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EXECUTIVE SUMMARY

The City of Suffolk, Virginia initiated a City-wide Geographic Information System (GIS) implementation in July of 1997, with the issuance of an RFP for a GIS consultant. Baker GeoResearch, the GIS consulting unit of the Michael Baker Corporation, was ultimately selected to work with the City to ensure the successful, multi-phased GIS implementation. Upon its successful implementation, Suffolk intends to utilize its GIS to improve the operating efficiencies, data exchange, and planning and analysis capabilities of over fifteen City departments.

Phase I of the implementation procedure includes the development of a comprehensive GIS Needs Assessment, Data Survey, Management Plan, and System Implementation Plan, intended to provide the basis for the design of the City's planned GIS. Cumulatively, Phase I is referred to as the System Planning Phase. Phase I is logically followed by System Design (Phase II), Implementation (Phase III), and System Production/Maintenance (Phase IV). The accompanying GIS Management Plan report is intended to present: the synthesis of information and issues identified throughout the Planning Phase, which will effect the organization and management of the City's planned GIS; the appropriate staffing levels required to support the GIS implementation and maintenance; the training required to provide the City's new GIS staff with the tools needed to maintain the planned GIS; and the data maintenance responsibilities and procedures required to ensure an accurate and up to date GIS.

The overall results of the Planning phase indicate that the City is anxious to implement a GIS, and looks forward to maximizing the benefits of such a system. In order to ensure the successful implementation of the GIS, the City's GIS Committee must work closely with their consultant, other City departments, and City Council to keep the planned GIS implementation a priority for the *Twenty First Century*. Proper management of the City's political, managerial, and human related issues will ensure the project's ultimate success.

In order to properly implement and maintain the planned GIS, the City will need to train existing staff, and hire new staff dedicated to the system's operation and maintenance. Based on the Focus Applications, and the planned level of GIS use throughout the City, adequate staffing levels will include:

- GIS Manager (1)
- GIS Analyst (12)
- GIS Programmer (2)
- GIS Technician (12)

This ultimate recommended staffing level is expected to be achieved at some point near the fifth year of the implementation process. These positions should be filled through a combination of existing City employees and new hires.

The City will need to design and implement a training plan that will provide the GIS with the required initial and on-going training they will need to support the GIS throughout its life cycle. This plan should address the following training requirements: baseline computers, GIS software, database administration/programming, and field data collection.

The City will also need to implement a series of data maintenance standards and work flows. GIS data maintenance responsibilities will need to be distributed among the following core user groups:

- City Assessor
- GIS Department
- Neighborhood Development Services
- Planning
- Public Safety (Fire and Police)
- Public Utilities
- Public Works

Data maintenance responsibilities and work flows should be developed to best fit within the City's existing structure, with data consolidation opportunities being maximized whenever possible. A series of GIS maintenance applications will need to be developed to ensure the most spatially accurate and current data is made available to all users.

Through proper planning and management, the proposed GIS will become a powerful tool used to support many of the City's existing work processes, while introducing new capabilities that will improve the way Suffolk conducts business.

CHAPTER 1 – ORGANIZATIONAL FACTORS

As with the implementation of any large-scale technology project, a variety of mitigating factors will directly effect the overall success or failure of the City’s GIS. Aside from the obvious factors, such as the choice of the hardware/software platform; the selection of vendors; and the cost of system development and maintenance, a variety of additional factors will impact the City’s GIS program.

The fact that the GIS will drastically change the way the City currently conducts business, through data consolidation, automation and re-engineering of workflows, etc., introduces a variety of additional success/failure factors that need to be addressed. These factors, including the City’s political environment, as well as a variety of personnel and management issues are all addressed in this chapter.

POLITICAL

Municipal organizations, such as the City of Suffolk, often find it difficult to implement large-scale projects, such as the GIS, due to competing political interests. In such cases, managing the associated politics is often more difficult than managing the project’s technical components. For this reason, it is imperative that the City’s GIS Committee continue to develop, sell, and implement the project at a City-wide level. All City departments must realize that the GIS implementation will provide all City departments, employees, and citizens with a variety of benefits. Without continued City-wide buy-in and support, the project will likely fail in the face of competing political interests. To date, the City’s GIS Committee has done an excellent job of managing the political aspect of the project, and all indications point toward City-wide support and continued approval of the project.

With a five-year implementation budget estimated at over \$6.9 million, it is critical that the GIS receive City Council’s continued and unwavering support. In order to ensure this continued support (funding), the City must realize an early return on their investment through increased customer service and improved operating efficiencies. City Council can be shown these returns on investment through “early project successes” via .be able to One way to ensure this support is to show members “early successes” by means of the Focus Application deployment. Additionally, the project’s success is directly tied to Council’s perception that the system is developed as a tool to meet their objectives for the *Twenty First Century*

(i.e. Economic Development, Managed Growth, Neighborhood & Downtown Revitalization, and Education).

To date, the City's GIS committee has been able to obtain/maintain City Council's support. As the City moves forward with its planned GIS, it must ensure Council's continued understanding of the system's far reaching benefits, which include but are not limited to:

- An accurate (1"=100' scale) and up-to-date base map of the City
- A series of automated/re-engineered workflows to improve the City's level of customer service and operating efficiencies
- The ability to rapidly/efficiently share data across departments
- The ability to rapidly/accurately perform the data analysis required to support the City's business decisions

MANAGEMENT

The effective management of the City's GIS from implementation through full system production is another of the project's critical success factors. The GIS implementation must be managed in a manner that addresses each of the user groups' individual data and application requirements. Each of the City's user department directors must see that the GIS implementation will improve the manner in which their employees currently conduct business. It is critical that City management views the GIS as a means to improved efficiencies and customer service.

Chapter 4 presents a series of data sets that must be maintained to support the GIS, along with the proposed data maintenance responsibilities. In most instances, the assignment of these responsibilities is straightforward, with either the existing data steward, or the new GIS department, being assigned the responsibility. However, certain redundant maintenance tasks, currently performed by more than one department, are more difficult to assign. In such instances, each of the departments currently maintaining the subject data may have a vested interest in retaining certain data maintenance responsibilities within the proposed GIS structure.

Since the proper implementation of the GIS requires the consolidation of data maintenance functions, one, or more, departments will inevitably be relieved of specific maintenance responsibilities related to a particular data set. In some cases, the effected department directors may have a tendency to view the data consolidation efforts as a threat to their staff's job security, since their work load will be somewhat reduced. The City's GIS Committee must work together to manage the data consolidation component of the GIS implementation in a manner that eliminates any potential conflicts. Personnel whose data maintenance responsibilities will be re-assigned to another department must be made to view the action as an opportunity to focus their efforts on more productive work tasks.

A GIS management structure must be developed and implemented prior to initiating the system implementation phase. Adequate staff must be allocated (existing or new) to assist the City's contractor with the hardware/software procurement, data development, and system installation. Staff members must be available to quality control the various deliverables and execute the daily operation and maintenance functions associated with a City-wide GIS. The appropriate staffing levels are detailed in Chapter 2 of this report.

HUMAN

The City's employees are very skilled in their native fields (drafting, engineering, planning, accounting, etc.), and have spent countless hours mastering their jobs. They are used to performing their daily tasks, and exchanging information in a certain way. In many instances, the implementation of the planned GIS will require a change in the way these work tasks are currently performed.

For example, the automation and re-engineering of many existing work flows will ultimately eliminate the need for performing certain traditional manual tasks (addressing, work orders, etc.). This shift in the way work will be performed may cause certain employees to view the GIS as a threat to their positions. As a result, their natural defense mechanisms will cause them to put up a resistance to the GIS implementation. For this reason, it is imperative to receive "buy-in" from City employees.

It has been evident, throughout the GIS planning process, that the City does have the required "buy-in" from all participating employees. This is a direct result of the GIS committee's ability to include the employees in the planning process, thereby providing them with a sense of ownership in the overall

project. While the City has done an outstanding job in this regard, it is important to maintain the current level of enthusiasm and buy-in. In order to achieve this, the GIS committee will need to:

- show employees how the GIS will improve their working conditions
- identify the appropriate existing personnel within each core user group who are best suited to be trained in the use of the new technology
- provide these core users the appropriate training
- continue to solicit input from the core users on all major system design and implementation issues

Provided each of these issues are adequately addressed, the City should not experience any significant difficulties in managing the human issues associated with the GIS implementation.

PROPOSED ORGANIZATIONAL STRUCTURE

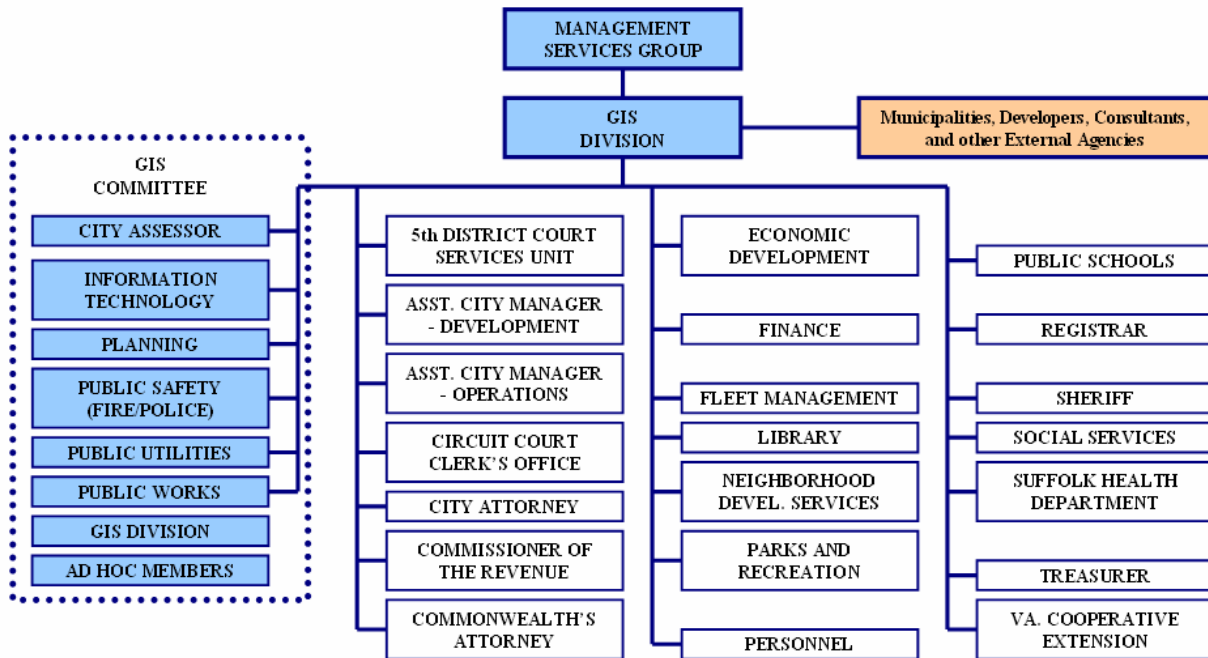
There are two major types of organizational structures, around which GIS's are typically developed, implemented, and managed. The first type, referred to as a "centralized" organization, is maintained and operated by one dedicated department. Under this scenario, all data development, maintenance, and distribution is performed by one group of dedicated employees reporting directly to the organization's GIS Manager. The second type of organization is referred to as a "distributed" organization. In a "distributed" organization, one department (or division) is usually responsible for maintaining the GIS base map (landbase) layer, while the creation and maintenance of the other data sets (utilities, parcels, census, crime, transportation, etc.) is performed by a variety of independent departments/agencies. These various data sets are posted to the GIS server for use by all other approved users. In consideration of each of the previously discussed political, human, and managerial issues, the City of Suffolk's planned GIS should be implemented/operated as a "distributed" system.

Employing this approach, a newly created GIS division (operating under the existing Management Services Group) will be the hub of the City's GIS operation. Under the direction of the City's GIS Manager, the GIS Division will provide overall management of the GIS. The GIS Manager will direct the division's staff of programmers, analysts, and technicians who will collectively administer the system's daily operation and maintenance functions related to the hardware/software/peripherals, base map, and

digital orthophotography. The division will also coordinate the efforts of the City’s various user group (department) GIS staff members charged with developing, maintaining, and distributing the Focus Application data sets. Specific data maintenance responsibilities are detailed in Chapter 4 of this report.

The GIS user organization structure included on the following page illustrates how the City’s various user departments will be managed and interact. The required staffing levels needed to successfully support this proposed GIS organizational structure are presented in Chapter 2.

GIS USER ORGANIZATION CHART



CHAPTER 2 – STAFFING REQUIREMENTS

In order to ensure the successful implementation and operation of the City's planned GIS, an adequate level of appropriately trained staff must be dedicated to the GIS throughout all phases of the project lifecycle. Optimal staffing levels will be greater during the implementation and data conversion phases of the project lifecycle, and tend to decrease and level out during the operation phase. For this reason, it is not recommended that the City hire or appoint an unreasonable number of full time equivalents to fill the required roles. Rather, emphasis should be placed on maximum use of currently available City employees, supplemented with contract and/or intern labor.

GIS MANAGER

An effective GIS Manager is critical to the success of any major GIS program. This individual should have a thorough knowledge of municipal government operations, as well as a detailed understanding of GIS technology. The GIS Manager must be empowered with the authority to commit project resources (staff, technology, and funding) and make important project decisions. Additionally, the position requires the management skill-set needed to provide day-to-day leadership and management of the City's GIS program.

The GIS Manager should serve as the chairperson of the City's GIS Committee. In this role, the GIS Manager will work with other Committee members to direct the City's GIS program through the development and enforcement GIS of policies and procedures.

The GIS Manager will oversee daily system operations and maintenance functions to include, but not be limited to:

- Hardware/software/peripherals
- Data development/acquisition/maintenance
- Application development/maintenance
- Training

The GIS Manager will also be required to manage the City's phased GIS implementation. The implementation management duties of the GIS Manger include, but are not limited to:

- Selection and management of the City's vendors/consultants
- Management of the City's implementation quality assurance/quality control program
- Administration of the City's training program
- Administration of the hardware/software/peripheral selection and procurement process
- Selection and hiring of the City's core GIS staff
- Coordination among the City's various departments and user groups

The appropriate individual should possess, at a minimum, a bachelor's degree in Geography, Management Information Systems, Planning, Computer Science, Engineering, or a related field. Additionally, the individual should have 5 to 7 years of proven experience designing, implementing, and managing complex technology projects. In addition, the selected GIS Manager should be experienced with the appropriate core GIS software platform selected by the City. Qualified Municipal GIS Project Managers are commanding salaries of between \$55,000 and \$90,000 per year depending on their level of experience.

It is recommended that the City initiate a search for a qualified GIS Manager as soon as possible since the selected employee will serve a critical role during the City's GIS implementation.

PROGRAMMERS

Adequately trained GIS programmers are required to support the daily operations and maintenance of the City's planned GIS. The programmers will be expected to develop and maintain a variety of standard and custom applications to support the data development, manipulation, querying, analyses, viewing, map production, and report development requirements of the City's GIS user community.

The GIS programmers should possess, at a minimum, a bachelor's degree in Computer Science, Management Information Systems, Engineering, or a related field. Additionally, the individuals should

have 3 to 5 years proven experience developing, implementing, and maintaining complex municipal and engineering software solutions. Relevant, proven experience should include, but not be limited to:

- GIS software (ESRI, Intergraph, MapInfo, etc.)
- Database software (Oracle, Microsoft Access, Sybase, Informix, etc.)
- Inter/Intranet (HTML, JAVA, etc.)
- Standard languages (Visual Basic, Visual C++, etc.)
- Wide Area Networks (WANS) and Local Area Networks (LANS)
- Operating systems (Windows NT, UNIX, etc.)

Additionally, since the City will be integrating a variety of AS400 legacy applications with the planned GIS, the qualified programmers should possess an adequate level of AS400 programming experience. It is envisioned that existing staff within the City's Information Technology department may be able to satisfy this requirement.

Qualified GIS Programmers are commanding salaries of between \$45,000 and \$75,000 per year depending on their level of experience.

ANALYSTS

The GIS analysts' primary responsibilities include the daily operation of the planned GIS. Analysts will perform a variety of daily tasks associated with data management, system queries, map/report production, and output analyses. A knowledge of the City's selected base GIS software and data maintenance procedures are necessary.

Competent GIS analysts are critical to the success of the City's planned GIS. The analysts will be directly involved in all phases of the GIS, from implementation through system operation and maintenance. During the initial phases of the GIS implementation, the analysts will be required to support the data conversion/development components. The analysts will be utilized to prepare the source data for conversion by the City's selected data conversion vendor. Additionally, the analysts will provide quality assurance/control, and discrepancy resolution throughout the data conversion phase of the project.

Once the initial data conversion phases are completed, the analysts' duties will shift to operation and maintenance of the GIS. The analysts will be relied upon to perform the spatial analyses; develop the thematic output; and generate the various reports required of the GIS users. The analysts' responsibilities include, but are not limited to:

- Data management (data creation and editing)
- System operation (queries, and map/report production)
- Data analysis

The analysts should possess, at a minimum, a high school education and have 1 to 2 years proven experience in the Engineering, Planning, or Computer Science fields. A significant amount of GIS experience is not critical since the GIS programmers will be able to mentor the selected analysts. In addition, the analysts will receive the required GIS training through the City's training program.

Depending upon their competency levels, GIS analysts are receiving salaries of between \$20,000 and \$30,000 per year.

TECHNICIANS

The GIS technicians are users of the system whose primary responsibilities include data preparation for the data conversion and data maintenance phases. These are the users who enter and update the data sets maintained in the GIS. The technicians must be proficient with the selected GIS maintenance software and various data entry techniques and procedures. In the data conversion phase, the GIS technicians will work closely with the analysts to gather and organize the source data material required for conversion.

The City's GIS technicians should possess the following minimum competencies:

- Capable of reading and interpreting various maps and engineering drawings
- Capable of performing low to mid level computer operating functions (data entry, query, etc.)

The City may choose to staff the technician positions through the use of recent high school graduates, and local college interns. The technicians will be able to be mentored by the GIS programmers, analysts, and consultants. Technicians typically earn between \$6 and \$10 per hour based on their level of competency.

REQUIRED STAFFING LEVELS

In order to maintain the successful evolution of the GIS, the implementation of the required GIS staff positions should be coordinated with the three-phased implementation of applications and all necessary hardware, software and peripheral equipment installation. Each phase is eighteen months in duration, for a total implementation period of five years. In accordance with the following proposed staffing implementation schedule, the City should be adequately staffed and trained for on-going system operation and maintenance upon completion of the third phase.

IMPLEMENTATION

The system implementation phases will require the greatest amount of dedicated staff positions. The required staffing should be achieved through a balance of existing City employees, new hires, interns, and consultant (contract) labor. The following tables detail the required staffing levels throughout the three major phases (approximately 18 months each) of the City’s planned GIS implementation:

IMPLEMENTATION PHASE I – STAFFING LEVELS				
STAFF POSITION	REQUIRED FULL TIME EQUIVELANT POSITIONS			
	CITY	INTERN	CONTRACT	TOTALS
GIS MANAGER	1			1
PROGRAMMER	1		2	3
ANALYST	1		2	3
TECHNICIAN	2	3	4	9

IMPLEMENTATION PHASE II – STAFFING LEVELS				
STAFF POSITION	REQUIRED FULL TIME EQUIVELANT POSITIONS			
	CITY	INTERN	CONTRACT	TOTALS
GIS MANAGER	1			1
PROGRAMMER	2		2	4
ANALYST	2		2	4
TECHNICIAN	3	3	4	10

IMPLEMENTATION PHASE III – STAFFING LEVELS				
STAFF POSITION	REQUIRED FULL TIME EQUIVELANT POSITIONS			
	CITY	INTERN	CONTRACT	TOTALS
GIS MANAGER	1			1
PROGRAMMER	2		2	4
ANALYST	4		2	6
TECHNICIAN	6	2	4	12

SYSTEM OPERATION AND MAINTENANCE

Upon successful implementation of the Focus Applications, and associated data sets, the City’s GIS staff roles will shift from implementation to operations and maintenance. Throughout the life of the GIS, there will still be numerous applications and data sets to be implemented. However, the required level of effort will be significantly less than that required for the initial implementation. It is anticipated that these tasks can be rolled into the staff’s daily operation and maintenance responsibilities, with external labor being utilized as needed. The ultimate recommended staffing levels needed to adequately support the daily operation and maintenance (and additional implementation) of the City’s GIS are presented in the table on page 2-9.

While the City’s Needs Assessment identified a total of twenty-nine user departments, several of these will only be casual users/viewers of the developed data sets. These departments, including: 5th District Court Service Unit, Circuit Court Clerk’s Office, City Attorney, Commonwealth’s Attorney, Fleet Management, Personnel, Sheriff, and Treasurer have not been allocated any full time equivalent staff positions. Since the demands placed on the GIS by these user departments are expected to be minimal, the required resources can be allocated, as required, from the GIS department.

The required staff positions are presented as Full-Time Equivalents (FTE). Those departments requiring a significant amount of resources (30 or more hours per week) should have the appropriate FTEs assigned to the particular department. All other required FTEs should be assigned to the City’s planned GIS department, and support each of the user departments’ needs, as required.

ULTIMATE ANTICIPATED STAFFING NEEDS				
Department	Required GIS Staff Positions (hours/week)			
	Manager	Programmer	Analyst	Technician
GIS Division	40			
Assist. City Manager – Development			5	
Assist. City Manager – Operations			2	
City Assessor		5	10	40
City Manager’s Office			2	
Commissioner of the Revenue			2	
Economic Development			10	
Finance			2	
Fire Department			10	5
Information Technology		10		
Neighborhood Development		5	10	20
Parks and Recreation			2	10
Planning		10	20	40
Police Department		10	10	10
Public Schools		10	2	5
Public Utilities		20	30	60
Public Works		10	10	20
Social Services			2	2
Suffolk Health Department			2	2
Virginia Cooperative Extension			2	5
Total Hours per Week:	40	80	133	219
Full Time Equivalents:	1.00	2.00	3.33	5.48

The ultimate allocation of the required FTEs should be distributed in a manner similar to the one detailed in the following table:

ULTIMATE RECOMMENDED STAFFING LEVELS				
Department	GIS Staff Position (FTE) Allocation			
	Manager	Programmer	Analyst	Technician
GIS Division	1	1	2	2
City Assessor				1
Information Technology		1		
Planning				1
Public Utilities			2	2
Total Full Time	1	2	4	6

The ultimate Full-Time-Equivalent allocations presented in the previous table are expected to be realized at some point after the completion of the City’s planned 5-year implementation process.

CONTRACTORS

As is evidenced by the previous table, a fully staffed GIS will require a significant investment in personnel and specialized training. To achieve these staffing levels may put the City at risk of not realizing an acceptable return on the investment, as there is a chance that the trained employees may leave the City seeking employment in the private sector where salaries are traditionally higher.

One method of reducing such a risk is to retain the services of a GIS consultant/contractor throughout the project’s life-cycle. While this option may first appear to be cost prohibitive, it will most likely reduce the required GIS operating budget over the life of the project. The City will most likely pay a higher per hour rate for a consultant, but the salaries and benefits will be distributed over a number of projects for different clients, thereby reducing the total cost for the City. There is also the added benefit of utilizing a resource with a stable labor pool of highly trained GIS specialists.

CHAPTER 3 - TRAINING

Implementation of the City's planned GIS will introduce a variety of new computer programs, applications, and digital data sets (tabular and graphic) to the users. In order for the City to: realize maximum benefits from the GIS implementation; achieve the earliest return on investment; and ensure the program's continued success; it is highly recommended that a formal training program be implemented for the GIS users identified in the Needs Assessment.

A comprehensive City-wide training plan, addressing each of user groups' particular needs, should be developed as part of the City's overall GIS program. A well established and executed training plan will ensure the City's GIS users will be provided with the "in-house" skills needed to support the planned GIS. To meet the needs of all user groups, the adopted training program should provide for a wide variety of training, from baseline computer training through highly specialized GIS software / programming training.

The specific training requirements and recommended approaches for each user group are presented in the following sections.

BASELINE COMPUTER TRAINING

A baseline computer training program should be developed to provide those users with little or no previous computer experience with the elementary skill sets needed to realize the full benefits of the planned GIS. The baseline computer training should consist of the following:

- General computer
 - ✓ Keyboarding and mouse skills
 - ✓ Internet and Intranet browsing
 - ✓ Printing
 - ✓ Data and directory structures
 - ✓ File naming conventions
- Networks and operating systems

- ✓ Wide Area Networks (WANs)
- ✓ Local Area Networks (LANs)
- ✓ Windows (95, 98, and NT) operating systems

Users to be trained

The level of baseline computer skills will vary widely among each of the identified potential GIS users. Some users will have exceptional PC and network computing skills, while others may have never used a computer to perform their jobs. For this reason, the City’s GIS Committee should work in conjunction with the managers of all potential user departments to: identify those employees requiring baseline computer training; and assess the required levels of training. It is anticipated that one or more users within each of the following identified user groups will require some level of baseline training prior to being able to employ the proposed GIS software in their daily work flows:

- Assistant City Manager – Development
- Assistant City Manager – Operations
- City Assessor
- City Manager’s Office
- Commissioner of the Revenue
- Economic Development
- Finance
- Fire Department
- Information Technology
- Library
- Neighborhood Development Services
- Parks and Recreation
- Planning
- Police Department
- Public Schools
- Public Utilities
- Public Works
- Registrar
- Social Services
- Suffolk Health Department
- Virginia Cooperative Extension

Recommended Training Method

There are several options available for baseline computer training. Numerous local and regional companies offer training programs that can be implemented either on-site (at the City), or off-site (at the training company’s facilities), should the City elect to outsource the program. Another option is to utilize

the City’s existing in-house training network to train the users. The City’s existing IT staff are considered high level users and possess all of the technical skill sets necessary to train other users. A third option would be to train a select group of individuals (either through external training programs or the City’s IT staff) within one or more user groups, and have them, in turn, train the other users. This option is often referred to as a “Train the Trainer” program.

A one to two week baseline computer training program, developed to address each of the previously identified required skill sets, should be sufficient. A summary of the recommended baseline computer training program is presented in the following table:

BASELINE COMPUTER SKILLS TRAINING PROGRAMS		
Course Type	Duration	Number of Users to be Trained
General Computer		
Keyboarding/Mouse Skills	¼ - ½ day	To be determined
Internet/Intranet Browsing	¾ - 1 day	To be determined
Printing	¼ - ½ day	To be determined
Data and Directory Structures	¾ - 1 day	To be determined
File Naming Conventions	¾ - 1 day	To be determined
Networks and Operating Systems		
Wide Area Networks (WANs)	¾ - 1 day	To be determined
Local Area Networks (LANs)	¾ - 1 day	To be determined
Operating Systems	1 – 2 days	To be determined

Timing

The GIS users should be competent in all of the required baseline computing skills prior to advancing to GIS related computer usage. For this reason, it is recommended that those users requiring baseline

training be identified as early as possible. Ideally, baseline computer training should be provided three to four weeks prior to the City accepting the first delivery of data/applications. This will allow sufficient time to provide the next level of required training (GIS software). A detailed training schedule is included in the Implementation Plan.

GIS SOFTWARE

A variety of GIS software packages will be implemented throughout the City in support of the planned GIS program. GIS data creation and manipulation software will be used by the “Doers”, while GIS viewing and data management software will be used by the “Users”. The “Viewers” will utilize a series of simplified data viewing software packages.

Users to be trained

A variety of different user types will need to be trained in each of the GIS software platforms tailored for their use type. The different software types include:

- **GIS development software** – to be used by “Doers” (the City’s consultant, GIS Manager, Programmers, Analysts, Engineers, Planners, CADD Operators, and Mappers) to construct, maintain, and distribute the planned GIS data models
- **GIS analysis and data management software** – to be used by the “Doers” and “Users” to display, query, update, and analyze the maintained GIS data
- **GIS viewing software** – to be used by all user group types to view, query, and output (maps, reports, etc.) the GIS data

The user groups, and number of users (by position) that require training in each type of GIS software are detailed in the following table:

GIS SOFTWARE TRAINING REQUIREMENTS					
Staff Positions	GIS Development Software			GIS Analysis and Data Management Software	GIS Viewing Software
	GIS Data	CADD Data	Web Data		
GIS Manager	1	1	1	1	1
GIS Programmers	2	2	2	2	2
GIS Analysts	12	12	0	12	12
GIS Technicians	0	5	0	12	12
Engineers	5	5	0	5	5
Planners	3	3	0	3	3
Inspectors	0	0	0	4	4
CADD Operators	0	10	0	5	5
Viewers	0	0	0	0	23
Totals	23	38	3	44	67

Recommended Training Method

Each of the major GIS software types will require varying levels of training for each of the individual users. In most cases, one or two users should receive extensive formal training in the selected software platform. These users should, in turn, be expected to train other casual users in the basic concepts of the software. Today’s GIS software programs, developed to operate in a Windows environment, are intuitive and relatively easy to learn and use. This will enable the City to make a minimal investment in formal training, and rely upon the employees’ continued software use, and participation in local/regional user groups, to round out the necessary, on-going, training requirements. A recommended training program for each of the types of GIS software is presented in the following sections:

GIS Development Software

This is the core software around which the City's GIS program will be developed. The software will be used to create, maintain, and distribute the City's geospatial data, and all other selected software applications will interface with it. Efficient use of this type of software requires an extensive knowledge of data development structures, as well as custom and open development programming languages. The core users of this software will be the GIS Programmers and Analysts, with limited use by the GIS Technicians, CADD Operators, Engineers, and Planners.

It is recommended that the City give due consideration to hiring a GIS Manager with an adequate (proven) background in the selected GIS development software platform. This should help foster a mentoring environment within which the GIS Programmers and Analysts can receive a significant portion of their training from the GIS Manager. The required new hire GIS Programmer (identified in Chapter 2) should also possess an adequate (proven) background in the selected GIS development software platform. Hiring a GIS Manager and Programmer already experienced with the selected core GIS software platform will provide the City with immediate in-house expertise.

The other identified Programmers (1 existing); Analysts (5 existing; 7 new hires); Technicians (6 existing – Planning, Public Utilities, Public Works); CADD Operators; Engineers; and Planners should be provided with adequate core GIS software training. The initial training should be obtained through a formalized certification program (provided by the GIS software vendor or other qualified training group); with on-going training being provided by existing trained staff and continuous education programs.

There are a variety of formalized GIS development software training programs to choose from. The cost and duration of these courses varies. A summary of the typical GIS development software training program requirements is provided in the following table:

GIS DEVELOPMENT SOFTWARE TRAINING PROGRAMS		
Course Type	Duration	Number of Users to be Trained
GIS Data		
Introduction	2 – 5 days	23
Advanced	3 – 5 days	18
Database Design	3 – 5 days	12
Custom Applications	3 – 5 days	8
CADD Data	2 – 5 days	38
Web Data		
Introduction	3 – 5 days	3
Implementation	3 – 5 days	3
Custom Applications	3 – 5 days	3

GIS Analysis and Data Management Software

The majority of the City’s identified “Users” will utilize the viewing and analysis software. Effective use of this software does not require as much specialized training as is needed for the previously described GIS development software. Most users will be able to effectively utilize the analysis software through the inherent Windows-based point and click user commands.

The GIS Programmers must be capable of developing and maintaining customized viewing, querying, reporting, and output applications. Similar to the GIS development software, this will require an extensive knowledge of data development structures, as well as custom and open development programming languages. It is recommended that the City ensure the new hire GIS Programmer has adequate proven GIS analysis software programming experience. Again, this will help foster a mentoring environment, and provide the City with immediate in-house expertise.

The other identified GIS analysis software users should be divided into two groups – those who will receive formalized training, and those who will receive their training on the job and through internal work shops. A summary of the typical GIS analysis software training program requirements is provided in the following table:

GIS ANALYSIS SOFTWARE TRAINING PROGRAMS		
Course Type	Duration	Number of Users to be Trained
Introduction	2 - 3 days	44
Advanced	3 – 5 days	18
Database Design	2 - 3 days	12
Custom Applications	3 – 5 days	8

GIS Viewing Software

It is anticipated that the GIS viewing software requirements will be met through the use of standard internet browsing software packages (Microsoft Internet Explorer, Netscape, etc.). For this reason, no formal training (beyond that provided as part of the previously detailed baseline computer training program) should be required. The inner workings of the viewing software will be transparent to the users, who will only need to be able to execute basic computing functions (point and click, data entry, etc.). A series of half day in-house seminars should be all that is required to provide the users with the training they need to efficiently use the GIS viewing software.

Timing

The required training, for each of the previously detailed GIS software applications, should be provided prior to the City accepting the first delivery of data and applications from the vendor. This will ensure that the City employees tasked with data development and maintenance tasks are prepared to efficiently utilize the software solutions. This will help the City to ensure the newly developed GIS is maintained in

the most accurate and up to date fashion. A detailed training schedule is included in the Implementation Plan.

DATABASE ADMINISTRATION/PROGRAMMING

Users to be trained

The City’s GIS Programmers and Analysts, along with additional identified staff, must collectively possess the database administration and programming skill sets required to support the GIS program. A typical GIS organization will have a wide cross-section of expertise and skill levels among their programmers and analysts. Working together, these employees should be able to address all of the GIS database and programming needs of the City. In instances where the dedicated staff does not possess a certain required skill set, an outside consultant may be retained to supplement the City’s staff until the skills can be acquired in-house.

The user groups, and number of users (by position) that require training in each type of database administration and programming software are detailed in the following table:

DATABASE ADMINISTRATION AND PROGRAMMING TRAINING REQUIREMENTS						
Staff Positions	Programming Languages				Relational Databases	AS400
	Visual Basic	Visual C++	JAVA / HTML	Proprietary		
GIS Programmers	2	2	2	2	2	1
GIS Analysts	6	6	6	6	6	
Totals	8	8	8	8	8	1

Recommended Training Method

Appropriate training should be provided to the programmers, analysts, and other identified users through a combination of certification programs, mentoring, and continued education programs. After assessing the employees’ skill levels in the following areas, the City should be able to determine who should receive further training, and in what areas the training is required. A summary of the typical database administration and programming training program requirements is provided in the following table:

GIS DEVELOPMENT SOFTWARE TRAINING PROGRAMS		
Course Type	Duration (assumes 8 hrs/wk dedicated)	Number of Users to be Trained
Programming Languages		
Visual Basic	3 – 6 months	8
Visual C++	3 – 6 months	8
JAVA/HTML	2 – 4 months	8
Proprietary	3 – 6 months	8
Relational Databases	4 – 8 months	8
AS400	8 – 12 months	1

The durations presented in the previous table assume a person with above average computer skills, and no previous exposure to the referenced technology/language will be trained. However, it is anticipated that all of the new hire programmers and analysts, and the majority of the existing employees dedicated to the GIS, will be competent in one or more of the required areas.

Timing

The City’s dedicated GIS staff must collectively possess all of the database administration and programming skills outlined above prior to accepting the first delivery of data/applications from the vendor. A combination of skilled City personnel and consultant labor should suffice until the City can

acquire all of the required programming expertise “in-house”. The City should rely on their ability to dedicate or hire adequately trained staff, and implement the previously detailed training program on an as needed basis to supplement the staff’s required skill sets. A detailed training schedule is included in the Implementation Plan.

FIELD DATA COLLECTION

A very large component of the City’s planned GIS will be the development and maintenance of the geospatial data stored within the selected GIS data model. A variety of methods will be employed to initially collect the required data (feature locations and attributes). These methods may include, but not be limited to:

- Stereo-compilation of aerial photography
- Field surveying
- Traditional paper to digital conversion
- Digital file translation

Likewise, a variety of methods will be employed to maintain the data once it has been initially collected. One of the more efficient methods is referred to as field data collection. Recent advances in mobile computing and Global Positioning Systems (GPS) have made field data collection a viable GIS maintenance tool. Field data collection solutions can be designed and implemented throughout the City’s GIS user departments to efficiently collect the positional and attribute data required by the GIS maintenance program.

Users to be trained

The City’s GIS Manger, Programmers, Analysts, and consultants should all be familiar with field data collection techniques in order to effectively support the design, implementation, and integration of the maintenance program. The core users of the field data collection solution will be the City’s various engineering and surveying contractors, as well as Public Utilities and Public Works field crews, and Neighborhood Development Services inspectors.

Recommended Training Method

The selected field data collection solution should incorporate industry standard databases and programming languages. For this reason, the Programmer and Analyst training required to support the system will be obtainable as part of the previously detailed database administration and programming training plan. Beyond this, the core field data collection users will need to be trained in the specific methods and procedures developed as part of the maintenance program. Specific training requirements will depend upon the technology solution selected by the City. This issue is addressed further in the Implementation Plan.

Timing

The field data collection users will need to be trained prior to initiating the program. Additional training will be required each time a new user is introduced to the field data collection program, or whenever changes are made to the program (new features or attributes added to the collection work flow). A detailed training schedule is included in the Implementation Plan.

CHAPTER 4 – DATA MAINTENANCE

At a predetermined point during the City’s implementation of the planned GIS, the GIS staff must be prepared to maintain the associated data and applications. This point, which is detailed in the Implementation Plan, will occur when the City accepts the first delivery of converted data (base map and parcel data). At this time, the GIS data is considered the City’s most current and accurate geospatial source data. All identified user groups will rely upon this data to efficiently perform their daily work tasks. In order to support the developed Focus applications, this data must be kept current through regularly scheduled maintenance/updating procedures.

Specific data maintenance responsibilities, as well as opportunities for consolidating existing data sets and eliminating redundant maintenance tasks are addressed in the following sections.

DATA MAINTENANCE RESPONSIBILITIES

The selected Focus Applications require a significant volume of accurate and up-to-date graphic and tabular data in order to function as intended. Some of these data sets are currently maintained by various City departments and outside agencies (refer to the *City of Suffolk Geographic Information System Final Data Survey*, February 8, 1999), while others do not currently exist. In order to ensure the City realizes the maximum benefits of the Focus Applications, through increased efficiencies and cost savings relevant to data collection/development, maintenance, and distribution, certain data maintenance responsibilities must be assigned to the appropriate user departments. While the Focus Application data will initially be integrated into the GIS by the City’s selected consultant, as part of the implementation process, on-going data maintenance will become the responsibility of the various user departments.

The following tables identify the various user departments or external agencies currently responsible for maintaining the data required to support the City’s Focus Applications, as well as those departments that are best suited to maintain the data within the planned GIS. In order for the GIS to be a success, each of the responsible departments must be accountable to the other user groups, and understand that the value of the City’s GIS is directly impacted by the currentness of the data they are tasked with maintaining.

Data Set	Current Maintenance Responsibility	Proposed GIS Maintenance Responsibility
Digital Orthophotography	Data set does not currently exist	GIS Division – through regularly scheduled base map updates (contractor services)
Base Map		
Building Foot Prints	DPU – limited data is being collected as part of the City’s Sewer Master Plan (northern Suffolk)project	GIS Division – through regularly scheduled base map updates (contractor services) and data received from various departments
Contour Lines (Existing)	DPU – limited data is being collected as part of the City’s Sewer Master Plan project (northern Suffolk)	GIS Division – through regularly scheduled base map updates (contractor services)
Hydrography	Data set is not currently maintained	GIS Division – through regularly scheduled base map updates (contractor services)
Street Centerlines	DPW, VDOT	GIS Division – through regularly scheduled base map updates (contractor services) and DPW / Planning supplied data
Edge of Pavement	DPW, VDOT	GIS Division – through regularly scheduled base map updates (contractor services) and DPW supplied data

Data Set	Current Maintenance Responsibility	Proposed GIS Maintenance Responsibility
Parcel Data		
Easements	Assessor, DPU, DPW, Planning	GIS Division – through regularly scheduled postings of DPU, DPW, and Planning provided data
Parcel Addresses	NDS	Assessor – parcel addresses assigned when deeds/plats are posted to GIS, or NDS – based upon field investigations
Parcel Boundaries	Assessor	GIS Division – through GIS parcel maintenance application
Parcel Centroids	Data set does not currently exist	GIS Division – through GIS parcel maintenance application
CAMA Database	Assessor	Assessor – in accordance with existing CAMA maintenance work flow procedures
Boundary Data		
Business Districts	NDS, Planning	NDS – or –Planning – through GIS parcel maintenance application
Chesapeake Bay Areas	State Department of Conservation	GIS Division – as updates are received from the State Department of Conservation
Communities/Neighborhoods	NDS, Planning	NDS – or –Planning – through GIS parcel maintenance application

Data Set	Current Maintenance Responsibility	Proposed GIS Maintenance Responsibility
Boundary Data (continued)		
Flood Plains	Federal Emergency Management Agency	GIS Division – as updates are received from the Federal Emergency Management Agency
Political Districts	Planning	Planning – through GIS parcel maintenance application
Subdivisions	Planning	Planning – through GIS parcel maintenance application
Zoning Districts	NDS	NDS – or – Planning – through GIS parcel maintenance application
Census Data		
Census Blocks/Groups/Tracts	Data set is not currently maintained	GIS Division – as updates are received from the US Census Bureau
Census Level Data Sets	Data set is not currently maintained	GIS Division – as updates are received from the US Census Bureau
Infrastructure Data		
Contour Lines (Proposed)	Data set is not currently maintained	GIS Division – through data provided by DPU, DPW, and Planning
Parking Facilities	Data set is not currently maintained	DPW

Data Set	Current Maintenance Responsibility	Proposed GIS Maintenance Responsibility
Infrastructure Data (continued)		
Sanitary Sewer Infrastructure	DPU	DPU
Sewer Service Area Boundaries	DPU	DPU
Storm Sewer Infrastructure	DPW, VDOT	DPW
Survey Control Points	Data set is not currently maintained	GIS Division – through data provided by DPU, DPW, and Planning
Transportation Infrastructure	DPW, VDOT	DPW
Water Distribution Infrastructure	DPU	DPU
Water Service Area Boundaries	DPU	DPU
Environmental Data		
Hazardous Materials	Fire Department	Fire Department – through a GIS parcel maintenance application
Soils	United States Department of Agriculture	GIS Division – as updates are received from the USDA and other City departments
Wetlands	US Fish and Wildlife Service – National Wetlands Inventory	GIS Division – as updates are received from the USF and other City departments

Data Set	Current Maintenance Responsibility	Proposed GIS Maintenance Responsibility
Private Utility Infrastructure Data		
Cable Television	Data set is not currently maintained by the City	GIS Division – through data provided from cable companies
Fiber Optic	Data set is not currently maintained by the City	GIS Division – through data provided from fiber optic companies
Natural Gas/Petroleum	Data set is not currently maintained by the City	GIS Division – through data provided from gas/petroleum companies
Electric	Data set is not currently maintained by the City	GIS Division – through data provided from electric companies
Telephone	Data set is not currently maintained by the City	GIS Division – through data provided from telephone companies
Automatic Vehicle Location and Routing Data		
Street Centerline Impedances	Data set does not currently exist	GIS Division – through data provided from DPW

The previous tables identify a total of thirty-eight (38) discreet data sets required to support the City's Focus Applications. Inclusion of these data sets into the City's planned GIS will introduce a variety of new data maintenance work flows, and require the automation and/or re-engineering of certain existing data maintenance work flows.

Fourteen (14) of the thirty-eight (38) required data sets are not currently maintained by any of the City's departments. Incorporation of this data will introduce new data maintenance work flows to the respective data stewards. These work flows will be supported by a series of automated GIS functions, to be developed as part of the system implementation phase. Inclusion of the twenty-four (24), currently maintained, data sets into the GIS will provide the City with the opportunity to automate and/or re-engineer the associated maintenance work flows. These work flows will also be supported by a variety of GIS functions, to be developed as part of the system implementation phase.

The City's new GIS department is the proposed data steward for twenty (20) of the thirty-eight (38) required data sets. These data sets, along with the anticipated maintenance frequency are presented in the following table:

Data Set	Maintenance Frequency
Digital Orthophotography	Once every 2 – 3 years
Building Foot Prints	Once every 2 – 3 years; supplemented w/ project specific updates
Contour Lines (Existing)	Once every 2 – 3 years; supplemented w/ project specific updates
Hydrography	Once every 2 – 3 years
Street Centerlines	Once every 2 – 3 years; supplemented w/ project specific updates (monthly)
Edge of Pavement	Once every 2 – 3 years; supplemented w/ project specific updates (monthly)
Chesapeake Bay Areas	As changes are made by the State Department of Conservation (annually)

Data Set	Maintenance Frequency
Flood Plains	As changes are made by FEMA (annually)
Census Blocks/Groups/Tracts	As changes are made by the US Department of Census (every 10 years)
Census Level Data Sets	Project specific (quarterly)
Contour Lines (Proposed)	Project specific (monthly)
Survey Control Points	Project specific (annually)
Soils	As changes are made by the USDA; supplemented w/ project specific updates (monthly)
Wetlands	As changes are made by the USF Service; supplemented w/ project specific updates (monthly)
Cable Television	As updates are provided by the cable companies; supplemented with project specific updates (monthly)
Fiber Optic	As updates are provided by the fiber optic companies; supplemented with project specific updates (monthly)
Natural Gas/Petroleum	As updates are provided by the gas/petroleum companies; supplemented with project specific updates (monthly)
Electric	As updates are provided by the electric companies; supplemented with project specific updates (monthly)
Telephone	As updates are provided by the telephone companies; supplemented with project specific updates (monthly)
Street Centerline Impedances	As updates are provided by DPW (daily)

The remaining eighteen (18) required data sets will be maintained by a variety of existing City departments. These data sets, along with their anticipated maintenance frequency are presented in the following table:

Data Set (Proposed Steward)	Maintenance Frequency
Easements (Assessor)	As part of GIS parcel maintenance work flow (daily)
Parcel Addresses (Assessor or NDS)	As part of GIS parcel maintenance work flow (daily)
Parcel Boundaries (Assessor)	As part of GIS parcel maintenance work flow (daily)
Parcel Centroids (Assessor)	As part of GIS parcel maintenance work flow (daily)
CAMA Database (Assessor)	As part of CAMA maintenance work flow (daily)
Business Districts (NDS or Planning)	As changes are required due to development/re-zonings (monthly)
Communities/Neighborhoods (NDS or Planning)	As changes are required due to development/re-zonings (monthly)
Political Districts (Planning)	As re-districting occurs based on population changes (every several years)
Subdivisions (Planning)	As changes are required due to development/re-zonings (weekly)
Zoning Districts (NDS or Planning)	As changes are required due to development/re-zonings (monthly)
Parking Facilities (DPW)	As facilities are added (monthly)
Sanitary Sewer Infrastructure (DPU)	As infrastructure changes occur (daily)
Sewer Service Area Boundaries (DPU)	As infrastructure changes occur (daily)

Data Set (Proposed Steward)	Maintenance Frequency
Storm Sewer Infrastructure (DPW)	As infrastructure changes occur (daily)
Transportation Infrastructure (DPW)	As infrastructure changes occur (daily)
Water Distribution Infrastructure (DPU)	As infrastructure changes occur (daily)
Water Service Area Boundaries (DPU)	As infrastructure changes occur (daily)
Hazardous Materials (Fire)	As HAZMAT inventory is updated (weekly)

CONSOLIDATION OPPORTUNITIES

Implementation of the City’s planned GIS will present numerous opportunities to consolidate numerous data maintenance functions, presently performed by multiple departments/agencies, within a single department. The consolidation of these maintenance tasks will enable the City to:

- Provide the most accurate and current information to all GIS user departments
- Eliminate islands of redundant data and their associated maintenance work tasks
- Increase operating efficiencies and customer service through more productive use of employees’ time

As presented in the previous section, numerous data sets are presently maintained by multiple departments/agencies. These data sets, along with the current and proposed data stewards are presented in the following table:

Data Set	Current Maintenance Responsibility	Proposed GIS Maintenance Responsibility
Street Centerlines	DPW, VDOT	GIS Division
Edge of Pavement	DPW, VDOT	GIS Division
Easements	Assessor, DPU, DPW, Planning	Assessor
Business Districts	NDS, Planning	NDS – or –Planning
Communities/Neighborhoods	NDS, Planning	NDS – or –Planning
Storm Sewer Infrastructure	DPW, VDOT	DPW
Transportation Infrastructure	DPW, VDOT	DPW

The street centerline and edge of pavement data sets are included in the GIS base map layers, and are considered static (requiring major updates every 2 to 3 years). Since this data is most accurately derived from aerial photography, the new GIS department is best suited to assume the associated data maintenance responsibilities as part of their overall base map maintenance work flow. While it is not possible to completely eliminate DPW’s and VDOT’s responsibilities regarding these data sets, requiring the data to be posted to the GIS by the GIS department will ensure the most accurate data is always available to the City’s user departments.

Easement data is currently maintained by numerous City departments in support of their individual work flows. Inclusion of the easement data maintenance in the Assessor’s overall parcel maintenance work flow will ensure that the most current data set is accessible to each user department via desktop GIS viewing functions. This will increase each user department’s productivity, as well as eliminate the redundant, and often disparate, easement data currently maintained by the different departments.

NDS and Planning both currently maintain separate business district and community/neighborhood data sets. While this does not necessarily pose a significant problem in terms of data accuracy, currentness, and redundant maintenance effort (each data set is considered static), having more than one department responsible for their maintenance is not an ideal situation. By assigning these maintenance

responsibilities to one department or the other will ensure the most accurate data is available to users at all times.

The storm sewer and transportation infrastructure data sets presently maintained by both DPW and VDOT are ideally suited for DPW to assume full data maintenance responsibility. However, unless the City assumes the complete infrastructure design, operation, and maintenance responsibilities from VDOT, DPW will need to continue to rely upon VDOT for updates to these data sets. Until it becomes clearer that the City will assume these responsibilities from VDOT, a series of GIS functions employed to post as-built data to the GIS data layers, as it is received from VDOT, will offer the best opportunity to ensure users are provided access to the most current data.

SYSTEM SECURITY AND DATA ACCESS PRIVILEGES

In order to ensure the City's GIS users are provided access to current and accurate data, while ensuring the data's integrity/security, certain system security and data access privileges need to be established and enforced.

This is achieved by first identifying the particular individual users within each department who will be responsible for data maintenance. These users will fall within the "Doer" category of the three user group types. Each of these users will be provided with Administrative access to their department's assigned data sets, as detailed in the previous sections. Administrative access will permit these users to: post updates; build topology; create and modify feature symbology; create and enforce rule-based GIS functionality; and generally make major revisions to their specific data sets.

Secondly, the individual users falling within the "User" category will need to be defined. These users will be provided with Read/Write access to data, based on their department's assigned data maintenance responsibilities. Users within this group will be able to modify features and attributes; build and execute spatial queries; and generate reports and thematic map output products.

After the identification of the "Doers" and "Users" is completed, all other individual users will fall into the "Viewer" user group. These users will be provided with view only access to the City's GIS data sets.

Users within this group will be able to execute pre-defined spatial queries, and generate reports and thematic map output products.

Each of these levels of access is easily administered through the use of Work Groups and passwords via Windows NT's inherent functionality. Additional levels of security will need to be defined and enforced in order to protect certain sensitive data sets, such as hazardous materials data; crime data; health department data, and social services data. While each of these data sets, with the exception of hazardous materials, is not included as part of the Focus Application implementation, they will be added to the GIS in the future.

The following tables identify each of the Focus Application data sets, and the specific user departments to be provided with Administrative (A) and Read/Write (RW) access to the data:

FOCUS APPLICATION DATA SETS	RESPONSIBLE DEPARTMENTS							
	GIS Division	City Assessor	Fire	NDS	Planning	Public Schools	Public Utilities	Public Works
Digital Orthophotography	A							
Base Map								
Building Foot Prints	A			RW	RW			
Contour Lines (Existing)	A							
Hydrography	A							
Street Centerlines	A						RW	RW
Edge of Pavement	A							RW

FOCUS APPLICATION DATA SETS	RESPONSIBLE DEPARTMENTS							
	GIS Division	City Assessor	Fire	NDS	Planning	Public Schools	Public Utilities	Public Works
Parcel Data								
Easements	A	A			RW		RW	RW
Parcel Addresses	A	A		RW	RW			
Parcel Boundaries	A	A						
Parcel Centroids	A	A						
CAMA Database		A						
Boundary Data								
Business Districts	A			RW*	RW*			
Chesapeake Bay Areas	A				RW			
Communities/Neighborhoods	A			RW*	RW*			
Flood Plains	A				RW			
Political Districts	A				RW			
Subdivisions	A				RW			
Zoning Districts	A			RW*	RW*			
Census Data								
Census Blocks/Groups/Tracts	A				RW			
Census Level Data Sets	A				RW			
Infrastructure Data								
Contour Lines (Proposed)	A				RW		RW	RW
Parking Facilities	A							RW
Sanitary Sewer Infrastructure	A						A	
Sewer Service Area Boundaries	A						A	
Storm Sewer Infrastructure	A							A

FOCUS APPLICATION DATA SETS	RESPONSIBLE DEPARTMENTS							
	GIS Division	City Assessor	Fire	NDS	Planning	Public Schools	Public Utilities	Public Works
Infrastructure Data (cont.)								
Survey Control Points	A				RW		RW	RW
Transportation Infrastructure	A							A
Water Distribution Infrastructure	A						A	
Water Service Area Boundaries	A						A	
Environmental Data								
Hazardous Materials	A		RW					
Soils	A				RW			
Wetlands	A				RW			
Private Utility Infrastructure Data								
Cable Television Infrastructure	A						RW	RW
Fiber Optic Infrastructure	A						RW	RW
Natural Gas/Petroleum	A						RW	RW
Electric Infrastructure	A						RW	RW
Telephone Infrastructure	A						RW	RW
Automatic Vehicle Location and Routing Data								
Street Centerline Impedences	A		RW				RW	RW

- - RW access will be assigned to either NDS or Planning, but not both.

RECOMMENDED MAINTENANCE PROCEDURES

The City’s ability to ensure accurate and up to date data sets is critical to the overall success of the planned GIS. The previously presented data maintenance responsibilities; consolidation opportunities;

and system security and data access privileges all work to ensure accurate and current data is made available to all of the City's GIS user groups. However, these actions will only work if a series of effective data maintenance procedures is developed and adhered to throughout the entire GIS lifecycle.

The City relies upon different data sets, submitted by various external agencies, consultants, contractors, developers, etc., to support its daily work flows. Implementation of the planned GIS will require the on-going incorporation of these varied submittals into the GIS data sets. Such data as subdivision plats, site plans, building floor plans, utility design/as-built drawings, grading plans, master plans, etc. will all ultimately be compiled into the appropriate GIS data sets.

In order to ensure the accuracy of this data, relative to the GIS base map; as well as the consistency of the data, relative to the other data sets, the City should develop, implement, and enforce a series of data development and submission standards. At a minimum, these standards should set forth the following data submission requirements:

- Site plans, utility design/as-built plans, and all other submissions involving the representation of infrastructure, parcels and base mapping features, must include accurate references to two or more of the City's previously established permanent survey control monuments. This reference will enable the GIS department (or other appropriate data steward) to accurately post the data to the GIS with minimal rectification, registration, warping, rubber sheeting, etc.
- All digital computer aided drafting submissions must adhere to a standard software specification (DWG, DGN, DXF, etc.), to be determined by the City's GIS Committee. This will allow the appropriate data steward to post the data to the GIS without concern of software compatibility issues, as the GIS functions used to post the data sets will be developed accordingly.
- All digital computer aided drafting submissions must adhere to a standard specification in terms of layer/level structure, symbology, line type, attribution, etc., to be determined by the City's GIS Committee, DPU, and DPW. This will allow the appropriate data steward to post the data to the GIS without concern of data definition issues, as the GIS functions used to post the data sets will be developed accordingly.

Specific recommended data maintenance procedures, and work flows, for each of the Focus Application data sets are outlined in the following sections:

Digital Orthophotography

The digital orthophotography will add value to the planned GIS by providing users with a high resolution background image, upon which the various GIS data sets can be displayed, geo-referenced, compared, and contrasted. The feature sets, which are readily identifiable from the digital orthophotos are generally static. However, on-going City-wide development (new roadways, subdivisions, utility infrastructure, etc.) will require regularly scheduled updates be made to the digital orthophotography.

A two to three year update schedule should be adequate to maintain the digital orthophotos as current. Once the initial product is developed, the City should not need to develop a complete set of digital orthophotos for many years. Updates can be made only to those areas where significant development has occurred since the previous update. The new GIS department should have the skill sets required to work with a qualified contractor to develop and maintain the City's digital orthophoto base.

With the base map data compiled from aerial photography and registered to the digital orthophotos; and data submissions adhering to the ground control reference requirement stated above, interim updates to the various data sets can be accurately posted to the GIS, and referenced to the existing data sets, without being significantly impacted by the currentness of the digital orthophoto base.

Base Map

Major base map data maintenance will be performed in accordance with the same schedule established for the digital orthophotography updates. Since the base map data is considered static, more frequent updates should not be required. However, similar to the digital orthophotos, on-going City-wide development will require regularly scheduled, project specific, updates be made to the base map.

With data submissions adhering to the ground control reference requirement stated above, interim updates to the base map data can be accurately posted to the master GIS coverages without having to be rectified

to a current set of digital orthophotos. Each time an update to the digital orthophotos is performed, the base map data (posted to the GIS since the previous orthophoto update) should be rectified to the new orthophotos.

Parcel Data

Proper parcel data maintenance procedures are critical to the success of the City's GIS. Since the majority of the Focus Application data sets are tied to the parcels, the City's GIS users will rely heavily on accurate parcel data.

With the implementation of the GIS, the City Assessor should continue to perform parcel data maintenance on a daily basis. Deeds and plats recorded in the Circuit Court Clerk's Office, and delivered to the Assessor, should be processed and posted to the GIS in a timely manner in order to provide value to the various GIS users. A series of automated parcel maintenance routines will be implemented to support this work flow. These applications will provide the Assessor with the scanning, digitizing, and coordinate geometry tools needed to process and post the parcel data to the GIS.

The initial parcel data conversion effort will provide the City with an accurate cadastral (property) layer rectified to the digital orthophotography and base map data. From this point forward parcel data updates required by splits and combines can be readily posted to the GIS with a relatively high level of accuracy. As digital orthophoto and base map updates are performed (every 2 – 3 years), the parcel data can be rectified to the new mapping data.

CAMA Database

The City Assessor currently has a CAMA database maintenance work flow in place. This work flow should not be significantly impacted by the implementation of the planned GIS. The existing CAMA database will be linked directly to the GIS parcel data through the use of a unique GIS parcel identifier and open database connectivity (ODBC).

Boundary Data

The business districts, Chesapeake Bay Areas, flood plains, political districts, and zoning districts data sets are considered static, and will not require any significant level of maintenance. After the initial data conversion effort is completed, as part of the GIS implementation, updates to these data sets should be performed by the appropriate data steward on an as needed basis.

The communities/neighborhoods and subdivisions data sets are also static. However, these data sets will need to be continually updated, and appended as new developments are constructed throughout the City. The maintenance of these data sets should be linked to the parcel maintenance work flows, with the appropriate data steward posting the required updates to the GIS as the parcel data becomes available.

Census Data

Census data is updated every ten years by the United States Census Bureau, and will not require any significant level of maintenance once it is posted to the GIS. Updates will be posted to the GIS by the GIS department as they are received from the Census Bureau.

Infrastructure Data

Infrastructure data can be considered both static and dynamic. Conceptual design data, posted to the GIS to support alternative and impact analyses, is considered dynamic, as it is subject to frequent changes. Once the final project is constructed, and the as-built data is posted to the GIS, the data sets become static. A series of maintenance functions will need to be developed to support the daily creation, posting, rectification, and editing of the City's infrastructure data sets.

Conceptual data should be maintained independently of the as-built infrastructure data. This will allow users to modify the conceptual data without jeopardizing the integrity of the as-built data. The system design should provide for the appropriate directory and file structure required to segregate these differing data sets, while allowing for their concurrent display and analysis.

With the City's infrastructure data submissions adhering to the ground control and CADD standard requirements stated above, conceptual and as-built data set postings will adhere the City's established accuracy requirements.

Environmental Data

Each of the three identified environmental data sets (hazardous materials, soils, and wetlands) require a different set of maintenance functions.

The hazardous materials data is considered dynamic, as hazardous materials are frequently brought into, and taken out of the City. The Fire Department will require a set of maintenance tools that allows them to update this data set on a regular basis, as inventories are performed and revised. This data set will also need to be password protected, and its distribution limited to only those authorized users within the appropriate departments.

The soils data is considered static, and will not require a significant level of maintenance. However, certain users will require the ability to append the original data set with project specific attribution. For example, as boring samples are obtained to support a variety of engineering and development projects, the data should be posted to the GIS to update the original soils coverage and support a variety of analyses.

The initial wetlands data coverage will most likely be obtained from the most current National Wetlands Inventory, maintained by the United States Fish and Wildlife Service. While valuable, this data is maintained at a lower level of accuracy than that established for the City's GIS. For this reason, a maintenance application should be devised that permits the City to update the wetlands data set with more accurate information as it is obtained through project specific data collection methods (GPS delineation, photo interpretation, etc.)

Private Utility Infrastructure Data

Of all the identified data sets, the City will have the least control over the format and accuracy of the private utility infrastructure data. Currently, many of the regional utilities do not maintain an accurate

digital inventory of their infrastructure, and those that do may provide it in a format that is not compatible with the City's GIS.

These data sets will need to be normalized, rectified, and adjusted to the City's base map and data structure on a case by case basis as they are delivered by the various utilities. Once they are posted to the GIS, they will be relatively static, and will not require a significant amount of maintenance. However, as changes to these various infrastructure assets made, due to the City's own infrastructure improvements, updates will need to be made. These maintenance procedures should be incorporated, and made a part of the functionality developed to support the maintenance of the City's own infrastructure data.

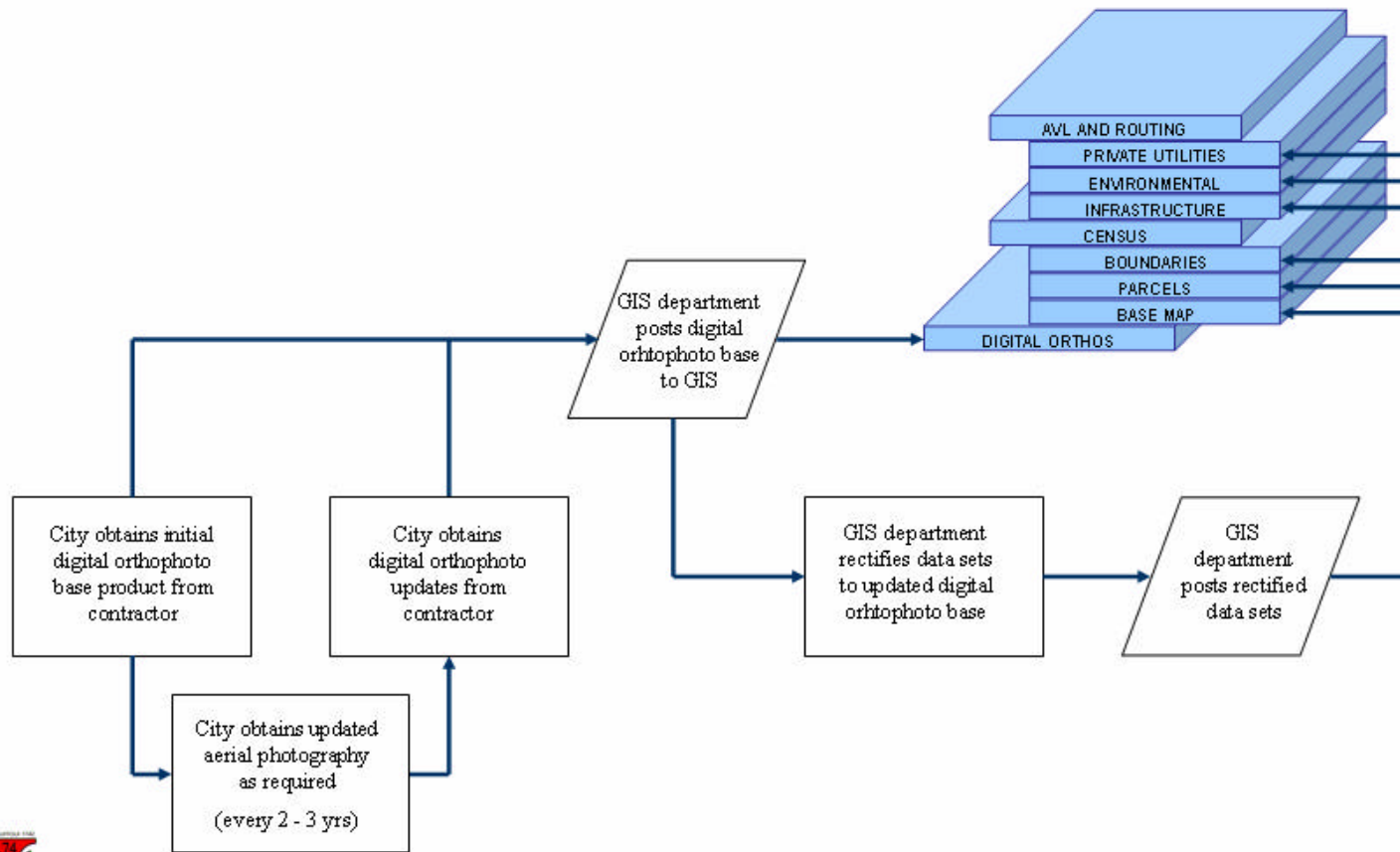
Automatic Vehicle Location and Routing Data

This data is critical to the full implementation and operation of the City's planned routing applications. It is also the most difficult data to obtain and maintain. Impedance information (travel direction, speed limit, traffic light cycle times, level of service, accidents, detours, etc.) will need to be updated and posted to the GIS on a real-time basis in order to provide any value to the routing applications.

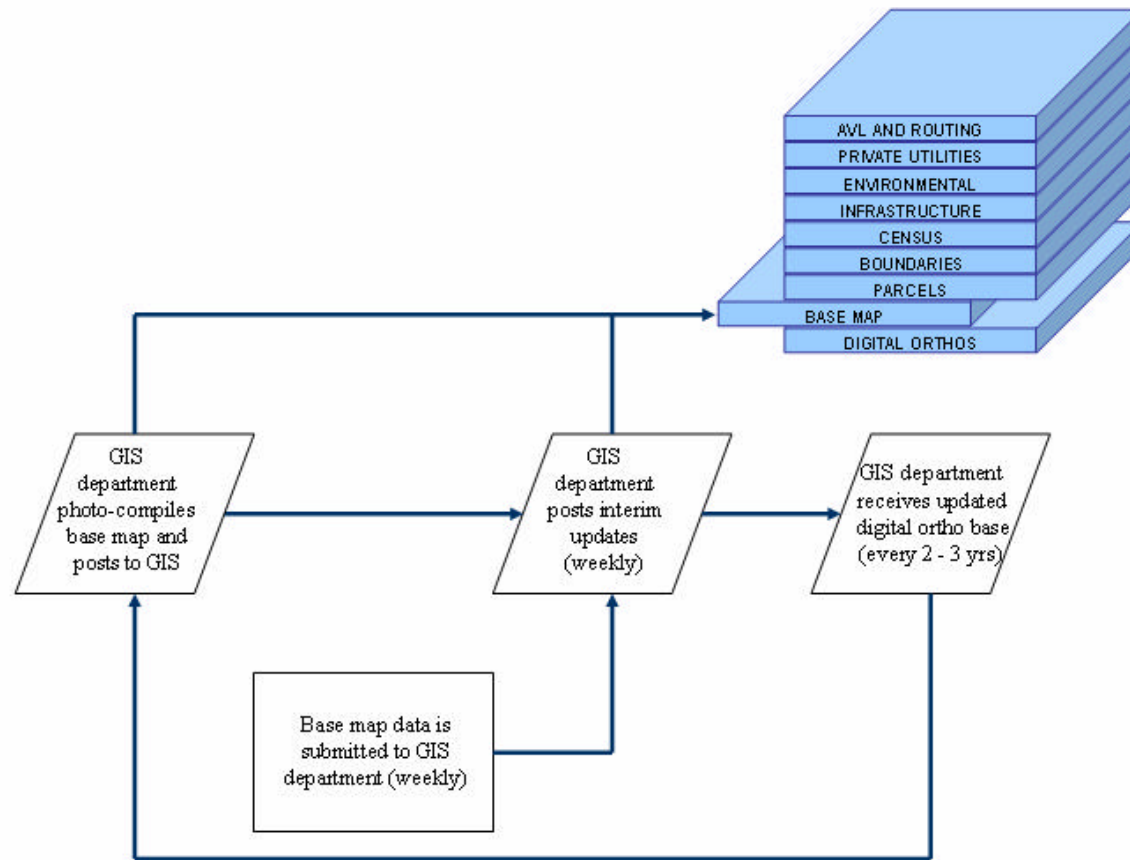
All user departments, whose daily work tasks impact traffic flow throughout the City, will need to be able to update pertinent impedances in the street centerline data set. Users within DPU, DPW, Police, and Fire must be assigned to maintain impedance data as part of their daily work tasks. A set of desk top applications will need to be developed to allow users to update this data.

DATA MAINTENANCE WORK FLOW DIAGRAMS

A series of data maintenance work flow diagrams is presented on the following pages:

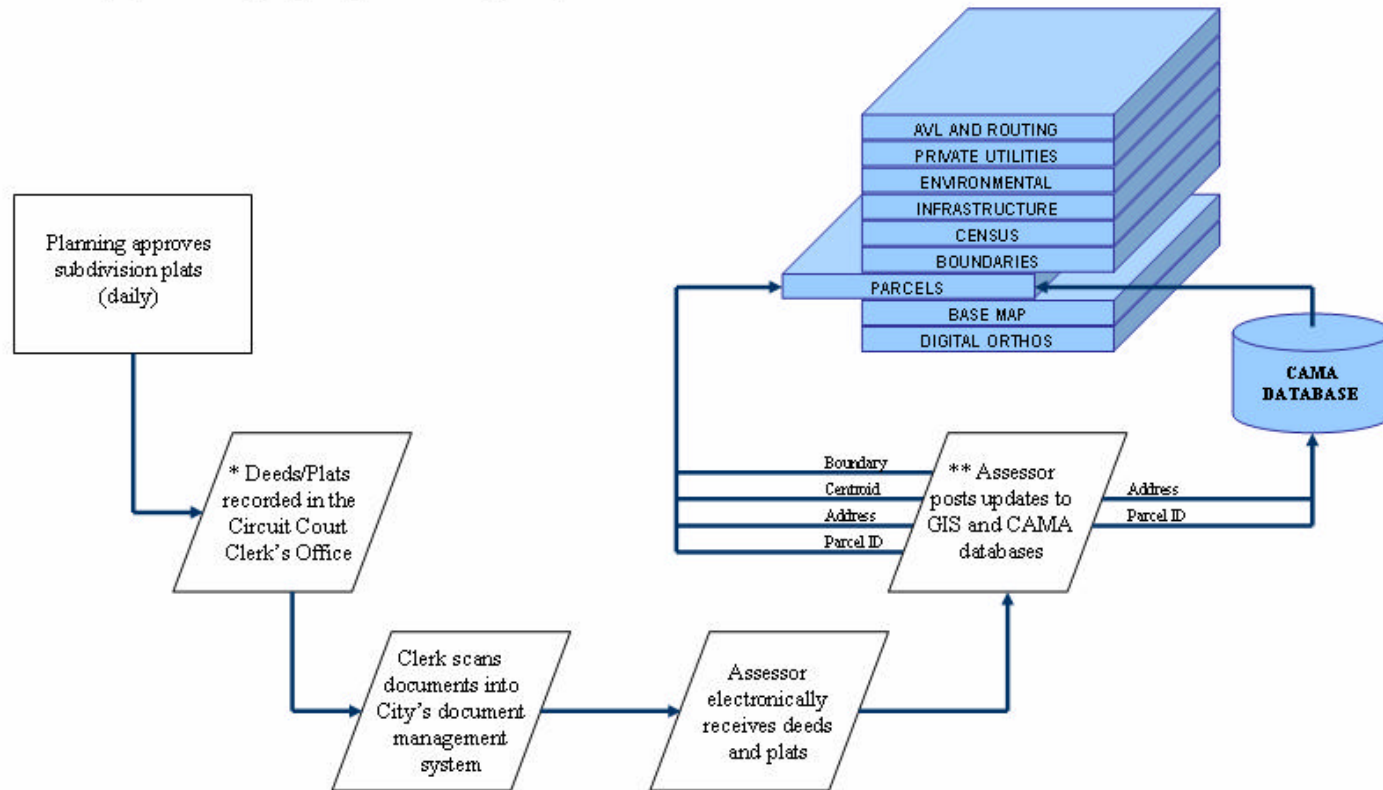


Digital Orthophotography Maintenance Work Flow



Base Map Maintenance Work Flow

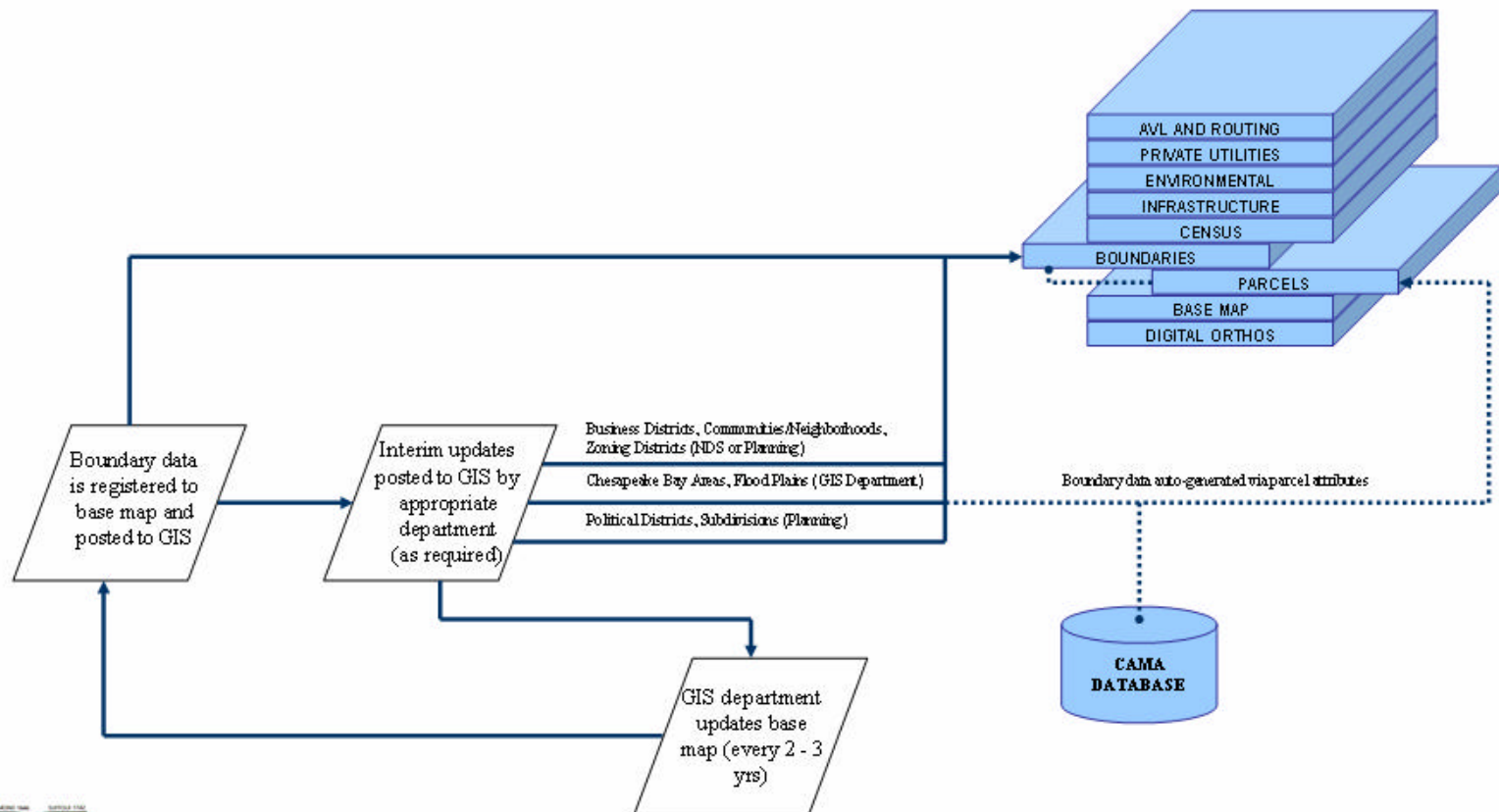
- * Documents will be referenced to two or more known control points
- ** Changes posted through digitizing or coordinate geometry



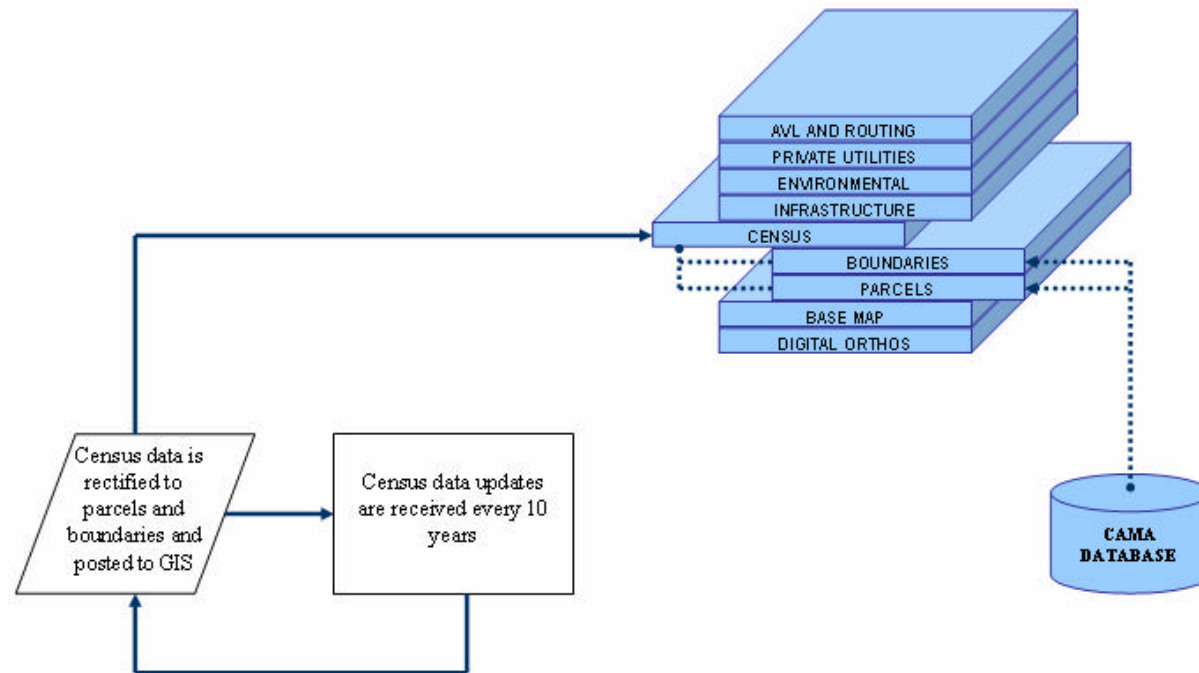
Parcel Data Maintenance Work Flow

The identification of CAMA database maintenance procedures is not within the scope of the current GIS implementation project.

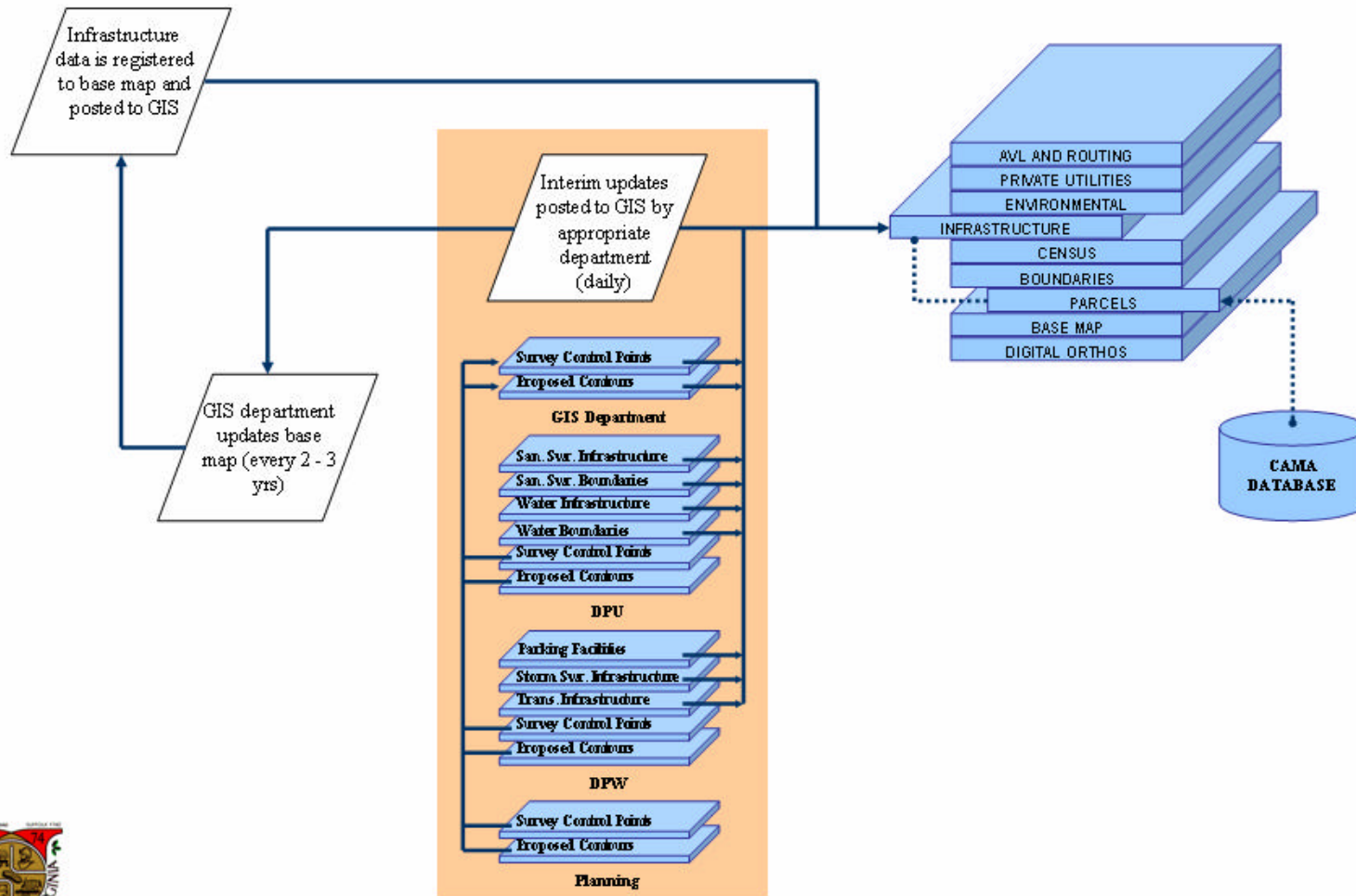




Boundary Data Maintenance Work Flow

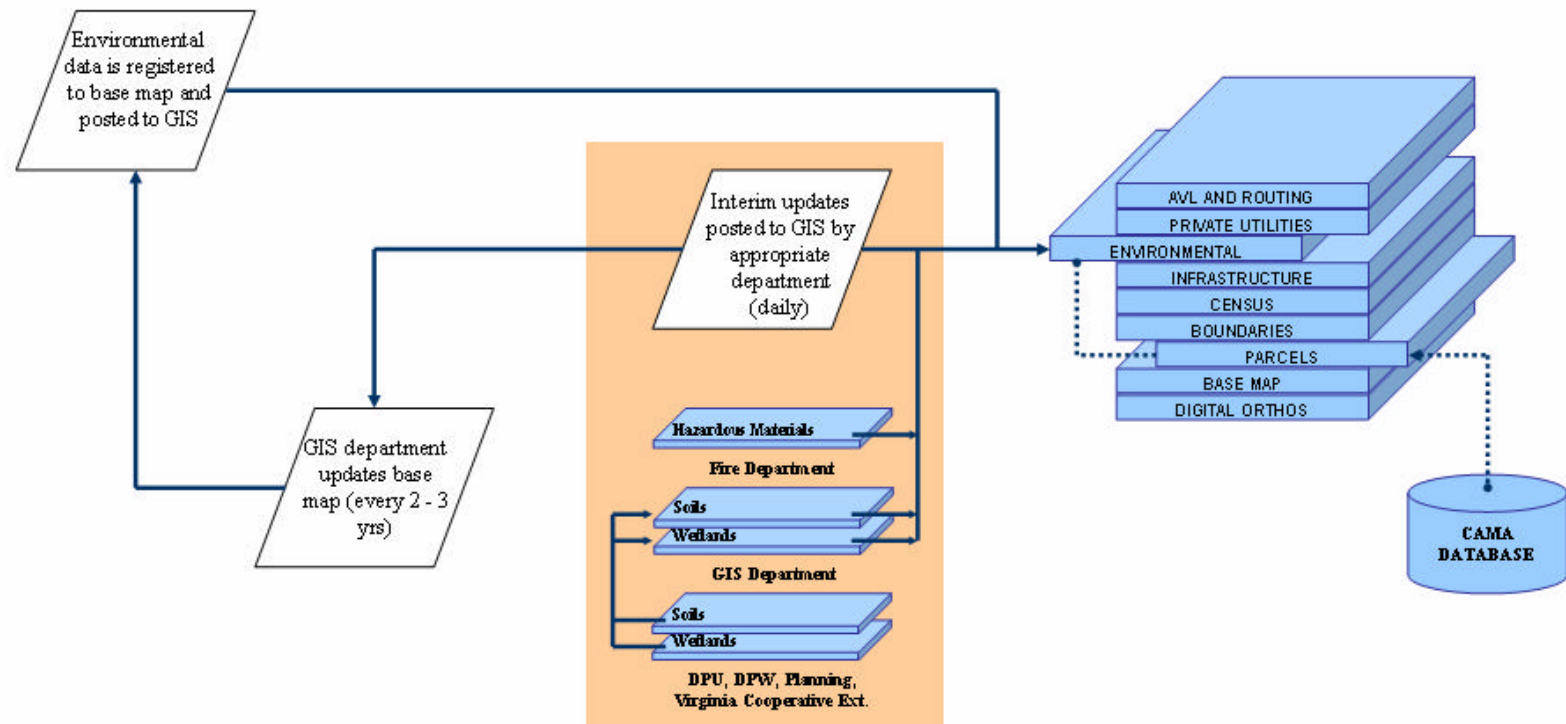


Census Data Maintenance Work Flow

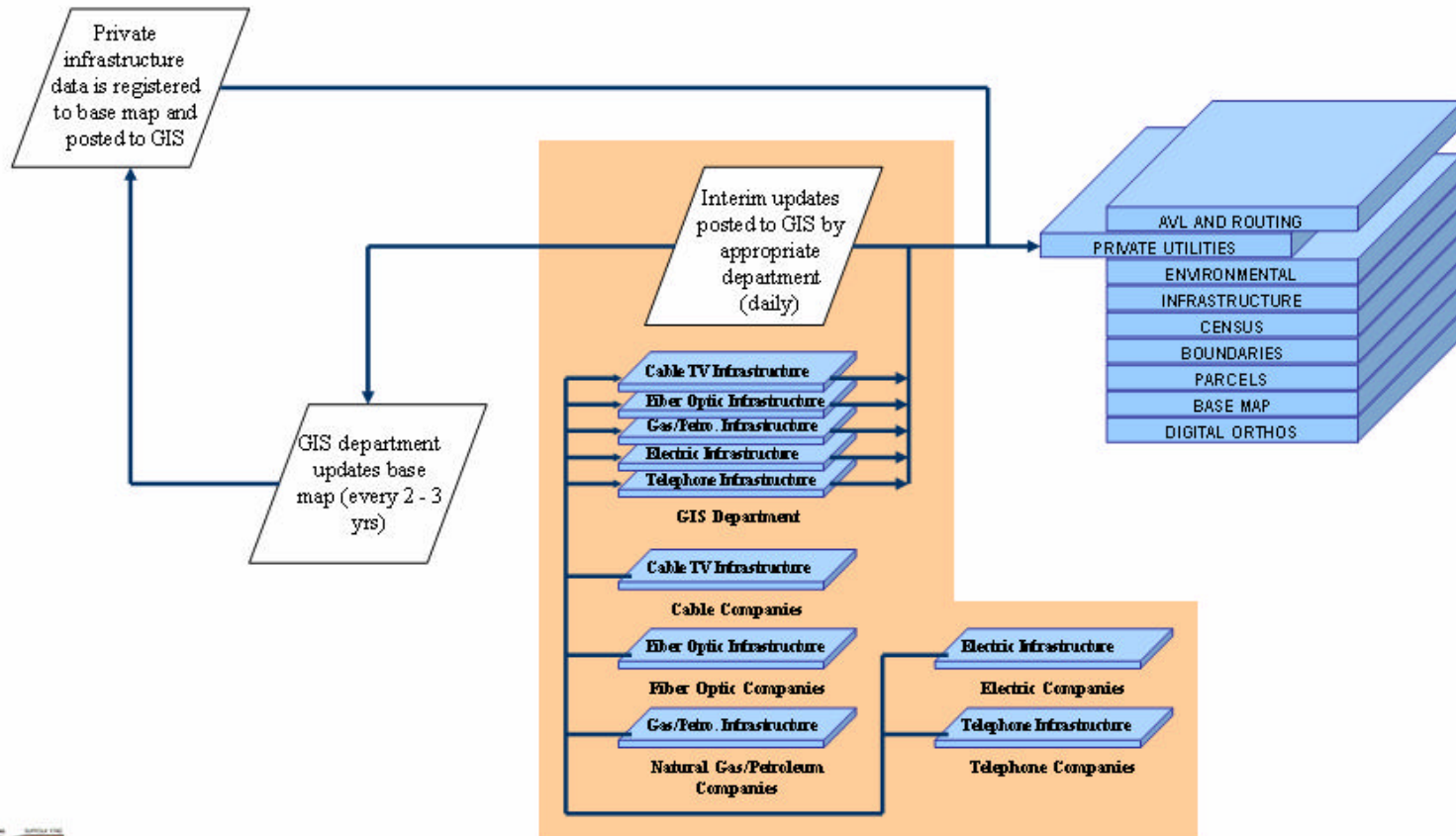


Infrastructure Data Maintenance Work Flow

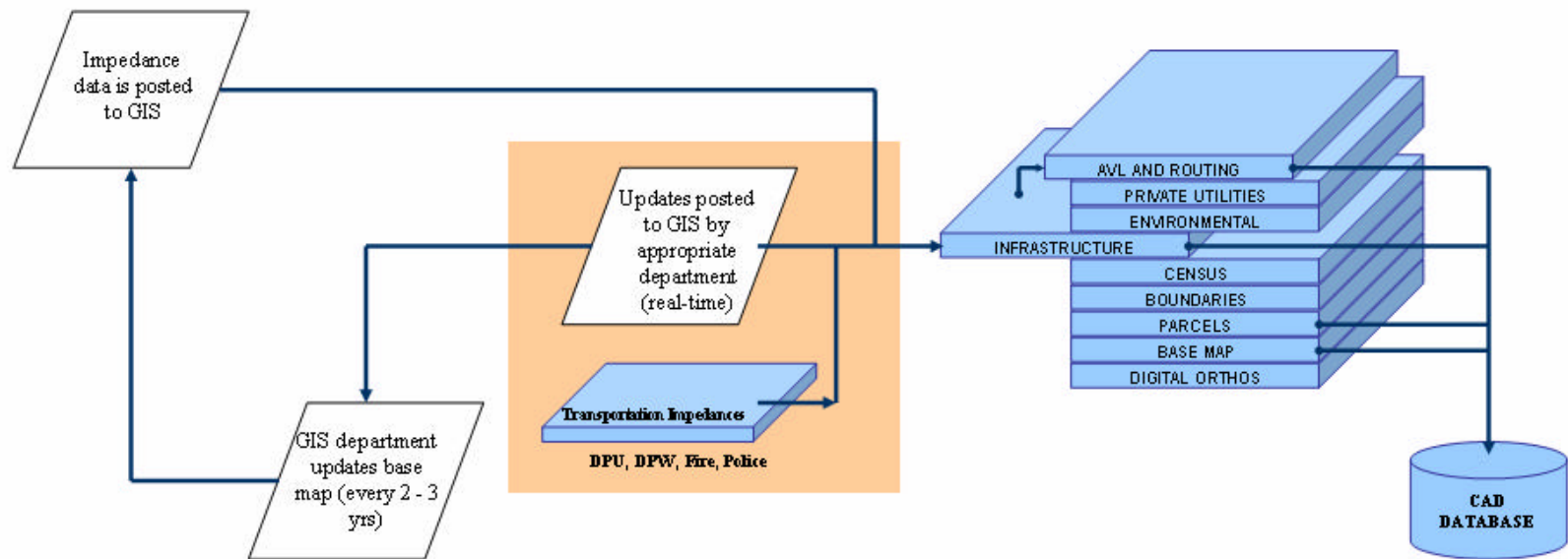




Environmental Data Maintenance Work Flow



Private Utility Infrastructure Data Maintenance Work Flow



Automatic Vehicle Location and Routing Data Maintenance Work Flow

