced to a qualified GIS services vendor.

Database Support: Most GIS packages are designed to operate from commercial relational database management systems (RDBMS), such as Oracle, MS SQL Server, or MS Access. ESRI’s ArcGIS uses a geodatabase model for data storage, retrieval, and editing from an RDBMS. This allows for the preferred creation of a central GIS data repository. Therefore, it is imperative that knowledgeable staff is employed to implement and maintain the effective operation of the central GIS repository. If a County is already using a specific RDBMS Countywide, it makes sense to use that same RDBMS for its GIS, as it ensures compatibility and easier. Additional responsibilities of database support are the enforcement of GIS data structure and metadata standards for GIS - participating departments. No specific database support staff is recommended at this time for Spotsylvania County. Database support tasks can be conducted by the GIS Manager and other personnel in the GIS Division and Information Services Department.

User Support: This is a very broad category, and encompasses both GIS-core staff and GIS-departmental staff, especially with a Hybrid GIS organizational structure. Generally, GIS Analysts and Specialists fall under the User Support category. This staff provides enterprise-wide GIS activity support as well as support to departments beyond what existing staff requires. A successful GIS effort must be results-oriented. Therefore, the expertise and quality of analysis conducted by User Support staff are vital. It is recommended that the GIS Division personnel provide User Support for those departments that they deem appropriate. As GIS usage grows throughout the County, the GIS Division may wish to tailor their additional GIS hires to meet future GIS user support demands. For example, the currently open GIS Technician position could be filled by someone with health related dataset and analysis experience. This would enable the GIS Division to give enhanced support to the Health Department, considered to be future daily users of the enterprise GIS.

Data Collection/Production: A great deal of time and effort is spent by most organizations to develop accurate and effective GIS datasets. This data must be maintained properly for it to retain its usefulness. For Spotsylvania County, this is primarily the role of GIS Technicians and GIS Specialists. As GIS develops within an organization, new data will be collected and will need to be converted to adhere to data standards. Specific tasks such as digitizing, scanning, and metadata creation are also the responsibility of GIS Technicians and/or GIS Specialists. It is recommended that the GIS Division personnel continue to collect, produce, and maintain GIS datasets for those departments that do not have the necessary staff to perform this task.

Hiring vs. Retraining
A fundamental question encountered by organizations during implementation of an enterprise-wide GIS is: “When should we hire additional GIS staff, and when should we retrain existing staff to handle GIS responsibilities?” The answer to this, in large part, depends on the existing status of GIS within each organization. Larger cities will require GIS staff in several functional areas.

There are two general categories for the hiring or retraining of staff. The first is core GIS staff. As outlined previously in this chapter, even decentralized GIS organizational structures require core GIS staff to handle non-department specific GIS issues. Many of the responsibilities of core GIS staff require specific knowledge of GIS and Information
Technology issues. As a general rule, a large organization without existing staff to handle all of these responsibilities will need to hire additional staff.

Staffing issues in GIS-participating departments are more complex when compared to core GIS staff. A primary reason for implementing an enterprise-wide GIS is to facilitate and improve existing business processes. A large organization utilizing enterprise-wide GIS will have more end-users of GIS than specific GIS staff. The majority of staff within GIS-participating departments will primarily utilize GIS data browsers. Although basic GIS data browsing and querying require limited training, the functionality required for advanced spatial analysis, using robust applications such as ArcEditor or ArcView, is much more complex. Individual departments will need to have staff with appropriate knowledge to effectively operate these applications. In general, it is easier to hire a professional for the required business function (such as engineer or planner), and train them in GIS, than it is to hire a GIS-trained staff member and train them for the required business function. In addition, professionals will have more intimate knowledge of the specific objectives and goals that they wish to accomplish.

As GIS within individual departments grows, it may be found that existing staff cannot handle all of the desired GIS analyses; under these circumstances, the hiring of additional staff should be assessed.

Position Classes
Within each functional area there can be several specific position titles. One effective method is to differentiate position classes within position titles. For example, the general position “GIS Specialist” can be differentiated into “Senior GIS Specialist” and “GIS Specialist.”

The reason for creating position classes is two-fold. First, it allows for greater flexibility. As GIS technology grows, and use within the County expands, job responsibilities may change. Position classes will accommodate any changes needed to adapt to changing responsibilities. Second, position classes allow for mobility and career potential. As specific staff members demonstrate initiative and capability, it is advantageous for an organization to offer upward mobility as an incentive to existing staff members to perform well and learn as much as possible.

Salary Structures
Equitable and consistent salaries for GIS staff and professional staff with GIS skills are important for the success of Spotsylvania County’s GIS endeavor. Enterprise-wide GIS implementation can only be as successful as the people that supervise and operate it. Attracting and retaining qualified staff are inherently tied to the compensation that Spotsylvania County is willing to provide. It should be noted that public sector GIS salaries traditionally have been less than those obtainable in the private sector; accordingly, every effort must be made to make Spotsylvania County an attractive place to work.

Salaries primarily depend on two factors: market conditions and skill sets. Although every organization is unique, Spotsylvania County must ensure that salaries for GIS staff are in line with other organizations of equal size and structure. As aforementioned, it is expected that public sector jobs will offer less compensation than the private sector; however, the difference in compensation cannot be too great if Spotsylvania County expects to hire and retain qualified GIS staff.
Different functional areas require positions with varying skill sets. The GIS Manager is the most important position to the success of Spotsylvania County’s GIS effort. It requires a broad knowledge of both GIS technical expertise and management skills. Proper compensation for this position should be of the highest priority. Frequent turnover in this position can have disastrous consequences to the overall success of the GIS effort.

System Support, Application Development, and Database Support positions require personnel with advanced technical capabilities. These positions require knowledge of hardware specifications, networks, programming, and database administration. These same skills are also easily transferable to the Information Technology sector, where salaries are consistently higher, both in the public and private sector. Salaries for these positions must be reasonably competitive with public sector IT positions.

User Support positions are occupied by full-time GIS Analysts and GIS Specialists, as well as professionals with GIS skills. Full-time GIS Analysts and GIS Specialists typically have bachelor’s degrees at a minimum, and often they have graduate degrees. In many cases, GIS is not their only skill set – they learned it in addition to another field of study. Salaries must be in line with professional jobs in their area of focus. For example, a GIS Analyst in Public Works should receive a similar salary to an engineer in Public Works with similar education and work experience.

Department-specific professional staff positions that require GIS usage need to be addressed separately. Once GIS has been effectively integrated into the business processes of individual departments, employees with GIS skills become more valuable. Applicants with GIS skills should receive higher compensation than comparable candidates without GIS skills. Additional compensation should be dependent on the time and finances required to train an employee without previous GIS skills. It should be noted that time spent training is time that employees are not spending on their required job responsibilities. Current professional staff members that learn required GIS skills should also be appropriately compensated. Existing employees may be hesitant to take the time to learn these skills, as it will detract from their job responsibilities in the short-term. However, if GIS is effectively integrated into business processes, the amount of time spent training will be recouped by more efficient work facilitated by GIS. Additionally, employees become more marketable when they acquire new skill sets. In order to retain qualified staff that attains new marketable skills, it is prudent to appropriately compensate them.

Production/Data Collection positions can be difficult to properly staff. These positions (primarily filled by GIS Technicians) are primarily at the lower end of the GIS hierarchy. Nonetheless, qualified GIS Technicians are essential to GIS efforts. The work of a GIS Technician can be repetitive and uninteresting at times. The key to ensuring job satisfaction is to assign a variety of responsibilities, so that less satisfying tasks are interspersed with more challenging tasks. Effective production and data collection work requires knowledgeable employees. Although the manual tasks of digitizing, scanning, or GPS data collection are not terribly difficult during the actual performance of the task, prerequisite knowledge for proper setup, techniques, and post-processing is important. Spotsylvania County should investigate the use of local college/university students as interns or in co-op positions (cooperative partnership positions) to supplement the work performed by other GIS Division personnel. This is mutually beneficial, as university students with GIS education have the background knowledge to successfully complete tasks, yet they are willing to accept lower salaries in return for gaining experience.
GIS Steering Committee and Users Group

Creation of a GIS Steering Committee for Spotsylvania County

Spotsylvania County should create a GIS Steering Committee. The GIS Steering Committee should be relied upon to guide GIS implementation development for the County. The GIS Steering Committee should meet on a monthly basis; however, as critical strategic issues are resolved, it may need to meet less often. Spotsylvania County should ensure that its GIS Steering Committee consists of upper management and high-level GIS staff. A management-level employee from each major Spotsylvania County department should be on the committee. This committee ensures that GIS is implemented effectively throughout the organization and that enterprise-wide goals and objectives are being met.

The GIS Steering Committee provides critical, high-level commitment to investment in GIS. Each member of the committee will gain an understanding of the technology and feel some ownership for the County’s GIS Implementation. These high-level participants will be indispensable during budgeting, and each will serve as a champion for GIS within his or her own department. Committee members will see the benefits of GIS, subsequently lobbying for greater utilization of the technology.
Creation of a GIS Users Group

Spotsylvania County should create a GIS Users Group. The GIS Users Group should include GIS-utilizing staff from all departments with identified GIS needs. The GIS Manager should lead this group. A GIS Users Group meeting provides an excellent opportunity for communication between all GIS users. It is a good venue for users to share their successes and failures. Duplication of efforts will be minimized and sharing of ideas and data will be optimized. A GIS Users Group is also a great platform for internal training initiatives.

In addition to GIS Steering Committee and GIS Users Groups, it will be beneficial for Spotsylvania County to create a GIS Newsletter. Development of a GIS Newsletter
should be supervised by the GIS Division, but there also must be contributions from each department that utilizes GIS on a regular basis. A GIS Newsletter will help foster communication between departments and help build support for increased GIS use.

Sample GIS Newsletter (Courtesy of City of Salisbury, NC)